



CIBSE JOURNAL

DAVID PARTRIDGE ON
STRIVING FOR NET ZERO
CALCULATING EMBODIED
ENERGY IN FAÇADES
ENGINEERS CELEBRATE
THEIR 2022 INSPIRATIONS

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December 2022

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A tragic reminder



The death of toddler Awaab Ishak because of excessive mould in a housing association flat in Rochdale is a tragic reminder of the importance of installing and maintaining adequate ventilation in habitable buildings.

The coroner's report found that an overall lack of an effective ventilation system in the property was a direct contributing factor in the development of the mould that would lead to Awaab's death.

As Hywel Davies points out on page 19, with the pressure to insulate homes to save energy, there is a danger that retrofits will lead to more unhealthy homes if adequate ventilation is not installed during energy

efficiency improvements. It is up to building control inspectors to ensure that ventilation requirements in Buildings Regulations are met. The HSE is consulting on a competency framework for building control inspectors that includes references to ventilation. Details on responding to the consultation are in Davies' article.

By the time you read this, CIBSE's Build2Perform LIVE would have taken place at Excel in London. One of the key speakers was set to be David Partridge, who is the chair of the governance board overseeing the development of the Net Zero Carbon Buildings Standard (NZCBS).

This is an industry-wide attempt to define what a net zero carbon building is across 14 sectors. Our interview with Partridge explains why he thinks the standard will be embraced by the property industry, as it will create a level playing field. 'If everyone knows they are measuring equally, then it will be fair. There will be no more greenwashing,' he says.

Key to the development of the standard is the collating of operational and embodied carbon data from real and modelled buildings, allowing the NZCBS group to establish performance benchmarks for each of the 14 building types. Data can be submitted before 16 December at www.nzcbuildings.co.uk, where you can also find out more about the initiative and how to get involved.

The pro forma used to gather operational data is based on the template developed by CIBSE for entrants to the Project of the Year category at the Building Performance Awards. Judging for the 2023 awards took place last month, and a report on the judging process – and the final shortlists – appear on page 24.

The record level of entries was particularly impressive considering the upheaval caused by Covid. Not surprisingly, the remote collaboration enforced on us by the pandemic is reflected in the large number of entries for Best Digital Innovation, which is a new category for the 2023 awards.

ALEX SMITH, EDITOR asmith@cibsejournal.com

CONTRIBUTORS



Hywel Davies

What can the industry learn from the tragic death of toddler Awaab Ishak through exposure to mould



Chris Macey

Co-founder of the Society of Façade Engineering on designing facades with low embodied energy



Sana Hafsa

CIBSE's Graduate of the Year recalls her year's highlights in our review of 2022, focusing on CIBSE's 125 challenges



Tim Dwyer

This month's CPD focuses on room air distribution for effective ventilation in occupied spaces

Hoval



Bivalent systems for heating, cooling and ventilation

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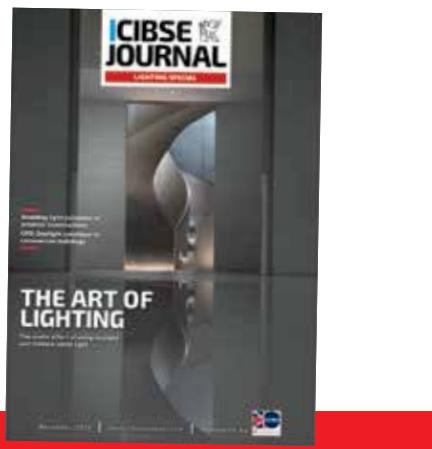
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World Cup carbon claims labelled 'misleading'

FIFA's pledge to deliver a carbon neutral World Cup is 'dangerous and deeply misleading', according to a leading climate scientist.

Qatar has used carbon credits to offset the carbon emissions released in the construction of the seven stadiums built to host the 2022 tournament.

Mike Berners-Lee, professor and fellow of the Institute for Social Futures at Lancaster University, believes that the schemes chosen don't actually remove carbon from the atmosphere, and calls the claim 'completely bogus'.

'It looks as though the Qatar World Cup is going to be the highest carbon event, aside from war, that humans have ever staged,' he said. 'FIFA estimated a carbon footprint of 3.6 million tonnes – we think its way over the 10 million mark.' For example, FIFA have assumed flights to the event are one way.

Morten Thorsby, Norway international and environmental campaigner, felt the event be used to raise awareness of key issues. Instead, he said, 'it is an absolute disaster in terms of its carbon footprint'.

'Every Grenfell Tower death avoidable', says inquiry lawyer

Richard Millett KC says all risks should have been known

The companies and organisations whose actions contributed to the Grenfell Tower fire have been accused of 'casuistry' by the chief lawyer for the inquiry into the disaster, who said the 72 resulting deaths were all 'avoidable'.

In his concluding comments at the closing session of the inquiry, which began more than four years ago, in May 2018, Richard Millett KC highlighted an admission by Celotax that it had added a layer of magnesium oxide to its RS5000 insulation when it was tested at the BRE.

However, the manufacturer concealed the addition of this layer in its marketing leaflets and blamed the designers, who specified the materials at Grenfell Tower, for not reading them fully to ensure it matched the system that passed the BRE test.

'This kind of casuistry... is not helpful to you

in working out who is to blame,' he said, adding that an 'enduring mark' of the inquiry had been attempts by those involved in the tower's botched refurbishment to 'exculpate themselves and to pin the blame on others.'

'There was nothing unknown or not reasonably knowable which caused or contributed to the fire and its consequences. On the contrary, each and every one of the risks which eventuated at Grenfell Tower on that night were well known by many and ought to have been known by all who had any part to play.'

'Each and every one of the deaths that occurred in Grenfell Tower on 14 June 2017 was avoidable.'

Millett displayed a web diagram on screens in the inquiry room showing the occasions when companies, professionals and public authorities involved in cladding the council block had blamed one other.



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The Fund provides practical advice, information and financial assistance, in times of difficulty, for CIBSE members, former members and their dependent families worldwide. The fund is also open to former members of the Institution of Heating and Ventilating Engineers (IHVE) and the Illuminating Engineering Society (IES).

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Awaab Ishak, who died because of mould problems in his housing association flat

Gove urges landlords to learn lessons from mould tragedy

Two-year-old Awaab Ishak died after exposure to mould in a housing association flat

Secretary of State for Levelling Up, Housing and Communities, Michael Gove, has urged social landlords to go ‘further than the letter’ of the Decent Homes Standard when it comes to damp issues, after a coroner’s ruling that a toddler died because of mould problems in his housing association flat.

Gove’s call was triggered by a finding by Greater Manchester coroner Joanne Kearsley, following a seven-day inquest, that two-year-old Awaab Ishak died in December 2020 as a result of a severe respiratory condition caused by prolonged exposure to mould in his home.

Awaab’s parents had previously complained to their landlord, Rochdale Boroughwide Housing (RBH), about the black mould present in the kitchen and bathroom, and had asked to be rehoused. Their flat did not have a window in the bathroom and the window in the kitchen led to a communal walkway. A health visitor had twice written to RBH expressing concern about the mould in the property.

Kearsley has called for the government’s Decent Homes Standard for social housing to be strengthened to include damp and mould.

In a letter to all social landlords, Gove urged them to absorb the lessons of the inquest’s finding: ‘All social homes must meet the Decent Homes Standard; you must be aware of any that do not and undertake rapid remedial works. However, in light of this case, I expect you to go further than the letter of the standard and have particular regard to damp and mould.

‘Damp and mould are not “lifestyle issues”, as the Housing Ombudsman Service underscored last year. Where people complain about damp and mould, you must listen; where you find them, you must take prompt action. To keep tenants safe, you must not hide behind legal process.’

He added that social landlords will be expected to undertake assessments of damp and mould issues affecting their properties, including the prevalence of category 1 and 2 damp and mould hazards, and any resulting actions that need to be taken.

● See page 18 for Hywel Davies’ article on the case.

Extract ventilation firm left hundreds exposed to risk of lung disease

A ventilation company has been fined for putting hundreds of workers at risk of serious lung diseases, following an investigation by the Health and Safety Executive (HSE).

Airtec Filtration Ltd tested extract ventilation systems, which reduce exposure to airborne contaminants in a workplace, for businesses. However, an investigation by the HSE found that the firm, based in St Helens, gave customers inaccurate test results, potentially leaving staff in those businesses unaware of the risks they faced. In one incident, when assessing a car manufacturing business, the Airtec engineer failed to identify the presence of carcinogenic rubber fumes.

Visits by HSE inspectors to multiple sites where Airtec had carried out testing found a number of ‘significant and common failings’ at each one. Documents received by inspectors raised concerns about the accuracy of its tests of several businesses’ local exhaust ventilation systems.

Airtec pleaded guilty at Manchester Magistrates’ Court on 4 November to contravening Section 3(1) of the Health and Safety at Work etc Act 1974. The company was fined £2,666 and ordered to pay costs of £4,074.

IN BRIEF

Britain falls behind as European heat pump sales soar

New analysis from the Energy and Climate Intelligence Unit (ECIU) has found that UK domestic gas usage would fall by 31% compared with 2021 rates if the country’s heat pump uptake matched that of Poland and Estonia.

Pressure from the war in Ukraine has driven up heat pump sales across Europe. As gas prices have risen, there has been an urgent demand for heat pumps to replace gas boilers, which are becoming too expensive to run.

‘Heat pumps have been dubbed by the US as freedom pumps, because they reduce dependence on Russian gas,’ said Jess Ralston, senior analyst at ECIU.

In 2021, Estonia sold 1,583 heat pumps per 100,000 people – 25 times more than the UK’s 63 per 100,000. Heat pump installations in France total 3.1 million, compared with just 280 000 in the UK.

Octopus offers heat pump incentive

Octopus Energy and Lloyds Banking Group have launched a pilot scheme to slash the cost of installing heat pumps for Halifax mortgage customers.

Under the scheme, the lender’s mortgage customers will be eligible for a £1,000 Green Living Reward if they take advantage of an offer by Octopus to provide and install one of its heat pumps.

In conjunction with a £5,000 grant from the government’s Boiler Upgrade Scheme, this cashback sum could cut the cost of getting a heat pump installed to as little as £2,000.

Giant battery storage system goes live

A battery energy storage system near Hull, which can store enough electricity to power 300,000 homes, has gone live. The Pillswood facility in Cottingham has the capacity to store 196MWh in a single cycle. Developed by North Yorkshire renewable power firm Harmony Energy, the Tesla-based storage has been built next to the National Grid’s Creyke Beck substation, which will be connected to the world’s largest offshore wind farm at Dogger Bank, which is under construction.

Hywel Davies receives top industry accolade

CIBSE technical director Hywel Davies has received the Gold Award for outstanding achievement from the Building Engineering Services Association (BESA) as part of this year's *H&V News* Awards.

The award is presented annually to someone whom BESA and *H&V News* believe has gone above and beyond the call of duty for the greater good of the building services industry.

BESA chief executive David Frise praised Davies' 'granular appreciation' of regulation, technical detail and professional standards, and his determination to ensure the voice of building services engineering 'is heard in the places that matter'.

'Dogged persistence and a willingness to speak out are among his key skills,' said Frise, who added: 'This particular recognition marks the coming to fruition of a long project – the push for "culture change" around building safety following the Grenfell Tower tragedy. Hywel is at the forefront of efforts to prepare the industry for the most far-reaching reform of building regulation since the Second World War... and we are all in his debt.'

Provide clarity on CE marking, urges CLC

European Union product marking regime extended for two years in many sectors

The introduction of the UK's post-Brexit product safety regime has been delayed for two years, but not for construction products.

Grant Shapps, Secretary of State for business, energy and industrial strategy, said on 14 November that the European Union's CE marking for non-construction products will continue to be recognised in Britain for a further two years.

He blamed 'difficult economic conditions created by post-pandemic shifts in demand and supply', alongside the war in Ukraine and associated high energy prices, for the delay.

This extension gives businesses until 31 December 2024 to prepare for the UK Conformity Assessed (UKCA) marking, which is designed to replace the CE system.

The Construction Leadership Council (CLC)



The EU's CE mark is set to be replaced by UKCA

is now urging the Department for Levelling Up, Housing and Communities to make an announcement on recognition of CE marking for construction products, for which the department has responsibility.

The CLC says an announcement is needed urgently to give clarity about which products can be legally placed on the UK market.

UKCA marking was originally set to be introduced in December 2020, but has already been pushed back twice.

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STAYING COOL UNDER PRESSURE



Air conditioning is playing a prominent role in the Qatar World Cup. The cooling system used in all the grounds was developed by Saud Abdulaziz Abdul Ghani, known as Dr Cool. He worked for 13 years on the solar-powered cooling system that is keeping players and fans comfortable and the turf healthy. Seven new stadiums were built for the World Cup, which FIFA claims will be the first to be carbon neutral. However, advertising complaints have been lodged in a number of countries, with campaigners claiming an underestimation of emissions and carbon-offsetting initiatives that fail to actually reduce carbon (see page 6).

Chancellor vows to cut UK energy usage by 15%

Hunt pledges £6bn of new funding to retrofit the country's building stock

In his Autumn Statement on 17 November, Chancellor of the Exchequer Jeremy Hunt announced a series of steps to cut energy bills by delivering a new 'long-term commitment to drive improvements in energy efficiency'.

As well as cutting consumption, Hunt said he plans to establish a new energy efficiency task force and invest £6bn in energy efficiency measures between 2025 and 2028, doubling the annual spending currently earmarked for building retrofit.

The Treasury also announced that its

support for energy costs of businesses and households will be extended after April, but will be more tightly targeted towards those in greatest need.

The commitments by Hunt on energy efficiency, which he described as a 'vital step' in Britain's long-term energy policy, were warmly welcomed by industry bodies.

Simon McWhirter, director of communications, policy and places at the UK Green Building Council, said: 'This could signal the most important boost to energy saving and reduced energy bills in many years.'

'The shift to make energy saving an equal priority with energy supply – setting a clear level of ambition and path forward for industry – and new government funding could be the turning point needed. Getting the details and wider strategy right will be critical, but this is progress in the right direction. The new task force to advise government is welcome news.'

Professor Noble Francis, economics director at the Construction Products Association, said how the government delivers energy efficiency is 'crucial given previous flops in government policy'.

A government public information campaign advising households how best to cut energy use is expected to run before Christmas. *The Times* says the campaign will suggest eight ways to save energy including reducing boiler temperature and investing in thermostatic radiator valves.

Infrastructure projects spared by Hunt

The construction of a £20bn nuclear power station at Sizewell C in Suffolk will go ahead, according to the Chancellor in his Autumn Statement.

He also committed to completing the HS2 high-speed rail line, and said the core of the Northern Powerhouse Rail project and East West Rail scheme would go ahead.

Hunt also confirmed plans for the second round of the Levelling Up Fund, with at least £1.7bn to be allocated to priority local infrastructure projects around the UK before the end of the year.

Rowley is building safety minister

Conservative MP for North East Derbyshire, Lee Rowley, has been appointed as the government's new building safety minister.

He previously held the housing brief at the Department for Levelling Up, Housing and Communities during Liz Truss's short-lived tenure as Prime Minister.

Under Rishi Sunak, Rowley has been moved to the post of parliamentary under-secretary of state (local government and building safety) within the same department. He will oversee the building safety – remediation and regulation regimes, and has responsibility for Building Regulations, climate change, net zero and energy efficiency.

Meanwhile, Michael Gove has returned to his previous role as Secretary of State for levelling up, which he held until being sacked by Boris Johnson the day before the former PM's resignation.

Lord Callanan keeps his responsibilities for clean heat, energy efficiency and fuel poverty at the Department for Business, Energy and Industrial Strategy, and energy minister Graham Stuart has retained his portfolio. Nus Ghani has been named as the new construction minister, the fourth person to hold the role this year. She takes over from Jackie Doyle-Price, who left after just two months in the post.



Building safety minister Lee Rowley

SHORTLISTS REVEALED FOR 2023 CIBSE BUILDING PERFORMANCE AWARDS



A quartet of high-performance buildings has made the shortlist for the non-domestic Project of the Year at the 2023 CIBSE Building Performance Awards. Clockwise from top left, the buildings are: Chobham Manor, submitted by LLDC; Cranmer Road, King's College Cambridge, Max Fordham; Harris Academy, Sutton, BDP; and the ESB Offices Fitzwilliam Street, BDP. Book a table at www.cibse.org/bpa and see page 24 for all the finalists.

IN BRIEF

Energy efficiency priority for properties

Four out of five European commercial real estate asset managers are accelerating plans to improve energy efficiency across their portfolios to deal with rising heat and power bills, according to research by ESG data intelligence firm Deepki.

The survey of 250 managers in the UK, Germany, France, Spain and Italy found that 53% had seen energy costs rise by more than 50% across their portfolios. In addition, 56% of respondents have seen an uplift of 11-15% in the value of buildings that have good energy efficiency performance, while 82% expect the energy costs crisis to cause a dramatic increase in unoccupied buildings that perform poorly on energy efficiency.

Net zero standard group calls for building energy data

Team seeks to establish benchmarks and a view of best practice

A call for evidence has been launched to inform and guide the development of the UK's first Net Zero Carbon Buildings Standard (NZCBS).

The team developing the standard is seeking operational and embodied energy data for buildings, to help benchmark different building types. It will be looking for in-use consumption data from the best-performing existing buildings and modelled performance data for buildings in design or construction.

The NZCBS team is also seeking embodied carbon data from both new and retrofit projects.

Data should be submitted by 16 December

and details are at www.nzcbuildings.co.uk.

David Partridge, recently appointed chair of the UK NZCBS governance board, said: 'We are looking for built environment professionals to contribute data from a number of different asset types to develop a single, agreed methodology, and for all stakeholders in the real estate industry, who will be using the standard, to get involved to formulate it appropriately.'

The group developing the NZCBS includes CIBSE, the Low Energy Transformation Initiative, LETI, and the Better Buildings Partnership, the Institution of Structural Engineers, the Royal Institute of British Architects and UK Green Building Council. Read an interview with David Partridge on page 20.

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COP27 commitment on emissions 'disappointing'

Summit's biggest achievement is climate change fund for vulnerable countries

Limited progress on cutting emissions at the UN's COP27 summit has been described as 'disappointing' by the director of sustainability at one of the UK's leading building engineers.

The main breakthrough at COP27 was a step forward by governments to establish a loss and damage fund for countries that will suffer extensive harm as a result of rising emissions, for which they are not responsible. David Symons, UK director of sustainability at WSP, said the agreement to create a global 'loss and damage' was positive, but he said 'limited additional commitment on cutting emissions was disappointing.'

The global climate change summit, held in the Egyptian resort of Sharm el-Sheikh, concluded on 19 November with the publication of a final communiqué. Countries in the High Ambition Coalition, which includes developing nations at greatest risk from climate change, as well as more developed states, such as the USA, tried to extend a commitment to phase down coal to all fossil fuels in the final text.

However, the language on accelerating the phase down of coal and scrapping fossil

subsidies was a 'cut and paste' of commitments in the Glasgow Climate Pact at last year's COP26, according to environmental consultancy E3G. The final text also missed opportunities to set targets for renewable energy and energy efficiency, it said.

Symonds said: 'Delivery in key areas is vitally important now: fast emission cuts, resilient infrastructure and growth through climate action.'

The conclusion of the COP27 summit followed an agreement by leaders at the G20 meeting in Bali to pursue efforts to limit the rise in global temperatures to 1.5°C and recognise the need to speed up efforts to phase down coal use.

Arup reveals whole life carbon data

Arup has assembled an international dataset capturing total forecast emissions - whole life carbon - for almost 1,000 building projects in which it is involved.

Data from 30 nations on five continents has been collected and analysed by the consultancy using its new software platform, Zero. Arup unveiled the dataset at the COP27 climate summit, and announced that it aims to pursue a UN goal for all new and refurbished buildings to be net zero in operation, and to achieve at least a 40% reduction in embodied carbon by 2030.

IN BRIEF

Scotland launches new fund for green heat technologies

Scottish Enterprise has launched a new £17.6m fund to encourage the development of innovative low carbon heat solutions and technologies. The Green Heat Innovation Support Programme has been developed in conjunction with the Scottish Government and aims to support the growth of a green heat supply chain capable of delivering at scale across Scotland.

The programme is open to manufacturers of heat network components and heating products, including heat pumps and thermal storage, as well as energy efficiency products, components and technology, such as heat storage and digital/smart controls.

Commercial retrofit task group seeks members

The UK Green Building Council (UKGBC) has opened applications for members to join its new specialist commercial retrofit task group.

The group will support and deliver the UKGBC's Commercial Retrofit - Part 2 project. This aims to deepen awareness and understanding among industry stakeholders of the carbon- and cost-effectiveness of different retrofit measures, inform planned upgrades to existing commercial assets, and overcome common challenges.

Applications for membership of the task group will remain open until Monday 5 December.



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Arup and Buro Happold double up at façade awards



Design and engineering accolades celebrate sustainability and innovation

Arup and Buro Happold each won two accolades at the Façade Design and Engineering Awards, organised by the Society of Façade Engineering and sponsored by Reynaers Aluminium.

For the first time, the awards joined forces with Zak World of Façades' London Conference, and included 10 categories that shone a light on exceptional façade projects.

Arup picked up the award for Project of the Year, Sustainability – UK for 1 Triton Square, and Project of the Year, Refurbishment for the Burrell Collection.

Arup was invited by British Land to modernise the 1990s structure of 1 Triton Square, and it introduced high-performance façades while refurbishing and retaining parts of the existing one.

Buro Happold won Project of the Year, New Build – International with the Museum of the Future in Dubai, while its employee Simon Bate won Young Façade Engineer of the Year.

Simon graduated from the University of Warwick in 2019 and has worked as a façade engineer for Buro Happold ever since. In nominating him, Peter Goff, associate director at the consulting engineers, praised Simon's diligence, rigour and maturity, particularly when working on some of the most challenging projects relating to the remediation of combustible cladding on high-risk buildings.

Aecom was recognised in the International Sustainable Project of the Year category for the Gillies Hall student accommodation in Melbourne, Australia. The engineer returned to first principles to deliver a project that, once complete, will be the largest Passivhaus-certified project in the Southern Hemisphere.

Eckersley O'Callaghan took the Project of the Year, Innovation (International) award for the K11 Art and Cultural Centre in Hong Kong.

Effisus and Serge Ferrari were named joint winners in the Product of the Year category. The judges said both companies demonstrated a focus on quality and had responded to market needs, particularly in light of changing fire regulations.

Chris Macey FSFE, CEO of Wintech Group, was recognised with a Lifetime Achievement Award. The citation, by Skanska's Saverio Pasetto, said Chris had been instrumental in the development of façade engineering as a recognised specialism. Since the Grenfell Tower disaster, he has contributed to sub-committees focused on the remediation of building façades to prevent spread of fire (see Q&A with Macey on page 81).

Rimmy Vij, vice-chair of the Society of Façade Engineering and technical director, façade engineering, for WSP, said of the awards: 'With the challenges presented by climate change, it's fantastic to see façade design and engineering leading the way in terms of sustainability and retrofit, both in the UK and internationally.'

The 2022 Façade Design and Engineering Award winners

Project of the Year, Refurbishment, sponsored by Aecom

Winner: Arup for The Burrell Collection

Project of the Year, Sustainability (UK), sponsored by Reynaers Aluminium

Winner: Arup for 1 Triton Square

Project of the Year, Innovation (UK), sponsored by Buro Happold

Winner: Skanska UK for Outernet London

Project of the Year, Innovation (International), sponsored by Effisus

Winner: Eckersley O'Callaghan for K11 Art and Cultural Centre

Project of the Year, New Build (UK), sponsored by Mafeis

Winner: Wintech for LSE

Project of the Year, New Build (International), sponsored by CIBSE

Winner: Buro Happold for the Museum of the Future

Product of the Year, sponsored by Arup

Joint winner:

Serge Ferrari, Stamsol Safe One
Effisus UK, Ecofacade

Young Façade Engineer of the Year, sponsored by Sir Robert McAlpine

Winner: Simon Bate, Buro Happold

Lifetime Achievement Award, sponsored by SFE

Winner: Chris Macey, Wintech





David Wood (centre), receiving his CIBSE Gold Medal, is stepping down as chair of the Benevolent Fund

Benevolent Fund marks 90th anniversary

Increasing numbers turn to hardship fund as cost-of-living crisis hits

The CIBSE Benevolent Fund is to start its 90th year by welcoming a new chair – immediate past president Kevin Kelly FCIBSE.

Current chair David Wood FCIBSE, who was recognised for his contribution to CIBSE with a Gold Medal in February 2022, is stepping down after 14 years.

He has had a long association with the Institution and was CIBSE President in 2000. The Benevolent Fund said it was incredibly grateful for his untiring commitment and dedication during his time as chair.

Set up in 1933 to help those in need, whether because of sickness, bereavement or financial hardship, the Benevolent Fund provides aid and grants to CIBSE members, former members, and their dependents.

Members can make a valuable monetary contribution to the fund by ticking the relevant box when renewing their annual membership subscriptions.

The fund helps people by making payments to supplement pensions, giving assistance towards the cost of equipment – such as a stairlift – and assisting with major, one-off bills.

Many CIBSE members benefit each year and their families have been aided at times of adversity, such as bereavement and redundancy.

Currently the fund's finances are healthy, but it is seeing an increase in cases and expects this trend to continue with the rising cost of living.

CIBSE is asking members to consider raising money for the Benevolent Fund at

regional events, such as annual dinners. Alongside membership contributions, this is the main source of income for the fund, while a number of CIBSE's professional review interviewers also donate their fees to the fund.

The role of the almoner

Almoners and regional committees help the Benevolent Fund identify members or former members in need. They meet with individuals to assess their need before presenting the details at a confidential meeting with the trustees, where an appropriate level of support is agreed.

Vince Arnold, Benevolent Fund trustee said: 'Being a volunteer almoner is very rewarding. You are directly helping someone in their time of need. We have a few vacancies for regional almoners, so why not volunteer in your local region?'

'We would like to thank all our almoners for their time, hard work and dedication to the fund. You are all vital to the work that we do.'

Getting help to those who need it

According to CIBSE one of the challenges for the Fund is finding out about members who may need help but who are reluctant to ask for it.

Members can help by identifying people who may be able to find support from the Fund, said Kevin Kelly, incoming chair. 'If you know of a member, or former member, who needs help, please notify your regional almoner or committee.'

- Find and contact your local almoner at: www.cibse.org/about-cibse/benevolent-fund/almoners
- For more information visit: www.cibse.org/benfund

New guidance for internal shading as temperatures rise

CIBSE's new technical memorandum *Dynamic thermal modelling of basic blinds* (TM69:2022) recognises the role of internal shading in reducing indoor air temperatures, as well as the impact on internal daylight and acoustics.

The UK has recently experienced air temperatures in excess of 40°C, smashing previous records.

The new guide highlights some of the issues associated with the discrepancies between blind performance in a model and in a real-life application. Future software applications will need to align with the relevant standards.

TM69 recognises that shading systems, such as internal blinds, simultaneously affect internal daylight and acoustic conditions, as well as the thermal and solar performance of a building.

It also examines some of the limitations that are present when including moveable blinds in a dynamic thermal model.

The guide's focus is on representing a more straightforward approach, in thermal analysis terms, to glass-blind systems in some typical software packages. It also suggests 'workarounds' for better representations.

Although Approved Document O: Overheating for newly developed residential buildings only accepts external shading as a measure to mitigate solar gains, the content of TM69 is helpful in giving background to the combined physics of glass-blind systems, recognising the differences between external and internal blind elements.

The development of TM69 was led by the CIBSE Building Simulation Group.

- Copies of TM69:2022 are available from the CIBSE Knowledge Portal at www.cibse.org/knowledge

Dynamic thermal modelling
of basic blinds



TM69:2022



Winners' blogs aim to inspire award entries

The winners of the CIBSE Young Engineers Awards (YEAs) have each written a blog to share their experience and inspire others to enter future awards.

Sana Hafsa, CIBSE ASHRAE Graduate of the Year, is currently working on sustainability guidelines for a new city in Saudi Arabia. She believes the biggest influence you can have on people is 'simply through sharing your stories, and it is through people that we can create change where needed'.

Harvey Hudson, CIBSE Apprentice of the Year Level 3-4, is working on site at the New Cross solar farm in Wolverhampton, where 15,000 panels will produce around 288 days of self-generated renewable energy. He is inspired by the positive impact that the industry has on the world, and said: 'I know that every project I work on is helping towards the UK's net zero target.' Winning the award has significantly boosted his confidence, he said.

Louis Kimber, CIBSE Apprentice of the Year Level 5-7, is working on a Passivhaus housing scheme in Cardiff, and says the greatest benefit of winning the award has been exposure to the wider business, and industry as a whole.

When asked why people should enter the YEAs, he said: 'It does not make sense not to! Even if you don't make it to the shortlist, the whole experience of presenting and answering challenging questions as part of the submission process has been invaluable.'

● Read the blogs at bit.ly/CJDec22CN1

CIBSE revises its Code of Conduct

The CIBSE Code of Conduct is reviewed every two years by the Professional Conduct Committee (PCC) and updated as necessary to incorporate changes in guidance, and to align with good practice elsewhere.

This year, the PCC has undertaken an in-depth review of the code's content and style compared with those of several other institutions. This has resulted in a substantial rewriting of the code and the new revision is available on the CIBSE website: bit.ly/CJNov22CN2. It will come into force from 1 January 2023.

Regional accolade for new air ambulance HQ

Helimed House named best project in East Anglia thanks to sustainable design and collaborative approach

The new headquarters building for the East Anglian Air Ambulance has won Project of the Year at the CIBSE East Anglia Region Awards.

Helimed House was entered for the award by the project's M&E consultant, Johns Slater and Haward, a building services consultancy in Ipswich.

The judges described it as an excellent example of sustainable design, producing

a great working environment, with attention paid to ventilation and thermal comfort. This was achieved through a truly collaborative approach, including the client, design team and manufacturers, they added.

Matthew Jones, East Anglian Air Ambulance CEO, said: 'There was excellent collaboration by the project team, which means we can now offer current and future employees a healthy, comfortable working environment - essential for attracting and retaining excellent people.'

Joshua Willis was named Young Engineer of the Year, impressing the judges with details of how he set up his company, JLB Electrical, during the pandemic to serve a real need in his local community.

The judges said Joshua is a credit to the industry, and a great example of how a focus on customer service and attention to detail really pays off.

The awards ceremony took place in October, at the University Arms Hotel in Cambridge, and 180 guests attended.

● For more on CIBSE East Anglia, visit www.cibse.org/get-involved/regions/east-anglia



From left: Laura Mansel-Thomas, Adrian Catchpole, Joshua Willis, and CIBSE East Anglia chair Nicola Booth

Teams light up competition in three hours or less

Teams led by Cundall, CBG Consultants and Marlow Integrated Design picked up the main awards at the Ready Steady Light competition, which took place in October.

The Society of Light and Lighting's (SLL's) annual event is organised in association with Rose Bruford College, and 13 mixed teams of students and lighting professionals competed this year to design and set up temporary exterior installations with a limited range of equipment in only three hours.

Returning to basic engineering and design, they were tasked with lighting their site in its natural state with the equipment provided. Team Cundall won the Technical Award, Team CBG Consultants the Artistic Award, and Team Marlow Integrated Design the Peer Award.

Each year, SLL Ready Steady Light welcomes teams from University College London's light and lighting MSc course, plus a team from Rose Bruford College. It offers an opportunity for students to gain hands-on experience, experimenting with lighting techniques and working alongside practising lighting professionals.

While the lighting community has worked to overcome the challenges presented by the pandemic, day-to-day work has continued. There have been new starters and the same requirements to support development, but without the crucial interaction of getting to work alongside colleagues in a shared space.

So the Society felt it was more important than ever to provide design practices, students and lighting professionals with an opportunity to have fun and work together, with the added element of some friendly competition.

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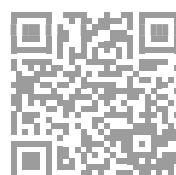
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Ventilation – a matter of life and death

Awaab Ishak 13 December 2018 – 21 December 2020

The tragic death of Awaab Ishak should be a very clear reminder to us all of the fundamental importance of the Building Regulations' requirement to provide adequate ventilation in any habitable building, and not just in a pandemic, says Hywel Davies

Awaab Ishak was born in December 2018, the first son of refugee parents from the Sudan. Two years and eight days later, he died of cardiac arrest brought on by severe respiratory problems. He lived in a one-bedroom flat in Rochdale.

In 2017, before he was born, his father raised concerns with the borough housing body about mould in the flat. He was advised to paint over the mould, and is thought to have done so then and on further occasions. However, because of his limited English skills, he did not understand the need to use a paint intended for this purpose.

Because of the recurring mould problem, in July 2020 the family instructed solicitors to raise a claim for disrepair and began to seek advice from health professionals. A health visitor who visited in July 2020 wrote to the borough raising concerns about mould in the flat and the potential impact on Awaab's health.

Within a week, a disrepair manager visited and found mould on the kitchen and bathroom ceilings and walls that required treatment, and evidence of mould in a bedroom cupboard requiring more specific treatment. There was no evidence of structural problems or leakage.

The manager did not observe the ineffective mechanical ventilation in the bathroom, a poorly working fan, or total absence of mechanical ventilation in the kitchen. That was identified four months later by a technical inspector who visited after the health visitor resent her letter in November.

But it emerged at the inquest that it is widespread policy when claims are made not to take remedial action until it has been agreed with the claimants' solicitors, so no action was taken in Awaab's home.

The Coroner's Report sets out the findings of the Home Office and paediatric pathologists that Awaab had severe granulomatous tracheobronchitis, a condition that is usually a longstanding process taking weeks or months to develop.

The court was told that the presence of granulomas is evidence of a long-term inflammatory process, worsening with continued exposure and very rare in young people. The distribution observed fitted a pattern of something entering the airways and causing the granulomas. The court was told that this fitted with fungal infections.



Together with the history and circumstances and post-mortem findings, the only explanation, in the pathologists' opinion, was that death was due to chronic exposure to fungus. The coroner found, as a matter of fact, that the medical cause of Awaab's death was acute airway oedema with severe granulomatous tracheobronchitis due to environmental mould exposure.

The coroner heard from Richard Blakeway, the housing ombudsman, who reported increasing numbers of complaints relating to this issue, with emerging common themes. One theme is an over-reliance on the contribution of a tenant's 'lifestyle' as the cause of the problem, or blaming tenants instead of preventing problems.

The coroner found that 'the most likely cause of any damp or moisture in 2020 was, more likely than not, due to normal daily living activities', and stated that 'there is no evidence that the ways of living by the family were in anyway excessive'. The idea that those in rented housing should be expected to cook, shower and wash their clothes less frequently is simply ridiculous.

Awaab Ishak died just eight days after his second birthday



This tragic death was utterly preventable. Had the flat been adequately ventilated then it is highly likely that Awaab would be alive now. The coroner reports: 'Furthermore, I find as a matter of fact that the ventilation in the bathroom was not effective, there was a lack of ventilation in the kitchen and an overall lack of an effective ventilation system in the property. This was a direct contributing factor in the development of the mould.' (Coroner's Report, para 30)

Put simply, Awaab died as a consequence of the mould that grew because his home was inadequately ventilated.

Part F of the Building Regulations requires that 'there shall be adequate means of ventilation provided for people in the building'. The coroner's finding of inadequate ventilation is therefore a finding of fact that the home did not comply with Building Regulations in respect to its ventilation.

This tragedy clearly demonstrates the importance of homes that are designed to comply with the ventilation requirements of Building Regulations, built with effective, compliant ventilation, and maintained in that state.

This is not a novel or shocking discovery – a simple review¹ of research and case studies of mould and damp in buildings reveals a host of papers published over the past 30 years covering the UK and Europe. The shock is that a two-year-old child has to die to make this front-page news.

It also underlines the need for all properties to be provided with adequate ventilation, irrespective of their age, and that improved ventilation should be a requirement of thermal

"Awaab Ishak's shocking death shows that ventilation is a matter of life safety. Like fire, it needs treating as such"



improvements such as retrofitting insulation. When homes are retrofitted with insulation to improve their energy efficiency, it is essential that the ventilation is also addressed and, if need be, improved. This also highlights the importance of infection-resilient environments² in day-to-day life and not just in pandemics.

The coroner has written to Michael Gove and Steven Barclay, as housing and health Secretaries respectively, setting out her very legitimate and reasonable concerns and areas of actions that need to be taken³. However, these concerns all relate to the management of occupied social housing. They do not include asking how building control allowed this one-bedroom flat to be created with inadequate ventilation that did not meet the legal requirements.

It is therefore very timely that the Health & Safety Executive (HSE) is currently consulting on its proposed competency framework for building control inspectors. Those who read this column promptly still have a week to respond to the consultation⁴.

There are four instances of ventilation in the framework, on pages 21-23. Please send your thoughts and suggestions on the draft to CIBSE, but in this instance – and especially on this topic of building control competence in relation to ventilation – please also send your thoughts directly to the HSE, setting out why you think it is essential that building control practitioners are fully competent in the provision of adequate ventilation to buildings of any type, but especially dwellings. This is our chance to make the point and demonstrate the issues that are at stake if building control does not act to ensure that buildings are ventilated.

Gove and Barclay have until mid-January to reply. It is imperative that they not only reply, but that they act decisively on the coroner's letter, unlike the instance of the coroner's letter to Eric Pickles about the Lakeland House fire.

Michael Gove has, commendably, already written to Local Authority and Housing leaders with statutory directions under the Housing Act to address mould and damp, requiring initial responses by the end of November. But the coroner has not highlighted to him that non-compliance with Building Regulations was a contributing cause of this child's death. Gove's department needs to address that urgently, too.

Awaab Ishak's shocking death shows that, just like fire, inadequate ventilation can be fatal. Like fire, ventilation is a matter of life safety. Like fire, it needs treating as such.

I am indebted to Giles Peaker, solicitor and creator of the 'Nearly Legal' housing blog (bit.ly/CJDec22HD5), for detailed information about this tragic case.

References:

- 1 SD Platt et al, 'Damp housing, mould growth, and symptomatic health state', *The BMJ*, 1989 bit.ly/CJDec22HD1
- 2 Infection-resilient environments, National Engineering Policy Centre, bit.ly/CJDecHD2
- 3 Coroner's Report, bit.ly/CJDEC22HD3
- 4 Building Control Inspectors Framework Consultation, bit.ly/CJDec22HD4
- 5 Council housing and housing association, bit.ly/CJDEC22HD5



DR HYWEL DAVIES

is technical director at CIBSE www.cibse.org

As one of the most prominent figures in property, David Partridge is in an ideal position to oversee the governance of the Net Zero Carbon Buildings Standard and ensure a definition for net zero is embraced by those who develop, own and build real estate. **Alex Smith** reports



MEASURING UP

The Net Zero Carbon Buildings Standard (NZCBS) is an ambitious cross-industry initiative that aims to provide a single agreed definition and methodology to determine what constitutes a net zero carbon building.

It will set out performance targets and limits for operational and embodied carbon emissions in new and existing buildings, which will align with the UK's 2050 net zero targets.

The development of the standard, which will apply to new and existing buildings, is being developed by a partnership of professional bodies: CIBSE, RICS, Institution of Structural Engineers, UKGBC, LETI, RIBA, the BRE Trust, the Carbon Trust and the Better Building Partnership. By March next year, 300 industry experts from these institutions will be working on the standard through various task and sector groups.

Last month, the NZCBS group launched a call for evidence to help inform and guide the development of the standard. It wants consumption data from existing buildings, modelled performance data for buildings in design or construction, and embodied carbon data from both new construction and retrofit projects. The data will enable the NZCBS development team to understand the benchmark for energy performance, and what current and future best practice might look like (see 'How the standard will work' on page 22).

Related Argent chair David Partridge is chair of the governance board overseeing the development of the standard, to ensure it is technically and philosophically

robust and fit for purpose. The board will engage with all parts of the built environment sector to encourage universal adoption of the standard.

'It's really important that we come together as an industry to agree a standard that everyone can be held to,' says Partridge, who was a key speaker at CIBSE's Build2Perform conference at London's ExCeL last month.

'There are myriad initiatives to try to cut down CO₂ emissions, but without a common standard forged and agreed upon, these uncoordinated initiatives risk sowing confusion among stakeholders and, at worse, allow some to greenwash their assets.'

The governing board will engage with all parties in the property industry that don't necessarily work with engineering professionals, such as investors, lenders, funders, insurers and construction teams.

'The group behind the Net Zero Carbon Buildings Standard are essentially from professional design backgrounds,' says Partridge. 'What we didn't have was those owning, developing and constructing the real estate. They are the critical stakeholders and the ones who will be using the standard. We can design like mad, but if other stakeholders don't buy into the standard, it will be left on a shelf.'

Partridge adds that the standard must align with stakeholders' reporting and environmental, social and governance verification systems, and be in their economic interest: 'The technical side must be robust, but we mustn't overlook the market's ability to verify and certify the standard.'

Partridge is the former chairman of UKGBC, immediate past president of the British Property Federation and sits on the Construct Zero advisory board of the Construction Leadership Council. He was recently presented with the President's Award by the British Council for Offices in recognition of his significant contribution to

"We must stop burning gas now, have net zero in operation, and start reversing the clock on the carbon we're emitting"

the property industry over more than 30 years. Partridge believes it is this background that makes him a good fit as chair of the NZCBS governance board. 'I know the language they speak,' he says.

As the managing partner and now chair at Argent, Partridge helped drive the regeneration of King's Cross in London, which always had sustainability at its heart. King's Cross declared itself a carbon neutral development in November 2021, thanks to having energy efficient buildings, switching to renewable gas and electricity, and offsetting the embodied energy in buildings and operation through carbon credits from independently verified global projects.

'We must stop burning gas now, have net zero in operation, and start reversing the clock on all the carbon we're emitting,' says Partridge. 'That's huge in the construction industry. We have to start taking carbon out.'

He is particularly keen to see a robust verification process for carbon offsets to mitigate the residual carbon that cannot be avoided on projects. 'You shouldn't need operational energy offsets, but you will need to offset the carbon from the building process,' he says.

To account for his own family's carbon emissions over the next 100 years, Partridge has taken control of his offsets by buying a 25-acre

wood in Norfolk, while King's Cross has pledged to plant 600,000 trees as part of its net zero goal.

'If the standard can get you to a place where the offsetting is verified properly, and transparent, that's the holy grail. A tonne of offset carbon must be a true tonne of carbon,' he says.

Partridge believes there will still be plenty of work to do once the standard is established. 'We must ensure it remains operational and current, and the governing board will make sure the standard is sustainable and has a life beyond the development and delivery process,' he says.

'We have to make sure it sticks and becomes embedded in Building Regulations or planning permissions, in the same way Breeam has.'

For the industry to work to a net zero carbon standard, it will be necessary to upskill the workforce, says Partridge. 'There's no point having a standard if we can't deliver it,' he says. 'Upskilling is a massive challenge. That's why I'm working closely with the Construction Leadership Council. I don't think our work stops when the standard is in place.'

Partridge is highly optimistic that the standard will be widely adopted. 'I don't think there will be any market resistance. Everyone is crying out for something,' he says. 'If everyone knows they are measuring equally, then it will be fair. There will be no more greenwashing.'

The standard will not be prescriptive, adds Partridge – designers can choose any approach as long as they meet the limits and targets for their sector building. 'We're not saying how you should do it. That's up to the market. If we can measure accurately what you are emitting through those activities, the market will work out what technology is required.'

He believes it will be a no-brainer for government to embrace the standard: 'If we say everyone supports it, it's likely that the government will rally around and adopt it.'

For more details on submitting operational and embodied energy data, visit www.nzcbuildings.co.uk. The deadline for submission of data is 16 December. **CJ**

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HOW THE STANDARD WILL WORK

For buildings to meet the proposed Net Zero Carbon Buildings Standard, they must achieve a level of operational and embodied energy that is compatible with the UK's remaining carbon budget and the projected capacity of renewable and zero carbon energy available in the future.

The aim of the standard is to develop industry-agreed limits and targets for operational and embodied carbon in 14 building sectors (see below) by the end of 2023. The standard will also cover the procurement of renewable energy and the treatment of residual emissions, including carbon offsetting.

To establish average and best practice performance, the NZCBS group is calling on industry to submit project operational and embodied data.

Operational data should be submitted via a pro forma at www.nzcbuildings.co.uk. The main aim of the template is to identify a project's energy use intensity, based on metered energy. Data from energy models can also be submitted. Embodied energy data should be submitted to the existing Built Environment Carbon Database.

Sector groups will develop the bottom-up operational benchmarks for each building type based on the data collated by the operational energy group. Benchmarks for embodied carbon will be developed by the embodied energy group.

There are three performance levels: a benchmark, representing the current sector average for buildings today; limits, which are the maximum performance level that must not be exceeded – for example, maximum embodied carbon; and a target, which is the minimum performance level – for example, minimum renewable energy generated.

Another 'top down' group will establish the metrics and establish the total budgets for the metrics identified that would allow the UK building stock to achieve net zero. A carbon accounting group defines the rules for measuring embodied and operational energy, and identifies acceptable options for mitigating residual emissions. Finally, a reporting, disclosure and verification group will agree the approach and requirements for verifying net zero carbon claims. **CJ**

BUILDING SECTORS

- | | |
|--------------------------|-----------------------------|
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| ■ Schools | ■ Sports and leisure |
| ■ Higher education | ■ Healthcare |
| ■ Commercial | ■ Heritage |
| ■ Offices | ■ Datacentre |
| ■ Hotels | ■ Culture and entertainment |
| ■ Retail | |
| ■ Science and technology | |

When is training a qualified success?

After attending a career day for young engineers, Exyte Hargreaves' **David Fitzpatrick** considers the appropriate mix of qualifications and expertise

Over the past few months, I have been involved with CIBSE Young Engineers Network (YEN) groups on a careers day in London looking to attract new talent into our industry, the Young Engineers Awards, and various other events with YEN.

I have found it inspiring to see the engineering talent we already have in the industry and their passion for what they believe the building services sector can achieve.

It is interesting to see the different routes via which they have taken into the industry, often not through a building services course, but through a module on another course or being guided by a teacher, lecturer or mentor.

It makes you wonder how we can make it easier to show potential careers in the industry at an earlier stage, and how we can keep them motivated and developing when they are part of the industry. Is it worse to let talented people drift away from the industry or not attract them in the first place?

I also ask myself if we have the correct type of courses available in all aspects of the building services industry for the talent to be attracted in the first place.

I was thinking about the smoke industry, with its focus on competence in the Fire Safety Act 2021. For example, is competence about being able to show you have a set of procedures and forms to prove you can carry out a safe installation on a project – which to me is about ISO 9001 Quality management systems – or is it about the expertise of the people actually designing and installing a smoke control system?

If it's about expertise, are we referring to experience or qualifications, or both? If it is about having qualifications, what are they? For example, a fire engineer has a wealth of knowledge, but does he have the specific expertise to design a detailed fire engineering design solution for a complex building?

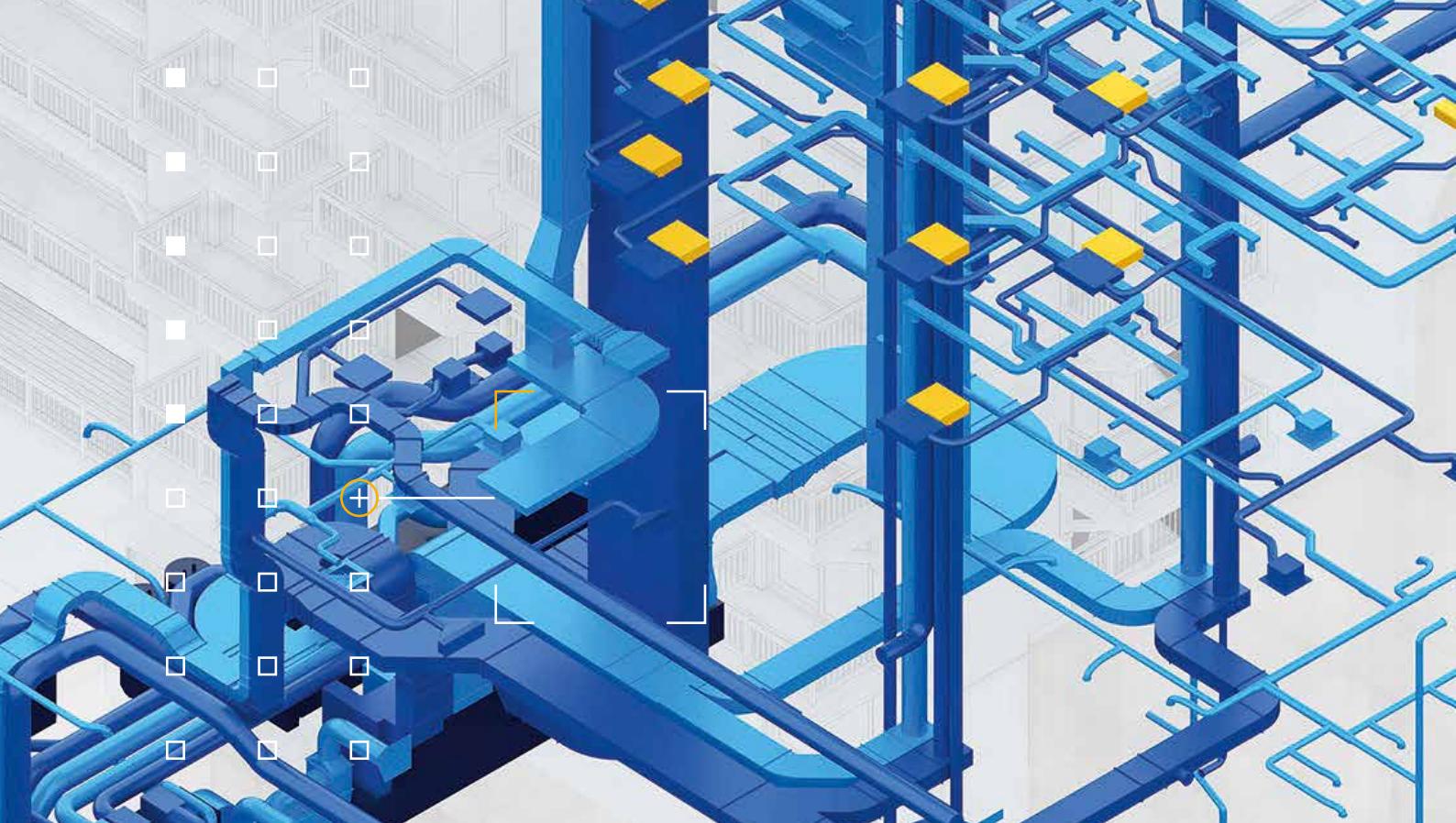
Then I looked at what training is available for somebody wishing to begin in smoke control systems. There is a lot of excellent guidance, but very few actual qualifications, although I did find some through the Fire Service College.

It got me thinking. Have we created the correct type of courses required for the industry today, to attract new people and to give the industry the knowledge it needs for the future?

Also, when a company is looking for a smoke control specialist, what should they be looking for – experience within the industry or proven qualifications?

- **David Fitzpatrick** is director for SFS Business Unit at Exyte Hargreaves and elected CIBSE Board member





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The finalists for the 2023 Building Performance Awards have been announced, with 14 high-calibre shortlists selected last month. Alex Smith sat in on judging day

THROUGH TO THE FINAL

The record number of entries for the 2023 Building Performance Awards gave this year's judges an unenviable task – identifying the best in class across 15 award categories. (see page 26 for the full list of finalists).

Bearing in mind the entries were for projects and initiatives that took place during the period of Covid from 2020-21, the number of submissions was particularly impressive.

Expert judges from across the building services sector were led by chair of the judges Dr Hywel Davies. With the passing of the Building Safety Act this year, CIBSE was keen that entrants should explain how they were going to ensure projects, products and processes meet the requirements of the act.

The award for Building Performance Consultancy of the Year was split into three categories to represent the difference in scale of companies operating in the industry.

In the Building Performance Consultancy of the Year category for firms with up to 50 employees, the judges saw an 'incredible focus' on net zero carbon and were very impressed by actions to reduce carbon in firms' own operations. They noted extremely good progress on equality, diversity, and inclusion (EDI) by shortlisted firms.

However, some responses suggested that consultants'

offers of post-occupancy evaluations and assistance with commissioning are not always taken up by clients. The judges thought consultants might push clients harder in this direction to ensure good performance in operation.

In the category for companies with 51-300 employees, the judges found that entries were comprehensively completed and they were impressed by how questions around EDI were 'considerably more robust' than previous years' entries.

They were keen to highlight the high proportion of projects that had completed post-occupancy evaluation, and praised the commitment to a wide range of knowledge-sharing initiatives, both internal and external.

Judges for the over-300 employee category also saw clear evidence that EDI had risen significantly up the agenda. Shortlisted companies were also showing industry leadership qualities and helping define future policy and best practice. They 'talk the talk and walk the walk by demonstrating evidence of improvements to buildings they occupy', the judges said.

There was a diverse range of entries in the Project of the Year category, which has been split into two awards, for non-domestic and

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"The shortlisted engineers [of the year] were natural collaborators, who saw this approach as essential to solving future challenges"

domestic buildings. The judges said comprehensive post-occupancy evaluation, monitoring, and engagement with feedback were consistent themes in the strongest entries.

This is the second year that entrants have had to complete a standardised data form, designed to allow judges to compare buildings' performance and, in particular, their energy use intensity.

The design of the data entry forms has been adopted by the Net Zero Carbon Buildings Standard group, which is calling for buildings owners to send in performance data so benchmarks for different sectors can be determined (see page 20).

In the keenly fought Engineer of the Year category, the judges said the finalists' breadth of experience and knowledge was outstanding. They added that the shortlisted engineers were natural collaborators who saw this approach as essential to solving future challenges.

The Best Digital Innovation Award is new for 2023, and the judges had the difficult task of drawing up a shortlist from dozens of entries. They said the breadth of topics across the digital engineering space was amazing, and entries covering existing buildings, embodied carbon metrics and remediation were prevalent.

Reflecting on the challenge of cutting carbon over a building's lifetime, there are two Embodied Carbon Awards. In the manufacturers and suppliers category, judges remarked on good-quality entries, covering a wide range of products, and saw evidence of engagement throughout manufacture and supply chains. They noted a clear trend on the uptake of environmental product declarations by manufacturers and the consideration of the whole life impact of products.

In the Embodied Carbon award for consultants, the judges saw more integration of embodied carbon of building services in projects. They judged a wide variety of entries from calculations methodologies, the development of technical guidance, and policies.

For the Collaboration Award, the judges said they were looking for 'unique multidisciplinary cohesion', not just business as usual. They added that the entries, which showed a strong focus on climate change, should be commended for demonstrating collaboration during Covid, when face-to-face contact and group meetings were severely limited.

There was also clear evidence that collaboration had led to entrepreneurial and innovative engineering solutions.

In the Facilities Management Award, the judges saw strong use of analytics and said every entry demonstrated that repair, maintenance and improvement projects can proceed in occupied buildings, proving that this is not a significant barrier to reducing carbon emissions in the existing building stock.

However, they would have liked to have seen more evidence of feedback loops, with corrective actions and application of lessons learned.

There was a wide range of entries in the Learning and Development Award, spanning infection control to virtual environment and graduate training programmes. The judges said the entries demonstrated that at least some sections of the industry were addressing challenges around climate change and fire safety, and welcomed entrants' efforts to address the critical shortfall in skills.

There are three product or innovation categories at the 2023 awards: thermal comfort, wellbeing and air quality.

Judges described a wonderfully varied and diverse range of entries in the thermal comfort category, and that they were of a high standard. They were pleased to see reinventions of existing products demonstrate the possibilities of thinking outside the box.

For the air quality award, the judges commented on the high standard of technical content in the entries, demonstrating 'excellent levels of R&D'. They also saw a trend for entries embracing cloud computing to optimise maintenance and indoor air quality.

The award winners will be announced on 1 March 2023 at the Park Plaza Westminster Bridge. To book a table for the event, visit www.cibse.org/bpa

THE JUDGES

Mel Allwood, director, sustainable buildings, Arup
Will Arnold, head of climate action, Institution of Structural Engineers

Jan Artemenko, associate, Stantec UK

Jon Belfield, managing director, InTandem Systems

Nick Buckingham, UK managing director, Colt International

Emma Bushell, senior sustainability manager, Southern Housing Group

Carl Collins, head of digital engineering, CIBSE

Darren Coppins, director Built Physics

Hywel Davies, technical director, CIBSE

Kathryn Donald, partner, Max Fordham

Sally Godber, director, Peter Warm

Julie Godefroy, head of sustainability, CIBSE

Joanna Harris, hard FM ambassador, UK&I, Sodexo

Mina Hasman, sustainability director, SOM

Jeff House, external affairs and policy director, Baxi Heating

Aidan Kelly, senior mechanical engineer, XCO2

Lucinda Lay, associate director, CBRE

Laura Mansel-Thomas, senior partner, Ingleton Wood

Anastasia Mylona, head of research, CIBSE

Helen Newman, head of sustainable finance, CBRE

Ted Pilbeam, building services and sustainability director, Volker Fitzpatrick

Michael Powers, director, Clancy Consulting

Craig Robertson, head of sustainability, AHMM

Jon Saltmarsh, deputy director engineering and research, BEIS

Fabrizio Varriale, place and space analyst, RICS



CIBSE BUILDING PERFORMANCE AWARDS 2023

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BEST DIGITAL INNOVATION

- A new modelling approach - Electrical & Mechanical Services Department, HKSARG
- Clarence - Remote Watering Monitoring Box - Angel Guard
- Cloud-Based Smart Energy Management Platform (CBSEMP) - Swire Properties
- Digital Twins for Net Zero Roadmaps - IES
- Intellect - Skanska
- Net Zero Carbon Pathways App - Mott Macdonald
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- Elementa Consulting
- Hoare Lea
- Pick Everard

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- Arup
- BuroHappold Engineering
- Elementa Consulting
- Mott Macdonald
- Rebelleon

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- NorDan UK
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- BMS Support & Energy Initiatives - IO Controls
- HMRC National Office Relocation Programme - AECOM
- Gallions Quarter - FairHeat
- Working closely together to deliver whole house energy system domestic retrofits that significantly reduce carbon emission, help reduce fuel poverty and provide better built environments - Low Carbon Built Environment Team, Welsh School of Architecture, Cardiff University
- Savills Central London, Smart & Econowise Sentinil 99 Gresham Street Collaboration - Savills
- The Welcome Building, RHS Garden Bridgewater - BAM Services Engineering (BAM Construction)

ENGINEER OF THE YEAR

Sponsor: Ideal Heating Commercial

- Graeme Brady, Engineering Manager - NG Bailey
- Mary-Ann Clarke, Regional Director - AECOM
- Michelle Agha-Hossein, Senior Sustainability Consultant - Buro Happold
- Philip Draper, Managing Director - Twenty One Engineering
- Stephen Hill, Associate Director in the Buildings Sustainability Team - Arup

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- Exchange House - British Land
- Hong Kong Hospital Authority
- Savills Portfolio - Smart Managed Solutions

LEARNING AND DEVELOPMENT

Sponsor: Sfs - Smoke & Fire Safety

- Airborne Infection Reduction through Building Operation and Design (AIRBODS) - Loughborough University
- 'Build Better Now' COP26 Virtual Pavilion - AECOM
- BEMS (Building Energy Management Systems) Controls Engineer Apprenticeship - Building Controls Employer Group
- Fairheat Industry Research & Development - FairHeat
- Net Zero Carbon Training - AECOM
- Transition Programme to be a Fire Engineer - Arup
- University of Salford Energy House 2.0 - AECOM

PRODUCT OR INNOVATION OF THE YEAR - AIR QUALITY

- AirScore - AirRated
- Aurabeat NSP-X1 AG+ Sanitizing Air Purifier - Aurabeat Technology
- Demand Logic IAQ Cause & Effect - Demand Logic
- Healthy Air 800 (HA800) - Healthy air technology
- HVR Zero - Hybrid Ventilation with Heat Recovery - Monodraught
- Smart Filtration Management - ARM Environments

PRODUCT OR INNOVATION OF THE YEAR - THERMAL COMFORT

- Hybrid Ventilation Methodology - BDP
- iAirDoor - Wirth Research
- ICON Connected Heat Interface Unit (HIU) - Switch2
- MTA Plus TWIN - Modutherm
- Omni Systems - Omni Telemetry Systems
- POD - Ideal heating

PRODUCT OR INNOVATION OF THE YEAR - WELLBEING

Sponsor: Tamlite Lighting

- Clarence - Remote Water Monitoring Box - Angel Guard
- Daikin VRV 5 Heat Recovery - Daikin UK
- Modulhaus - VOLUMETRIC™

PROJECT OF THE YEAR (Non-Domestic)

- Chobham Manor - LLDC
- Cranmer Road, Kings College Cambridge - Max Fordham LLP
- Harris Academy, Sutton - BDP
- The ESB Offices Fitzwilliam Street - BDP

PROJECT OF THE YEAR (Domestic)

- Brambles – bere:architects
- Shepherds Barn - LEAP
- Mews House Deep Retrofit - Prewett Bizley Architects
- Whole house energy retrofit of 6 terraced bungalows in Swansea driving towards zero carbon targets - Cardiff University

AN INSPIRING YEAR

CIBSE President **Kevin Mitchell** launched five challenges to mark the Institution's 125th anniversary: celebrate, inspire, boost, share and engage. We spoke to Kevin and four others who did exactly that, and asked them about their 2022



Tim Dwyer
FCIBSE,
CIBSE Journal
technical
editor and
winner of a
CIBSE Gold
Medal in 2022

What is your 2022 highlight?

One of the great joys and privileges of my 40 years as a building services engineering lecturer has been to witness the progress of former students who, in many cases, become lifelong friends.

A particular highlight this year was to celebrate the election of Kevin Mitchell as CIBSE President – a graduate from the MSc class of 1996 – a friend and technical confidant, who demonstrates his technical, practical and leadership excellence guided by his questioning and compassionate personality.

Who or what inspired you?

I have been fortunate enough to benefit each and every year, for more than 25 years, from the inspiring presentations at the CIBSE ASHRAE Graduate of the Year. No matter how wearied one might be of popular culture, or uncertain of today's educational practices, the talent, enthusiasm and erudition of this year's young engineers again quelled any concern, and

shone a beacon on the well-informed, creative, emerging talent that will lead the industry towards sustainable, net zero built environments.

What lessons learnt have you 'passed on' in 2022?

My life is filled with justifications for continued learning, research, creation, dissemination and communication.

Whether it be developing a new course of study, preparing a lecture, writing an article, scrutinising a technical conundrum, or designing a presentation, I recognise that a holistic approach nurtures success and that simplicity and concision will yield the most effective solution.

So, in 2022, I have learnt – and freely shared with others – that, in many of life's endeavours, the most fulfilling and worthwhile achievement will stem from embracing the KISS principle: keep it simple, stupid.



Sana Hafsa,
sustainability
coordinator
at AESG and
CIBSE ASHRAE
Graduate
of the Year
2022

What is your 2022 highlight?

The six-month long Expo in Dubai was a huge inspiration. It facilitated global connectivity and exemplified the marvels we are capable of when we come together. It involved countless events and talks facilitating the exchange of knowledge and ideas.

The pavilions of each country were innovative in themselves: biophilic design and sprays for cooling; using 100% locally sourced material for construction; embedding spaces below ground to reduce cooling loads; a closed-loop farm generating energy, water and food... the list goes on!

With my company, AESG, I have worked on Well certifications that support developing healthier buildings with a focus on wellbeing



of the users. The ability to impact the users directly, along with implementing energy or water performance-related improvements, has felt highly rewarding.

What inspired you in 2022?

The CIBSE ASHRAE Young Engineers Awards in London was definitely inspirational, as it allowed me to have interesting conversations with numerous significant individuals in the industry. These connections have become a source of opportunity and growth for my career. This was also the year I graduated and completed a year-long MEP design project and a dissertation about PVs!

What lessons learnt have you 'passed on' in 2022?

To keep the inspiration alive, which can happen in two ways: ensure people are always challenged in their work environment, and provide reminders of the end goal. With inspiration comes a higher quality of work, which increases its impact, especially if we share our stories.

Who or what inspired you?

I have been inspired by members and their willingness to get involved in the 125 challenges and share their stories about their route into the industry. I've been particularly impressed by the stories from people who have taken an alternative path into building services engineering.

What lessons learnt have you 'passed on'?

After six months of my presidency, I've learnt that time goes very quickly and it's important to make every day count. For me, this year has reinforced the importance of paying forward; it's something we can all do, including those new to engineering. Be confident that you have something to contribute and share. It's hugely rewarding for both parties, even if you do feel out of your comfort zone.



Dr Anastasia Mylona, head of research at CIBSE and co-author of TM65
What is your 2022 highlight?

One of the highlights has been the success of the embodied carbon in building services guidance series, developed by CIBSE with Elementa Consulting and Integral Group. When we started, we were not sure what the outcome would be and how it would be received by the industry.

There was a clear gap in knowledge, where the embodied carbon of building services was misrepresented in whole life assessments because of the lack of data, but such a gap could only be filled with access to manufacturers' data and with industry buy-in.

Who or what inspired you?

It was inspirational to see experts, industry professionals and manufacturers volunteer time, knowledge and data to create an industry-wide methodology and suitable embodied carbon data for building services. After the publication of the TM65 methodology, we saw significant

sectoral and international interest to produce embodied carbon data for different building applications and regions. With such interest, the TM65 series is looking to grow considerably.

What lessons learnt have you 'passed on'?

Sometimes it is important to take the first step towards producing knowledge in an area for which we haven't got all the answers yet. Once the gap is identified and the first steps taken, it is only a matter of time before industry and policy adopt the new knowledge and bring it forward. It is the role of professional institutions to take such risks.



Farah Naz FCIBSE, Middle East Innovation & ESG lead at Aecom, and chair of CIBSE UAE

What is your 2022 highlight?

The visit of Ruth Carter and Kevin Mitchell to the UAE. It showcased CIBSE's commitment to this region and the members.

CIBSE UAE held its Annual Awards at the Armani Hotel in the Burj Khalifa, which were attended by more than 200 people. Past chair and membership officer Reid Donovan, and vice-chair Imran Shaikh won CIBSE UAE Bronze Medals.

On a personal note, I won the Sustainability Leader of the Year award, nominated as Zayed the Inspire, and was recognised by CIBSE President Kevin Mitchell for my services to the Institute. This was a great honour and I am humbled.

Who or what inspired you?

The CIBSE Yen members in the UAE region; the work they are doing for the younger generation is fantastic!

What lessons learnt have you 'passed on'?

Think global, act local. We have the power to create the blueprint for an equitable, sustainable and liveable future. Every day we go to work, we deliver solutions that transform our cities and communities for the better.



Kevin Mitchell, CIBSE President
What is your 2022 highlight?

The response from CIBSE members, staff and other engineering institutions to the CIBSE 125 challenges we laid out when I became President. I was amazed when IET and IMechE stood up at the Presidential inauguration and said they were behind this. As a result, we are having more discussions with other institutions. I was really pleased with the response from ASHRAE when I visited Toronto.

The strength of the relationship is great and the level of collaboration between us is fantastic. Visiting CIBSE UAE was also a highlight; so many events were laid on for me. Everywhere I've visited I've seen the high regard there is for CIBSE and that's down to Members and staff over a sustained period of time.



MOVING TOGETHER

The internet of things, energy efficiency and post-Covid building use were key themes at the Lift & Escalator Technologies Symposium, which returned as an in-person event. **Richard Peters FCIBSE** reports

Looking back at the 2022 Lift & Escalator Technologies Symposium, I don't think I recall seeing so many smiling faces at a lift conference. Post-pandemic, we all really appreciated the chance to meet in person again.

Old friendships were renewed and new ones formed, and – not forgetting the purpose of the symposium – we were presented with the latest industry research and developments from around the globe.

It is an exciting time to be in the sector and there are many new innovations; events such as the Lift & Escalator Symposium give us an excellent overview of what is 'coming soon'.

This year, over the two days, we had 26 papers and a panel discussion, making it a packed and fast-moving programme. The 15-minute time slot for each speaker encouraged everyone to focus on the key innovations, leaving the written paper to speak to the details.

This format was popular with delegates; even the most committed conference delegate would prefer not to have a line-by-line exposition on the derivation of equations for traffic analysis, something I have been guilty of in the past!

In case of a recurrence of the pandemic, the event was planned to be hybrid, allowing people to join online or in person. The technicalities of running a Zoom call in a conference room are complex, but the technology worked, including conversations between online speakers and delegates in the room.

The conference was opened by Stefan Kaczmarczyk, who also chaired the first session on *Engineering and energy*. Matthew Appleby talked about the *Generation and application of dynamic kinematics* (without using any equations!) and Gabriela Roivainen addressed *Dynamic simulations for lift health diagnosis*.

Jaakko Kalliomaki took us back in time with his paper *1927 – the year that set the direction of traction lift engineering for a century*. Adam

Scott and I both addressed energy, Scott with his paper *Energy-efficient buildings – Assessing the impact of lifts and escalators*, while I spoke about *Lift energy modelling for green building design*. The need for our industry to consider the environmental impact of our design choices was one of the recurring themes at the conference.

Session 2 was titled *IoT and Technology*, chaired by Philip Hoffer. Kenneth Ong, Paul Clements and Michele Guidotti all spoke on the internet of things (IoT), which was another recurring theme of the conference.

Ong's paper was titled *Setting standards on remote monitoring and diagnostic for lifts – a Singapore context*, Clements' was *Exploring IoT applications for vertical transportation (VT) to tackle challenges in a modern world*, and Guidotti's was *Lift IoT: Turning sensor data into value*.

Miguel Castro reminded us about the importance of building information modelling (BIM) with his paper *Lift industry and BIM: a long overdue adopted and typically overlooked project enabler*.

Session 3, *Traffic analysis and dispatching*, was chaired by Graham Barker. For those of us heavily engaged in this topic, the symposium is where we pore over every paper and then discuss them enthusiastically in groups during the breaks; there was plenty to discuss in 2022.

Lutfi Al-Sharif presented on *Enhancing the I-S-P method (inverse stops-passengers) using the Monte Carlo Simulation method*, and Jonathan Beebe on *Global dispatcher interface – initial prototype design*. Aitor Arrieta discussed *Design-Operation continuum methods for traffic master*, Diana Andrei addressed *Impact of the load-area bypass feature on passenger service level*, and, finally, Gina Barney



Attendees at the 13th Lift & Escalator Technologies Symposium

spoke to the *Rated load and maximum available car area – A proposal to revise EN81-20, table 6*.

Session 4, the final one of the first day, was titled *Maintenance* and was chaired by Nick Mellor. It picked up the IoT theme and related technologies in the context of maintenance and repair. Kaczmarczyk presented *Vibration signature and the application of intelligent pattern recognition in detection and classification of damage in automatic power-operated lift doors*, while Matti Lin spoke on *System simulation for fault analysis of lift doors*, and Rory Smith on *The effect of artificial intelligence on service operations and service personnel*.

Day two started with me chairing Session 5, *Planning & Design*. It began with invited speaker Marja-Liisa Siikonen presenting an overview of her new book, *People flow in buildings*. This major piece of work shares much of Siikonen's extensive experience and is available on Amazon.

"The need for our industry to consider the environmental impact of our designs was a recurring theme of the conference"



We then had papers from Janne Sorsa, on *New evidence on lift passenger demand in high-rise office buildings*, Kasinadh Karra, on the *Component-based modular elevator*, and Phil Pearson on *The technical challenges involved in lifting 40-tonne trucks using rigid-chain technology in a confined space*.

A highlight for many was Session 6, a panel discussion, chaired by Adam Scott titled *Post-Covid: the impact on building and vertical transportation design*. Neil Pennell gave us the thinking behind the British Council for Offices' recent position paper as it seeks to reflect on the changing use of offices following the pandemic. More insights were provided by the other panellists – Len Halsey, Rory Smith and Jochem Wit – as they considered the implications of the pandemic on current requirements, and the uncertainty of what will happen in the future.

The final session was chaired by David Cooper and titled *Safety*. Daniel Meekin spoke on *Investigation into the closing force of passenger/goods lift automatic power-operated doors and recommendations to reduce the risk of injury to lift users*, and Mateusz Gizicki on *The investigation of efficacy and fire propagation thwarting characteristics of a fire barrier in the lift industry applications*. Returning to the IoT theme, Andrew Gorin spoke on *IoT safety predictive monitoring of lift operations, shafts and buildings*. Finally, there were papers from Qingping Guo, on *Disinfection efficacy analysis of an ultraviolet-C (UVC) device for escalator handrails*, and Nick Mellor, on *Challenges to drafting a standard for the evacuation of disabled people using lifts*.

I and co-chair Kaczmarczyk closed the event by thanking the Lift & Escalator Symposium Trust trustees, scientific committee, speakers and delegates for their efforts in making the event so successful. The full proceedings are available to download from www.liftsymposium.org. Papers and videos will also be added to www.liftescalatorlibrary.org, the charity's fast-growing library of lift (elevator) and escalator technology research papers and documents.

The 14th Lift & Escalator Technologies Symposium will take place on 20-21 September 2023. Speakers are invited to submit abstracts at www.liftsymposium.org.

RICHARD PETERS FCIBSE is a director of Peters Research and a visiting professor at the University of Northampton



Delegates listen to Nick Mellor's presentation

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CLEARER COMPARISONS

A new methodology for calculating embodied carbon in façade systems aims to ensure life-cycle assessments are consistent and can be compared with industry benchmarks. CWCT's **Teni Ladipo** and **David Metcalfe** explain

In June 2022, the Centre for Window and Cladding Technology (CWCT) announced that it had established a dedicated sustainability workstream of contractors and consultants to write an embodied carbon calculation methodology for façades.

In September 2022, the first issue of this methodology, *How to calculate embodied carbon of façades: A methodology*¹, was published for design and construction professionals.

This guidance, developed through collaboration with industry experts and a rigorous peer-review process, is a vital document. It provides a consistent embodied carbon methodology to allow for a better and more accurate understanding of the environmental impact of façades, comparative option studies, quantification of improvements, and target setting. The process overview can be seen in Figure 1.

The methodology required interpretation of existing European standards BS EN 15978 and BS EN 15804, to ensure principles on the assessment of the environmental impacts of buildings within these standards are applicable to the complexities associated with façade assessments.

It is anticipated that the results of assessments undertaken using the CWCT's methodology will feed into broader, project-wide whole life carbon assessments, so it was also important that the document aligned with widely referenced industry guides created for other building elements, to provide a degree of consistency.

While alignment and interpretation of existing standards was important, there were additional considerations that the CWCT's methodology had to include to capture the level of detail and approach required for an accurate façade life-cycle assessment (LCA). These included:

Scope: The methodology concerns the assessment of façade systems, commonly referred to as external walls or part of a building envelope. All components in a complete façade system assembly required to meet the functional, technical and aesthetic performance of the façade must be considered in a LCA.

Life-cycle stages and modules: As many life-cycle modules as possible must be considered in façade



More than 3,500m² of façade panels were dismantled and refurbished during the revamp of Triton Square

LCAs. However, considering the significance of certain modules over others when assessing façades, the CWCT guide defines that life-cycle modules for product [A1-A3], construction [A4-A5], replacement [B4] and end-of-life [C1-C4] must be in the assessments as a minimum.

Assessment approach:

At the early stages of a design, there is greater uncertainty about quantities and sourcing of materials and components. To address this, three approaches are defined to guide how embodied carbon can be assessed while addressing information gaps and limitations at time of assessment (see panel, 'Approaches to assessing embodied carbon in early design stages').

Offsite emissions: Façade system assembly and wastage can occur on and off site. This may be the result of the type of façade system and complexity of the supply chain required to fabricate and assemble the façade. Product stage offsite emission factors are included within the guide to allow required offsite emissions associated with producing a façade to be accounted for if applicable.

Uncertainties: A 'carbon calculation scale-up factor' is strongly recommended to account for potential underestimation because of various uncertainties that are more prevalent in early design stages – for example, unconfirmed supply chain and bespoke elements. The magnitude of the carbon calculation scale-up factor may be reduced through the design process to reflect changes in the level of uncertainty. This factor is a separate parameter from a material uplift factor.

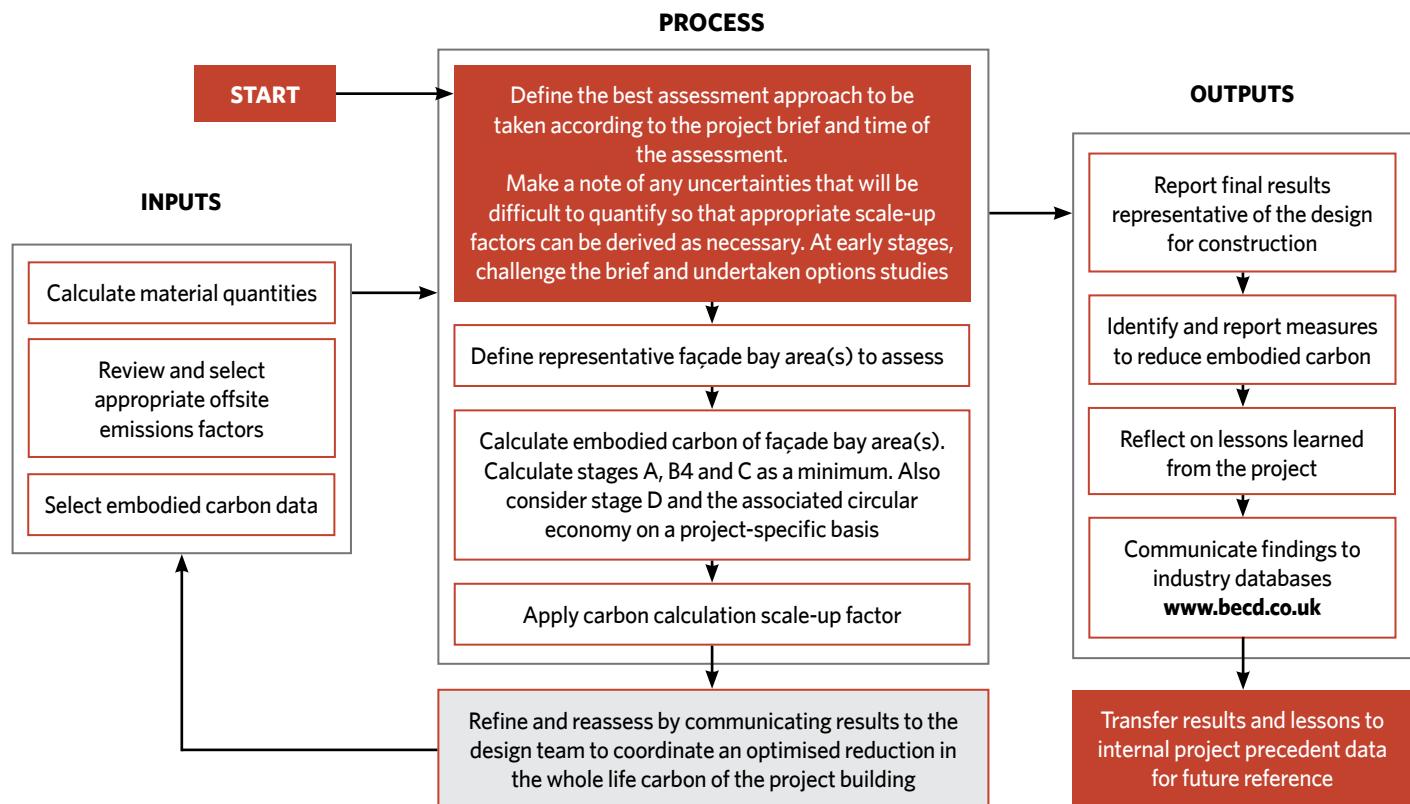


Figure 1: Calculating façade embodied carbon process overview (adapted from IStructE's *How to calculate embodied carbon*)²

» During the methodology peer-review process, revisiting the initial case study discussed in 'Facing up to embodied carbon in façades', *CIBSE Journal*, July 2022, was an important exercise to assess how consistency had improved in façade LCAs now using the methodology.

The original case study façade was used. However, participants calculating its embodied carbon were not part of the workstream writing the document. This enabled more feedback to be gathered on use and understanding of the guide.

Preliminary case study results are promising. Results using the methodology resulted in 4% covariance for the total embodied carbon compared with 28% covariance in total embodied carbon in the initial assessment.

Another takeaway from the revisited case study was that all life-cycle modules considered in the minimum scope of a façade LCA within the methodology were calculated consistently. This was not the case in the original case study, where some modules were not calculated because of an unclear understanding of the approach, or, if calculated, the methodology to do so varied.

This is a known factor contributing to low confidence in industry-wide reported results.

Although the methodology is now available, the work is not over. The CWCT has recognised that there are various limitations and the guidance needs to be updated to reflect the latest knowledge and experience. Such limitations have been highlighted, and will be reviewed when supporting data becomes available.

The CWCT continues to welcome comments on the methodology and intends to provide support to upskill users of the document (see panel, 'Future plans for methodology').

The CWCT embodied carbon methodology is free to download for CWCT Members from the Cladding Forum

and available to non-members to purchase. Find out more at: bit.ly/CJNov22Fac. Email comments to sustainability@cwct.co.uk.

■ **TENI LADIPO** is senior façade consultant at BuroHappold and sustainability engineer at CWCT; **DAVID METCALFE** is a director at CWCT.

References:

- 1 Centre for Window and Cladding Technology (CWCT), *How to calculate embodied carbon of façades: A methodology Issue 01*. Bath, UK: CWCT, 2022.
- 2 *How to calculate embodied carbon (2nd edition)*. London : IStructE, 2022.

APPROACHES TO ASSESSING EMBODIED CARBON IN EARLY DESIGN STAGES

Precedent studies: an approach that entails a review of precedent studies during RIBA Stage 0-2 to estimate the likely range of embodied carbon.

Simplified: a simplified approach during RIBA Stages 2-3 that entails use of early-stage quantity data and project assumptions. Material uplift factors are applied to account for quantity uncertainties to estimate the embodied carbon.

Full: a full approach during RIBA Stages 4-5, where the accuracy of quantities and project data is expected to be more refined, to allow for more detailed calculations. Full material take-off is carried out with no material uplift factors applied.

FUTURE PLANS FOR METHODOLOGY

- Reference values for a range of carbon calculation scale-up factors to address different types of uncertainties in assessments
- Further guidance on the assessment approach to module D in coordination with the CWCT's EPD Workstream guidance
- Additional product-specific guidance (in addition to the glazing guidance provided) for selecting embodied carbon factors for use during early design stages and in the absence of project-specific data
- Additional emission factors identified as necessary for assessments – and, as more data becomes available, refinement of existing factors
- Reference façade-specific embodied carbon factors from open-source databases
- Guidance dedicated to assessing existing façade systems.

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"Heat pumps have constraints and people are now realising that there's a heat pump for each situation. It's not one size fits all" – Wayne Early

THE DEFAULT SOLUTION

While heat pumps are becoming more common in many building sectors, there are still issues to overcome before they become mainstream in the UK. **Amanda Birch** reports on *CIBSE Journal's* latest roundtable, which considers the benefits and barriers of widespread adoption of heat pumps in commercial buildings

The main message from participants at *CIBSE Journal's* latest roundtable was that better education and skills, as well as early collaboration, are crucial if a more efficient integration of heat pumps into commercial buildings is to be achieved.

The event, which focused on what motivates commercial landlords to invest in heat pumps, was sponsored by Ideal Heating Commercial and held at the Building Centre in London.

While heat pumps are becoming mainstream in new commercial office projects, and in some refurbishment schemes, it was agreed that there are issues around the technology that still need to be resolved.

The roundtable debated the challenges of moving from gas

to heat pumps, while issues such as refrigerant leakage, whole life-cycle carbon, acoustics, storage, and the difficulties of installing heat pump systems in office refurbishments were also discussed.

Scott Crease, director and partner at Max Fordham, said heat pumps are now the default solution for their new commercial projects. Yet, compared with boilers, he added, heat pumps are more refined and therefore more challenging to get right for a building.

Wayne Early, director at Buro Happold agreed, and said that moving from gas and combined heat and power to heat pumps has been a major re-education for engineers. Heat pumps have constraints and people are now realising that there's a heat pump for each situation,' Early said. 'It's not one size fits all; different refrigerants operate at different temperatures, and there are different solutions that need to be considered.

'The system performance, how that performance is met, and what



"Clients need to be made aware of hidden costs. Power supply may have to be upgraded to accommodate heat pump technology and that's not cheap" – Teeba Almunshi

"We've seen an uplift in heat pump demand, but people are holding off. There's also a gap between what we're seeing in the north versus London" – Chris Caton



heat pump technology is best placed to do it all need to be considered. The application is always important.'

The participants agreed that a shift in legislation – including the new London Plan, the most recent changes to Building Regulation Part L (conservation of fuel and power), and energy targets – have all contributed to the take-up of air-to-air and water-based heat pumps.

Vince Ruane, director at RCDC, said his experience of switching to heat pumps has largely been driven by client requirements. RCDC's public sector projects have specific climate emergency action plans that are taking them down an all-electric route, he added.

One consideration with heat pump systems is refrigerant leakage. Crease referred to Max Fordham's Belgrave Road project, which is the first in the UK to achieve a 5.5-star National Australian Built Environment Rating System (Nabers) design-reviewed target rating

for building efficiency. He said they have done several whole life carbon assessments and the perceived contribution of a refrigerant in the system was approximately 20% of the total building services. They had assumed about 6% loss over the lifetime of the refrigerant charge.

Graham Wright, past chair of the Heat Pump Association (HPA), downplayed the focus on leakage rates. He said data from other countries has suggested a leakage rate of around 1.5% to 2%. He added that life-cycle, the energy used during the operational life of equipment, and energy saving should be the focus, especially while the industry is in a transition period.

'The bit at the beginning, when considering the materials and where all the equipment is coming from, is tiny in comparison to running that machine over 20 years,' said Wright. He added that the HPA has asked the Department for Environment, Food and Rural Affairs for data logbooks for every air conditioning and refrigeration system to record how much refrigerant is being used, but this hasn't been taken up.

Phil Draper, managing director at Twenty One Engineering, agreed with Wright that too much attention is paid to leakage rates. He said the CIBSE HVAC Systems Group, of which he is

»

THE PANEL

Teeba Almunshi, director at mstep

Richard Brown, head of specification sales at Ideal Heating

Chris Caton, product director – commercial at Groupe Atlantic UK, ROI & NA

Scott Crease, director and partner at Max Fordham

Phil Draper, managing director at Twenty One Engineering

Wayne Early, director at Buro Happold

Akos Revesz, senior research fellow at London South Bank University

Vince Ruane, director at RCDC

Graham Wright, past chair of the Heat Pump Association



"Training and skills are the biggest issues to overcome. There are about 70,000 engineers qualified in F-Gas refrigeration, but this needs to double" – Graham Wright

"Trying to sell a new system to clients is always difficult. Case studies and physical data give the industry confidence" – Scott Crease



» vice-chair, is looking at how to instigate changes in refrigeration loss and is teaming up with the CIBSE Facilities Management group to get key information from clients.

'I agree with Graham [Wright] that the only way [we know leakage rates] is with evidence, such as an F-Gas logbook,' said Draper.

The participants agreed that integrating heat pumps into new commercial buildings is more straightforward than installing them in refurbishment projects, for which Teeba Almunshi, director at mstep, said there are considerably more challenges.

'Refurb projects require extra planning permission, and we have big problems with cost, as the power supply has to be upgraded to accommodate the heat pump technology – and that's not cheap,' said Almunshi. 'Also, if you're getting lower temperatures, and it's a water-to-water system, the pipework and heat emitters have to be ripped out.'

Almunshi recommended that clients be made aware of the

hidden costs and of what achieving an efficient heat pump system entails, and argued that these discussions must take place early in the process.

Draper, who has worked on retrofit projects for British Land, including a groundbreaking air source heat pump system at 350 Euston Road, and Broadgate, said such projects were challenging in the past, but the situation has changed dramatically in the past two years.

'In 2013, putting a heat pump in a retrofit was unheard of, and to achieve a 95% gas saving with no electrical increase [at Euston Road] was a big achievement,' said Draper.

'With a recent retrofit project, we retained the heat emitters and used gas as a top-up. I recommend forging good relationships with heat pump manufacturers, as they keep abreast of the technology.'

Crease agreed that establishing relationships is vital. 'The relationship between consultants and manufacturers is very important for getting the right information about products,' he said. 'There is a right product and solution for a building, and the design support you get from the industry will make that project work.'

Richard Brown, head of specification sales at Ideal Heating, is an enthusiastic supporter of early collaboration between engineers and manufacturers. 'This is what I say to engineers – please get us involved as early as you can. We can help. [There needs to be] collaboration between engineers, end users, manufacturers, and contractors.'

Akos Revesz, senior research fellow at London South Bank University, asked the participants whether commercial landlords or building owners are aware of new heat network developments, and added that the university's research has involved describing the implications of connecting an individual air or water source heat pump to a new heat network.

'Buying a scheme can be a big barrier, with high capital costs and investment,' said Revesz. 'But a commercial landlord or owner can hire it out or just buy the heat. It's telling them the pros and cons of the different options and getting them on board with a new scheme, because they must decarbonise their buildings if they are committed to net zero by 2030.'

A key selling point for heat pumps is the ability to store electricity, which makes it more compelling to invest in the technology, Revesz added. Crease agreed, and said storage and flexible tariffs will be big game-changers. However, Revesz pointed out size is a big constraint

"I recommend forging good relationships with heat pump manufacturers as they keep abreast of the technology" – Phil Draper



with thermal storage and the challenges of finding space to store them.

Batteries were suggested as an alternative, although they aren't being used in commercial projects yet. As Ruane said, there is no real driver for commercial landlords to have batteries, as there is currently a higher tax on electricity than gas – which, he argued, should be flipped, especially as it's a decarbonisation tax.

In retrofit projects, Draper said he has found that electrical batteries are easier to fit than a thermal store because they are modular and can be placed externally or where they feed back into the Grid. But Almunshi added that, in smaller refurbishments, there isn't as much space to put in a thermal store or add in batteries.

The participants stressed the importance of having data from operational projects to promote and convince clients to adopt new heat pump technologies in their projects.

'Having case studies and physical data published about a system would give the industry confidence to use it. Trying to sell a new system to clients is always difficult,' said Crease. He suggested that the Nabers process could be the game-changer for solving this problem, as the rating scheme could create a feedback loop from the operation of a building. It is designed to close the performance gap, with buildings being peer reviewed and the design interrogated, and it delivers buildings that work, Crease added.

Draper agreed that Nabers is very helpful. 'One of the main successes of making the British Land heat pump projects work is their metering data, and Nabers is one of the key things you have to have,' he said.

Ideal Heating product director Chris Caton highlighted the knowledge disparities between London and the north of England. He has never heard consultants in the north talking about Nabers and other rating processes, he said, adding: 'There's a gap between what we're seeing in the north versus London.' Ideal had seen an uplift in heat pump specification, said Caton, but it believed people were holding off until building efficiency can be improved in line with the Building Regulations uplift, ultimately allowing heat pumps to operate efficiently.

Draper suggested it would be easier and cheaper to get heat pumps installed outside of London, given that there is more space for the equipment. Heat pumps need ventilation, and they can also be noisy, so the equipment can be located outside.



"This is what I say to engineers – please get us involved as early as you can. We can help. There needs to be collaboration" – Richard Brown

Early is also an advocate of Nabers and said that many clients now want it. 'Clients are becoming more educated about what they want and what they expect,' he said. 'The climate crisis has sunk in and we're seeing a sea change. We shouldn't be arguing about technology – it's about how best we apply it. It's part of a bigger solution, which is that we need to use less energy.'

There was a groundswell of opinion from the participants that a significant constraint to the widespread adoption of heat pumps is a lack of skilled professional installers. 'By having more trained people available that can do the refrigerant and handling side in one hit, the greater the uptake of the technology, and the costs of the kit should come down,' said Ruane.

Wright agreed, and said, 'Training and skills are the biggest issues to overcome. There are about 70,000 engineers qualified in F-Gas refrigeration, but this figure needs to be doubled.'

'We're currently in a transition period, which makes it tricky. The future is going to be different, and I predict that there will be a mosaic of different skills required.' CJ

"Buying a heat pump system can be a big barrier, with high capital costs and investment, but a commercial landlord can just buy the heat" – Akos Revesz



"By having more trained people available that can do the refrigerant and handling side in one hit, the greater the uptake of technology" – Vince Ruane





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Light where you need it

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Light pollution has soared in recent years, with a particular increase in blue light. Iain Macrae argues it's time to rethink external lighting

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Incorporating daylighting into the built environment and the guidance available

It turns out that light pollution is a more complicated problem than simply having too much light, or having it in inappropriate places. As Iain Macrae, former president of the Society of Light and Lighting, puts it: 'We have underestimated the total amount of light pollution and we have remained blind to how bad it really is.' (See page 50.)

As an energy-saving source, LEDs have proliferated, but the blue-wavelength light many emit has a negative impact on humans, animals and plants, as well as contributing to skyglow.

Lighting designers – already acutely aware of the need to reduce and control light levels in the exterior environment – are beginning to consider more radical solutions. A project in Copenhagen, which uses red light to illuminate a major highway and cycleway, may be the start of more lateral – and research-based – thinking (page 53).

Where interiors are concerned, the case for sustainability is increasingly about daylight. Two winners of a 2022 IALD Award of Excellence are new art galleries in China, and exemplars of a seamless amalgam of daylight and artificial light (page 48). In one scheme particularly, natural light drove the specification to minimise use of artificial light. 'An ode to daylight,' said one judge.

■ **Jill Entwistle**, editor of the CIBSE Journal Lighting Special

Lightening the load



Amid the ongoing energy crisis, we are all under pressure. The sad truth is, it could have a lasting impact on how firms operate for many years to come. Coupled with the growing urgency to decarbonise the built environment, such challenges are causing

business leaders, and those responsible for the operation of buildings, a huge headache.

The government has taken active steps to quell the stormy seas, but it has been made clear that such support cannot, and will not, last indefinitely.

We have seen ministers want to drive the right behaviours to reduce energy consumption and increase the implementation of energy efficiency measures. Surely this sends a clear message that businesses should use the next few months to focus on sustainable solutions that reduce energy demand and improve operational efficiency?

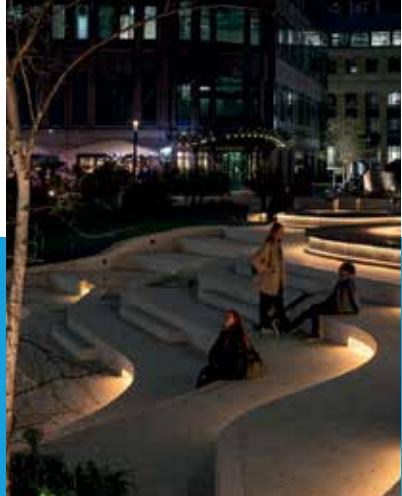
While innovative low carbon technologies could be seen as the key to improving energy

efficiency, they are an expense that many can't afford in the current economic state. Are too many overlooking the far simpler and more cost-effective solutions – such as replacing outdated lighting with modern LED systems – that could be vital in cutting energy bills?

There has never been a better time to review core building systems – of which lighting is one of the most fundamental – and implement measures that save energy, and reduce operational costs and carbon emissions, as part of wider sustainability efforts. No organisation can afford to pay the price of inaction when it comes to energy, and lighting is the perfect place to make positive changes.

■ **DEBBIE-SUE FARRELL**, head of wellbeing and marketing manager at Tamlite Lighting





New manifesto launched for lighting the night

Ten core principles for external illumination have been laid out in a new manifesto supported by the Society of Light and Lighting (SLL) and other groups from industry and academia.

Accompanied by an action plan, the manifesto for responsible outdoor lighting at night (Rolan) is designed to implement positive changes for a sustainable, healthier and safer environment. It states that everyone should have the right to access darkness and quality lighting, and light must be used and distributed without discrimination. A design should begin in darkness, and lighting should only be added if it supports nocturnal placemaking and protects a view of the stars.

The benefits of outdoor lighting at night to maximise safety are recognised and encouraged, if the designs adhere to the five principles of resource outdoor lighting.

If your lighting organisation would like to support the Rolan movement, please contact: k.zielinska-dabkowska@pg.edu.pl

Young lighters prepare for SLL final

The SLL Young Lighter of the Year awards celebrate talented individuals in the early stages of their lighting career. Open to all under the age of 30, the shortlist for this year's award has now been released.

Four entrants will deliver a 15-minute presentation on their projects in the final on 15 December. Each finalist gets a cash prize, with the winner being named SLL Young Lighter and receiving £1,000.

The finalists and their projects are:

- Anna Forrester: *Improving the circadian rhythms in children through the means of a lighting device*
- Scott Kluger: *Daylight harvester: A tool to enhance lighting operational performance*
- Hiba Mazhar: *Do we own the night? Reimagining traditional city lighting with a new light recipe to confiscate light pollution*
- Kenny Cliffe: *Adapting to the digital future (surveying)*

For more information on the awards, visit bit.ly/SLLawards2022

SLL launches new edition of Code for Lighting

The updated Code was launched at Build2Perform and, here, author Sophie Parry FSLL explains the main changes since the last edition

Since 1936, the Society of Light and Lighting (SLL) and its predecessors – the Lighting Division of the Chartered Institution of Building Services Engineers and the Illuminating Engineering Society (IES) – have published recommendations on lighting best practice. These recommendations, called Codes for Lighting, have contained details of the illuminances required for use in different applications, plus qualitative guidance on how to implement these recommendations.

For many years, the IES *Code for Interior Lighting* was the de facto standard for lighting provision in the UK. However, in 2002, the Committee for European Standardisation (CEN) took on the task of providing harmonised lighting recommendations and, as a result, there are now harmonised European Standards (BS EN series in the UK) that specify the quantitative lighting requirements for a wide range of applications.

Consequently, the role of the SLL *Code for Lighting* has changed from being the only source for quantitative lighting recommendations to being a guide on how to interpret the BS EN recommendations and how to apply them in practice.

Over the years, understanding of how lighting conditions can affect visual performance and, in some cases, cause visual discomfort, has increased. As a result, additional quantitative lighting criteria have been added, notably those concerned with minimum requirements for colour rendering and the limitation of discomfort glare.

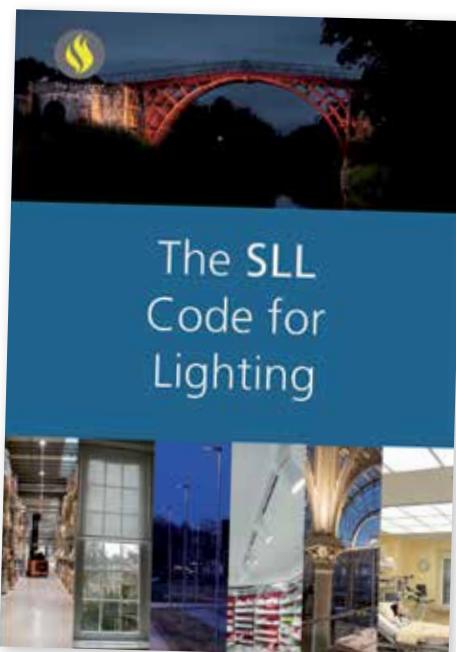
Since the previous edition of the Code was published in 2012, the most noticeable effects on lighting have been the rising dominance of the LED light source, and the developing subject of melanopic weighting and the non-visual effects of lighting. These advances are the stimulus for new thinking in surface and vertical illuminance metrics, the spectral content of LED light sources, and colour rendering. This edition of the SLL *Code for Lighting* includes:

- A summary of the effects of lighting on task performance, behaviour, safety, perception and health, as well as the financial and environmental costs.

- A compendium of all lighting recommendations relevant to the UK, with suggestions on how these should be interpreted. This covers recommendations for interior and external lighting in normal conditions.
- A detailed description of all the calculations required for codified quantitative lighting design. While most calculations are carried out using software tools based on the fundamental calculations found in this Code, it is difficult to assess the meaning and merit of the results produced by software without prior knowledge of these calculations.

The SLL Code's sister publication, the *SLL Lighting Handbook*, complements the *Code for Lighting* in that it is more aligned to project-based lighting design, technology and applications.

- This article was taken from the foreword of the Code, which is free to members at www.cibse.org/knowledge
- **SOPHIE PARRY** FSLL is head of Trilux UK Akademie



The Code was launched at Build2Perform

Guiding lights

SLL Lighting Guides for emergency and residential lighting have been updated this year, while a guide on lighting control rooms has been published for the first time.

Jill Entwistle summarises the key changes and introductions

Lighting Guide 12 (LG12): Emergency lighting

Advances in technology, plus changing legislation and BS EN standards, prompted the revision of *Lighting Guide 12: Emergency Lighting*, which had last been updated in 2015. According to author David Mooney, compliance with emergency lighting standards is lacking. 'My own company [Atkins] surveys a huge number of existing emergency lighting installations and it's rare that we don't discover issues with them,' says Mooney. 'Typically, they relate to installation defects, a lack of maintenance or incomplete documentation.'

Changes in the regulatory framework, including the new Building Safety Act, bring additional emphasis to the correct delivery of all building safety systems, including emergency lighting.

In terms of technology, emergency lighting is changing rapidly, with the introduction of LEDs, new battery types, automatic testing and monitoring systems, and wireless technology.

Where standards are concerned, the BSI issued a new version of BS EN 5266-1 in 2016, with radical changes in its guidance, such as the addition of emergency safety lighting.

The revised LG12 includes a fundamental change in emphasis, covering the delivery of emergency lighting installations rather than just technical principles. It seeks to clarify the type of emergency lighting, and the design and delivery approach, appropriate to the size and complexity of the project.

Emergency lighting isn't changing fundamentally, says Mooney, but it is



Designers must ensure that there is no glare or reflections on control room screens

going to become a more regulated area of building design and there will be a more formal method of demonstrating compliance. 'In the near future, it is likely that competency statements will need to be provided to clients by all building professionals on a project-by-project basis.'

Lighting Guide 9 (LG9): Lighting for communal residential buildings

The communal residential category covers a very wide range of building types and sizes, public and private – from the communal areas of houses divided into flats to a large residential home for the elderly. Five key changes have been made to the 2013 document:

- The wellbeing of residents has become a priority
- Dimming and controls form an integral part of a lighting scheme, and a much wider range of products is available. Compatibility between these and the luminaires specified is examined
- Emergency lighting starts with a risk assessment and identification of the responsible person. Each building must be considered individually, so it is no longer permissible to simply reproduce a template arrangement
- Daylight is important, both to maximise access to it for residents and to meet energy efficiency targets
- Energy efficiency standards have increased significantly and the document notes the changes in the 2021 Approved Documents of the Building Regulations Part L.

Lighting is key to the atmosphere of a room, and needs to be specified with the occupants in mind. Of fundamental importance to wellbeing, says the guide, is individual control over lighting, and a variety of luminaires and lighting methods

"Many control rooms operate 24 hours a day... and large spaces, particularly, have inherently complex visual and lighting issues"



for different spaces. A chapter of LG9 is devoted to discussing different lighting methods, with their pros and cons. Also addressed are the considerations for lighting external areas around communal residential buildings and the importance of maintenance.

'This document is not intended to be prescriptive or restrict innovative ideas,' says co-author Benedict Cadbury, 'but to provide sufficient information and guidance to allow readers to make informed choices.'

Lighting Guide 22 (LG22): Lighting for control rooms

From transport signalling and control suites in nuclear power stations or chemical plants, through to CCTV and security, control rooms are diverse in context and scale. What mainly characterises their function is the number and variety of display screens, and their various locations and angles to the users.

Whatever the context, the purpose of a control room is to clearly present information on the state of a system to the operators. Many rooms operate 24 hours a day, some monitoring and controlling safety-critical operations, and large spaces, particularly, have inherently complex visual and lighting issues.

LG22 examines the need to understand the geometry between operators, their screens and larger, remote room displays before the lighting can be designed. While ensuring absence of glare and reflection on screens, the lighting designer also needs to make sure there is adequate illumination on

The Building Safety Act means there is more emphasis on emergency lighting



Daylight is important for residential properties

information boards and tables where paper-based documentation may be in use.

Also covered is the control of daylight. Some rooms have windows to give occupants contact with the outside world, but in others they are essential, allowing the controller to see out over an external process plant or an airfield.

The guide has an extensive chapter describing different lighting techniques determined by the rooms and task characteristics. One frequently overlooked issue is the need to provide a constant minimum lighting level across the room and on surrounding walls, to ensure operators remain alert – especially crucial at night.

The use of full or partial standby lighting is also covered, given that some control rooms will be monitoring life- or safety-critical operations, emphasising that early discussion with the electrical designers about lighting loads and supply cable diversity is vital. **CJ**

All available from the CIBSE Knowledge Portal
cibse.org/knowledge

LATEST LIGHTING GUIDANCE

SLL Lighting Guide 12 (LG12): Emergency lighting

By David Mooney FSLL
bit.ly/CJNov22LG1

SLL Lighting Guide 9 (LG9): Lighting for communal residential buildings

By Nigel Monaghan FSLL and Benedict Cadbury FSLL
bit.ly/CJNov22LG2

SLL Lighting Guide 22 (LG22): Lighting for control rooms

By Paul Ruffles FSLL
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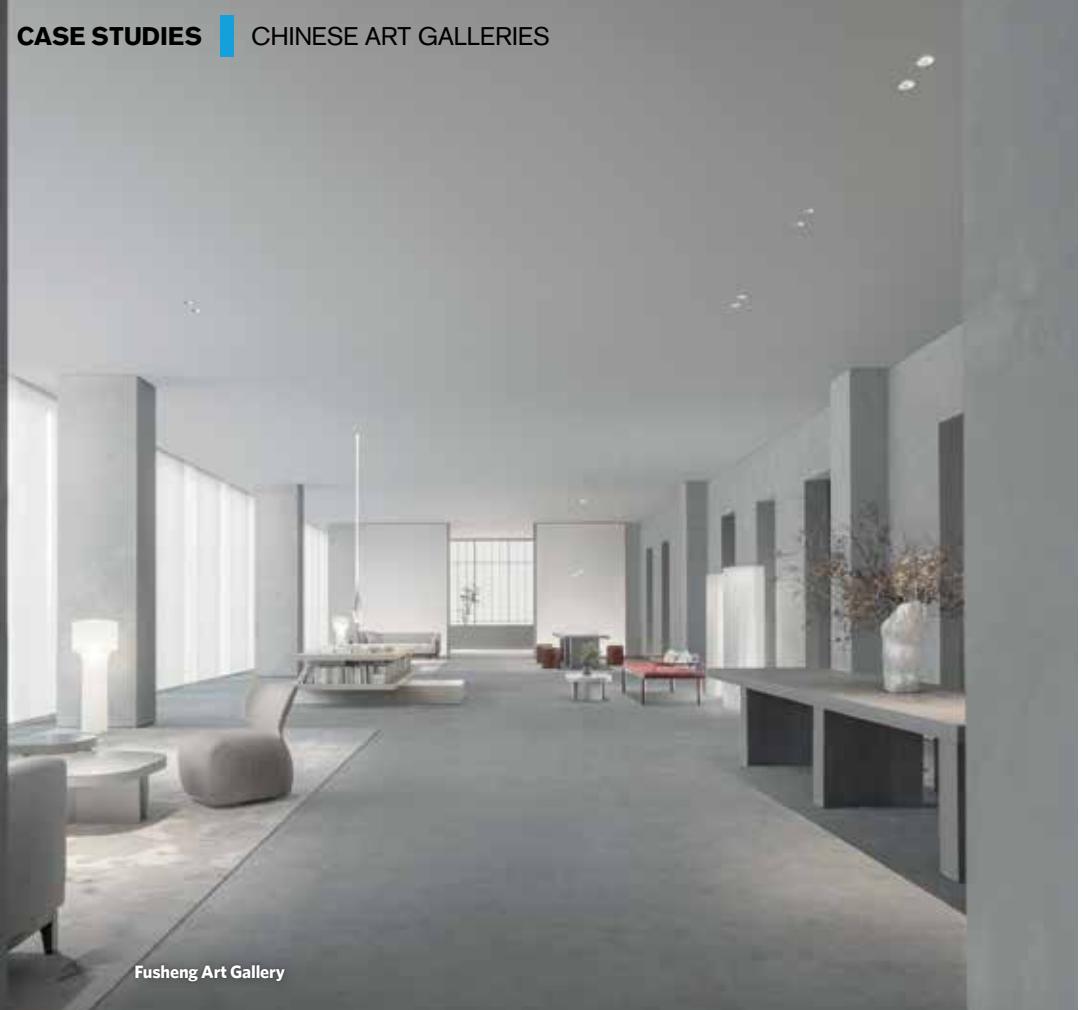
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Pure and simple

Two of this year's IALD Award of Excellence-winning schemes were new art galleries in China. Both are minimal, monochromatic spaces, and both are masterclasses in combining natural light with subtle white-light schemes to poetic effect

Fusheng Art Gallery, Wuhan, Hubei, China

The capital of Hubei province in central China, Wuhan was once known as 'the city of a hundred lakes'. Urbanisation has reduced this to 30 lakes, but the floating life theme persists and informs the architectural concept of the city's latest art gallery.

The lighting scheme for the interior of Fusheng Art Gallery 'not only creates the space's atmosphere, but also presents the power of silence', said the International Association of Lighting Designers (IALD) award judges. Core to the scheme is natural light, which is balanced with, and minimises the use of, artificial light.

The first-floor exhibition space and second-floor experience space have floor-to-ceiling glass curtain walls and are connected by a void atrium. 'Sunlight has an intense influence, and balancing the impacts of daylight on the space became the most difficult part of this project,' says lead designer Lili Zhou.

The team carried out simulation tests to establish daylight intensity and penetration. This enabled the designers to develop a system of light that used minimal electric light by combining it with the natural effects of daylight.

Light strips in the floor and wallwashers along the ceiling and on luminous surfaces form the space's boundaries. The exhibition space has a shallow pool at its centre where water drops from the ceiling. Daylight is softened by diffusers on the glazing so that the boundaries are softened but clearly defined. Inverted images of the space are reflected on the water's surface. The lighting is designed

to make a statement while remaining a backcloth to exhibits.

'The light in the exhibition space and the atrium void is configured to shape the space while leaving full potential for various exhibition forms,' explains Zhou. 'The light is gentle, yet it creates a strong visual presence in the blank space.'

In the experience space, there are flashing façades and hidden light strips on the floor. In the seating area, downlights are arranged in sets that combine wide and narrow light beams to create a restful atmosphere. The light is centrally distributed and gentle.

'This project is an ode to daylight,' said one judge. 'Truly poetic.'

Xu Wei Art Museum, Shaoxing, Zhejiang, China

Xu Wei Art Museum was built for the 500th anniversary of the 16th-century artist's birth. It is located in his hometown, in what was



Xu Wei Art Museum

the Shaoxing machine tool factory.

The lighting schemes for the interior and exterior were created by the Lighting Design and Research Institute, part of the Architectural Design and Research Institute of Zhejiang University, and were led by principal Xiaodong Wang. Her first Master's degree was in comparative literature, but she subsequently gained a Master's in lighting design, a field in which she has now specialised for more than 20 years. The combination of disciplines informs her work. 'Darken elegantly, and lighten poetically. This is my basic guiding design principle,' she says.

The extensive daylight ingress in the atrium that runs through the first and second floors of the museum – together

"With a sympathetic use of light and shadow, the building celebrates the ink-wash paintings of Xu Wei"

with the pure-white surfaces – allow a minimal use of artificial light. Although, at one end, the double-height glazing is transparent, in parts the natural light is diffused through narrow louvres, the linearity echoed by the LED ceiling fittings that are integrated into, and underline, the architecture. The overall uniform effect has subtle counterpoints in the graphic zigzag of the handrail lighting and the pools of light on the floor, signifying a view onto a pool of water outside.

The exterior lighting is also understated and precise. The building is monochromatic – with white granite walls and black herringbone roofs – and with a sympathetic use of light and shadow celebrates the ink-wash paintings of Xu Wei. Linear wallwashers are embedded in the L-shaped grooves hidden in the lower horizontal frame of the façade, brightening the granite walls. An additional, concealed, in-ground, linear wallwasher uplights the wall in front of the façade.

There are also artistic touches, such as the tree shadows cast on the lane near the preserved walls of the old machinery workshop, designed to 'appear like moonlight that passes through branches'.

Located in the residential area of the ancient city, the site functions as an urban public cultural space. For the opening of large exhibitions, a more literal artistic reference is made with distinctive scenes – calligraphy, works of art – that are displayed on the museum façades using four, 32,000-lumen projectors.

One of the two raised areas on the outdoor square acts as a viewing platform. Here, concealed handrail lighting provides glare-free illumination to the platform, while trees are lit to contrast with the fountains, producing a subtle balance of lightness and darkness. A bronze statue of Xu Wei is intentionally given subdued lighting, with two in-ground, low-power fixtures used just to brighten his face and the brush in his hand.

'A perfect harmony between projection and architectural lighting, inside and outside,' said one of the IALD judges. CJ

PROJECT TEAMS

Fusheng Art Gallery, Wuhan, Hubei, China

Lighting design: Beijing Bamboo Lighting Design

Client: Wuhan United Investments and Properties

Architect: East China Architectural Design and Research Institute

Interior design: Yu Studio

Xu Wei Art Museum, Shaoxing, Zhejiang, China

Lighting design: Lighting Design and Research Institute of UAD

Architecture: Architectural Creation Research Center





The blue, white and red

Light pollution is about way more than too much light, as **Iain Macrae** FSLL MCIBSE explains

For nearly 100 years we have installed exterior lighting to provide illumination on roads and in outdoor spaces, so that people can enjoy the night-time, travel from here to there, and feel safer. Over that time, we have had many discussions on the latest and best solutions.

Initially, light was for safety as we drove new-fangled cars at speed along roads trying to avoid pedestrians and cyclists. Along the way, we have researched and invested in better technologies and methods of lighting. From mercury lamps to LEDs, there has always been a reason to upgrade – the latest and greatest story being the energy we save.

The real question might be, why, at the same time, did we not see the mess we were creating in the way of light pollution? Sure, we have benefited people and it is safer to travel. There is better night-time entertainment, though research suggests we might be healthier adjusting our sleep patterns to the natural length of the day as the seasons change (Thomas Kantermann, 2007; Wright, 2009; Kohsaka, 1992).

The impression is of greater community safety, though, in my area, it is rare that people use the all-night street lighting to take a walk, and the only house to be burgled in recent years sits right next to a streetlight. This feeling of safety, by the way, has a diminishing return above five lux (Svechkina, Trop and Portnov, 2020).



The outcomes of night-time lighting have not been truly understood until recently. The body of evidence has been growing for more than a decade and, along with it, the number of concerned and protesting voices (see panel, 'Light pollution facts').

We have underestimated the amount of light pollution and remained blind to how bad it really is. The facts opposite estimate an increase in light pollution between 270% and 400%, yet the measurement is only 45%. The blue in our story is largely about our failure to measure light pollution effectively – sensors within the measurement satellites we have been using do not measure blue light.

This has increased because many white LED street lights have a spectrum that contains a strong spike in the blue wavelength. That not only increases localised skyglow, but also has a particular and direct impact on life for the planet's inhabitants, whether human, animal, insect or plant.

What about white light generally? Two



things have led to an increase in white light used outdoors, gradually replacing the widespread use of sodium sources.

Research confirms that, by using white light, we can reduce the amount of light we need for the same visibility (Knight, 2010). This, and the technological revolution that is LEDs, has led to rapid adoption for savings in energy.

Growing evidence, however, shows that the number of lighting points is increasing as the cost to purchase and use LED lighting has fallen. The Jevons Paradox – an increase in efficiency in resource use will generate an increase in resource consumption rather than a decrease – strikes again.

As mentioned above, the wider use of white light and LEDs increases the amount of blue light in the environment. The technology of LEDs often uses blue-light-generating diodes, coated with phosphor to create the white light we see. In the process, these white light sources emit a lot of the blue end of the spectrum.

In cold colour appearance LEDs, 4,000K-6,500K, this blue content is considerably higher. Hence, our move to use white light, first with metal halide lamps and then LEDs, has increased skyglow. The Jevons Paradox has made this worse as we add more light to our public spaces and to our gardens as the falling cost makes it viable.

A GLOWING PROBLEM

- Four-fifths of the world lives under light-polluted skies: the Milky Way is hidden from more than one-third of humanity, while 88% of Europe and 50% of the USA experience perpetual twilight. (Falchi, 2016)
- Global light pollution is up by 45% in 25 years, according to satellite imagery, but the real increase may be more like 270% – and even 400% in some regions. (Sánchez de Miguel, Bennie, Rosenfeld, Dzurjak and Gaston, 2021)
- Human circadian sleep/wake cycles, and those of many other species, are affected by light from the blue end of the spectrum. (Sanders, 2021)
- Blue light has a significant impact on photosynthesis. (Aubé, 2013)
- Blue light is a major contributor to skyglow. (Luginbuhl, 2014)

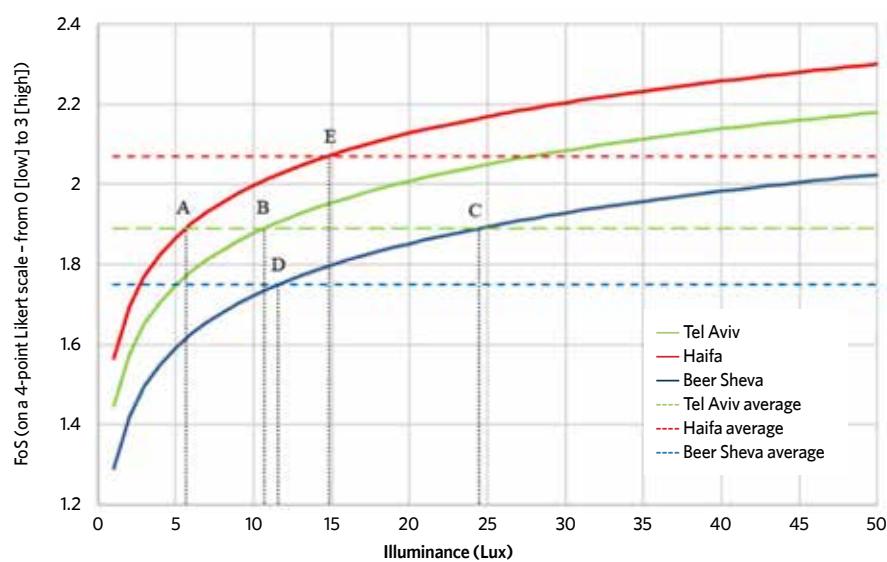


Figure 1: How much light is required to feel safe (Svechkina et al, 2020)

"The real question might be, why did we not see the mess we were creating in the way of light pollution?"

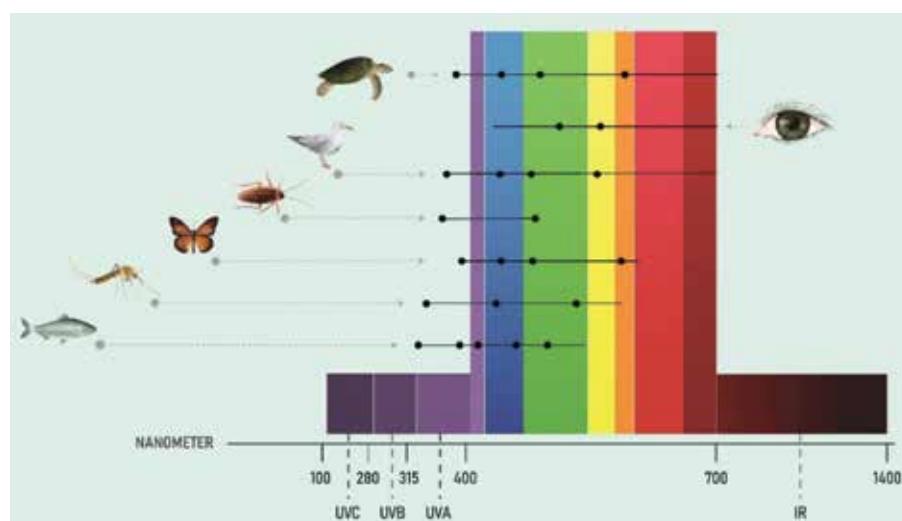


Figure 2: Ability to perceive different wavelengths of light in humans and wildlife is shown by horizontal lines. Black dots represent reported peak sensitivities. Figure from National light pollution guidelines for wildlife, including marine turtles, seabirds and migratory shorebirds, Commonwealth of Australia 2020

» Use of white light has also impacted insect populations. While you might like the fact there are fewer flies around to annoy you, the long-term ill effects on nocturnal species and plant pollination are already starting to show (Avalon C. S. Owens, 2020).

That leaves us with a problem: how to reduce light pollution and, specifically, skyglow? The amount of skyglow increases near densely populated areas (Bierman, 2012) and our current light pollution guidance (ILP, 2020) allows for a further increase with every new installation.

Guidance allows light onto façades in all but protected areas, and this light then reflects into the sky. Limits on upward light into the sky in rural, suburban and urban areas range from 2.5% to 15% for luminaires, meaning that new installations are allowed to add upward light, making the current situation even worse. If light pollution guidance sets targets that allow a site to increase upward light, then skyglow can only increase as our cities grow.

Could it be time to ban upward light and limit façade lighting to buildings of historical importance?

Light pollution guidance offers some solutions, including recommending fixtures that only emit light below the horizontal, and consideration of task focus and the amount of light. Even so, light often reflects off the façade, road, decking or paving, and this reflected light is still a concern.

In the table, you might notice two LED solutions that offer an alternative way forward – which brings us to the red in this article. Reducing the blue content of our light sources will definitively reduce skyglow. Using narrow band or phosphor-coated amber LEDs, while reducing colour rendering, will also impact skyglow. Red LEDs would go a step further. These light sources are not white light.

For sure, your expensive electric vehicle paint work is going to look a little off colour parked on the street at night, but there is good evidence that using such technologies will significantly reduce the impact of human lighting on our ecosystem.

Maybe it's time to rethink our negative connotations of a red-light district and use this light for all our benefit. 

IAIN MACRAE, CEng FSLL MCIBSE, is a past president of the Society of Light and Lighting (SLL), chair of SLL LG5: Lighting for Education, and member of British and European standards panels. He is founder of the training company Light Unwrapped.

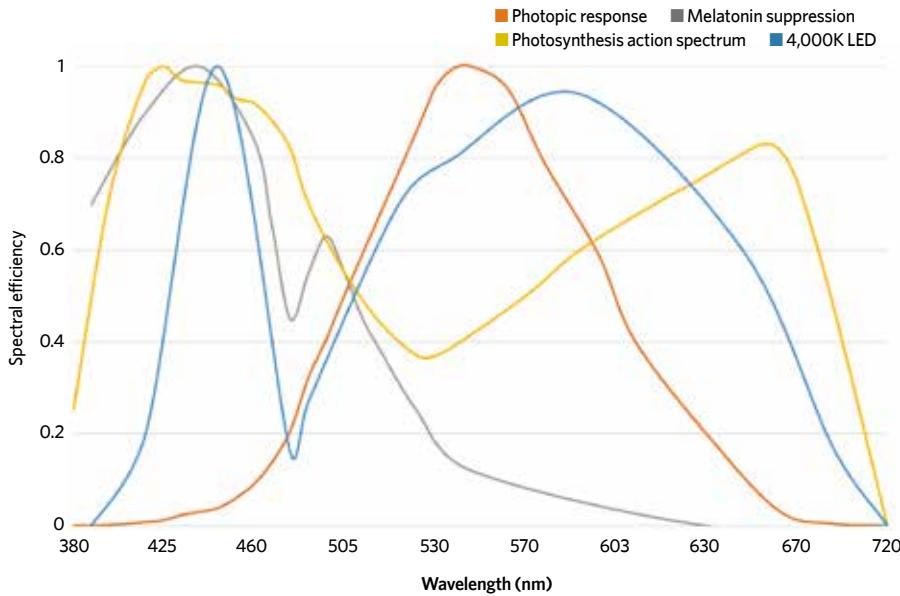


Figure 3: Photosynthesis, human vision and melatonin response compared with typical LED spectrum. The blue peak of this LED directly overlaps human sleep and photosynthesis responses.

Table 1: Skyglow brightness ratios for different light sources relative at 1km

Lamp type	Description	Skyglow relative to low-pressure sodium
NBA LED	Narrow band amber LED	1.0
HPS	High-pressure sodium	2.4
PC-A LED	Phosphor-coated amber LED	2.4
2,400K LED	Warm white LED	4.3
4,100K MH	Neutral white metal halide	6.4
5,100K LED	Cold white LED	7.9

Adapted from Luginbuhl, 2014.

BLUES IN THE NIGHT

'Many white LED street lights have a spectrum that contains a strong spike in the blue wavelength, which is most effective at suppressing melatonin during the night. In the absence of electric lighting, humans begin the transition to night-time physiology at about dusk... These 4,000K lighting fixtures may contribute to delay in the transition, which could, at a minimum, reduce sleep quality.'

'Of particular importance is the now voluminous data showing a higher risk of hormonally linked cancers with melatonin suppression, such as breast carcinoma (an increase risk of about 15%) and prostate carcinoma.'

'The visual discomfort that can be created by very intense point sources, especially for older drivers, is magnified by higher colour-temperature LEDs because blue light scatters more in the human eye, leading to increased disability glare.'

'Many beneficial insects are drawn to blue-rich lighting, and circle under them until they become exhausted and die... Even bridge lighting that is "too blue" has been shown to inhibit upstream migration of certain fish species, such as salmon returning to spawn.'

- Extracts from *LED street lighting: the human and environmental effects* by Dr Mario Motta, Light Lines May/June 2022, special ROLAN issue

More information

The May 2022 ROLAN (responsible outdoor lighting at night) Conference, co-organised by the SLL and Dr Karolina M Zielinska-Dabkowska, head of Illume, brought together world experts on artificial lighting at night. For selected articles by key speakers go to: bit.ly/CJNOV22LP1

Sharing the night

A Danish highway uses red lights rather than white to minimise impact on bats while still providing a safe, illuminating route for road users. **Jill Entwistle** reports

The 'We share the night' bat superhighway is a radical scheme to use red light rather than white light to illuminate a major road. The 700m stretch of road, the Frederiksborgvej on the outskirts of Copenhagen, includes a cycle superhighway, 'the Farum route'.

The main challenge for the lighting scheme designed by Light Bureau was that the area is home to several species of roosting and foraging bats. It was central to the brief from the local authority concerned, Gladsaxe Municipality, that the lighting for both the road and cycle path had the lowest possible impact on the nearby bat colony.

The solution was based on research that shows that red light is less disruptive for wildlife, while allowing people to find their way and even maintain their dark adaptation for night-time viewing.

The scheme involved 30 bollards, each 1m high and spaced 30m apart, creating corridors of complete darkness in between. While still providing ample lighting for cyclists, this ensures minimal impact on the bats and allows light-shy, ground-based species to cross the area without being

exposed as potential prey. In addition to the bollards, 12 higher poles (3.5m) have been positioned where cyclists and pedestrians need to cross the road, creating a change in the environment to help improve awareness and increase safety in these areas.

The light level where cyclists cross the street is 2.5 hemispherical lux with a uniformity of 0.15.

'This is a new type of project for us and we had several discussions with biologists and bat experts to establish how we could achieve the best compromise between fulfilling human and bat needs,' says Light Bureau's Philip Jelvard, who acknowledges that the approach is an experimental one.

'In the coming year, we want to establish more cooperation with the biologists, to evaluate if it has had the planned effect, and learn from this case.'

The project also has wider implications, adds Jelvard. 'It will form the basis for future discussions on how we translate scientific research and technical knowledge into site-specific lighting projects and how to design low-impact lighting solutions.' **CJ**

Red lighting lines the cycle superhighway, the Farum route, on the outskirts of Copenhagen, to minimise the impact on a nearby bat colony



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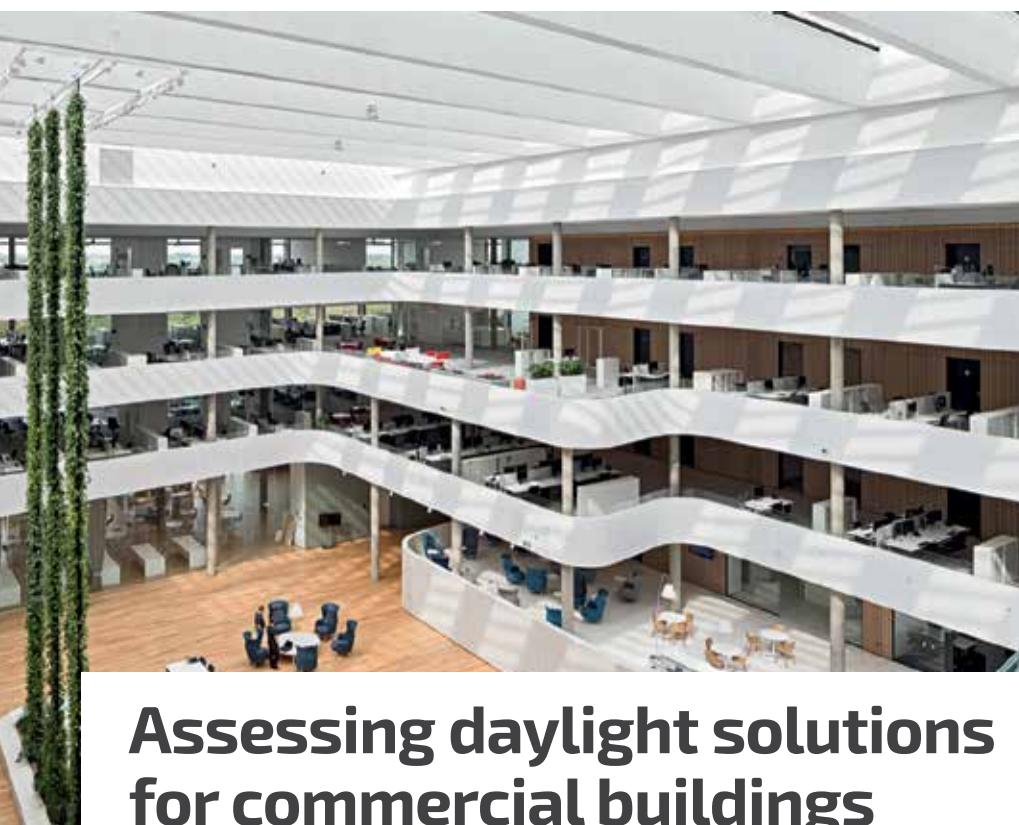
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Assessing daylight solutions for commercial buildings

This module explores some of the reasons for incorporating daylight into the built environment and the latest guidance on such solutions

Incorporating daylight into building lighting design has been shown to enhance the wellbeing and performance of occupants, while inappropriate lighting has been associated¹ with adversely impacted sleep patterns and potentially increased risk of health problems such as diabetes, heart disease and depression. Standards and methods for assessing and designing daylight for built environments have recently been significantly revised. This CPD article will consider some of the justifications for incorporating daylight into design, and provide an overview of the recently introduced recommendations and methods.

As noted in *CIBSE SLL LG 10 Daylighting and window design*, daylighting 'is more than lighting tasks: it is also about lighting spaces so that they are pleasant to be in. In general, people prefer spaces to appear bright; "light and airy" is a common description. To create this effect the window area must provide sufficient light and the windows be placed in positions where they illuminate building surfaces, particularly the walls which form a major element in the normal field of view'.

The summary paper by Wargocki and Wyon² highlighted an array of studies that suggest that the impact of poor thermal conditions and inadequate indoor air quality can be shown to reduce performance by 5-10% for adults and by 15-30% for children. Importantly, they advised that individuals' acceptance of indoor environmental conditions does not necessarily lead to optimal performance – highlighting the need for robust, objective metrics and methods for environmental assessments. Edwards and Torcellini,³ in their review of the impact of daylight on building occupants, discovered that companies recorded an increase in productivity of staff of around 15% after moving to a new building with better daylight conditions, which in turn resulted in considerable financial gains. The positive impact extends beyond workers, and typically will also enhance the use of the building for visitors, customers, clients and guests.

Light can affect energy levels as well as alertness and productivity. The regulation of sleep and alertness is processed by the human body's circadian rhythm, which

responds to light changes in the environment. As explained in the recent review paper⁴ by Reddy et al, circadian cycles are being disturbed – advanced or delayed – by exposure to diverse light spectra and intensities and, as a consequence, metabolism and behaviour patterns are impacted, which can affect mood, influence cognitive performance and alter social behaviour.

Work undertaken by Acosta⁵ concluded that the circadian rhythm is a decisive variable in the wellbeing of students, and so both natural and artificial light sources are important for providing a sufficient amount of light and suitable spectrum to promote a good circadian entrainment.

A study⁶ of office workers during the Swedish winter showed that mood and vitality were enhanced in healthy people with higher levels of exposure to bright daylight, and research undertaken by Santiago⁷ found strong evidence students taught in classrooms with windows achieved better results than those in the basement. In a set of controlled tests by Jamrozika,⁸ it was determined that providing access to suitably shaded daylight and view, limiting glare, can improve occupants' performance and satisfaction,

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- » while also reducing eyestrain, compared with unshaded daylight sources.

An authoritative set of recommendations recently published by Brown et al⁹ included enhancing daytime melanopic exposure – as measured by the International Commission on Illumination (CIE) ‘melanopic equivalent daylight illuminance’ (m-EDI) (see boxout) – by increasing access to natural daylight in the workplace, has been shown to improve sleep and increase objectively measured cognitive office worker performance. In work reported by Rohit Manudhane¹⁰ that explored the application of spectrally tunable lighting systems, he found that occupants preferred the variability in electric lighting that reflected real-time daylight conditions, as illustrated in Figure 1, effected by a link to an outside light sensor.

The recent extensive critical review undertaken by Vasque¹¹ – which considered the effects of window views, daylighting and lighting on occupants’ behaviour, perception, performance, and wellbeing – came to a conclusion that the lack of standardisation across the studies often generated inconclusive results or results limited to the specific study conditions. It notes that more data – and more standardised and comparable data – is required.

Abundant natural daylight can reduce the dependency on artificial light, resulting in energy savings and reduced operational impact on the environment, as well as potentially improving workers’ physical and mental health and productivity. The World Green Building Council¹² reported that overall, the evidence is unequivocal that office occupants prefer access to windows and daylight, which bring consistent benefits in terms of satisfaction and health.

Incorporating ‘natural’ elements such as daylight and good ventilation can help mitigate the negative effects of hours spent indoors. Glazing units, including roof glazing, can make an important contribution to ventilation in buildings while also enhancing the quality of the space, as demonstrated in the multi-award-winning UK Hydrographic Office (UKHO) headquarters in Taunton, Somerset, rated BREEAM excellent and shown in Figure 2.

MELANOPIC EQUIVALENT DAYLIGHT ILLUMINANCE (M-EDI)

m-EDI, measured in lux, is the circadian metric adopted by the International Commission on Illumination (CIE) that accounts for the colour of the light (in terms of constituent wavelengths and intensity), the response of five photoreceptors on the retina as related to the ‘standard’ daylight spectrum (roughly the average midday light in western Europe, known as ‘CIE D65’).

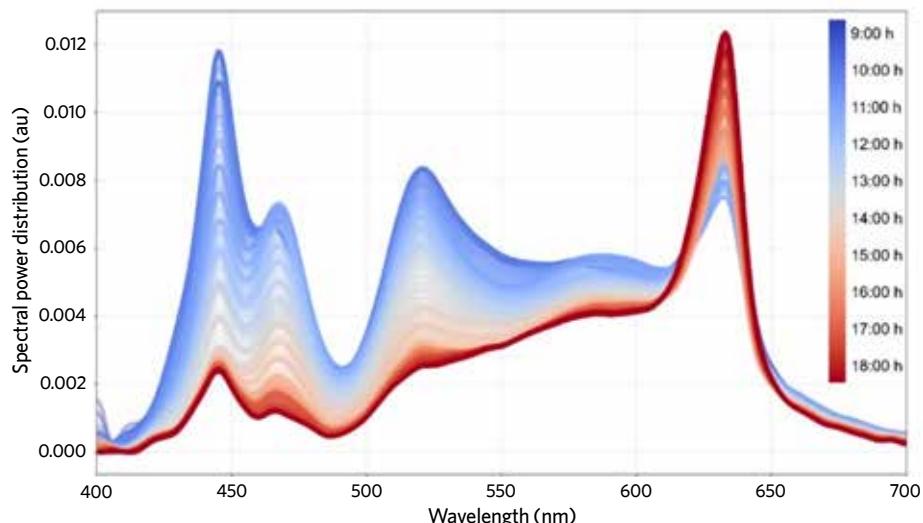


Figure 1: The spectral distribution of light across the working day that provided the preferred environment for occupants, which emulated real-time daylight conditions (Source: CIBSE Journal¹⁰)

Even when the majority of the outdoor air requirement is supplied by controlled, mechanical systems, having the option to open windows is important for building occupants to maintain some control of their personal environment and comfort. Rooflight solutions may be employed to improve thermal comfort through natural ventilative cooling, as well as providing access to unobstructed sky and sunlight. This may complement vertical windows in external walls that might be significantly constrained by adjacent buildings or other obstructions.

BS EN 17037¹³ *Daylight in buildings*, first published in 2018, is a code of practice that focuses completely on the quantity and quality of daylight for building users, by providing recommendations to deliver appropriate levels of daylight in any type of building. It fully recognises that the need to provide glazed openings and well-distributed daylight to interior spaces, while reducing artificial lighting in use, must be considered with the balance between heat loss and solar gains. The standard notes that solar gains can contribute positively to heating but in warmer months, or where there is potentially unacceptable glare, solar shading should be provided either as static or moveable devices.

BS EN 17037 sets minimum levels of performance, which can be assessed using simplified or detailed methods, to address each of four aspects of daylighting:

Daylight provision is the amount of available daylight in habitable rooms – this can be established by employing either climate-based modelling or daylight factor calculations. This directly impacts the likelihood of artificial lighting being switched

Figure 2: Opening rooflights and vertical glazing provide natural ventilation and daylight for the UK Hydrographic Office (UKHO) headquarters building in Taunton that opened in 2019 (Source: AHR Architects – www.ahr.co.uk/)

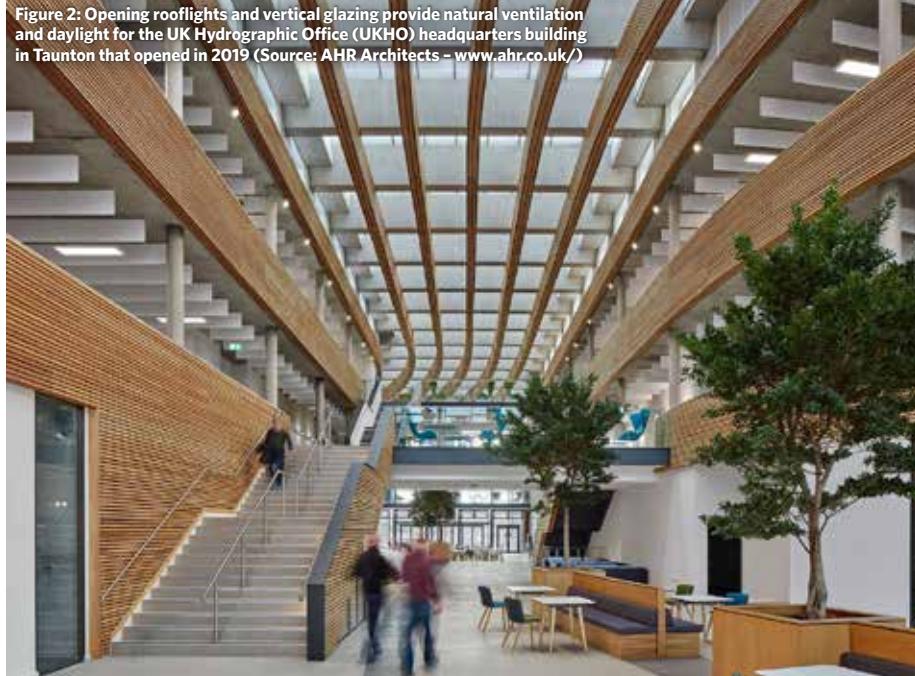




Figure 3: Luminance map of a task area showing sun patches causing glare on the left, and, on the right, with glare control using external solar shading (Source: VELUX Commercial - bit.ly/CJDec22CPD22)

on and, for example, sets a minimum target illuminance 300lux across 50% of the reference plane (normally 0.85m above the floor) for wall-based daylight openings, increasing to 95% for horizontal openings, since there is greater daylight opportunity presented by rooflights. Alternatively, calculated daylight factors may be used as a proxy to indirectly check that a design meets the recommended provision.

View out ensures that wherever possible occupants have a large, clear view of the outside that they should perceive as clear, undistorted, and neutrally coloured. BS EN 17037 considers the width and outside distance of the view, in terms of three 'layers' – sky, landscape and ground. View out can be classified using a simplified method or an advanced method that uses fisheye projections. A minimum recommendation requires that at least 14° horizontal view of a landscape (further than 6m away) should be visible to 75% of the utilised internal area.

Sunlight exposure is noted as 'essential' for any interior space and generally desirable, except during hot climatic conditions. It enhances overall brightness of the interiors with patches of high illuminance through careful planning of building and room orientation, and openings, including appropriate solar shading, while considering obstructions and surroundings. A climate-based approach is employed to determine whether habitable rooms receive at least 1.5 hours of sunlight on a specific date between 1 February and 21 March (specifically, 21 March in the UK).

Prevention of glare aims to reduce the probability of glare for building users, especially for those whose activities include reading, writing or using display devices and are not able to choose where they sit. BS EN 17037 notes that glare is dependent on individual perception and, as well as impacting visual performance, it may also cause headaches or fatigue. A complex luminance distribution is required to assess glare – BS EN 17037 suggests daylight glare probability (DGP) as the metric to consider both the illuminance at eye level and individual glare sources of high luminance to estimate the fraction of dissatisfied persons. The minimum recommendation is that DGP for the occupied space does not exceed a value of 0.45 for more than 5% of the occupied time – above 0.45 indicates that glare is readily perceivable and mostly intolerable.

To reduce the occurrence of glare, and to lower the DGP, shading devices should be selectively employed, such as the example in Figure 3 where glare is controlled by retractable external solar shading. The standard is clear that there needs to be an 'appropriate selection of shading systems to minimise possible thermal and/or visual discomfort to the occupants'.

Recommended levels of performance are tabulated for each of these four aspects – designers select the level that best relates to the building design and proposed building use. The recently revised UK daylight planning guidance BRE 209¹⁴ notes that if a room faces significantly north of due east or west it may struggle to meet the recommendations (with traditional vertical windows). The calculations account for national and local conditions, so solutions are appropriate and specific to each project and are not confined to new buildings. The provisions can be applied to works undertaken on existing buildings where openings may be assessed in terms of the four aspects of daylighting to inform any potential improvements.

The method of aperture-based daylight modelling (ABDM) may be employed when assessing the daylight performance of openings to provide measures of

sunlight, skylight and view potential at the window aperture for application with BS EN 17037. ABDM is considered a significant advance on methods that have historically been employed, as discussed by Mardaljevic in his paper to IBPSA.¹⁵

Traditionally, assessment of daylight provision might only have been carried out at later stages of a project. However, digital tools such as that illustrated in Figure 4 can be readily used in conjunction with the recommendations of BS EN 17037 to evaluate early design concepts. BRE 209 notes that 'interiors with very high daylight levels sometimes have problems with summertime overheating or excessive heat loss in winter'. Simulation tools may be used to undertake cost-effective analysis that can consider the holistic impacts of a daylighting scheme, including thermal and comfort analysis. 3D building thermal simulation tools often link with software packages such as Radiance¹⁶ to evaluate daylight solutions, while coincidentally optimising the building thermal performance.

It is still early days for BS EN 17037, but its timely introduction has caught the wave of building designers and clients that have increasing awareness of the benefits of daylighting to the health, wellbeing and productivity of building occupants. This appears to be evidenced by the current stream of buildings with high BREEAM and LEED ratings that incorporate significant daylighting designs, with the finest attracting awards and public acclaim.

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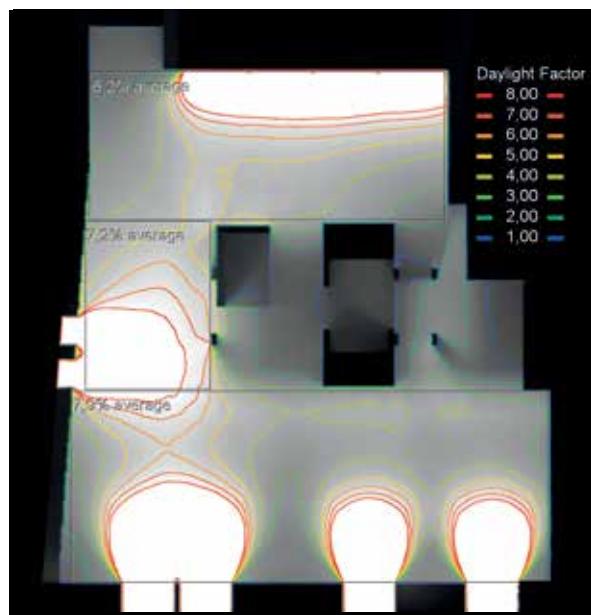


Figure 4: Example of daylight prediction output from simple, freely available, daylight visualiser software (Source: VELUX Commercial - bit.ly/CJDec22CPD21)

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Module 209

December 2022

» 1. Which SLL lighting guide is particularly relevant to this article?

- A 4
- B 7
- C 10
- D 12
- E 15

2. What is m-EDI used to represent?

- A Melancholic exposure
- B Melanitic exposure
- C Melanoid exposure
- D Melanopic exposure
- E Melanosomic exposure

3. What minimum daylight provision is recommended by BS EN 17037 where there are wall-based daylight openings?

- A 300lux across 50% of the reference plane
- B 300lux across 75% of the reference plane
- C 300lux across 85% of the reference plane
- D 300lux across 95% of the reference plane
- E 300lux across 99% of the reference plane

4. In the illustration of glare in the office, what was used to reduce the DGP?

- A High-level static louvres
- B Lightweight internal blinds
- C Photchromic glass
- D Retractable external solar shading
- E Tinted sunglasses

5. What does the article suggest be used as a means of analysing the combined design in terms of daylight, thermal performance and comfort?

- A BRE 209
- B BREEAM
- C CIE
- D LEED
- E Simulation tools

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Further reading: (beyond references cited in this article):

CIBSE Lighting, Research and Technology Journal - free access for CIBSE members.

The impact of daylight on occupants in commercial buildings provides useful background information (this was published pre-BS EN 17037) - www.velux.com/deic

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Ideal Heating launches air source heat pumps for commercial buildings

Monobloc air source heat pumps cover outputs of 14kW up to 70kW

A new range of monobloc air source heat pumps (AHSPs) has been launched for commercial buildings by Ideal Heating. There are six outputs across seven models in the range spanning 14kW to 70kW.

Ideal heating's Ecomod heat pumps have a coefficient of performance of up to 4.85 and minimum A++ Energy related Products (ErP) efficiency rating. The heat pumps use R32 as the refrigerant.

The heat pumps include an inverter-controlled compressor that can manage building temperature based on specific

requirements of the space. The heat pumps can be used alone or cascaded to meet the heating requirements of larger commercial buildings.

'The Ecomod launches as businesses accelerate decarbonisation efforts to work towards net zero targets, meet new standards for Building Regulations, and reduce their exposure to volatile energy prices,' said Chris Caton, product director at Ideal Heating. 'The range of outputs means we can cater for many commercial buildings. For example, our 14kW single-phase unit is suitable for sites without access to three-phase electricity, such as care homes or community halls.'

Vaillant adds heat pump production line to Belper factory

Vaillant has unveiled a new multimillion-pound heat pump production line at its headquarters in Belper, Derbyshire. The line will be dedicated to producing Vaillant's aroTHERM plus air to water heat pump.

Launched in 2020, the aroTHERM plus is the first UK-manufactured heat pump available in the market to use the natural refrigerant R290, which has a global warming potential of just three.

The aroTHERM plus can achieve hot-water flow temperatures of up to 75°C, meaning the water stored in the cylinder is at a usable temperature without needing a backup heater. With this new line, Vaillant claims it is the first manufacturer to produce heat pumps and high-efficiency boilers in the UK.

Addressing refrigerant leakage

Refrigerant leakage can have a substantial impact on embodied carbon energy. Mitsubishi Electric's Mark Grayston answers questions on what his company is doing to tackle it.

What is your current strategy regarding refrigerant leakage?

We rigorously test our product units before they leave the factory. We recommend all local regulations are followed upon application, with the EN 378 and European Fluorinated Gases Regulation (F-Gas) standards outlining best practice for installation to mitigate risks from leaks.

Do you recycle refrigerants?

We work with recyclers to manage recycling at end of life, rather than dealing with end-of-life products directly ourselves.

What method(s) do you promote as being the most suitable for leak testing?

Leak testing is a key part of F-Gas requirements, so we would recommend following this standard. Leak detectors should also be used to detect operational leakage, where applicable, according to EN 378.

What are the challenges with leaks from the 'new' (application) refrigerants – for example, hydrocarbon (HC), hydrofluoro-olefin (HFO), CO₂ and ammonia?

EN 378 offers standard guidance for each refrigerant based on toxicity and flammability, and each refrigerant has different levels of these. While the EN 378 guidance is provided to ensure safe application design, HC poses additional challenges around flammability and is classed as A3, so must be managed.

For us, CO₂ is less of a challenge because it is contained within hermetically sealed systems; however, it operates at a high pressure, so extra care and training is needed to ensure competence when dealing with it.

Where new refrigerants have different characteristics, training around design, installation and servicing and maintenance is key to ensuring risks are minimised and systems are operating at their most effective.

How effectively do you think the industry is dealing with issues of refrigerant leakage?

F-Gas is doing a good job, with the UK installation base also of high quality. But greater visibility of its effectiveness would be useful – for example, using records to highlight if certain systems or installations are more likely to leak than others. Then further improvements can be made to minimise leakage across the product life-cycle.

Mark Grayston is at Mitsubishi Electric

Indirect Heat Interface Unit



Features



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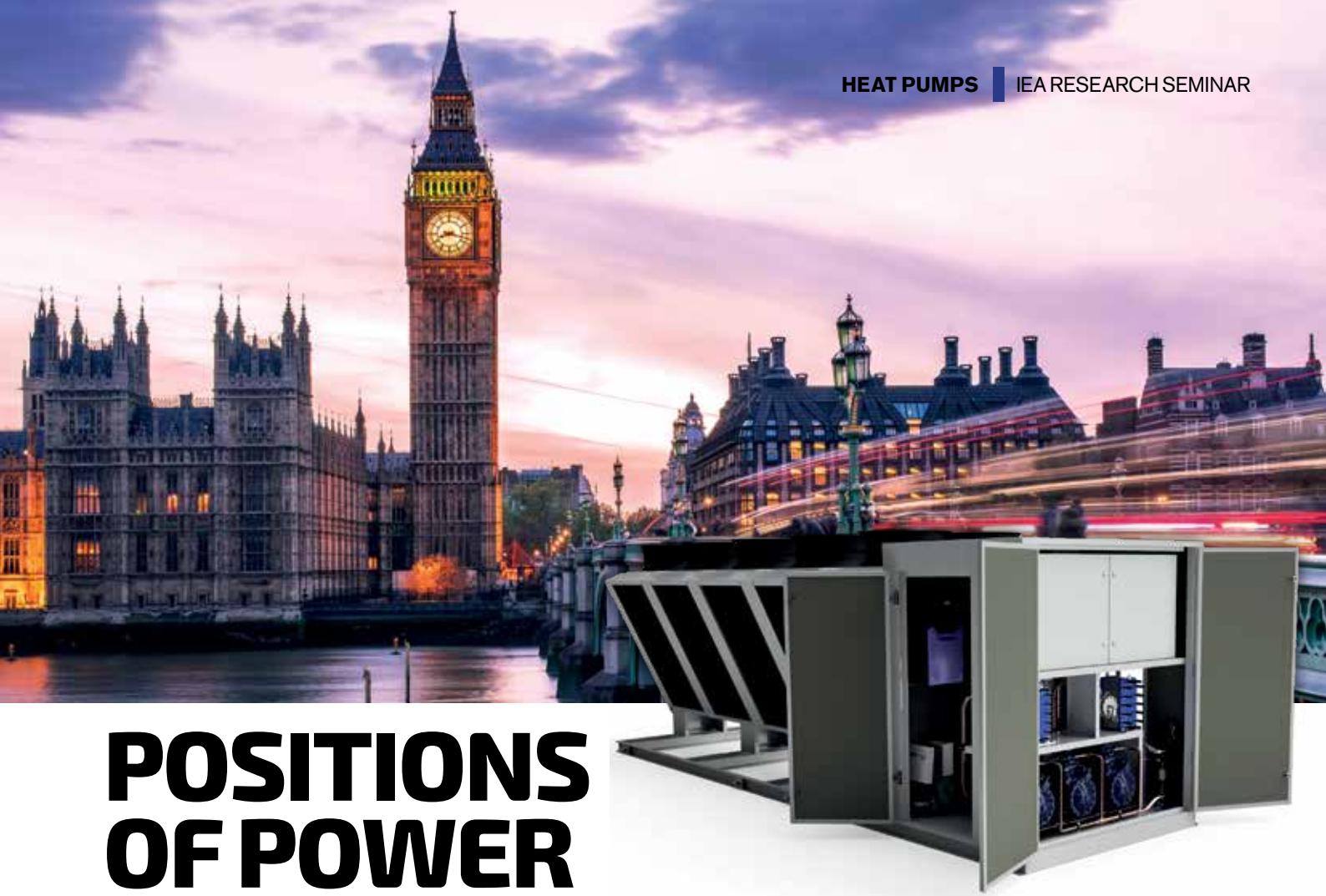
Cold Water and Heating Drain Valves

Dual Thermostatic Control Heads

Manual Air Vent

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POSITIONS OF POWER

The government is aiming to increase annual heat pump installations from 30,000 to 800,000 by 2028. How this can be achieved was discussed at the IEA's annual research seminar last month. **Molly Tooher-Rudd** reports

The annual International Energy Agency (IEA) Heat Pump Research Seminar, hosted by the Department for Business, Energy and Industrial Strategy (BEIS) started with a warning by Stephen Renz, chair of the IEA Heat Pumping Technologies (HPT) technology collaboration programme (TCP). 'If we follow current trends, we will not reach net zero in time. We need to take action to change this,' he said.

The necessary action, according to Renz, is the installation of 500MW of heat pumps every month until 2050. This would be necessary to enable the UK to cope with the expected tripling of electricity and cooling demand in the next 30 years, he said.

The government's target is 800,000 heat pumps installed per year by 2028, a significant uplift on the 30,000 currently installed.

Tara Deshpande, deputy director of the net zero buildings team at the Clean Heat directorate, BEIS, described the UK government's current policy on heat pumps. In the current political climate, she said, energy security is a big priority for the government, with consumer access to heating of prime importance.

In discussing the decarbonisation of heat, Deshpande added that there would need to be a mix of heating technologies in the future because of the diverse needs of consumers and buildings, but that 'heat pumps would play a major role'.

She addressed the challenges of large-scale heat pump deployment, saying there was an evident need for more resilient supply chains, affordable pumps, and quicker and easier installations.

Deshpande said that, by 2026, decisions would be expected to be made around the strategic role that hydrogen will play in providing heat, but 'even with a lot of hydrogen heat, the country would still need at least 600,000 heat pumps installed per year by 2028'.

There was a conflict among speakers about the suitability of hydrogen as a source for heating buildings. Bean Beanland, director of growth and external affairs at the Heat Pump Federation, expressed concerns about the powerful fossil fuel industry lobbying for hydrogen and the 'lack of understanding' among some of our policy-makers.

He is keen for off-gas buildings to move to heat pumps. 'We cannot allow the hydrogen debate to mask off-gas opportunities. There are currently four million houses in the UK that are off gas,' said Bean, who urged that a programme to install heat pumps at these properties be mobilised.

Octopus' *Hitting the target* is a simulation-based assessment of the interventions required to meet UK government heat pump targets. Lucy Yu, chief executive at the Centre for Net Zero, founded by Octopus Energy, outlined the methodology and results.

Just less than 25 000 households were simulated, with data gathered daily over several years. Key interventions modelled in the report were the Boiler Upgrade Scheme, the redistribution of policy costs across gas and electricity, and a boiler ban, starting on 1 January 2035.

The study found that the government could meet its 600,000 installation annual target if it: grew the number of heat pump installers to as many as 30,000 by 2028; announced the upcoming ban as soon as possible, to send a clear signal of intent; and increased consumer

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The UK government wants 800,000 heat pumps to be installed annually by 2028

» awareness of heat pumps to give them the confidence and knowledge to try unfamiliar products.

Beanland said installer training capacity was climbing fast, with new apprenticeships starting in 2023, and manufacturing and drilling capacity for ground source heat pumps increasing. 'We are becoming investable, but timeframes are becoming very constrained.' Like Yu, he was concerned that the window of opportunity was closing fast, and called on politicians to stimulate the market.

Renz said the IEA's HPT TCP was established to accelerate the universal implementation of heat pumps, and he believes the UK should collaborate with other nations to help reach the government's target. 'The HPT TCP is an international framework of cooperation and networking with 17 member countries and several new countries in progress,' he said. 'It is essential we work as a global community to find the best solutions for a net zero future.'

Noel Salmon, energy innovation project manager at BEIS Data Insights, shared the results from demonstration projects that were designed to test the feasibility of a large-scale rollout of heat pumps in a range of housing archetypes. Heat pumps were installed in a representative

sample of 742 homes, and data was collected at two-minute intervals, resulting in a huge data set with more than a billion lines of information. The project analysis looked at the experience of an installation for occupiers and the barriers to adoption, such as cost and disruption.

The data revealed that hybrids were the cheapest to install because they did not require a hot-water tank. For air source heat pumps, upfront costs were £15,000 up to a maximum of £27,000, while costs for individual ground source heat pumps were £40,000. Costs were due, in part, to heat emitters needing to be replaced. On average, there were 8-10 radiators in the home, 80% of which would need to be replaced. The perception of the disruption that installation would cause was the main reason people dropped out of the trial.

Clearly, there are barriers to overcome if there is to be mainstream adoption of heat pumps, so while there was an air of positivity among the speakers, it was apparent that action needs to be taken now, particularly by politicians, if government targets are to be met.

'Our technology is moving into the mainstream, almost in spite of the politics – policy and government are broadly aligned with us here, but politicians may not be,' said Beanland, who felt the UK government is terrified of making mistakes and had a 'no regrets' approach to making policy decisions. 'We must accept we will make some mistakes or we will not reach the degree of change we need,' he added. □

A EUROPEAN VIEW

Martin Forsén, manager of international affairs at NIBE, spoke about the European policy environment.

The European Green Deal in 2020 proposed that Europe become the first climate-neutral continent by 2050. However, initial targets of a 20% reduction in greenhouse gas (GHG) emissions and a 15% increase in the use of electrical and renewable energy won't take us there. In July 2021, after multiple revisions, the reduction in GHGs was increased to 55%, renewable energy increased to 40%, and energy efficiency by 36%.

Forsén said the war in Ukraine had prompted the European Commission to come up with a strategic plan to rapidly reduce dependence on fossil fuels and accelerate the green transition, known as REPowerEU. He added that an increase in heat pump sales was already reflecting the change in approach.

The potential of natural refrigerants to help decarbonise heating and cooling was discussed by several speakers. 'We want to go in this direction,' said Forsén, 'but we need help from policy-makers to do this.'

He said products using natural refrigerants were regulated 'as if we were installing a nuclear powerplant in our basement'.

'Gas boilers are not so regulated, although these are products manufactured to emit [gases] – it does not seem fair,' he added.

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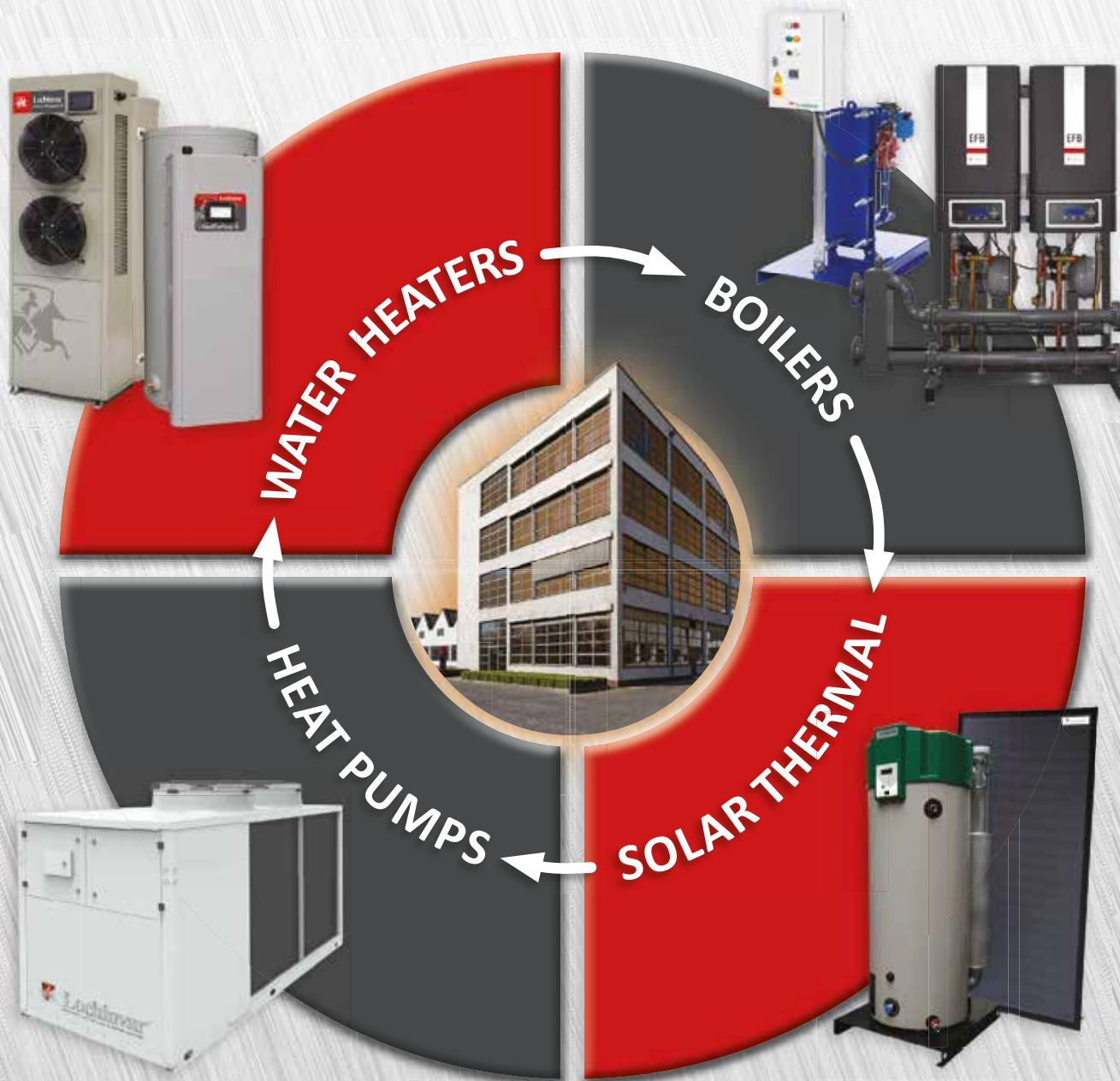


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GENERATION GAINS

Bankside Yards is set to become the UK's first major mixed-use regeneration project with zero emissions in operation. **Phil Lattimore** looks at the fifth-generation ambient energy network at the heart of the design strategy

Set in a prominent 5.5-acre site between Blackfriars Bridge and the Tate Modern, Bankside Yards redevelopment is a major £2.5bn mixed-use regeneration project that aims to be fossil-fuel free and the first of its kind in the UK.

The development – by an international consortium comprising Native Land, Temasek, HPL and Amcorp Properties – will feature a mix of apartments, offices, retail and cultural facilities.

Core to the sustainability strategy of this 1.4million ft² (130,000m²) development scheme is the installation of a low-temperature, all-electric 'fifth generation' energy network, which the developer says will be the biggest in the UK.

The energy network is an ambient loop system, which is designed to balance thermal energy requirements across all the site's eight new buildings, providing cooling and heating where needed through energy sharing between the adjacent buildings. The loop temperature will be 20°C to 25°C supply, depending on the season, and between 15°C and 20°C return.

It will also serve the thermal needs of the 14 repurposed Victorian railway arches that will house shops, restaurants and performance spaces, all intended to create a 'new village high street' focal point.

Engineering consultancy Sweco is providing building services, vertical transportation (lifts and escalators) and the sustainability consultancy for the whole of the Bankside Yards development, including the arches. This covers the key design and implementation of the fifth-generation energy network.

Strategy

As part of the heating and cooling strategy, each building on the Bankside Yards development will 'extract' or 'reject' energy via an energy network running through the development. Heat pumps within the buildings will exchange ambient thermal energy via bidirectional heating and cooling loops. In addition, air source heat pumps (ASHPs) on the roofs of the buildings supplement heating and cooling energy



"Optimised façades and high-efficiency building services systems are part of the strategy to minimise energy use"

balance across the site where necessary.

All electricity required for the site will be provided through supply contracts with renewable energy providers (although there will also be a modest number of solar photovoltaic panels on site to meet Greater London Authority planning requirements).

The fifth-generation thermal energy system linking the buildings can be connected to an external district heat network infrastructure in the future.

Optimised façades and high-efficiency building services systems are also part of the strategy to minimise energy use.

Kartik Amrania is head of building sustainability at Sweco UK. He explains that the central urban location of the development is particularly beneficial to the deployment of a fifth-generation

GLOSSARY: NEXT GENERATIONS

- **Third generation:** Heat distributed at 90/70°C flow/return usually fuelled by a combined heat and power energy centre.
- **Fourth generation:** Temperatures are below 55/25°C flow/return, which leads to greater efficiencies, especially if using heat pumps or energy from waste. Onsite renewable generation can be integrated.
- **Fifth generation:** An ambient temperature energy network (which will run below 25/20°C at Bankside Yards) has a wider range of lower-grade heat sources, and accepts simultaneous cooling heat rejection, along with heat supply.



ambient loop network: 'The location of the project in the middle of London provides the opportunity to utilise waste heat, particularly with the urban heat island effect found in large cities,' he adds.

'The site is a "hyper-mixed" development, and when it comes to mixed use, a fifth-generation network really starts to provide a lot of benefits,' Amrania says of the project. 'You have a variety of demands and different heating and cooling loads – for example, the heat rejection from offices concurrently with major hot-water demands. You have that interaction between cooling and heating requirements that suits a fifth-generation network.'

Amrania says that well-insulated buildings have sufficient heat in them, via human activity and ambient heat sources, to produce the residual heat required. 'By harvesting these low streams of energy and connecting different parts of mixed-use buildings, we are essentially balancing the energy needs between them,' he says.

The heat-rejection apparatus for the office spaces is a network of air source heat pumps providing sensible cooling to the air, which is connected to the ambient loop system. It works with the end-users' water source heat pumps to absorb or reject energy. 'Individual buildings have these water source heat pumps, and for the office buildings these are centralised and add heat to the network,' Amrania explains. 'ASHPs are used when there is not enough heat within the building, or to reject that heat when necessary.'



In total, the eight buildings in the development are set to deliver 350,000ft² (32,500m²) of office space, around 30 new bars, restaurants and shops, around 700 new homes and a 150-room hotel.

The first phase of the Bankside Yards project, a high-specification office block called Arbor that sits above the regenerated railway arches, is due to be completed at the end of 2022.

Arbor is designed to be a green building supporting green businesses and be carbon neutral, reaching the Breeam Excellent standard. Construction of the 48-storey residential tower and other buildings on the site is due to start next year.

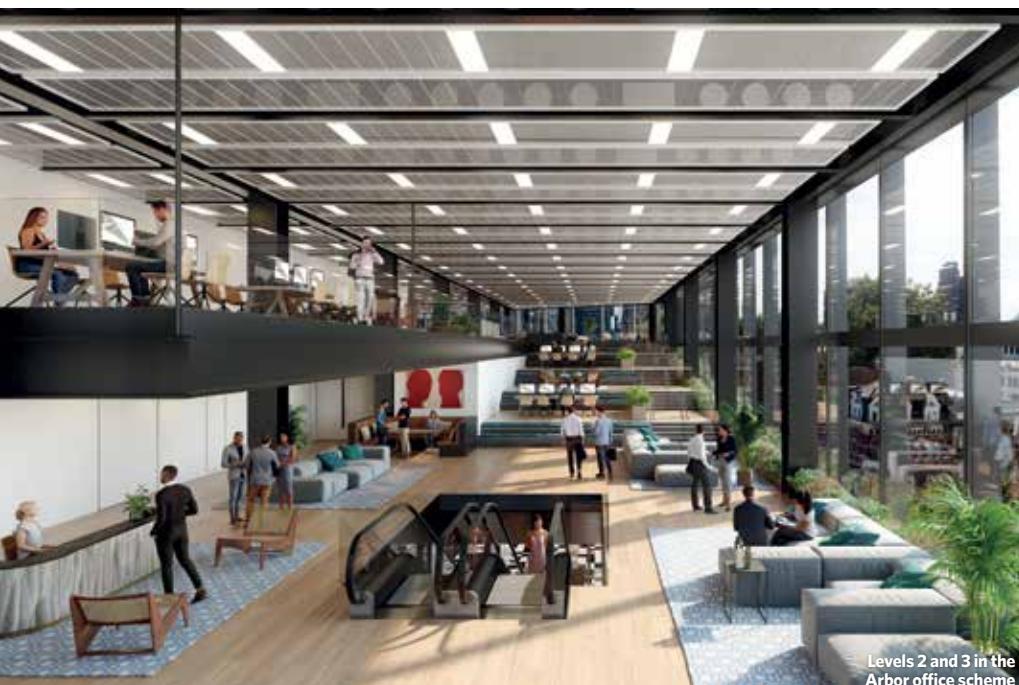
Generational change

Sweco was engaged in the early design stages of the project. Initially, the company had intended to deliver a third-generation heat network, but by 2017-18, as it went through phase two of planning, the client decided to advance the system and make it all-electric.

Sweco benefited from its Scandinavian background and knowledge of ambient loop networks across Western Europe. One example cited by Sweco is one of the first ambient loop networks in Sweden at Lund City (see panel, 'Lund network').

The network temperature of the system can vary depending on season. During the heating season, the flow will be 25°C, while during cooling season the flow temperature is likely to be around 20°C, Amrania says. The system requires waste heat to be viable, which can come from plantrooms and office electrical equipment, for example.

A network of thermal storage cylinders will be located in various plantrooms around the site, while the network itself effectively

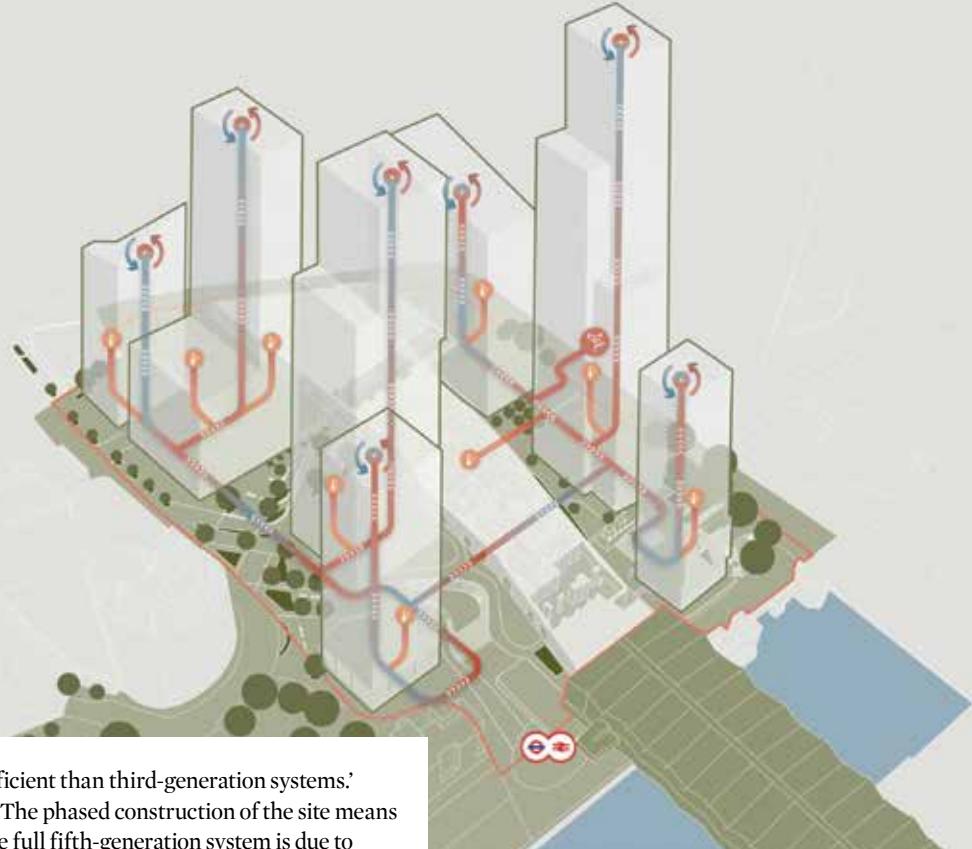


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Bankside Yards

Fifth-generation energy network

- Heat sharing**
Low-temperature fifth-generation network allows energy sharing
- Optimised façades and efficient systems**
Optimised façades, systems and infrastructure, combined with energy sharing and green energy purchasing, will achieve net zero carbon in operation
- Air source heat pumps**
Air source heat pumps supplement heating and cooling energy balance across site
- Future-proofed**
Future connection to external district heat network infrastructure



» acts as a thermal store. 'In future projects we will use the ground for thermal storage,' Amrania says, 'but in this instance it was not considered a cost-effective solution in terms of its high capex. With energy prices going up now, though, conditions for this option are becoming more favourable.'

Targets

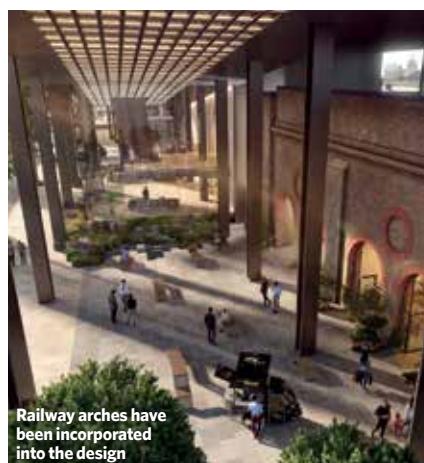
In terms of energy efficiency, Amrania believes the fifth-generation network being installed at Bankside Yards will provide 'unprecedented' energy saving. 'With a third-generation network, you got network energy losses. And reduction of those losses relies essentially on the skill of the facility management [FM] team and how well equipped they are with knowledge to fine-tune the system and kit installed.'

'With an ambient loop network, such as the one at Bankside Yards, you immediately save 30% to 40% on heat energy. Also, for example, because the network is operating at a low temperature, the coefficient of performance for ASHPs remains well above those of fourth-generation networks – around 30% for a typical heat pump. These networks could be 50% to 60% more energy

efficient than third-generation systems.'

The phased construction of the site means the full fifth-generation system is due to be completed and commissioned around 2027. Initially, the Arbor building will be using ASHPs for its standalone heating and cooling requirements, and will eventually be connected to the energy network as the building of the site progresses.

'With the ambient loop it is quite easy to phase in connections,' says Amrania. 'ASHPs can be installed in the buildings individually,



and once the network is up and running you can connect them.'

The project team has developed a soft landings strategy to ensure a smooth transition as each building comes online and the phased switch to the ambient network takes place.

'There may be a few teething issues initially, as people come to terms with this new system,' Amrania admits. 'It's a new system and a different approach, so there's a massive learning curve. But that has been built into our thinking and planned for, so that the FM team are well prepared to tackle these systems.'

Ultimately, when operational, the fifth-generation network has been designed to use data to improve performance and optimise energy efficiency across the development. For example, the temperature maintenance system will eventually integrate elements such as weather predictions as well, so it can adjust heating or cooling for expected temperatures rather than reacting to current conditions.

'The whole idea behind the fifth-generation network concept is that they begin as a fifth-generation network, but eventually, within a few years, once you accumulate the data it turns into a "sixth-generation" network because it becomes data-driven,' Amrania says.

And the benefits? 'A significant increase in energy efficiency and energy saving, as well as helping to decarbonise energy and tackle the impact of the urban heat island effect.' CJ

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UPGRADING A THIRD-GEN NETWORK

The ambient heat network in Lund, Sweden, connects multiple buildings at Medicon Village and is operated by energy company E.ON. The network continues to employ a gas-fired combined heat and power plant as the source of heat, reflecting its conversion from a third-generation network.

So why transition from the original third-generation scheme straight to a fifth-generation network? Amrania says there are two key reasons. The first is that a fourth-generation network still has quite elevated temperatures compared with a fifth-generation ambient loop network. So any waste-heat capture in a fourth-generation network still has to be upgraded.

If you capture heat from a transformer, say, it will be giving you around 20°C, says Amrania, which would need to be raised to around 60°C. In an ambient loop, that waste heat goes into the network, and can be absorbed straightaway, he says. 'There's no need for additional energy to raise the temperature.'

There's also no extra embodied carbon within the kit needed to upgrade the energy. That's the key,' says Amrania.

A stepping stone to decarbonisation

With the United Nations Secretary-General saying that the world is on a 'highway to climate hell' at the COP27 climate change summit last month, we have all been starkly reminded that net-zero plans must remain a core priority for businesses and households.

The UK Green Building Council is urging the nation's representatives at COP27 to 'remain steadfast' in keeping the 1.5°C global warming target alive.

With the current energy crisis at the forefront of everybody's mind, it is clear that the UK must urgently reduce its gas consumption not only to mitigate carbon emissions, but also to help reduce costs for businesses, consumers and the government.

The UK imports around 60% of its gas and heat pumps are among the most effective measures available to reduce this. Replacing

a gas boiler with a hydronic heat pump could reduce a home's gas use by more than 70%. This means that for every heat pump installed, at current prices, the UK could save around £1,100 in wholesale gas costs¹. So, if all 23 million homes with gas boilers switched to a heat pump, the savings in wholesale gas costs would be equivalent to around 1.2% of GDP, which would significantly benefit the UK economy and the government's finances.

The Future Homes Standard, which will ban gas boilers in new builds from 2025, is also looming and the route to the decarbonisation of heat remains uncertain. But what we do know is that heat pumps are far more energy-efficient than gas boilers. For example, the LG Therma V is typically 4.7 times more efficient than conventional boilers based on tests at A7/W35 in accordance with EN14511.

Historically, heat pumps have made specifiers in the building services sector slightly nervous.

Which is understandable – it's a huge change for the sector and some have had negative experiences in the past. However, advanced technology is becoming more mainstream and we now know how to harness its benefits to provide ultimate efficiency, as well as thermal comfort, in the UK's housing stock.

Furthermore, it is evident that attitudes are changing. The original LG Therma V Monobloc has seen enormous success in the UK marketplace as heat pump sales in 2021 trebled over sales in 2020. But as more housebuilders, developers, and housing providers look to more renewable heating solutions, the 'S' version is set to make unparalleled sales figures in 2022.

The Monobloc 'S' requires 16.7% less refrigerant compared to the existing model – reducing emissions and environmental impact even further. This newer version features LG's revolutionary R1 Compressor technology which offers advanced efficiency, reliability and operational range – up to 135Hz, due to the enhanced tilting motion of the scroll. This also ensures higher durability, bottom compression, and simple structure that offers lower noise and vibration, less weight and superior reliability.

The UK's ambitious net-zero targets mean there is a real need to decarbonise our homes and buildings. With the varied and complex housing stock in the UK, it is imperative that we take a pragmatic view and utilise every available option. So, as heat pump technology has advanced over the years, it is clear that they will play a major role in providing a consumer-friendly stepping stone to full decarbonisation.

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BUILDING A FUTURE WITH APPRENTICES

Apprenticeships are a valuable, yet underused, resource in the building services industry. At an event led by the CIBSE FM & Controls groups, the benefits of bringing apprentices into the workplace were discussed. **Molly Tooher-Rudd** reports



Skills shortages across the building services industry are proving to be a major obstacle to the timely delivery of high-performing, low carbon buildings. For many, studying full-time at university is not an option and apprenticeships are an attractive alternative – but the pathway remains underused.

So, the CIBSE FM & Controls group recently held an event on how apprenticeships can launch careers and deliver skills. A panel of senior employers and CIBSE's 2021 Apprentices of the Year, Harry Playfair (technician level) and Josie Cheeseman (degree level 5-7), talked about their experiences and explored the benefits of apprenticeships for organisations and future professionals.

'I didn't like school and its teaching environment, so an apprenticeship really appealed to me. I still wanted to learn, but also be independent and earn money; an apprenticeship allowed me to do all of those things', said Darren Wright, global commissioning and building performance evaluation leader at Arup.

Wright's path into engineering has made him a strong advocate for this route into the industry, and he urged employers to recognise the value of this type of learning. 'An apprenticeship should be seen as a different career path to the same outcome, as it was for me,' he said.

Tailoring relevant skill sets through training means organisations can build the team they need. 'Inspiring the next generation and promoting long-term development from highly experienced employees has a net positive impact on a business,' Wright said.

Sean Harlow, associate director, and sustainability and technical services manager at BNP Paribas Real Estate, said the industry has

experienced a 50% reduction in apprentice uptake since the 1980s, and there isn't enough investment in apprenticeship programmes to close the current skills gap.

Empowering new engineers at multiple levels of skill is crucial, especially for specialist industries. 'The social impact of apprenticeships must also be recognised,' said Harlow. 'It gives young people an opportunity for meaningful work.'

Harry Playfair is a building services project engineer apprentice at NG Bailey, and is currently working on his level 4 qualification. He is keen to change perspectives on this route into employment. 'An apprenticeship provides individuals with a wage while working towards nationally recognised qualifications,' he said.

'When I left school, the dominant focus was on taking the traditional university route; I didn't hear of many opportunities from apprenticeship providers.'

After leaving school in 2017, Playfair studied at college for a BTec level 3 extended diploma in engineering before starting at NG Bailey in 2019. He has been able to balance studying and gaining practical experience on projects, with 20% of his time spent on academic training away from daily workplace duties.

Josie Cheeseman said the opportunities and advancements she has been able to access so early in her career would not have been possible if she had taken the university route.

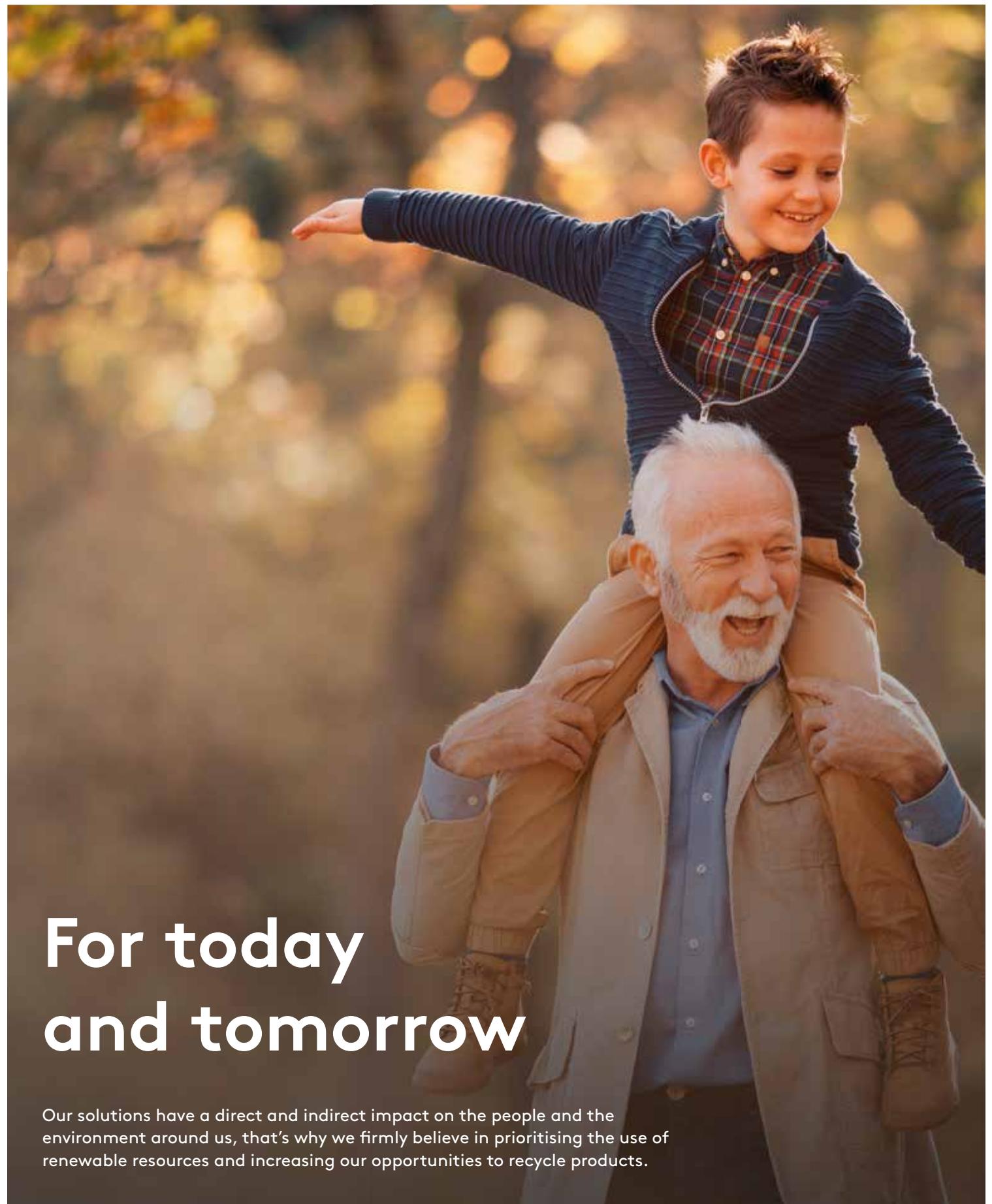
She joined WSP's rail team in 2019 and is currently in the fourth year of her apprenticeship. Her projects have focused on the HS2 line, across a variety of disciplines. 'My apprenticeship has given me a head start into the working world,' she said. 'I've been encouraged to try everything and have been given a lot of responsibility.'

Cheeseman particularly enjoys the financial independence, and the knowledge that she won't be tied down with massive student loans like so many others.

She acknowledged there may be a few drawbacks to this pathway, with big time demands and the feeling of missing out on the university experience. Overall, however, Cheeseman is a strong proponent of apprenticeships.

'My experience really has been nothing but positive,' she said. 'I feel that I am equipped with many skills, and reckon they will stand me in good stead for the future.'

Jon Belfield, CIBSE IT & Controls committee member, concluded by summarising the benefits of apprenticeships as outlined by the panel, but said there must be more communication about their potential. 'Apprenticeships need to be rebranded as aspirational and socially, economically and educationally viable,' he said. **CJ**



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Room air distribution for effective ventilation

This module explores some of the basic parameters for air movement associated with ventilation for occupied spaces

The supply and removal of air by ventilation terminals significantly impacts the effectiveness of the environmental system. In occupied buildings, this can influence comfort, productivity, and occupant wellbeing, as well as the environmental impact and financial cost of operation. This CPD will focus on some of the basic parameters that describe air movement associated with provision of ventilation for occupied spaces.

The start of any ventilation system design will be an examination of the room-by-room loads and outdoor air requirements, with checks and iterations to moderate those needs by refining the building structure, fenestration and shading – as well as expectations of occupancy and use. The iterative process depends on system constraints and needs that are influenced by numerous factors. These could typically include: the building and room types; planned usage; spatial restrictions; aesthetic demands; matching of any existing systems; client expectation; capital budgets; and designer preferences. Finally, when the system type has been selected, the supply and extract terminals, known collectively as 'air terminal devices' (ATDs), may be evaluated and selected – a process that, in itself, may demand a reconsideration of earlier decisions. As noted in the BSRIA BG 10¹ guide, the choice of system, and associated supply and extract position (for example, high-level diffusers, mid-level or low-level displacement terminals) may well be dictated by the room loads, the configuration of the space, and the use of the space. The goal is to achieve good ventilation effectiveness – that is, the ability to remove internally produced contaminants, avoid draughts, and ensure that the air is at a satisfactory condition to contribute to appropriate occupant comfort. Aside from the ability to ventilate the space, there are other important factors that will influence ATD selection, which would include: aesthetics; cost; space requirement; acoustic performance; energy efficiency; maintainability; and sustainability.

For most applications, it is beneficial to define an **occupied zone** – typically, a

volume where thermal comfort conditions are maintained for occupants, bounded by zones parallel to walls, ceiling and floor, as illustrated in Figure 1.

The selected room volume will be related to the expected use of the space. It is rare that people sit directly next to walls, and there are very few occupants who reach beyond two metres high. For situations where shoes and leg coverings are de rigueur, 0.1m from the floor may be seen as a reasonable boundary. However, where there are likely to be exposed ankles, care is needed to avoid draughts when introducing cool air. (The concept of an occupied zone is not as relevant with a displacement ventilation system.)

Normally, the air velocity in the occupied

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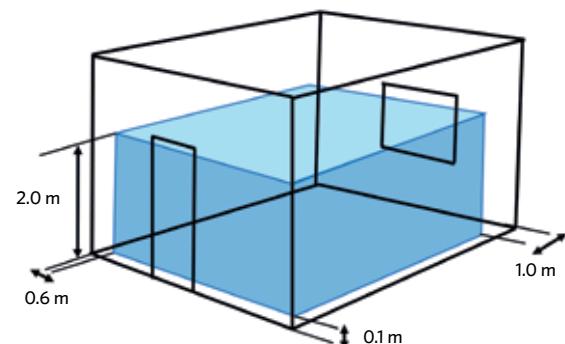


Figure 1: A nominal occupied zone (Source: Swegon)

» zone would be designed in the range $0.15\text{m}\cdot\text{s}^{-1}$ to $0.25\text{m}\cdot\text{s}^{-1}$. Below $0.05\text{m}\cdot\text{s}^{-1}$ the air is considered 'stagnant' and not appropriate for sedentary occupation. However, as with so many 'rules' in building services engineering, it is important to consider the potential benefits of stretching these limits. For example, in cooling applications as illustrated in the chart in Figure 2, based on ISO7730,² where the curves indicate a constant level of comfort (for office-type applications) a higher air velocity may be used to offset the warmth sensation caused by increased temperature – so reducing the potential cooling requirement. This will be significantly affected by the mean radiant temperature, θ_r , – when θ_r is relatively low (the higher curves), a larger increase in air velocity is needed to maintain comfort as air temperatures rise.

Fluctuations in air velocity will impact occupant comfort, and for cooling applications may be assessed by determining the turbulence intensity (T_u) (see boxout, 'Assessing turbulence and draught'). As T_u increases, the acceptable mean air velocity for comfort will reduce. For air conditioned and mechanically ventilated buildings, the draught rating (DR) combines air velocity, temperature and turbulence intensity into a discomfort factor that is often used in conjunction with predicted percentage of dissatisfied (PPD) to provide an assessment of comfort conditions in a space. A DR value of approximately 15% is typically considered acceptable for people undertaking light, mainly sedentary activity (with any draught being assumed at neck level).

The significance of perturbations in air velocity (that is, air speed and direction) can potentially transform a comfort zone into one that generates occupant complaints. For example, as taken from CIBSE Guide A,³ if the temperature of air passing over the body is 23°C and the turbulence intensity is 60%, a draught rating of 15% corresponds to an air velocity of $0.14\text{m}\cdot\text{s}^{-1}$. However, if the turbulence intensity is only 10%, the limiting velocity for comfort is increased to $0.23\text{m}\cdot\text{s}^{-1}$.

For comfort, it is recommended³ that there should be not more than 3K difference in air temperature between ankles and head. However, if air velocities are higher at floor level than across the upper part of the body, CIBSE recommends that this could be increased to a maximum temperature gradient of 2K for each metre height.

To characterise the moving plume of air emanating from a supply ATD, as illustrated in the high-level example of Figure 3, there are several terms that are reasonably universal in application, although quoted 'typical' values can vary between

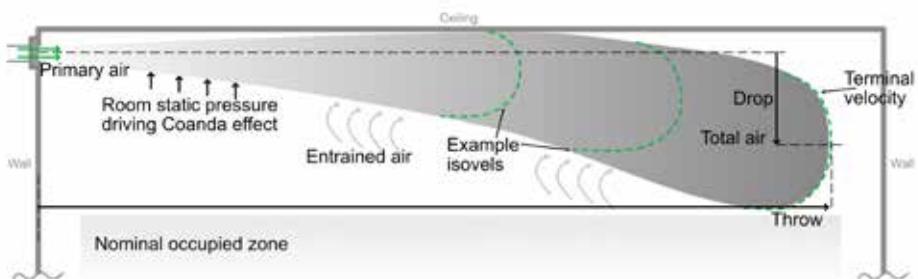
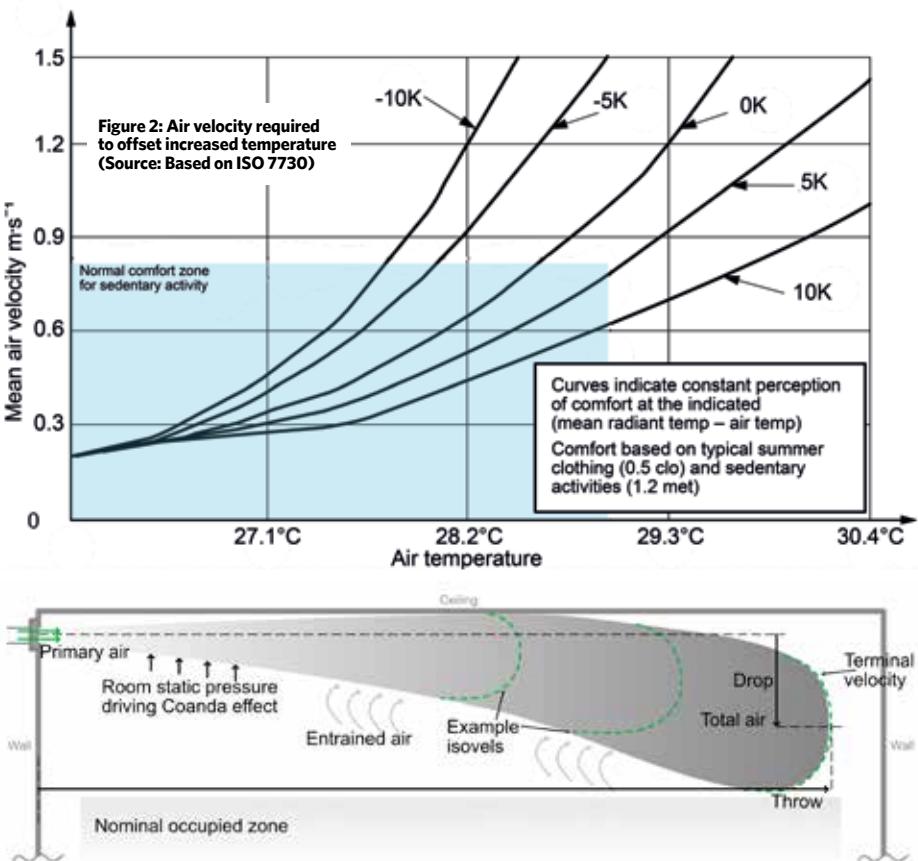


Figure 3: The top section of a room with a high-level wall-mounted supply air diffuser

manufacturers. (BS EN 12792⁴ provides an extensive list of standard terminology.)

The **primary air** leaves a supply ATD at an **outlet velocity**, $\text{m}\cdot\text{s}^{-1}$, which will be determined by the total pressure (velocity pressure + static pressure) at the rear face of the ATD and the geometry of the outlet. The velocity of the air in the room is often described by considering envelopes known as an **isovels** (as in Figure 3) that indicate a boundary line linking points of common air velocity. As air leaves an ATD, room air is entrained and mixed into the air stream, so reducing the velocity of the moving mass of air while increasing the **total volume**. After the air leaves from the ATD the flow tends to **drop** or **rise** depending on its temperature relative to the room air. As the velocity and inertia of the total air reduces, its trajectory will become increasingly influenced by gravitational forces. In a horizontal supply, the air stream will tend to curve upwards if the incoming air is warmer than room air and downwards if cooler. The velocity of the air will reduce more swiftly if the air has a greater **spread** as it is introduced into the space, and the air will increasingly diverge (typically with⁵ an included angle of between 20–24°) as it entrains surrounding air; so increasing the total air volume.

The **terminal velocity** is when it is assumed that the inertia has reduced to such a point that gravitational forces begin to dominate, typical considered as $0.25\text{m}\cdot\text{s}^{-1}$ although, as reported by Legg,⁶ this can be a rather arbitrary value. It is variously

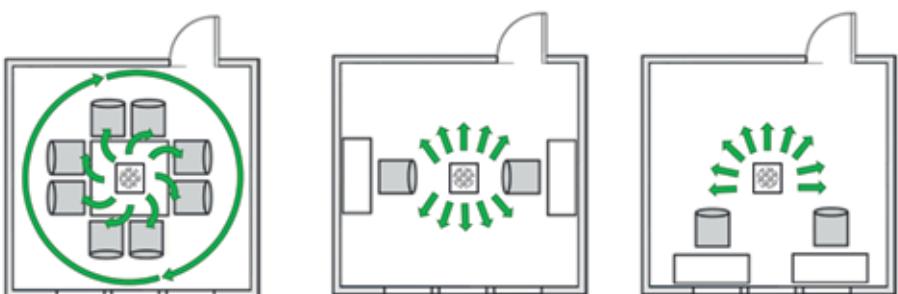


Figure 4: Adaptable air diffuser employing adjustable air nozzles (Source: Swegon)

Type of outlet	Approximate supply potential per unit floor area L·s ⁻¹ ·m ⁻²
Grille	3-6
Linear/slot	4-10
Perforated panel	4.5-15
Ceiling diffuser	4-25
Ventilated/perforated ceiling	5-50

Table 1: Approximate air supply potential from example ATDs
(Source: Fundamentals of Air System Design¹¹)

referenced between between 0.25m·s⁻¹ to 0.75m·s⁻¹. The distance measured from the face of the ATD to that point, in the intended direction of flow, is known as the **throw**, measured in metres. Values of throw, flowrates, outlet velocity, distribution characteristics, and noise data are provided in manufacturers' catalogue data for ranges of ATDs – they will all vary depending on the chosen primary flowrate. In some situations, a short throw length is required – for example, to prevent the total air stream striking a structural beam or light fitting, so producing an unwanted deflection of high-velocity air into the occupied zone (Jones⁵ provides a useful commentary on the influence of obstructions on supply airflow to allow more nuanced selection of supply ATDs).

A long throw can usefully provide increased opportunity to entrain room air as well as supplying treated air across a greater area. **Overblow** describes an airstream that meets an opposing wall and is deflected downward towards the occupied zone, as part of the throw distance. Supply air diffusers that discharge towards each other may cause a downward airstream that can create draught in the occupied zone. However, with proper consideration of throw, the outlets can usually be placed relatively close to each other without the combined stream reaching the occupied zone at a velocity beyond the comfort range.

If the supply air is introduced adjacent and parallel to a surface, as is often the case from a diffuser mounted less than about 300mm from a ceiling, the 'Coanda effect' (or 'ceiling effect') will tend to extend the air's throw as the airstream is pressed to the surface by the higher room static pressure. An ATD design that strengthens the Coanda effect can deliver increased cooling effect to the room, with a lower risk of draught. As discussed in *CIBSE Journal*,⁷ exposed, suspended supply diffusers without an adjacent ceiling may be augmented with a horizontal, surrounding 'Coanda plate' that has been shown to increase the effective throw.

Practically, the selection of ATDs can readily be undertaken by employing one of the many manufacturers' ATD selection programmes or by employing CFD simulation tools, but can also be simply verified with sketched Straub⁸-style diagrams that are similar to that shown in Figure 3.

Selection will include considerations of the design air volume flowrate, distance available for throw, spatial constraints, and aesthetic demands. The selection and location of extract ATDs is typically less critical than supply, since flow through an exhaust ATD has very little influence on the local air movement, as air approaches from many directions so that significant velocities only occur close to the device. However, as discussed in the September 2022 issue of *CIBSE Journal*,⁹ their position can have a significant impact on the containment of contaminants emitted in the space – they should not encourage entrainment of contaminant across occupied zones but can usefully be located close to points of contaminant generation. Generally, it is beneficial if air is extracted near points of heat gain in cooling applications, and vice versa where heating is the dominant mode. To avoid short-circuiting primary air directly into extracted air, ATDs are preferably located outside the throw of the supply (and potentially in what would otherwise be a stagnant zone). For displacement ventilation systems, extracts would be at the highest level in order to extract the warmest air.

The types of ATDs are many and various. The freely downloadable HEVAC guide to air distribution¹⁰ provides an extensive illustrated description of the most common type ATD types. The flows available from supply ATDs would be determined from manufacturers' data. However, Table 1 provides an indication of the comparative ability of ATDs to effectively move air into a space.

Adjustable devices offer flexibility of application that can be utilised at the time of

system commissioning (or recommissioning) to service flexible use of spaces. For example, the ceiling diffuser application in Figure 4 employs air nozzles that can be adjusted so that the distribution pattern suits the room. The standard setting would typically be a swirl pattern that can supply the air volume across the whole room. However, it is also possible to adjust the distribution pattern so that, for example, the airflow is directed away from workstations, to minimise the risk of draughts.

No matter what overall system is employed in the building – whether it be mixing, displacement or laminar flow – ATDs will ultimately determine the success, or failure, of the whole installation. And so, as with all building services systems, supply and extract devices merit the care in their selection and application that reflects their critical role in providing good quality built environments.

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■ Turn to page 76 for references



ASSESSING TURBULENCE AND DRAUGHT

The turbulence intensity (Tu) is the ratio of the root mean square of the fluctuating air velocity to the mean air velocity expressed as a percentage (40% is a regularly used default value). Figure 5 illustrates different levels of turbulence for a room where the average velocity is the same, but the method of air supply has been varied (for example, different diffusers or obstructed flow), so producing different levels of turbulence.

The draught rate (DR) is the percentage of people predicted to be bothered by draught and can be quantified² by DR = ([34 - 0.1 [v̄ - 0.05]^{0.62}] (0.37 · v̄ · Tu + 3.14)%

Where DR = predicted percentage of people dissatisfied due to draught, %, θ_a = local air temperature, °C, v̄ = local average air velocity, m·s⁻¹. This may be applied where 20°C < θ_a < 26°C and 0.05m·s⁻¹ < v̄ < 0.5m·s⁻¹ and 10% < Tu < 60%

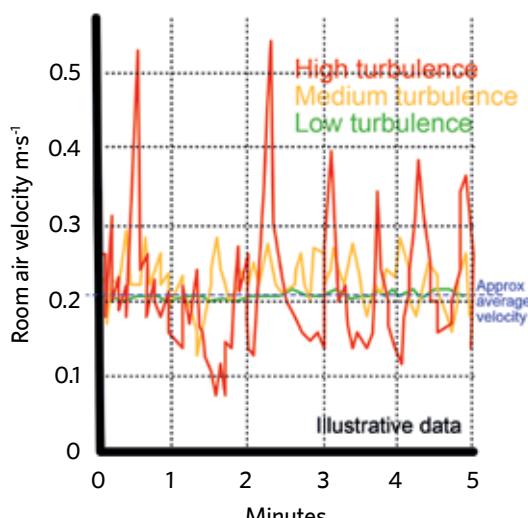


Figure 5: Examples of measured room air velocity creating levels of turbulence while average air velocity is constant

Module 208

December 2022

- » 1. Which of these requirements was not specifically included in this article as a factor that would influence the selection of ATDs?

- A Acoustics
- B CE mark
- C Cost
- D Energy efficiency
- E Sustainability

2. What is considered the maximum acceptable value of draught rating for people undertaking light, mainly sedentary activity?

- A 5%
- B 10%
- C 15%
- D 20%
- E 25%

3. What approximate included angle will an air flow typically diverge at when leaving a diffuser?

- A 0°-4°
- B 10°-14°
- C 20°-24°
- D 30°-34°
- E 40°-44°

4. A room has an air temperature of 28°C and a mean radiant temperature around 5K cooler than the air. What approximate air velocity is most likely to provide comfort for occupants wearing typical summer clothing and undertaking sedentary activities?

- A 0.4m·s⁻¹
- B 0.5m·s⁻¹
- C 0.6m·s⁻¹
- D 0.7m·s⁻¹
- E 0.8m·s⁻¹

5. What is the typical value quoted for terminal velocity as noted in the article?

- A 0.05m·s⁻¹
- B 0.10m·s⁻¹
- C 0.15m·s⁻¹
- D 0.20m·s⁻¹
- E 0.25m·s⁻¹

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Products of the month

Samsung launches low-noise, high-temperature heat pump

EHS Mono HT Quiet can replace gas boilers

Samsung has launched a new high-temperature heat pump, targeting self-builders, housing developers and other building owners.

The EHS Mono HT Quiet is a low-noise heat pump that provides a leaving hot-water temperature of up to 70°C for domestic heating purposes (when the outdoor temperature is between -15°C and 43°C). Samsung says that even at -30°C it can supply hot water of up to 60°C.

Samsung says the high leaving water temperature makes the heat pump an ideal replacement for a gas boiler.

The heat pump is Quiet Mark certified and operates at noise levels as low as 35d(B), using what Samsung calls a four-step Quiet Mode.

The outdoor unit features a double-layered sound insulation system fitted with a patented groove grid felt design, which Samsung says blocks and absorbs



noise produced by compression parts and vibrations. The dark colour is designed for the one-metre high heat pump to blend into a building's exterior. It has a black grille that screens the internal mechanics.

The outdoor unit features anti-corrosion capabilities on the heat exchanger and chassis, to ensure maximum durability in harsh environments, and it has a seasonal coefficient of performance of A+++ energy efficiency.

Samsung says the internal parts of the heat pump can be accessed via a side panel

by having to remove just three screws.

It is currently available in the UK in three capacities - 8kW, 12kW, and 14kW - including both the single and three-phase power supply system.

The dimensions of all three models are 1,270mm x 1,018mm x 530mm.

The unit can be remotely controlled with SmartThings, an integration platform for smart devices in the home.

■ Visit bit.ly/CJDec22Prod1

Multimillion-pound leisure centre on Golden Mile gets premium Toshiba Solution

A Toshiba heat recovery VRF air conditioning system has been installed in Great Yarmouth's new £26m Water and Leisure centre.

The Toshiba system, installed by Adcock Refrigeration and Air Conditioning, serves the centre's pool and water facilities, 100-station health and fitness gym, sports hall with climbing zone, and café.

Based on a combination of Toshiba's three-pipe SHRM-e and two-pipe SMMS-u VRF systems, the HVAC system is designed to maximise energy efficiency and optimise the comfort of the centre's indoor climate. Because of the coastal location, outdoor condensers are treated with an epoxy coating to protect against corrosion.

The centre includes 28 Toshiba indoor units, mainly ceiling-suspended cassettes, supported by wall-mounted and ducted units. IT and comms suites have a dedicated air conditioning system with Toshiba R-32 digital inverter splits. The cooling system is designed to N+1, ensuring there is always a unit on standby in the unlikely event of a failure.

Control is provided by a Toshiba Carrier UK touchscreen unit, which connects to the BMS, providing facility managers with full visibility and control of operating conditions, and the ability to optimise total system performance.

■ Visit www.toshiba-aircon.co.uk/product/shrme-3-pipe-heat-recovery-outdoor



▼ Aquatech Pressmain Fire Safety Valve ensures sprinklers take priority

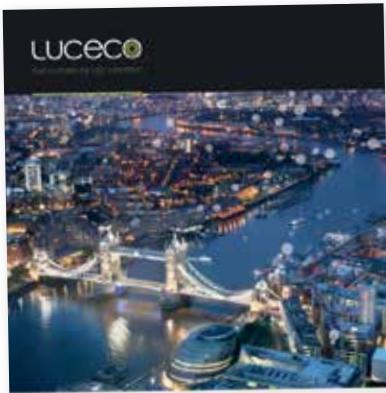
Aquatech Pressmain's Fire Priority Demand Valve is designed to be fitted to the cold water branch of any combined domestic water and sprinkler system supply.

If the sprinklers are activated, the valve will close, isolating the flow of domestic water. This will enable the booster set to pump all available water to the sprinkler system.

The fire safety valve is fitted with failsafe close on power failure and break tank level interlock to meet the requirements of BS 9251:2021.

■ Visit www.aquatechpressmain.co.uk
email sales@aqpco.co.uk





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▲ Luceco launches lighting controls and solutions guide

Luceco has launched a new publication demonstrating the range and diversity of its lighting control systems. Controls become standard in many new lighting installations and Luceco provides solutions for refurbishments in existing infrastructure.

LED luminaire technology coupled with lighting controls can help save up to 70% on energy consumption, Luceco says. By using scene-setting, presence-detection and daylight-dimming controls, the technology ensures spaces are lit appropriately for safety, security and comfort.

Both Platform and Elevate from Luceco offer wireless-controlled lighting solutions. Platform offers simple and cost-effective wireless control, with Elevate benefiting the client with a function-rich system, including energy and emergency lighting reports and asset tracking, as well as the primary functions of dimming, scene-setting, presence detection and daylight control.

The company understands the importance of end users controlling their own space, and said it can offer a lighting control solution for projects ranging from a small office to multiple estates.

■ Download a copy of the guide from Luceco's website: www.luceco.com/uk/lighting-control-systems

Pump Technology offers 'pop-in' pump demonstrations ▶

Pump Technology's David Johnson is offering to 'pop in' to your work or local coffee shop to demonstrate pumping products. The 20-minute, hands-on reviews and discussions are not designed as a CPD, said Pump Technology, but as a straight-to-the-point, pros and cons discussion. Those taking up Johnson's offer will learn which products are available, get to know the ideal wastewater or sewage pump system selection for a particular application, and gain confidence in the best technical and commercial pump specification, according to the company. Johnson is currently on a grand tour and would be pleased to pop in, said Pump Technology

■ Call David Johnson on 07984 520515 or visit www.pumptechnology.co.uk



Titon reaches golden milestone ▶

Titon Hardware has celebrated its 50-year anniversary. John Anderson launched Titon Hardware from his garden shed in Essex when he created a window casement stay. Fifty years later, Titon Hardware is now a large supplier of window and door hardware and ventilation products.

Anderson said: 'I have seen Titon progress from its inception and I'm very proud of what has been achieved from humble beginnings. We have always been grateful to our staff, who have developed the company into a successful organisation.'

■ Contact James Griffith at james.griffith@titon.co.uk or call 01206 814864



▼ Cambridge University Passivhaus installs Trilux luminaires



Trilux lighting has been specified for a new student accommodation building at the University of Cambridge's Lucy Cavendish College.

The Passivhaus design comprises 72 student bedrooms and social space. In the bedrooms, LED wall-mounted Trilux LC60 lights have been specified to create a cosy, inviting atmosphere for students. In the café, there are Trilux Limba pendants in a gold and black finish.

Electrical contractors Munro Building Services has specified Trilux LEDs in corridors and stairwells to the plantrooms and external stores. Lights include SNC Point, LC60, 74RS, Amatris, Osram LED Tape, Skeo Q B1, LTX Z, Skeo Curv and Skeo Q.

■ Visit www.trilux.com

◀ Elco's Hybrid System Selector Tool aims to reduce emissions and costs

Elco Heating Solutions has launched a new tool that calculates annual carbon emissions and running costs. Aimed at consultants and D&B contractors, the Hybrid System Selector Tool uses extensive parameters to calculate the most suitable, and sustainable, heating product for a commercial project.

For building services engineers working on heat pump-only or hybrid system projects, Elco's digital tool can help quickly identify the best combination of products to match the project requirements.

Elco said it is ideal for planning stages 1 and 2, as it provides detailed 'lowest yearly CO₂' and 'lowest yearly cost' comparisons between a heat-pump-only system, hybrid system and a boiler-only setup.

It is also capable of calculating system parameters at any external temperature, as well as the seasonal performance factor as per CIBSE AM17.

These calculations can be repeated across multiple system designs and flow temperatures, said Elco. The Tool can select the switch point for heat sources, and provide analysis and an explanation of the selected option.

■ Visit www.elco.co.uk



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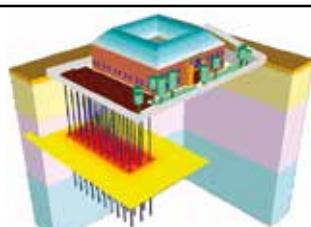
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For an informal discussion please contact Samantha Saunders
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Facing the challenge

Chris Macey explains how façade engineering will evolve in response to the Building Safety Act and net zero goals

Chris Macey FSFE, co-founder and CEO at Wintech Façade Engineering, is one of the founding members – and past chairman – of the Society of Façade Engineering (SFE) and has been active in the sector for more than 35 years. In acknowledgment of his service and contribution to the industry, Macey was presented with a Lifetime Achievement accolade at the 2022 Design and Engineering Awards.

We ask him what the future of façade engineering will look like as designing for net zero comes into focus in a period of great scrutiny of safety in construction.

What role does the SFE play?

A façade is one of the most expensive elements and primary modifier of the energy consumption of a construction. For proper building execution, engineers must be conversant in all aspects of the science of façade engineering – for example, material sciences, structural engineering, manufacturing engineering, construction process, vapour transfer, thermal bridging, and Psi values. This isn't fully recognised, and there is an urgent need to train experts in the discipline.

The SFE's primary role is to accredit those who operate in this specialised field, giving clients comfort that their engineers are competent. It aims to promote excellence and best practice in façade engineering, and offers a platform to collaborate and share expertise across the industry. The SFE will play a greater role in ensuring competence within the industry as part of the Building Safety Act.

How do you ensure your staff can keep abreast of technical developments while designing safe and efficient façades?

The world is changing rapidly and, to keep pace, our company needs to be engaged in the wider dialogue within the construction industry. We must innovate, train, and disseminate learning, to ensure the ongoing success of the company.

Wintech is one of the largest sponsors of students on the MSc course in Façade Engineering at the University of the West of England. In addition, SFE and CIBSE membership is encouraged for technical staff, as well as regular CPDs, using online forums, and holding technical workshops. We encourage all in the industry to follow suit.

What is the biggest façade challenge in achieving net zero carbon?

There are several, including the need for clear, consistent and enforceable guidance, reducing the performance gap, and legitimate carbon offsetting.

As homes become better insulated, the effect of thermal bridges is becoming more significant, and this is now recognised in the new Approved Part L 2021 amendments. Ensuring that thermal bridging targets are met will be complex, as façade detailing becomes constrained at an early stage.

Environmental engineers in the building sector now recognise that Psi values and thermal bridging are increasing contributors to a façade's energy performance.

The minutia of façade design is a significant influence on the delivered result; as an industry, we can't continue to estimate these figures in the hope they are right. Measurement and reduction of embodied carbon of a façade is being given greater emphasis. Lowering it without significant additional costs is a challenge.

Are new energy requirements in Building Regulations changing façade designs?

Absolutely. There is little we can achieve without considering the contribution of façades – which are generally getting thicker, with less glazing-to-wall ratios, especially on southern elevations, to limit overheating – with consideration of external shading and passive ventilation. The façade design process needs to occur earlier in a project, or there will be a gap between 'architectural aspiration' and what is delivered.

What impact are embodied energy considerations having on design?

Currently, embodied carbon measurement and targets do not form part of the regulatory framework – a mistake in my opinion. Without clear targets and enforcement, embodied carbon calculations are having little effect on designs. If this is changed, however, there will be implications for façade designs. Efficient building form factors will be given greater consideration, operational versus embodied carbon analyses will become commonplace, and there will be greater emphasis on material efficiency, and use of lower embodied carbon materials and materials with longer lifespans and reduced replacement periods.

EVENTS



NATIONAL EVENTS AND CONFERENCES

CIBSE Building Performance Awards

1 March, Park Plaza Westminster Bridge, London
The shortlist has been revealed for the 2023 CIBSE Building Performance Awards. Celebrate with the winners in person and see what can be achieved by those developing strategies for refurbishment and energy-efficient operation of existing buildings, designing new buildings that operate more effectively, and developing products and systems that support them. View the shortlist on P.26.
cibse.org/bpa

CIBSE Technical Symposium

20-21 April, University of Strathclyde, Glasgow

Titled *Delivering sustainable, safe and healthy buildings for a net zero future*, the 2023 symposium will focus on the challenge of decarbonising our buildings and infrastructure, and delivering net zero carbon buildings over the next 25 years.

www.cibse.org/technicalsymposium

CIBSE REGIONS AND GROUP EVENTS

Check the website for up-to-date information on regions and

groups meetings, webinars and podcasts. Visit www.cibse.org/events

CIBSE Fellows Network

7 December, London

Evening Fellows event at the Passmore Centre, London South Bank University.

HCSE: Feldenkrais-Kinetics, fluid dynamics for health and wellbeing

7 December

Feldenkrais is based on the principles of physics, biomechanics, psychology, motor development, martial arts, and the reconnection of self-education as to how the body moves and develops. This online event asks what we can learn from other disciplines that will develop our understanding of health and wellbeing in the built environment.

SLL: Defining colour: using TM30 as a specification tool

13 December

This event will take a detailed look at the TM30 specification as a means of defining colour for lighting. It will cover existing metrics, such as colour rendering index, and explain why a new approach is needed in the era of LED lighting.

SLL Young Lighter Final

15 December

The finalists will deliver a



CIBSE JOURNAL WEBINARS

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/

15-minute presentation prior to judging. Meet the finalists at bit.ly/CJDec22SSL

West Midlands: Building Regulations Approved Document O Overheating – Reflection on early use

10 January

This roundtable panel discussion will bring together experts in the assessment of overheating, and perspectives from a ventilation/cooling supplier and a lead designer for a property developer.

LIVE ONLINE TRAINING COURSES

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:

Below-ground building drainage

1 December

Mechanical services explained

6 December

Emergency lighting to comply with fire safety

7 December

Design of heating and chilled water pipe systems

12 December

Building services explained

13 December

Electrical services overview

15 December

Fire safety building regulations Part B

15 December

ISO 50001:2018 Energy Management System

16-17 January

Design of ductwork systems

16 January

Mechanical services explained

17-19 January

Electrical services explained

17-19 January

Energy surveys

20 January

Energy Savings Opportunity Scheme (ESOS)

20 January

Low Carbon Consultant Building Design

23-24 January

Dates for 2023 training courses have now been released. For the full programme and further information visit www.cibse.org/training

ONLINE LEARNING

CIBSE has a portfolio of online learning courses, which contain interactive content with quizzes and additional resources to support your learning.

www.cibse.org/training

Membership webinars



CIBSE Membership hosts free, two-part webinar series to support members with applications for the Associate and Member grades and registration with the Engineering Council at Incorporated Engineer and Chartered Engineer level.

To register for this and other membership webinars, go to: bit.ly/CJDec22events

Upcoming webinars:

■ 6 and 13 December



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



Thank you for being part of the CIBSE community this year

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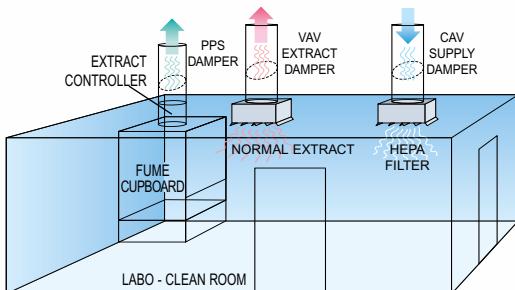


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