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Open to change

In the five years since the Grenfell Tower disaster, little has changed in the way high rise buildings are designed, built and operated, despite Dame Judith Hackitt calling the building safety regime not fit for purpose in her seminal *Building a Safer Future* report.

That s all about to change. The recommendations in Hackitt s report have been adopted by government and were mandated through the recently passed Building Safety Act.

A new Building Safety Regulator (BSR) within the HSE is now overseeing the certification of buildings and its mode of operation is very different from the previous building control regime. Among the changes, developers will now have to provide evidence of the safety of designs at different stages under a new Gateway system. If safety is deemed to be compromised, the regulator will be able to freeze projects.

While the BSR won t be issuing building certificates for another two years, the effectiveness of the new system is already being felt by developers who have had their buildings assessed at what is called Planning Gateway One (PGO).

This came into force in August 2021 and mandates statutory consultation with the Health and Safety Executive (HSE), requiring the developer to submit a fire statement setting out fire safety considerations specific to the development. The HSE says it has raised fire safety concerns with more than half of the 1,000 developments on which local authorities have already sought advice.

It has identified issues with smoke vents, external wall openings close to neighbouring properties and non existent access for fire appliances, and it has also highlighted concerns around single fire shafts.

While the number of issues is worrying, the response of developers is encouraging, says Mark Wilson, the operational lead for policy and PGO at the HSE. In our feature on page 41, he says that in general most developers want to do the right thing most of them respond positively to what we say, and are increasingly amending their plans based on our feedback .

For the construction industry, PGO is an early warning. If their buildings are found to be in breach of Building Regulations at a later stage in design and construction, remedial work will be expensive.

While the focus is on higher risk buildings, the BSR led regime covers all work that needs building control approval. Developers and designers wishing a plain passage through the planning gateway would do well to take advantage of the HSE s pre application advice service, which can be accessed at **bit.ly/CJJul22PG1**.

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Government confirms heat network zones

In its response to the consultation on proposals for heat networks zoning, the government has said it will develop a standardised methodology to identify potential heat network zones.

Local councils will have the power to act as, or appoint, a zoning coordinator, who will determine the delivery model for the heat network in their zone.

A national mapping exercise, led by a central authority, will identify and prioritise areas where a heat network zone could be situated. Specific buildings or groups of buildings within a zone will be given a prescribed timeframe in which to connect to a heat network. A minimum carbon standard will also be introduced for new networks and new connections of existing heat networks in zones.

Ofgem has been appointed as regulator of the sector. A stakeholder scrutiny board will also be formed to advise on how to design and implement a cost effective regulatory framework.

A pilot programme was launched in February, with 28 towns and cities in England testing the methodology for identifying heat network zones.

BCO Specification Guide set to lower occupancy density

Report recommends occupancy density change from 8m² to 10m² per work setting

Individual workers should be provided with more space and workplaces occupied less intensively, according to a new position paper issued by the British Council for Offices (BCO).

The paper outlines the key design criteria for the forthcoming update of the BCO's Guide to Specification. It says offices should avoid over-specification, minimise waste, and move towards net zero carbon.

The guide was last revised in 2019, when, says the BCO, it was informed by market trends before the Covid-19 pandemic and the upsurge of concern about climate change.

In its new position paper, the BCO proposes that the base-level occupancy criterion should be relaxed from 8m² to 10m² per work setting, and space utilisation to 60% from 80%.

The paper also outlines new recommended consideration for office design, such as: improved ventilation, with a higher rate of outdoor air supply per occupier; new criteria for office lighting and daylighting; and reduced small power and lighting load allowances.

While post-pandemic office working patterns have not yet settled down, the paper states, the emerging trend is that many staff work from home on Monday and Fridays, with occupancy peaking on Wednesdays.

The BCO has commissioned further research that will report later in the summer.

Neil Pennell, chairman of the BCO's technical affairs committee, and head of design innovation and property solutions at Landsec, said: 'We have heard from customers that, while the office remains an important part of their businesses, they are using their space differently.

'The BCO's renewed proposal will help create healthy, comfortable and productive workspaces that are fit for the future.'

Call for infection resilience to be mandated in buildings

Building Regulations should improve indoor environments, says report

A new report by the National Engineering Policy Centre says the Building Regulations should be beefed up to require indoor environments that can cut the transmission of infectious diseases.

Led by CIBSE and the Royal Academy of Engineering, the report was commissioned last year by the government's chief scientific adviser, Sir Patrick Vallance, in a bid to identify the interventions required to reduce transmission of infections in buildings.

Among eight headline recommendations, the report calls for the Department for Levelling Up, Housing and Communities to increase the prominence of health and wellbeing across parts of the Building Regulations.

This would include creating a regulation for health and wellbeing that requires an adequate indoor environment that protects occupants throughout the life of the building.

To ensure that buildings operate as designed in terms of infection resilience, the report says improvements to the commissioning and testing of the building systems are 'essential'.

To help drive what the report describes as a 'culture shift' to promote health and wellbeing, it says any system used within a building's design should be tested and monitored from an infection perspective.

It also says the government must ensure major retrofit programmes take into account resilience against infection.

Spaces that are of greatest risk, because they are used by high densities or vulnerable people, should be prioritised, adds the report.

Kevin Mitchell CEng, CIBSE President, said: 'This report highlights the importance of good operational practice in our buildings, and the significant costs to business and society of not building and managing our buildings to meet standards of health and wellbeing.

'CIBSE is committed to working with government, industry and the research community to deliver improved standards in our existing building stock, and in new construction.'

● Read Shaun Fitzgerald on page 14.

New boss and strategy for Cundall

Multidisciplinary engineering consultancy Cundall has appointed Carole O'Neil as managing partner. She will take up her new role at the beginning of July, having joined the company as human resources director in 2007.

O'Neil takes over from Tomás Neeson, who has served as managing partner for eight years and moves to a new role as chair of Cundall's partners. Her time at Cundall includes an 18-month spell in its Asia Pacific offices in Hong Kong and Australia, assisting local management teams to develop and implement their business strategies.

The appointment coincides with the launch of Cundall's new strategy, which includes a pledge that the business's projects will all be zero carbon in design by 2030. O'Neil said: 'Successive generations of Cundall Partners have built an amazing business, founded on the principle that we will act as custodians of that business for the next generation.

'Our drive towards zero carbon design on all our projects will continue as we commit to it as one of the cornerstones of our business.'

Carole O'Neil

IN BRIEF

Gove orders public inquiry into M&S demolition

Michael Gove, Secretary of State for levelling up, has ordered a public inquiry into controversial plans to redevelop Marks & Spencer s flagship store at 458 Oxford Street, in London s West End.

Campaigners against the retailer s application to replace the existing art deco store with a taller, 10 storey retail and office block have claimed that the scheme runs counter to emerging policies to reduce embodied carbon in the built environment.

The inquiry will examine: the extent to which the proposed development is consistent with government planning policies to protect the historic environment; whether it is consistent with the area s development plan; and any other matters considered relevant by the inspector.

Offsetting emissions reductions overestimated

Emissions reductions caused by sourcing renewable electricity using carbon offsetting certificate schemes has been overestimated, according to new research. A paper published in the journal *Nature Climate Change* in June analyses the renewable energy certificates (RECs) bought by 115 companies to help meet their emissions reduction targets. It finds that the emissions associated with the RECs are rarely zero, meaning they were unable to offset totally electricity use not directly provided by renewable generation.

CLARIFICATION: Kevin Mitchell

In Kevin Mitchell s interview in the June edition, we omitted a reference to Kevin meeting Hoare Lea partner Alan Knight early in his career. We should also have mentioned that Kevin was a partner at Buro Happold, as well as a country director. We apologise for these omissions. The amended interview can be read at **bit.ly/CJJul22KM**

IN BRIEF

Recruiting and retaining staff main barrier to growth

Almost half (43%) of building engineering firms reported an increase in tender enquiries during the second quarter of this year, according to the latest Building Engineering Business Survey. Conducted quarterly by electrotechnical trade body ECA, in partnership with BESA, the survey says recruiting and retaining the right calibre of staff is now the biggest curb on business growth. Materials shortages and cash flow also continue to affect the sector, the survey found. Almost a quarter (24%) of surveyed firms said they were hiring more apprentices than last year and 32% plan to directly employ more staff than in the past.

Energy from waste to power Leeds network

Plans have been unveiled for a £25m low carbon district heating and electricity scheme in Aire Valley Leeds. SSE Energy Solutions is developing the network, which will capture waste heat created by a new energy from waste plant currently under construction at nearby Skelton Grange. The heat will be piped to the approximately 400 businesses located in Aire Valley, which may also benefit from cut price electricity supplied directly from the incinerator.

GSHPs for homes in Cornwall

Work has begun on the latest phase of an £8.7m project to heat hundreds of homes across Cornwall with ground source heat pumps (GSHPs) connected to shared loop ground arrays. Drilling has started on the arrays boreholes in the villages of Carlyon Bay and Harlyn Bay, which will be connected to heat pumps supplied by Kensa Utilities. Kensa, which is part funding the Heat the Streets project, will retain ownership of the ground array and charge households a fixed annual fee for its use. A £6.2m grant by the European Regional Development Fund has enabled the project to install ground source pumps for less cost than their air source equivalents.

Privatisation eroded building control rigour, inquiry told

Professor Luke Bisby says previous cladding fires were missed opportunities

Privatisation 'continuously eroded' the 'independence and rigour' of building control activities during the three decades leading up to Grenfell, according to a report by an expert witness to the ongoing inquiry into the fire.

Written by University of Edinburgh professor of fire and structures Luke Bisby, the report, (**bit.ly/CJJul22LB**) says a string of previous cladding fires were 'missed opportunities' to carry out regulatory changes that may have prevented the disaster.

Between 1984 and 2017, 'the independence and rigour of building control activities was continuously eroded due to changes resulting from the introduction of privatised building control via approved inspectors', the report says. 'A culture shift in building control had gradually occurred, from one of building control actors "policing" developers to one of them "working with clients" under commercial duress. This resulted in a "race to the bottom" in the resulting practices within the construction industry.'


Luke Bisby

While there were 'many opportunities' to make guidance and tests 'simpler or less permissive', the report adds, in each case there 'appear to have been powerful commercial and ideological incentives to increase complexity while also increasing flexibility'.

This included legacy standards being 'routinely retained' within guidance, adding multiple routes to compliance or generating confusion. 'These multiple routes to compliance, when combined with widespread incompetence, inadequate oversight, and a perceived absence of liability, made misinterpretation, misapplication, and "gaming" easier, more attractive, and therefore more likely.'

Even before its privatisation in 1997, safety research and testing body the Building Research Establishment (BRE) had a 'significant organisational incentive to enable overcladding solutions while being seen to mitigate their fire risks – rather than to prohibit their use' Professor Bisby's report states.

Mark Rowe, Fire Brigades Union national officer, said it is 'vital' that the BRE is taken back into public ownership.

Energy efficiency is only silver bullet for cutting carbon, says E.ON chief

A 'massive ramp-up' in home insulation and other energy efficiency projects is the 'only silver bullet' for slashing power bills and carbon emissions, the CEO of E.ON UK has told MPs.

Delivering evidence to the House of Commons Environmental Audit Committee on 8 June, Michael Lewis urged the government to increase investment in energy efficiency. He said: 'Our plea to the government has always been to push hard on energy efficiency, because that's the proven way, the only silver bullet, for this crisis. It will reduce prices, reduce energy consumption, and contribute to net zero on a sustainable basis.

'The next phase of tackling this has to be a massive ramp-up in measures to deal with energy efficiency,' said Lewis, adding that bringing all homes up to Energy Performance Certificate band C standard will save the equivalent of six nuclear power plants' worth of energy.

Lewis also called on the government to push through legislation for the next phase of the supplier-funded Energy Companies Obligation before parliament's summer recess begins in late July.

He also called for a bigger scheme that can help provide the funding upfront for those who can afford to pay for their own upgrades

HSE red flags 50% of Gateway One planning applications

Smoke vents and single fire shafts among safety design issues identified at Planning Gateway One

The Health and Safety Executive (HSE) has raised concerns about more than half of all applications it was required to be consulted on under the recently introduced first stage of the Planning Gateway process for vetting fire safety.

The Planning Gateway system was introduced in August 2021 as part of wider reforms to improve fire safety in the built environment following the Grenfell Tower disaster, the fifth anniversary of which was marked last month. It is intended to ensure that developers consider fire safety needs – such as site layout, safe escape routes and safe access for firefighters – when buildings are being designed and planned.

Planning Gateway One (PGO) applies to applications for buildings 18m or more in height, or of seven or more storeys, and that include at least two dwellings.

The HSE's PGO service, a statutory consultee under the new process, says it has raised concerns about more than half of the applications it has had to be consulted on since the beginning of this year. Common fire safety design issues identified by it include smoke vents and external wall openings close to neighbouring properties, and restricted or non-existent access for fire appliances.

Others include single fire shafts, which represent the only means of escape for residents on upper storeys and could become compromised where they connect with higher fire-risk areas, such as car parks.

The PGO service provides pre-application advice for developers to encourage safer designs from the outset and reduce the risk of costly remediation action later.

Mark Wilson, the HSE's operational policy lead on PGO, said: 'Industry needs to stop thinking that fire safety should only be dealt with at the Building Regulations stage – it starts at planning. The application of PGO is changing this thinking and paving the way for the... much more stringent building safety regime envisioned by the new Building Safety Act.'

● Read the building safety article on page 41

Tougher cladding rules brought in

Regulations governing cladding on medium- and high-rise blocks have been tightened as part of the ongoing drive to improve building safety in the wake of the Grenfell Tower disaster.

On 1 June, the Department for Levelling Up, Housing and Communities announced tougher standards for external wall materials on new medium-rise blocks of flats. New statutory guidance will be introduced to restrict the combustibility of materials used in and on the external walls of residential buildings between 11m and 18m in height. Further regulatory updates will ban the use of combustible materials in and on the external walls of new hotels, hostels and boarding houses more than 18m high in England. There is already a ban on using such materials to clad new flats, hospitals, student accommodation and boarding school dormitories over this height.

Metal composite material panels with unmodified polyethylene cores will also be banned on all new buildings because of the serious fire-safety risks associated with this material, uncovered by research and during the Grenfell inquiry. Elements of solar shading devices are also included within the ban.

In addition, the government has published an update to its technical review of Approved Document B guidance on Building Regulations for fire safety and supporting evidence.

IN BRIEF

Construction output slips in April

The volume of construction output fell in April for the first time since October last year, according to the latest figures from the Office for National Statistics. These showed that construction output decreased by 0.4%, largely fuelled by a 2.4% fall in repair and maintenance (R&M) work, albeit following 3.0% growth in this sector as a result of works required in the wake of the winter storms. At the sector level, the main contributors to April s decline were private housing R&M and commercial new work, which decreased by 6.5% and 3.8%, respectively.

S I Sealy creates net zero division

Building services engineering design consultancy S I Sealy & Associates has launched a new Net Zero UK division. The Stockport based company will advise clients on how to decarbonise their buildings, both new build and retrofits. S I Sealy s recent projects include detailed decarbonisation feasibility studies for Greater Manchester Fire Service, Manchester University NHS Foundation Trust, and Liverpool Heart & Chest Hospital. These three studies identified carbon reduction measures of up to 85%, with potential savings of almost 1,000 tonnes of carbon per year.

Modular building can cut carbon by 45%

Construction using volumetric modular systems, manufactured off site, can produce 41% to 45% less CO_2 than traditional methods of building homes, according to a new study by academics at the universities of Cambridge and Edinburgh Napier. The study of two London residential developments delivered by Tide Construction, using its modular system, found a combined 28,000 tonnes of embodied carbon emissions were saved from construction across both schemes. The schemes, designed by HTA Architects, were for 546 homes in Croydon and a 333 bed student accommodation scheme in Gants Hill, East London.

President s medal awarded to Peter Raynham

Contributions by individuals to the lighting industry were recognised at the SLL AGM.

A significant lifetime contribution resulted in the President's Medal being awarded to Peter Raynham, professor of the lit environment at University College London, past president of SLL and former principal author of the *Code for Lighting*.

Atkins associate David Mooney received the Lighting Award for his outstanding service to the society. Most recently, he led and authored LG12 on emergency lighting.

Peter Hunt, recently retired COO of the Lighting Industry Association, was given an Honorary Fellowship, while the SLL's Regional Award was presented to designer Bonnie Brooks, director of Lighting Bee.

The Leon Gaster Award for best paper concerned with lighting applications published in the *Lighting Research and Technology Journal* went to Christopher Kyba, Andreas Ruby, Helga Kuechly, Bruce Kinzey, Naomi Miller, Jessie Sanders, John Barentine, Ralph Kleinodt and Brian Espey for *Direct measurement of the contribution of street lighting to satellite observations of night-time light emissions from urban areas*.

The Walsh Weston Award for best paper covering more fundamental lighting matters went to Ayesha Batool, Peter Rutherford, Paul McGraw, Timothy Ledgeway and Sergio Altomonte for *View preference in urban environments*.

New SLL president says future is bright

Andrew Bissell believes lighting designers can improve people's lives


Andrew Bissell

Andrew Bissell has been inaugurated as the new president of the Society of Light and Lighting (SLL).

He took over the role from Ruth Kelly Waskett MCIBSE FSLL at the society's AGM and awards, held at the People's History Museum in Manchester last month.

After more than 15 years as director of Light4 at Cundall, Bissell recently became a partner at property and construction consultancy Ridge. In his presidential address, he was optimistic for the future of the lighting industry.

'Light and lighting can, and will, have a pivotal role in conserving the planet, benefiting society and improving the lives of every individual,' he said.

Bissell believes progress in knowledge, research and awareness are leading to a better understanding of how lighting – and its absence – can contribute to wellbeing. He focused on the importance of better access to daylight, particularly with the increase in home working.

He said: 'Most of us chose our own lighting at home and when to use it, even preferring lower lighting levels if it meant we were lighting our spaces with daylight.'

He went on to highlight the ecological benefits of limiting the use of light at night, drawing attention to the SLL's LG21: *Protecting the night-time environment*.

Bissell emphasised that, regardless of the issue, the expertise of lighting designers was key: 'As lighters, we have the knowledge, ability, products and passion that can improve people's lives.'

He called on those in the audience to ensure the next generation of lighters continued to make the society relevant and ambitious.

Finalists announced for Ken Dale award

The Ken Dale Travel Bursary awards the winner up to £4,000 to do research within the built environment. This year s finalists and their projects are:

Samuel Shuttleworth: *A study into the influence that the Nabers rating scheme has had on Australian buildings, to highlight the benefits of implementing the rating scheme more widely in the UK.*

Agha Hassan: *Future proof supermarkets: A study to enhance the building performance under future climate change.*

Eyob Kibrom: *Solar energy and buildings in Eritrea.*

Aluwaine Tanaka Manyonga: *Assessing the impact of using off grid solar powered DC LED lighting systems on improving reliability and access to lighting in Southern Africa s rural buildings (case study of schools and residential buildings).*

Kyle Thirwell: *An investigation of the commercial, technical and end user experience of existing heat and cooling networks in the Nordics capturing lessons learnt in which the UK data centre market will look to follow.*

Krebs calls for more involvement as he takes up chair of SDE


Andrew Krebs

The Society of Digital Engineering (SDE) welcomed new chair Andrew Krebs at its AGM in June. He takes over from Les Copeland, to whom Krebs paid tribute.

He praised Copeland for 'steering the society since 2017 from a mere idea to an industry touchstone devoted to digitising the built environment. His contribution to the industry cannot be overstated'.

Krebs outlined three areas of initial focus for the SDE: creating a complete and equitable membership setup; developing and improving the SDE's communications with members; and increasing the visibility of the SDE within the built environment and wider society.

On taking up the role, Krebs called for more people to come forward and be involved. 'There is a lot of work to do and we need you to help us in defining how we move forward and shape the built environment,' he said.

'Whatever background you come from, whichever part of the industry you work in, I want the SDE to be a home for you to connect with peers and to make the world better, one digit at a time.

'I feel really very grateful to be given the chance to lead the society after the immense hard work that has gone into the past 5-6 years,' he added.

● For more information on the SDE visit: **www.cibse.org/sde**

New members, fellows and associates

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Agg, Chloe Jennifer
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Cameron, David Christopher
Carluke, United Kingdom

Early, Wayne
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Newton Abbot, United Kingdom

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Kowloon, Hong Kong

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A welcome change

With industry reform on the horizon, the SCA s **David Mowatt** discusses the part the Fire Safety Regulations will play in improving safety in high rise residential buildings

Following the tragic Grenfell Tower fire, the independent inquiry into the disaster made a number of recommendations that could only be implemented through changes to the current laws.

The Fire Safety Regulations 2022, set to come into force on 23 January 2023, will implement many of the recommendations put forward.

As the new regulations are being placed under article 24 of the Fire Safety Order 2005, they can impose requirements on responsible persons or others – including building owners and building managers – in relation to mitigating the risk to residents. The Fire Safety Order applies to all premises, including workplaces and the common parts of all multi-occupied residential buildings.

The Fire Safety Regulations will make it a requirement for responsible persons of high-rise residential buildings to provide information to fire and rescue services to assist them to plan – and, if needed, provide – an operational response. The regulations will also require responsible persons in multi-occupied residential buildings to provide additional safety measures.

The responsible person is the individual who is responsible for the safety of themselves and others who use a regulated premises. This is normally a building owner or, in residential properties, any other person in control of the premises. The responsible person is the individual on whom most of the duties set out in the Fire Safety Order are imposed.

Considered alongside the Fire Safety Act 2021, the Building Safety Act and the recently introduced Fire Reform White Paper, there is a sense that the industry is finally on the cusp of meaningful change.

The Smoke Control Association (SCA) has consistently campaigned to raise industry standards, and its robust membership criteria mean that all smoke ventilation systems and products offered by its members are designed and installed in accordance with all relevant regulations and standards.

In addition, SCA members who install smoke control systems are required to apply for, and receive, SDI 19 Certification scheme accreditation.

The introduction of the Fire Safety Regulations 2022 will further encourage best practice and the SCA is fully supportive of all risk-mitigating fire safety measures that allow people to feel safer in their own homes.

- For further information on the SCA and its membership criteria, visit: **www.smokecontrol.org.uk**
- **David Mowatt** is chair of the Smoke Control Association

Counting carbon

In late May, the Commons Environmental Audit Committee called for urgent action to reduce greenhouse gas emissions, as well as operational carbon targets. Hywel Davies outlines its call to government for a rapid response

The UK's built environment is responsible for 25% of our greenhouse gas emissions. In 2021, the Environmental Audit Committee (EAC) launched an inquiry into the sustainability of the built environment, looking to understand the routes to net zero carbon for our future building needs.

This included looking at low carbon materials and policies to minimise the whole life carbon impact of new buildings. This in turn led to a focus on embodied carbon in buildings.

While current regulations require energy performance certificates for all buildings and display energy certificates for public buildings, which seek to quantify the operational carbon impact of the buildings, we currently have no similar requirements for those outside London to measure the impact of the carbon embodied in the fabric and systems that make up a building.

With the government seeking the building of 300,000 new homes each year, there will be a significant volume of construction activity over the next decade. So there is an urgent need to measure embodied carbon in our buildings.

The EAC report[1] was published in May 2022 and the second chapter is devoted to embodied carbon. It sets out the case for mandatory whole life carbon assessments, which would identify products with low embodied carbon, enabling constructors and developers to decide which low carbon materials and systems to use.

To reduce carbon emissions from construction, the committee recommends that the government introduces a mandatory requirement for whole life carbon assessments for buildings. It proposes that this requirement should be incorporated into Building Regulations and the planning system. Such an assessment would calculate the emissions from the construction, maintenance and demolition of a building, and the energy used in its day to day operation.

The current proposal is not to set targets or regulate the amount of embodied carbon, just to measure and declare it. As has already been indicated by the response to the industry proposals for a new part to the Building Regulations covering embodied carbon measurement, the Part Z proposal which CIBSE supports, many in the construction industry are willing and able to undertake such assessments.

The EAC ambitiously calls for a clear timeframe for the introduction of whole life carbon assessments

There are already standards, a clear methodology and a framework around which to standardise reporting. The cost of carrying out assessments can be minimal if undertaken as part of the design process alongside energy performance calculations.

Other countries, such as the Netherlands and France, already require assessments and some UK local authorities are already asking for them too. Without a national approach, the UK risks slipping behind comparator countries in monitoring and controlling embodied carbon in construction.

The committee is also clear that if the UK continues to drag its feet on embodied carbon, it will not meet net zero or its carbon budgets. Once assessments are being done, then we will have the data to provide evidence based targets for buildings to align with the UK's net zero goals.

The EAC ambitiously calls for a clear timeframe for the introduction of whole life carbon assessments, government targets to be set by the end of 2022 at the latest, and for these to be introduced not later than December 2023.

It also identifies retrofit and reuse of buildings as a means to keep carbon locked in and argues for prioritising reuse over new build. While government policy is said to prioritise retrofit and reuse, the committee is concerned that reforms to permitted development rights appear to have created an incentive to demolition and to build new, rather than retrofit.

The EAC has also identified a chronic skills gap in energy efficiency and retrofit and notes that, without these vital green skills in the UK economy, we will simply fail to achieve our net zero ambitions. As we look to develop our net zero carbon policy, the EAC has provided a timely call for government to tackle the challenge of embodied carbon. *Journal* readers will wish to watch.

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

References:

1 *Building to net zero*, Environmental Audit Committee, House of Commons, May 2022, **bit.ly/CJJul22HD1**

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Covid 19: a lasting legacy

Lessons learned from Covid-19 should be applied now to ensure resilience against future pandemics, according to a new NEPC report. Among recommendations are a Building Regulation for health and wellbeing, and in-use testing of ventilation. Shaun Fitzgerald FCIBSE shares the findings

Covid 19 has brought into focus the question of how well prepared we are as a society to cope with pandemics. The increase in our understanding of how viruses spread has highlighted the importance of the built environment the majority of transmission of the SARS Cov 2 virus occurs indoors, whether that be in buildings or transport systems.

In light of this finding, chief scientific adviser Sir Patrick Vallance commissioned the Royal Academy of Engineering, together with CIBSE and other partners at the National Engineering Policy Centre (NEPC), to identify the interventions needed to increase the infection resilience of buildings. The report *Infection-resilient environments: time for a major upgrade* (**bit.ly/CJJul22SF**), published last month included eight recommendations: a mixture of carrots and sticks, and the result of extensive consultation with stakeholders.

The first urges BSI to convene the relevant expertise and develop meaningful standards that are embedded into existing design and operational practices. It is key that the existing standards committees from the built environment, transport, healthcare, and other relevant sectors work together to ensure, as a minimum, that best practices can be shared with others.

It is key that the existing standards committees work together to ensure, as a minimum, that best practices can be shared with others

Recommendation two proposes that the Department for Levelling Up, Housing and Communities (DLUHC) increases the prominence of health and wellbeing across parts of the Building Regulations, with a new part established that has an explicit functional requirement for a building to provide an adequate indoor environment that protects the health and wellbeing of those using the building. This will require guidance and training to build the competence of the sector.

The third recommendation says industry bodies and public procurement must drive improvements to the commissioning and testing of building systems. This should be supported by better enforcement of the existing Building Regulations throughout the life of a building.

Recommendation four says in use regulations need to be established with local authorities to maintain standards of safe and healthy building performance over a building s lifetime. Various building safety features already require regular testing and inspection to comply with certain codes, or for insurance purposes. Other features, such as ventilation, do not have the same levels of scrutiny, so this would be a significant change.

The fifth recommendation suggests BSI should develop standards that manufacturers can use and that can be independently certified by others. This would enable innovation, and assure the efficacy of products and systems.

The pandemic exposed gaps in our standards. For example, the effectiveness of an air cleaner device tested in a lab can be very different in a real world setting.

Recommendation six urges the departments for Business, Energy and Industrial Strategy, Transport, and the DLUHC to use the opportunity created by the net zero strategy to ensure retrofit programmes address infection resilience. There should be no trade off between that and energy efficiency.

While increased infection resilience can require more ventilation, increased levels are not needed all the time in many cases, and energy efficiency can be enhanced with heat recovery or pre mixing.

The final recommendations call on the UK Health Security Agency and others to communicate awareness of infection resilience and wider health considerations for indoor environments. The government also needs to identify a lead department to create the joined up policymaking that will align infection resilient environments with net zero, safety, equality, and accessibility goals.

The changes are significant, but so are the stakes. In the event of another pandemic in the next 60 years, the estimated societal cost of infection caused by influenza type pandemics and seasonal flu in the UK could equate to £23bn a year and the costs to individuals in terms of mental health, lost education, and so on are arguably even more important. However, the benefits of really improving our health and wellbeing are enormous, too.

So, these recommendations are not just about managing risk; they will also lead to a more enjoyable, stimulating environment in which we can thrive.

DR SHAUN FITZGERALD OBE FCIBSE is a director at the Centre for Climate Repair, University of Cambridge

KEEPING HEAT AT BAY

The new Approved Document O and overheating were the focus of a recent CIBSE Heating, Ventilation and Air Conditioning Systems Group technical meeting. Aecom s **Matt Dickenson** provides a summary

The CIBSE HVAC group discussed compliance with Approved Document O

The CIBSE Heating, Ventilation and Air Conditioning Systems (HVAC) Group recently hosted a technical meeting to discuss methods for compliance with the new overheating regulations set out in Approved Document O. Attention was drawn to the value of using ambient heat networks to reduce overheating.

Susie Diamond, partner at Inkling, gave an overview of Approved Document O, which aims to regulate overheating risk in dwellings (including student accommodation, care homes and boarding schools). She described the two main routes to compliance the simplified method and the dynamic thermal modelling method and emphasised that the aim is to avoid mechanical cooling where possible by using passive, natural cooling. She also outlined the main criteria to consider, regardless of method, which include noise, security and fall protection (see panel, Overheating risk: what to consider).

Focusing on the simplified method, Diamond explained how it prescribes limits on glazing and free area based on location, cross ventilation suitability and size of plot. Every unit must be assessed independently, as orientation affects the targets. In comparison, the dynamic thermal modelling method only requires a representative sample of units to be assessed. The methodology is based on CIBSE TM59. One major change is that shading from blinds and curtains can no longer be considered within the calculation for compliance. Diamond concluded that both compliance methods were challenging, but felt that dynamic thermal modelling may be favoured, as it allows for more design flexibility and is less prescriptive.

Imogen Christodoulou, sustainability associate at Hoare Lea, looked at the human aspects of overheating, emphasising how it is becoming more important, not only to improve occupants sleep, but also to prevent fuel poverty as energy prices rise, and even to prevent death. She highlighted how early design consideration of the key aspects of overheating is essential for a successful project. Coordinating fa ades with air quality assessments, solar analysis, and so on will enable occupants to better manage their overheating risks. External shading, such as shutters, may also be worth considering.

Alasdair Donn, head of building performance at Willmott Dixon, provided an insight into the practical application of Part O and overheating assessments, from a contractor s perspective. He evaluated the results of a study of a low density residential scheme, where the developer was keen to pursue a low carbon heating strategy on a low budget. A shared loop ground source heat pump strategy for heating was proposed, partly because the ambient loop temperatures could be used to provide passive cooling at a future date.

A similar strategy was used on another project, using an air source heat pump based ambient loop system on a higher density building to deliver heating and cooling. Donn highlighted the benefit of installing this type of system: it provides cooling to dwellings and minimises overheating risks in communal corridors. He also highlighted *CIBSE AM16 Heat pump installations for multi-unit residential buildings* as an essential in advising on heat pump installations for residential buildings.

A recording of the event is available on the HVAC Systems Group webpage: **bit.ly/CJJul22MD**. Subscribe to the group s mailing list and follow it on LinkedIn. CJ

MATT DICKENSON is a mechanical engineer at Aecom and events coordinator of the CIBSE HVAC Group

OVERHEATING RISK: WHAT TO CONSIDER

- **Noise (in bedrooms): in locations with high levels of night-time noise, it may be acceptable to use mechanical ventilation only at night, and openable windows during the day – with noise being an issue for an estimated 30% of homes, a lot of developments are expected to be affected.**
- **Security: ground-floor bedrooms can be made secure with window bars, railing or lockable louvre shutters.**
- **Fall protection: with details of minimum sill height in relation to how much windows open.**

SPECIAL CHEMISTRY

Recruiting engineers with chemistry degrees is giving FairHeat the expertise to fully optimise heat network performance. **Amanda Birch** speaks to four FairHeat engineers who took a non traditional route into the building services industry

From left: Nikzad Falahati, Lucy Sherburn, Simran Chaggar and Jake Adamson

Specialist energy consultancy FairHeat is a firm to watch. Still glowing after being named 2021 CIBSE s Employer of the Year (small category), the consultancy which focuses mainly on heat networks is growing fast. Founded in 2015, FairHeat already has 26 employees and has plans to recruit at least 10 more this year.

The company hires graduates via the more traditional route, such as mechanical engineers, but, unusually, its happiest hunting ground is among chemical engineers.

Really good chemical process engineers have a wonderful base level of skills, and exactly the sort of analysis we want for coming into this area of heat networks and heat pumps, says Gareth Jones, FairHeat s managing director.

Responding to CIBSE President Kevin Mitchell s call for engineers to share career stories, four FairHeat chemistry graduates, including CIBSE ASHRAE Graduate Engineer of the Year Lucy Sherburn, tell us what inspired them to become building services engineers (opposite).

An important factor underpinning FairHeat s growth is the government s decision to identify heat networks as a key technology for helping decarbonise the way in which UK homes are heated. Given that 90% of FairHeat s work is dedicated to this growing, sustainable technology, does it have difficulty recruiting the right people?

Jones says: If we could double the size tomorrow, we would, but when you re growing quickly, you need to make sure you bring in people that contribute to the culture rather than destabilise it. If you grow too quickly, that can be a challenge. We have limited the number of mid to senior level engineers and brought in graduates, which is easier, because they come in and pick it up.

Jones says they receive hundreds of applications every year, but to get the right people, particularly for FairHeat s graduate programme, they look for young engineers with a particular mindset and who have trodden a slightly different path. Recruits need to be good at maths, as there is a lot of site auditing work. FairHeat also likes people »

FAIRHEAT'S CHEMICAL ENGINEERS

Lucy Sherburn

Lucy Sherburn, winner of the 2021 CIBSE ASHRAE Graduate Engineer of the Year award, is a rising star. Aged 25, she is already a consulting engineer at FairHeat, which she joined as a graduate more than two years ago. She had just completed a chemical engineering degree at the University of Sheffield – where she gained a first and was awarded a Mappin Medal for her hard work – when she spotted a job advert at FairHeat.

'The job ticked all the boxes,' says Sherburn. 'My desire to work in a sustainable, low-carbon industry led me to FairHeat, and the company helped me understand the importance of heat networks.'

Given FairHeat's track record of employing chemical engineering graduates, does Sherburn believe her degree has helped her develop a building services career? 'The fundamentals of chemical engineering, such as heat transfer and fluid dynamics, are pretty much the fundamentals of heat networks,' she says. 'This basic knowledge helped me build on my understanding of the technology. With a chemical engineering degree, there is a building services element, a construction element, and an energy heat element, so having this broader understanding of energy did help.'

Before she joined FairHeat, however, Sherburn admits she had very little idea about heat networks or what building services involved. 'At university, I barely knew what heat networks were – I only knew of the concept.'

She has quickly made up for this gap in her knowledge, though, and has completed many, high-standard research projects that have contributed to – and changed – the company's processes. For example, she did a review of optimal plate heat exchanger sizing for heat networks that resulted in FairHeat adopting the output as standard in its design guidance.

Sherburn has also developed a graduate mentoring scheme, and helped attract graduates into the industry by doing presentations at the University of Sheffield and showcasing the role of building services in decarbonising heat. She also has a passion for making the construction industry more attractive to women and, in her role as a STEM ambassador, she promotes building services to young children, particularly girls.

'One of the most difficult aspects of the industry,' she says, 'is inertia and resistance to change. We need to instil a sense of urgency in people in terms of decarbonisation. It's a wider society thing and it will be a huge transition for everyone.'

Despite the massive challenges the industry faces, Sherburn remains positive about the future. 'The best thing about building services is knowing that your work is making a real-life impact and difference," she says.

Simran Chaggar

Simran Chaggar joined FairHeat as a graduate chemical engineer in September 2020. She says her experience of working in emissions control within the automotive industry made her want to work in the renewable fuels area of building services.

FairHeat's graduate scheme has enabled Chaggar to work on some exciting and varied projects in the fields of decarbonisation and decentralised energy – and she says her degree has helped her understanding of the core principles.

'The principles behind the work FairHeat does – such as heat transfer, flow within a pipe, and safety considerations within design and on site – are fundamental concepts that are taught on day one of the course,' says Chaggar. 'Softer skills gained naturally from the degree – such as problem solving, analytical skills and team working – are used on a daily basis in heat network engineering.'

The real-life experience of working with contractors, testing, commissioning, installing, and observing site audits has enabled Chaggar to fast-track her technical competencies, and she says FairHeat is committed to creating future leaders in the industry.

'Outside of the graduate scheme, I've been encouraged to pursue volunteering initiatives with STEM and given opportunities to participate in industry events. This has been invaluable for my development and networking,' she says. 'The supportive and nurturing culture at FairHeat equips graduates to create much-needed change within this industry.'

Jake Adamson

Jake Adamson joined FairHeat in 2021, after completing a Master's degree in chemical engineering and working in the energy sector for a year. He decided to pursue building services because he aspired to work in the district heating sector. He wanted to work in a field that helped the UK meet its target of net zero and be a part of the transition from carbon-intensive energy to cleaner, low carbon technologies.

'My degree taught me a lot about fundamental topics, such as heat transfer and fluid dynamics, which are commonly used when designing and implementing heat networks,' says Adamson. 'As you progress through the degree, more advanced themes arise, such as optimising a system based on cost and efficiency. These areas are essential when designing an optimal heat network to provide a low carbon and cost-effective solution.'

His degree also equipped Adamson with the skills to know how best to approach a problem. Presenting project work to peers as a student developed his communication skills, which has helped with relaying key information to contractors and clients.

Adamson argues that it's important for all M&E services to come together and work as a team to achieve successful and sustainable developments. 'I hope to develop into a competent technical engineer in the district heating industry,' he says. 'An aspiration of mine is to become an industry leader as the UK approaches its target of net zero by 2050.'

Nikzad Falahati

Nikzad Falahati joined FairHeat with a Master's degree in chemical engineering from Imperial College and a PhD in chemical engineering and biotechnology from the University of Cambridge.

An opportunity to work in building services was important to Falahati for two reasons.

Firstly, he could work on projects that improved people's lives through engineering, and, second, by working on heat networks, he could be part of the UK's drive towards net zero carbon by 2050.

'Designing heat networks requires many of the fundamental concepts and equations that were taught during my degree,' says Falahati.

'Many of the engineering tools developed at FairHeat are based on such concepts, which means my degree has been crucial to their understanding, allowing me to adapt them to optimise designs.'

He adds that many of the soft skills gained from the degree have also played a significant part in progressing as a heat network engineer. These skills include time management of projects and working in teams of varying sizes, both on site and in the office.

Falahati says working with other engineers, such as mechanical and electrical engineers, has been important for his growth, as there are many things to learn from other areas.

This has been especially helpful, he adds, when on site, because issues can be resolved and ideas discussed on a range of problems.

'FairHeat fully supports graduate engineers in becoming competent heat network engineers, while encouraging everyone in the company to be part of the significant changes being made in buildings services because of the UK's net-zero drive,' Falahati says.

'I intend to develop as an engineer at FairHeat and become knowledgeable in a range of heat network aspects, with the aim of becoming an expert.'

» who are resilient, have good interpersonal skills, and can fit into a team.

We like diversity in a team; we don t want clones, because people look at things in different ways, adds Jones.

He says chemistry graduates tend to have focused, more rigorous training. The level of detail they go into with the fundamentals is a step up from what we re seeing in traditional routes, says Jones. In the past, a lot of young graduate engineers would have gone into the traditional oil and gas industries, Jones adds, but this area isn t as appealing as it once was.

Lucy Sherburn, consulting engineer at FairHeat and winner of last year s CIBSE ASHRAE Graduate Engineer of the Year is a case in point. For me, and for younger people still at school and university, there is a desire to work in industries that deal with the impact of climate change, she says. As a chemical engineering student, I was told that oil, gas, water, pharmaceuticals, and nuclear are the classic industries to go into, but not once did anyone suggest building services as a profession. I didn t even know that degrees in building services existed.

Oil and gas will be around for a while, adds Jones, but if you are starting your career now, it has a use by date. Young graduate engineers want to feel good about the work they do, and they see heat networks as a high growth area.

Jones argues that different types of people need to be brought into the industry to make it grow. Traditional routes, going to the same pool, is not the way to do that, so we re trying to identify people who have the right skills and funnel them back into building services.

Sherburn adds: There are huge opportunities in helping to decarbonise buildings. At FairHeat, I work on new builds and get involved at the very early stages of the heat network, working through the design, build, installation, and commissioning. There are so many opportunities to get involved, whether it s improving an existing building, retrofitting, or designing a new building, it s such a dynamic industry.

Jones suggests one of the reasons fewer students are studying building services is because of its image. To get top calibre engineers, we need to promote what we re doing as being at the forefront of decarbonisation, he says. The industry should be doing more to make the sector sexy, and help widen our minds about who we bring into the industry.

Sherburn agrees: Young people often don t know what building services is and, if they do, they think its all about radiators and air conditioning. They think it s not a technology for the future, but building services will play a huge part in decarbonisation.

The industry needs to shout louder and market itself correctly so young people can see that they can play a major part in this renewable, sustainable revolution and design really cool, low energy buildings. CJ

CIBSE EMPLOYER OF THE YEAR 2021 AWARD

Current FairHeat graduates (from l-r) Nikzad Falahati, Simran Chaggar and Jake Adamson

FairHeat is on a hot streak. The specialist energy consultancy has been presented with the CIBSE Employer of the Year small business category award for a second time. Key to its success and winning the award is its two-year graduate scheme, which brings young engineers – mainly chemical engineers – into the industry and upskills them. FairHeat created the graduate scheme in response to the lack of skilled engineers in the industry and to develop engineering talent for the future.

Tom Naughton, associate at FairHeat, who co-runs the scheme, says that around 70% of the company's employees are currently doing the graduate programme or have completed it within the past five years. Of the first three engineers who joined the scheme, all are now senior team members, are Prince2 [Projects in Controlled Environments] certified, and have achieved chartership with CIBSE.

'The scheme has been developed in a structured way that enables graduates to gain solid knowledge and experience in all aspects of heat network development,' says Naughton. 'This includes six-month rotations across each of FairHeat's four business areas, covering all aspects of building and operating heat networks, from design and delivery to performance improvement and monitoring. Over the years, we have put a lot of effort into building up a talented group of engineers through our graduate scheme, and they now form the core of the business.'

During each six-month rotation, the graduate engineers are assigned a research project, for which they manage their own time and budget, and present back to the team. The research is published, raising the profile of each young engineer.

To help provide a nurturing structure for each young engineer, FairHeat has established a mentoring scheme through which consulting engineers are assigned to a graduate. The mentors help the graduates to self-reflect and discuss objectives for their development. External mentoring programmes are also encouraged, to ensure knowledge transfer is applied within the industry.

During 2021, nine of FairHeat's young engineers reached out to their universities and presented the graduate scheme, highlighting building services as a career. This was a successful initiative, not only to drive fresh talent to FairHeat, but also to expand awareness of the industry.

'We are particularly proud of the opportunities we are giving engineering graduates,' says Naughton. 'The number of high-calibre engineers that the graduate scheme has supported is a testament to its success, and it will continue to be an integral part of our company's DNA.'

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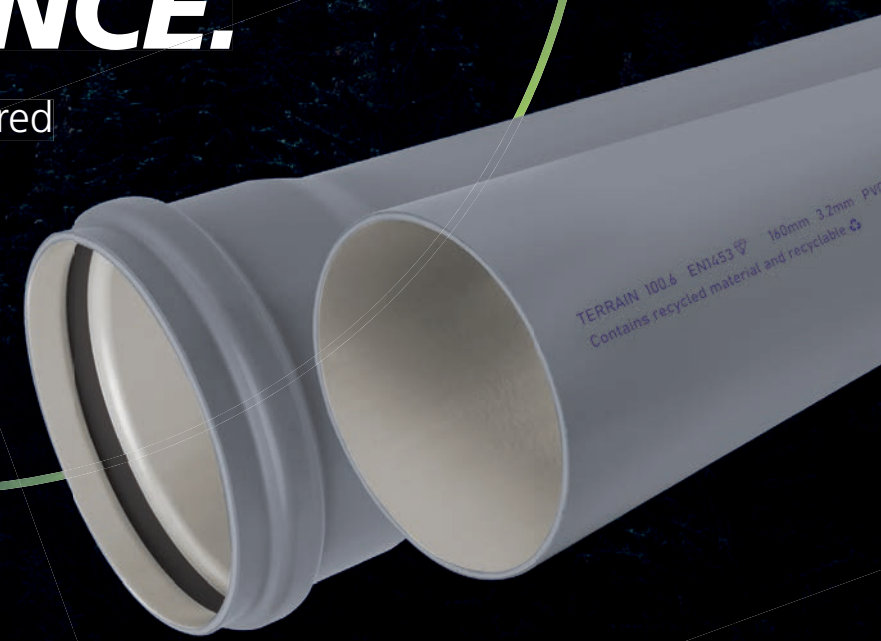

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CIBSE BUILDING PERFORMANCE AWARDS 2022
WINNER

Clatterbridge is designed to be a positive and uplifting environment centred around patients and staff

CARE PROVIDER

Patient comfort was at the heart of Aecom s award winning design for Clatterbridge Cancer Centre, which used modern methods of construction and a digital twin to ensure the building achieved industry leading savings in energy and carbon

'The strategy we pitched was that we can deliver this project more efficiently and effectively by applying the benefits of modern methods of construction (MMC) and Design for Manufacture and Assembly (DfMA), explains Richard Mann, head of healthcare and science for Aecom UK and Ireland.

Mann is talking about the award of the contract to design and build the 11 storey Clatterbridge Cancer Centre in Liverpool, where digital planning and design software were used extensively to enable the offsite manufacture and assembly of the majority of the project s construction elements.

He says prefabrication and modularisation aid construction, improve quality of build, and reduce project timescales and onsite health and safety risks. Adopting the technique helped the team bring the project in on time and on budget, despite a change in scope midway through the design that added three additional floors, and construction completion being impacted by the pandemic.

The new hospital was needed to deliver highly specialist cancer care, including chemotherapy, immunotherapy and radiotherapy. It is part of a £162m investment to transform cancer care for Cheshire and Merseyside. The NHS Foundation Trust s brief for the scheme was to design a visually striking facility that would create a positive and uplifting environment centred around patient and staff needs.

Working with architect BDP and contractor Laing O Rourke, Aecom engineered the Breeam Excellent design for a wedge shaped building to sit on a constrained triangular site adjacent to the Royal Liverpool University Hospital. To enhance patient wellbeing, healing and recovery, the design incorporates patient access to external landscaped areas on the upper levels of the building s distinctive curved prow, where wards and the chemotherapy floor are located.

Beneath the prow, a sunken landscaped courtyard provides a covered winter garden, while, internally, a large, bright atrium allows daylight to flood the building s core. Away from the patient areas, at the opposite end from the prow, is the building s plantroom tower. This is, perhaps, the most obvious manifestation of the scheme s DfMA approach to building services engineering.

Modular MEP

Each floor of the building has a dedicated plantroom; these are stacked vertically, one on top of the other. The original intention was that each plantroom would be built off site, for delivery on the back of a truck, says Chris Taylor, Aecom s MEP healthcare lead for the north of England. However, logistical issues meant the plantroom enclosures were, instead, built in situ, on a concrete frame, with all of the MEP plant pre assembled and moved into the plantrooms on skids.

Taylor adds that there are significant benefits associated with the plant tower approach, in terms of operational and embodied energy, primarily because it enables plant to be situated adjacent to the department it serves.

The arrangement will also make it easier to reconfigure the floors more easily in the future. Normally, hospitals have interstitial plant floors and lots of risers to distribute services vertically, Taylor says. Adopting a horizontal approach to building services distribution improves flexibility and adaptability of the building, while facilitating the design for manufacture approach.

The only services that still run vertically are centralised ones, including the main electrical riser, heating, chilled water and domestic hot water.

From the plantrooms, modularised piped and ducted services are distributed at high level in the corridors, including to 110 individual inpatient bedrooms.

A central air handling unit (AHU) ventilates each floor via the ductwork distributed above the corridor false ceiling. The scheme is full fresh air, with air change rates »

> The building s dynamic control systems help the building perform more than 50% better than the Department of Health s guideline carbon targets

PROJECT TEAM

Client: PropCare
Architect: BDP
Building services engineer: Aecom
Civil and structural engineer: Aecom
Acoustic engineer and sustainability, including BREEAM and environmental services: Aecom
Main contractor: Laing O'Rourke
MEP contractor: Crown House Technologies
Facilities management: Vinci Facilities

» based on the clinical function of each space.

A lot of areas are not defined in the HTM [Health Technical Memoranda], so, during the early stages, we sat down with the users to understand their requirements for each space. We then proposed environmental conditions to ensure infection control procedures and air change rates that would allow staff to carry out procedures successfully, explains Taylor.

Glazed cladding

The building envelope features a glazed, curtain wall cladding system. One of the key challenges was that the building needed to be visually striking, so the design went down the route of a glazed cladding system, Taylor says.

In helping to develop the design, Aecom undertook an assessment to ensure the envelope achieved an appropriate annual balance between the rate of heat loss and the amount of solar gain, to minimise energy consumption during both heating and cooling seasons. The assessment of solar gain included energy saved by a reduction in the need for artificial lighting.

Cancer patients can be very sensitive to environmental conditions, so while the glazed fa ade provides patients with views out over the city of Liverpool Aecom had to ensure it had no detrimental effects on the thermal comfort of patients . It used IES software to model

Circulation areas, entrances and basement waiting areas are all naturally ventilated

Cancer patients can be very susceptible to environmental conditions, so while the glazed fa ade provides patients with views out over the city of Liverpool, Aecom had to ensure it had no detrimental effects on patients recovery

the anticipated environmental conditions in all patient spaces. The models were very detailed; they even included an appropriate metabolic rate and appropriate clothing for a patient, explains Taylor.

However, because patients respond to treatments in different ways, he says Aecom has built flexibility and capacity into the services, so the internal environment can be adapted to suit an individual patient s requirements .

Additional solar control has been incorporated on the southern elevation, including frit to some windows and the inclusion of blinds and curtains to minimise heat gains and control glare. The building is predominantly glazed and a portion of the fa ade faces almost due south, so we needed to enhance the cooling in these areas to ensure comfort criteria could be achieved, says Taylor.

Active chilled beams keep patient and clinical spaces on the southern elevation comfortable, while ceiling mounted radiant panels heat spaces on the northern elevation. The chilled beams are run at an elevated temperature to reduce the risk of condensation occurring. We re controlling each beam independently so that, if condensation is likely to occur within a space, the connections to that beam are shut off, Taylor explains. To further minimise the likelihood of condensation occurring, the supply air is dehumidified. Each AHU incorporates a plate heat exchanger to transfer heat and coolth between the supply and exhaust air streams without cross contamination.

Aecom spent a lot of time with the AHU manufacturer to maximise the unit s thermal and distribution efficiencies, Taylor says. During the design period the AHUs were identified as the largest energy consumer. It was time well spent: We re now getting similar efficiencies from the plate heat exchanger than we would from a thermal wheel, as well as high distribution efficiencies.

Despite its enhanced efficiencies, however, the heat exchanger will only provide sensible cooling, so the chilled water coil of the AHU is used to trim humidity , Taylor says.

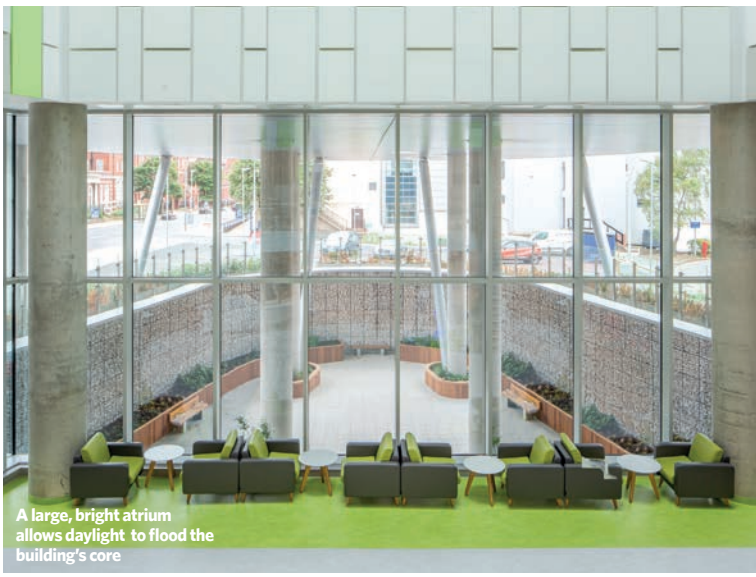
Chilled water to the AHUs, chilled beams and the recirculating fan coil units that serve back of house spaces, such as server rooms, are supplied from two roof mounted air cooled chillers, while heating is provided from a district energy network, which is set to be decarbonised as part of the wider estate development.

Circulation spaces, entrance areas and basement waiting areas are naturally ventilated, with outside air introduced through glazed rooflights. The environmental modelling for these areas included a check on their ability to maintain comfortable temperatures based on current and predicted climate trends.

The modelling was enhanced to ensure the temperature directly below the glazing did not exceed 35 C, because the rooflight glazing incorporates an internal laminate layer that can soften when the temperature exceeds 40 C, reducing the glazing s impact resistance.

The project encountered a number of challenges, throughout the design and construction period. Carillion was building the adjacent Royal Liverpool Hospital, which was designed with some services interconnections to Clatterbridge.

Carillion s collapse in 2017 resulted in some infrastructure elements having to be redesigned and temporary services provided, to ensure the cancer »



A large, bright atrium allows daylight to flood the building's core

» hospital could open. In addition, the project completion and commissioning stages took place during the coronavirus pandemic. Nevertheless, the Clatterbridge Cancer Centre was completed on programme and on budget, and received its first patients in June 2020.

As part of the handover process, Aecom implemented its bespoke soft landings procedure, EVOL+VE, to ensure the building was operating efficiently, reduce operational energy, and assist the facilities management (FM) operators to maintain a comfortable environment for patients and staff. All too often, the designers never remain involved, so there is a huge performance gap between design data and reality, explains Mann.

As part of the EVOL+VE process, and alongside the creation of the IES thermal comfort model, Aecom built a digital energy model, based on CIBSE TM54, which it then used to undertake operational energy simulations (see panel, Creating a digital twin).

Energy and carbon saving measures implemented so far include reducing the internal space temperature in the spaces with active chilled beams and reviewing operation of the site CHP plant. As the humidity levels in rooms with active chilled beams need close control to prevent condensation, lower internal temperatures can provide a greater energy recovery benefit, and reduce the AHU reheat requirement, says Taylor.

An assessment of the CHP plant operation and its ability to provide the project with a positive carbon benefit has also been undertaken. We re advising Clatterbridge how they can phase in and phase out the operation of the CHP to provide the greatest carbon benefit, which is when the grid operates using fossil fuel power stations.

According to Mann, Aecom s interventions have resulted in the building using 30% to 40% less thermal energy than NHS Benchmarks. Our continuing support to the Trust, through the Aecom EVOL+VE initiative will ensure we continue to reduce the buildings consumed energy. It is running so much better than the trust thought it would because of us working with the FM provider, he says.

The building s dynamic control systems also help the building perform more than 50% better than the Department of Health s current guideline carbon targets.

So, it was no surprise that the scheme won Project of the Year Healthcare at this year s CIBSE Building Performance Awards. The judges said: This project can be used by others as an exemplar of how buildings can be designed and then constantly tuned to ensure they continue to perform. Hear, hear. CJ

CREATING A DIGITAL TWIN

A digital model based on CIBSE TM54 was created to simulate energy use in operation. It includes plant efficiencies and operational profiles, along with details of the building fabric and 'everything we know about the building', says Taylor.

Information included occupancy and regulated and unregulated energy use, which it combined with CIBSE weather data to understand how the building is expected to operate. The model and system performance were then validated during the building's commissioning period, with the model updated to incorporate actual measured operating efficiencies.

Mann says the digital twin which allows Aecom to look at the building's energy consumption and predict the impact of tweaking set points.

This can then be measured and discussed with the client before making final set point adjustments without affecting the actual building.

To populate the digital twin, Aecom was granted read-only access to the hospital's building energy management system. This allowed the digital energy model to be updated with energy usage data to ensure alignment between it and the building. The process becomes more accurate with each iteration.

'Using the IES model, we could simulate plant operation and easily make changes to set points and time schedules, so we could assess their impact on energy consumption very quickly,' says Taylor.

'By testing our proposed changes on the digital twin, we can make minor adjustments add up to a significant benefit to the client, in terms of a reduction in energy use, without compromising patient comfort.'

A sectional view of the cancer centre

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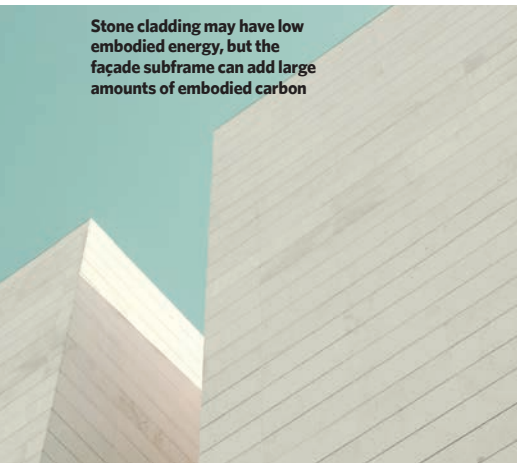
FACING UP TO EMBODIED CARBON IN FA ADES

Fa ades account for up to 30% of a building s embodied carbon, which is why the Centre for Window and Cladding Technology is working to produce a new methodology to bring consistency to life cycle assessments. Buro Happold s **Teni Ladipo** reports

The UK s goal of reducing net emissions of greenhouse gases by 100% by 2050 (relative to 1990) has prompted industries and organisations to set carbon reduction targets to reduce emissions. To quantify the operational and embodied carbon of buildings and infrastructure accurately, life cycle assessments (LCA) calculations are required. Furthermore, with reductions in operational carbon in construction because of changes to legislation and the decarbonisation of the energy Grid, embodied carbon now forms a greater percentage of emissions associated with buildings. Consequently, it requires more detailed quantification to better understand emissions and how they can be reduced.



Stone cladding may have low embodied energy, but the façade subframe can add large amounts of embodied carbon

European standards BS EN 15978 and BS EN 15804 provide guidance on the assessment of the environmental impacts of buildings, but further interpretation is often required to apply these principles in practice. Several industry bodies have provided further guidance to aid clarification and promote adoption. These guides typically relate to specific disciplines and building elements, including the primary structure IStructE guide *How to calculate embodied carbon*, and Embodied carbon in building services: A calculation methodology CIBSE TM65.

While the fa ade accounts for between 10% and 31% of the embodied carbon of a building, according to studies by the World Business Council for Sustainable Development[1], there is currently no aligned method for how fa ade embodied carbon is to be calculated.

Complexity

Calculating the embodied carbon of fa ade systems requires a detailed understanding and awareness of the many components and processes that can vary widely between different system assembly life cycles and project scenarios. Assessors who are not experienced in fa ades can inadvertently make inaccurate assumptions or omissions relating to a component and system life cycles, which may fail to account for system differences and requirements that can have a large influence on the total embodied carbon of the fa ade. Inaccurately reporting the fa ade s embodied carbon will have consequences when, for example, comparing different construction strategies across multiple building elements to optimise the overall emissions of the building.

As an example of how fa ade complexity can often be underestimated in embodied carbon calculations, consider a rainscreen cladding system comprising natural stone panels. The stone panels have a low associated embodied carbon factor when only considering the natural stone material during the product stage. However, the metal subframe required to support the stone and the additional components and processes necessary for the system to achieve the

Left: The complexity of calculating the embodied carbon of façade systems should not be underestimated

required level of performance can add a large additional amount of embodied carbon.

Changes in environmental loadings for example, wind load, external temperatures, and corrosivity in various geographic locations also influence fa ade system requirements, where more materials and/or processes may be required to accommodate project specific loads and environmental conditions. Additionally, the durability and service life of fa ade materials and system components could necessitate enhanced maintenance requirements, or the replacement of failed systems multiple times over the lifetime of a building.

Glazed systems are an example of this; a fully glazed curtain wall, including insulated glazing units (IGU), could require IGUs to start being replaced around the 25 year mark when failures drive the demand.

> Assessors who are not experienced in fa ades can inadvertently make inaccurate assumptions or omissions

Masonry or precast concrete fa ades, including openings with IGUs, would similarly require replacement of IGUs within the lifetime of the building. The masonry or precast concrete included in the wall could last 60 years or more, however, which would reduce the material quantities required for replacement during the life of the building.

All of this and more must be considered in the calculation of a fa ade s embodied carbon to achieve more accurate assessments that will contribute to identifying the most effective carbon reduction strategies in fa ade life cycles, as well as more precise inputting into larger, whole building LCAs.

Consultants and contractors specialised in fa ades have started addressing this need, with efforts made to assess the embodied carbon of fa ade systems on their projects, to provide guidance and inform whole building LCAs by sustainability consultants.

Consistency

While efforts by the industry to quantify the embodied carbon of their designs is a much needed step in the right direction, a critical prerequisite is missing from this effort LCA consistency. Without a consistent methodology for fa ades to interpret the general LCA framework set out in BS 15978:2011,[2] different approaches will be taken, so causing inconsistencies.

Following the formation of a sustainability committee and the publication of its first »

COMPARING EXISTING LIFE-CYCLE ASSESSMENT METHODS FOR FAÇADES

To compare life-cycle assessment methods, six façade consultants and contractors carried out an LCA on a case study façade.

There was a significant variance in results across all life-cycle stages (A-D), otherwise known as cradle to cradle[3]. Results varied by approximately 20% in the A1-A3 stage, and this further increased in stages B, C and D because of the greater level of uncertainty and inconsistency over how these stages should be assessed for façades (see Figure 1).

A large contributing factor to this variation was because of differences about which façade components were included and how they were considered in the calculations, as well as the lack of a consistent approach on what embodied carbon factors to use in calculations and where to source this data from. In some cases, individuals in the case study group developed their own embodied carbon factors for IGUs, and replacement factors by extrapolating available manufacture data. However, this was not guided by a specific process to allow for consistency.

The case study also showed that façade emissions beyond the product stage can be a significant contributor to total emissions, ultimately requiring stages such as (A4) transportation, (A5) construction, and (B4) replacement, more specifically, to be included as a minimum from the outset.

The main conclusions from this case study are summarised as follows:

1. **A defined method for calculations and assumptions are required for façade LCAs**
2. **Consistency is required over what façade components must be included in LCAs**
3. **Guidance is required on how to derive and apply embodied carbon data in façade LCAs**
4. **The significance of developing an approach to calculating life-cycle stages beyond A1-A3 for façades must not be overlooked.**

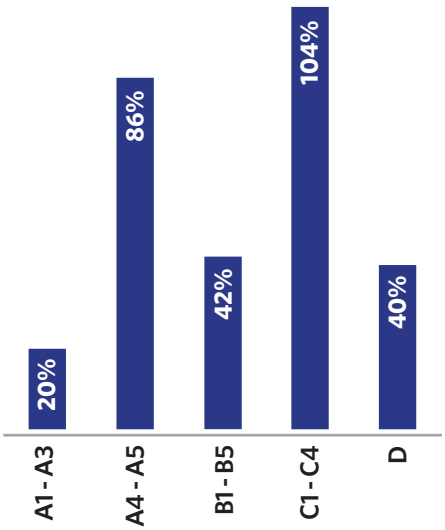


Figure 1: Case study results – coefficient of variation by life-cycle

» guidance paper, the Centre for Window and Cladding Technology (CWCT) established a further workstream to focus on producing an embodied carbon methodology for fa ades.

The group, consisting of six UK fa ade consultants and contractors, first used methods and tools from their respective companies to carry out an LCA on a case study fa ade. The outcome would be crucial in revealing the work needed to produce a consistent methodology. When results were compared, they revealed a significant variance across all life cycle stages (A D). See panel, Comparing existing life cycles assessment methods for facades , on page 25.

The case study provided the catalyst for the group s next task, which was to develop an embodied carbon calculation methodology dedicated to fa ades, ultimately to bring consistency and accuracy to fa ade LCAs. This is just the first step in a much larger plan,[2] which will require implementation of the methodology by the industry so that we can establish a clear picture of how different fa ade systems and strategies compare with regard to embodied carbon. Most importantly, it will help show how we can reduce embodied carbon by setting targets and having more reliable data available.

> The methodology was developed with input from manufacturers, contractors and consultants in the UK and throughout Europe

The draft CWCT methodology is currently undergoing peer review by a group of industry members, including the main developers of the widely used methodologies for other building elements, such as the IStructE and CIBSE guides.

The methodology was developed with input and collaboration from manufacturers, contractors and consultants working in the fa ade industry, primarily in the UK, but also throughout Europe. It aims to address inconsistencies identified in the case study while ensuring alignment with standards such as BS EN 15978 and the RICS Professional Statement, including its interpretation for fa ade LCAs.

The CWCT considers this to be a document that will be updated to reflect the most recent knowledge and developments in the field of whole life carbon assessment of fa ades. The methodology is anticipated to be released to the wider public in autumn 2022. **CJ**

- For more CWCT guidance on sustainability, reducing carbon, environmental product declarations, and life-cycle modules, visit **www.cwct.co.uk**

- **TENI LADIPO** is senior façade consultant at BuroHappold

References:

1 *Net zero buildings: where do we stand?* World Business Council for Sustainable Development, 2021.
2 BS EN 15978:2011 Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method.
3. LETI Embodied Carbon Primer, Jan 2020, **Bit.ly/CJJul22TL1**

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Cost model

Build to rent housing

With the demand for build to rent accommodation accelerating, Aecom s **Garry Burdett** outlines a cost model for a typical project

With the historic, continued rise in property values and the growing affordability gap between wages and property prices, there is a real and increasing demand for an alternative approach to UK housing, as evidenced in the build to rent (BTR) sector. The target market for a vast majority of these BTR schemes is the younger generation and boomers, who are attracted by the offering and flexibility of the BTR market compared with the alternative available from individual landlords in apartment blocks, often providing limited facilities and a lack of community.

End users

A number of cities outside of London have a relatively young population. A demographic analysis of Birmingham s city centre, for example, shows that 75% of the population is below 35 years old. For a city such as Birmingham, this younger population is made up of students who remain and work within the area after finishing college and university, and career starters who are establishing themselves within their chosen industry.

The BTR end users are very different from the traditional users of private developments. There is a demand for tech enabled apartments equipped with high speed broadband, and keyless entry via smartphones. The onus is on flexibility, onsite facilities (bookable by app) and move in ready homes.

The BTR developer must focus and understand what this means in terms of specification and capital cost impacts; there needs to be a forward assessment in terms of whole life cycle costs, with a balancing act between capital costs and costs in use. While the returns for a private for sale development will yield significant early returns, the longevity of the returns over a 30 year period for a BTR development mean they can be substantial.

Community and connectivity are key in attracting the BTR user. In terms of community, this relates to a real sense that the development hosts a similar demographic to them. Often, postgraduate BTR users will have lived in

Shell and core	Quantity	Unit	£/unit	Total
Sanitary ware Allowance for sanitary ware to concierge/amenities/ cleaners' sinks	21,000	m²	£0.82	£17,136
Disposal – rainwater/balcony/foul drainage	21,000	m²	£32.32	£678,748
Water Meter, tanks, pumps, distribution, valves and insulation	21,000	m²	£31.82	£668,304
Heat source – ASHP	21,000	m²	£21.59	£453,304
Space heating and air treatment systems Pumps, buffer vessels, plantroom installations, distribution, insulation, cooling via splits/VRF installation to BoH, plantrooms, amenity areas	21,000	m²	£38.20	£802,193
Ventilation Ventilation to reception, amenity areas, plantrooms, BoH areas, smoke clearance to apartment corridors	21,000	m²	£23.53	£494,088
Electrical installations Low-voltage installation, apartment power, life safety installations, generator, power and lighting to landlord areas, earthing and bonding	21,000	m²	£72.67	£1,526,129
Protective Sprinklers, wet riser, earthing and bonding	21,000	m²	£37.55	£788,542
Communications Fire alarm, fire brigade evacuation finished sockets	21,000	m²	£22.58	£474,095
FIRS, fibre to premises, Wi-Fi, keyless entry, videophone entry, building and management APPS, DAS, security, BMS, billing	21,000	m²	£86.88	£1,824,545
Fit-out				
Disposal Foul disposal to apartments, connections to pods	21,000	m²	£9.71	£203,987
Water Hot and cold water to apartments, connections to pods	21,000	m²	£23.27	£488,719
Heat source – HIU to apartments	21,000	m²	£22.26	£467,470
Space heating and air conditioning Underfloor heating	21,000	m²	£35.41	£743,580
Ventilation – MVHR, ductwork and accessories	21,000	m²	£29.84	£626,707
Electrical Consumer unit, power and lighting installation, earthing and bonding	21,000	m²	£87.69	£1,841,549
Protective – sprinklers	21,000	m²	£16.53	£347,061
Communications Fire alarms, TV and data installations, videophone entry	21,000	m²	£26.98	£566,630
Total			**£619.66**	**£13,012,787**

Cost model for example BTR block, which is in northern England and has 25 storeys and 248 65m² apartments

Communal lounges and bookable workspaces are typical in built to rent schemes

student accommodation and want to have a similar social experience as they had while at university. In addition, connectivity isn t just defined in terms of internet speeds, but also by location for travel, both local and international, and easy access to a great and diverse nightlife.

Route to market

The current route to market for BTR schemes is the tried and tested single stage design and build procurement route. This, though, will depend upon: funder choice; maturity of client (in terms of the number of schemes brought to market); contractor and supply chain appetite; and prevailing market conditions.

The supply chain (contractors) will tend to lean towards a two stage approach, which will provide a certain level of flexibility and ability to influence the design, buildability and, therefore, cost of a scheme. The two stage approach is often at odds with the fund and client, who will demand competition at all stages and drive to secure the price at the earliest opportunity.

The general embryonic nature of the BTR market means that specifications are still in development; developers need to consider embodied and operational carbon, capital costs, operational costs, ongoing maintenance, and replacement/disposal costs. The answer to this may well be a turnkey approach, with the supply chain providing construction, maintenance and operational services.

Move in ready

The type of end user for BTR developments expects to have everything ready to go straight away. This includes set up facilities such as keyless entry to apartment doors via an app, enhanced videophone entry system, and fully activated fibre from day one, which normally forms part of the rental agreement. A single app that provides all services at one s fingertips is also key to the delivery of a BTR development.

All electric

The example cost model opposite is based upon a mid quality BTR development of 25 storeys with 248 units, with the apartments offering an average footprint of 65m² each. The location for the project is the outside of London, in the north of the UK.

The scheme incorporates an amenity space, breakout work spaces, a caf and formal lounge area, and 24 hour concierge facility. Gross internal area is 21,000m² and the net internal area is 15,624m², providing a net to gross ratio of 74.40%.

The cost model includes an all electric scheme, with roof mounted air source heat pumps (ASHPs) providing heating only to the apartments via underfloor heating. Cooling to apartments is excluded. The cost model is based upon fourth quarter prices in 2021 prices have been taken from similar, competitively tendered projects within the local market on a single stage design and build procurement route.

The cost model is based upon bathroom pod construction (which is excluded from the MEP costs), excludes professional fees, local authority fees and charges, associated section 106/278 agreements, and VAT. CJ

About the author

GARRY BURDETT is director, cost management at Aecom. Aecom senior project surveyor Rebecca Turner helped prepare the cost model

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Heat recovery cooling installed in City office

Toshiba Carrier helps City retrofit achieve Breeam Excellent rating

A major office refurbishment in the City of London has included the installation of heat recovery VRF air conditioning from Toshiba Carrier, helping the building achieve a Breeam Excellent rating.

The Toshiba SHRM-e heat recovery VRF air conditioning was chosen for the 22,575ft^2 office at 120 Cannon Street.

Connected to 135 ceiling-mounted slim-ducted indoor units, the high-efficiency system uses 10 roof-mounted Toshiba outdoor VRF condensing units to provide heating and cooling for the upper storeys. In the basement, a digital inverter condensing unit and a hi-wall fan coil unit were installed.

Breeam's energy-monitoring requirement was met by Toshiba's BMS-CT2560U-E Touchscreen Central Controller used in conjunction with Toshiba's BMS-IFWH5E Energy Monitoring Interface.

The controller enables effective management of the VRF systems in multi-tenant buildings, allowing for scheduled programming and full function control, says Toshiba Carrier.

Tom Jones, project director at the Designer Group , said: 'We worked closely with Toshiba and the installer to ensure the client's requirements for performance and finish were delivered.'

The fully exposed ductwork and air diffusers of the system contribute to the office ambience, creating a stylish space for its tenants. The refurbishment was carried out by main contractor 8build.

Trane offers low GWP refrigerant for multi pipe units

Trane has announced that it is offering Sintesis Balance CMAF units using R-454B refrigerant.

The multi-pipe units give simultaneous cooling and heating and offer a range of capacities from 150kW to an increased 1,400 kW. Trane says that by using recovered energy to produce hot water, the CMAF can replace the existing fossil-fuel boiler and chiller system to deliver both chilled and hot water for the whole building.

R-454B is the lowest GWP alternative for R-410A, and Trane says its energy efficiency ratio is 3.5% better than R-410A in cooling mode and 4.5% better in cooling and heating mode

The firm offers the lower-GWP R-454B refrigerant across its entire portfolio of scroll compressor chillers, heat pumps, multi-pipe units and rooftops.

Ella s Law calls for air quality reform

New legislative proposals mandating the compulsory monitoring of air quality in public, office and residential buildings have undergone a first reading in the House of Lords.

In 2020, a coroner ruled that air pollution had directly contributed to the death of schoolgirl Ella Kissi-Debrah – the first official recognition of air pollution as a cause of death.

Dubbed Ella's Law, the Clean Air (Human Rights) Bill campaigns for the access to clean air to be a human right under international law.

Introduced as a private member's bill, it aims to limit public exposure to polluted air in indoor and outdoor environments. If the bill is passed, developers will be required to assess concentrations of indoor air pollutants in line with ISO standards.

A second reading of the bill is expected in late June and sent to the House of Commons by September. If successful, the changes to how air quality is treated in health and safety will be drastic.

New subsidy for Greek air con

Greece is to offer a subsidy for the installation of up to three new energy efficient air conditioners and refrigerators in all households.

Up to 50% of the cost of a new device will be covered by the initiative, with an investment of €150 million (£128.7 milllion). It gives households the chance to cut power consumption by up to 40%, leading to an annual reduction of 126,000 tonnes in CO_2 emissions.

The replacement scheme could save consumers up to €300 (£257) per year.

BSRIA to test fan coil units

The Building Services Research and Information Association (BSRIA) has extended its scope of the United Kingdom Accreditation Service (UKAS) to include fan coil unit testing in accordance with BS EN 1397:2015.

BSRIA provides both thermal and airflow performance testing for all types of fan coil units, which are used in air conditioners. Testing is carried out in BSRIA's dedicated environmental chamber, where it can be witnessed and live test data observed.

UN backs seawater cooling study for new Egyptian city

Project for New Alamein City will start with single district cooling plant

The United Nations Environment Programme (UNEP) has designed a feasibility study for the implementation of a seawater air conditioning system in New Alamein City, Egypt.

Situated on the Mediterranean coast, city temperatures can reach 40ºC in summer. In such extreme heat, an estimated 50% of electricity is used for air conditioning.

The city is under construction, with phase II now beginning, which includes 10 coastal towers. The seawater project, which proposes using water from the Mediterranean, initially will consist of a single district cooling plant.

Cold water will be pumped into the plant and passed through a heat exchanger, where it absorbs heat from the buildings.

Cool air is generated from the cold water, while warm water is sent back into the sea.

A capacity of 30,000 tonnes of refrigeration would be sufficient to cool entire neighbourhoods and would cost US$117m in building production facilities.

CO_2 refrigerant trial sees 20% cut in carbon emissions

Trials on a new generation of CO_2 refrigeration systems by Elta has shown a 20% fall in carbon emissions

The three-year Life-C4R project, co-financed by the European Union, carried out seven trials of the manufacturer's full transcritical efficiency (FTE) and extreme temperature efficiency (ETE).

The research found the CO_2 systems tested achieved an annual reduction in energy of 15-23% and a life-cycle analysis found overall emissions fell by up to 20%.

Elta says the efficiency of the FTE system derives from better use of evaporators for medium temperature users in 'flooded' mode.

German data centre uses Bitzer screw compressors

Bitzer screw compressors are being used by Italian air conditioning company HiRef to cool a German data centre adiabatically with air-to-air heat exchangers.

The application has low-GWP refrigerant R513 and can be converted to use the HFO refrigerant R1234ze, which has a GWP of less than six.

HiRef used 96 screw compressors with external frequency inverters in the 48 cooling systems at the German data centre instead of scroll compressors.

Bitzer says that with screw compressors, certain temperature levels can be maintained precisely and constantly. If the preset maximum temperature set point is exceeded, the evaporative cooling system lowers the condensing temperature and therefore the energy intake.

CIBSE offers air conditioning training

CIBSE is organising a number of air conditioning training sessions in the coming months including: air conditioning inspections for buildings on 7 July and 15 September; design of heating and chilled water pipe systems on 8 September; and air conditioning and cooling systems on 20 October.

All events will be held online and can be booked at **https://cibse.org/training**

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BIRTH OF THE COOL

David Arnold s *20th century air conditioning* provides a fascinating insight into the development of air conditioning technology and its applications over the past century. Former CIBSE President and air conditioning expert **Doug Oughton FCIBSE** reviews the contents. Overleaf, Arnold spells out the cooling milestones

With ASHRAE and CIBSE recently celebrating their 125th anniversaries, it s apt that David Arnold s *20th century air conditioning* details the evolution of air conditioning over the past century as it relates to comfort in the built environment.

From its raw beginnings using technologies from process industries, the publication is a chronological review of the methods used in ventilation, air filtration, cooling, heating, and total system design and control.

Arnold s book has been extremely well researched as evidenced by more than 600 technical references and approaching 200 illustrations and is an important record of the development of components that comprise complete systems, put into context of commercial pressures over the period that drove change.

The text and illustrations provide sufficient technical information to explain the principles of design and operation at each significant stage in development, without this detracting from the logical flow of descriptive material.

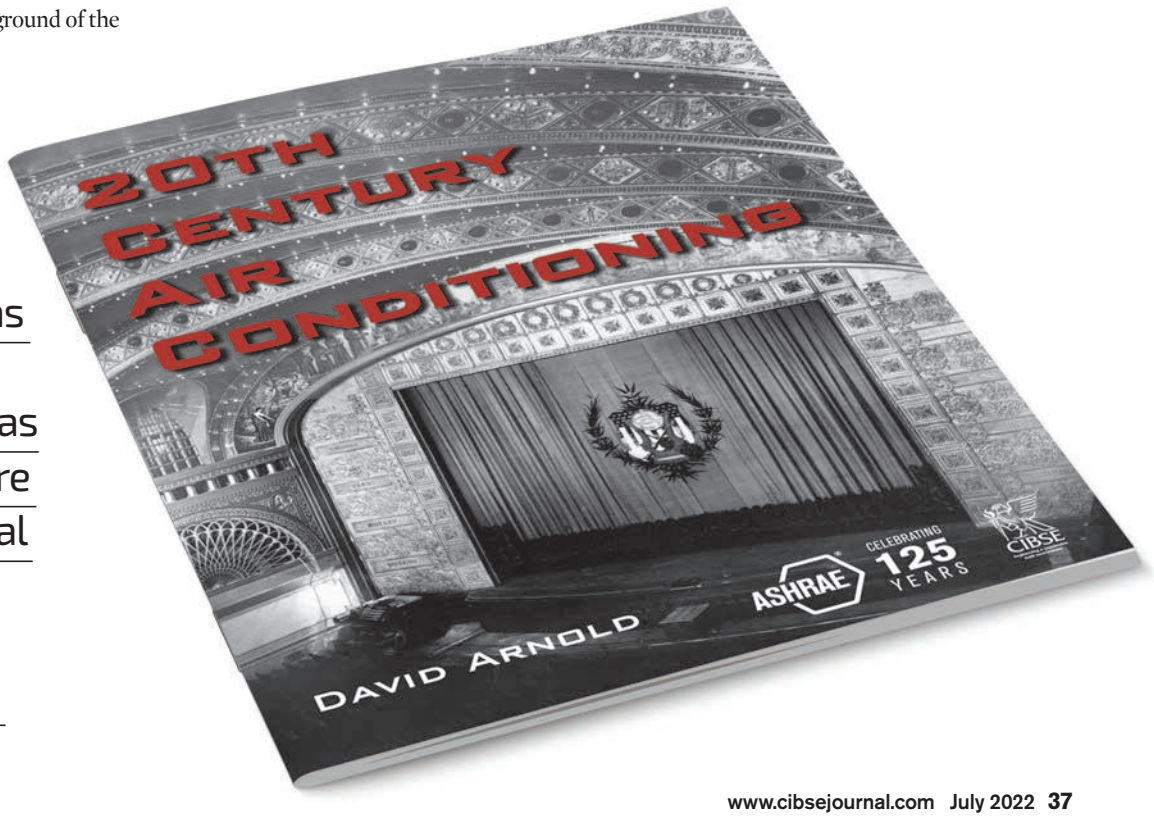
A good balance has been achieved between technical content and the background of the engineers and others contributing to the expanding industry. There are also many references to those buildings some well known, others not where new concepts were introduced.

As it was in other industries, the extent of change in technology in this field during the century was quite remarkable, and is clearly demonstrated here. One example highlighted is in controls from early manual adjustment, using trays of ice in an airstream to effect cooling, through pneumatic, electrical and direct digital controls, to modern state of the art building management systems.

Progress in this industry has been almost totally driven by the US market, to satisfy commercial imperatives and provide a comfortable and healthy environment for building occupants.

However, I noted with interest a development attributed to the UK namely, that of panel heating, with the redevelopment of the Bank of England (1924) referenced. Also, the UK climate enabled, mixed mode systems to be installed combining natural ventilation and passive cooling, with mechanical cooling only used when necessary; the 1990s Barclaycard headquarters building is cited as an example of such application.

On a purely personal note, having been associated with the air conditioning industry since the early 1960s, I found this publication not only extremely interesting from an engineering perspective, but also a journey along memory lane. An excellent publication highly recommended. CJ



The publication clearly demonstrates the extent of change in technology in air conditioning over the century

Arnold s book has been extremely well researched, as evidenced by more than 600 technical references and approaching 200 illustrations

MILESTONES IN AIR CONDITIONING

by David Arnold

1900 The Acme air washer
Patented by Richard Thomas, the air washer was intended to clean the air in ventilation systems and could cool the air for comfort cooling, too. The first prototype was successfully installed in the Chicago Public Library in 1900, to keep books and papers free from 'accumulations of dust and soot'. Air washers became the most common method of air conditioning in large buildings and remained very popular until the 1930s.

1904 Psychrometry and control of humidity
While researching ways to control humidity for a firm of lithographic printers, Willis Carrier discovered the humidity of air could be reduced by bringing it into contact with moisture at a temperature below the dew point or condensation temperature of the incoming air. This led him to design improved air washers and establish the principles of psychrometry used by air conditioning engineers today.

1906 1906 Air conditioning
The term 'air conditioning' was first used by Stuart Cramer, a cotton mill designer, and referred to the control of temperature and humidity to condition yarn processed in cotton mills. He designed the air conditioning for numerous cotton mills in the southern US, and the term was adopted much later by Carrier to define what is now called 'full' air conditioning.

1919 Movie theatre – mechanical air cooling
Air conditioning was introduced to many new luxury movie theatres in the 1920s, as it allowed operators to remain open during the summer, a time when they were usually closed if cooling wasn't available. Fred Wittenmeier, a refrigeration engineer, developed a technique of adding cooling coils to existing hot-blast systems (plenum heating and ventilating systems) connecting the coils to CO_2 refrigeration plant.

1928 'R12' – the first synthetic refrigerant gas
Early refrigeration systems for air conditioning used refrigerant gases that were toxic, flammable or explosive. General Motors' Frigidaire division, a leading manufacturer of systems, was developing a non-toxic, non-flammable alternative to existing gases. General Motors Research Corporation assembled a team, led by Thomas Midgley Jr, that developed the first synthetic gas, Freon 12, later called R12 – and now banned.

1929 The 'split' air conditioner
Frigidaire announced its new Electric Room Cooler. The unit, designed for rooms and small offices, was fully automatic, with a fan that drew air over cooling coils connected to a remote condenser and compressor.

1933 Fan coil unit
Fan coil units (FCUs) were being developed by both Trane and Westinghouse in the early 1930s. The first heating and cooling system, similar to today's four-pipe FCUs, was in the Tribune Tower, Chicago, when air conditioning was installed in 1934. The units were unique in that they could warm, cool, dehumidify or humidify. They were connected to a new steam-jet chilled-water system and the original steam heating installation..

1933 Reverse-cycle unit heat pump
The first free-standing, self-contained room air conditioner – an air source heat pump that could heat or cool – was patented by Henry Galson in 1932 and manufactured by De La Vergne. The energy source was outside air unit, changed from cooling to heating – similar to today's units, with the operation of the evaporator and condenser reversed. The units had hermetically sealed compressors charged with Freon 12 (see above).

1937 Induction units
In 1937, Carrier adopted the principle – patented in 1919 by Albert R Klein – of distributing air around buildings at high velocity, to save space required for ducts, and discharging the air through high-velocity nozzles into conditioned spaces. Called the Conduit Weathermaster, the system was first installed in the Statler Hotel, Detroit, in 1943. Induction units were the popular method of air conditioning large buildings until the 1970s.

1962 Moduline variable air volume (VAV)
Perimeter induction units were very popular by the 1950s, suiting narrow buildings. Richard A Church and colleagues developed a ceiling-mounted, high-velocity variable air cooling system that could cool interior spaces with less variable heat gains and losses. This led to the development of variable air volume that could both cool and heat, which became the most popular method of air conditioning large, open-plan buildings.

1970s Direct digital control (DDC)
The automatic control of air conditioning in buildings since the early 1900s had pneumatic systems patented by Warren Seymour Johnson in 1895. Computer-based direct digital control (DDC) was introduced around 1980 and led to the development of the ubiquitous building management systems common today. It became cheaper than pneumatic systems and offered many control functions not available until then.

1982 Moduline variable air volume (VAV)
Daikin Industries obtained a manufacturing licence for the scroll compressor developed by the Trane Company and Arthur D Little in the early 1970s. This resulted in Daikin developing its variable refrigerant volume system in 1982, using the Trane compressor. The system is similar in some respects to a four-pipe fan coil system in that fan coil (indoor) units are distributed in the space to provide cooling or heating.

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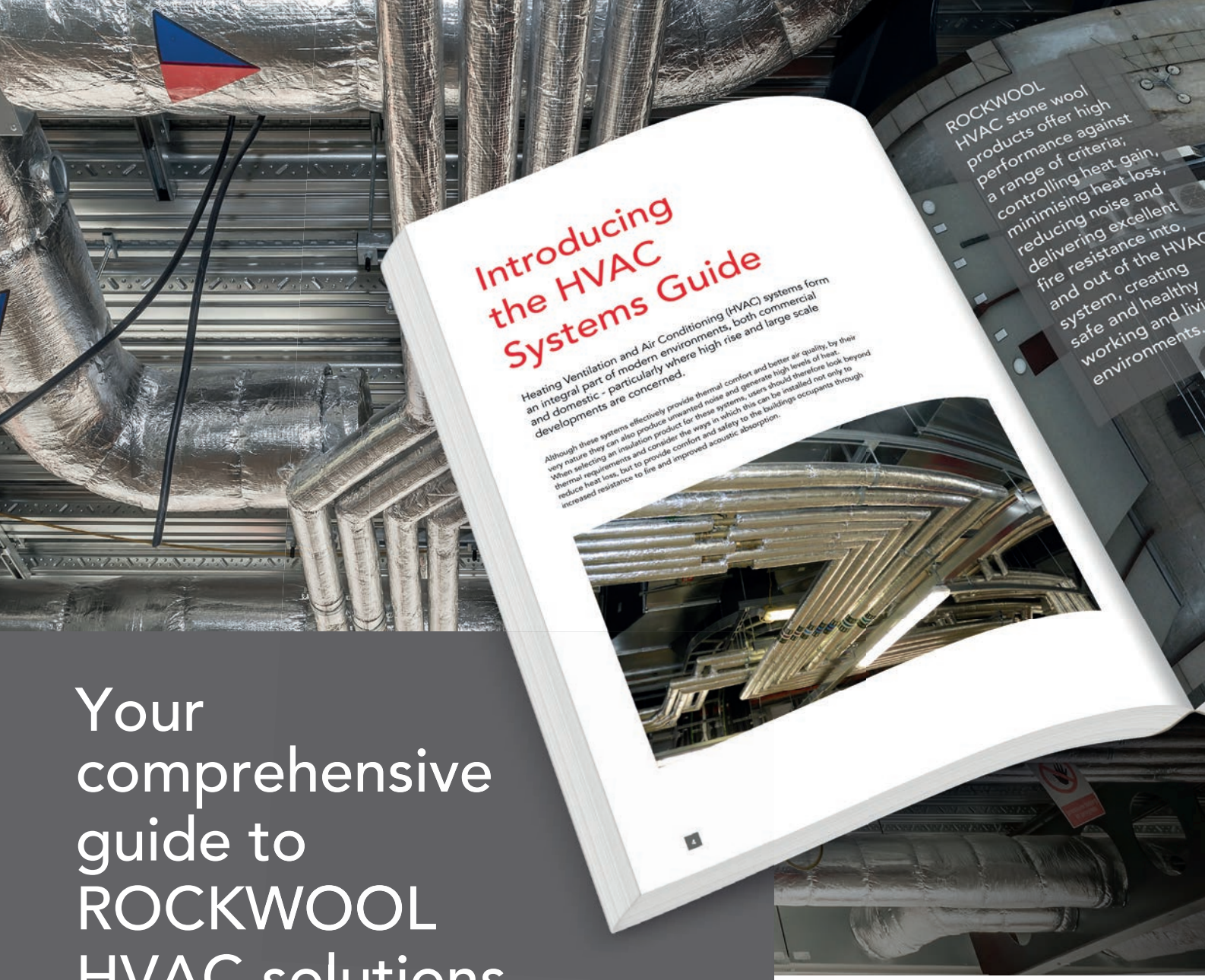

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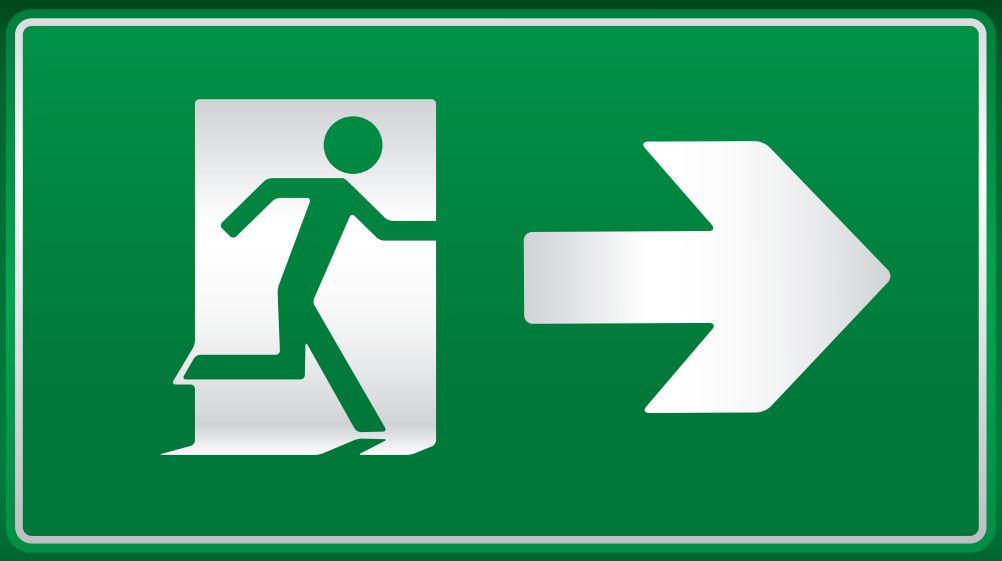


SAFE PASSAGE

As the Building Safety Act comes into law, the industry is facing the biggest reform of building control ever seen. With the HSE raising concerns about 50% of designs at the first planning gateway of the new safety regime, it s clearly essential to get to grips with the changes now. **Phil Lattimore** reports

Five years after the Grenfell Tower disaster marked a nadir for the construction industry, the new Building Safety Act is set to bring a fundamental change to the way building safety is regulated and controlled in England.

The regulatory framework of the act will establish new duties and accountability for those responsible for the safety of high rise and complex buildings, including three gateway decision points during the planning and construction process. Responsibility for the regime lies with a new Building Safety Regulator (BSR) under the auspices of the Health and Safety Executive (HSE).

The changes are fundamental and there are signs that the industry has not yet got to grips with the new regime.

In May, the Planning Gateway One (PGO) service at HSE raised concerns on more than half of applications it was required to be consulted on for the first safety decision point at design and planning stage.

Gateway One, at the planning application stage, came into force through changes in planning law on 1 August 2021. It mandates statutory consultation with the HSE, and requires the developer to submit a fire statement setting out fire safety considerations specific to the development with a relevant full planning application.

According to HSE s PGO service, a number of fire safety design issues have been identified with applications such as smoke vents and external wall openings close to neighbouring properties and restricted or non existent access for fire appliances.

The HSE also highlighted issues such as single fire shafts the only means of escape for residents on upper storeys that could easily become compromised where they connect with higher fire risk areas, such as car parks or waste storage facilities.

Mark Wilson, operational lead for policy and PGO at HSE, said that more than 1,000 consultation requests from local planning authorities had been received since the PGO service had started, with concerns raised with local planning authorities on 50% of these.

Feedback from local planning authorities is that they are supportive of what we re doing, he said. They are rightly concerned about granting planning permission for developments that we have identified as unsafe, and reluctant to provide consent where fire safety concerns »

» have been raised. Others question whether the scope of change the reforms bring has been fully appreciated and understood. There is a huge piece of work getting people to understand the change in the building control regime, says Hywel Davies, technical director at CIBSE.

It s not going to be the same people doing the same jobs it s the HSE fundamentally changing the way building control works. It will be risk based and evidence based, and in reality, this is not how building controls works at the moment. We have to start communicating this more.

The Local Authority Building Control (LABC) which represents all local authority building control teams in England and Wales has also warned that despite the five year lead in period, publication of this act will come as a shock to many who have not yet started preparing for the changes.

Mark Wilson from the HSE

The new Planning Gateways

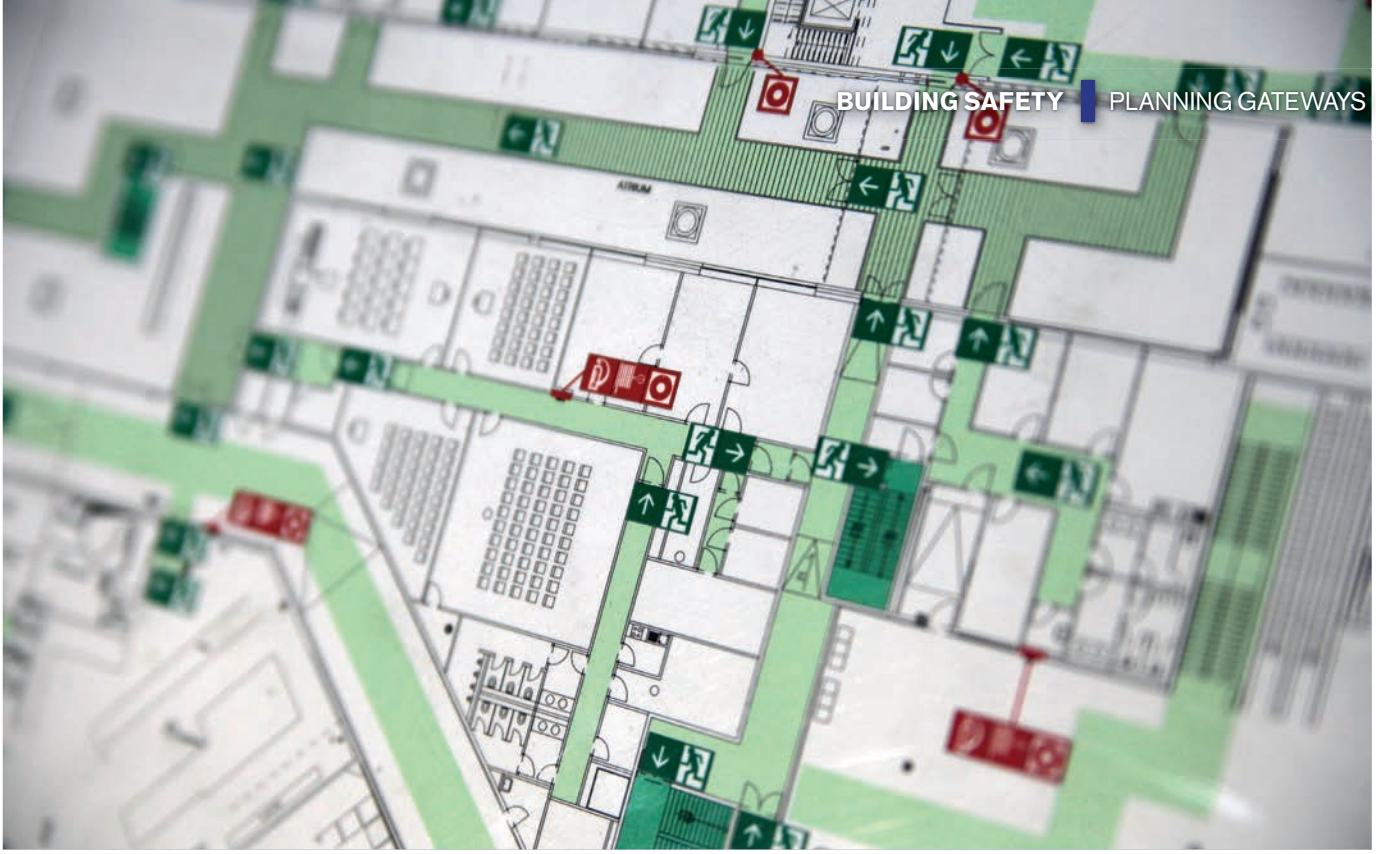
The act, which received Royal Assent on 28 April, will see a wide range of regulatory changes come into effect, impacting on the design and construction of buildings.

At each of the three gateway points for high risk buildings, the regulator will assess whether duty holders are properly considering building safety and meeting regulations. The new regime also introduces competency standards for work on building and provisions to strengthen the regulation of construction products.

While Planning Gateway One is already in operation, Gateways Two and Three are due to come into force in 2023. Gateway Two will be before building work starts and Gateway Three will be for when building work is completed.

Gateway Two will replace the building control deposit of plans stage, before building work starts, for higher risk buildings. Building control approval must be obtained from the BSR before relevant building work starts and applicants must demonstrate how proposals comply with Building Regulations and how they have reduced the possibility of building safety risks arising.

Gateway Three is a stop/go point and building approval must be obtained from the BSR before higher risk buildings can be occupied. Applicants must demonstrate how building work complies with Building Regulations to assure buildings are safe to occupy. The applicant must present plans and documents that reflect the as built building, and this will form part of the Golden Thread of information.



Major changes between Gateways Two and Three will require building control approval before they can be made.

The BSR will have strong enforcement tools where building work commences without first obtaining building control approval.

It will also take responsibility for building controls to provide stronger oversight of safety and performance for all buildings, introducing the new safety regime for high rise buildings (see panel, The new building control regime). It will have to approve higher risk residential projects over 18 metres or with seven storeys that have two or more separate homes through the planning application stage and at initial building control stage.

Although the act came onto the statute book in April, a number of the provisions will come into effect in stages, some in the first 12 months, but the majority scheduled to come into effect 12 18 months after Royal Assent, including Gateways Two and Three. Secondary legislation to complement the act is expected to be introduced following consultations, some of which are scheduled for the summer.

However, Wilson says industry needs to stop thinking that fire safety should only be dealt with at the Building Regulations stage it starts at planning. Designers need to respond to the good practice that is being established so fire safety design standards are raised at the start of a building s life cycle, he says.

Despite the number of building applications that are raising HSE concerns, Wilson says their intervention is having an impact: In general, most developers want to do the right thing most of them respond positively to what we say, and they are increasingly amending their plans based on our feedback. For example, they are adding additional firefighting shafts, moving fire mains, improving fire appliance accessibility, removing firefighter hazards, and changing designs to protect escape routes and prevent fire spreading.

Design process

The initial figures from HSE PGO suggest that many designers still need to adjust to the demands of the new fire safety regime. Teodor Sofroniev, principal fire engineer at Cundall, says: With regards to my role, I think it s important to say that this isn t about fire engineers doing something differently or implying that they need to do more, it s more about making the process more robust and requiring design teams to consider fire safety at an earlier stage.

There have been too many cases where fire engineers and authorities have been engaged too late in the process, at which point implementing the best solution for fire safety may be more difficult or costly so there s pressure to compromise.

> The Building Safety Act, which will affect all English and Welsh local authorities not just those with tall residential buildings in their area

As the gateways are implemented during the design and construction process, Sofroniev says, there will be risks of delays that can have considerable financial impact.

Stephen Jeffery is Mace s chief technical officer and heads up its group technical services team. He says the firm is well placed, having taken a number of detailed actions to prepare for the implementation of the act over the past five years. He believes it offers positive change, and the impact of the initial PGO changes will improve the design process. If the legislation is successfully implemented we should see a safer, more competent and digitally driven industry, he says.

Jeffery says designs are going to have to be far more complete at an earlier stage than they are currently. Value engineering and provisional sums are likely to be frowned upon as any of these design changes will need signing off by the regulator. This could significantly delay a project, and who carries this risk? This is why the act is often referred to as the designers charter . Designs will need to be much better detailed, drawn and substantiated at the planning approval stage. This represents a sea change in adopted building practices, he says.

Wilson advises developers not to rush fire statements provided with planning applications, or put them together as an afterthought to the plan, and to make sure the information is consistent with other documents submitted at planning, because they all will be scrutinised.

We re not averse to fire engineered solutions, with »

» departures from fire standards but we do require evidence at planning stage to back up any departure from them to demonstrate equivalence with fire standards in terms of level of fire safety that s being offered.

Although half of applications have raised concerns, Wilson believes this may be something of a wake up call. The industry s becoming more aware of us. I think the initial impression given of us may have been that we were going to provide a light touch regime, and we would only comment on issues like cladding and fire service access. The reality is that we ve been applying the fire standards in the way the industry has not been used to. We re giving it an indication now of what a more stringent regime is going to look and feel like in the future.

Wilson says the BSR can help by offering pre application advice and communicating information generally at Planning Gateway One. He hopes this will ultimately raise standards. When Gateway Two and Three start up, they will be in a better position, certainly in terms of builds that have come through Gateway One, to apply their parts of the regime. **CJ**

- For more details on the HSE's pre-application advice service, visit **bit.ly/CJJul22PG1**
- To get updates on developments with the BSR, sign up to the e-bulletin at **bit.ly/CJJul22GP2**

THE NEW BUILDING CONTROL REGIME

While the focus may be on its role in the oversight of high-rise buildings, the BSR-led regime covers all building work that requires building control approval – whether through a building notice or full deposit of plans, while the BSR will set standards for building control officers.

It will have oversight of enforcement of Building Regulations, with potential criminal sanctions in the worst cases.

As such, local authority building control surveyors will form part of the regulator's multidisciplinary team alongside HSE inspectors and fire service officers. These teams will work together to regulate new buildings and refurbishments and will have a significant role in assessing and certifying the 12,500 existing high-rise buildings in England covered under the new legislation.

The HSE's operational timetable to prepare the new building safety framework indicates that new buildings, where work starts on or after 1 April 2023, must follow the gateway approval process during design and construction introduced under the new regime.

Existing higher-risk buildings will have to be registered between then and October 2023. New buildings where work is already under way before 1 April 2023 must be registered on occupation. From April 2024, the BSR is scheduled to start calling in buildings for assessment and issuing building certificates.

Everyone who works in the building control profession, whether public or private sector, will be required to join the new building inspector and building control approver registers, which open in April 2024, if they want to continue to practise. The registration deadline for this will be October 2024.

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FIRE ALERT

A new version of BS 9991, the fire safety standard for residential buildings, is expected later in 2022 and contains changes that will impact the design of all flats, not just high rise buildings, says Cundall s **Teodor Sofroniev** and **Andy Bishop**

This long awaited new version of BS 9991, used as the basis for fire strategies relating to blocks of flats, introduces considerable changes that will impact the design and systems of residential buildings. The full release for this standard is not expected until late 2022 but the draft includes notable changes.


Andy Bishop


Teodor Sofroniev

BS 9991 is a code of practice for fire safety, which complements BS 9999, the standard covering non residential buildings.

BS 9991 gives guidance on the design, management and use of residential buildings so they achieve compliance with Part B of the Building Regulations covering fire safety of people in and around them and for firefighters.

This is tailored specifically to blocks of flats and houses and how they are designed, managed and occupied. It advises on the specific fire safety measures required for these buildings, such as fire detection and alarm systems, fixed firefighting systems and so on.

This document is an alternative to Approved Document B Volume 1 and is generally preferred by fire engineers and designers because of the greater level of detail and flexibility it provides.

Note, Building Regulation requirements can leapfrog standards (and vice versa). For example, changes to Approved Document B reduced the trigger height for sprinklers in flats to 11 metres. Designers should be aware of the latest guidance changes and refer to the more recent and onerous.

It is important that we build structures that place safety of people above all else. The suitability of current guidance and design practices has come under scrutiny and the standard reflects this. The most significant changes are listed for each of the following: all residential buildings; over 11m high; over 18m high; and over 30m high.

All residential buildings

In all developments where passenger lifts are installed, at least one lift should be an evacuation lift. The previous document was ambiguous when it came to the design of secondary power supplies. This draft clarifies the issue. The only acceptable arrangements for secondary power supplies are:

- a generator
- an independent high voltage supply provided it is fed from an independent utility primary network substation to that of the primary supply
- an uninterruptible power supply (UPS).

A single electrical intake with diverse routes and life safety distribution board is no longer acceptable.

Cross referencing with the new residential sprinkler standard, BS 9251:2021: the use of a modified residential sprinkler system is acceptable for some ancillary areas such as retail, bin stores and plantrooms subject up to 100m². Any non residential areas larger than this will require protection using a commercial BS EN 12845 system.

Residential buildings over 11m

In line with changes to the Approved Documents, sprinklers will be required in all residential buildings with a floor over 11 metres.

However, the standard advises that all areas are protected, including corridors and stairs, even if fire sterile (where a person can be considered to be safe from immediate danger from flame and smoke).

Residential buildings over 18m

Single stair, high rise buildings will only be acceptable in some circumstances (see panel).

An evacuation alert system that complies with BS 8629 will be required for buildings over 18m with a stay put policy that keeps people safe, and in place, when they are not in an area affected by fire.

BS 8629 is evacuation alert system code of practice for use by fire and rescue services in buildings containing flats. Systems designed to BS 8629 provide sounders in flats connected to a central fire alarm panel for use by the fire service to raise an evacuation alarm in specific, or all, flats.

The alert system in BS 8629 is not a change to the stay put policy but is an aid to firefighting operations in extreme scenarios.

Buildings over 18m require two evacuation lifts, regardless of the number of staircases provided and one should always be available.

Additional lifts may be required depending on the building layout. In some cases, fire fighting lifts need to be separate to evacuation lifts. Firefighting lifts will need to be accessed from a separate lobby adjacent to the stair that does not serve the main corridors directly

Residential buildings over 30m

The revision to BS 9991 provides the first definitive guidance on the operation and programming of evacuation lifts in residential buildings. It is likely that most lifts will need to have an automatic evacuation mode as well as the standard driver assisted mode.

For flats over 30m, natural smoke shafts are no longer acceptable and mechanical smoke extract or pressurisation systems will be the only acceptable means of smoke ventilation.

Please note our comments relate only to the draft revision of BS 9991. CJ

ANDY BISHOP is a partner and **TEODOR SOFRONIEV** is a principal engineer at Cundall

WHEN BS 9991 SAYS SINGLE STAIRS ARE ACCEPTABLE

In high-rises over 18m, compliance with Part B1, reasonable means of escape, may be able to be shown where:

- **The stair is provided with a pressurisation system**
- **Structural protection is increased from 60 minutes to 90 minutes fire rating**
- **Timber structure is not acceptable**
- **An additional lobby needs to be provided between the stair and corridor affording access to the flats (similar to current arrangements in Scotland)**
- **Stairs should be wider than 1,200 mm (increased from the 1,100 mm width for firefighting stairs)**
- **If extended corridors are present, additional mechanical smoke extraction may be required in addition to the stair pressurisation.**

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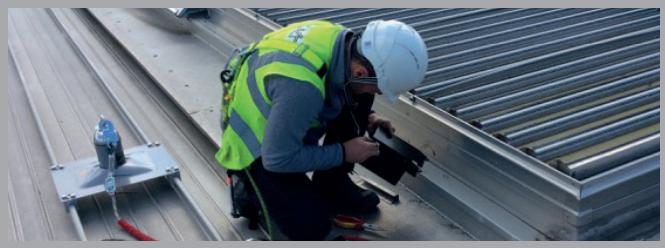

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EXPERTS IN HEATING

Application of gas fired boilers and hot water heaters to meet Approved Document L2 2021

Exploring elements of the revised Approved Document L of the England Building Regulations and the impact on fossil-fuelled systems for domestic hot water and space heating in non-dwelling buildings

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On 15 June 2022, the approved documents (ADs) to the UK Building Regulations for England saw the first significant revisions in almost a decade come into force as a first step along the path towards the UK 2050 net zero target. This CPD will consider elements of Part L of those revised documents focusing on conservation of fuel and power and, specifically, the impact on fossil fuelled systems to provide domestic hot water (DHW) and space heating in buildings other than dwellings.

The UK Government has a target of net zero emissions by 2050,[1] with the interim target to reduce emissions in the UK by 78% by 2035, compared with 1990 levels.[2] The UK Government s *Heat and Buildings Strategy*[3] notes that to meet net zero will require virtually all heat in buildings to be decarbonised. The ambition is to gradually move away from burning fossil fuels for heating, while increasing the application of low carbon products, fuels and energy sources that it is hoped will be transformed from niche applications to mainstream consumer choices.

The recent changes to the ADs supporting the Building Regulations for England included reorganisation and revision of AD Part L *Conservation of fuel and power*, and AD Part F *Ventilation*, and the introduction of AD Part O *Overheating*. By adopting the provisions of these ADs, the aim is to reduce the regulated carbon emissions of new non domestic buildings by an average of 27% compared with the previous versions.

The December 2021 changes to AD Part L *Conservation of Fuel and Power* has created two volumes. AD Part L volume 1 (replacing ADL1A and ADL1B) relates to dwellings, and volume 2 (replacing ADL2A and ADL2B) to buildings other than dwellings. There is concurrent activity to develop the Building Regulations (and supporting documentation) across the four nations of the UK England (AD Part L), Northern Ireland (Booklet F), Scotland (Section 6) and Wales (AD Part L). This article will focus on the recent revisions for England that particularly relate to the provision of boilers to deliver heating and hot water for non dwellings, as referenced by ADL2.

Unlike previous revisions, the transitional implementation of the revised England documents relate to individual buildings rather than whole developments (that might be, for example, individual office units as part of an industrial estate). So, as of last month, the new provisions apply to all buildings individually unless a building notice or an initial notice has been given to, or full plans have been deposited with, a local authority, in respect of that building, before 15 June 2022, provided that the building work on that building is started before 15 June 2023 .[3]

Fuel type	$kgCO_2 \cdot kWh^{-1}$	$kWh_{PE} \cdot kWh^{-1}$
Natural gas	0.210	1.126
LPG	0.241	1.141
Biogas	0.024	1.286
Fuel oil	0.319	1.18
Biomass	0.029	1.037
Grid electricity**	0.154	1.572

** average of October-March monthly figures provided in NCMMG[4] Table 30

Table 1: Examples of carbon factors and PEFs used in UK National Calculation Methodology (for England)

» The key developments in ADL2 include updated CO_2 and primary energy targets for buildings, minimum standards for building fabric and fixed building services, as well as guidance to support the new legislation .[4] This iteration, which remains as a support to Part L of Schedule 1 to the Building Regulations 2010, introduces a metric for the assessment of energy efficiency in the form of the target primary energy rate (TPER) in $kWh_{PE}·m^2$ per annum. This measure, which is already employed across the EU, will coexist with the previously employed target emission rate (TER) the maximum CO_2 emission rate for the building, expressed as $kgCO_2·m^2$ per annum. The adoption of the TPER is to provide a measure of the true primary energy use that, in practice, may be relatively straightforward to evaluate with Grid supplied electricity and gas, so long as there is an appropriate, up to date, primary energy factor (PEF) for the respective energy source. Examples, taken from the most recent[5] of PEFs and fuel carbon factors are shown in Table 1.

So, for example, if an old 85% efficient oil fired boiler was to be replaced with either a 93% efficient natural gas boiler or a 100% efficient direct electrical heater, the comparative CO_2 emissions and primary energy demand can be determined using the data in Table 1, as shown in Table 2. This indicates that although the electric boiler has the lowest CO_2 emissions, the primary energy demand of the natural gas boiler is the lowest. The practical impact of this, in terms of compliance, is to discourage the use of electricity as a direct form of heating, in order to meet the TPER.

It may prove more challenging to determine an appropriate PEF for other energy sources, including locally produced renewables.

As with earlier requirements for regulatory compliance, a building is evaluated by comparing calculations of the performance of the actual building against calculations of the performance of a theoretical building the notional building , as described in the National Calculation Methodology Modelling Guide (NCMMG).[5] This is done by determining the building s emission rate and, as introduced in this update, primary energy rate. It is carried out both at the design stage and when work is complete to assess compliance with the target values. For a building that is connected to an existing district heat network, in a change from previous regulations, the calculation should not include the impact of any change in heat sources expected after the building is connected and, so, cannot claim any benefit from envisaged enhancements to the heat network.

CO_2 emissions	Oil-fired boiler: $0.319/0.85 = 0.375kgCO_2·kWh^{-1}$ Natural gas-fired boiler: $0.210/0.93 = 0.225kgCO_2·kWh^{-1}$ Direct electric boiler: $0.154/1 = 0.154kgCO_2·kWh^{-1}$
Primary energy	Oil-fired boiler: $1.180/0.85 = 1.388kWh_{PE}·kWh^{-1}$ Natural gas-fired boiler: $1.126/0.93 = 1.211kWh_{PE}·kWh^{-1}$ Direct electric boiler: $1.572/1 = 1.572kWh_{PE}·kWh^{-1}$

Table 2: Example of comparative CO_2 emissions and primary energy demand for boilers

Fuel	System	Boiler gross seasonal efficiency	
		Previous requirement	ADL2 2021
Natural gas	Single-boiler ≤2MW output	91%	93%
	Single-boiler >2MW output	86%	88%
LPG	Single-boiler ≤2MW output	93%	93%*
	Single-boiler >2MW output	87%	88%*
Oil	Single-boiler	84%	93%*

* not explicitly shown in ADL2 – value shown as recommended by ADL2 clause 5.1

Table 3: Minimum boiler seasonal efficiency for heating systems in new buildings

Fuel	System	Boiler gross seasonal efficiency	
		Previous requirement	ADL2 2021
Natural gas	Single-boiler ≤400kW output	84%	91%
	Single-boiler 401kW–2MW output	84%	88%
LPG	Single-boiler ≤2MW output	85%	93%
	Single-boiler >2MW output	85%	88%
Oil	Single-boiler	86%	93%

Table 4: Minimum boiler seasonal efficiency for boiler systems in existing buildings

Fuel	System	Boiler gross seasonal efficiency		
		Previous requirement	ADL2 2021	Note
Natural gas	New, direct >30kW	90%	91%	
	New, direct ≤30kW	73%	91%	
LPG	Existing, direct	73%	91%	
	New and existing indirect	80%	91%	boiler efficiency
LPG	New, direct >30kW	92%	92%	
	New, direct ≤30kW	74%	92%	
	Existing, direct	74%	92%	
	New and existing indirect	81%	91%	boiler efficiency
Oil	Existing, direct	86%	No option	
	New and existing indirect	75%	No option	
	New and existing indirect	82%	91%	boiler efficiency

Table 5: Minimum thermal efficiencies for new and existing domestic hot water (DHW) systems

When considering a boiler installation in a new building, the boiler seasonal efficiency is required to be at least as high as listed in ADL2 (as shown in the abbreviated list of Table 3), which have incremental uplifts compared with the previous versions of the ADs. When replacing existing boilers, the requirements have a significant uplift, compared with those previously scheduled (in the 2013 *Non-Domestic Building Services Compliance Guide for England*), as shown in Table 4; they are now practically all in line with those required for new buildings. This effectively means that, in normal applications, non condensing boilers will not meet the requirements and cannot be installed in new buildings, nor as replacements.

If the replacement employs a different fuel, it should not produce more CO_2

Figure 1: Two stacks, each with two condensing gas boiler modules, employed for a refurbishment of St Paul's Cathedral, London, with maximum output 1,016kW and able to modulate down to 50.8kW (a turndown ratio of 20:1)

emissions per kWh of heat than the appliance being replaced and, as a new requirement in ADL2, not have a higher primary energy demand per kWh of heat than the appliance being replaced. ADL2 requires that when a new heating appliance is installed in an existing building system it should have time and temperature controls and, where appropriate and technically feasible, weather compensation.

Like for like replacements of non condensing water heaters will not be possible in commercial buildings, unless exceptional circumstances are approved by the local authority. As can be seen in Table 5, the minimum performance of DHW heating systems has been increased significantly so that condensing systems are practically the only suitable solution for fossil fuelled water heaters. Where a condensing means of delivering hot water cannot feasibly be fitted in an existing building for example, where there is insufficient space for a replacement flue system a boiler with minimum seasonal efficiency of 80% for natural gas and 79% for LPG may be used. Such exceptions are likely to be rare, and only when options to install compliant (condensing) units have been exhausted. Different flue types are likely to be required on a condensing boiler if original units were non condensing, as flue material needs to be resistant to corrosion (generally stainless steel or polypropylene), whereas an existing flue installation might not use suitable materials. (The requirements are provided in AD J *Combustion appliances and fuel storage systems*.)

Many currently installed non condensing DHW heating systems serve applications, such as hospitals and leisure centres, that have high hot water demand and employ water heaters with a significant volume of integrated storage. The requirements of ADL2 will undoubtedly neccessitate more careful consideration and planning when replacing such critical services.

In many cases, it is unlikely that replacement boilers and hot water heaters, which are supplanting non condensing equipment, can utilise existing flue equipment and termination positions. Condensate removal will require a suitable drainage point, and applications below ground level such as in basement plantrooms may need to consider making provision for alternative methods of condensate removal, such as condensate pumps.

When sizing new and replacement space heating systems, ADL2 requires that, where feasible, all parts of the system, including pipework and emitters, should be sized to allow the space heating system to operate effectively, and in a manner that meets the heating needs of the building, at a maximum flow temperature of 55 C or lower . This lower temperature will allow the effective use of current technology heat pumps as a heat source, but will also ensure effective and efficient use of condensing boilers; for gas boilers to condense, and benefit from the recovery of latent heat from flue gases, requires a system return water temperature below (approximately) 54 C.

Although systems may be designed for eventual potential operation at 55 C flow, this does not preclude the initial system to efficiently employ condensing gas boilers operating with a higher flow temperature. Considering that heat pumps typically require a low condenser (heating system) flow/return temperature difference of around 5K, the average temperatures in heat emitters supplied from a heat pump with a flow temperature of 55 C, would produce a mean water temperature of approximately 52.5 C (or possibly lower, with a larger temperature difference as discussed by Palmer in April s *CIBSE Journal*[6]). Many condensing gas boilers can operate with a relatively large temperature differential so, for example, could provide flow water at 65 C with a design return water temperature of 40 C, and thereby operate with a mean water temperature of 52.5 C, matching that of a potential future heat pump installation. At these conditions, the boilers have the opportunity to condense as well as deliver higher temperature water that is useful for supplying hot water calorifiers and plate heat exchangers. The higher temperature differential of the condensing boiler system will mean heating water flowrates that will be lower than those used by the heat pump system, so reducing pumping costs appreciably (if employing a variable speed pump). The lower flowrates will also produce a significantly lower pressure drop through the condensing boiler itself, so lowering pump energy consumption.

The revisions to the ADs that support the England Building Regulations are an interim measure towards the Future Buildings Standard. The UK Government considers that these revisions will make sure that construction professionals and supply chains are working to higher specifications in readiness for the introduction of the Future Buildings Standard from 2025.[7] A full technical consultation on this new standard is expected in 2023, which will undoubtedly benefit from the input of practising engineers who have implemented the interim changes to ADL2.

Turn to page 52 for references. »

Figure 2: Example of stacked modular condensing gas-fired boilers that operate with a differential temperature of up to 40K

Module 199

July 2022

» **1. What is the target to reduce emissions in the UK by 2035, compared with 1990 levels?**

- ☐ A Practically net zero
- ☐ B 27%
- ☐ C 35%
- ☐ D 78%
- ☐ E 85%

2. What does the abbreviation TPER stand for?

- ☐ A Target primary energy rate
- ☐ B Target prime energy resource
- ☐ C Tonnes primary equivalent rate
- ☐ D Total primary energy ratio
- ☐ E Totalised primary energy resource

3. Which of these is likely to have the lowest PEF, according to the data in this article?

- ☐ A Biogas
- ☐ B Coal
- ☐ C Fuel oil
- ☐ D LPG
- ☐ E Natural gas

4. Which of these water heater types showed the greatest uplift in the required minimum efficiency in ADL2 compared with previous requirements?

- ☐ A LPG, new and existing indirect
- ☐ B LPG, New, direct >30kW
- ☐ C Natural gas, new and existing indirect
- ☐ D Natural gas, new, direct ≤30kW
- ☐ E Oil, new and existing indirect

5. What year is the Future Buildings Standard planned to take effect?

- ☐ A 2022, alongside ADL2
- ☐ B 2023
- ☐ C 2025
- ☐ D 2035
- ☐ E 2050

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Products of the month

Rinnai reveals 100% hydrogen for continuous flow water heaters

Manufacturer one of the first to display I2HY20 gas category certification for all of its products

Rinnai has created a continuous flow hot-water system fuelled by 100% hydrogen.

In November last year, the company announced the release of its Rinnai Innovation Manifesto 2050, describing its commitment to global carbon neutrality. A Rinnai spokesperson said: 'As a company that produces appliances that require fossil fuels, Rinnai feels a deep sense of responsibility to embrace all aspects of global decarbonisation.'

Current UK Rinnai product ranges – both domestic and commercial – are hydrogen-blends ready, which means that units will accept the proposed 20% hydrogen/natural gas blend.

Rinnai UK is one of the first manufacturers to display the I2HY20 gas category certificate for all its products.

'If we can develop a 100% hydrogen combustion technology that emits no CO_2, we can help achieve carbon neutrality,' the company spokesperson said, adding that Rinnai's 100% hydrogen combustion water-heater models can contribute significantly towards cutting emissions.

He said: 'An adoption of global infrastructural modifications is a prerequisite for hydrogen-burning water heaters to become a valid, global decarbonising technology.

'Major international economies are focusing on introducing clean and domestically sustainable sources of energy, such as renewables and hydrogen, into separate energy mixes before or around 2050.'

In the UK, HyNet North West is a project trialling hydrogen distribution and supply to both industry and residential sites The lead partner is Cadent, the UK's largest gas distribution network. Reports show that the trial is progressing up to and beyond expectations.

In Australia, major energy companies are implementing a series of demonstration tests using 100% hydrogen water heaters in residential applications from October 2022. Rinnai will take part in these tests in the hope that its 100 years of experience can assist in producing technology that accepts clean energy.

Chris Goggin, operations director at Rinnai UK, said: 'We are delighted to see this development coming to market after a period of intense research and design work conducted on a global scale.

Chris Goggin, operations director at Rinnai UK

'The quality of our range of products, coupled with service excellence to all customers, is – and always will be – our first priority. We have responded to the need for decarbonisation by redesigning those parts of our products that warranted it – and we have recognised that all fuels will factor in the future.

'Hence, we have launched our H3 initiative – hydrogen, hybrid and heat pump – so that our customers have the best possible choices to assist them to maximise their own energy efficiency programmes.'

Rinnai plans to continue researching and developing next-generation decarbonising technology. It is determined to introduce combustion technology that encourages a greater sense of customer convenience and clean air quality.

A hydrogen CPD is now freely available at www.rinnaiuk.com

Products of the month

Rinnai units supply limitless hot water on demand to offgrid sites

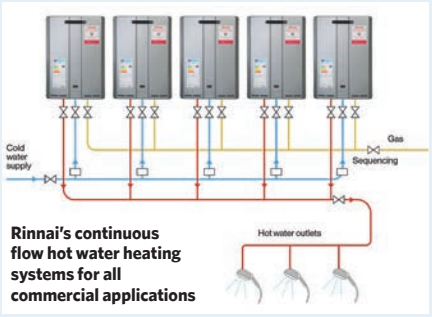
Alternative fuel sources to LPG and diesel oil can be used in Rinnai systems, says the company s Chris Goggin

Low carbon alternatives to liquid petroleum gas (LPG) and heating oil can be used in Rinnai hot-water heating units and systems. Further alternative fuel sources are currently in demand because of the impact of the war in Ukraine.

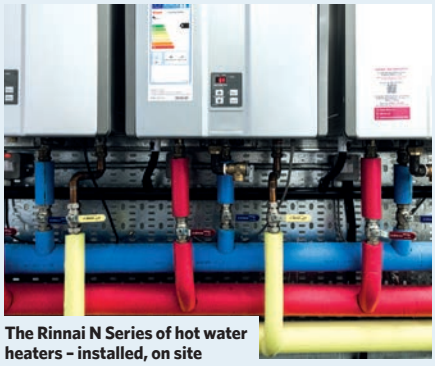
BioLPG is a lower-carbon-intensive source of fuel than LPG, and is made from a blend of waste, residues and sustainably sourced material.

Renewable biofuel dimethyl ether (rDME) is a molecule-based fuel produced through renewable feedstocks, and can be used to replace heating oil. It has a very high cetane number, which is a measure of the fuel's ignitibility in compression ignition engines.

The energy efficiency and power ratings of rDME and heating oil engines are virtually the same, but rDME can reduce greenhouse gas emissions by up to 85%. Before this development, LPG was the lowest-carbon-emitting source of fuel for the 15% of UK businesses and homes that function off grid. BioLPG releases no harmful emissions, and DME performs to a higher standard when compared with heating oil.



Rinnai's continuous flow hot water heating systems for all commercial applications



The Rinnai N Series of hot water heaters – installed, on site

LPG and BioLPG are the ideal solutions for rural or off-grid commercial business use. An adaptation to BioLPG is simple and swift, and new BioLPG units can be 'dropped in.'

The transition to BioLPG will ensure businesses can continue to operate normally and efficiently, with limited disruption and minimum stress – no technical adjustments are required to your heating and hot-water system.

BioLPG and LPG are interchangeable, which means the fuel can be used with a current Rinnai system. The performance of BioLPG is comparable with LPG, as is DME when compared with diesel. They can create cleaner local air and help meet international decarbonisation targets.

Visit www.rinnaiuk.com

Rinnai CPD reveals carbon and expenditure savings in hot water heaters

New service allows manufacturer to analyse user s carbon emissions and advise on potential savings

A new Rinnai CPD shows the carbon and cost savings that can be achieved through investing in both hydrogen blend-ready and BioLPG-ready continuous flow hot water heaters. The CPD *Carbon and economic benefits of zero storage in hot water systems* is available on Rinnai's website **www.rinnauk.com**.

The current rise in energy prices and living costs is an issue at the forefront of many people's minds at the moment. Rinnai is continuously working to produce products that will benefit the customer in terms of performance, finance and convenience.

The company's research shows that instantaneous hot-water systems offer significant savings over traditional storage systems in five key areas: operational costs; capital cost; carbon footprint; space; and weight.

The approximate savings that can be achieved by replacing a traditional storage-based system with a commercial Rinnai continuous flow hot-water system amount to: 15-20% on running costs; 30% on upfront costs; a 15-20% reduction in carbon; a 60% saving in space; and an 80% saving in weight.

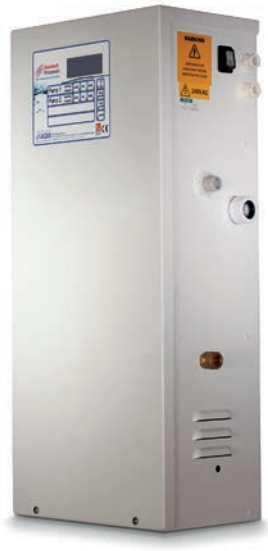
A three-step formula has been created to measure these cost and carbon savings calculations. The first step collects and processes data from previous real-life projects. This data is used to gain a better understanding of peak-loading conditions and usage patterns. The second step then sizes the system according to the loading. Finally, the third step calculates the capital expenditure, operational expenditure, carbon emissions, efficiency, energy use, performance, plant space, and weight.

Rinnai is a registered provider of CPD courses with CPD UK and CIBSE. Each course is designed to facilitate a better technical understanding of low carbon heating, and hot-water delivery systems. Rinnai's CPD courses can be found on its website by keying 'training' into the Rinnai search area, located at the top-left side of the opening webpage. The CPDs are free to all.

Rinnai's recent CPDs aim to increase knowledge, skill and expertise, and offer an insight into the current energy market, and how continuous flow technologies actively assist in customer cost and carbon reductions.

Visit www.rinnaiuk.com

Minipack pump that s perfect for small buildings ›



The Aquatech Pressmain Minipack pressurisation unit is ideal for small domestic and commercial buildings.

The product is wall-mounted, and available with single or twin pumps and full building management signals, to maintain water pressure in small heating and chilled water systems. It can deal with temperatures of 3°C to 90°C, a fill pressure of 3.5 bar and system content of 5,000 litres of water. Built to last, Minipack runs quietly and saves energy, with its components easily accessible for servicing.

Email sales@aqpm.co.uk or visit www.aquatechpressmain.co.uk

‹ ELCO reinforces sales team with new appointment

ELCO Heating Solutions has appointed Lee Atkinson as area sales manager for London and the central regions, with the company looking to strengthen key relationships with consultants and specifiers.

Atkinson will be responsible for helping ELCO drive specifications of the company's latest range of commercial heat pumps, low-emission boilers, network heating and hot-water products.

He arrives at ELCO with more than 20 years' experience in the commercial heating and hot-water industry. After starting out as an apprentice, Atkinson developed his career as an engineer for HVAC manufacturers, before transferring his skills to a sales role six years ago.

Visit: www.elco.co.uk, follow ELCO on Twitter @elco_uk or connect on LinkedIn

^ Carrier chillers selected for new landmark building in Manchester

A Carrier chiller has been specified for the new Manchester Goods Yard. Carriers AquaForce Vision 30KAV air-cooled chillers will deliver 2.4MW of cooling to the Goods Yard as part of a sustainable and intelligent building and cold chain solution. The AquaForce 30KAV chiller is an energy efficient solution that works to reduce its customers' carbon footprint by more than one gigaton.

Enhanced efficiency is achieved through variable-speed screw compressors and dual variable-speed pumps, plus Carrier's proprietary Greenspeed intelligence control system.

Visit bit.ly/CJJul22Carr

Weatherite cools with Condair ME ›

The Condair ME evaporative humidifier is helping Weatherite reduce cooling system energy consumption for its data centre and telecoms clients by up to 80%.

Condair's evaporative humidifier is providing adiabatic cooling in Weatherite's innovative Adtec-D free air cooling unit. The Condair ME boosts the cooling capacity of the system, allowing the Adtec-D to replace the need for mechanical cooling in some applications.

The Adtec-D is a self-contained, modular cooling system that can be located inside or outside of a building.

Visit www.condair.co.uk

‹ Aquatech Pressmain marks 40 years of innovation in the pump industry

Aquatech Pressmain has celebrated its 40th year as a manufacturer of water-booster sets and pressurisation units.

The Essex company was set up as Aquatech Ltd in 1982, and initially supplied packaged pump sets, specialist control panels and controls for servicing company Acorn.

In 2006, the company bought Pressmain Pressurisation and Warmac, and it became Aquatech Pressmain. The company supplies buildings in the industrial, commercial and domestic sectors across the UK and overseas.

The family-run business has more than 100 staff and its clients include Carlsberg, Harris Tweed and the University of Kent.

Email Jenny Elsey at jenny@elseyadcock.co.uk

^ The compact Micromatic HM2AV packs a powerful punch

Despite its small footprint, the HM2AV is a sophisticated, powerful booster set for supplying water to flats, schools and hospitals. The WRAS-approved, energy-saving pumps start softly, then increase the water pressure to 7.0 bar or the water flow to 4 l/s. The HM2AV design ensures easy servicing, tidy build and ample safe water.

Email sales@aqpm.co.uk or visit visit www.aquatechpressmain.co.uk

Jung Pumpen training opportunity for public health engineers ›

Pump Technology is set to host an in-depth wastewater and sewage training programme for public health engineers in Germany. Taking place from 30 November to 2 December 2022, the programme will be led by manufacturer Jung Pumpen, in Steinhagen, Germany.

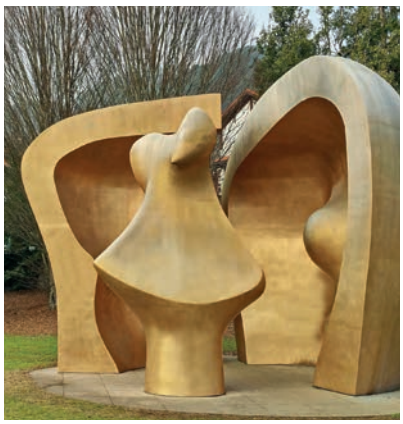
The manufacturer's well-equipped training centre has been established to enable engineers to understand exactly which factors are important to consider when specifying a pumping solution. A factory visit will also be included in the event.

Call 07984 520515, email davidj@pumptechnology.co.uk or visit bit.ly/CJJul22Jung

Domus Ventilation welcomes Jessica Cook ›

Domus Ventilation, which manufactures and designs ventilation systems, has appointed Jessica Cook as general manager. It says her enthusiasm will help it offer practical solutions for complying with Building Regulations, and develop the right tools to support customers' needs. With 15 years' experience in UK manufacturing, Cook will help Domus become more customer-centric, and drive it towards a cleaner, more sustainable future.

Email vent.info@domusventilation.co.uk or visit www.domusventilation.co.uk



‹ Condair humidifiers protect important artworks

Two Condair RS steam humidifiers have been installed by Ceilite Air Conditioning at the Henry Moore Foundation in Hertfordshire. The artworks in the Moore exhibits require constant environmental control for their preservation. The Condair RS was specified as a resistive steam humidifier capable of providing 45%RH control when operated on regular mains water and 42% with reverse osmosis water. Due to its compact, weatherproof and temperature-controlled case, the model is an efficient method of humidification in spaces unsuitable for standard models.

Company s website www.condair.co.uk.

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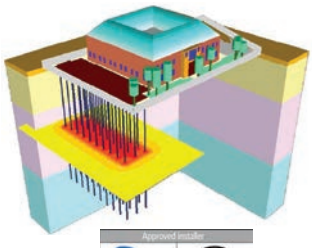

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Zambia is one of the countries in which SolarAid is focusing its efforts

John Keane

Bright idea takes off

International charity SolarAid is on a mission to bring ultra-low-cost solar lighting solutions to rural communities in sub-Saharan Africa. CEO John Keane explains how

John Keane became acutely aware of the challenges of living without electric light after he moved to rural Tanzania as a volunteer in 2000 and saw people using hazardous alternatives, such as kerosene lamps and paraffin candles. This led him to co found SolarAid in 2006.

As CEO of the charity, Keane works across Africa to establish solar projects and social enterprises, and encourage innovation, to provide safe, sustainable solar lighting to rural communities. This includes the development of the SM100 solar light, which retails at $5. From its start in Malawi, the charity has expanded to Tanzania, Zambia, Kenya and other nations across sub Saharan Africa.

How big a problem is kerosene lighting in Africa?

More than 578 million people across the continent live without access to electricity. To have light in homes after dark often means turning to rudimentary, kerosene lanterns made from tin cans, which spew out black smoke, or paraffin candles that are expensive, dangerous and polluting.

Not only is there an obvious fire risk, but there is also the impact on health, while the quality of lighting is poor, which affects the ability of people to read and study. It s also an issue for schools and clinics. One in four clinics in Africa has no access to electricity, which means quality healthcare is limited. Electric lighting with LEDs is clean, safe, convenient, high quality and, with solar power, free to run.

What was your motivation for creating an alternative solution?

When we set up SolarAid, there wasn t anything suitable on the market for small scale use. Solar was quite expensive and usually involved fairly large systems. So, we looked at producing solar lamps for rural households that were designed to be low cost, but high quality and reliable. We set up cottage industries in Africa with people assembling them. The technology was becoming smaller, cheaper and better, but, even 10 years ago when the cost of lights had dropped to around $10 there was still an affordability barrier. So, in 2013 14, we teamed up with Yingli Solar to make the world s most affordable solar light. This led to the launch of the SM100 in 2016, which retails for $5. Our work with rural communities feeds back into the improved design of products.

How many lights have you produced, and how much carbon have you saved?

We ve distributed around 2.2 million solar lights, working with entrepreneurs who we have helped establish across the continent. But we are all about kick starting solar markets, so we want others to be making and distributing quality, affordable solar lights too. We are a charity we can lead the way, show it s possible, and then others can follow and start building on that success. In terms of carbon, 2.2 million solar lights equates to a rough saving of 2.2 million tonnes of CO_2 over their lifetime.

What are the challenges of promoting SolarAid lighting?

In the UK, it s to get people to understand the context in which we work, and to make it clear how much of a challenge it is to live without electricity and electric lighting. In terms of the environments in which our teams operate, these are often hard to reach rural communities, so if it s the rainy season the roads can become impassable.

Another key issue is affordability. In many communities, the majority of people are subsistence farmers, so they have to be very judicious about how they spend any disposable income. They need to be able to trust that the solar light is going to work and, if there are issues, that there is an after sales, customer care service. So, the challenges are creating access, creating demand and trust, and creating affordability.

What are your plans to develop SolarAid over the next few years?

Our mission is aligned with UN sustainable development goals; by 2030, we want no home, school or clinic to be left in the dark. At the moment, we re focusing on Malawi and Zambia, where access to electricity is particularly problematic. We re also developing models that prioritise reaching the most marginalised sectors of the community; models such as light libraries that allow people to access solar light without having to purchase it and ones where we help light up a whole village, so every home gets access to a multi light solar system.

We are trying to break the barriers of price point. Our objective is then to work with other actors across sub Saharan Africa, so that the models we develop can be replicated to widen their impact.

● Visit **https://solar-aid.org/**

EVENTS

NATIONAL EVENTS AND CONFERENCES

Young Engineers Awards
Entry deadline 29 July
Awards 11 October
Entries are now open for the Young Engineers Awards, which encompass the Apprentice, Graduate and Employer of the Year. The awards recognise the best new talent entering the building services industry, plus those businesses that go the extra mile to support and nurture them. The awards will be held at a new location this year: RIBA, London. Enter now at: **www.cibse.org/yea**

Build2Perform Live
29-30 November
The flagship event returns as a face-to-face event for 2022, at London ExCeL. The two days will feature a carefully curated CPD programme with more than 160 speakers and 70 exhibitors.

Register your interest to be kept up to date with the latest news by going to **www.build2perform.co.uk**

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**

SoPHE Industrial Associates Summer Exhibition
7 July
This exhibition will provide information on new products and processes, and offer a chance to meet professionals from across the public health sector and supply chain, learn more about SoPHE, and meet the SoPHE Industrial Associates.

East Midlands: Building Regulations Part F update and Part O introduction
7 July
CPD event, presented by Nuaire, to highlight the key changes from Approved Document F 2010 (2013 amendments) to Approved Document F, 2021 edition.

Home Counties North East: BS 7671 18th Edition amendment 2 update
26 July
The first in-person CPD event for the region since Covid, with speaker Leon Markwel, senior engineer in the IET technical regulations department, and chair of CIBSE Electrical Services Group.

SLL and South West: New LG12 Emergency lighting in partnership with Philip Payne
27 July, Exeter

28 July, Bristol
Craig Meakin, sales director at Philip Payne, will present on the new LG12 Emergency lighting guidance.

CIBSE JOURNAL WEBINARS

The latest *CIBSE Journal* webinar, sponsored by Grundfos in May, is now available on demand: *Upfurbishment – designing new pump technology into older spaces.*

You can watch this, together with all other previous webinars on demand at **www.cibsejournal.com/cpd/webinars**

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:

Electrical services explained
5-7 July

Above ground building drainage
5 July

Emergency lighting to comply with fire safety requirements
6 July

Air conditioning inspection for buildings
7 July

Circular economy in lighting and building services
7 July

Embodied carbon in MEP design: How to use CIBSE TM65
8 July

Heat networks code of practice (CP1)
13 July

Energy efficiency related building regulations: Part L
14 July

Overview of IET wiring regulations (18th edition)
19 July

Residential fire sprinkler design BS 9251:2021
19 July

Fire safety building regulations: Part B
20 July

Energy efficiency related building regulations: Part L
20 July

Introduction to the Building Safety Act
25 July

Earthing and bonding
27 July

Mechanical services explained
2 August

Energy efficiency related building regulations: Part L
9 August

For details and the full programme 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 a 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 all other membership webinars: **www.cibse.org/webinars**

Upcoming webinars:
- **12 and 19 July**
- **16 and 23 August**

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

CIBSE BUILDING PERFORMANCE AWARDS 2023

CATEGORIES ANNOUNCED

CIBSE Building Performance Awards are back for their 16th year with 23 categories to recognise and celebrate engineering excellence in the built environment.

Four new categories have been added to the list:

- **Engineer of the Year**
- **Embodied Carbon** – Manufacturers and Suppliers
- **Embodied Carbon** – Consultants
- **Building Safety**

Awards ceremony: Wednesday 01 March 2023.

Scan to view the full list of categories

cibse.org/BPA

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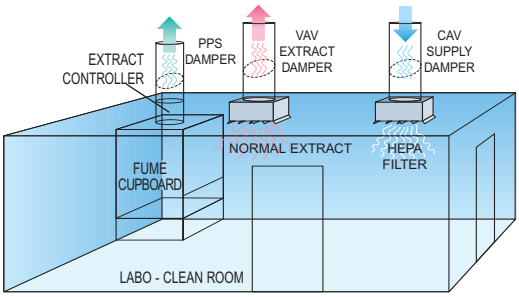

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