



**SHOOTING THE BREEZE ON  
NATURAL VENTILATION**

**COST MODEL HEAD TO HEAD:  
HEAT PUMPS V BOILERS**

**NASA OFFERS CLOSE-UP  
VIEW OF CLIMATE CHANGE**

## **UNTANGLING THE THREAD**

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## Foward thinking



With the ongoing machinations around Brexit, it may feel as if the government has limited time for any other business. Thankfully, however, it made two announcements last month – around fire safety and climate change – that should benefit industry, and society at large, for many years to come.

Theresa May's commitment to the 2050 net-zero carbon targets recommended by the Committee on Climate Change will be backed up in law, as she unveiled a statutory instrument to amend the Climate Change Act of 2008. It is positive news, and will give the industry confidence to develop and build innovative new systems to reduce our reliance on fossil fuels.

There will need to be more buildings like the Breeze Hotel in Amsterdam, which uses sun, wind and water to heat, cool and ventilate its 11 storeys (see page 26).

Last month, the government also published its proposals to reform building safety in line with the recommendations made in Dame Judith Hackitt's review of building regulations and fire safety. They will force the industry to tackle the issues of quality and performance that it has been grappling with for years.

The proposals aim to ensure fire-safety systems in new, high-rise residential towers operate in the way originally intended by the designer. The document also tackles existing buildings, and the government is currently exploring ways of collecting fire-safety information from existing towers through a series of building pilots. (The fact that multiple developers and housing associations have signed up to a Building Charter exploring the proposals is heartening.)

A new building safety regulator will check the information at three 'gateway points', including at handover. It is proposed to also have accountable dutyholders, who will be responsible for the fire safety of the building at different stages of its lifetime.

A 'big stick' comes in the form of the powers of enforcement given to the building regulator. A three-step process will eventually result in enforcement action – and, possibly, prosecution – against accountable people if there is non-compliance.

The proposals come two years after the Grenfell Tower fire, and it is appropriate that the government is proposing to involve residents in the fire-safety strategy of their buildings. Key facts will be shared with tenants and it will be the building managers' responsibility to update them on pertinent changes to the premises that might affect fire safety. This will, hopefully, go some way to restoring the trust that has been lost between the construction industry and the people who occupy its buildings.

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*CIBSE Journal* is written and produced by CPL (Cambridge Publishers Ltd) Tel: +44 (0)1223 378000. [www.cpl.co.uk](http://www.cpl.co.uk) 1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PB.

**Editorial copy deadline:** First day of the month preceding the publication month

The opinions expressed in editorial material do not necessarily represent the views of the Chartered Institution of Building Services Engineers (CIBSE). Unless specifically stated, goods or services mentioned in editorial or advertisements are not formally endorsed by CIBSE, which does not guarantee or endorse or accept any liability for any goods and/or services featured in this publication.

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**Anastasia Mylona**  
Highlights from the academic research papers on overheating in the latest *BSER&T* journal



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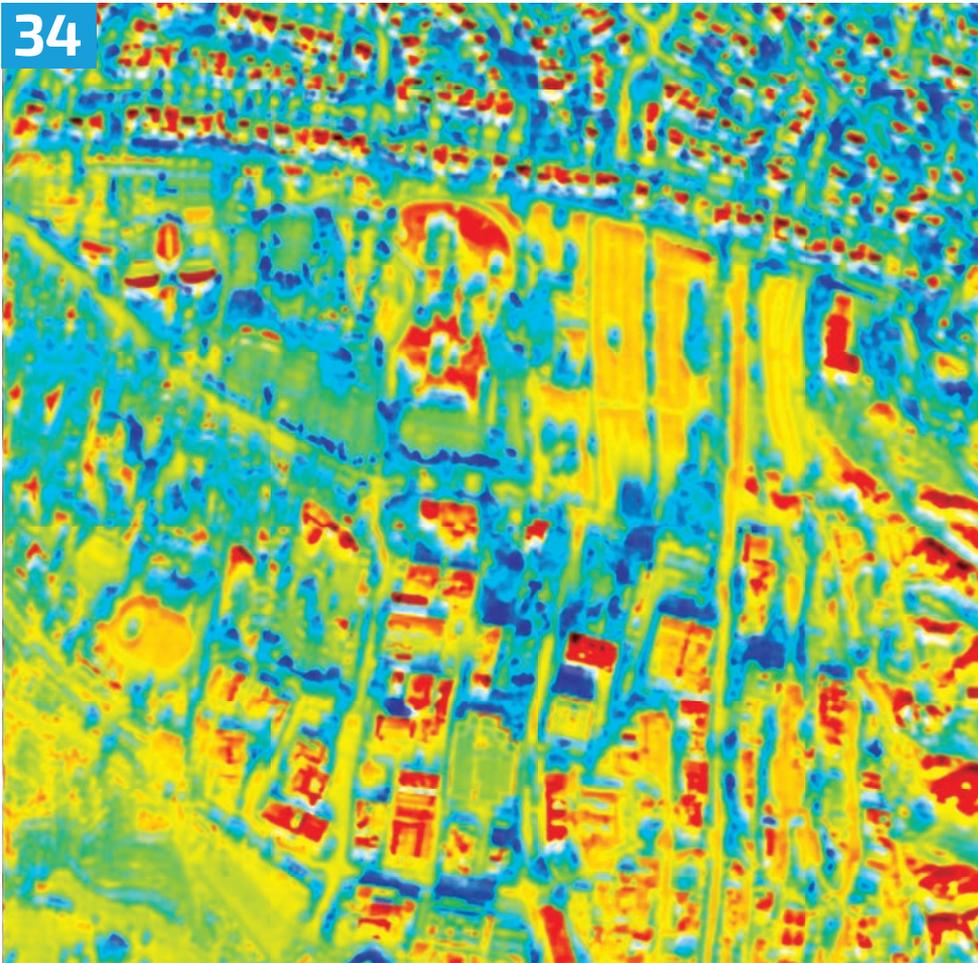
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©CIBSE Services Ltd. ISSN 1759-846X

## SUBSCRIPTION ENQUIRIES

If you are not a CIBSE member but would like to receive *CIBSE Journal*, subscribe now! Costs are £80 (UK) and £100 (international). For subscription enquiries, and any change of address information, please contact Nicola Hurley at [nhurley@cibse.org](mailto:nhurley@cibse.org) or telephone +44 (0) 20 8772 3697. Individual copies are also available at a cost of £7 per copy, plus postage.

*CIBSE Journal*, ISSN 1759-846X (USPS 4070) is published monthly by CPL, 1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PB, UK.

The US annual subscription price is £100. Airfreight and mailing in the USA by agent named WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Periodicals postage paid at Jamaica NY 11431.

US Postmaster: Send address changes to *CIBSE Journal*, WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Subscription records are maintained at CIBSE, 222 Balham High Road, London, SW12 9B, UK.

## CREDITS

P07 Getty images / SOPA Images PA Images / Dominic Lipinski P08 iStock.com / Danchooalex P09 PA Images / Stefan Rousseau P10 Credit / Grimshaw Architects iStock.com / Dreamnikon P16 iStock.com / Milanvirijevic P18 iStock.com / Dimitris66 P19 PA/PA Archive / PA Images iStock.com / Georgeclerk P22-24 iStock.com / Imamember / Ida Jarosova / Uplifted / Artursfoto / Memorystockphoto P37-38 iStock.com / A stockphoto P47 iStock.com / Enot-poloskun



ABC audited circulation:  
17,765 January to December 2018  
Printed by: Warners Midlands PLC



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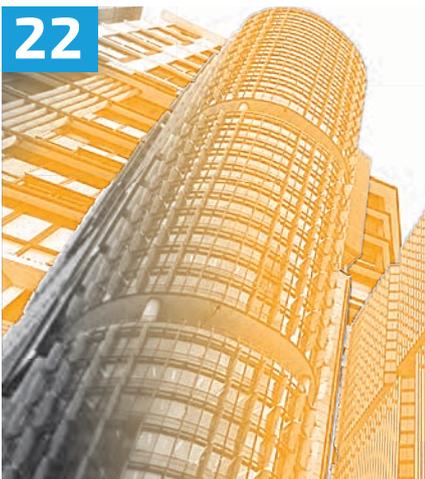
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# Industry set for change after radical proposals

## High-rise safety reforms include the creation of regulatory body

New positions of accountability across the life-cycle of high-rise residential tower blocks have been proposed in a consultation launched by the Ministry of Housing, Communities and Local Government (MHCLG).

*Building a Safer Future* calls for the formation of a new regulatory framework to implement the recommendations of the Hackitt Review.

A dutyholder regime will cover the whole life of a building, from design through to construction and occupation. The statutory responsibilities will include creating and maintaining digital records and producing a safety case for approval by the new building safety regulator before a safety certificate is issued.

'This is radical,' said Hywel Davies, technical manager at CIBSE. 'The proposal requires the principal contractor to produce a final declaration with the principal designer, confirming that the building complies with Building Regulations.'

There is also a proposal for a new national regulator for building safety (see

panel, right), 'whistleblower protection' for workers making disclosures in the public interest, and the involvement of residents in decisions around fire safety.

The document proposes that, for residential buildings that are 18m tall or higher, there should be three 'Gateways', at which point safety information will have to be disclosed to the building safety regulator.

The government's consultation on the proposed building safety reforms closes on 31 July. Read more on the proposals on pages 16-20.



## Barking fire widens cladding fears

The block of flats in East London engulfed by flames last month was not covered by the government's combustible cladding ban because it is less than 18m high.

More than 200 blocks with the same type of timber cladding, containing more than 12,000 flats, received planning approval in the past six years, according to construction data analyst Glenigan. All are now subject to safety reviews, and the incident has opened up the possibility that thousands more tower blocks will have to be re-clad.

The Barking fire, which is thought to have been caused by a barbecue, engulfed the whole building in less than six minutes. It is estimated that timber accounts for more than 15% of all cladding sold in the UK - much of it for balconies.

Similarities were drawn between this fire and the Grenfell Tower fire two years ago. However, aluminium composite material (ACM) cladding was used to refurbish Grenfell. This was found on another 328 high-rise blocks in England - 221 of which are still awaiting re-cladding.

The fact that the Barking fire was spread by timber cladding has prompted many experts to call for a much wider review of combustible building cladding.

The government has so far committed to pay £200m to remove ACM from privately owned blocks, but there are now calls for the funding to be extended to other forms of cladding and fire-safety measures.

To mark the second anniversary of the Grenfell fire, survivors organisation Grenfell United arranged for messages to be projected onto high-rise buildings that are still awaiting remedial safety work.



## New UK regulator to oversee building safety

The government plans to create a new national regulator for building safety, in response to the Grenfell Tower disaster. It also aims to make it a criminal offence to fail to comply with its proposed new safety regime for high-rise residential blocks.

'We have outlined plans for a new regulator to provide oversight of the new building safety regulatory regime,' said Secretary of State for Housing, Communities and Local Government James Brokenshire. '[They] will also oversee the wider building and regulatory system, and watch over efforts to assure the competence of those working on buildings.'

The minister said the government would strengthen 'oversight and regulation of construction products', adding that the proposed system would be underpinned by 'strengthened enforcement and sanctions to deter non-compliance with the new regime... to help drive real culture change in the industry'.

## Government considers mandating BIM

Building information modelling (BIM) could become compulsory on high-rise residential projects of more than 18m high (six storeys and above) under the government's building safety reform proposals.

'Mandating BIM would make best use of ongoing work to promote digitalisation in the construction industry,' the consultation document said. It explained that the use of BIM would make it easier to record key changes to a building's design and the products and materials used in its construction. This would create the 'golden thread' of life-cycle information called for by Dame Judith Hackitt's Independent review of Building Regulations and Fire Safety.

## 'Early adopters' sign up to safety charter

Developers, contractors and housing associations have signed a charter aimed at improving building safety. The eight-strong group of 'early adopters' joined forces after the Hackitt Review and have promised to 'put safety before profit' during design, construction, refurbishment and occupation of residential buildings.

Other firms will have the opportunity to sign up to the charter via the *Building a Safer Future* website when it is fully launched later this year.

Barratt Developments, Kier, United Living, Wates and Willmott Dixon, plus housing associations L&Q, Peabody and Salix Homes, said they had been trialling new ways of working ahead of any changes to legislation.

## IN BRIEF

### Harmony for lift standards

The first international standard for lifts has been published, bringing together multiple existing standards to try to harmonise international working practices.

Part One of ISO 8100 covers the safe transportation of people and goods, while Part Two sets rules for design and component testing.

Dr Gero Gschwendtner, chair of the ISO technical committee that developed the standard, believes it should remove barriers to international trade for manufacturers and coordinate safety levels.

'This will not only reduce administration for many businesses, but will also provide a platform for safety, innovation and new technologies to grow,' he said.

### Shaylor employees laid off by email

Staff at large Midlands contractor Shaylor were told about the company's collapse into administration by email.

Attempts to refinance the business failed last month with many subcontractors left unpaid. The email told employees that the group had 'recently suffered from a number of project delays, payment disputes with clients and failure of several key subcontractors'.

Despite returning a profit of £7.6m on turnover of £142m last year, subcontractors had been complaining about late payments since early this year. The staff were told not to turn up for work.

### Call for papers

The 10th CIBSE/ASHRAE Technical Symposium will be held in Glasgow, Scotland, in April 2020 – and its theme is mitigating and adapting for a changing climate.

A call has gone out for papers, posters, technical reviews, case studies and opinion presentations based on recent or current research or application, as well as those that examine actual or potential impact on the built environment.

The symposium encourages industry practitioners, researchers and building users to share knowledge and develop networks.

Submit your 250-word abstract online by 16 September 2019 at [www.cibse.org/symposium](http://www.cibse.org/symposium)

# Skills shortages could push up tender prices from 2022

## Labour-market pressures could also boost offsite fabrication, says forecaster

Tender prices could rise by as much as 4% from 2022, because of skills shortages linked to Brexit, according to forecaster Arcadis.

It said the cost could increase after a period of 'treading water' caused by political stagnation during negotiations with the EU. As a result, short-term rises will be restricted to between 2-3% until 2021, as clients adopt a 'wait and see'



approach, but could then take off as the market speeds up.

Average pay for construction employees rose by 4.2% in the past 12 months, up from 2.1% in 2017. As projects come back on stream from 2021 – and pressure grows on labour markets – Arcadis expects these cost pressures to increase. This could drive an uptake in offsite fabrication, as employers look to improve productivity and reduce dependence on site-based labour. Currently, it accounts for only 8% of industry output, but with the introduction of a government mandate, this could increase significantly, the forecasters said.

'UK construction has a long-established skills and training problem,' said Simon Rawlinson, head of Arcadis strategic research and insight. 'With skilled EU labour making up 8-10% of the workforce, specialist contractors and employers have been shielded from developing and maintaining the skills of their workforce.'

'With the prospect of post-Brexit restrictions on migration, however, we're facing a crisis in terms of labour capacity. The supply chain will need other options for increasing productivity.'

## Confidence returns to M&E firms

Building services contractors have reported a cautious return to business confidence, despite rising costs and persistent payment issues, according to the latest survey by trade bodies.

The Building Engineering Business Survey, by Besa, the ECA, Select and Snipef, found that the turnovers of 75% of businesses had increased or remained steady during the first quarter of this year, compared with the last three months of 2018.

Outlook for the period to the end of June was largely positive, with almost 29% of businesses estimating that their turnover would rise. Costs are also on the up, however, with 58% of businesses reporting higher labour costs and 73% saying materials costs are higher compared with last year.

Payment terms and retentions remain problematic, with 81% of survey respondents saying they wait 31 days or more to be paid for work completed on commercial projects; 63% said that was the typical waiting period on public sector projects.

During the first quarter of this year, 58% of businesses had between 1-10% of their turnover tied up in retentions.

## ... but Kier cuts workforce by 1,200

Major construction and project management firm Kier is to cut its workforce by 1,200 over the next 12 months. It is also selling its housing division, and plans to leave the facilities management and environmental services markets.

High levels of debt have hit Kier's performance, and chief executive Andrew Davies said the changes would reduce costs by £55m from 2021. The company will re-focus on regional building projects, infrastructure, utilities and highways.

A strategic review concluded that the group's portfolio was 'too diverse and contains a number of businesses that are incompatible with the group's new strategy and working capital objectives', said Davies.

Kier's share price plunged by 12% after the announcement.



Theresa May visited Imperial College London where she saw machinery that converts CO<sub>2</sub> into oxygen

## Government commits to zero carbon targets

### Theresa May says UK must lead world to 'greener form of growth'

In one of her last acts as Prime Minister, Theresa May committed the government to achieving the net-zero carbon targets recommended by the Committee on Climate Change (CCC). She unveiled a statutory instrument to amend the Climate Change Act of 2008 to account for a net-zero target by 2050 saying: 'Now is the time to go further and faster to safeguard the environment for our children. This country led the world in innovation during the Industrial Revolution and we must lead the world to a cleaner, greener form of growth.'

The CCC said the construction industry had little more than a decade to ensure all new buildings are net-zero carbon if the longer-term goal is to be met. The sector would also have to move away from fossil-fuel-based heating and

improve the energy efficiency of existing buildings, while accelerating adoption of heat pumps to replace boilers and the take-up of district heating and hydrogen.

Julie Godefroy, CIBSE technical manager, said: 'The CCC have made clear the scale of the challenge; we need to deliver buildings that are zero-carbon, and tackle existing building stock. There are significant opportunities for health and wellbeing, from green infrastructure to air quality.'

BSRIA said the task was 'challenging given that the UK is significantly behind the targets set out in the fourth and fifth carbon budgets'.

Besa believes the target is 'eminently achievable' and should not require people to make sacrifices, or slow economic growth. Chief executive David Frise said: 'Investment in low to zero carbon technologies will be a significant contributor to our economic prosperity.'

## Public doesn't know about IAQ

Almost three-quarters of British adults say they know very little about indoor air quality (IAQ) and its potential impact on their health, according to new research. More than half (55%) said they were not concerned about it.

Veolia commissioned a study by YouGov, published on World Environment Day (5 June), and used the findings to urge the government to revise its IAQ guidance. It said indoor pollution could be eight times more dangerous than outdoor conditions and may be responsible for 20,000 premature deaths in Britain every year.

'The public are poorly informed about an issue that will affect every one of us,' said chief technology and innovation officer Richard Kirkman. 'Current government advice is fragmented, ineffective and has been poorly enforced. Solutions are available to prevent further indoor air-related health impacts, but only if the problem is taken seriously.'

### YouGov survey results:

- 72% said they did not know 'much' about IAQ or had not heard about it
- 31% of respondents had never heard about IAQ
- 55% of respondents said they were not concerned about IAQ and their health
- 73% agreed the government should develop IAQ guidelines for all public buildings.

## Nabers coming to the UK

A group of British property owners has joined forces with Australia's New South Wales Office of Environment and Heritage (OEH) to replicate its 'Design for Performance' (DfP) energy rating scheme in the UK market

The Better Buildings Partnership (BBP), which has 31 members covering a property portfolio of £250bn, is to adapt the Nabers Energy for Offices programme into a certification scheme suitable for new UK office developments.

The Nabers scheme, run by the OEH on behalf of the federal government in Australia, verifies the performance in use of office buildings, to ensure they deliver on their design promises.

More than 86% of Australia's office market has a Nabers rating, and it has had a 'transformative impact', according to the BBP, with average energy intensity improving by 36% since 2010.

The BBP and OEH will develop a rating system, technical guidance, training and market engagement for the UK. This will be accompanied by work to adapt the Nabers Commitment Agreement framework, which enables developers to set performance targets and embed these within the supply chain, from design to operation.

Eleven consultancies have committed to become DfP delivery partners. They are Aecom, Arup, Atkins, Built Physics, BuroHappold Engineering, Cundall, Hoare Lea, KJ Tait, Ramboll, TFT and Watkins Payne. Each partner commits to advocating DfP to their clients, supporting the development of the initiative and upskilling teams to be able to support developers.

## Gender equality is two centuries away

It will take until 2194 before women make up half of the construction workforce, according to the GMB. At its annual Congress in Brighton, the union said the female share of the industry workforce grew by just 2.1% between 2009 and 2018.

'Our analysis is a sobering reminder of the scale of the challenge facing the industry,' said national secretary Jude Brimble.

The union has arranged a summit meeting with large firms working on the Hinkley Point nuclear project to find ways to increase the number of women they employ.

Shadow Education Secretary Angela Rayner told the Congress that major state-backed projects such as Hinkley were opportunities for the government to 'step in and take action'.

'Ministers should tell us how they will ensure the opportunities they present are open to all,' she said. 'We need to ensure that apprenticeships, for example, are available to more women and people who are historically under-represented in certain jobs and industries.'



## IN BRIEF

### Modelling experts to speak at CIBSE event

Advanced building modelling techniques will be discussed in an event organised by the CIBSE HVAC Systems and Building Simulations Groups. It will focus on the potential for advanced models to improve buildings.

Speakers Ant Wilson, Robert Cohen and Darren Coppins will talk about why modelling is used, how to choose appropriate models, and the competency of modelling in the UK. Cohen will also discuss what can be learned from Australian practitioners.

The event starts at 6pm on 18 July at Hoare Lea's London office.

### Fire safety switched on at Royal Papworth



Consultant Troup Bywaters + Anders has worked with contractor Skanska and fire safety company Static Systems Group to provide fire engineering at the new Royal Papworth Hospital in Cambridge.

The fire alarm and management system consists of 15 networked panels and more than 4,000 addressable devices, including 1,900 detectors. It interfaces with other equipment in the hospital, including the security, nurse-call and sprinkler systems.

### BSI releases revised fire standard

Business improvement company BSI has published the revised BS 5839-6:2019 *Fire detection and fire alarm systems for buildings*.

Among the main revisions are: the regrading and revision of statistics and recommendations; a new table on testing and servicing by grade of alarm system; increased protection in sheltered and supported housing; and a new recommendation about communal fire alarms in blocks of flats.

This standard is aimed at architects, engineers and other building professionals, enforcing authorities, installers and those responsible for implementing fire precautions in domestic premises.

## NORTH-EAST OF EDEN

The team behind the Eden Project in Cornwall is hoping to replicate the attraction's success – in Morecambe Bay.

Eden Project International has submitted a first planning report to Lancaster City Council for its proposed £85m Eden Project North, which will 'offer a vision of a seaside resort for the 21st century'. It hopes to attract 760,000 visitors per year, and be carbon neutral and free of fossil-fuelled cars except for accessibility reasons.



# Growing momentum behind hydrogen for energy storage

## IEA claims hydrogen could be set to fulfil its potential as a clean energy solution

A dramatic acceleration in the use of hydrogen for heating and renewable-energy storage, as well as for transport and some industrial processes, may be essential to meet global climate targets, according to a report from the International Energy Agency (IEA).

*The Future of Hydrogen* report said clean hydrogen – which is produced by electrolyzers powered by renewable energy (or by fossil fuels with carbon capture) – could act as large-scale energy storage, so improving the viability of weather-dependent renewables.

'Hydrogen is one of the leading options for storing energy from renewables and looks promising to be a lowest-cost option for storing electricity over days, weeks or even months,' the report said. 'Because hydrogen

can be stored or used in a variety of sectors, converting electricity to hydrogen can help with the matching of variable energy supply and demand.' The IEA report said there was 'unprecedented momentum' behind hydrogen and it could finally be 'set on a path to fulfil its long-standing potential as a clean energy solution'.

'To seize this opportunity, governments and companies need to be taking ambitious and real-world actions now,' it added, explaining that the next 12 months could be crucial if long-term low carbon goals were to be reached.

The cost of the electrolyzers that are used to split water molecules into hydrogen and oxygen – and fuel cells for converting hydrogen into electricity – are still relatively high. Government support could drive higher volumes of production, however, which would – in turn – reduce costs, according to the IEA.

# Coal-free to be 'new normal'



The UK went for more than two weeks in May without burning any coal to generate power – the longest coal-free period since the Industrial Revolution. National Grid Electricity System Operator (ESO) said coal-free generation would become 'the new normal' over the next five years.

The Grid went through three periods of more than 100 hours without coal burning during May, meaning there were more hours of zero-coal generation that month than in January, February and March combined.

National Grid ESO's director Fintan Slye said zero carbon electricity generation would be common by 2025, creating a 'major stepping stone to full decarbonisation of the entire electricity system'.

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## IN BRIEF

### Are you saying #IamCIBSE?

The #IamCIBSE campaign has prompted many members to share selfies, words and photos, letting the world know the best things about their jobs, being part of CIBSE, and working in the building services sector. Visit [cibse.org/IamCIBSE](http://cibse.org/IamCIBSE) to get involved and start celebrating the industry.

### Reward for backing engineers' careers

The entry deadline for CIBSE Employer of the Year is fast approaching. Part of the CIBSE Young Engineers Awards – which include the Graduate of the Year accolade – the competition celebrates employers that show dedication and commitment to recruiting, nurturing and empowering young engineers, as well as supporting them through their careers.

Entries must be received by 1 August. Visit [www.cibse.org/yea](http://www.cibse.org/yea). Winners will be announced at the awards event on 10 October.

### Patrons support new career guides

CIBSE has updated its range of building services career guides, sponsored by CIBSE Patrons and targeting students and their parents. The guides aim to promote careers within the industry, and look at what it is like to work in building services. They also provide guidance on how to develop a career as a building services engineer.

There are fact sheets for three age groups – 11-14, GCSE (or equivalent) and those considering university – and two parents' guides. Download them at [www.cibse.org/careers](http://www.cibse.org/careers) or request them from [membership@cibse.org](mailto:membership@cibse.org)



# New SLL president urges an emphasis on quality

## Shove also calls for renewed focus on technical education and apprenticeships

In his inaugural address as president of the Society of Light and Lighting (SLL), Jim Shove set out plans to emphasise the importance of quality and best practice in the face of 'value engineering'.

Shove was appointed president at the SLL AGM in May, taking over the role from Iain Carlile. He thanked Carlile and his predecessor, Richard Caple, adding that he was keen to build upon the work they have done in relation to science, technology,

engineering and maths (STEM), and close the gaps where talent might not be recognised or nurtured.

Shove said he had enjoyed watching the developments in lighting technology, manufacturing and design, but is concerned about instances where design integrity is challenged on the basis of value engineering. He outlined his intentions to work alongside other professional bodies and government to promote a better understanding of the ramifications of putting cost above quality within the built environment.

The new president also wants the Society to be a leading source of information on circadian lighting, an area of increasing interest. Referencing its position paper on the subject, he highlighted ongoing research in this area and emphasised the importance of clarity – particularly in relation to health.

In addition, Shove called for renewed focus on access to technical education, enabling students that may not be academically strong to gain confidence and skills through a learning style more suited to their needs. He will be looking to the SLL to work with other institutions to promote the benefits of apprenticeships.

He concluded his address by recognising the ongoing work of the Society's committee chairs, members, regional representatives and staff.

For more information, visit [www.sll.org.uk](http://www.sll.org.uk) or contact [sll@cibse.org](mailto:sll@cibse.org)



New SLL president Jim Shove

## SoPHE Northern Dinner a success

The 9th Northern Dinner of the Society of Public Health Engineers (SoPHE) took place at the Midland Hotel, Manchester, on 10 May.

SoPHE chair Jonathan Gaunt started proceedings by updating guests on the progress the Society has made during the year, including around the number of individual and industrial associate members. He thanked all the regional secretaries for their hard work and dedication.

The event was attended by new CIBSE President Lynne Jack, who co-founded the Scottish region of SoPHE, and the guest speaker was Graham Poll, former Premier League football referee. He entertained the attendees with stories from his sporting past, including the infamous incident when he booked the same player three times in the same match in the World Cup in Germany.

Alan Flight, SoPHE industrial associate chair, concluded the evening by thanking everyone present and especially the table sponsors for their continuing support.

SoPHE Northern would like to thank everyone involved for their support with this dinner. The next one – the Society's 10th – will be held on 8 May 2020.





# Enter now for Building Performance Awards

## Streamlined entry forms make submitting nominations easier

The CIBSE Building Performance Awards 2020 are now open for entries. They showcase the highest achievements in building performance across the industry, and are the only awards in the built environment sector judged on actual, in-use performance.

The 2020 Awards will focus on all aspects of a project, product or innovation, looking for the delivery of safe, healthy, functional and sustainable buildings that operate efficiently and meet users needs.

Entry to the awards is free, and there are streamlined entry forms for 2020, to make it easier to enter. For the first time, the Product and Innovation category will include an award to recognise products and innovations that make a significant contribution to wellbeing or thermal comfort.

The deadline for entries is Friday 13 September 2019, and the shortlist will be announced in November.

The winners will be revealed at the Grosvenor House Hotel, London, on 11 February 2020. For the full list of award categories and to enter visit [www.cibse.org/BPA](http://www.cibse.org/BPA)

## Graham Manly remembered

Industry figures gathered at St Giles' Church, Ashted, Surrey, on 22 May, to celebrate the life and work of Graham Manly OBE FCIBSE.

A widely respected and hugely popular figure, Graham served as President of CIBSE and the HVCA (now Besa), and as chair of BSRIA. He joined the industry in 1962, studying for a HND in environmental engineering at the National College of Heating, Ventilating, Refrigeration and Fan Engineering. He joined J Jeffreys, later part of Balfour Beatty, and became senior design engineer.

Graham left to join mechanical services contractor A G Manly & Co, his father's firm, as contracts director, becoming managing director in 1982. A G Manly was acquired by Gratte Brothers in 2000 and Graham became business development director, with special responsibility for technical innovation.

Having joined CIBSE in 1965, he served as President in 2004 – presiding over governance reforms to create the current Board of Trustees – and later served as treasurer. He oversaw works to the Balham offices, and in 'retirement' served as a STEM ambassador and trustee of CIBSE Benevolent Fund.

Former HVCA chief executive Robert Higgs OBE said: 'It was not only that Graham's contribution to the industry was so immense, it is as much his style, personality and generosity of spirit that will be remembered. He never said 'no' when asked for help.'

Graham's service to CIBSE and the wider industry was recognised in 2013 with a CIBSE Gold Medal. He was made an OBE in 2012 for services to building engineering and, in 2018, received an honorary doctorate from London South Bank University, where he was a visiting professor.

The thanksgiving was a celebration of Graham's life and of his quiet Christian faith. The gathering afterwards in the Dell Centre, the two-storey 'church hall' that he helped to create, epitomised his life in the industry. It brought together colleagues and friends from all parts of the sector, just as Graham did in so many ways in more than 50 years.



Graham Manly

## Build2Perform Live 2019 programme announced

Build2Perform Live 2019 will take place at Olympia, Kensington, on 26-27 November. It is free to attend and will bring together people to learn about, discuss and collaborate on the issues that are vital for delivering better building performance.

The programme has a mix of detailed technical presentations, case studies, workshops and panel debates. Highlights include: decarbonising heating and cooling for a low carbon future; technologies of the 'fourth industrial revolution'; competence in a post-Hackitt world; new climate projections; responsible retrofits; and what health and wellbeing mean in practice.

The programme will also feature the latest policy updates, including Building Regulations and compliance responsibilities.

Speakers confirmed include Kathryn Brown, head of adaptation for the Committee on Climate Change, and Cundall sustainability partner Simon Wyatt

To find out more, and to register for your free place, go to [www.cibse.org/b2plive](http://www.cibse.org/b2plive)



Kathryn Brown



Simon Wyatt

## CIBSE lines up expert speakers for regions

A pilot scheme that matches high-quality, technical speakers – in a variety of fields – to CIBSE regions has been launched.

The initiative has been set up to encourage the development of a diverse set of recognised speakers who can, collectively, address the breadth of CIBSE interests in a knowledgeable and engaging manner.

CIBSE regions that are organising an event, and that wish to invite a technical speaker on a given topic, can check the list of speakers in their area and book them. Regional chairs have been given contact details for the speakers.

It is hoped that the initiative will help raise the profile of CIBSE regions locally and increase attendance at meetings.

For the pilot, speakers have been found from a number of UK regions. Although not all areas are covered, it is hoped – if feedback from the pilot is positive – that the scheme may be expanded.

For a full list of speakers, please visit [www.cibse.org/networks/regions/cibse-speakers](http://www.cibse.org/networks/regions/cibse-speakers)

For further information, contact Sara Kassam, head of sustainability, [skassam@cibse.org](mailto:skassam@cibse.org)

# MINUTES FOR CIBSE ANNUAL GENERAL MEETING

The Annual General Meeting of the CIBSE was held at the Royal Society, Carlton House Terrace, London, on 7 May 2019. Stephen Lisk, outgoing President, chaired the meeting. Chief Executive Stephen Matthews read the notice convening the meeting.

The minutes of the 41st Annual General Meeting of CIBSE, held on 8 May 2018 and published in the August 2018 issue of *CIBSE Journal*, were accepted as a correct record and signed by the Chair.

## ANNUAL REPORT AND FINANCIAL STATEMENTS

Stephen Lisk introduced the Annual Report for 2018, referring to the pace of change arising from a range of issues, including Brexit and the review of Building Regulations, and stressing the importance of inclusivity, diversity and engagement with the membership. He thanked the staff team for the development of the Annual Report, which sought to communicate the breadth of CIBSE's ambition and reflect its continuing work to make lives better.

He drew attention to key metrics set out in the report, and referred to the many face-to-face conversations he had held with members and stakeholders during his presidency; these had been empowering, challenging and enjoyable, and reflected a wide diversity of opinion.

He asked members to contribute to debate, drawing attention to the '#IamCIBSE' cards available at reception, and the opportunity to email the President at [President@cibse.org](mailto:President@cibse.org). He noted the importance of CIBSE as a community and expressed thanks to the Trustees, staff and all the Institution's volunteers, and for the opportunity to lead the Institution.

Richard Willis, audit partner of BDO LLP, then read the audit report, which confirmed that the Annual Report and Financial Statements gave a true and fair view of the state of the group and the parent charity's affairs, and of the income and expenditure for the year, and had been prepared in accordance with all relevant requirements. He further confirmed that there were no matters to which he would be required to draw attention by exception and no undisclosed material issues or inconsistencies between the Annual Report and the Financial Statements.

Honorary Treasurer Adrian Catchpole then reported in more detail on the Financial Statements, confirming that Investments were presented at market value at end year, that the transactions of Regions and trading subsidiaries were included in the Group accounts. He drew attention to the transfer of Publications activities from CIBSE itself to the subsidiary CIBSE Services Ltd, as this better reflected the management of this area of work and changing practices for the production and issue of knowledge. He also drew attention to the reserves and other policies set out in the accounts.

Adrian then presented slides setting out the income and expenditure for the year. Total income for the year was just over £7m, and attention was drawn to the breakdown of main income areas, such as fees for charitable services, membership income, subsidiaries and investments.

He went on to outline the breakdown of CIBSE Services Ltd's turnover, noting that income had increased from Training, Online Learning and the *Journal*, in addition to the uplift from the inclusion of Publications; Certification income had, however, dropped, reflecting a fall in purchases of credits by assessors.

Regarding expenditure, costs of subsidiaries had increased because of the transfer of publications activities. Membership costs were down, partly because of staff vacancies during the year. Technical and Research costs were up, while there were savings in other areas (in part because of changes in cost allocation, which remained under review).

There was an overall operational surplus of £103K for the year. This was very welcome, and Adrian thanked the staff team for their efforts to turn around an operational deficit of nearly £400K in the previous year. Despite this, the net movement in funds showed a deficit of £104K, because of sharp falls in investment markets towards the year end. This had affected the Institution's own investments and the Pension Scheme valuation, but markets had recovered considerably during the first quarter of 2019, with most of the drop in value recovered.

Attention was drawn to the summarised balance sheet, which reflected

the fall in investment values in the final quarter. Debtors were up, but this was a very variable figure and was not regarded as a concern. Cash at bank had increased, and the Pension Scheme asset showed a surplus of £45K, though this valuation was a 'snapshot' at a moment in time, and could vary considerably.

Adrian concluded that some increase in income had been achieved, while close control of costs had been undertaken to achieve the operational surplus. There were positive developments within CIBSE Services Ltd and, since the year end, progress had been made with Certification income. While the IT Strategy and new CRM

system had been expensive and challenging, it was felt that benefits were now being realised from these.

Questions were invited and Mike Smith, while welcoming the return to profit of CIBSE Services Ltd, asked why no Gift Aid transfer to the Institution was shown in the accounts. It was explained that this reflected a change in accounting standards; Gift Aid had previously been reflected in the year the profit arose, but was now accounted for when the payment was made, which was always in the following year. CIBSE Services' profit for 2018 would be paid to CIBSE under Gift Aid as previously, but this would now be reflected in the 2019 accounts.

Chris Jones referred to the transfer of publications activity to CIBSE

## “President Stephen Lisk expressed thanks for the opportunity to lead the Institution”

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Services Ltd, pointing out that CIBSE's intellectual property in publications and knowledge reflected the donation of much time by CIBSE members in the past to create that knowledge. He requested that any proposed future change to the shareholding of CIBSE Services Ltd by the charity be referred to a General Meeting. This request was noted.

Luke Yeates-Mayo asked how the improvement in the operational position had been achieved (from a deficit of £398K in 2017 to a surplus of £103K in 2018). Adrian said that many factors were involved, including an increase in income, and a close emphasis on cost savings wherever they could be achieved. This had included some staff positions being left unfilled for a period, projects being deferred, venue costs being scrutinised and a wide range of other measures.

#### AUDITORS

Adrian proposed that BDO LLP be appointed as the Institution's auditors for 2019, and that the Board be empowered to agree their remuneration. This was seconded by Ashley Bateson and approved nem con.

#### SPECIAL RESOLUTION

Adrian proposed adoption of the Special Resolution for Membership Subscriptions for 2020 as set out in the Calling Notice. The proposal was based on a 4% increase to the Member rate, which was believed to be comparable to, or less than, increases applied by many other institutions. The proposal was seconded by Les Copeland and approved nem con.

#### BOARD AND COUNCIL FOR 2019/2020

Stephen Matthews reported that Officer and Board Member appointments and elections had been carried out in accordance with the revised arrangements agreed at the EGM in May 2018 and subsequently approved by Privy Council. For those positions subject to election, there had been no more candidates than vacancies and the candidates had, therefore, been declared elected unopposed. He declared the following individuals appointed and elected to serve as Officers, Board Members and Council Members following the AGM 2019:

#### Officers:

**President:** Lynne Jack

**President-Elect:** Stuart MacPherson

**Immediate Past President:** Stephen Lisk

**Vice-Presidents:** Ashley Bateson

Kevin Kelly

Kevin Mitchell

**Hon Treasurer:** Adrian Catchpole

#### Members of the Board:

**Elected Members:** Les Copeland, Fiona Cousins,  
David Fitzpatrick

**Continuing Members:** L Susan Hone-Brookes, PL Yuen

#### Members of Council:

**Elected Members:** Sebastian Gray, Andrew Piper,  
Linda Vidler

#### ANY OTHER BUSINESS

There was no other business.

# Building a safer future

Almost two years after the conflagration at Grenfell Tower that claimed 72 lives, the government has published a far-reaching consultation on how we build and operate multi-occupancy residential buildings. Hywel Davies outlines some of the more challenging proposals

**B**uilding a Safer Future, a consultation on proposals to reform the building safety regulatory system, was published on 6 June. It is the next stage in implementing the independent review of building regulations and fire safety led by Dame Judith Hackitt.

There is concern about the slow progress in addressing Dame Judith's review, but the consultation suggests significant thought and work behind the scenes. It covers almost 100 pages, with 90 pages of supporting annexes.

The proposals deliberately go beyond the narrow focus on high-rise residential buildings. While Dame Judith's terms of reference limited her scope, she repeatedly called for her recommendations to be applied more widely than residential buildings more than 30m in height. Government has lowered the threshold to 18m and is consulting on exactly which buildings should be covered. Tucked away are three proposals that could radically change the way we work.

## A new building safety regulator

Fundamental to the reforms is the creation of a new building safety regulator – which goes beyond Dame Judith's recommendations. The regulator will oversee the design, construction and management of buildings effectively and robustly, enforcing the new, stricter regime for buildings that fall within its remit, with possible criminal sanctions. It will also be responsible for: the regulations; overseeing the competence, throughout their working lives, of those working on buildings; and operating registers of competent people and licensed buildings.

## Sign-off at handover

Dame Judith proposed a series of gateways for projects within her scope. The proposals for Gateway two include a requirement for the new regulator to approve the full plans – including a digital model and full fire-safety strategy – before work can begin. Gateway three sets preconditions for handover.

For multi-occupied residential buildings of 18m or more, the contractor will be required to hand over safety information about the final, as-built building before



**“The designer can't risk their PI insurance on a declaration they cannot make with confidence”**

occupation is permitted. This information includes the original full plans and agreed deviations; the Construction Control Plan; a digital record of the building as built; and an updated Fire and Emergency File from Gateway two.

It is intended that this package, which forms a key part of the 'golden thread' of information about the building and its management, will be handed to the client. It will also form the basis for the safety case for ongoing occupation of the building.

As well as providing this package, the contractor and the designer will be responsible for verifying compliance with the regulations. It is proposed to require 'the principal contractor to produce a final declaration with the principal designer, confirming that the building complies with Building Regulations and that this documentation has been handed back to the client'.

This is radical. No more will contractors be able to say 'building control signed it off', as the answer will be 'you signed a declaration that it complied, and you delivered a digital model'. If the designer has to make the declaration, they cannot disappear from the scene at Gateway two: they have to be involved in the



# Bring in the ghostbusters

The government has committed to a legally binding target of net-zero carbon emissions by 2050. What an opportunity for the building services industry, says CIBSE Patrons chair **David Fitzpatrick**

building process on site. They can't, realistically, risk their PI insurance – and, indeed, the registration of their competent professionals – on a declaration they cannot make with confidence.

It also raises some interesting questions about commissioning. Commissioning is not a bit of good-practice guidance in the Approved Documents – it's a statutory requirement in Regulation 44 of the Building Regulations. The designer and contractor will now have to declare that the regulations, including the one on commissioning, have been satisfied.

Of course, the unscrupulous could just declare they have and be done, but another radical provision is for the new building safety regulator to become a prescribed person under the Public Interest Disclosure Act 1998 (PIDA). This legislation protects workers from victimisation by their employer when making disclosures in the public interest, and is more commonly known as 'whistleblowing protection'.

This suggests a clear understanding that people may have to speak up and risk trouble by telling the regulator what is really happening on a project.

## Competence

Underpinning much of the new regime is a requirement for competent people. The proposals anticipate a register of those deemed competent to work on buildings in scope.

The Industry Response Group's competence steering committee will report shortly on the work it has completed since May 2018. The clear ambition is to ensure that those who work on multi-occupancy residential buildings are competent, with a clear threat that those who do not follow the new rules may lose their registration.

This all signals a significant change of approach to building safety from the very much more *laissez-faire*, market-led approach of the past 35 years. This consultation is not the work of a few moments, but signals a determination to drive real and lasting change in our sector. Between now and 31 July we have a chance to give our views.

■ Readers are encouraged to share their thoughts on the consultation via the CIBSE website at [bit.ly/CJJul19Fire](http://bit.ly/CJJul19Fire) – it is a once-in-a-lifetime chance for you to have your say.

When the United Nations said we had just 11 years left in which to take action to avert a climate-change catastrophe, there was a flurry of political promises to transform the UK into a zero-carbon economy by 2050. However, many Patrons members are asking what that is likely to mean in practice.

At the recent CIBSE Technical Symposium, delegates were given a fascinating taste of the innovations our industry is developing to tackle the myriad threats from climate change. At Build2Perform in November, we will also see how many of our ideas and concepts are being put into action.

The important role of building services engineers was acknowledged by Baroness Brown of Cambridge, vice-chair of the Committee on Climate Change (CCC), during April's CIBSE Patrons annual lunch at the House of Lords. In an inspiring speech, she told us that buildings could get to 'real' zero – not just 'net' zero – over the next 30 years. In a sneak preview of the committee's report, which came out a few days later, she said the government should legislate for a 100% reduction in greenhouse gas emissions – and urged our industry to redouble its efforts.

## Transition

Major improvements to the insulation, ventilation and energy efficiency of existing buildings, plus a wholesale shift away from fossil fuel-based heating, were among her key recommendations. The CCC estimates the transition to green heating systems will cost about £15bn a year up to 2050 and involve widespread adoption of heat pumps, plus greater use of district heating and hydrogen. 'There is a lot of change, but none of it is rocket science,' Brown said. 'Your industry is doing these things already and what I want to hear in the future is that you are busy and expanding, because that will mean the right things are being done.'

Guest speaker and Sky News presenter Adam Parsons also acknowledged our role in delivering climate-change objectives and paid tribute to the industry's role in 'building, fixing and maintaining the nation'. He described building services engineers as 'the ghostbusters of public life because we turn to you when things need to be sorted out'.

This should inspire us, but also remind us that we have a huge responsibility. The country needs a climate-change response and our industry will be in the vanguard. That will create wonderful business opportunities and career-changing legacy projects, but the work will be challenging. Fortunately, we have the ideas and the technology – and now, it seems, we have the political will to back us up.

● To join CIBSE Patrons and/or to suggest topics for future columns, please email [cbrown@cibse.org](mailto:cbrown@cibse.org)



# THREADS OF RESPONSIBILITY

Government proposals to improve building safety call for a golden thread of information to be passed between accountable people at every stage. **Alex Smith** looks at how industry is responding to the challenge of recording and retaining robust and reliable information

**T**he government's plans for reforming the building safety regulatory system are extensive and ambitious. Published last month in *Building a Safer Future*, the proposals build on the recommendations in Dame Judith Hackitt's independent review of regulations and fire safety. In some cases, they go further. For example, the government is proposing the scope of the regulations is residential buildings above 18-metres high, rather than 30 metres, as stated in the Hackitt report.

Under the proposals, the construction industry will have to consider fire safety at every stage of the building life-cycle – from planning and design to construction and occupation. Failure to do so may prevent projects from being signed off by a building regulator. 'There will be a huge amount of stress for the developer and occupier if the building can't be occupied until the regulator signs it off,' says Miller Hannah, partner and principal of fire engineering at Hoare Lea. 'It will be for their own good, but there might be delays.'

The consultation document proposes making people accountable for fire safety during the building life-cycle. Five 'dutyholder' roles are proposed in the design and construction phase – client, principal designer, principal contractor, designer, and contractor – with safety responsibilities set out in law. During the occupation phase, an accountable person must appoint a building safety manager to carry out functions in accordance with the requirements of the building safety certificate and the safety case, which is the evidence showing that life-critical risks are being proactively managed.

There are three key points at which the dutyholder must demonstrate they are managing building safety risks appropriately before they can continue to the next stage of development. The first of these 'gateways' occurs before planning permission is granted, the second before construction begins, and the third before occupation.

The proposals refer to a 'golden thread' that runs through the whole life of the building. This involves making sure the design works and that the products procured support the design ethos. These products

then need to be installed correctly and commissioned properly. The occupiers and building managers must also understand, and be able to maintain, the fire-safety features, and there must be an ongoing inspection regime.

Key to maintaining the golden thread is the quality of information that is passed to enable the person inheriting the risk to understand how the building operates, what layers of protection exist, and what needs to be done to manage risk in the future.

Building insurers rely on fire-safety information to assess building risk for professional indemnity cover. 'Record keeping hasn't been the forte of the construction sector. The golden thread – and the requirement for a fire-safety case – will force people to keep better information,' says Thomas Roche, senior consultant for international codes and standards at FM Global. Finding relevant fire-safety information in buildings often felt like a voyage of discovery, Roche adds. 'We have to figure out what information they have and, sometimes, information is missing or not in the right format. There is a lack of clarity.'

Gavin Dunn, chief executive of the Chartered Association of Building Engineers (Cabe) says the golden thread of information means something different to everyone involved in buildings. 'For contractors, it's about recording changes made on site. That's different from the information designers provide,' he says. The information exists, but – adds Dunn – 'we have to be much more methodical about how we present it'.

Roche agrees: 'The data's great, but unless you have a mechanism to interpret the

information, it's not helpful. The golden thread is about providing context. Clients need to know the reason for the fire-safety system – what it protects you against and what it means if you make a change.'

Hannah likens the information required to a car logbook. 'I don't need to know how the internal combustion engine works, I just need to know how to maintain the car.'

At the design and construction stage, the golden thread will consist of information and data collected as the building passes through the gateway points. At Gateway two, for example, the government proposes that dutyholders provide full plans produced by the principal designer, including a 3D digital model of the building and a fire and emergency file. The file should be updated and passed across to the



Dame Judith Hackitt

**“There needs to be clearer product descriptions, which are robust and honest on performance. We need less gobbledegook and more clarity”**

person accountable for safety in the occupation phase.

Information handed over should include the construction control plan produced by the principal contractor, which describes how building safety and Building Regulations compliance will be maintained during the construction phase, and how change will be controlled and recorded. In occupation, the information included within the golden thread will be different for new and existing buildings. For new buildings, it will initially be comprising information collected through the gateway points during the design and construction phase. For existing buildings, the content will be started during the building safety registration process.

Hackitt's independent review noted that, in the current system, there is a lack of clarity on responsibility and requirements across areas such as product performance, traceability and labelling. It also stated that there was a need to clarify roles and responsibilities in higher-risk residential buildings, and to strengthen national regulatory oversight and market surveillance of construction products.

*Building a Safer Future* seeks to make explicit roles and responsibilities in legislation, particularly in relation to the performance of products that can have a critical impact on safety. It proposes these products are put on an 'inventory list'.

Acting chief executive of the Construction Products Association (CPA) Peter Caplehorn chaired the Regulations working group for Hackitt's independent review, and sat on both the products and the golden thread working groups. 'There need to be clearer product descriptions, which are robust and honest on performance,' he says. 'We need less gobbledegook and more clarity.'

'For example, we don't want to read that a product has been "tested to" a particular standard, or is "in compliance with". It's not clear. Information should state that the product "has been tested to this standard and passed under the following criteria". Or it has been "assessed in accordance to this scheme and these are the results".'

Caplehorn is working on a marketing integrity group that intends to establish a code of practice, in the autumn for technical and marketing literature. 'It's a plain-English standard that will bring an element of



**“Engineering and architecture in the public domain are a mystery to most people and, after Grenfell, public confidence has taken a knock”**

» quality control. It’s a voluntary scheme, but the legitimate parts of the industry will sign up for it,’ says Caplehorn. ‘The code means that, if you are achieving performance in alignment with a certain standard, it has to be clear that it does do that, and has passed an appropriate test.’ (CIBSE is contributing to the code, and members are welcome to comment via email at [technical@cibse.org](mailto:technical@cibse.org)).

The standard is meant to address the issue of substituting products with ones with different performance characteristics, says Caplehorn. ‘The consultation is talking about people having real, tangible responsibility – so they will need to make sure the substitution is a sensible one and is not offering poorer performance. The new code will make sure performance and characteristics are clear and transparent.’

In the proposals, the government states that it is working with the British Standards Institution, the UK Accreditation Service, and wider industry to develop minimum requirements and establish clear standards for independent assurance schemes. It envisages an umbrella BSI standard specification that can apply across all construction product schemes.

Currently, there are no minimum requirements for independent assurance schemes and, as a result, there can be a lack of clarity on the risks these schemes are mitigating – whether that be integrity of the design or constancy of the manufacture.

**Digital records**

The product information will form part of the digital record that will be passed between dutyholders and, finally, to the building safety manager. Roche says this should be a living document: ‘One of the tools of the trade.’

The proposals say that using BIM would make it easier to record key changes to a building’s design and to the products and materials used. ‘While we do not plan to mandate that particular software is used to store information, we may choose to mandate that the golden thread of building

information complies with BIM standards,’ the proposals said. A pilot involving housing association L&Q is exploring the feasibility of creating BIM models of existing residential towers (See panel, ‘Creating an evidence base for existing buildings’).

While high-end buildings may have the resources to use BIM and create digital twins, Dunn says, most won’t. ‘It will have to be a simple information set that can be accessed by a mid-level technician on a laptop,’ he adds. Whatever form it takes, the information will be made available to the building end users. A key proposal of the report is to put residents at the centre of the regulatory process. This means having an open, transparent engagement strategy, where fire-safety information is given in a clear, accessible format by the building safety manager. This will be a mandatory condition of the building safety certificate.

*Building a Safer Future* proposes that part of the information in the golden thread be made available to residents, the building safety regulator and parliament. This ‘key dataset’ will be maintained through the life-cycle of the building, and could include a unique building identifier, as well as location, size, building type, current and past dutyholders, accountable persons and building safety managers, plus minimal information on safety features such as fire doors and systems.

‘This is an opportunity to engage with end users,’ says CIBSE past president and Spie director of energy and engineering George Adams. ‘The perception of engineering and architecture in the public domain is a mystery to most people and, after Grenfell, public confidence has taken a knock.’ Arup associate director Nick Troth agrees that ‘this objective is the right one’. ‘If residents are concerned about fire safety in buildings in which they live, there should be a route to raising concerns.’ **CJ**



Thomas Roche, of FM Global



Gavin Dunn, chief executive of Cabe

**CREATING AN EVIDENCE BASE FOR EXISTING BUILDINGS**

The level of information held in a digital format for existing buildings varies widely. To understand how enough data could be gathered to form a safety case for existing buildings, housing association L&Q has selected a team of specialists – architect, fire engineer, structural engineer, BIM consultant and digital survey company – to consider three existing higher risk residential buildings (HRRBs). These ranged from a 1960s tower block to a new build.

It is using a range of data collection systems to find the most effective way of closing the information gap. These include using laser point cloud scans and photogrammetry to construct a 3D Revit model for each building with the aim of creating a ‘digital twin’ of the existing building.

The project will test how practical it is to use the ‘digital twin’ as the evidence base for the safety case. It will also explore if there are other benefits the ‘digital twin’ can provide for asset and building management.

The pilot scheme is important as the proposals state that in future it expects a safety case will be required to be submitted to the building safety regulator for all existing HRRBs.



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Maximising Performance for You

# HOT OFF THE PRESS

The latest research on assessing and mitigating overheating in buildings is the focus of a *Building Services and Engineering Research and Technology Journal* special edition. CIBSE'S **Anastasia Mylona** looks at the key findings

**O**ver the past 40 years, *BSER&T* has been reporting the latest on indoor environmental quality in buildings – and, more specifically, on the thermal comfort of occupants.

Research in this area has evolved greatly in recent years. In particular, the assessment of thermal comfort has moved from rules of thumb to a deterministic approach – for example, a standard temperature threshold – to a more dynamic approach, such as the adaptive comfort method.

Designers can now assess thermal comfort for future climate projections, as well as for observed weather events. Although our understanding of occupant comfort and health has increased greatly, climate change – and the resulting higher temperatures – mean

we are having to evolve designs continuously, to ensure buildings don't overheat. The effects of global warming are being exacerbated by the policy requirement for higher levels of insulation and airtightness, and the urban heat island (UHI) effect.

In normally temperate climates, homes typically rely on passive design measures to tackle hot-weather events, rather than the mechanical means of ventilation and cooling employed in commercial buildings. Furthermore, occupancy in the domestic sector is much more unpredictable than in the non-domestic sector, with families using their homes in a variety of ways. These factors make homes more prone to overheating, and their design presents a greater challenge to professionals to make them resilient to hot-weather events.

It is the most vulnerable occupants – the elderly, the young and those with pre-existing health problems – who will suffer most as a result of higher internal temperatures. They are more likely to be confined to their homes and less able to make their environment more comfortable.

## Mitigation options for domestic retrofit

Previous research has established that shading and ventilation can reduce the risk of overheating in homes considerably. This is reiterated by De Grussa et al,<sup>1</sup> who monitored a real-life retrofitted apartment building in London to investigate the effectiveness of passive measures in mitigating high indoor temperatures.

The measures tested included different internal and external shading options combined with a night-time natural ventilation strategy. Results showed that external shading offers the most effective option in reducing solar gains and, therefore, overheating risk. Furthermore, external shading – such as shutters – can

All of these papers may be accessed in the July 2019 issue of *BSER&T* [bit.ly/CJJul19bsjuly](http://bit.ly/CJJul19bsjuly) CIBSE members can access *BSER&T* for free at any time [bit.ly/CJJul19BSERT](http://bit.ly/CJJul19BSERT)

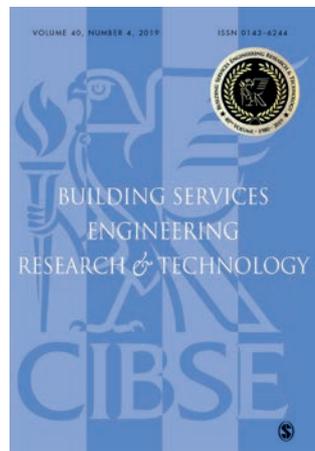
offer daytime and night-time secure ventilation. Despite the academic consensus on the effectiveness of external shading, the authors highlight that current construction practices in the UK do not allow for such a measure to be introduced as a retrofit option as, in most cases, windows open outwards.

The authors also highlight the importance of external factors, such as noise, when considering night-time ventilation – especially in an urban environment – and the potential reduction of daylight availability when external shading is used. The paper emphasises the significance of looking at glazing, shading, ventilation, daylighting and noise exposure in a holistic way, at the building design stage, to ensure appropriate design of an effective façade-management strategy to tackle overheating risk.

Taylor *et al*<sup>2</sup> focused their research on a loft conversion – a popular retrofitting trend, driven by the high cost of housing per square metre and demand for extra living space. Typical loft characteristics – top floor (directly under the roof) and usually of lightweight construction – make them vulnerable to overheating. Results showed increased overheating risk of lofts when appropriate mitigation options are not considered, and climate change projections indicate the risk will increase in future.

De Grussa had found that external shading with night-time ventilation was the most effective passive mitigation option. Looking at the cost of passive mitigation measures, strategies with internal shading were the most cost-effective retrofit options. The analysis also highlighted that passive measures, although effective under current climate, are not

**“Construction practices in the UK do not allow for external shading to be introduced as a retrofit option as, in most cases, windows open outwards”**



enough to eliminate the risk in the future, with active cooling likely to be the only solution to future overheating.

Both papers highlight how occupant behaviour can reduce overheating risk by appropriate operation of windows and shading devices. Those with limited mobility are more vulnerable because they have limited ability to change their circumstances, the authors warn.

### Assessing overheating of the elderly

Hughes *et al*<sup>3</sup> and Salem *et al*<sup>4</sup> concentrated their research on the elderly. The Hughes paper looked at thermal comfort of the elderly in their homes, while the second investigated the impact of a near zero-energy building (NZEB) standard retrofit on the thermal comfort of the elderly in a retirement home, now and in the future.

Hughes *et al* compared field studies with current design standards to assess the comfort perception of the elderly occupants. As most current industry standards – mainly based on the adaptive model as per BS15251 – are founded on field studies involving healthy individuals at work, the study identified a discrepancy between the comfort perception of the elderly at home compared with the results when applying the thermal design standards. Further research is required to consider how current design practices and standards need to be adapted for use in the homes of vulnerable occupants.

Salem *et al* investigated the impact of a changing climate on the risk of overheating and energy performance for a UK retirement village. The application of NZEB retrofit measures for energy efficiency increased the risk of overheating of the village, and none of the mitigation option combinations seems to have eliminated the risk – which was much worse when the analysis was done using future climate projections.

Although the energy efficiency agenda is important, the authors highlight that ignoring its effect on overheating could compromise it, as increased use of mechanical cooling will also impact on energy use. >>



Those with mobility issues may not be able to reduce overheating risk by, for instance, opening windows

» **Vulnerability of existing housing stock**

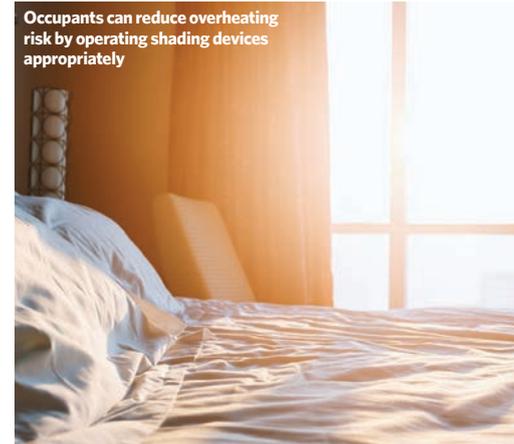
Petrou *et al*<sup>6</sup> statistically analysed the indoor temperatures and occupant and dwelling-type characteristics of a large housing dataset, to try to create correlations between the factors that increase (or decrease) the risk of overheating. One particularly notable correlation was between the size of a property and the household vulnerability, with the latter increasing when the size is reduced.

Results also showed that pre-1900 dwellings were cooler overall than post-1900 ones, and that the presence of children was associated with higher bedroom temperatures, as was the presence of vulnerable occupants. Indoor temperatures were also highest for dwellings that rated highly in the UK compliance test for homes at design stage, which reinforces the need for the regulatory framework to address summer as well as winter performance.

**New-build practices**

One of the current trends in energy efficiency design is the Passivhaus standard, which promotes highly insulated buildings with good standards of airtightness. This type of construction is perceived to have a higher risk of overheating than more 'draughty' homes.

Mitchell *et al*<sup>6</sup> interrogated data from 82 homes built following Passivhaus principles. The analysis showed that the majority of Passivhaus homes passed the overheating design criteria, but a high number of bedrooms experienced high temperatures during the night. The authors propose a more in-depth, room-by-room approach to design where the whole-year performance of the building is assessed.



**Modelling v monitoring**

The paper by Roberts *et al*<sup>7</sup> investigates the consistency of the design tools used to assess overheating and compares them with real-life monitored data. The results showed that, during warm weather, the models consistently predicted higher peak temperatures and larger diurnal swings than the measured data.

When looking at the intermodel comparison, both software tools that were used presented the same trends, but there was considerable discrepancy between actual overheating hours predicted. Considering that the modelling was coordinated to eliminate any assumptions specific to the modeller, the results question the appropriateness of models – primarily built for energy assessments – to give designers a reliable assessment of overheating. The analysis also highlights the importance of intelligent interrogation of results to assess by how much it is acceptable to fail the design thresholds. The paper says thresholds could be used as prompts for further investigation rather than absolutes.

As global temperatures increase, human vulnerability to summer overheating will increase and, consequently, understanding the internal environment of those most at risk is becoming more significant. Very little is known about appropriate threshold temperatures or acceptable durations of overheating in vulnerable populations, such as the elderly. Design standards need to be further developed to reflect the thermal comfort thresholds of vulnerable populations.

A clear message from all the papers is that the UK regulatory framework and construction practices need to reflect year-round energy and indoor environmental performance of homes and buildings. The Environmental Audit Committee's report on heatwaves, [bit.ly/CJJul19OH](https://bit.ly/CJJul19OH), released on the hottest day of summer 2018, put more pressure on industry and policy-makers to address overheating risk in a more holistic way. **CJ**

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# FORCE OF NATURE

The 11-storey Breeze Hotel in Amsterdam has a unique natural ventilation system that uses solar chimneys and water droplets sprayed into a shaft to move air around the building. **Andy Pearson** speaks to the academic behind the concept, Dr Ben Bronsema, and looks at how his 'earth, wind and fire' theory became reality

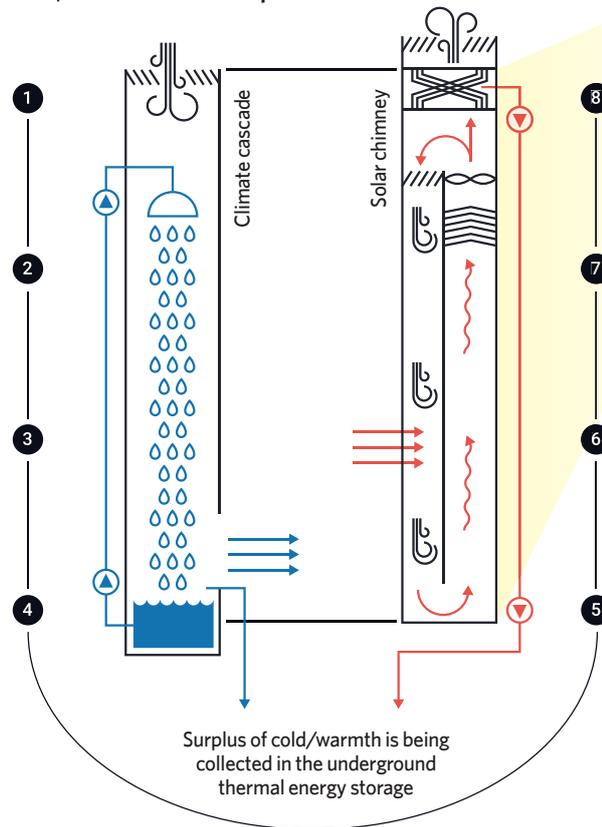
**T**he 198-room Breeze Hotel in Amsterdam is a pioneering, ultra-low-energy building. Developed by Amstelius/Dutch Green Company in association with Borghese Real Estate, it is the first building in the world to use the 'earth, wind and fire' natural ventilation concept conceived by engineer Dr Ben Bronsema. As such, it eschews mechanical systems in favour of using the sun, wind and water to heat, cool and ventilate all 11 storeys.

Bronsema was inspired to develop the concept after studying how African termites keep the internal temperature of their mounds at a constant 30°C, even though external temperatures fluctuate from 50°C in the midday sun to almost zero at night. 'I thought, can we build buildings the way termites do, using natural air conditioning to avoid the need for fans?' said Bronsema, in a TEDx talk from 2013.

The result of his cogitations was the earth, wind and fire concept, which subsequently became the subject of his PhD at the Technical University, Delft. As part of his research, Bronsema developed the natural air conditioning concept using simple computational modelling. This was refined using computational fluid dynamics and validated using experimental mock-ups of elements of the concept. The Breeze Hotel is the first building to make use of the concept, and Bronsema is working on the project with installation consultant Green Building Engineering and contractor Van Delft.

When the hotel opens its doors this summer, some of its more observant guests may notice the two glazed columns on the southwest façade, which rise from the ground floor to the roof of 33m-high building. These are the solar chimneys that help drive the building's natural air conditioning. In plan,

Earth, wind and fire concept



- 1 Warm air blows inside the turbines on the rooftop
- 2 Wind pressure pushes warm air into the climate cascade
- 3 The air is sprinkled with water of 13°C
- 4 Cold air is blown into the building, providing cooling and ventilation
- 5 Warm air from the building is extracted by the solar chimney
- 6 The air heats up and ascends in the solar chimney
- 7 At the top of the solar chimney, the air reaches a heat exchanger
- 8 Warm air transfers heat to the thermal energy storage through the use of a heat recovery system. Excess air leaves the system

Dr Ben Bronsema developed his natural ventilation concept after watching the building skills of termites in Africa





each chimney measures 0.65m deep by 3.5m wide. The front and sides of each chimney are glazed to allow in sunlight, while the rear wall is formed of black PV panels mounted on insulation; these generate 18,000kWh of electricity annually.

Sunlight warms the air in the solar chimneys, causing it to rise at approximately  $1.5\text{m}\cdot\text{s}^{-1}$  until it reaches the roof. This creates an area of lower pressure at the base of the chimney, which Bronsema exploits to draw stale air from the building into the chimney.

At the top of the solar chimney, the warmed air – which can reach temperatures of up to  $60^{\circ}\text{C}$  – passes through a heat-recovery system to capture its heat before it is discharged into the atmosphere. The estimated total annual thermal energy yield of the twin solar chimneys is 101 MWh.

The captured heat is stored in water at a relatively low temperature. This water can be used to heat the building and domestic hot-water (DHW) supply directly, or indirectly via heat pumps, which will raise its temperature. There is a 10,000-litre DHW storage tank on the 10th floor of the hotel. The chimneys are so efficient that, on a sunny day, not all of the heat they produce is required by the hotel – so the captured heat is stored in the ground beneath the building, for use in heating the building in winter via a heat pump.

Fresh air to replace the air expelled by the solar chimney is drawn into the hotel at roof level, where it enters the 'climate

»

“On a sunny day, not all of the heat the chimneys produce is required by the hotel – so the captured heat is stored in the ground”

» cascade'. This is a vertical shaft that drops down through the centre of the building – from the roof to the ground floor – where air for ventilation is cooled, heated, dried or humidified as needed, by nine water sprays fitted to the top of the shaft.

Water extracted from boreholes beneath the building is sprayed into the air at a relatively constant temperature of 13°C all year round. 'The high heat-transfer coefficient of the falling water droplets – and the large active surface area of the millions of droplets in the spray – ensure the climate cascade can operate at very small temperature differences between air and water,' says Bronsema, who describes the climate cascade as a 'gravity-activated heat exchanger'.

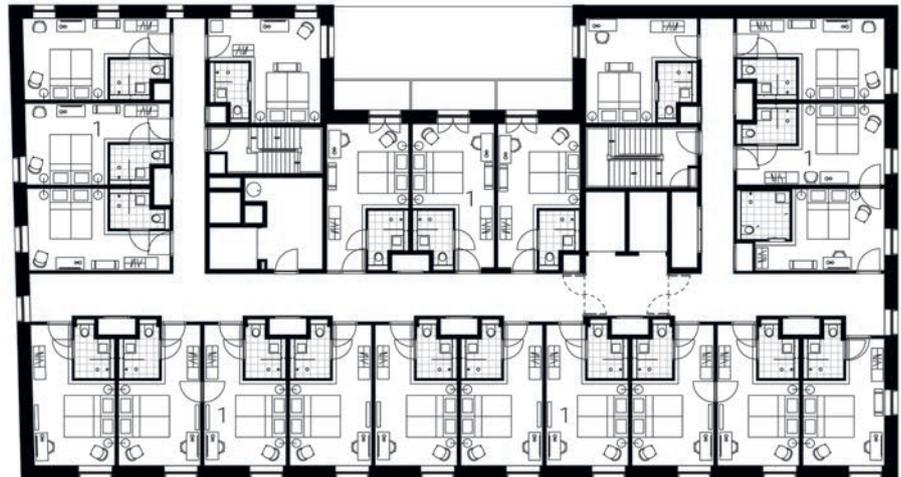
In summer, the water sprays can cool the outside air from 28°C to 18°C. As it cools, it sinks to the base of the shaft, and the downward movement of air is reinforced by momentum transfer from the water droplets to the air. Spraying the air with water also has the effect of scrubbing particulates from the air, thereby cleaning it. 'This aerodynamic pressure, together with the hydraulic pressure and the downward thermal draft, makes fans superfluous,' explains Bronsema.

As the cooled air sinks, the pressure increases at the foot of the cascade, which Bronsema uses to move the cooled fresh air into the rooms.

In winter, the water sprays are relatively warm to humidify the supply air. A heater battery is installed at the base of the cascade, which raises the temperature of the air for supply to the rooms. 'The injection water temperature is 13°C throughout the year; in summer, this produces cooling and, in winter, it heats the air and humidifies it,' says Ronald van Luijk, principal of Green Building Engineering. The spray water is collected at the base of the climate cascade and pumped through a water-treatment installation for reuse.

The climate cascade and solar chimney generate only a modest pressure difference to move the ventilation air, which means the air ducts must have larger dimensions than a traditional mechanical air conditioning system to minimise the pressure drop in the system. 'Both the supply and exhaust systems are fitted with axial fans to assist the airflow when necessary,' says Van Luijk.

The system whereby air is drawn into the hotel via the climate cascade and expelled via the solar chimney enables all rooms and communal areas to be ventilated by natural means, without the need for mechanical ventilation. Fresh air is supplied to each of



The plan of two floors in the hotel

"In the climate cascade, air for ventilation is cooled, heated, dried or humidified as needed, by nine water sprays"

the guest rooms through a system of large ducts to minimise the pressure drops.

'The ducting is designed as big as possible to reduce pressure loss, with the air introduced to each room through a constant volume valve,' explains Van Luijk. A fan coil unit enables guests to control the temperature and airflow rate in their room. 'When guests leave their room, the conditions revert to an energy-saving condition,' he adds.

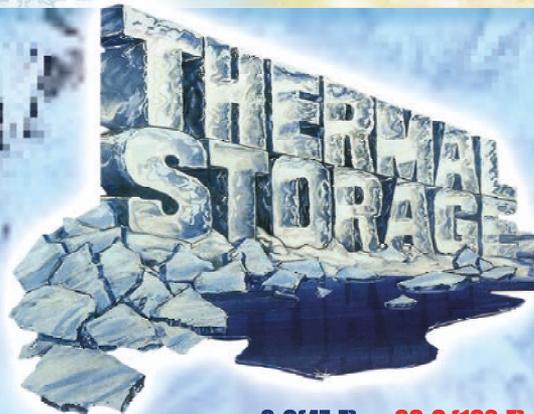
According to Bronsema, his system ensures that nature 'inhabits' the building by architectural means – and because the building design is fundamental to the success of the natural air conditioning concept, the engineer and architect have to work together from the outset. 'It is the architect who shapes the design of the building as 'climate machine,' he says.

Minimal energy is used by the natural air conditioning system, and the biggest energy consumer is the pump that delivers the borehole water to the spray heads at the top of the climate cascade. The system can be made more energy efficient by turning off the sprays when the outside temperature or relative humidity allows. 'We only need one small pump to pump water to the sprays,' says Bronsema.

'With a hotel concept such as this, we had to design a very efficient and realistic building based on a good, compact floor plan, to enable maximum investment in all of the alternative energy systems,' says the »



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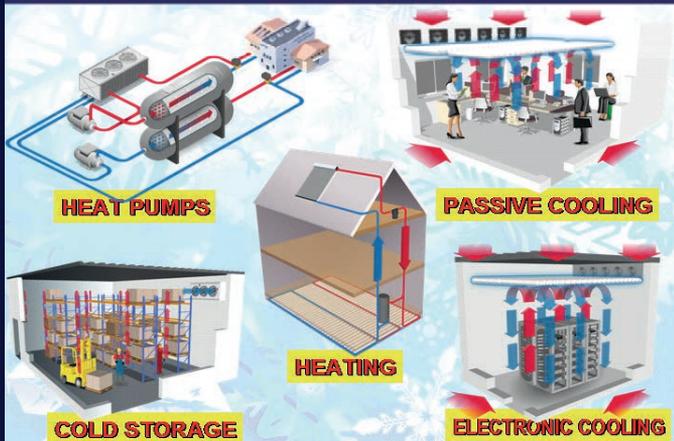
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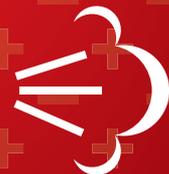
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**HUMIDITY  
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» project's architect, Wouter Zaaier, director at architect office OZ.

The building is designed to be almost energy self-sufficient. While the natural air conditioning system uses very little energy, other systems that keep guests comfortable and fed do use energy, supplied, predominantly by electricity generated by photovoltaic (PV) panels. In fact, the hotel is clad almost entirely in PV panels; the roof and all of the walls – with the exception of the north-east elevation – are covered in PVs, and even the canopy that projects from the front of the building has them. The electricity produced by the panels is in addition to the electricity produced by the PVs that line

the solar chimneys. 'We had to design a hotel to fit into the urban scheme, which produces a lot of energy – almost as much energy as we are using,' says Zaaier, who describes PVs as 'not the nicest façade material'. So OZ worked with the glass industry to develop a silver/black panel glass to form the PV cladding panels.

'These are overlapped slightly to help break up the flat expanse of cladding, so we don't have a strong, hard, blue shiny building, but a nice inviting hotel,' says Zaaier.

To maximise the area available for energy production, the window sizes have been kept to an optimal position. The main façade faces mostly south-east. 'We did not want the windows to be too wide, but we wanted guests to have a pleasant view out, so we designed the windows vertical – high to the ceiling to let in maximum daylight and low enough to enable guests to let them make a connection to the plaza,' says Zaaier.

The 'earth, wind and fire' concept is suitable for most new buildings, as long as the influence of wind and sun is not impeded by the surrounding buildings – the solar chimney, for example, should not be shaded by other buildings or vegetation.

Bronsema and his colleagues at Delft University of Technology have put together a virtual case study on an existing building, and the results were encouraging. They found that the earth, wind and fire concept could reduce the energy consumed by air conditioning systems by 40-60%, with the remainder of the demand met from a roof-mounted wind and solar power plant.

The costs of using the system were similar to a conventionally air conditioned hotel, if the costs of the solar chimneys were not included.

Breeze Hotel is set to open this summer –although perhaps it should be September, in honour of Earth Wind & Fire's greatest hit. **C**

**Air conditioning v earth wind and fire**

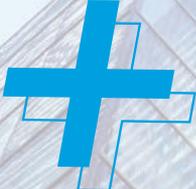
	<b>Traditional air conditioning</b>	<b>Earth, wind and fire concept</b>
<b>Space requirement plantroom two air handling units</b>	220m <sup>2</sup> (EN 13779)	50m <sup>2</sup>
<b>Cross-section of shafts: air velocity</b>	2.5m <sup>2</sup> ≈ 6m·s <sup>-1</sup>	2.5m <sup>2</sup> ≈ 3m·s <sup>-1</sup>
<b>Energy consumption EU 1253/2014-SPF int-limit</b>	50MWh·a <sup>-1</sup> 0.8kW·(m <sup>3</sup> ·s <sup>-1</sup> ) <sup>-1</sup>	10MWh·a <sup>-1</sup>
<b>Average lifespan</b>	15 to 20 years (mechanical services)	40 years (architectural structure)

The airflow rate of the Breeze Hotel is 25.000m<sup>3</sup>·h<sup>-1</sup>



Amsterdam's Hotel Breeze is due to open to the public this summer



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**Cost model**

# Large-scale heat pumps

Aecom's cost-management team compares heat pumps to traditional boilers and chillers for low-temperature hot water and chilled water generation in a large, speculative commercial office block development within the M25

**W**ith an increasing drive from developers to demonstrate their green credentials, and a demand from tenants for more environmentally friendly buildings, the use of heat pumps is on the rise – not only as part of the heating/cooling installation, but as a replacement for traditional boilers and chillers.

Commercial developments for offices and residential buildings have to compete for tenants, sales and investors, and one way to achieve a commercial edge is to demonstrate how they help to reduce carbon.

Legislation is driving interest in the built environment switching from traditional fuel sources to lower-carbon technologies using renewable energy, such as solar, geothermal, tidal, water and wind. Alternative heating and cooling systems are being developed to combat environmental challenges and, as a result, large-scale heat pumps are becoming a viable solution.

They demand more electricity than traditional boilers and chillers, but the National Grid's movement towards a larger proportion of its energy coming from renewable sources – such as solar and wind – is making large heat pumps far more attractive, as their lifetime carbon footprint will be reduced.

A word of caution over demanding more and more electricity from the Grid, however. In recent years, there has been a push to make office developments taller and to increase the density of populations on floor plates, to make projects more economic. From a residential perspective, the growing population requires both low-and high-rise development – and, in certain locations, it is increasingly difficult to deliver electricity at a cost that makes the capital expenditure (capex) of heat pumps viable.

Despite the potential for heat pumps to result in higher capital costs, these can be offset over the life-cycle of the equipment because of higher efficiencies. The energy-saving characteristics of heat pumps



Example of a heat pump with output ratings up to 1,200kW [Source: Viessmann]

make them eligible for the Enhanced Capital Allowance (ECA), so businesses can set 100% of the asset costs against their taxable profits in a single tax year.

There is potential to tap into the Renewable Heat Incentive – a government environmental programme that gives financial incentives to promote and increase the uptake of heating from renewable sources. It has two schemes – non-domestic and domestic – which have separate tariffs, joining conditions, rules and application processes. Depending on the scheme, quarterly payments are given over a number of years to eligible installations, based on the amount of heat generated.

As with any alternative to traditional approaches there are advantages and disadvantages (see panel opposite). Many of the disadvantages of the heat pump approach can be overcome. The initial high capex cost is often stated as the primary reason for not considering them. With more units and manufacturers coming to

Central plant air-cooled chiller + gas-fired boiler				
Description	Qty	Unit	Rate	Total
<b>Heat source</b>				
Boiler	1,170	kW	£47	£54,990
Flue	100	m	£640	£64,000
Primary pump set/pressurisation units	1	item	£58,000	£58,000
Primary distribution	1	item	£87,000	£87,000
<b>Space heating and air treatment</b>				
Chiller	1,450	kW	£260	£377,000
CHW primary and secondary distribution	15,000	m <sup>2</sup>	£22	£330,000
LTHW secondary distribution	15,000	m <sup>2</sup>	£17	£255,000
<b>Gas installation</b>				
Gas distribution	15,000	m <sup>2</sup>	£3	£45,000
<b>Electrical installation</b>				
Mechanical equipment power supply	1	item	£50,000	£50,000
<b>Communications, security and control systems</b>				
Controls	1	item	£50,000	£50,000
<b>Total costs</b>				<b>£1,370,990</b>



market, however, the capital cost is reducing. Noise issues can be overcome with careful selection of plant and well-designed attenuation.

The issues of limited heat output, reduced capacity at low ambient temperature, and low flow temperatures can be dealt with at early design stages. A small makeup boiler can deal with heating issues – and while this introduces a gas-driven heat source into a scheme, it is considerably smaller than a traditional approach and is used intimately.

The cost model comparison of an ASHP system and a traditional boiler and chiller central plant is based on a central London office development arranged over 14 floors, with one basement level. It has a GIFA of 15,000m<sup>2</sup>, with an approximate net lettable area of 11,250m<sup>2</sup> – resulting in a net-to-gross efficiency of about 75%. The office has been designed to comply with Part L and to achieve Breeam Excellent. Occupational density – the total net internal area (NIA) divided by the number of workplaces in the building – is assumed to be 1:8.

The comparative costs exclude any capital costs associated with upstream reinforcement of the electrical infrastructure, as this is site and area specific, and could negate any potential decision. However, it does take account of additional shell and core infrastructure to support the associated electrical load, such as additional substations, distribution boards and cabling.

The model compares a 1,450kW cooling and 1,150kW heating output from a boiler/chiller combination against the equivalent ASHP using four-pipe water distribution systems. It should be noted that costs could vary from project to project depending on, but not limited to:

- Location
- Size, shape and configuration
- Procurement route
- Programme
- Design criteria (flow rates, material and performance specifications, and so on). **C**

Central plant (chiller/boiler)	Large-scale heat pump (ASHP)
<b>Advantages</b>	<b>Advantages</b>
<ul style="list-style-type: none"> <li>● More stable heating/cooling source</li> <li>● Fast heating (boiler)</li> <li>● Lower initial cost</li> <li>● High leaving water temperature (boiler)</li> <li>● Large capacity available</li> <li>● Traditional technology, so known and understood by all parties</li> <li>● Natural gas is still very cheap (boiler)</li> <li>● Scalable</li> </ul>	<ul style="list-style-type: none"> <li>● Lower running cost</li> <li>● Less maintenance</li> <li>● Safer to use than combustion-based system</li> <li>● Low carbon technology</li> <li>● Efficient conversion of energy</li> <li>● Longer lifespan</li> <li>● No flue or impact on local air quality</li> <li>● Industry compliant</li> <li>● Provides heating and cooling</li> </ul>
<b>Disadvantages</b>	<b>Disadvantages</b>
<ul style="list-style-type: none"> <li>● Less effective use of primary energy</li> <li>● High operating cost</li> <li>● Burns fossil fuel (boiler)</li> </ul>	<ul style="list-style-type: none"> <li>● High initial cost</li> <li>● Noise</li> <li>● Capacity is reduced at low ambient temperature</li> <li>● Relatively low flow temperature</li> <li>● Requires careful design/application</li> <li>● Requires significant space to allow free airflow</li> </ul>

Many of the disadvantages of the heat pump approach can be overcome, and the higher capex cost can be offset by greater efficiencies over the lifetime of the equipment

Central plant air source heat pump (ASHP)				
Description	Qty	Unit	Rate	Total
<b>Heat source</b>				
Boiler	1,170	kW		not required
Flue	100	m		not required
Primary pump set/pressurisation units	1	item	£87,000	£87,000
Primary distribution	1	item	£87,000	£87,000
<b>Space heating and air treatment</b>				
Chiller		kW		not required
ASHP	1,450	kW	£340	£493,000
CHW primary and secondary distribution	15,000	m <sup>2</sup>	£25	£375,000
LTHW secondary distribution	15,000	m <sup>2</sup>	£21	£315,000
<b>Gas installation</b>				
Gas distribution				not required
<b>Electrical installation</b>				
Mechanical equipment power supply	1	item	£50,000	£50,000
<b>Communications, security and control systems</b>				
Controls	1	item	£50,000	£50,000
<b>Total costs</b>				<b>£1,457,000</b>

Cost variance ASHP v central plant
<b>(£54,990)</b>
<b>(£64,000)</b>
<b>£29,000</b>
<b>£0</b>
<b>(£377,000)</b>
<b>£493,000</b>
<b>£45,000</b>
<b>£60,000</b>
<b>(£45,000)</b>
<b>£0</b>
<b>£0</b>
<b>£86,010</b>

**ABOUT THE AUTHORS**

■ Authors **PETER BAXTER** and **WILL HOLLAND** are part of the specialist MEP cost-management team at Aecom Engineering Services, which provides cost estimating, procurement and cost management of building services installations.

**Notes on the above cost:**

1. Based on shell and core only; excludes all CAT A fit-out costs
2. Base date of Q1 2019, and the prices used are reflective of a project procured through a competitive two-stage tender
3. Unit rates are inclusive of MEP subcontractor testing and commissioning, and MEP subcontractor preliminaries
4. Excludes builder's work, main contractor's preliminaries, design reserve, contingencies and inflation allowances

Ultra-high-resolution thermal imaging technology is giving researchers much more detail on how cities are affected by high temperatures. **James Richards** explains how a land-temperature sensing project, led by King's College London, could help assess urban overheating risk and model ventilation strategies

# IN PLANE SIGHT

**F**or three weeks this summer, a bright red Twin Otter aircraft belonging to the British Antarctic Survey (BAS) will be taking to the skies over London and Europe. On board will be a 300lb thermal imaging device, built by Nasa's Jet Propulsion Laboratory (JPL), along with a team of scientists and engineers from JPL, the UK's National Centre for Earth Observation (NCEO), and King's College London. The highly sensitive infrared imaging instrument, a hyperspectral thermal emission spectrometer known as HyTES, will map surface temperature and water evapotranspiration data in unprecedented detail. For building service engineers, this could be a big deal.

According to Dr Anastasia Mylona, head of research at CIBSE, data from the mission could lead to a more accurate understanding

of thermal activity in and around urban areas. 'The industry is increasingly looking at the surrounding environment when specifying buildings. The HyTES aerial data could be useful in understanding more about the urban heat island (UHI), city airflows, and the albedo effect, especially in combination with the existing information we have from the Met Office. It may help us understand how cities are affected by high temperatures, and how green spaces impact on city temperatures.'

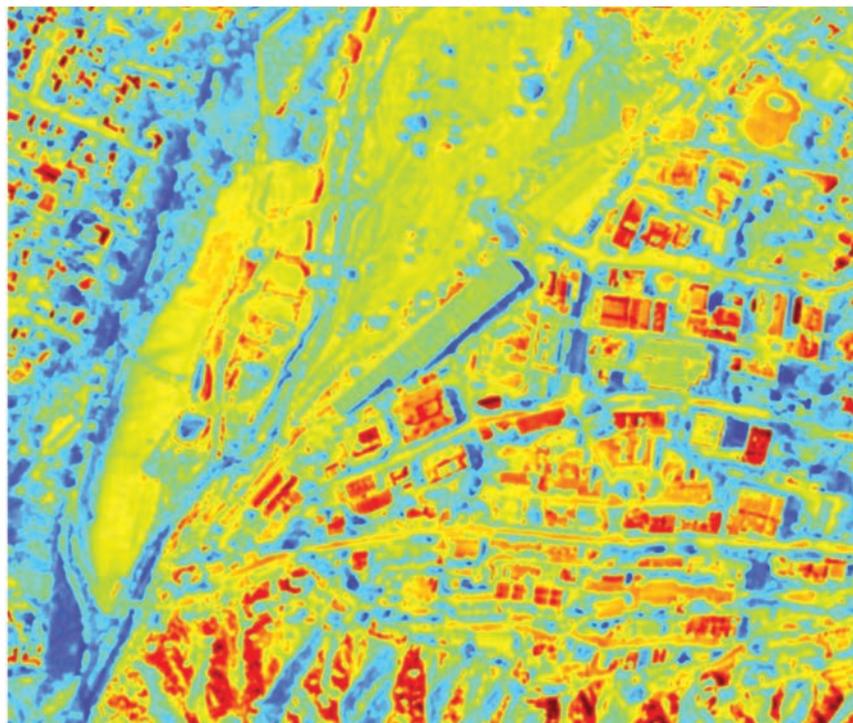
The project, dubbed NETSense, is being led by King's College London and the NCEO, and involves intensive collaboration with JPL, BAS and the Centre for Ecology and Hydrology (CEH). The project is funded by Nasa and the European Space Agency (ESA), and is part of a Nasa-ESA Bilateral Agreement. Flights over London, Italy, France and Spain are expected to yield thermal imagery that will be compared with data

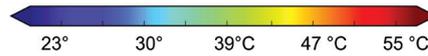
gathered concurrently by ground teams.

Data such as this may also provide crucial information for governments seeking to meet challenging climate targets, such as in the UK, where outgoing prime minister Theresa May has pledged to cut greenhouse gas emissions to almost zero by 2050. Such goals can be contributed to by increased building thermal efficiency, among other measures.

## Lofty goals

NCEO divisional director Professor Martin Wooster, who heads up the King's College London team, explains the main aims of the NETSense project. 'The primary goal is to collect data that can contribute to the design of a new land surface temperature monitoring (LSTM) satellite mission being considered for inclusion in Copernicus, the European Union's flagship Earth observation programme. These next-generation thermal





**HyTES will capture surface temperature and water evapotranspiration data in unprecedented detail**

imaging satellites are being designed to map land temperature and evapotranspiration from low Earth orbit. The science behind the LSTM mission is also led by NCEO staff from its University of Leicester site.

‘Data collected by HyTES could help determine the best spectral band positions for the candidate LSTM satellite mission. It could also provide precursor datasets for developing and testing the algorithms that may be used to turn future LSTM data into accurate maps of land surface temperature and evapotranspiration,’ says Wooster.

Flying HyTES over existing UK and European experiments run by collaborating institutions will yield airborne data that could expand ongoing research in these locations. To this end, the mission will also test a commercial thermal imaging instrument operated by NCEO called the OWL, which performs a similar function as HyTES but not as precisely. The team is open to new collaboration proposals for commissioning and using OWL data in UK urban applications, subject to the necessary funds being raised.

Professor John Remedios, director of the NCEO explained the value of the data from a building services point of view: ‘One of the key considerations in planning is the thermal environment in which the building exists. Cities make a large perturbation by changing the interaction between the land and the atmosphere. This can be observed in the impact of buildings and the airflow through the city, as well as the downstream impacts.

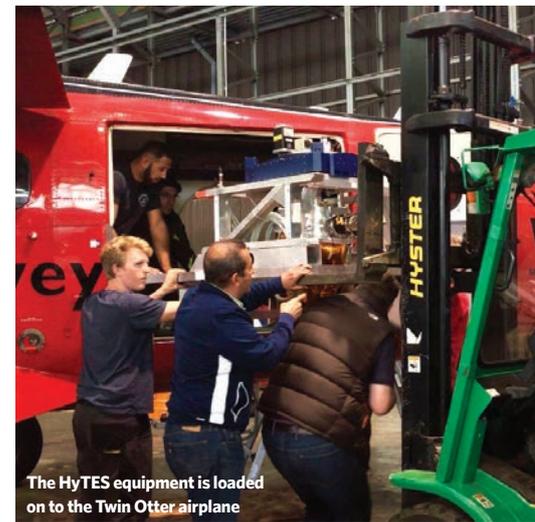
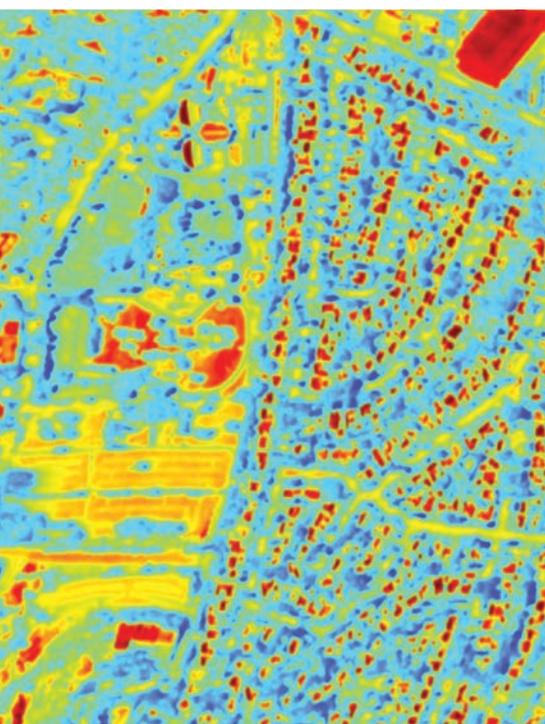
‘Up to now, our models for these processes haven’t been as accurate as we would ideally like. This is because we’ve lacked data worldwide for a variety of cities at a high enough resolution and with the right quality.’

### Modelling and UHI

According to Remedios, the NETSense project is a step towards achieving this data. ‘There’s a big difference between the temperature at surface level and temperature at head level; in cities, essentially, we’re all walking through this temperature gradient. We want to understand those gradients better, as they affect physical processes such as health, building management and design, choices of materials, and the consequences of transport, such as pollution.’

Remedios explains that the HyTES

**“In London, the team hopes to map the temperature of the surfaces and, from that, derive the sensible heat flux distribution”**



The HyTES equipment is loaded on to the Twin Otter airplane

instrument can pick up spatial distribution of heat in urban settings at really fine scales, which could help with assessing building overheating risk, triple jeopardy modelling (as developed by University College London) and, potentially, modelling of ventilation strategies for climate adapted/responsive buildings.

In London, the team hopes to map the temperature of the surfaces and, from that, map the distribution of sensible heat flux (heat moving from the land to the atmosphere, thereby increasing the air temperature). It will also be possible to estimate the albedo of surfaces from companion data being collected by another NCEO-operated airborne imaging spectrometer that collects data in the solar-reflected wavelength region.

Data pixel size from the airborne campaign is expected to be ~1-2m, which is far more granular than that offered by satellites or high-altitude platforms. This could also lead to a better understanding of infrastructure projects – for example, in terms of the temperatures of roads and other impervious surfaces, which can impact on the environmental health of city residents.

According to Wooster, ‘the data profiles over the urban areas could also improve our understanding of the impact of the different

»

» thermal infrared properties of materials used within cities (for instance, building façades and the materials that form our roads and pavements), which can influence the intensity of the urban heat island.'

UHI is a term for an area of industrial or urban cover that, because of anthropological activity, experiences generally higher temperatures than seen in nearby rural regions. To fully characterise the UHI, regular and accurate data is required at the city scale. LST data provides a regular and robust source of information over an entire city. It is not as directly linked to thermal comfort, heat risk and air pollution as is the air temperature itself, but it is an important factor and offers a robust way to map thermal information across the urban environment, with spatial and temporal consistency.

**Connecting to academia**

The UK is arguably a world-leader in Earth observation and the NETSense project builds on several decades of work in this field. However, while the results could open the door to the next phase of granular data gathering, the issue of how building services professionals can use the data remains; how should the gap between the engineering and academic communities be bridged?

'This part of the discussion is embryonic,' says Remedios. 'I feel we could make progress quite quickly with the right conversations. What's necessary is a few "champion" experts within the engineering community who can give us guidance about what the benefits are for them. It's also about knowing the standards and any databases they're using. We'd want to demonstrate we can contribute usefully against these standards.'

In fact, a huge amount of Earth observation data already exists. For instance, ESA has supported the GlobTemperature portal through which thermal data, produced



The NETSense project team from ESA, NERC-NCEO, King's College London, and Nasa JPL, in front of the Twin Otter aircraft

by NCEO and partners, are available at resolutions of 1km or 5km. The portal includes a prototype long-term record containing 17 years' worth of data. A first version of a definitive climate data record will be released this year through the Climate Change Initiative (CCI) open-data portal, also operated by the ESA and specific to climate. In other words, much of the really difficult work of establishing the climate data record has already been done.

Indeed, the NETSense project could pave the way for a much closer future relationship, if the engineering community is able to translate its needs to Earth observation academics and research teams. 'We need to know what engineers are using,' says Remedios. 'Would they use application

programming interface (API) or a web-based interface? Certainly, the Climate Data Store can take API.'

Useful for comparison are the CIBSE weather files, which are an example of how future weather data has been packaged up in an accessible way for building services engineers.

CIBSE's Anastasia Mylona welcomes the project and highlights the requirement for a significant store of data before useful conclusions can be drawn. However, she too sees an opportunity for working together in the future. 'It might take a collaboration between the research team and CIBSE to determine how to bridge the gap between the data-generation work and engineers at the user end' 

**HyTES**

**Bjorn Eng, of Nasa's Jet Propulsion Laboratory, explains how the HyTES device works:** HyTES is one of the world's most sensitive thermal imaging devices. Cryocoolers bring the instrument down to an operating temperature of 40° Kelvin (-233.15°C), far colder than liquid nitrogen, which takes about one week. Various gyro systems compensate for the aircraft's movement; however, the Twin Otter is an ideal platform for the equipment because of its wide loading doors, reliability, and the fact it flies slowly. This is more of an issue when collecting data at such a high spatial resolution (1m). However, the detector requires cloud-free conditions in order to operate, which can't always be guaranteed, especially in the UK.

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## LIFE SAFETY SUPPORT

Grenfell put fire safety in building design under greater scrutiny. **Martin Kealy** introduces the new CIBSE guide to fire safety engineering, which – in its fourth edition – has been updated to take account of the findings from Grenfell Tower and other fires

**P**ublication of *CIBSE Guide E: Fire Safety Engineering* follows the second anniversary of the Grenfell Tower fire, in West London, in which 72 people died and 70 more were injured.

This new version of the guide was close to publication before the fire; subsequently, the steering committee decided to postpone publication, as the repercussions of Grenfell for the fire industry were so significant.

Post-Grenfell, the government has:

- Set up an independent public enquiry into why the fire at Grenfell Tower happened
- Established an independent review of building regulations and fire safety, led by Dame Judith Hackitt, to consider how the system might need to change
- Identified significant building safety risks arising from Grenfell and all residential high-rise buildings (more than 18m high) with aluminium composite material (ACM) cladding, which was found to be unsafe
- Addressed the safety of buildings with ACM by taking immediate measures and laying out longer-term plans to make them safer.

The UK's Approved Document B was amended in November 2018 and again in April 2019, to address the combustibility of external walls. Regulation 7 of the Building Regulations, covering Materials and Workmanship was extended to prohibit the use of combustible materials in the external walls of buildings more than 18m in height containing residential accommodation – the so-called 'combustible cladding ban'. The new edition of Guide E



takes account of the additional requirements in regulation 7.

Approved Document B is also under technical review. There was a call for evidence seeking opinions on the future of the technical guidance. This consultation ran from 18 December 2018 to 15 March 2019, and the government is currently analysing the feedback.

### What's in the guide

The new guide addresses the design of essential life-safety systems that aim to protect building occupants, firefighters, and businesses and properties (including heritage buildings).

Fire engineering is carried out on premises where typical fire solutions are not appropriate, often because of the uniqueness of their design, to meet building codes. The benefits that fire engineering alternatives can bring to a design include: greater flexibility; reduced costs; and, measures more suited to the building use.

CIBSE Guide E is intended to be the 'go to' document for building services engineers and fire life-safety consultants. It has been updated by experienced fire engineers, all of whom practice fire-safety engineering in the UK and overseas. Many are members of the main professional bodies, including the Institution of Fire Engineers and the Society of Fire Protection Engineers.

The guide includes content on international best practice – including from North America, Australasia, and the Gulf region. The previous version was widely referenced by government organisations in codes, >>

» standards and guidance, including in the UK, the US, Hong Kong and Australia.

Its three main uses are:

- Design of fire systems, including suppression and smoke-control systems, and detection
- Design of fire strategies, such as means of escape, fire compartmentation and firefighting
- To give regulatory bodies a well-referenced and trusted set of internationally accepted design criteria and methodologies to approve fire-engineering designs.

The design of fire systems usually sits with the MEP engineers, and the fire strategies with the specialist fire life-safety consultants. There is much crossover between building services and fire engineering, and the new framework of the guide has been modified to make this clearer. For example, the designer can now access the section on smoke-control system design directly, without being sidetracked by issues that are not relevant to their task.

The guide overlaps with other disciplines, such as architecture and structural engineering. For example, the chapter on fire resistance includes more practical advice on fire and smoke dampers that aligns with the latest British Standard BS9999. The fire-resistance chapter also contains a new section that addresses structural fire protection. While it does not include structural fire calculations, it sets the framework and points the reader to other detailed references.

A new Section 16, entitled 'Fire safety of building façades', was to have been published in the guide in 2018. This would have offered advice on the design of building façades based on current UK guidance and international best practice. As a result of the significant regulatory uncertainty, however, Section 16 will now only be published online, so it can be updated as and when the government announces changes to the legislation.



## Guide outline

**Chapter 1: Introduction**

**Chapter 2: Legislation** Top-level overview of the consultation with local fire authorities, in the UK and overseas, from design to post-completion.

**Chapter 3: Building designation** Addresses how buildings are classified and the implications for design, and includes a useful checklist.

**Chapter 4: Performance-based design principles** Basic design principles, including objectives and scenarios. The fire-safety design process is described, and UK and international documents referenced.

**Chapter 5: Application of risk assessment to fire-engineering designs** This chapter has been substantially modified to address business resilience and insurance, as well as societal concerns and risks to firefighters.

**Chapter 6: Fire dynamics** The processes of fire and smoke development, and techniques for calculating design fires, smoke-production rates, flame heights and fire resistance. Simplified, with new diagrams and equations, it reflects the latest research on smoke-control design.

**Chapter 7: Means of escape and human factors** Covers the basic principles of designing for escape using traditional code and alternative fire-safety engineering approaches, including evacuation simulation models.

**Chapter 8: Fire detection and alarm** Looks in detail at the design of fire-alarm systems and automatic fire-detection systems.

**Chapter 9: Emergency lighting** Gives detailed practical guidance on the design of emergency escape lighting provisions.

**Chapter 10: Smoke ventilation** Significantly updated and simplified, this chapter describes the objectives of smoke-ventilation systems – such as tenability criteria – and the design of systems and components.

**Chapter 11: Fire suppression** This substantially updated chapter contains design guidance on fire-suppression systems within buildings, including automatic sprinkler systems, and foam, gaseous and water-mist systems.

**Chapter 12: Fire resistance** Covers fire compartmentation, fire resistance and maintenance of fire-resisting barriers, with additional guidance on fire and smoke dampers. A new section on structural safety fire engineering describes the framework for this alternative approach and references other publications for detailed calculations.

**Chapter 13: Firefighting** Revised in consultation with the London Fire Brigade, it includes references to international practices and codes. This chapter describes principles of firefighting, equipment, fire-department response, vehicle access and water supplies, and addresses firefighting timelines and an alternative fire-engineered approach.

**Chapter 14: Fire-safety management** Reflects the importance of the proper management of a building with respect to fire safety. Addresses legal obligations, design, maintenance, fire prevention and planning.

**Chapter 15: Fire safety on construction sites** This updated chapter reflects new industry guidance and designers' responsibilities. It also addresses the use of timber products and timber-framed building structures.

**Chapter 16: Fire safety of building façades** A new chapter, added as a result of Grenfell and other large fires involving external façades in the past 10 years (including 2019). This chapter will only be published online.

Design of façade systems is a highly specialised area of fire engineering and should only be undertaken by someone who is competent to do so. The Society of Façade Engineering ([www.cibse.org/society-of-facade-engineering-sfe](http://www.cibse.org/society-of-facade-engineering-sfe)) is the specialist group within CIBSE. Corporate members of the society have demonstrated their competence and have the knowledge to offer advice on cladding and façade engineering.

Thanks to the authors of the chapters. Without their dedication – and the time and expertise they have given freely – this new, improved edition of Guide E would not have been produced. **CJ**

■ **MARTIN J KEALY** MCIBSE is chair of CIBSE Guide E Steering Committee and managing director and principal fire consultant at MKA Fire. He has been involved with the guide since its first edition, in 1997, and has written fire sections for the more recent *Buildings for Extreme Environments: Arid and Tropical* guides.

“My supplier said the smoke vents are compliant” ...but can they issue the proof?



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# Rewriting the rulebook on fire responsibilities

In response to the publication of the government's open consultation, *Building a safer future: proposals for reform of the building safety regulatory system*, Ian Doncaster, from the Smoke Control Association, discusses the impact it may have on the industry and outlines the measures being taken by the association to bring about cultural change

Led by Dame Judith Hackitt, the independent review of building regulations and fire safety, carried out in the wake of the Grenfell Tower fire, has focused attention on the way high-rise residential buildings are designed, built and managed. Plans are now being put in place to rewrite the rulebook on building safety, offering clearer guidance on accountability for those responsible for the construction and management of such buildings.

Responsibility for building safety during the design and build stages will now sit with five 'dutyholders' – the client, principal designer, principal contractor, designer and contractor. These dutyholders must ensure that Building Regulations are met and must prove that they are managing risks at established gateway points before they can continue with other phases of the build.

A long-term campaigner for competency improvements in fire safety, the Smoke Control Association (SCA) has a particular interest in 'Gateway one'. This states that, before planning permission can be given, the dutyholder will need to submit a 'fire statement' and the regulator will consult the Fire and Rescue Authority to make sure fire safety is considered at an early stage.

The SCA has previously argued that smoke ventilation systems should be designed into a building and not added at a later date. By compelling dutyholders to consider fire safety from the outset, there is a clear opportunity for them to engage with a smoke-ventilation specialist on the most suitable life-safety systems, ensuring the correct design and installation of smoke-control systems and reducing the risk of critical failure.

Responsibility for smoke-control design, installation and maintenance shouldn't be left to someone who has little more than a basic understanding of its complexities – a scenario that has become all too common, unfortunately. As an example, a competent fire engineer, widely regarded as an expert in his/her individual field, may not have the necessary expertise to take sole responsibility for the



**“The dutyholder and gateway methodology will prevent commercial imperatives overriding safety ones”**

design of the smoke-ventilation system – just as a facilities manager is not typically an expert in checking on the condition of a life-safety system in a high-rise building.

The dutyholder and gateway methodology will help to maintain the 'golden thread' and prevent commercial imperatives from overriding safety considerations. Broadening the scope to include buildings higher than 18m, meanwhile, is a welcome step in recognising that safety provisions must be upheld in tall buildings that are not regarded as high-rise.

Included in the government's reform proposal is the suggestion that someone will remain responsible for managing and minimising fire risks throughout the life-cycle of the building. BS EN 12101, BS 9991 and BS 9999 document maintenance requirements, for both natural and powered smoke-control systems, advise that life-critical equipment should be included in a building services maintenance schedule. The SCA supports this approach, and the responsible person should be aware of these requirements when developing a schedule to maintain equipment on an ongoing basis.

As part of a sustained campaign to improve competency, all SCA members who install smoke-control systems are now required to apply for, and receive, accreditation to a specialist third-party competence scheme for smoke-control systems, such as the IFC SDI 19 scheme. Certification guarantees that the company employs staff who are suitably skilled and experienced in fire-strategy verification, system design, installation and commissioning. Accredited contractors will have demonstrated that their trained staff adhere to industry best practice, fully appreciate the importance of appropriate installation, inspection and maintenance procedures, and have the correct infrastructure to support this.

The introduction of a new building safety regulator should also ensure that existing and new building safety requirements are enforced properly, and that the industry

**IAN DONCASTER**  
is fire and smoke  
solutions director  
at the SCA

» fully embraces the high standards of competence that should apply whenever life-safety systems are being considered in high-rise residential buildings.

The proposal to give the regulator powers to take action against transgressors – with new criminal offences and monetary penalties – is fundamental to forcing change and holding people to account. Currently, developers and contractors feel no pain if they ignore safety standards in a race to the bottom on price. As long as the regulator maintains an independent stance and has the authority to take strong and timely action against those who wilfully overlook regulations, the SCA is optimistic that the industry will back the new regime and meet the minimum requirements laid out in the restructured Building Regulations.

Toughening up national regulation of construction products with a complaints system and a stronger focus on enforcement has been a long time coming. Manufacturers with fully certified products have been let down by a lack of enforcement since the construction products regulations were introduced. This is an opportunity to clarify and rectify the situation.

Overall, the most important outcome should be a change of behaviour and culture in the construction industry, such that stakeholders in the safety of buildings comply with their responsibilities.

### SMOKE-CONTROL SYSTEMS: ADVICE NOTE

In February, the government issued an Advice Notice to building owners on smoke-control systems. It recommended reviewing the use of electromagnetic holding devices for vents, which could fail in a fire because of power loss or because their magnetic fields are weakened by rising temperatures in, and around, the smoke shaft. Consideration should be given to replacing them with 'a more robust form of vent actuator'. Manual override controls for automatic smoke-control systems should also be reviewed, to ensure they function effectively and can be identified by firefighters.

If any element of a building's smoke-control system is found to be defective, it should be repaired immediately. If this is not possible, a risk assessment should be carried out and – after consulting a qualified fire engineer – mitigation measures put in place. These should be communicated to the local fire and rescue service and remain in place until the smoke-control system has been repaired and tested.

Issues with compartmentation should also be looked at, as defects that were low priority to remedy while there was a functioning smoke-control system may now be urgent.

Professional advice on smoke control should be obtained from a qualified engineer, who will normally be chartered and registered with the Institution of Fire Engineers, but may come from another built environment profession. See the note at [bit.ly/CJJul19advice](http://bit.ly/CJJul19advice) See the new CIBSE Guide E chapter on smoke control for more information.



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## TOSHIBA AIR SUPPLIES AIR CONDITIONING FOR SOLENT UNIVERSITY SPORTS COMPLEX



A new sports complex opened as part of Solent University has been specified with a variable refrigerant flow air conditioning system from Toshiba Air.

The facility comprises two sports halls, three studios and an exercise therapy space, and was designed to achieve a Breeam Excellent rating.

The project combines Toshiba's three-pipe heat recovery SHRMe and two-pipe SMMSe VRF systems, plus Toshiba Digital Inverter splits and applied AHU-DX combined coil systems. Along with a CIAT Floway DX system, these provide the complex heating and cooling requirements of the multiple sports spaces within the buildings.

Toshiba Carrier UK is a joint venture between Toshiba and Carrier in the UK, and is part of Carrier, a supplier of heating, ventilation, air conditioning and associated services.

## Historic Bratislava castle installs HVAC basement

A historic castle in Bratislava, Slovakia, has benefited from a new HVAC basement, as part of an extensive eight-year refurbishment.

Güntner has installed seven of its Vertical Vario GFV units, with an overall cooling capacity of 1,400kW, in the castle.

The fans of the fluid cooler are virtually flush-mounted into the wall and project into a neighbouring room. From there, the heated air is dissipated to the environment via ceiling grids.

The Güntner Vertical Vario fluid coolers cool a 34% ethylene/glycol solution from 46°C to 41°C.

The dry coolers use an energy-efficient, partial-load operation that makes particular sense when there are no visitors to the museum and no events going on inside the castle.

## Daikin UK's recycling initiative puts reclaimed refrigerants on the agenda

### New service encourages re-use of refrigerant from existing buildings

Heating and cooling specialist Daikin has introduced initiatives to increase the use of reclaimed refrigerants. Launched last month, the scheme involves: the allocation of certified reclaimed refrigerant in certain VRV systems; the use of reclaimed refrigerant in Daikin's 'commission with confidence' service; and the launch of a new 'reclaim with confidence' service, in partnership with A-Gas.

The new VRV IV+ systems and existing VRV IV S-series units now have certified reclaimed refrigerants allocated to them during production – so these units have no impact on F-Gas quotas.

Daikin marketing manager Martin Passingham said: 'Reclaimed refrigerants could be your best

defence against the F-Gas regulations. Reclaimed refrigerant avoids the CO<sub>2</sub> emissions that are produced when manufacturing refrigerant.'

The quantity of reclaimed refrigerant allocated to these units avoids more than 300,000 tons of CO<sub>2</sub>eq being generated in the production of virgin refrigerant, he added.

A new compressor for the VRV IV+ delivers an average 15% increase in seasonal efficiency over the previous ranges of Daikin VRV systems. According to Angela McGinley, managing director for Daikin UK, the 'reclaim with confidence' service will 'help to ensure a greater supply of reclaimed refrigerant re-enters the market.'

It forms part of Daikin's commitment to providing safe and healthy work environments, as the business strives to become carbon neutral by 2050.

## Carrier adds leak monitoring to range



Carrier has released an upgrade to its AquaSnap 30RBMP-30RQMP chiller range that includes built-in connectivity for fixed refrigerant-leak monitoring and Carrier's Touch Pilot control system.

The upgrade adds significant new capabilities that make the chiller easier for end users and maintenance contractors to operate.

It will also help to reduce the cost of ongoing maintenance by automating the checks required by F-Gas regulations.

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# MAKING A DIFFERENCE

Electrocaloric cooling works by applying an electric field to change temperatures and requires no refrigerants. **Metkel Yebiyo** and **Professor Andy Ford** look at the benefits of the technology and the challenges of bringing it to market

**R**efrigeration, air conditioning and heat pumps account for 19% of UK electricity demand and around 10% of total greenhouse gas (GHG) emissions.

In 2015, the EU agreed to intensify reductions in carbon emissions between 2020 and 2030. This will include a further 40% reduction in GHGs, through much greater use of renewable technologies and a massive increase in energy efficiency.

Several promising alternative, innovative heating and cooling technologies are under development, including elastocaloric, magnetocaloric, thermoelectric, barocaloric and electrocaloric. While the magnetocaloric effect has been studied extensively since its discovery by Emil Warburg in 1881 (see 'Magnetic attraction', *CIBSE Journal*, February 2016, [bit.ly/CJJul19electro](http://bit.ly/CJJul19electro)), electrocaloric cooling (EC) – discussed in this article – has had much less interest. It is, however, an emerging, innovative and potential low carbon technology.

The first experimental measurement of the EC effect was reported in the early 1930s, but the scale was very small. This changed with

the recent discovery of the 'giant EC effect'. Since then, the practical application of EC heating and cooling has been subject to a lot of research, and commercial applications are now on the radar.

## Basic working principles

The principle of EC cooling is based on the 'EC effect' – the ability of a material to change temperature when an electric field is applied. An EC device has two thin materials separated by a vacuum layer. Application of an electric field causes the most energetic electrons on the negative side to jump across to the positive side. As they leave the negative side, it gets colder. Figure 1 helps to demonstrate how to use this effect. Two types of materials are normally used for EC – ceramics and polymers. Ceramics have more advantages because of their high breakdown field, higher electrocaloric efficiency, and larger cooling capacity.<sup>2</sup>

The main limitation of the EC system shown in Figure 1 is the relatively small temperature difference that can be achieved between the cold and hot source. A number of techniques have been used to increase this exchange, such as active caloric regenerative process. The principle of this cycle uses a heat-transfer fluid in contact with the EC materials flowing from the cold side to the hot side when the

»

**"An electric field causes electrons to jump across to the positive side. As they leave the negative side, it gets colder"**

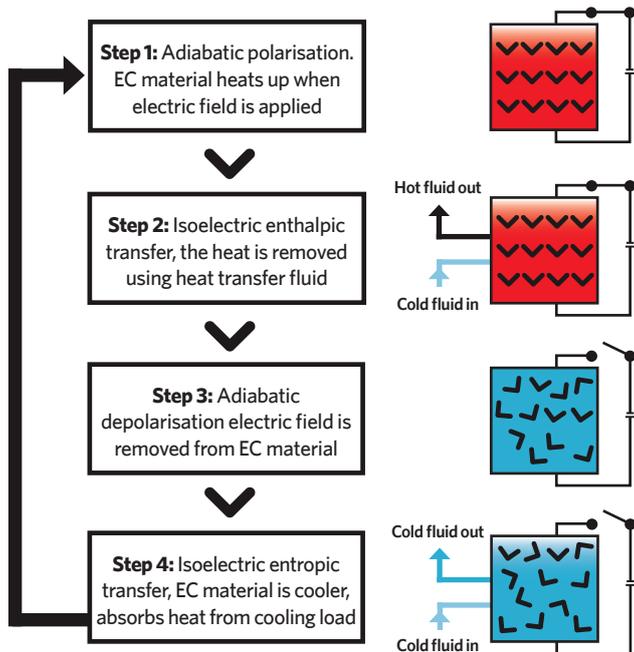


Figure 1: Schematic showing basic working principle of electrocaloric refrigeration

» material is heated, and from the hot side to the cold side when the material is cooled down. This progressively increases the temperature difference between the cold and hot source to about 40K<sup>1</sup>, making the system potentially suitable for a range of commercial applications.

One of the obstacles to achieving a sufficient EC effect is related to the exposure of the material to very high electric fields.

**Benefits**

EC cooling does not use refrigerant gas but, instead, a cooling fluid, which could be water-based. As a result, there are no direct CO<sub>2</sub> emissions and EC heat pumps comply fully with all regulations, such as F-Gas in Europe and EPA regulations in the US.

Its advantage over magnetocaloric cooling is that the high electric fields required for

**CHALLENGES**

- To improve and implement new manufacturing and processing methods for materials and regenerators
- Lead-containing ferroelectric ceramics show great potential for EC refrigeration technologies, but they are not acceptable environmentally. With this in mind, more research on lead-free materials is required
- Advances in materials that support the absorption of large amounts of heat from a cold reservoir have been established as a priority. As such, good progress has been noted over the past five to 10 years, with the improvement of EC temperature change from 2.5K (in ceramics) to 40K (in thin films)<sup>1</sup>
- Use the EC principles to generate electric energy.

refrigeration are easier and less expensive to generate than the high magnetic fields required for magnetocaloric refrigeration. There is no dependence on rare-earth materials and the pumps are the only moving parts.

Compared with existing refrigeration and heat pump technologies, EC refrigerators or heat pumps are predicted to have efficiencies of 60-70%.<sup>3</sup> The coefficient of performance of existing refrigeration and heat pump technologies is in the range of 3-5. Major research is required to get EC refrigeration to the development stage, and there remain some challenges (see panel). Fundamental and technical features have yet to be resolved – but watch this space. **C**

■ **METKEL YEBIYO** is a PhD researcher at London South Bank University

■ **PROFESSOR ANDY FORD** is acting director of research and enterprise and professor of building systems engineering at LSBU

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- 3 Analysis of potential of novel refrigeration technologies suitable for selected industries for application and improvement of food quality, energy consumption and environmental impact, FRISBEE project, 2011

**POTENTIAL APPLICATIONS**

There are various potential applications for this technology<sup>1</sup>, including:

- Replacement of vapour compression in small refrigerators
- Small heat pumps
- Thermal management of power electronics in integrated circuits
- Air conditioning of hybrid and electric vehicles.

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## Effective control for condensing gas boiler systems

This module looks at key drivers for deploying condensing gas boilers and the control requirements to optimise their performance

The boiler is at the heart of most institutional and commercial buildings, to provide the heat for hot water and space heating. This article will consider the key drivers for deploying condensing gas boilers, and explore some of the principal control requirements to ensure effective operation and to minimise environmental impact.

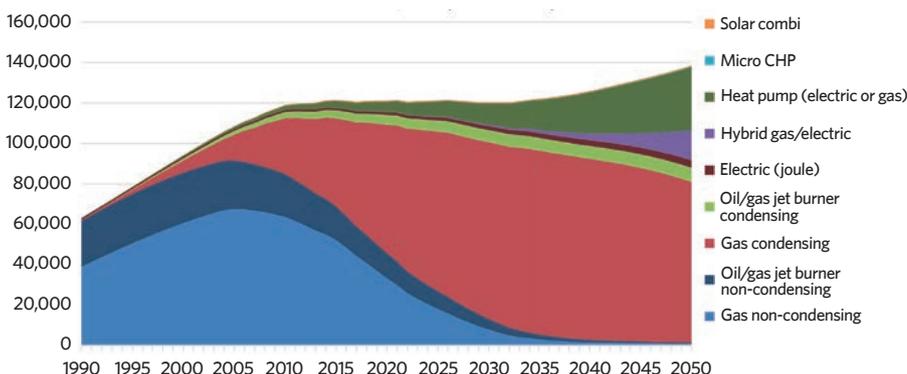
Condensing gas boilers, whether fuelled by natural gas, or potentially by hydrogen, are forecast to be the predominant heat source for European buildings for many years to come, as indicated in the data produced for the latest EU Ecodesign review, shown in Figure 1.

The minimum performance for a boiler is typically set by codes and standards. Across the EU (including the UK), the Energy-related Products Directive (ErP) leads the regulations of individual member states that, in the Ecodesign regulation EU 813/2013,<sup>2</sup> sets efficiency standards for boilers that have an output power of

less than 400kW. The Medium Combustion Plant Directive (EU 2015/2193) sets limits for appliances over 1MW thermal input up to 50MW. The various UK Building Regulations determine the requirements for 400kW to 1MW (such as the Non-Domestic Building Services Compliance Guide<sup>3</sup>).

Manufacturers indicate this performance based on calculation methods that apply factors providing standardised interpretations of how the boiler will perform seasonally, such as those explained in EU communication 2014/C 207/02<sup>4</sup> and BS EN 15502-1:2012+ A1:2015.<sup>5</sup>

Aside from specific installations (in applications with shared chimneys), the requirements of the ErP effectively restrict the majority of non-renewable heating installations to condensing gas boilers. However, the ErP performance metric is based on an idealised set of parameters that are unlikely to wholly reflect the vagaries of real applications. Ensuring that an installation provides expected performance requires appropriate design, which crucially includes a properly considered control strategy and suitably informed end-user operation and maintenance.



**Figure 1: Installed number of heating appliances (in '000s of units) across the 28 states of the EU.<sup>1</sup> To provide some context, data from 2016 indicate 95% of appliances have output  $\leq 70$ kW**

» Figure 2 indicates the operating efficiency of a typical commercial condensing boiler at different loads and return water temperatures. Unlike non-condensing boilers, the performance will increase at part-load – this would allow the boiler to operate typically below 20% full load several per cent more efficiently than at full load. Similarly, as the temperature of the return water reduces, the efficiency of the boiler will increase. There are inflexion points in the efficiency characteristic of Figure 2 at around 54°C and 27°C – respectively, the points at which condensation commences and the temperature where condensation will be at a maximum.

So, to maintain a high level of thermal performance, a condensing boiler should not only operate in condensing mode (that is, a return water temperature lower than approximately 54°C), but also be controlled to deliver a heat output that continuously matches the demand of the building, while aiming to operate with a return water temperature as low as practicable. Return temperatures at the lower end of this range should be readily achievable from (properly controlled and configured) domestic hot water calorifiers, air handling unit (AHU) heating coils, and, potentially, underfloor heating and ceiling radiant panels. Radiator heating systems can be readily selected so as to return water that is below the condensing temperature. In refurbishment projects, the inherently oversized existing systems typically allow lower mean water temperatures and are still able to meet heating loads and so enable operation in the condensing range.

This might suggest that the most thermally effective option is to use one large well-sized boiler to serve a building, knowing that for practically all the time of operation the boiler will be at part-load, and so be able to operate at a higher efficiency. (This is the opposite of the technique employed for non-condensing boilers, where the efficiency will decrease as the load reduces.) However, the use of a single boiler will increase the risk of total system failure (as there is no redundancy), limit the opportunity for planned maintenance, and also restrict the minimum possible turndown to that of a single boiler module. Installing multiple boiler modules will not only increase redundancy – and so reduce the problems arising from failure or maintenance – but also increase the available turndown potentially to a very few per cent of maximum load.

Boilers should not cycle excessively, as this increases thermal losses and increases the output of NO<sub>x</sub>.<sup>6</sup> The efficiency benefits of continuously operating multiple condensing

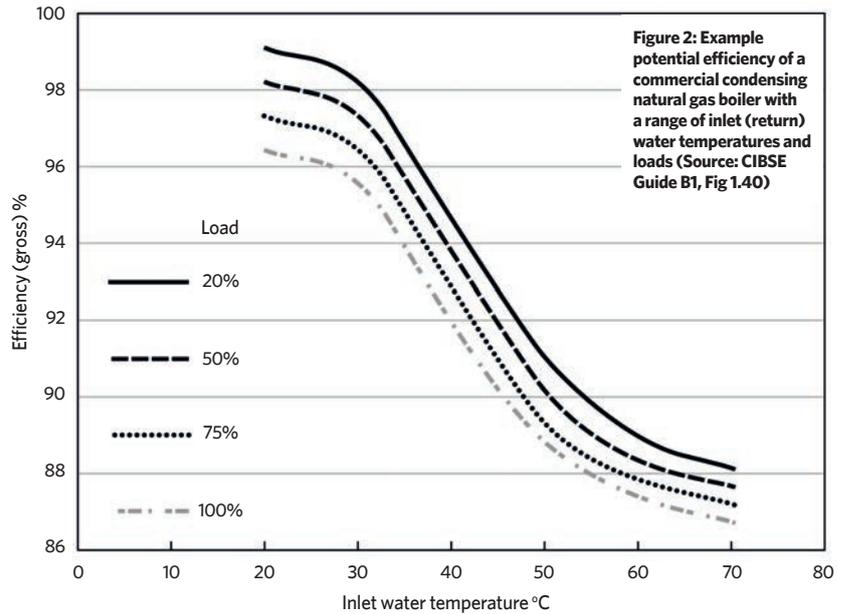


Figure 2: Example potential efficiency of a commercial condensing natural gas boiler with a range of inlet (return) water temperatures and loads (Source: CIBSE Guide B1, Fig 1.40)

boiler modules at reduced load – rather than cycling fewer boilers at higher outputs – will mean that, as discussed in more detail in section 10.1.2 of CIBSE Guide F,<sup>7</sup> it is generally more efficient to modulate all boilers in ‘unison’, compared with a step control (which would attempt to minimise the number of operating boilers). Unison control would, for example, control three separate boiler modules as in Figure 3. As the load drops below the minimum turndown for a single module, the control could sequentially switch off modules or, to prevent such cycling, make use of a buffer load.

Most modern boilers will accept a 0-10V control input to modulate the boiler output directly, or to adjust the setpoint of the boiler or incorporate their own master/slave control system.

The flow water temperature feeding the building heating system may be dynamically controlled with weather compensation. This will reduce the boiler flow setpoint and/or the temperature in separate zone circuits as the outdoor (ambient) temperature increases, as illustrated in the example simple optimiser schedule in Figure 4.

This can provide feed-forward control of the space conditions as well as reduce the thermal losses from the distribution systems. Historically, this was principally delivered through separately pumped secondary mixing heating distribution circuits, while maintaining a notionally constant boiler supply temperature in a primary header circuit. Since modern gas boilers are able to modulate output temperatures – rather than simply being on/off – the compensation can be usefully applied to condensing gas boilers with a 0-10V control input to reduce the boiler supply temperature at higher outdoor temperatures. As discussed in section 5.9 of CIBSE AM14, a ‘fully integrated zone and boiler control system will determine the highest zonal water temperature at any time and then directly compensate the boiler

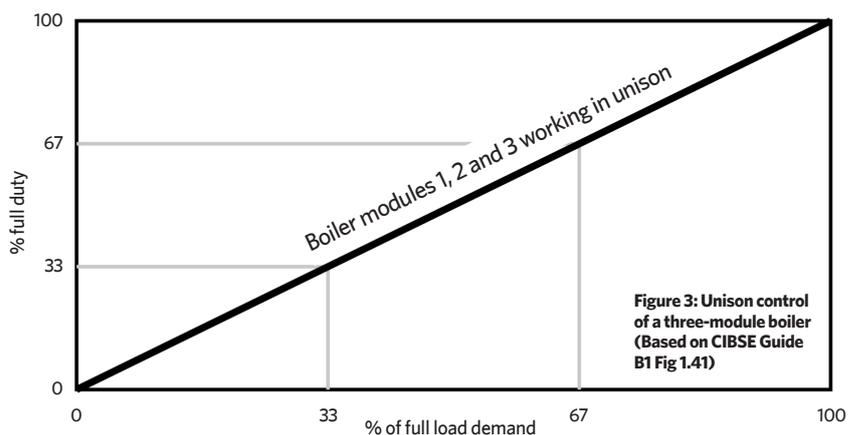
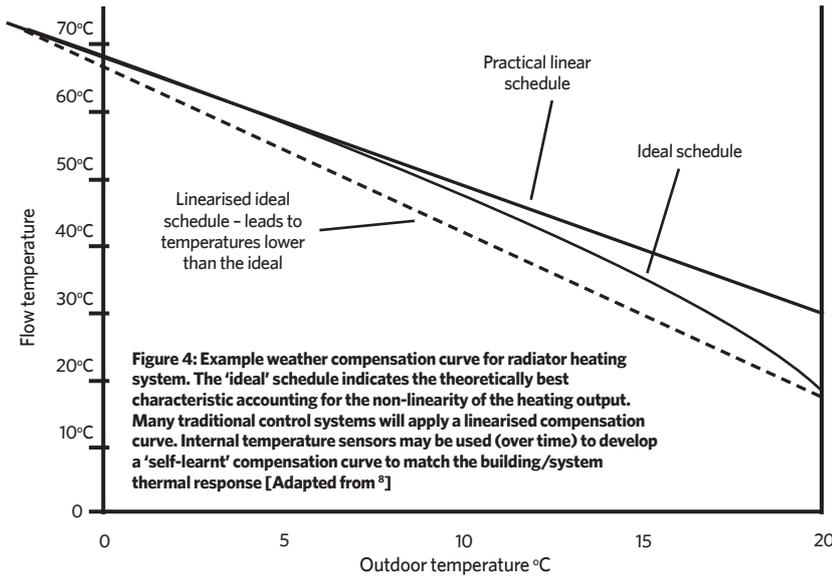


Figure 3: Unison control of a three-module boiler (Based on CIBSE Guide B1 Fig 1.41)



to achieve this temperature. Zones requiring lower temperatures will use three-port mixing valves to reduce the temperature in these zones. Weather compensation can provide low return water temperatures in milder weather, allowing condensing boilers to operate at higher efficiencies’.

Intermittent heating, typically with a reduced unoccupied temperature, can save considerable amounts of energy for many buildings.<sup>8</sup> The time at which the plant must operate so as to provide acceptable internal temperatures for the occupied period will be a function of the internal and ambient temperature for a particular building. This would typically be facilitated with ‘optimum stop and start’ control. As discussed by John Hammond (Letters, *CIBSE Journal*, October 2018) there can be an advantage in employing excess boiler capacity, as may be available at many times when using modular condensing gas boilers, to reduce seasonal heating requirements. In appropriate applications (particularly in buildings with lower thermal inertia), the pre-heat period (prior to full building occupation as part of an optimum start routine) is reduced, so dropping the average internal temperature over the heating day, and hence reducing total seasonal heat loss and energy use. As noted in CIBSE Guide B1 section 1.5.3.6, there is a balance of pros and cons to increasing the ‘plant size ratio’ and there ‘is therefore an optimum plant ratio based on total life-cycle costs. This requires an assessment of annual energy and capital costs for different plant ratios using a discounted cash-flow method. Alternatively, a life-cycle carbon emission assessment may be preferred’.

The benefits of condensing modular gas boilers will only be maximised if they are set up and controlled correctly. The overall efficiency of a multiple boiler plant will depend on how closely total output can be controlled to match the load profile of the building. CIBSE AM14 notes that ‘sophisticated strategies can be developed with advanced control systems. Many boilers have in-built extendable control packages that combine direct compensation, optimum start/stop and sequencing. Zone and hot water controls can be linked in and thus provide demand-based boiler control packages’. However, as highlighted by CIBSE Guide H, ‘unsuitable control strategies for boilers can lead to inefficient and problematic operation’, so it is important to consider carefully the operational needs of the specific application when establishing the control regimes.

This control can be carried out at the boiler and through a building management system (BMS) that, in turn, can be



**Figure 5: The refurbished heating system in St Paul's Cathedral required controls that are able to account for the building thermal inertia**

internet connected – so allowing remote control, monitoring, fault diagnosis and alerts. Some manufacturers integrate networkable controllers into the boiler packages that have been designed to optimise the boiler operation across the life-cycle of that specific boiler system.

As well as maintaining safe boiler operation, such an integrated controller is able to work in a master/slave arrangement to provide time and temperature managed unison and sequence control across several boiler modules. This would allow zoning of



**Figure 6: Four 254kW modular gas condensing boiler sections that combine to provide the heating for St Paul's Cathedral**

several heating circuits together, with weather compensation based on input from ambient, room, flow and return temperature sensors. Together with the other control parameters, domestic hot water control priority (with daily anti-legionella boost) can be set through the local user interface or from local or networked connected devices. The controller will also provide the interface and management for ancillary items such as pumps, circuit valves and buffer tanks, maintaining the most effective operation to deliver the best performance for the system. Some systems also include provision to control multi-mode heat generation, so as to usefully employ renewable heat sources.

Such controls can be adapted and integrated with existing heating distribution systems, as the equipment being controlled normally requires on/off control. For example, the two banks of dual 254kW condensing gas boiler modules (including integrated and networked controls) with a total maximum output of up to 1,016kW, as shown in Figure 6, were recently installed in St Paul's Cathedral (Figure 5) and are able to provide a 20:1 turndown, serving the legacy heating system and a new fast-recovery domestic hot water calorifier.

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Turn to page 54 for references.





# Module 149

July 2019

» 1. **Between the years 2030 and 2050, what type of heating appliance is predicted to be the second most commonly installed heating source after gas condensing boilers?**

- A Electric (Joule)
- B Gas non-condensing
- C Heat pump
- D Hybrid gas/electric
- E Micro CHP

2. **Which of these temperatures would be the maximum that could be suitable for the inlet water for a gas condensing boiler?**

- A 27°C
- B 37°C
- C 47°C
- D 57°C
- E 67°C

3. **What is the term for the control method that is used to provide a common level of heat output across multiple boiler modules?**

- A Union
- B Unison
- C Unitarian
- D Unity
- E Universal

4. **Which of the following was not explicitly included in the article as one of the potential benefits of integrated controllers?**

- A Domestic hot water control priority
- B Indoor CO<sub>2</sub> monitoring
- C Safe boiler operation
- D Time and temperature managed unison control
- E Weather compensation

5. **What turndown was achieved in the boiler installation for the St Paul's Cathedral refurbishment example?**

- A 5:1
- B 10:1
- C 15:1
- D 20:1
- E 25:1

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AWARDS  
2019



# CIBSE Employer of the Year 2019

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## Product of the month

### Mini-touchscreen air conditioning room controller enables client customisation

With colour interface and 30 contrasting backgrounds, Toshiba Carrier's new controller is a perfect match for any room

**T**oshiba Carrier UK (TCUK) has developed a new mini-touchscreen air conditioning room controller with an intuitive interface that enables clients to add their own branding and corporate messages.

Based on a clear, capacitive icon-driven touchscreen, the unit operates on the same lines as a high-end smartphone. It is designed to be easy to use for end users, and quick and simple to install for contractors. It uses the same two-wire connectivity as a standard controller, enabling it to be installed quickly without adding an external power supply on new projects, and as an upgrade on existing systems.

TCUK's managing director for sales, David Dunn, said: 'Wall-mounted room controllers in hotels and offices are the vital interface between the user and the air conditioning system. However, their design has not kept pace with changing user needs and expectations, often having complicated interfaces that confuse people and make the controllers difficult to use.



**"The design of room controllers has not kept pace with changing user needs"**

'We went back to the drawing board and asked clients: "What do you want from a wall controller? How can we make it as easy to use as possible, and a stylish addition to a room?" We took the findings and came up with a new approach to room-controller design.'

The new controller's contemporary look is designed to lend style to a room. The colour

interface can be customised easily to match room decor, with 30 contrasting backgrounds available to create different moods or messages. Clients can also customise the interface with their own corporate images, colours and logos by uploading images via the unit's built-in USB connection. It enables the unit to blend in with any environment, while carrying the brand identity of the client to the heart of a hotel room or serviced office.

Which icons and functions are displayed is determined during the installer set-up and according to the client's preference. This overcomes a problem common to some traditional controllers, in which all functions are visible but not all are accessible, leading to user frustration.

■ Call Sarah Woolley on 01372 220 260 or email [sarah.woolley@utc.com](mailto:sarah.woolley@utc.com)

### New Jung Pumpen high head drainage pump

In deep basements, such as those often found in the City of London, normal drainage pumps are not adequate, because they need to be able to handle high head and flow rates.

The New MultiDrain range from Jung Pumpen offers a reliable solution to these problems.

Its features include three model ranges with a maximum discharge head of 25m and side or vertical discharge, allowing installation in small sumps as narrow as 40cm diameter. Pumps are available in 1ph or 3ph motor options.

■ Call 0118 9821 555 or visit [www.pumpstechnology.co.uk](http://www.pumpstechnology.co.uk)



### Aquatech Pressmain booster sets ideal for flats and schools

The new Aquatech Pressmain Micromatic HM2AV is a specially developed, compact, cost-effective, powerful range of booster sets with two pumps. It is suitable for boosting pressure in flats, medical centres and schools, where water needs to be distributed to upper floors or roof-top tanks.

Its small footprint ensures easy installation, and it comes with the build quality and peace of mind you would expect from Aquatech Pressmain.

■ Call 01206 215121, email [marketing@aquatechpressmain.co.uk](mailto:marketing@aquatechpressmain.co.uk) or visit [www.aquatechpressmain.co.uk](http://www.aquatechpressmain.co.uk)



### Rinnai ensures Stafford launderette is awash with cost savings

Rinnai has completed the installation of two HDC1500i continuous flow hot-water heating units at a busy launderette in Stafford, which serves businesses as well as the public.

The launderette needed to change its existing heated stored-water system, to cater for fluctuations without running up huge energy bills.

Now, the two Rinnai HDC1500i internal-mounted water heaters, with secondary circulation, provide hot water for 12 commercial machines, plus a sink and a wash-hand basin.

■ Visit [www.rinnaiuk.com](http://www.rinnaiuk.com)



### ↗ Grundfos takes on SW19 No 1

Wimbledon is the oldest tennis tournament in the world and, each year, one billion people around the world follow the action on television, with 500,000 people attending the All England Club. This makes it the largest single annual sporting event in Europe.

Such a massive undertaking relies on many hidden heroes, such as a wide range of pumps for heating and cooling; primary and secondary hot and cold water; a range of pressurisation units; and multiple booster sets.

Relevant control panels are also required, all of which need to be linked to a building management system.

Another challenge for a UK venue is the weather. To ensure continuity of play, a second court – Court No 1 – has been reconfigured and had a retractable roof fitted, at a cost of £70m.

The pump solution to support this revamp has included 48 Grundfos Unilift drainage pumps. Their role is to quickly and effectively remove any excess water that can be caused by torrential rain.

■ Visit [www.grundfos.co.uk](http://www.grundfos.co.uk)



### ↖ AET underfloor air conditioning for Belfast warehouse

Flax House, in Belfast, is a five-storey, Victorian building of red-brick, warehouse-style construction. It was designed by Young & Mackenzie and built in 1906-7. Strairdon Properties acquired the 83-91 Adelaide Street building in 2016, after it had been derelict for 30 years.

The refurbished and fully extended Flax House now offers five floors of exceptional grade-A office space, with each floor plate configured to provide around 5,597ft<sup>2</sup> of lettable space.

Underfloor air conditioning, with full underfloor supply and return air, was specified, so that the warehouse loft ceilings could be left exposed, highlighting the retained features and building characteristics.

AET Flexible space supplied 11 CAM-C downflow units and 128 TU4 fanlites for the building, which is now fully let, each floor with a different tenant. Among the businesses are modern, tech-focused firms that the developer was looking to attract.

■ Visit <https://www.flexiblespace.com/>

### Viega adds Megapress Easytop valves to its press-connection range >

Viega has extended its Megapress range with new Easytop ball valves designed for thick-walled, steel-tube systems.

The high-quality, German-engineered press-connection valves are quick, simple and clean to install. As with the rest of the Megapress range, the new valves feature SC-Contur technology, which is proven to deliver a 100% positive leak during testing if the fitting is inadvertently unpressed. This reliable method of detecting missed connections prevents costly and time-consuming issues occurring after installation is complete.

■ Visit [www.viega.co.uk](http://www.viega.co.uk)



### ↖ Exceptional efficiency with FSE cabinet heaters

Reznor, part of Nortek Global HVAC (UK), continues manufacturing high-efficiency heating equipment with the FSE range of cabinet heaters, which delivers exceptional efficiency and the potential to reduce energy costs.

The cabinet heaters combine innovative design and proven heat-exchanger technology, to create a cost-effective and durable range. Units may be specified for free-blowing applications or for use with ductwork.

Gas red cabinet heaters are suitable for use with natural gas (G20); most units can also be specified for propane (G31). Oil-fired cabinet heaters are suitable for use with Class D gas oil (35 sec) and most units can be specified for kerosene (28 sec oil). Oil red cabinets are supplied with factory-fitted re valve and oil filter. Vertical freestanding models are available from 40kW to 300kW.

■ Visit [www.reznor.eu](http://www.reznor.eu)

### McFadden and Breeze are the new faces in Ideal Commercial Boilers' business development team >

Ideal Commercial has appointed Lorraine McFadden as business development manager for Scotland and Peter Breeze as business development manager for West Midlands and Mid Wales.

Breeze has been promoted into his role after joining Ideal Commercial in 2017 as a sales support engineer. With 11 years' experience in the industry, he started out as a contractor for an independent merchant, working on renovation and heating projects in London and the Midlands. He then became a branch manager at Dougfield Plumbers Supplies.

McFadden will bring a vast amount of experience from the HVAC industry, including nine years as a technical engineer for ASM Pumps at BSS and two years at Neville Lumb. More recently, she was area sales manager for Scotland at Herz Valves for three years.

She will take over from Charlie Newell, who has been promoted to country manager commercial products for Scotland and Northern Ireland.

■ Call 01482 492251, email [commercial@idealboilers.com](mailto:commercial@idealboilers.com) or visit [www.idealcommercialboilers.com](http://www.idealcommercialboilers.com)



**Zehnder radiators look ace in Wimbledon's newly refurbished show court >**

Zehnder Group UK, the radiator and indoor climate solutions specialist, has installed 70 of its radiators in the redeveloped No 1 Court at Wimbledon, which opened with a grand ceremony on Sunday 19 May.

The revamped show court, which now features a roof, has been under construction since 2013 and was unveiled in time for the 2019 All England Championships, which take place from 1-14 July.

Four different Zehnder and Bisque (Zehnder's designer brand) radiator models have been installed in the development, all chosen for their robustness, impressive aesthetic and simple installation.

Sales manager Mark Prentice said: 'The All England Club at Wimbledon is such an iconic location and the No 1 Court project has been years in the making. We are so proud that so many of our products have been specified; the fact that different models have been installed in different locations shows the diversity of our range.'

■ Visit [www.zehnder.co.uk](http://www.zehnder.co.uk)



**Sontay sensors prove successful for French TV channel >**

Regional French television channel France 3 Normandie is moving its headquarters to a new building in Rouen.

Once the space is delivered, its occupants will benefit from a state-of-the-art building management system (BMS) that integrates a range of Sontay Smart sensors.

In keeping with the technology that France 3 is using in its day-to-day work, the BMS is sophisticated and forward thinking.

More than 80 ST-TOUCH-P touch thermostats, using Modbus, have been deployed on this project.

■ Visit [www.sontay.com](http://www.sontay.com)



**Bring retail to life with Sylvania Exposit**

Sylvania has launched Exposit, a highly functional LED, with aesthetics front of mind. Exposit gives high-quality light exactly where and how retailers need it most. With up to 129lm/W system efficacy and 50,000 hours' lifetime, the range is highly efficient, and capable of drawing attention to specific areas in store. Thanks to its flexibility, Exposit is designed to accommodate future changes to store layout and design trends.

■ Visit [lighting.com/en-gb/applications/retail](http://lighting.com/en-gb/applications/retail)



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**Energy Efficiency**



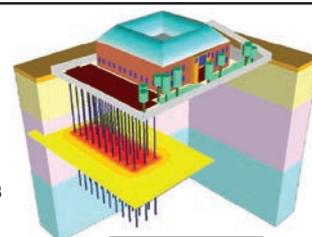
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### Senior Electrical Design Engineer

North London, £55k + bens

Award winning sustainability focused consultancy with an impressive portfolio is growing their team again due to increased workload nationally and overseas. With more than 30 years in the industry they continue to strengthen their reputation for delivering exceptional projects of all sizes across multiple sectors. Rapid progression, great benefits/package offered to a client facing leader. Ref: 5476

### Senior/Principal Electrical Engineer

London, £50 - £65k + bens

Dynamic, innovative and creative does this sound like you? How about working for all of the above with one of London's most pioneering and progressive MEP Consultancies? You will be working in partnership the world's leading architects on some of the most iconic and complex projects in London and overseas. Ref: 5412

### Intermediate to Senior Electrical Design Engineer

Dublin, Republic of Ireland, €50 - €60k + bens

This consultancy organisation employ well over 500 staff worldwide, with a network of offices in the UK, Europe, Middle East, North Africa, Asia, and Australasia. From the Dublin office alone they have worked on an impressive list of projects across a variety of sectors including healthcare, mission critical, commercial, and local authority. Their work has been noted for its innovation and sustainable approach, which has been recognised with several industry awards and commendations. Ref: 5520

### Mechanical Associate / Project Leader

London, £65k - £80k + bens

This is an exciting opening to work on some of London's flagship projects ranging from £30 - £80 million construction value, with a specific focus on large-scale mixed-use projects. You will be acting as Mechanical lead on this project liaising directly with in house design teams and external stakeholders. Ref: 5519

### Electrical Engineer

London, £41p/h

An Electrical Engineer is required to work on a long-term contract in London. You will initially provide conceptual design moving on to the detailed design afterwards. Designing on a large commercial project overseas the work includes, Low voltage, lighting, cable sizing, electrical power distribution and alarm system designs. Applicants must be proficient using Amtech software. Ref: 5511

### Senior Mechanical Consultant

London, £42p/h

A Mechanical Design Consultant is needed for an independent Building Services Company. You will report directly between the client and main contractor as the lead mechanical engineer. Working between site and from home, providing site inspections, review and comment on contractor's working drawings on a mixed use high end residential and commercial scheme in London. Ref: 5508



Modern manufacturing processes can reduce construction stresses on site, says Caplehorn (inset)

# Manufacture change

Building safety has long been of interest to CPA interim chief executive Peter Caplehorn, who chaired the Hackitt review's regulations working group

Peter Caplehorn was promoted to interim chief executive of the Construction Products Association (CPA) in May 2019, after five years as deputy chief executive and policy director. A chartered architect with more than 35 years' experience, he sits on numerous committees across the building industry. Most recently, he represented the CPA in the Industry Response Group, initiated by the UK government after Grenfell. He was also asked by Dame Judith Hackitt to chair the regulations working group for her independent review, and to sit on the products and the golden thread working groups.

## Can industry respond to the challenges laid down by Dame Judith Hackitt and the building safety reform proposals?

Industry has already started to respond. Build UK, the Construction Industry Council and the CPA formed an Industry Response Group – a joint government/industry forum set up to address shortcomings in building safety revealed by Grenfell. The group has welcomed and supported the proposed regulatory changes suggested in Dame Judith's review and has been engaging with, and responding to, the report's key findings – notably in the areas of competence in construction, product marketing information and digitalisation of the industry. The challenges are complex and the solutions require regulatory reform and cultural change across the sector. To reach permanent and robust reform, industry must continue to work in a proactive and collaborative manner with government.

## Must industry embrace modern construction methods to change?

Modern methods of construction are integral to the construction industry's future and offer exciting solutions to challenges around efficiency, skills shortages, quality control and waste. There are many other ways that our industry must change, however – by embracing digitalisation, reforming procurement and contracts, and creating new, more collaborative supply chain relationships. Together, these will help achieve necessary improvements in productivity, performance and safety.

Critically, too, there's more to be done to improve wellbeing and mental health. The use of manufacturing processes to reduce construction stress on site is a vital part of addressing this.

## What will manufacturers need to do to create digital records?

They already create significant digital records about their products, but most of the information remains behind factory gates. One of the key goals of digitalisation is to allow non-sensitive data to be shared easily and clearly across the wider construction industry.

A digital record will fundamentally change the way we generate, use and deploy information. It will offer more robust datasets that will reduce risk and build confidence by providing machine-readable interoperability and accessible and reliable information. For the digital record to become truly usable, all of these areas need to be joined up. There's been significant progress, but we still have some way to go.

## Are UK manufacturers ready to embrace the circular economy?

In many ways, they are already using principles of the circular economy. They can't act alone, however, and there needs to be further refinement of the supply chain, and activities before and during site operations must be more joined up. Industry should welcome the opportunities presented by moving towards a circular economy, rather than see it as an obstacle. Indeed, many manufacturers are aware of the advantages of reducing waste to a minimum and making sure materials are recycled or reused. Not only does this benefit the environment, but it also makes for a more profitable business model.

## How will Brexit change the movement of products to and from the UK?

Nearly 80% of all the construction products used in the UK are made in the UK. Of the 20% that comes from overseas, nearly 60% comes from the EU. Disruption of these products could be significant if the exact arrangements of customs certification and equivalency have not been rehearsed, or are lacking in practical detail. If and when Brexit goes ahead, we will need to ensure materials and components are not delayed because of customs issues or problems with certification. The UK government has developed the principle of the UK mark and an equivalent of the CE mark; however, the processes and bureaucracy that this involves need to be fully tested to ensure delays are eliminated, or at least minimised.

## NATIONAL EVENTS AND CONFERENCES

### Build2Perform Live 26-27 November, London Olympia

The programme for 2019 Build2Perform Live is now available. The free-to-attend event brings people together to learn about, discuss and collaborate on the current issues vital for delivering better building performance. It will host more than 60 sessions delivering high-quality content from 90-plus speakers.

Highlights of the programme include: decarbonising heating and cooling for a low carbon future; technologies of the 'fourth industrial revolution'; competence in a post-Hackitt world; new climate projections; responsible retrofits; and what health and wellbeing mean in practice.

The programme will also feature the latest policy updates, including Building Regulations and compliance responsibilities.

An exhibition - featuring more than 70 exhibitors from major manufacturers and suppliers from the building services engineering sector - will also be hosted at the two-day event.

[www.cibse.org/b2plive](http://www.cibse.org/b2plive)

### CIBSE TRAINING

For details, visit [www.cibse.org/training](http://www.cibse.org/training) or call 020 8772 3640

### Electrical services explained 2-4 July, London

### Fire safety in the design, management and use of buildings BS 9999 3 July, London

### Mechanical services explained 3-5 July, Birmingham

### Gas safety regulations (designing for compliance) 5 July, London

### Lighting design: principles and application 5 July, London

### Above-ground building drainage 8 July, London

### Low carbon consultant EnMS/ISO 50001:2018 8-10 July, London

### Low carbon consultant design 9-10 July, London

### Mentoring skills training 11 July, London

### Emergency lighting to comply with fire safety requirements 12 July, London

### Overview of current fire legislation and guidance 15 July, London

### Overview of IET wiring regulations (18th edition) 15 July, London

### Practical project management 16 July, London

### Low carbon consultant building operations 16-18 July, London

### Building services explained 17-19 July, London

### Lighting: legislation and energy efficiency 23 July, London

### Avoiding overheating 24 July, London

### High voltage (11kV) distribution and protection 31 July, London

### Energy Savings Opportunity Scheme 1 August, London

### Practical controls for HVAC systems 1 August, London

### Fundamentals of digital engineering (including BIM) 6 August, London

### Sanitary and rainwater Design 6 August, London

### Fire sprinkler systems: design to BS EN 12845 7 August, London

### ISO 50001 2018 half-day update 14 August, London

### The importance of energy efficient buildings 4 September, London

## CIBSE GROUPS, SOCIETIES AND REGIONS

For more information about these events, visit: [www.cibse.org/events](http://www.cibse.org/events)

### CIBSE closing date surgery 3 July, London

An opportunity for anyone applying for ACIBSE or MCIBSE to speak to a professional interviewer and get tips and advice on completing the Engineering Practice Report.

### North West: membership briefing 4 July, Manchester

Briefing that looks at routes to Associate and Member grades, and registration with the Engineering Council at Incorporated and Chartered Engineer levels.

### West Midlands: summer social 20 and 21 July, Shrewsbury

Visit to Loton Park speed hill climb to see a variety of sports, classic and racing cars.

### HCNE: lifts and escalators 23 July, London

With presentation from David Cooper, MD of LECS (UK).

### YEN South West: future-proofing our designs 25 July, Venue TBC

An evening discussion asking experts how we can design for the future, to respond to economic, environmental and social trends.

### South West: summer social 2 August, TBC

A games night summer social.

### West Midlands: summer social 3, 24 and 25 August, Shrewsbury

Visit to Loton Park speed hill climb to see a wide variety of sports, classic and racing cars.

### Northern Ireland: golf social 8 August, Bangor

Golf, followed by a meal at the clubhouse.

### Western Australia: IoT - the neurology of building operation 3 September, Perth

Part of the ANZ seminar series.

### Northern Ireland: golf social 5 September, Carryduff

Golf, followed by a meal at the clubhouse.

## HIGHLIGHT



David Cooper, LECS, will speak at the HCNE event on 23 July

## Tenth Symposium on Lift and Escalator Technologies 18-19 September, Northampton

The Lift and Escalator Symposium brings together experts from the field of vertical transportation, offering opportunities for speakers to present peer-reviewed papers on their research.

This year's event will be at Highgate House hotel, and speakers include industry experts, academics and postgraduate students. For more information, visit [www.liftsymposium.org](http://www.liftsymposium.org)



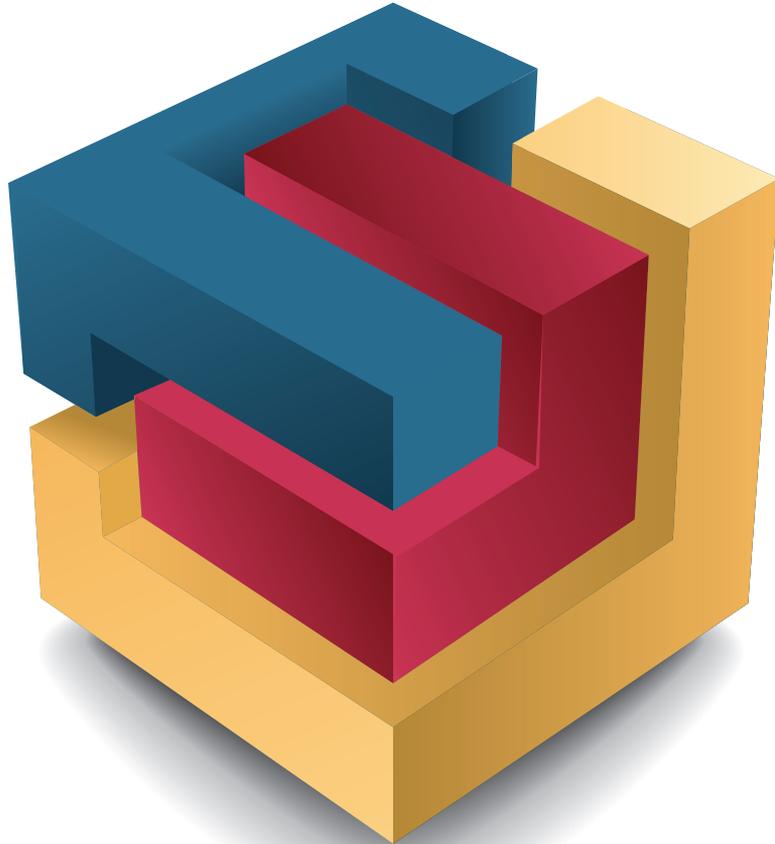


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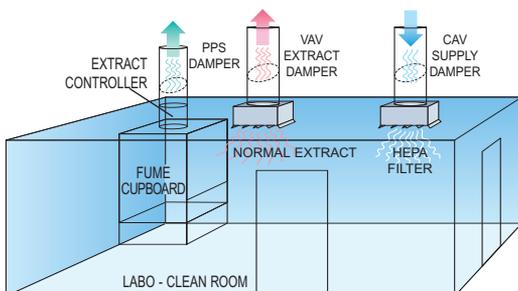


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