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#Build2Perform

June 2019

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Uncertainty, adaptability, agility. That was the title of Professor Lynne Jack's Presidential address last month. CIBSE's first female President outlined the challenges facing the industry around climate change and told the audience that the skills building services engineers possess mean they are ideally placed to decarbonise the built environment.

Jack's presidency comes at a defining moment for the construction industry. The government is expected to publish draft Building Regulation legislation shortly, which will implement Dame Judith Hackitt's recommendations in her *Building a safer future* report.

Grenfell should lead to a significant transformation

in the construction sector, said Jack. She agreed with the report's view that change will not be possible without the widespread adoption of digital technology, and said Dame Judith was absolutely correct with her call for the creation of digital records to maintain a golden thread of information for buildings. CIBSE's Society of Digital Engineering was at the forefront of the ongoing tech revolution in our sector, Jack added.

An example of how digital technology is having a real-world impact on building performance is MJ Mapp's plan to use Demand Logics' data-analysis platform on all 60 multi-tenant offices it manages (see page 65). Sustainability manager Carl Brooks says that the real-time analysis of performance has enabled it to save one client £45,000 in energy bills over one year – an 8% reduction. He says the same again has been saved in maintenance, as the platform enables engineers to be assigned tasks more efficiently through condition-based maintenance.

Demand Logic is also planning to install sensors to capture environmental data on CO<sub>2</sub>, relative humidity and air pollution. Brooks says these sensors are likely to identify areas with poor air quality that might require more energy-using ventilation – an unintended consequence of the wellbeing agenda that needs to be considered.

One way around this is to design naturally ventilated buildings, such as the LSE Aldwych campus designed by Rogers Stirk Harbour + Partners. ChapmanBDSP was the building services engineer and, on page 30, we explain how the consultant ventilated academic spaces from levels three to 12 by working closely with the architect on building orientation, shading and cross-ventilation from the start.

The aim was to show environmentally aware students that the LSE is doing all it can in its new buildings to reduce its carbon impact. As Jack says in her interview (page 22), it is the determination of young people to address climate change that will help drive industry and governments to help the planet... before it's too late.

ALEX SMITH, EDITOR [asmith@cibsejournal.com](mailto:asmith@cibsejournal.com)



## CONTRIBUTORS



**Hywel Davies**  
 CIBSE's technical director looks at the global fossil fuels industry and the rising demand for energy



**Russell Wood**  
 What building services engineers will need to do to ensure the resilience of future smart cities



**Liza Young**  
 With a female CIBSE President, what is industry doing to promote diversity and inclusivity



**Tim Dwyer**  
 The latest CPD looks at the practical requirements for efficient and safe refrigerants



# CONTENTS

## News

### 7 News

First-quarter slump blamed on Brexit; new zero carbon framework; mental health help

### 14 CIBSE news

New CIBSE president; façade engineers' fire-safety role; new heat pumps code of practice

## Voices

### 18 Fossil futures?

Hywel Davies ponders whether renewables can keep pace with demand for electricity

### 20 Climate action

Julie Godefroy outlines what CIBSE is doing – and plans to do – about climate change

### 37 Get smart about power

Russell Wood on ensuring resilience for an electric future

### 39 Broader perspective

Data centres need much wider limits on temperature and RH, says Professor Ian Bitterlin

### 65 Q&A

Carl Brooks on managing properties using data analytics

## Features

### 22 COVER FEATURE

#### Engineer first

Interview with new CIBSE President Lynne Jack

### 24 Prime example

Liza Young on why inclusivity and female role models benefit engineering organisations

### 28 Playing to win

Diagnosing building faults just got easier, with a BIM-computer games mash-up. James Milton explains

### 30 Treading lightly

Andy Pearson investigates a natural ventilation solution for a 13-storey tower in London

### 34 Leaner machines

Applying data to buildings will cut energy consumption, says Andrew Henderson



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with this issue or online at [www.cibsejournal.com](http://www.cibsejournal.com)

## Technical

### SPECIAL FEATURES

Chillers, air handling units

### 41 News

A round-up of chiller and air handling unit product news

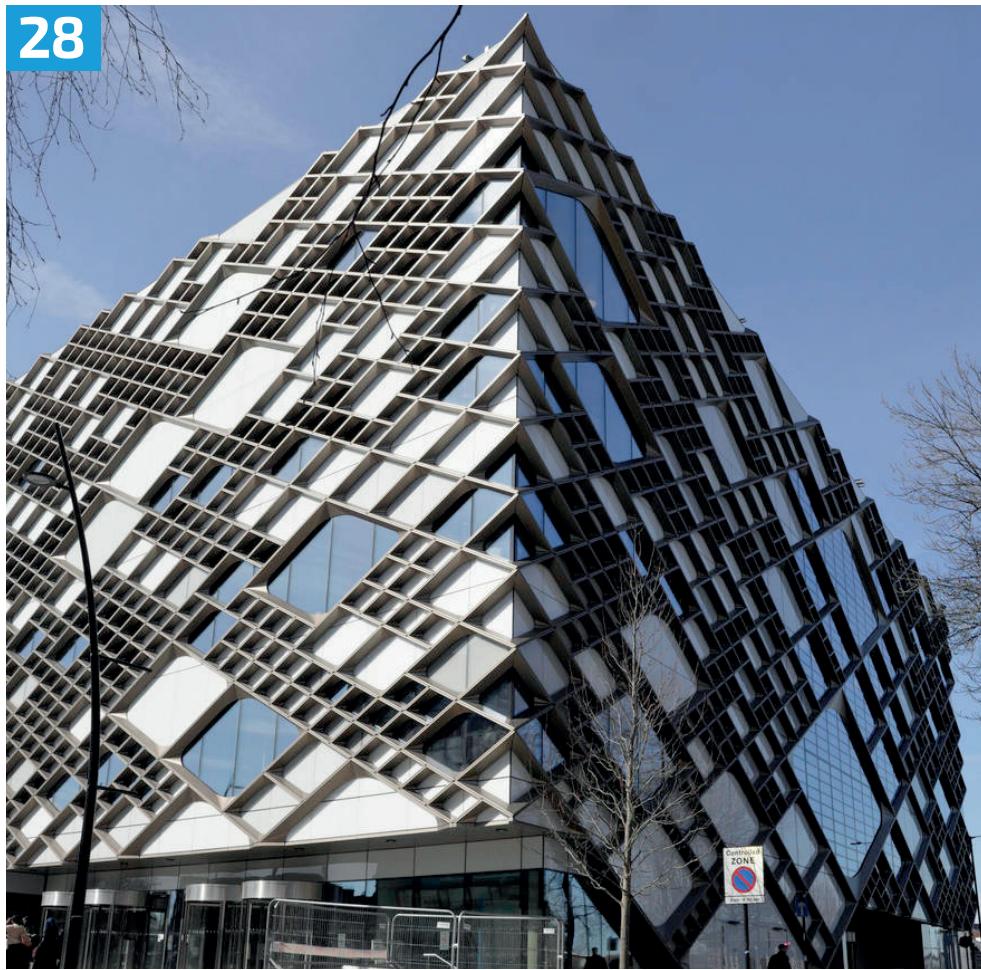
### 47 Singapore slim

A Tetris-like solution was the only option when a space-constrained data centre needed upgrading, as Michael Tang explains

### 50 Towering savings

Andrew Russell considers how to make savings by using non-potable water in cooling towers





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## CPD

### 55 Ensuring safe, environmentally sensitive refrigerants for building services applications

The demanding practical requirements for efficient and safe refrigerants and the application of lower-flammability refrigerants

## Classified

### 60 Products

A round-up of systems and services for the industry

## Jobs

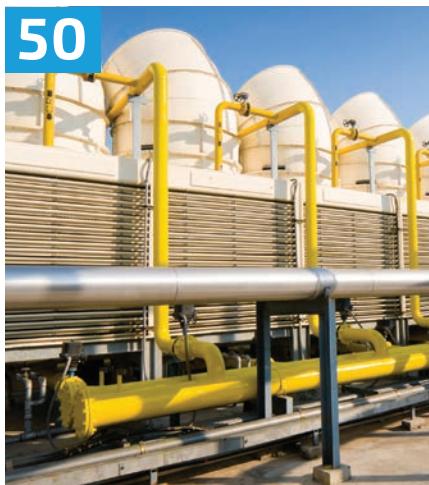
### 64 Appointments

Jobs at [jobs.cibsejournal.com](http://jobs.cibsejournal.com)

## Events

### 66 Looking ahead

Facilities Show; Build2Perform Live; avoiding overheating training course; CIBSE training; CIBSE groups, regions and societies



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## OPEN FOR PRAYER – CAMBRIDGE'S £23M SUSTAINABLE MOSQUE



A £23m sustainable mosque in Cambridge has opened for prayer. The Central Mosque has a 1,000-capacity prayer hall, community kitchen and café, teaching rooms, two residential units and an underground car park.

The form and fabric of the building ensures it can be naturally lit during daylight hours and naturally ventilated throughout the year, even during peak occupancy.

Air-source heat pumps are used for underfloor heating and cooling. Power produced by rooftop solar panels provide the hot water and cooling, and 13% of heating. Rainwater is harvested for flushing toilets and irrigation. The services engineer was Skelly & Cooch and the building was designed by Marks Barfield.

## Brexit blamed for sector's first-quarter slump

### Pipeline of forward projects down by nearly 25% on past two years

There was no growth in new construction work in the first three months of the year, according to the latest figures from the Office for National Statistics.

The infrastructure and public sectors did grow, by 5.6% and 3.3% respectively, but these figures were cancelled out by falls in the private commercial and housing markets of 4.7% and 1.2%. There was an overall dip of 1.8% in March, which coincided with the date the UK was supposed to leave the EU.

Output from the entire construction market grew by 1% in the first three months of 2019, thanks to a rise in repair and maintenance work, with the private housing and non-domestic sectors growing by 4.0% and 3.5% respectively.

Central London is bucking the trend, with new office construction growing at its highest level in three years, according to a new survey from Deloitte. It reported that 37 new schemes 'broke ground' in the past six months, with 3.5 million ft<sup>2</sup> of commercial space started – a rise of 38% since the previous survey late last year.

Four new starts at King's Cross will add almost 1 million ft<sup>2</sup>, including a new headquarters building for Facebook, while eight major refurbishment projects in the City of London got under way, delivering around 800,000ft<sup>2</sup>.

There is concern, however, that the pipeline of forward projects – totalling 30 million ft<sup>2</sup> – was down by nearly 25% on the past two years.

'London's office market remains resilient in the face of uncertainty as we witness an encouraging increase in new construction starts,' said Deloitte Real Estate director Mike Cracknell. 'This is testament to developers' continued confidence in London's office-leasing market long term.'



The London office market remains resilient

### SEC calls for action on payment as industry insolvencies rise

Campaigning industry body the Specialist Engineering Contractors' (SEC) Group has called for 'urgent action on measures to tighten payment security' in the wake of the latest insolvency statistics published by the Office for National Statistics (ONS).

There were 3,013 company insolvencies linked to construction in the year to the end of March, which is the highest number for any sector in the UK.

SEC Group chief executive Rudi Klein described the figures as 'alarming', adding that he was 'disappointed that, 18 months since the collapse of Carillion, we are still waiting for decisive action on payment'.

He said a large number of the business failures could be traced back to Carillion, but 'many are the result of worsening cash flow and widespread payment abuse'.

SEC Group is promoting two private member's bills in the House of Commons to improve construction payment security – the Construction (Retention Deposit Schemes) Bill, laid by Waveney MP Peter Aldous, and the Public Sector Supply Chains (Project Bank Accounts) Bill, laid by Debbie Abrahams, MP for Oldham and Saddleworth.

It plans to pursue these measures through to the next session of parliament.

## Coal-free record as UK draws on renewables

The UK has experienced its longest period without burning coal to produce electricity since the Industrial Revolution, according to the National Grid.

There was no coal-fired power generation at all during the first week in May, as renewables took up more of the demand. It comes just two years after the country experienced its first coal-free day.

The National Grid Electricity System Operator, which runs the network in England, Scotland and Wales, said high international coal prices were also making the fuel a less attractive source of energy. This prompted National Grid director Fintan Slye to predict that the Grid could go 'zero carbon' by 2025.

'[This would involve] integrating newer technologies right across the system,' he said, 'from large-scale offshore wind to domestic-scale solar panels, to increased demand-side participation, using smart digital systems to manage and control the system in real time.'

Falling coal usage has led to a 50% drop in carbon emissions from electricity generation since 2013, according to the Committee on Climate Change, which has urged the government to legislate for a zero-carbon future by 2050.

## New zero-carbon framework

### UKGBC report aims to build consensus on decarbonising buildings

A new 'framework' to help the construction industry deliver a net-zero carbon built environment by 2050 has been launched by the UK Green Building Council (UKGBC).

*Net Zero Carbon Buildings: A Framework Definition* has input from more than 180 experts and stakeholders, including CIBSE, and is supported by 13 industry bodies. It presents an overarching framework of consistent principles and metrics that can be integrated into tools,



policies and practices', said the UKGBC, adding that the intention was 'to build consensus... on the approach to decarbonising buildings'.

The framework includes guidance for developers, owners and occupiers, and explains how to measure progress towards zero carbon and gather evidence. Two approaches to net zero carbon are proposed for the construction and operational stages, including ways of measuring and offsetting embodied emissions and reducing the energy needed in operation - with residual demand met by renewables.

'The environmental imperative for targeting net zero is now loud and clear,' said Ashley Bateson, CIBSE vice-president and Hoare Lea partner. 'This gives industry a clear basis for reducing carbon emissions from the built environment towards zero in the near future.'

UKGBC said that over the next 10 years, the scope and ambition of the framework would be increased 'to encourage greater action'.

'Additional requirements will be introduced to challenge the industry, including minimum energy-efficiency targets and limits on the use of offsets,' it said.

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## CCC vice-chair says 'real' zero buildings achievable by 2050

**UK has the worst insulated homes in Europe, Baroness Brown warns**

Building services engineers will play a crucial role in delivering the UK's new zero-carbon vision, according to the vice-chair of the Committee on Climate Change (CCC).

Baroness Brown of Cambridge previewed the committee's latest advice to government two days before the publication of *Net Zero - The UK's contribution to stopping global warming*.

She told the gathering of members and guests at the CIBSE Patrons' annual lunch at the House of Lords that buildings would be a key focus of future government policy because they were responsible for a quarter of the country's total CO<sub>2</sub> emissions.

'This is an area where we know we can get to "real" zero - not just "net" zero - over the next 30 years,' she told the Patrons.

However, Baroness Brown warned that it would require a major transition, 'as we have the worst insulated homes in Europe and the

highest proportion of housing connected to the gas grid'.

In its report, the CCC told the government that a 100% reduction in greenhouse gas emissions should be legislated for 'as soon as possible', adding that it could be achieved for the same cost as the measures contained in the Climate Change Act - for example, 1-2% of gross domestic product (GDP).

The committee called for major improvements to the insulation and energy efficiency of existing buildings, as well as a wholesale shift from fossil fuel-based heating. It estimated that the transition to green heating systems would cost around £15bn a year up to 2050, and would involve widespread adoption of heat pumps - in place of conventional boiler-driven central heating - and an acceleration in the use of district heating and hydrogen.

Summer overheating in homes would have to be tackled in parallel, said the Baroness, who also chairs the Committee on Climate Change's adaptation group.

**Baroness Brown of Cambridge**

## Labour's solar plan to tackle inequality and environmental damage together

Labour has pledged to fit solar panels to 1.75 million homes occupied by low-income households as part of a 'green industrial revolution' that will address social injustice while reducing environmental harm.

The initiative would fit solar panels to one million social homes as part of an agreed upgrade programme; the rest would be provided via interest-free loans or grants to low-income households. 'We will reduce fuel poverty and increase support for renewable energy,' said party leader Jeremy Corbyn. 'Environmental destruction and inequality not only can, but must, be tackled at the same time.'

Labour has calculated that the panels would produce enough energy to cut consumers' bills by an average of £117 a year. It said any unused power would be transferred to the National Grid, and the project would create 16,900 jobs and cut CO<sub>2</sub> emissions by 7.1m tonnes. It is part of a wider plan to ensure more than 60% of the UK's electricity and heat comes from renewable sources by 2030, and to allow people to transfer out of carbon-emitting professions into 'skilled green jobs'.



## IN BRIEF

### Ice melting may raise sea level by 2 metres

Scientists believe global sea levels could rise by more than 2 metres by the end of the century, as a result of accelerating ice melting in Greenland and Antarctica.

A new study, based on expert opinions, found that - if emissions continue on the current trajectory - the world's seas would very probably rise by between 62cm and 238cm by 2100. This is double the upper limit outlined in the UN climate science panel's latest report, and would be in a world that had warmed by around 5°C - one of the worst-case scenarios. Around 1.79m km<sup>2</sup> of land could be lost, and up to 187 million people displaced.

### Safety council urges pollution protection for outdoor workers

The British Safety Council's *Impact of air pollution on the health of outdoor workers* report calls for ambient air pollution to be recognised as an occupational health hazard in Britain.

The charity wants the UK government to: adopt the World Health Organization's exposure limits for the main pollutants; ensure ambient air pollution is treated as an occupational health issue, and a workplace exposure limit for diesel engine exhaust emissions is adopted; improve pollution monitoring; and recognise that protection from the dangers of air pollution should be enshrined in law as a human right.

### Tarmac's 'dynamic discount' scheme

Tarmac has unveiled a payment scheme that will reward suppliers with early settlement of bills if they agree to discounts.

Several contractors and other suppliers have been invited to join its 'dynamic discounting' programme. According to a letter sent to suppliers, this makes use of a specialised IT platform (CF20). 'Tarmac shares information with CF20 and indicates an average discount rate that suppliers can offer to access this money, in exchange for earlier payment.'

Tarmac said the system would give its supply chain 'a simple way to manage cash flow and access more flexible payment options'.

**IN BRIEF****Hackitt worried change won't happen**

Dame Judith Hackitt has raised concerns that the change she called for in her review of Building Regulations and fire safety will not be delivered.

Writing in a briefing paper for property manager FirstPort, she said: 'It's really important we keep this dialogue going because the longer we go, post-Grenfell, the more concerned I become that we will allow this to fall away and we will not respond appropriately to change this broken system of ours.'

In its response to the Hackitt review in December, the government promised to implement her proposals in full. Almost all measures were subject to a consultation this spring, but no updates have been released by the housing department so far.

**Commissioning services guide**

To help site managers supervise commissioning activities, the NHBC Foundation, in collaboration with BSRIA, has launched *At your services – what to expect during commissioning*.

While commissioning must be carried out by specialists and competent installers, the new guide aims to help site managers engage more closely with the commissioning process, and to ask the right questions at the right time.

It aims to give them the tools to be inquisitive about the commissioning activities they should expect to see on their sites.

**Brexit stockpiling**

Manufacturing stocks of finished goods were reported as significantly 'above adequate', at their highest balance since the financial crisis, according to the latest monthly CBI Industrial Trends Survey.

The survey of 279 manufacturing firms revealed that order books further deteriorated compared with the previous month, with total orders reaching their lowest balance since October 2016. Export orders worsened to a balance not seen since July 2016.

Anna Leach, CBI deputy chief economist, said: 'These results provide further evidence that manufacturers have been stockpiling at a rapid pace as part of their Brexit contingency plans.'

# Engineers 'struggling' with mental health as stress rises

**BESA programme seeks to train people to offer colleagues support**

Many building services engineers are finding it hard to cope with stress in the face of increasing time and financial pressures, according to the current CIBSE Graduate of the Year.

Reanna Taylor (pictured), who is also chair of the Building Engineering Services Association (BESA) Future Leaders group, said more engineers were being forced to work long hours to keep on top of workloads. The additional stress and weight of responsibility were contributing to growing mental health problems, she added.

The BESA group has been rolling out a programme of mental health 'first aid' training. 'This is a huge priority area for us,' Taylor told a meeting of the Society of CIBSE Patrons.

'Employers and colleagues need to be more vigilant so they can spot when someone is really struggling. Stress levels are rising as project times become more compressed and relatively



Taylor: Engineers are being forced to work long hours

junior engineers are being given responsibility for increasingly large packages of work. It is so important that people are trained to understand how to offer support.'

Taylor also told the Patrons that the industry's record on diversity was improving. 'Women in engineering are definitely on the rise,' she said. 'That is fantastic because they bring freshness, new ideas and enthusiasm.'

## PAST-PRESIDENT GRAHAM MANLY DIES

It is with great sadness that *CIBSE Journal* learned of the death of Graham Manly OBE (pictured), past-president of CIBSE and of the HVCA – now BESA – in May. Graham was a dedicated CIBSE member, and known to many *Journal* readers.

Our thoughts are with his family at this time. The July edition will include a full obituary honouring his contribution to the industry, Institution and wider society.



# Antarctic wharf phase complete



Ramboll and BAM have completed the first construction phase of the new wharf being built for RRS Sir David Attenborough on Rothera in the Antarctic. Ramboll is working as technical adviser on the project for the British Antarctic Survey alongside construction partner BAM.

The team have dismantled the existing wharf and installed six of the 20 beams required for the new wharf. The work is part of a programme of works known as the Antarctic Infrastructure Modernisation, and Ramboll has used the experience of working in the extreme environment to inform lean designs in buildings elsewhere (see page 34).

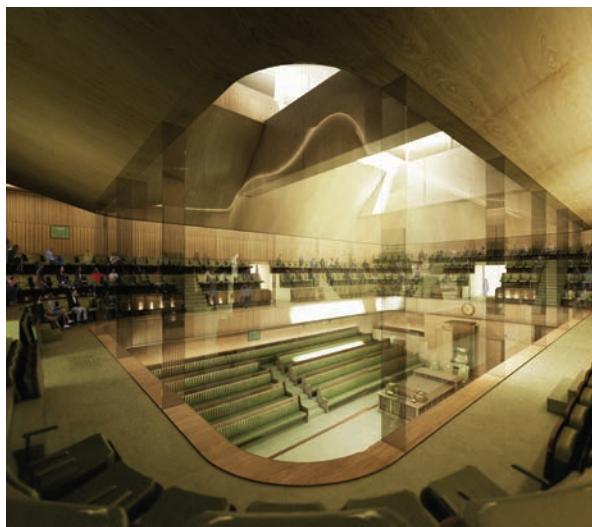
# MPs' temporary home to cost £1.6bn

**Plan is to recreate the House of Commons as faithfully as possible inside Richmond House**

Architects have released images of the temporary chamber being designed to accommodate MPs during their exile from the Palace of Westminster while it undergoes £4bn of urgently needed refurbishment work.

The plan is to recreate the House of Commons as faithfully as possible inside Richmond House, the former home of the Department of Health, to where MPs are expected to move in 2025. Nearby buildings will also be improved and a six-storey office block for MPs built at a cost of between £1.4bn and £1.6bn.

Speaking at Prime Minister's Questions, Theresa May said the refurbishment - which is due to be completed after 2030 - would allow the historic palace to be safeguarded for future generations. 'But it is imperative that parliament keeps the total bill as low as possible,' she said.



## Japanese firm to shake up offsite housebuilding

The government is part-funding the entry of Japan's biggest housebuilder to the UK market in a bid to speed up the adoption of prefabricated construction.

The offsite assembly specialist Sekisui House has received a £30m grant from the government's Home Building Fund and invested £22m of its own money to buy a 35% stake in the Urban Splash modular housing company. It is already building prefabricated housing in the US, China and Australia.

'Using modern methods of construction to build high-quality homes with short build times is one of our great strengths,' said Sekisui House president Yoshihiro Nakai. 'Our technology and know-how can help resolve pressing social issues in the UK.'

Housing minister Kit Malthouse said: 'Backed by government investment, [this] will support our urgent mission to deliver more, better and faster home construction, to ensure a new generation can realise the dream of home ownership.'

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## Researchers claim 3D sound breakthrough

A team from the Universities of Bristol and Sussex has developed 3D-printed metamaterials that could enable sound to be used in a range of health and wellbeing applications.

The researchers believe these new acoustic materials can be used to amplify and pinpoint sound to create high-intensity ultrasounds. These could be focused on cancer tumours, as well as being used to improve sound quality in theatres and concert halls.

'Acoustic metamaterials are normal materials – such as plastic, paper, wood or rubber – but engineered so their internal geometry sculpts the sound going through,' said Dr Gianluca Memoli, research lead and lecturer in Novel Interfaces and Interactions at the University of Sussex.

The metamaterials are 3D-printed into bricks, which are then assembled in a way that allows them to manipulate sound waves, with some of the frequency ranges dispersed, filtered or pinpointed.

## Funding for trees

The government is offering £10m over the next two years to green urban areas and help meet the UK's target to plant one million urban trees by 2022. The Urban Tree Challenge Fund administered by the Forestry Commission, will be open to individuals, local authorities, charities and NGOs. Grants will fund the planting of trees and the first three years of their care, Environment Secretary Michael Gove has confirmed.

# Automation could be boost for engineers, survey reveals



### More than half of respondents said tech would create more opportunities

The adoption of digital technologies may increase the engineering workforce linked to construction rather than shrink it, according to a survey of 800 employers by the Engineering Construction Industry Training Board (ECITB).

According to 62% of respondents, there will be higher demand for engineering technicians

as a result of greater automation, while 59% said more engineering and science professionals would be needed – with 54% anticipating greater demand for skilled mechanical, electrical, instrumentation and electronic trades.

Increased automation and the development of systems driven by artificial intelligence could increase employment opportunities over the next three years, according to 20% of respondents. Only 9% said it would reduce headcount. However, the research found that a lack of investment in training and skills means employers face challenges in harnessing new technologies and processes.

'Technology is a major driver of change across the engineering construction industry and will impact on all sectors,' said ECITB chief executive Chris Claydon. 'However, recruitment challenges and skills shortages are a particular concern.'

'We will continue to develop new training standards to support emerging technologies, and support training providers to equip learners with in-demand technological skills.'

## Underground map could save lives

A planned £3.9m digital register of underground pipes and cables could prevent costly accidents and help to save lives. The Underground Asset Register will show where electricity and phone cables, plus gas and water pipes, are buried, so making them easier to avoid.

Accidental strikes on underground pipes and cables is estimated to cost £1.2bn a year, and workers who hit gas pipes and electricity cables are regularly killed or injured. The government's Geospatial Commission is creating the register, which will involve gathering existing information into a digital database. The project has already started, with pilots in London and the North East.

Minister for Implementation Oliver Dowden said there was currently no comprehensive underground map of the UK's service network. 'Different organisations have their own maps, showing where such things as gas pipes and electricity cables are, but the lack of a combined map creates an increased risk of potentially lethal accidents.'

## Creating good energi

Adam Fabricius, Product Manager - Danfoss

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## IN BRIEF

### CIBSE supports Women in Engineering Day

International Women in Engineering Day is taking place on 23 June with the theme **#TransformTheFuture**. CIBSE will be supporting the day and celebrating the contribution of its female members.

The event was set up by the Women's Engineering Society (WES), to support, inspire, celebrate and raise the profile of women in engineering, and is now an international awareness campaign.

The day offers an opportunity to raise the profile of women in engineering and focuses attention on the amazing career opportunities available to females in the industry. It celebrates the outstanding achievements of women engineers throughout the world.

Get involved and use **#INWED19 #TransformTheFuture**. For more information visit [www.inwed.org.uk](http://www.inwed.org.uk)

### Caple and Rennie on 40 under 40 lighters' list

Two of the Society of Light and Lighting's stars have been named in the '40 under 40' list compiled by the Lighting Design Awards.

SLL past president Richard Caple and Juliet Rennie, SLL coordinator, have both made the list.

The shortlist celebrates the most promising and talented individuals working within the lighting industry. They received their awards at the Lighting Design Awards ceremony in May.



Juliet Rennie

# Façade engineers highlight fire safety role

### SFE chair Saverio Pasetto reports on work of the society's fire committee

The Society of Façade Engineering (SFE) 2019 AGM took place on 2 April in London, looking back over a year of intense society activities, with presentations from committee chairs, and the election of the new 2019-20 board.

It was an opportunity to draw attention to the need for the façade engineering discipline to be recognised outside the façade network in order to be a more established specialism in the construction



Saverio Pasetto

industry. This has been particularly important in the past 18 months with the Grenfell Tower fire bringing 'façade' and 'cladding' into the spotlight.

To this effect, the society engaged with other disciplines, industry bodies, such as CIBSE, RIBA, IStructE and CWCT, and government. The society also set up a specific SFE fire committee to respond to the various calls for evidence and activities related to the Independent Review of Building Regulations and Fire Safety, to provide guidance for SFE members on the emerging issues and resulting regulatory changes. It is also part of the ongoing work on professional competence and encourages all members to contribute to this work, either through the society and its committees, or independently.

With nearly 1,700 international members at various grades, the SFE also wants to encourage students and affiliates to progress to full, corporate membership and benefit from free access to its technical evenings and document downloads.

Due to interest in the UK's Manchester area and from Italy, the SFE Manchester region and SFE Italy have been launched.

Details of the new SFE Board can be found at [www.cibse.org/sfe](http://www.cibse.org/sfe)

Thanks were given to David Watabiki (regions) and Graham Fairley (secretary) for their invaluable contribution, as they step down from their roles.

## Register for 2019 Build2Perform

Registration is now open for the free-to-attend Build2Perform Live 2019 event taking place at London's Olympia on 26 and 27 November.

Now in its fifth year, Build2Perform Live is a huge annual event for practitioners in the built environment who want to be at the forefront of delivering safe, productive and healthy buildings. It brings people together to learn about, discuss and collaborate on the current issues that are important in delivering better building performance, and allow attendees to gain the knowledge and motivation they need to improve the performance of buildings throughout the whole lifecycle.

It will host around 60 free-to-attend sessions delivering high quality content from more than 90 speakers.

CIBSE will draw on the vast network of building performance experts to bring attendees engaging and interactive content focusing on relevant industry themes including: health and wellbeing; policy; digitalisation; modular and offsite construction; climate impact; retrofit and refurbishment; and competence and skills.

Find out more about Build2Perform Live and register for your free place at [www.cibse.org/b2plive](http://www.cibse.org/b2plive)





# Lynne Jack becomes first woman CIBSE President

**Lynne Jack becomes CIBSE President, while Stuart MacPherson is announced as president elect**

**Professor Lynne Jack FCIBSE FSoPHE** took up office as the new CIBSE President at the Institution's AGM on 7 May, becoming the first woman to hold the title. Jack gave her inaugural address 'Uncertainty, adaptability, agility' at the Royal Society in London.

Jack takes over from Stephen Lisk FCIBSE FSLL who handed over the presidency to her.

CIBSE also welcomed **Stuart MacPherson** as president elect, and the new senior CIBSE officers and board

members including:

- Immediate past president: **Stephen Lisk FCIBSE FSLL**
- Vice-president: **Ashley Bateson FCIBSE**
- Vice-president: **Kevin Kelly FCIBSE FSLL**
- Vice-president: **Kevin Mitchell MCIBSE**
- Hon Treasurer: **Adrian Catchpole FCIBSE**
- Board Members: **P L Yuen FCIBSE, Susan Hone-Brookes FCIBSE, Les Copeland FCIBSE, Fiona Cousins FCIBSE, David Fitzpatrick**

Further details and biographies can be found at [www.cibse.org/board](http://www.cibse.org/board) and the full AGM minutes will be published in July's *CIBSE Journal*.

An interview with Lynne Jack is on page 22.

## Chris Jones recognised for contribution with silver medal

Chris Jones has been awarded a silver medal in recognition for his hard work and service to CIBSE and the Home Counties North West region.

He was presented with the award at the HCNW AGM in April.

Since becoming and practising as an energy, environmental and building services engineer, Jones has been very active in contributing to the advancement of CIBSE and the promotion of engagement among members and the wider public within the HCNW Region.

He was elected onto the HCNW committee in 2007 and has since held various posts including treasurer, secretary, chair and events organiser. He wrote the region's Inclusivity Policy – the first region to have one, and has organised around 120 events for the region.

Jones remains a committed and active member, and hopes to continue to assist in developing CIBSE's vision and strategies.



Stephen Lisk hands Chris Jones the silver medal

## Is your membership application ready?

The next UK closing date for the Associate (ACIBSE) and Member (MCIBSE) grades is 1 August.

If you aim to submit, please ensure your application is complete and includes:

- Application form signed and checked by your sponsor
- Work experience listing/CV
- Engineering practice report (4,000-5,000 words excluding projects/career episodes, introduction and listings)
- Organisation chart
- Development action plan
- Qualification certificates, if required, signed by your sponsor
- Relevant fees

Visit [www.cibse.org/closingdate](http://www.cibse.org/closingdate) for further information.

For full details of the requirements and application processes for ACIBSE and MCIBSE membership please visit [www.cibse.org/membership](http://www.cibse.org/membership)

Don't forget you can gain professional registration even if you don't have any academic qualifications.

If you are looking to gain IEng or CEng registration and are not sure if you satisfy the requirements, do get in touch with details of your academic qualifications. We can then advise the best route to registration for you.

If you do not have academic qualifications, you can gain IEng or CEng by completing a technical report or undertaking further learning to the required level.

### Still need help and guidance?

CIBSE offers a wide range of support for applicants ranging from workshops to briefing sessions, and phone surgery appointments with CIBSE interviewers. Visit [www.cibse.org/briefings](http://www.cibse.org/briefings) for details.

It also provides sample reports, interview documentation and other useful information in the applicant help pages at [www.cibse.org/applicanthelp](http://www.cibse.org/applicanthelp).

If you have any questions contact [membership@cibse.org](mailto:membership@cibse.org) or call +44 (0)20 8772 3650.



## CIBSE Journal technical editor receives award

Professor Tim Dwyer has become the first-ever recipient of the Lord Howie Award presented by the Society of CIBSE Patrons.

The award seeks to recognise the contribution made by an individual to the building services industry, whose efforts do not always receive the recognition they deserve.

Named after Lord Howie of Troon, an engineer, journalist and parliamentarian, who was honorary president of the Patrons, the award was set up to commemorate his long support of the society. The award was presented by Lord Howie's daughter Alisoun at the Patrons Lunch held at the House of Lords in April.

In his citation, Mr Fitzpatrick described Dwyer as a 'well-known and extremely popular figure in our community who has never sought acclaim or profile - the ultimate unsung hero'.

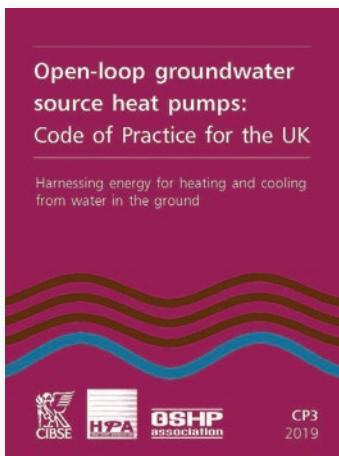
He added that Dwyer had worked diligently behind the scenes (and occasionally in front of them) 'for the best part of 40 years on many projects that sit at the heart of CIBSE and all that it stands for'.

Dwyer said he was overwhelmed to be the first recipient. 'This is a glorious industry, which has given me so many fantastic experiences over the years.'



**Professor Dwyer receiving his award from Lord Howie's daughter Alisoun and Patrons chair David Fitzpatrick**

# New code to help harness energy



### Guidance on harnessing energy from well and mine water

A new Code of Practice, offering guidance on harnessing energy from water in the ground for heating and cooling has just been published.

Titled, *CP3 Open-loop groundwater source heat pumps: Code of Practice for the UK*, the publication aims to raise standards across the groundwater source heat pump supply chain and encourage the adoption of the technology.

The code has been produced as a joint project between the CIBSE and the Ground Source Heat Pump Association (GSHPA) with the backing of the Heat Pump Association (HPA) and has been supported by BEIS.

This code can also be included in the tendering/contracting process to specify minimum requirements for a project. Its adoption by developers could be used to give assurance to customers and property purchasers that their GWSHP scheme has followed a set of design, installation and commissioning standards.

CIBSE, GSHPA and HPA are also working to develop compliance checklists and training to ensure the skills necessary to implement the code are available across the sector.

The draft of this Code of Practice was prepared by a consortium led by Themba Technology under contract to CIBSE and in association with HPA and GSHPA.

*CP3 Open-loop groundwater source heat pumps: Code of Practice for the UK* is available on the CIBSE Knowledge Portal at [www.cibse.org](http://www.cibse.org) hard copies priced at £20 for members and £40 standard, with PDFs £36.

## New members, fellows and associates

### FELLOWS

**Ebbatson, Simon James**

Woking, United Kingdom

**Hoppins, Shaun**

Plymouth, United Kingdom

**Leung, Ka-Yue**

Ap Lei Chau, Hong Kong

**Lysikatos, Konstantinos**

London, United Kingdom

**Naz, Farah**

Dubai, United Arab Emirates

**Norton, Michael Luke**

Bath, United Kingdom

### MEMBER

**Chan, Yuk Ching**

Kowloon, Hong Kong

**Greenall, Andrew James**

Whitley Bay, United Kingdom

**Ho, Shuk Ying**

New Territories West-2, Hong Kong

**Hui, Michael**

Fanling, Hong Kong

**Ikhade, Monday Aidelajo**

Coventry, United Kingdom

### Ku, Lo On

Taipo, Hong Kong

**Lau, Ka Wai**

Kowloon, Hong Kong

**Longo, Elena**

Potts Point, Australia

**Lui, Yeung Piu**

Sai Wau Ho, Hong Kong

**Makrodimitri, Magdalini**

London, United Kingdom

**McAleer, Connor**

Didcot, United Kingdom

**Mikos, Tomasz Pawel**

Manchester, United Kingdom

**Moore, John James**

Glasgow, United Kingdom

**Rawlinns, John William**

Solihull, United Kingdom

**Rigamonti, Camilla**

London, United Kingdom

**Riley, Oliver,**

Bayford, United Kingdom

**Utaiwim, Sadoon**

Kuala Lumpur, Malaysia

### ASSOCIATE

**Rees, Paul Timothy**

Caerleon, United Kingdom

**Smith, Daryl**

Leicester, United Kingdom

### LICENTIATE

**Ackroyd, Jack**

Leeds, United Kingdom

**Azevedo, Rui Manuel Vasconcelos**

Stoke-on-Trent, United Kingdom

**Barber, Daniel**

Altrincham, United Kingdom

**Burke, Michael Anthony**

Brentwood, United Kingdom

**Carney, Adam**

Liverpool, United Kingdom

**Chisholm, Matthew**

Leeds, United Kingdom

### Dawson, Emily

Surbiton, United Kingdom

**Everett, Simon David**

WREXHAM, United Kingdom

**Flanagan, Joe**

Laindon, United Kingdom

**Franklin, Ryan**

Birmingham, United Kingdom

**Jenkins, Corey**

Leeds, United Kingdom

**Jones, Rory**

Cardiff, United Kingdom

**Mistry, Trusha**

Birmingham, United Kingdom

**Newton, Daniel**

Bournemouth, United Kingdom

**Parker, Liam John**

Wakefield, United Kingdom

**Polkey, Matthew George**

Nottingham, United Kingdom

**Spurway, Peter**

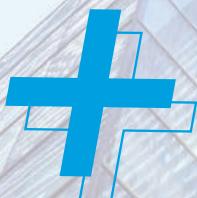
Belper, United Kingdom

**Todkill, Niall**

Leeds, United Kingdom



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# Fossil futures?

**Headlines have focused on Extinction Rebellion protests, teenage activist Greta Thunberg and the UK's drive to be zero carbon by 2050, but the global fossil-fuel market underlines the scale of the challenge, says Hywel Davies**

There has been much talk of the 'climate emergency' in recent weeks, alongside protests, meetings between campaigners and the Environment Secretary, and the latest report from the Committee on Climate Change.<sup>1</sup> This calls on the government to change the UK target, set by the Climate Change Act, from an 80% reduction in carbon emissions by 2050 to net zero.

The committee report examines a wide range of evidence that our climate is changing significantly – and the influence of carbon dioxide emissions on that change – and calls for a range of policy responses to reduce UK emissions.

Meanwhile, in the US, the most celebrated US investor recently placed a \$10bn bet on future global energy markets. Given Warren Buffett's track record, we should ask what we can learn from Berkshire Hathaway's major investment in the acquisition of Anadarko, a US shale gas producer, by Occidental Petroleum.

According to the International Energy Agency,<sup>2</sup> 'global energy consumption in 2018 increased at nearly twice the average rate of growth since 2010... [and] demand for all fuels increased, led by natural gas, even as solar and wind posted double-digit growth. Higher electricity demand [led to] over half of the growth... Energy efficiency saw lacklustre improvement... CO<sub>2</sub> emissions rose 1.7% last year and hit a new record'.

So, even as we consider a net-zero target for the UK – with a drive to electric vehicles [EVs] and more energy efficient buildings to reduce heating and cooling needs – we see growing total demand for energy and higher electricity demand, even before we start a mass move to EVs and gas-free homes.

The IEA says: 'Demand for all fuels rose, with fossil fuels meeting nearly 70% of the growth for the second year running. Renewables grew at double-digit pace, but still not fast enough to meet the increase in demand for electricity around the world.' One reason is clear – using wind, solar and batteries as our primary energy sources is unaffordable right now. The need for green energy incentives and subsidies demonstrates they are not yet economic.

However, a low carbon vision for the world requires wind, solar and batteries to add far more capacity to supply over the next two to three decades than US shale has added over the past 15 years. And that might just be



**"Renewables grew at double-digit pace, but not fast enough to meet the rise in demand for electricity"**

what has prompted Buffett to invest in Anadarko. If we cannot achieve further rapid growth in renewable generation, and a reduction in energy demand, fossil-fuel demand will grow. This may not fit with a low carbon vision, but it is current economic reality.

Chinese demand grew most – up 3.5%, the highest since 2012, and a third of global growth, with the world's largest increase in solar and wind generation. More than 95% of this went into electricity generation.

Europe, meanwhile, presents a different picture. With 1.8% economic growth, energy demand increased by only 0.2%. German energy efficiency resulted in a 2.2% drop in energy demand and a 6% cut in oil use. Coal and gas use fell too, with almost all net growth in Europe met by renewables.

So, the significant drive to cut energy use and carbon emissions in Europe is bearing some fruit. What Buffett's latest big bet shows, however, is that we need further significant growth in investment in green technologies and reductions in the cost of renewable energy generation and storage. The 'Sage of Omaha' recognises this. Berkshire Hathaway Energy (BHE) Renewables encompasses BHE Solar, BHE Wind, BHE Geothermal and BHE Hydro, making BHE the owner of one of the largest renewable energy portfolios in the US, delivering renewables to millions of US homes.

We must cut demand and emissions further, however, by improving energy efficiency across the economy, particularly in our building stock. We must not simply cut energy use, but improve the overall performance of the building. Australia's NABERS scheme shows what can be achieved in the commercial market – stable policies and political leadership delivering better buildings, attracting more demanding tenants and generating better returns.

We need to design buildings for better performance, both in terms of energy and their comfort, wellbeing and sustainability. New CIBSE guidance on health and wellbeing, as well as a new edition of CIBSE Guide L, will offer practical ways to do this.

## References:

- 1 CCC, *Net Zero – The UK's contribution to stopping global warming*, [bit.ly/CJJun19net](http://bit.ly/CJJun19net)
- 2 IEA, *Global Energy and CO<sub>2</sub> Status Report: the latest trends in energy and emissions in 2018*

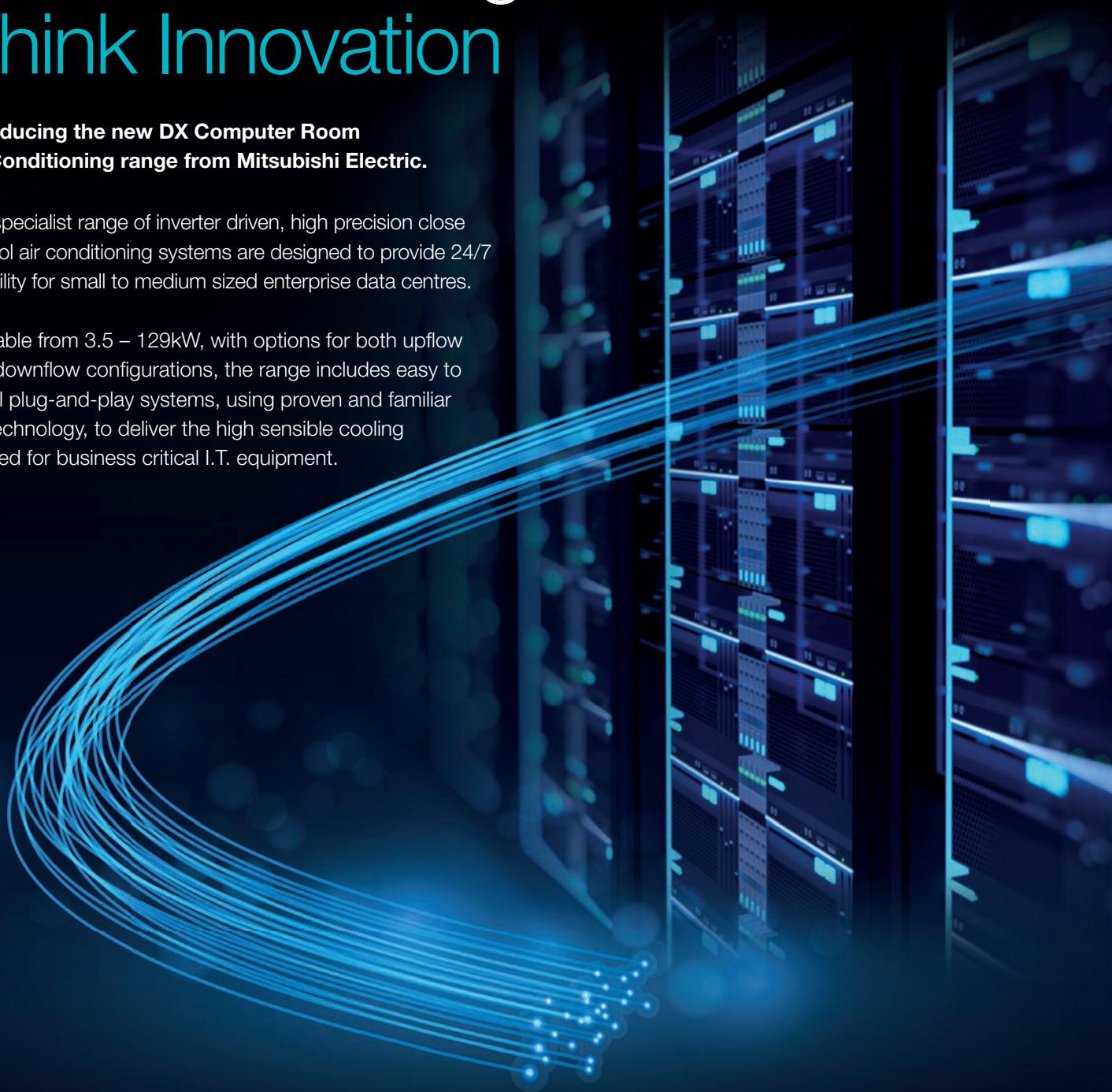


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# Climate action: what can CIBSE do?

The Institution has started mapping its activities around climate change, to allow members and others to understand and access the work being done. Julie Godefroy breaks down the main areas of action

**R**ecent events and reports make it clear that, collectively, we need to do more to reduce carbon emissions and prepare for the impacts of climate change.

CIBSE has long been active on the issue of tackling climate change and promoting building performance, but – to increase our efforts – we have started mapping our current and planned activities in areas where we have a duty – and the ability – to lead as a professional institution.

This is only a first draft. We are very keen to involve our members, other professional institutions and the wider industry.

Please send your thoughts on these initial ideas, additional suggestions for how we could help you, and where you could support our activities, to [technical@cibse.org](mailto:technical@cibse.org)

## Key

- ✓ What we currently do
- Further activity, already planned
- Possible further activity, to be explored
- Collaboration with others

## As a professional institution

- ✓ Code of Professional Conduct: [bit.ly/CJJUne19JG1](http://bit.ly/CJJUne19JG1) This includes:  
‘Members shall promote the principles of sustainability and seek to prevent avoidable adverse impacts on the environment and society’
- ✓ Annual report on activities and membership: [bit.ly/CJJUne19JG2](http://bit.ly/CJJUne19JG2)
- ✓ Collaboration on industry-wide guidance. For example, RIBA Plan of Work and Green Overlay: [bit.ly/CJJUne19JG3](http://bit.ly/CJJUne19JG3)
- Increase awareness of the Code of Conduct
- ► Adopt a common reporting standard across professional institutions – for example, The Edge good practice reporting standard [bit.ly/CJJUne19JG4](http://bit.ly/CJJUne19JG4)

## Events, dissemination and awards

- ✓ Regular reporting on low carbon policy and buildings through our website, *Journal*, blog and newsletter
- ✓ Regular CIBSE events on low carbon policy and buildings
- ✓ Since 2012, a requirement for in-use performance



**“This is a first draft. We are very keen to involve our members, other institutions and the wider industry”**

data for the CIBSE awards

- ✓ Initial steps with RIBA to better align the sustainability criteria in our awards
- Increase our coverage of retrofit design and skills
- ► Seek more collaboration with other professional institutions on sustainability awards

## Practising what we preach – CIBSE’s Balham office

- ✓ Disclosure: Display Energy Certificate
- ✓ Energy efficiency measures and energy monitoring
- ✓ Fuel cell since 2015 [bit.ly/CJJUne19JG5](http://bit.ly/CJJUne19JG5)
- ✓ Sustainability policy covering our activities, premises, staff, procurement, and transport [bit.ly/CJJUne19JG7](http://bit.ly/CJJUne19JG7)
- Planned improvements to our existing buildings, for better summer comfort, and health and wellbeing of staff
- Better use of the opportunities of Balham to test and demonstrate improvements in the performance of existing buildings

## Regulatory framework

- ✓ Regular engagement with policy consultations, including Building Regulations, retrofit, energy efficiency and low carbon heating [bit.ly/CJJUne19JG7](http://bit.ly/CJJUne19JG7)
- ✓ Position statements – for example, Building Regulations Part L and F, and overheating
- ✓ Members of Part L, Part F and overheating working groups for the 2019 Building Regulations review
- ✓ Collaboration with other organisations to align our recommendations where possible – for example, Green Building Council, the London Energy Transformation Initiative
- Review and produce new policy statements – for example, planning and climate change
- Seek more opportunities to collaborate with other institutions to send consistent policy messages

## Technical guidance

- ✓ Extensive coverage of low-energy and low carbon buildings in CIBSE guidance; recent publications

**JULIE GODEFROY**  
is technical manager  
at CIBSE

# No place for cut and paste

'Cut and paste' specification is a sad fact, but CIBSE Patrons are concerned it results in poorly performing – and even unsafe – buildings, writes their chair David Fitzpatrick



A very high proportion of specification documents are poorly written, confusing and misleading. Many even include technical solutions that have not been agreed – or even discussed – by the project team. Why? Because large sections are copied and pasted from previous documents used on other projects. Is this simply sloppy and lazy – or could it be undermining a building's safety measures and leaving the delivery team open to legal action? What about the costly delays that follow when contractors argue – often with justification – that what they have been presented with cannot be applied to the project in hand, and cannot be built without radical revision?

Late changes to a design are the enemy of good engineering, which is why we need clear and concise specification writing to avoid embarrassing our clients and ourselves. Woolly specifications also make it almost impossible to price a job accurately. Yet, sadly, the status of specification writer has been relegated in importance over the years – partly because of time and fee constraints.

This is not an exercise that should be regarded as an inconvenience, however, and delegated to someone with less experience, but more time. Specification is fundamental to the original design intent, and undervaluing it can undermine a building's performance and safety. That is not to say a junior member of the team cannot be given the responsibility, but they must be supported and given proper training.

Embracing digital processes could help, but many of the specification templates used in our sector are so out of date that they cannot be easily translated into the formats required to support modern construction methods and be integrated into building information modelling (BIM). Many don't even reference current standards and regulations. No matter how much technology changes, however, specification will remain at the heart of M&E engineering. How we communicate is vital if we are to remove the ambiguity of interpretation that leads to compromised designs.

- CIBSE Patrons is a group of organisations that give financial and technical support to CIBSE's work – primarily in the area of training, recruitment and career development for young engineers. They are the newest CIBSE Society. For more information and to join visit [www.cibse.org/patrons](http://www.cibse.org/patrons)

- To mark its 40th anniversary, the Society of CIBSE Patrons is contributing a regular column to the *Journal* on topical issues highlighted by members

include the revised Code of Practice for heat networks (CPI) and upcoming **Guide L – Sustainability, 2019**

- ✓ Coverage of climate-change adaptation in existing guidance and weather files
- ✓ Further guidance on delivering building performance, including building simulation
- ✓ Collaboration with others – for example, BSI working groups on retrofit standards
- Extend our guidance in low carbon buildings, with priority themes including:
  - heat pumps
  - heat networks: low-temperature, ambient loops, and low carbon network retrofits
  - demand management
  - reducing plant requirements for demand management and lower embodied carbon
  - retrofit
  - microclimates
- ► Explore opportunities for producing and promoting guidance jointly with other institutions

## Education

- ✓ CIBSE accreditation of engineering courses, including criteria covering low carbon design
- ✓ CIBSE support to the RAErg Centres of Excellence in sustainable building design [bit.ly/CJJune19CJ8](https://bit.ly/CJJune19CJ8)
- Reinvigorate the RAErg Centres for Excellence
- Give further prominence to low carbon design in CIBSE accreditation of courses

## Research

- Research on low carbon buildings, climate-change adaptation and future weather files
- Updated energy benchmarks and benchmarking tool to encourage continuous improvement
- Continuous review of research areas to align with needs for future guidance – for example, retrofit, circular economy, fuel cells, hydrogen boilers
- BSERT special issues on zero carbon and retrofit [bit.ly/CJJUne19JG9](https://bit.ly/CJJUne19JG9)

## Competence and training

- ✓ Regular training and CPDs covering climate change, low carbon buildings, and building performance; certification such as ESOS, Low Carbon Energy Assessor
- ✓ Joint training with Green Register on collaborative design and overheating risk
- Review training programme in line with new technical guidance
- ► Explore further opportunities for multidisciplinary training with other organisations – for example, retrofit, professional ethics
- Introduce mandatory CPDs on climate change and zero-carbon buildings.

# AN ENGINEER FIRST

The new President of CIBSE, Professor Lynne Jack, is the first woman to hold the position. Here, she tells **Alex Smith** that the notion of women reaching senior positions in building services now needs to be considered the norm

**C**IBSE's new President, Professor Lynne Jack FCIBSE FSoPHE, is a vastly experienced public health expert, whose research led to her being awarded the CIBSE Napier Shaw medal. She co-founded CIBSE's Inclusivity Panel and the Scottish region of the Society of Public Health Engineers (SoPHE), and is currently director of research at Heriot-Watt University's Malaysia campus, having spent 24 years at its Edinburgh site.

Jack also happens to be the first female president in the 122-year history of CIBSE. For the Institution, it is a momentous moment, and a powerful signal that women can succeed in what has traditionally been a male-dominated industry.

Its significance is not lost on Jack, who says she has been sent many messages saying how fantastic it is that CIBSE now has a female President. 'As a woman, you have to be visible. It's really important to raise awareness that having a female president should now be the norm, but you also have to know you are being asked to do things because of your own merits and achievements,' says Jack.

'That's important to me, and to many of my female colleagues. First and foremost, I want to be known as the incoming President of CIBSE, and then as the Institution's first female President.'

In her presidential address, Jack was able to share positive news about the increasing number of female CIBSE Members. She said there had been a 4% increase in the past seven years, and pointed out that 23% of graduate members – and 22% of student members – are now female.

Jack was very keen to point out that diversity is not just about improving male/female ratios. 'It's much wider than that. There's clearly work to be done on gender, but it's not the only characteristic that the CIBSE inclusivity panel is looking at.'

She is keen to ensure that diversity and inclusivity are part of CIBSE's make-up. 'They should not be a separate stand-alone strand,' Jack says, 'but should be embedded in the pillars of CIBSE's strategy – namely, membership, knowledge, building performance, voice and engagement.' Attracting a new generation of



engineers from diverse backgrounds will be key to closing the industry skill's gap, she adds.

In her address, Jack outlined that the UK will face a major shortfall in engineers at CEng, IEng and Technician levels by 2023, as the median age of engineers rises.

'We are struggling to attract school-leavers to building services engineering but, the fact there are now more female engineers, means we are doing something right,' she says. 'We know what engineers can achieve, and how rewarding it is as a career, but finding ways of conveying that to young people is crucial.'

Jack praises the #IamCIBSE social media campaign as a big step in the right direction. 'The positive comments engineers have jotted down have been completely inspirational. We have to convey that much more strongly.'

Her presidency comes at a pivotal moment for the building services industry, and she summed up the threats and opportunities in her presidential address, entitled *Uncertainty, adaptability and agility*. She told the audience that shifting global relationships and Brexit unknowns were causing uncertainty over future trade, skills recruitment and

## **'I genuinely don't think we will be able to deliver the recommendations of the Hackitt report unless we collaborate'**

legislation. At the same time, Jack warned the threat of climate change was becoming more acute, with population growth, urbanisation, and the continued emergence of megacities making sustainable development an ongoing challenge.

She says that recent demonstrations by young people over climate change have given her cause for hope. 'It is encouraging that so many people are now engaged in the discussion and that the government appears to be acknowledging energy and climate challenges. This can only be a good thing.'

'There is a heightened sense of awareness of climate change and the need to decarbonise buildings.'

Jack adds that CIBSE's responses to key government documents will help guide future UK policy on moving towards a zero carbon economy. These include: the Institution's response to the consultation on the future framework for heat in buildings; a detailed position paper on recommendations on changes to Building Regulations Part L and F; Defra's Clean Air Strategy; and the London Plan.

In her address, Jack was keen to emphasise that buildings have to be not only comfortable and energy efficient, but also safe. The Grenfell Tower fire still casts a shadow over the construction industry, and CIBSE is closely involved in the implementation of the recommendations laid out by Dame Judith Hackitt in her *Building a Safer Future* report last year.

'For me, Grenfell was a defining moment,' says Jack. 'It should be a moment that leads to a significant transformation in the construction sector.'

'Of course, we want to make society better, improve people's lives, and cut carbon – but the safety of people who live and work in buildings is the core reason we do what we do. We have a moral obligation to make sure Grenfell never happens again.'

If the UK construction industry is to decarbonise and deliver on Dame Judith's recommendations, Jack says the construction

## CAREER HIGHLIGHTS

- 2017-present: Director of research at Heriot-Watt University's campus in Malaysia
- 2018-present: CIBSE representative on the Engineering Council International Advisory Panel
- 2013-2017: Director of Heriot-Watt University's Royal Academy of Engineering Centre of Excellence in Sustainable Building Design
- 2013-2016: Deputy head of the Heriot-Watt School of Energy, Geosciences, Infrastructure and Society
- 2015-present: Chair of the Scientific Committee of the *Conseil International du Bâtiment* (CIB) W62 Working Group
- Co-founder of the Scottish region of Society of Public Health Engineers (SoPHE) Scotland (2009) and the CIBSE Inclusivity Panel (2017)
- Chair of CIBSE's Accreditation panel (2014-17), vice-chair of CIBSE's Education, Training and Membership Committee (2016-present), and member of the CIBSE Scotland Committee (2009-present) and the Ken Dale Bursary Panel (2001-2017).

industry has to work more closely together. 'I genuinely don't think we will be able to deliver against the recommendations of the Hackitt report unless we collaborate,' she says.

'This has to cut across all sectors and all layers, and must include all stakeholders. It's easier said than done, but we must deliver. From a CIBSE perspective we have an obligation to collaborate with other professional bodies. There's a need – and already a willingness – to be open, and to share information and knowledge.'

In East Asia, where she is based, Jack has noticed a willingness to share, particularly in the digital realm. 'There is generally a culture of data gathering, and an openness in sharing data,' she says, and she believes the potential of digital engineering must be realised to meet the challenges facing the industry.

'Dame Judith talked about the importance of holding a digital record of buildings to maintain a golden thread of information – and she is absolutely correct. We have to employ new technologies and techniques to be able to deliver against her recommendations,' Jack says.

CIBSE's growing Society of Digital Engineering is attracting those with IT skills who want to do more to push the digital agenda, she adds. 'There are huge opportunities in digital that will help us to do more with the big-ticket agenda items, such as decarbonisation, energy demand, environmental change and smart infrastructure.'

The society is helping CIBSE stay ahead in digital technology, but Jack believes that the big technology companies – such as Google and Apple – will inevitably enter the industry. 'The tech giants will be able to see the opportunities in the construction sector as well as us, and the question is how we can bring those discussions together?'

Jack says the digital and engineering skills CIBSE members possess will be in great demand as society addresses climate change and the reforms required to guarantee the safety of buildings are introduced. 'We're at the point where we have such a big contribution to make to key societal priorities. This is a really exciting time for CIBSE,' she says. **CJ**



# PRIME EXAMPLE

After the inauguration of the first female CIBSE President, **Liza Young** finds out why inclusivity and female role models benefit engineering organisations and looks at what industry is doing to boost diversity

**F**emale role models in positions of leadership are imperative in the built environment, because 'you can't be what you can't see'.

That's the view of Susie Diamond, partner at Inkling, who says a female CIBSE President [Lynne Jack] is 'bloody marvellous, and about time after 122 years'. 'She's very impressive in her field, she's international and she's smart – but the fact she's a woman is really exciting to me,' Diamond adds.

It's a view shared by many in the profession. Lucy Vereenooghe, operations director at ChapmanBDSP, says: 'The industry has been slowly making steps towards increased diversity and inclusion, but a female role model at the highest level is a step change, and will hopefully inspire future generations.'

David Stevens, vice-chair of the CIBSE Facilities Management Group and a member

of the CIBSE Inclusivity Panel, says Jack will be an excellent president, regardless of her gender. 'It is important, however, that we celebrate our first female president – a role model for young female engineers across the breadth of building services.'

It is just a pity CIBSE members have had to wait until 2019, Stevens adds, while other institutions have had female presidents for at least a decade – including the IMechE, which appointed Pamela Liversidge in 1997. 'Women are still under-represented on the CIBSE board, and there is no female candidate currently in the chain of succession,' he says.

Despite this, CIBSE's membership figures for the past seven years show an upward trajectory for female members. At the end of 2018, 10% of the Institution's membership was female, compared with only 6% at the end of 2011 (see graph on page 26).

The highest ratio of females to males is found among the graduate and student members, however, with women making up 23% of graduate members – up from 16% in 2011 – and 22% of student members, up from 11% in 2011.

However, the drive to get more women into the industry is almost the easy bit, says Kieran Thompson, head of talent, diversity and inclusion at Cundall. 'What we haven't tackled is the problem of women leaving the industry. We can do everything to get a 50-50 male to female ratio at

entry level, but that doesn't mean anything if we can't retain them.'

The equity and ethics strand of Cundall's new sustainability roadmap states that the company is committed to making sure everyone has the opportunity to succeed, regardless of their gender or background, says Thompson. The firm has pledged to substantially increase the proportion of female staff in leadership roles, as well as the proportion of female and ethnic minority global technical hires in all disciplines. As part of his role, Thompson is setting the strategy for the firm to address these challenges.

'Female role models occupying leadership positions are fundamental to the industry having any hope of moving towards gender parity,' he says. 'We've been talking in circles for decades about the gender-equality issue – and we've made some steps in the right direction – but, when you look at the leadership-level figures, there hasn't been a great deal of change. Unless we get that right, at the top level – and establish role models – people aren't going to take it seriously.'

### What can the industry do?

Businesses need to have diverse leadership teams to which all staff, including those who are underrepresented, can look and see clear role models, says Stevens. 'Companies that don't currently have diverse leadership teams should empower the women they do employ to shape the culture, make key decisions and provide support to leaders,' he adds.

Reverse mentoring – where older managers or directors are paired with younger engineers or graduates, often of a different gender or from a different background – is a good way to help senior managers understand the needs and cultural diversity of modern-day workers. 'Younger staff mentor their older mentees in aspects affecting the younger generation, including trends, social media, tech and work-life balance,' says Stevens.

Thompson adds: 'The industry is changing, and someone who is 60 years old needs to be

empowered to realise the positive impact they can have if they adapt their behaviours.'

Traditional mentoring is also important, says Dr Marialena Nikolopoulou, professor of sustainable architecture at the Kent School of Architecture and Planning. 'A mentoring scheme offered by a professional association is invaluable to help link mentors with people that need help and advice, or to offer a sounding board for ideas,' she says.

'When I had difficult decisions to make, I didn't reach out to people within my organisation, but to people outside my workplace – or in another department – whose professional judgement I trusted.'

### Attracting and retaining

To attract more women, the industry needs to showcase and celebrate the many career paths



**Marialena Nikolopoulou**

## "Companies that don't have diverse leadership teams should empower the women they do employ to shape the culture"

available, says Nikolopoulou. 'CIBSE has an important role to play in this, because it's not just about ducts and pipes any more – it covers so much more.'

Branding is a major part of this, says Thompson. 'Images of people in hard hats and high-vis jackets is a clichéd depiction of construction, which doesn't portray an accurate or attractive picture to those who might like a different profession in the industry, outside of being on site.'

People are very engaged politically and culturally, making values-based decisions at a young age, he says, 'so we need to have values-based organisations – and that means treating people with respect, and taking an interest in individuals.'

One of the most important things an employer can do to retain women who have gone on maternity leave, for example, is to offer flexibility and support. Thompson says it's key to maintain contact and to be responsive – and to manage people's expectations about coming back to the job they've left behind. He adds that firms can also showcase the experiences of women who have come back from maternity leave.

A guidance document might also help women feel their organisation cares about the struggle they might go through in the short term, as they get themselves back into a position of confidence, says Thompson. >



### ENGINEERING FOR EVERYONE

**CIBSE Inclusivity Panel chair Atif Rashid explains inclusivity guidelines for CIBSE staff and members, soon to be published by the panel.**

We all want to be treated fairly, whatever the situation or context. A major part of working in the built environment is contributing to improving quality of life for society as a whole. Professional engineering institutions should be driving the implementation of equality, diversity and inclusion practice. Our guidelines cover a range of issues – from events and accessibility to language and knowledge – providing actions that are clear and easy to implement. So, whether you are organising a special interest group event or electing a new regional committee, we'll be giving some top tips to help you treat people fairly, include them and help make CIBSE more representative of society.

Contact [inclusivity@cibse.org](mailto:inclusivity@cibse.org) for details.



Kieran Thompson



At the end of 2018, 10% of CIBSE membership was female, compared with only 6% at the end of 2011

» Keeping-in-touch days can help a new mother stay engaged with the workplace, adds Stevens. 'This can be supported by attendance at staff forums, CPD, professional networking and social events – all of which help reduce the anxiety of returning to the workplace after a long time away. Employers should also consider helping with the cost of childcare during these events.'

Flexible working, compressed hours and working from home – combined with other wellbeing and support programmes – will help staff feel valued, and encourage them to stay with employers too, says Stevens, who believes gender-coded language is another hurdle that needs to be overcome. 'Employers should review workplace policies and job adverts for bias, as masculine language tends to put women off applying for jobs.'

Thompson adds: 'The aim should be to get to a socio-economic spread of people in the organisation, because – as research shows – diverse teams perform better.'

In its report *Increasing diversity and inclusion in engineering – a case study toolkit*, the Royal Academy of Engineering (RAE) found that firms in the top quartile for gender diversity were 15% more likely to have financial returns above their industry's national median.

Tiptoeing around the issues of inclusion and diversity is no longer an option, says Thompson – 'the industry must change so we can fish from a bigger pool during times of talent deficit'.

The RAE report said engineering employers were projected to need 1.82 million skilled people from 2012-22, and 96% of its Diversity Leadership Group firms wanted to broaden their recruitment pool.

'How are we going to make construction an attractive proposition if we don't change internally? Leaders must lead by example,' says Thompson. 'If people feel welcome and have a sense of belonging – which comes from the top – they will stay.' □

## CIBSE RULES OF THUMB FOR WOMEN IN ENGINEERING

*Sara Kassam, head of sustainability at CIBSE, explains some rules of thumb for inclusivity.*

When I was working in a facilities team at a London university, I noticed that – in project meetings for new buildings – the majority of participants were white men. This got me thinking about how I was received and treated in such spaces.

When I moved to CIBSE, I came into contact with many inspiring women engineers and, over the years, have built up a trove of stories, anecdotes, observations, comments and ideas about women in the workplace. From this sharing of experiences, I found that solutions were emerging about how to handle particular situations, which culminated in an event at CIBSE Build2Perform last autumn.

The women's breakfast panel discussion, on making the working environment more inclusive, generated ideas for positive change that men and women can follow. I've distilled some of these into a document, *Rules of thumb for women in engineering*, which will be available online later this year.

These rules of thumb include:

- When a woman's idea is overlooked in a meeting, it's the responsibility of men in the room to go back and say 'she said...'
- Employers need to trust employees to do their jobs in a flexible way – we need to measure outcomes rather than X days of work a week
- More diverse management teams make better strategic decisions and show increased profitability.

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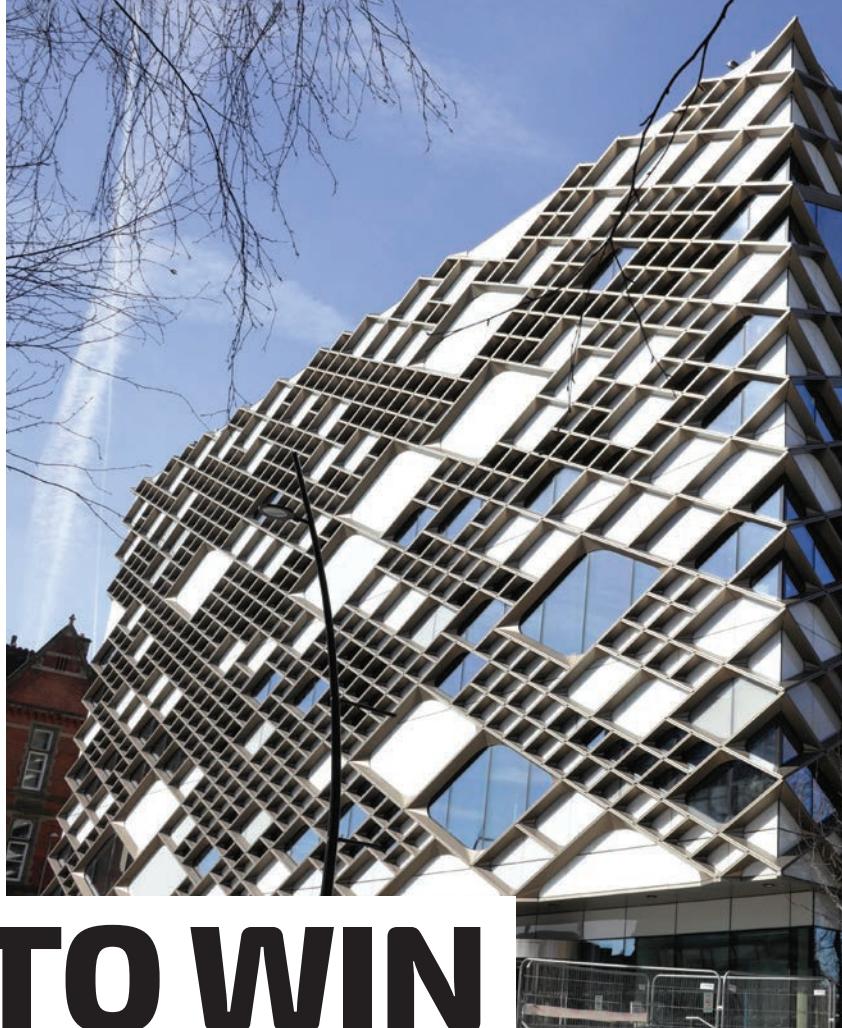
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By combining a BIM model with a computer games engine, **James Milton** was able to create a 3D visualisation of the environmental performance of Sheffield University's Diamond building. He explains how the system can be used with virtual reality headsets to help facilities managers identify environmental trends and diagnose building faults



# PLAYING TO WIN

**T**he University of Sheffield's Diamond building is home to 5,000 students from the Faculty of Engineering, and was the venue for this year's CIBSE Technical Symposium.

It was designed as a smart building and contains approximately 3,000 sensors, which report data about the internal environment continuously. Temperature, humidity, CO<sub>2</sub> levels, seat occupancy, lighting and the heating status are all recorded by the building management system (BMS).

Given the quantity of data recorded, it is not easy to understand the state of the building's environment using simple numerical figures. This means achieving the optimum working conditions of the Diamond – or diagnosing system faults – is not always straightforward, and can potentially lead to an uncomfortable and inefficient building environment.

While studying computer science at the University of Sheffield, I investigated a solution to this problem as part of my final-year dissertation project, supervised by Dr Ramsay Taylor. With the aim of improving

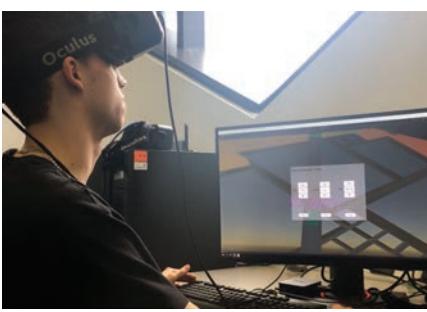
the understanding of the Diamond's internal environmental data, this project combined its building information model (BIM) with the building's data in 3D graphical visualisations, or virtual reality (VR).

The end result was an interactive system that graphically simulates the internal environment of two uniquely structured rooms within the Diamond. This was done by combining the data from its BMS database with an optimised version of Diamond's BIM within the game-development platform Unity.

By observing through a computer screen or VR headset, users can visualise snapshots of the room's environment or watch an animation displaying changes over time.

The application was evaluated by anonymous participants and staff from the University of Sheffield's Estates and Facilities Management department, who completed a survey after experiencing it first-hand. It was found that the implemented system improved the understanding of

Screenshots taken from a video demonstration of the final product. The user is looking around the scene and inspecting the graphical visualisations. They move their head to control the camera angle and use a hand-held controller to traverse the scene, which is being displayed to the Oculus Rift worn by the user and to the desktop screen. The video demonstration can be viewed at <http://bit.ly/CJun19JM>





the Diamond's internal environment.

For users with and without technical experience in building management, it helped identify trends in the environment's behaviour over time, and improved the efficiency of diagnosing building faults.

The images (right) are screenshots of the system in use, with descriptions below. To view a video demonstration of the system visit <http://bit.ly/CJJun19JM2>

Milton's paper *Visually Displaying Past and Present Smart Building Data Through Virtual Reality* was named as the 'Most Significant Contribution to the Art and Science of Building Services' at the 2019 CIBSE Technical Symposium.

**JAMES MILTON** is studying for a Masters in Design at the University of Leeds School of Design

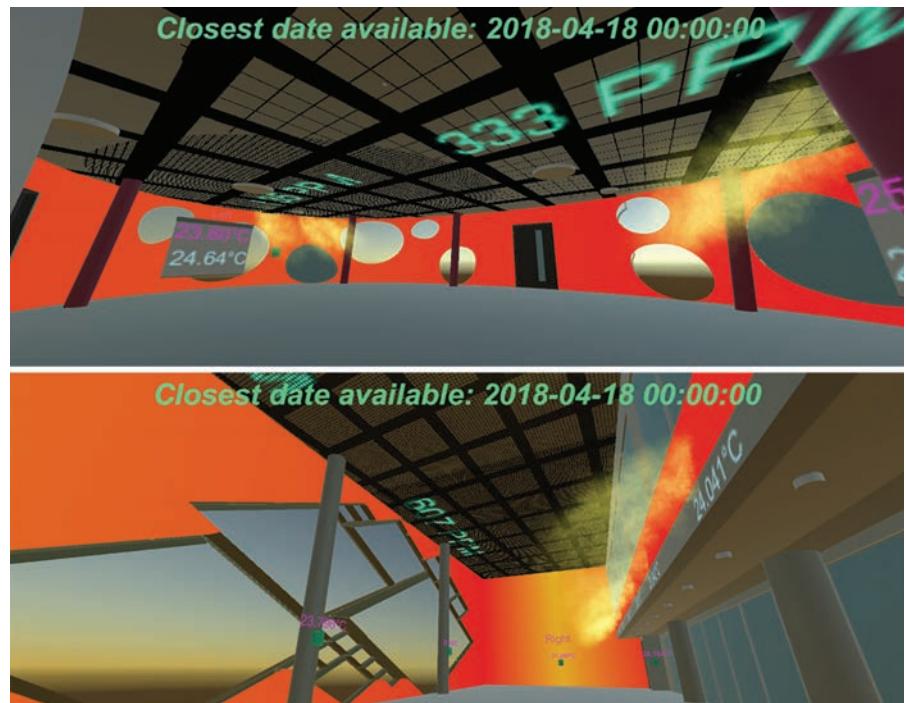
**Image 1:** This date and time picker is used to choose the period for which the user would like to visualise the environment.

**Image 2:** Demonstrates the visualisation of the room's air conditioning status. The user can see coloured smoke coming from the location of each air conditioning vent's position. The actual Celsius temperature figures, written in blue, are positioned beneath each smoke output.

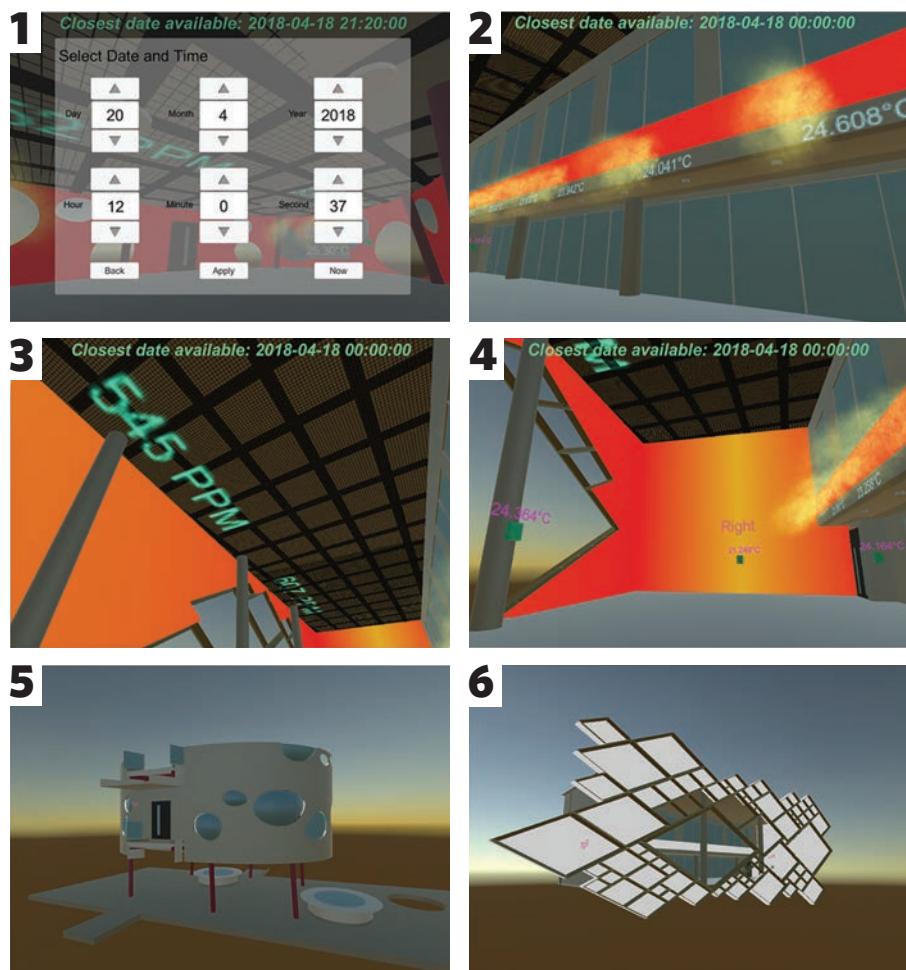
**Image 3:** Shows the visualisation of the room's varying CO<sub>2</sub> concentrations. The user can see two different-sized grids on the ceiling that demonstrate the CO<sub>2</sub> concentration for that area of the room. The large readouts in green show the actual CO<sub>2</sub> parts per million (PPM) data.

**Image 4:** A visualisation of the varying temperatures across the room, mapping the temperature data for each sensor to a colour and applying a gradient of all the colours onto the walls at the correct positions. Above each sensor, in pink, is a temperature readout showing the Celsius temperature figures.

**Image 5 and 6:** Show the exterior of each of the room's graphical models.



Visual output after applying 'Show environment at certain time' feature  
Top: Diamond Work Room 3, bottom: Diamond Computer Room 3



Screenshots of the system in use.

# TREADING LIGHTLY

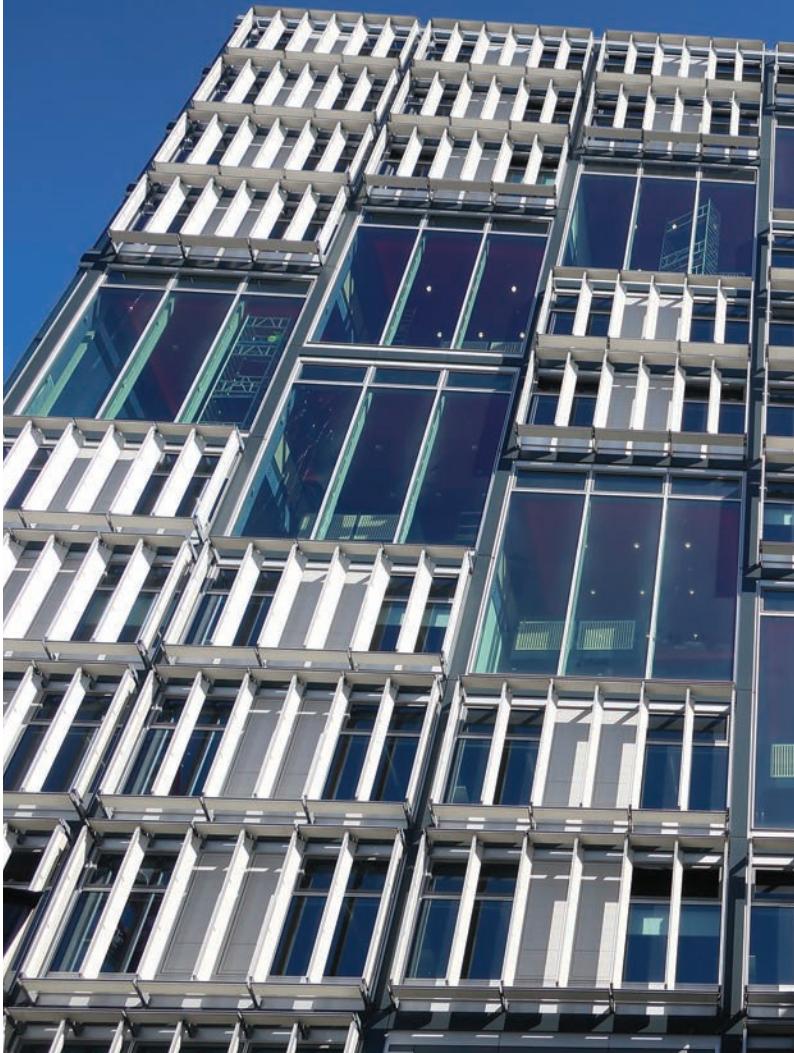
In response to the London School of Economic's zero carbon aspirations, RSHP and ChapmanBDSP have come up with a natural ventilation solution for a 13-storey tower in central London. **Andy Pearson** discovered how they rose to the challenge

**A**natural ventilation solution was never in question,' says Lucy Vereenooghe, operations director at engineering consultancy ChapmanBDSP. She's talking about the building services design for the Centre Buildings Redevelopment at the London School of Economics and Political Science (LSE), where ChapmanBDSP has been working with architect Rogers Stirk Harbour + Partners (RSHP) on a scheme that will form the heart of the School's Aldwych campus.

RSHP and its design team won an international design competition for the £78m project in 2013, with a predominantly naturally ventilated scheme – in response to the brief – that called for a Breeam Outstanding building with an aspiration to be zero carbon.

Opting for natural ventilation was ambitious; getting a solution to work in central London required total commitment. RSHP's design for the 19,000m<sup>2</sup> scheme comprises a 13-storey tower block and the adjoining six-storey Houghton Block, plus a new public square, all enclosed by LSE's existing buildings.

An atrium space separates Houghton Block from the tower, and houses a feature staircase that forms a dramatic circulation route between floors. The staircase continues



diagonally upwards through the tower as a series of double-height spaces, its route clearly visible in the façade.

To facilitate the cross-flow of ventilation air and provide thermal mass, the buildings have reinforced concrete floor plates that are just 16m deep. 'We worked with RSHP from day one on developing the building's form, to enable the scheme to be primarily naturally ventilated in response to LSE's zero carbon aspiration,' says Vereenooghe.

In addition to its form, spaces within the building have been organised to facilitate the natural ventilation solution. The design is vertically zoned, with highly serviced facilities – such as the cafe, auditorium and large lecture theatres – situated at the lower levels. General teaching spaces are on the first and second floors, from where there is access to a terraced garden. Above the second floor are the academic departments, a mix of open-plan and cellular accommodation.

'The occupancy densities, pollution, dust and environmental noise mean comfort conditions on the lower floors have to be maintained using mechanical systems,' says Vereenooghe.

From Level 3 to Level 12, however, comfort conditions in all of the academic spaces are maintained by natural ventilation alone. 'There is no plan B – no mixed-mode option available because there's no riser space and no available chilled water,' Vereenooghe adds. 'The client and the architect were totally committed to achieving this solution.'

The starting point for developing a naturally ventilated solution is the façade. LSE's tower is orientated such that the main areas of façade face east and west; its lower floors are shaded by the surrounding buildings, while the upper floors are subjected to longer hours of uninterrupted solar radiation.

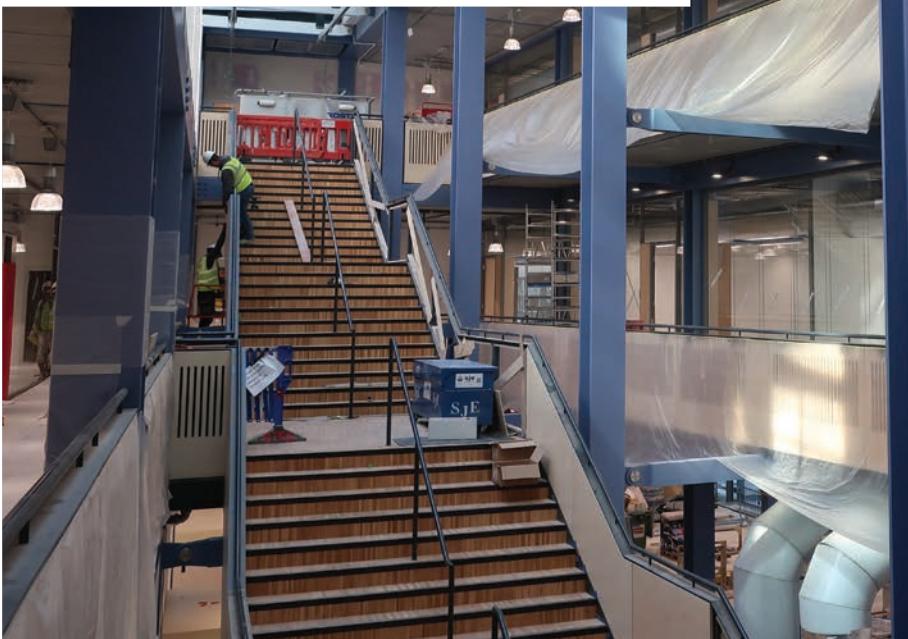
In response, these façades incorporate vertical fins of varying depths to shade the glazing from the oblique sunlight. Through parametric modelling, the fins have been sized to allow the more sheltered lower floors to achieve the necessary daylight levels. 'Solar shading was a big part of minimising the risk of overheating,' says Vereenooghe.

## PROJECT TEAM

**Client:** LSE  
**Architect:** Rogers Stirk Harbour + Partners  
**Building services and environmental consultant:** ChapmanBDSP  
**Structural consultant:** AKT II  
**Main contractor:** Mace  
**MEP contractor:** Dornans  
**Cost consultant:** Deloitte  
**Soft Landings and client's sustainability adviser:** Max Fordham



Vertical fins on the façade, left, and, below, the building's feature staircase



**"There is no plan B – no mixed-mode option available [above level two] because there's no riser space and no available chilled water"**

**Lucy Vereenooghe**

The scheme's ventilation design was driven primarily by the need to minimise overheating rather than provide fresh air to the occupants. ChapmanBDSP's overheating assessment was based on CIBSE's TM52: *Limits of Thermal Comfort: Avoiding Overheating*. Occupant comfort is also helped by the thermal mass offered by the exposed concrete soffit.

In addition to variations in solar exposure and incident solar angles, the functions on each of the floors meant there were variations in internal heat gains and in daily, weekly and annual occupancy patterns. The designers were concerned that, left unchecked, these factors – combined with the normal daily variation in external temperatures – could result in periods when high internal and external gains coincide with high ambient temperatures. They were also apprehensive about the demands by some of the academics for cellular offices.

To limit the internal heat gains, the designers gave LSE a series of guidelines on appropriate uses for the areas on each floor plate. They subdivided each floor into a series of zones and then created a schedule

of occupant densities for the different types of space that would provide an acceptable overheating risk.

Open-plan spaces are more densely occupied than cellular ones because heat can dissipate over a larger area and into surrounding zones. They are also more likely to have openings in both the east and west façades to facilitate cross-flow ventilation – all of which helps reduce the potential for these spaces to overheat. By contrast, any build-up of heat in cellular spaces has to be removed via single-sided ventilation.

'People will move in and out of cellular offices for various reasons, so there will be some periodic air exchange with surrounding zones,' says Vereenooghe. The design team established the location of openings in the façade to ensure sufficient cross-flow of air.

Using these guidelines, LSE's estates team and RSHP were able to work with the various departments moving into the new building, to develop spatial layouts. The guidelines will also be important in the future, to help LSE rearrange spaces as demands on the building change and the impact of climate change becomes increasingly important on the operation of the natural ventilation solution.

'An extensive body of work has developed over many months, starting from discussions on how individual categories of space will be occupied and evolving into a set of design principles,' says Vereenooghe. She adds that, in developing the natural ventilation strategy, the ➤

» team was helped by the 'amazing' historical occupancy data for each department supplied by LSE's Estates team. This confirmed that academics tend to work late into the evening and are absent for much of the summer.

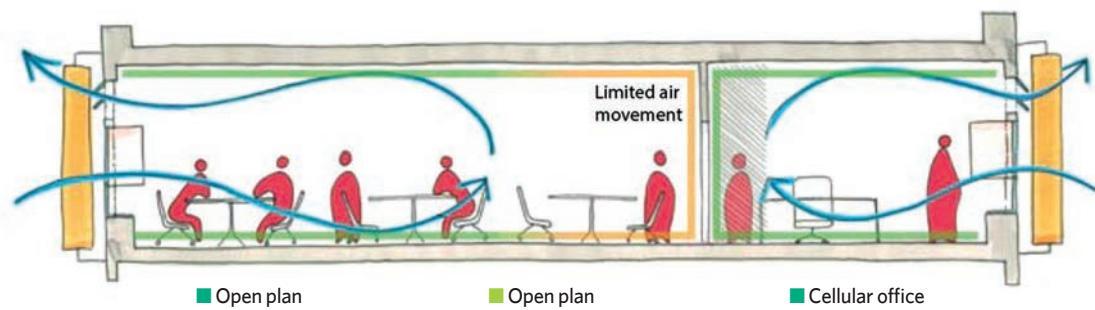
'It was such random occupancy that we decided to control the natural ventilation by enabling the BMS to kick in and open the windows when people are not occupying a space,' says Vereenooghe.

Each bay of the aluminium-framed, glazed façade incorporates openings to facilitate natural ventilation. Actuator-controlled top-lights open and close under control of the BMS to give daytime ventilation and night-time heat purge, while large, inward-

### Environmental design features

- Outdoor comfort
- Flexibility and adaptability
- Natural ventilation
- Daylight penetration
- Solar control (shading design)
- Atrium design and ventilation
- Green roof
- Rainwater management

Section drawing of the building



Section showing spatial arrangement (open-plan or cellular) and effect of natural ventilation

CIBSE overheating scale ■ Pass ■ Margin ■ Fail

opening, occupant-controlled, low-level, side-hinged, windows give occupants the option to boost ventilation.

Ultimately, the success of the natural ventilation solution in delivering comfort will rely on: the occupants' interaction with controls; acceptance of increased external noise; air quality; and being able to achieve acceptable levels of air movement that will avoid papers being blown from desks, for example. 'The building is under user control when it is occupied,' Vereenooghe explains.

Mechanical ventilation supplies fresh air and cooling to the lower floors. The plantroom, at Basement Level 1, houses the majority of the building's MEP plant, while a smaller plant space at Basement Level 2 houses rainwater attenuation and harvesting tanks, along with sprinkler tanks and associated pumps. Basement Level 1 also incorporates a large auditorium, bar area and breakout space.

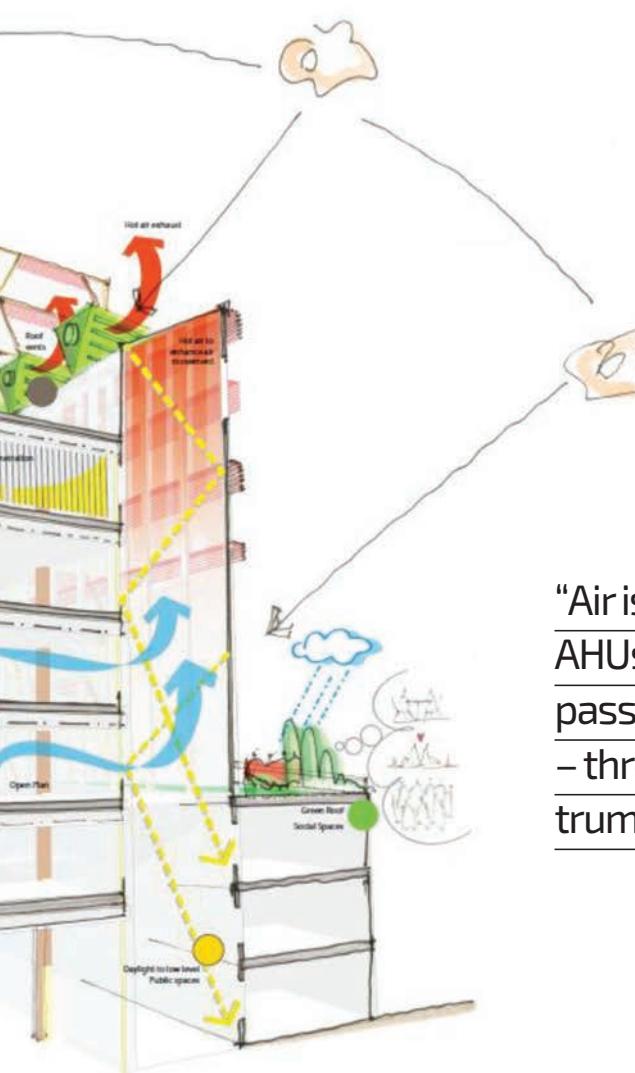
Seven air handling units (AHUs) – some serving individual lecture theatres and other more general spaces, such as the ground-floor cafe and reception – are housed in the Basement Level 1 plantroom. The main fresh-air intake is on the building's south elevation; air enters through a louvred opening and then passes down a shaft to the basement, where it feeds an AHU supply plenum running along the west side of the basement plantroom. Air

is discharged from the AHUs into a similar plenum running above the supply-air plenum, before passing out – in RSHP style – through two expressed exhaust-air trumpets in the plaza, and a louvred opening in the south elevation.

Evaporative humidifiers in the air handling plant, in conjunction with heat pipes, thermal wheels and chilled water coils, provide cooling in the AHUs. The wrap-around heat pipe consists of two sections: the pre-cool (evaporator) section, placed before the cooling coil, and the reheat (condenser section), placed after the reheat coil.

The pre-cool section is located in the incoming air stream before the cooling coil. When warm air passes over the pre-cool section, the liquid refrigerant vaporises, moving heat to the reheat section, downstream





**"Air is discharged from the AHUs into a plenum, before passing out – in RSHP style – through two exhaust-air trumpets in the plaza"**

from the cooling coil. As heat has been removed from the air before it reaches the cooling coil, the air passing through the cooling coil drops to an even lower temperature, resulting in more condensate removal. The over-cooled air is then reheated to a comfortable temperature and a lower relative humidity by the reheat section, using the same heat absorbed by the first section. The AHUs supply cooled air to the auditorium, teaching and learning commons, seminar rooms and lecture theatres.

There are also two water-cooled chillers in the plantroom. The chilled water generated by these serves the cooling coils in the AHUs, ground-floor cafe, Basement Level 1 kitchen, reception and Alumni Centre fan coil units, plus the main comms and uninterrupted power supply (UPS) room. Heat rejection is via two adiabatic hybrid coolers located on the roof. These cool the chilled water through a combination of heat transfer and water evaporation.

In dry cooling mode, the chilled water is circulated through the horizontal tubes within a closed circuit, and heat is removed from the tubes by fans blowing ambient air over the finned heat-transfer surface. When the return temperature of the chilled water circuit can no longer be maintained by dry air cooling, the finned heat-transfer surface is wetted by water, to benefit from additional cooling from the latent heat of evaporation.

Initially, Westminster Planning Authority didn't want plant on the building's roof. However, RSHP addressed its concerns and adjusted the top of the building to create a small, visually cohesive and acoustically screened area of plant, which was deemed acceptable. 'We only supply cooling up to level two in any case,' says Vereenooghe. 'This solution is very efficient, so the roof-top plant is very small.'

The basement plantroom is also home to a FleetSolve 225kW low temperature hot water (LTHW), thermally led, biofuel-fired, CHP engine. 'The biofuel is waste from pharmaceutical and cosmetics industries – the CHP's carbon emissions are significantly lower than they would be for a gas CHP,' says Vereenooghe.

The CHP generates electricity and captures heat produced by the generator. In summer, the CHP will meet the domestic hot water load; in the heating season, it will act as lead boiler, to service the domestic hot water and space heating. During peak winter conditions, the CHP is supplemented by two 650kW, high-efficiency, low-NO<sub>x</sub>, gas-fired condensing boilers. These are twin-module, floor-standing units.

Compensated heating circuits serve circulation spaces, toilets and a perimeter heating system. The heating circuit is split into two systems – one serving the lower levels B1-06, with a maximum operating pressure of 6 bar, and a 10 bar system serving levels 07-13. 'The height of the tower means the upper-levels circuit is split from the rest of the system by a plate heat exchanger,' says Vereenooghe.

The compensated heating circuits operate at 70°C flow with 45°C return. There is also an underfloor heating system, which is a 'blended' circuit to decrease the LTHW temperature to service underfloor heating circuits.

As part of LSE aspiring to zero carbon, ChapmanBDSP also looked at minimising the amount of carbon embodied in the building – see panel, 'Minimising embodied carbon'.

The new building opens in September. LSE will then have two years under a Soft Landings framework, led by Max Fordham, to hone the operation of the engineering systems and the natural ventilation solution. **CJ**

### MINIMISING EMBODIED CARBON

ChapmanBDSP developed a sustainability tool – validated by BRE – to help reduce the carbon footprint of the new Centre Buildings Redevelopment.

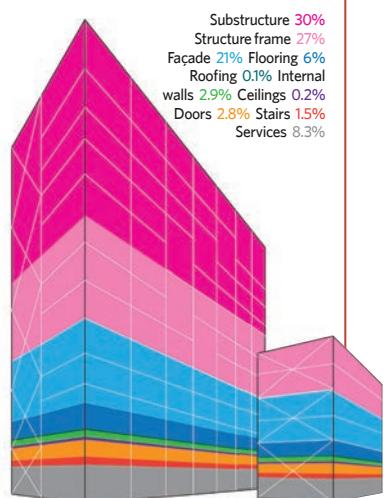
The 'carbon calculator' helps make the building more sustainable by mapping out the breakdown of embodied and operational carbon, to better inform project decisions at the design and construction stages.

It was instrumental in helping the building achieve a 35% reduction in embodied carbon compared with its benchmark building. This was achieved primarily through the use of a less carbon-intensive, 'lighter' concrete in some areas, says Vereenooghe. It also resulted in less aluminium being used in the façade's shading fins and the incorporation of more recycled and low carbon materials.

The tool also evaluated operational carbon energy use, which led to the implementation of low carbon energy supply technologies – such as biofuel CHP, the inclusion of photovoltaics on the roof, and extensive heat recovery – being applied across various technical systems.

'We looked for the big wins; by being involved early, we were able to reduce embodied carbon by more than 30%', says Vereenooghe.

**Embodied carbon as per building elements (%)**



# LEANER MACHINES

Data-driven design can reduce energy consumption by reducing the oversizing of plant. Ramboll's **Andrew Henderson** shares building performance data that suggests 30% of heating and cooling plant capacity will never be required

**I**n May this year, the Committee on Climate Change (CCC) recommended that the UK government immediately set legally binding targets to cut greenhouse gas emissions to zero by 2050.

It made it clear that this will not be easy to achieve, and stabilising global warming will require action from every sector. Construction is no exception, and is especially important because 50% of the world's raw-material consumption is through the development and use of buildings.

As well as galvanising government support, it is up to us – as an industry – to develop new methods of working that allow us to achieve this goal. This may seem daunting, but better environmental practices can also be beneficial for the bottom line.

Ramboll recently conducted analysis of the operational energy performance of more than 100 commercial properties within our clients' UK portfolios. We found that heating, cooling and electrical systems in buildings across the UK are regularly designed with more capacity than they will ever need – bad for the planet and the bottom line. So why is this happening and what can we do to solve it?

## Playing it safe

We found that, in its efforts to achieve technical compliance, the industry is over-designing and, consequently, installing too much capacity in building systems. Our analysis showed that, in the UK, designing to codes and guidance – as well as pressurised consultants commoditising and reusing 'safe' designs, often with only minor adaptations from previous projects – is leading to massive inefficiency. The reality is that there are smarter ways to achieve and exceed compliance standards without increasing capital expenditure.

We studied the operational energy performance of 100 commercial properties within our clients' UK portfolios, using real data. Often, we discovered, 50% of the electrical supply capacity will never be used, and 30% of the cooling and heating plant capacity will never run. Of course, the space required for this unnecessary plant will exist for the lifetime of the building and will never be monetised.

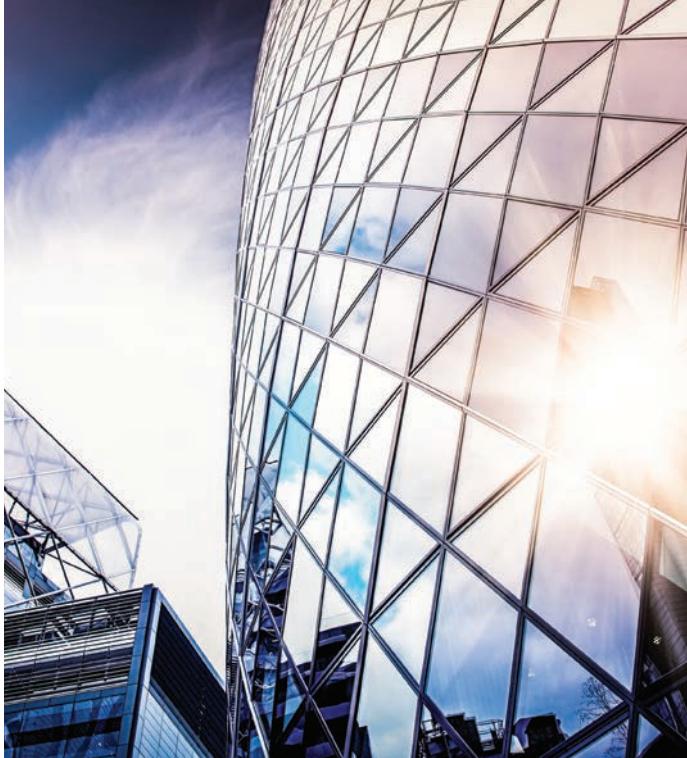
Normally, designers will turn to codes, occupancy levels and the extremes in environmental conditions to inform design – but this is causing significant waste and inefficiency in plant operation.

Our findings show there is a huge gap between predicted performance and reality. The key is to understand how a building will perform by simulating its

operation early in the design development, so more informed decisions are made to deliver more efficient buildings. We have also taken lessons from our work in extreme environments and applied it back into the UK, to deliver leaner systems.

While building owners and developers might make some savings on initial design fees, and take comfort in having a building 'designed to the codes', the outcome for them, the tenants, the building users and the environment, can be greatly improved. We need to break free from out-of-date delivery models and conventional thinking.





**"We need to break free from  
out-of-date delivery models and  
conventional thinking"**



### Data and hybrid energy solutions

Within our commercial portfolio, we estimate achievable savings to be in the region of £60/m<sup>2</sup> in capital expenditure (capex), and up to 50% in energy savings and carbon emissions. Scale this up to the 1.1 million m<sup>2</sup> of offices currently under construction in London, and you see the scale of opportunity in the capital city alone – approximately £70m in construction savings and 23,000 tonnes of CO<sub>2</sub> per year. So, sustainable solutions do pay.

The first priority is to establish accurate building demands. We have looked at occupancy profiles over a 12-hour working day, five days a week, and modelled the operation for 365 days, to derive highly accurate daily, weekly and monthly heating and cooling profiles. This enables the systems to be designed to maximise operational efficiency at any time of the year.

We can then take a hybrid energy approach, where heating and cooling systems are optimised for operational building requirements, rather than adapting systems traditionally based on design for peak winter and summer extremes.

The plant comprises a combination of boilers, heat pumps and chillers, selected to operate specifically to maximise efficiency from realistic internal occupancy demands. Essentially, we can design in reduced-size boilers and chillers, and use them only for the extreme short peaks in temperatures when they are highly efficient, but then rely on the heat pumps for the majority of the year, when temperatures are more stable.

A key feature is to use reverse-cycle heat pumps to take full benefit from simultaneous heating and cooling loads available for much of the year.

### Learning from extreme environments

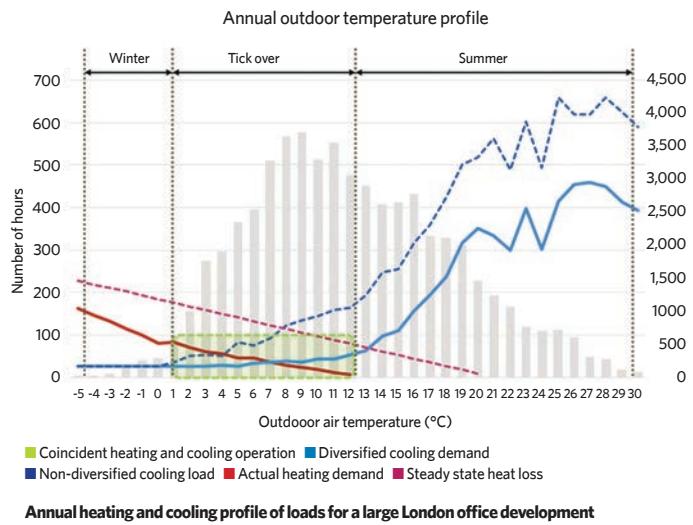
We have taken lessons from the practice of engineering in extreme environments, where – by virtue of location – the energy solutions demand extremely lean designs. These approaches can be brought back to the UK, and help show how we can adopt ‘extreme for lean’ engineering principles driven by sound data analytics.

With the British Antarctic Survey (BAS), the extreme environment makes designing differently a key necessity. Working together for the first phase of the Rothera Research Station Modernisation Project, Ramboll and BAS have developed a design that targets a reduction in energy consumption by up to 35%. A whole host of measures were taken, including: rationalising smaller buildings; recovering waste heat; using thermal storage; improved insulation and demand controls; snow deflectors; and photovoltaic generation.

Devising the right solution for a site-wide masterplan that included some existing buildings, as well as new ones, required the assessment of the heating and electrical loads of all these buildings – with numerous variables – simultaneously.

With five million possible energy scenarios, finding the optimum solution would be like finding a needle in a haystack when using conventional iterative approaches. So, instead, we incorporated a method into a parametric modelling tool called the Evolutionary Energy Solver. This mimics nature to identify and rank the combination

»



» of inputs that will give the best performing, or ‘fittest’, solutions. This reduced the time needed to identify these solutions by 88%, enabling Ramboll and BAS to interrogate quickly the options most suited to the needs of their organisation.

Coupled with more efficient buildings and energy re-use, the end result offers a solution that will reduce energy consumption significantly in the first phase of the modernisation project.



### Overdesigning building structures

The challenge of overdesign holds true for the structure, too. Ramboll is involved in an initiative, led by the University of Cambridge, that seeks to improve material efficiency across the construction industry. Research carried out as part of this work has demonstrated that we are using design loading in offices that may be more than double the loading the building will ever experience in its lifetime.

If you look at the current office space being constructed in London, we estimate that – by challenging just the design loading alone – 10,000-15,000 tonnes of embodied CO<sub>2</sub> could be saved.

In addition, around £15m-£20m could be saved on construction costs through reduced slab thicknesses, column sizes and foundations. Add to this the time and workforce benefits, and we can see the huge potential of improved building structures.

This is where data and digital tools can help transform the industry. Ramboll is inventing its own digital tools, which we are piloting with a number of developers.

One such tool is SiteSolve, which enables our clients to vary the development brief rapidly and review the impact of their assumptions. With the power to look at hundreds of options in the time it would take to look at just one traditionally, the tool uses engineering insight to bring data to the forefront of the design process. This allows us to evaluate and refine solutions while balancing many complex technical criteria.

By embracing data-driven design, the construction industry can reduce capital expenditure, save carbon, reduce energy consumption, and deliver more healthy and sustainable buildings.

The sector is facing pressure from climate change, resource efficiency, digitalisation, economic difficulty and industry productivity – but we have the tools, the know-how and, more importantly, the data to meet this challenge.

We can turn design on its head and enjoy the fruits of more economical, sustainable, safe, comfortable and compliant buildings. So why wait to change?

**ANDREW HENDERSON** is executive director, UK buildings, at Ramboll

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# Get smart about power

With architects, developers and regulators making plans for smarter cities, ABB's Russell Wood answers questions on how building services engineers can ensure resilience against these changes

**O**ur cities are changing fast. Few people in the 1980s or 1990s could have envisaged how fast the internet would transform our society, or how targets for energy efficiency and renewable energy would change how we manage energy. The trend is only set to accelerate as buildings and transport systems get smarter.

## How are buildings changing?

In future, sensors and controllers will optimise the consumption of energy, as well as the flow of transport and goods. Office and residential buildings will recognise individuals and teams, and adapt the environment to suit their specific lighting and HVAC preferences. Controllers will optimise the generation and storage of energy, and supply energy services to the power grid as a revenue stream.

At the same time, vehicle fleets will transition to electric and hybrid technology – and, eventually, to autonomous electric vehicles (EVs).

Energy efficiency legislation is also being tightened – for example, the EN 15232 standard for building automation, and the DCP161 regulation, under which Ofgem introduced new penalty charges last year. So it will pay to put an energy-management strategy and building management system (BMS) in place, to control supply and demand, limit peak consumption, and respond to requests from utilities to participate in demand-side response schemes.

## How can operators future-proof their building management?

It will be essential to have a BMS or building automation and control system (BACS) that is scalable and flexible.

Such systems typically work at field, automation and management levels. Devices, such as sensors and actuators, control lights and blinds at field level. The automation level includes timers, and logic and automatic controllers, while management integrates monitoring, alarms and reporting.

HVAC and lighting functions have, traditionally, required separate controllers. However, the latest systems share a common interface through the KNX protocol, and this is enabling straightforward integration of heating, cooling, lighting, monitoring, alarms and reporting. As a result, it's possible to achieve Class A energy savings under the EN 15232 standard.



**"A resilient power supply offers high reliability and availability, plus visibility and control"**

## How can building managers ensure a resilient power supply?

A resilient power supply offers high reliability and availability, plus visibility and control. Today's switchgear has inbuilt metering, communication and connectivity to provide data to building managers about the condition and status of critical systems. In addition, the latest safety and backup equipment – such as emergency lighting systems – can run diagnostics and testing automatically, and log test reports centrally.

Intelligent systems will become more common. For example, equipment with intelligent software for power management can guarantee that a facility will never exceed the peak half-hourly consumption allowed under a utility contract – so operators can avoid penalty charges from their energy suppliers.

Power management works by constantly measuring and evaluating loads, and automatically switching off low-priority loads to keep demand below its upper limit. It then reconnects the supply when capacity becomes available again. In many cases, building occupants will not notice a pause in output from an HVAC system or to a parked EV.

## What is the right choice for EV charging points?

The adoption of EVs is another area affected by emissions. In February, the Energy Networks Association introduced a new process to reduce red tape when installing EV charging points. This covers all types of property in the UK, including commercial sites.

Most of the UK's current EV charging points are domestic units that supply 3-22kW through the car's onboard AC-DC converter over a period of 4-16 hours, with no need to upgrade the incoming supply. It could take more than a day, however, to fully charge the 80kWh batteries in a Jaguar I-PACE, Audi e-tron or Tesla.

As a result, DC charging points are becoming more popular. They enable rapid charging through large and powerful roadside AC to DC converters. In general, the shorter a vehicle stays, the higher the power requirement. Motorway services are installing 150-350kW units for stays of less than 20 minutes. The sweet spot for supermarkets is 50kW charging over 30-90 minutes, whereas drivers at offices, hotels and car dealerships expect to stay around three hours – making 20-25kW a suitable power rating.

**RUSSELL WOOD**  
is product marketing director at ABB



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# Broader perspective

The idea that data centre loads work most reliably at an ambient 18-21°C is outdated, according to Professor Ian Bitterlin, who says ASHRAE guidance offers much wider limits for temperature and relative humidity

**T**he recent CIBSE Journal article on data-centre cooling – and, specifically, humidification – ‘Mist opportunity’ CIBSE Journal, April 2019 is misleading, as it lays down a set of thermal requirements for ‘the reliable operation of (ICT) servers and storage equipment’ that were superseded more than a decade ago. The basis of the article – adiabatic or evaporative systems as a low-energy form of cooling in a data centre – is not an issue. However, suggesting that data centre loads ‘operate most reliably at an ambient temperature of 18-21°C and a relative humidity (RH) of more than 45%... and air conditioning is essential’ is rooted in the past, and will waste a lot of cooling energy in the process.

Temperature and humidity control in data centres is a long story of continuing energy reduction, which started in the mid-1950s with IBM machine rooms and has accelerated in development since 2004 through the auspices of ASHRAE. The original requirements from the IBM Planning Guide for mainframe rooms were based on tight temperature and humidity limits for two technical reasons:

- Magnetic tapes did not like rapid temperature variation over time, as they were the cause of read/write errors, and this manifested itself in a  $21^{\circ}\text{C} \pm 1\text{K}$  temperature specification – although it was not stated ‘where’ that was to be maintained. The result was the application of precision air conditioning with a return-air setpoint of  $21^{\circ}\text{C}$ , ‘cold’ data centres with air below the raised floor of  $12\text{-}15^{\circ}\text{C}$ , and with more than 50% bypass air.
- Punched cards for data sorting – made of thin compressed cardboard – were sensitive to humidity. Below 45% RH, the high-speed card-sorting machines produced prodigious static electric charge that cracked like mini-lightning discharges every time an operator touched the cabinet frame. Above 55% RH, the cards absorbed moisture and the sorting machines jammed. The resulting specification,  $50\text{% RH} \pm 5\text{%$ , made precision humidity control a necessity.

These conditions – exacerbated by partial load, no variable speed fans or pumps, or free-cooling opportunities – often resulted in cooling systems that consumed nearly as much energy as the load; basically, a coefficient of performance (COP) of 1.0 to 1.4.



## “Temperature and RH control in data centres is a long story of continuing energy reduction”

This was not seen as a problem from the mid-1950s to 2000, however, because energy was cheap, and the business enablement of ICT produced near-exponential opportunities for commercial cost-effectiveness and growth. It was not until 2004 that ASHRAE changed the cooling landscape of data centres – and has continued to do so by publishing the Thermal Guidelines.<sup>1</sup> The committee that writes these is populated by the ICT hardware OEMs, and it issues the only globally authoritative specification for temperature, humidity and air quality for loads with embedded microprocessors.

ASHRAE is responsible for producing ANSI documents, so goes much further than one would assume a trade association to go. Its conditions are segregated into ‘Recommended’ and ‘Allowable’ envelopes for a range of electronic loads, with Class 1 most often used for data-centre equipment – although vendors such as Dell offer servers built to Class 3 as standard.

The ASHRAE Thermal Guidelines run to many chapters, and it is almost ‘wrong’ to quote just the temperature limits given in tabular form. However, to show how

far the industry has come since the ‘ $18\text{-}21^{\circ}\text{C}$  and  $>45\text{% RH}$ ’ type of specification mentioned in ‘Mist opportunity’, the latest version (2015) for Class 1 Allowable is  $15\text{-}32^{\circ}\text{C}$  and a humidity range based on dew point (DP) from a lower limit of  $-12^{\circ}\text{C}$  DP and 8% RH to  $17^{\circ}\text{C}$  and 80% RH, with many limiting conditions. For Class 3 (just for example), ‘Allowable’ is  $5\text{-}40^{\circ}\text{C}$ , and  $-12^{\circ}\text{C}$  DP and 8% RH to  $24^{\circ}\text{C}$  and 90% RH. Far, far wider than this article suggests.

The data centre tends to follow ASHRAE limits with a couple of years ‘delay’, so the 2011 Class 1 Recommended is still often quoted in design specifications –  $18\text{-}27^{\circ}\text{C}$  and a humidity range based on DP from a lower limit of  $5.5^{\circ}\text{C}$  DP to 60%RH and  $15^{\circ}\text{C}$  DP, with Allowable at  $15\text{-}32^{\circ}\text{C}$  and a humidity range of 20% to 80%RH.

Low-energy adiabatic and evaporative systems are being used successfully in some indirect-air, data centre cooling applications to the 2015 ASHRAE guidelines. In rarer cases, such as Google and Facebook, direct-air adiabatic systems outside of ASHRAE limits are being used where the ICT hardware is bespoke, not commercially standard.

### References:

- 1 Thermal guidelines for data processing environments, 4th edition, Ashrae, 2015

■ Professor **IAN F. BITTERLIN MCIBSE** is a consulting engineer and visiting professor at the University of Leeds



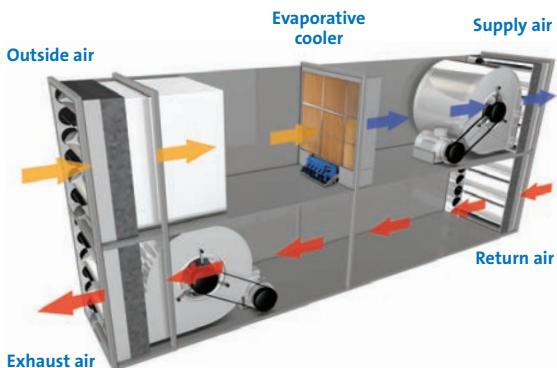
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# Clear GHG policies needed to hit net zero

## CCC calls for robust action on F-Gas to hit 2050 target

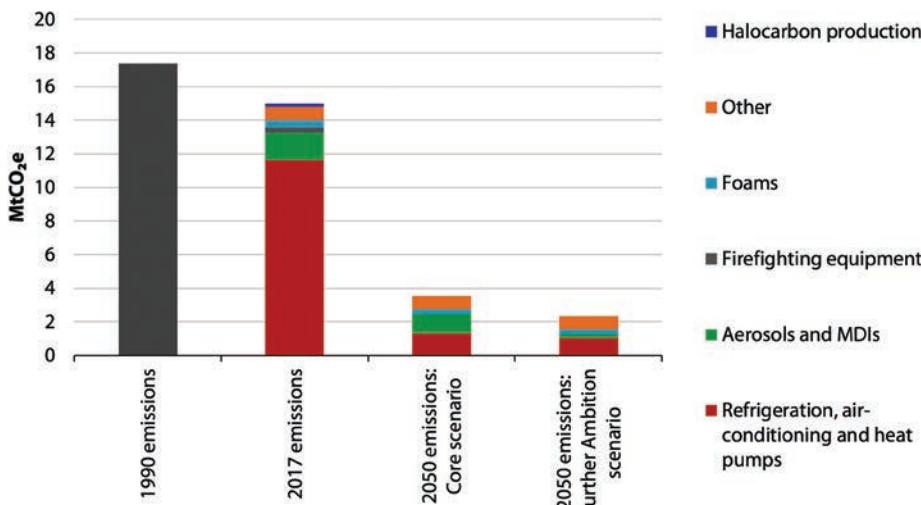
The UK must ramp up action to cut F-Gas emissions and focus on tackling non-compliance with regulations if the UK is to reduce its greenhouse gas (GHG) emissions to meet net zero targets by 2050.

The independent Committee on Climate Change (CCC) outlined its recommendations for reducing F-Gas emissions as part of its detailed report – *Net Zero The UK's contribution to stopping global warming* – released in May.

The report calls for the UK to phase out carbon emissions fully by 2050 to tackle climate change, recommending the urgent need for government to lead with clear, stable and well-designed policies across GHG-emitting sectors.

Refrigeration, air conditioning and heat pumps (RACHP) accounted for 78% of F-Gas emissions in 2017, it said. However, the use of hydrofluorocarbons (HFCs) in new RACHP systems is significantly restricted by the 2014 EU F-Gas Regulation.

The report says that existing policy is expected to deliver F-Gas emissions reductions of 65% from 2017 to 2030. The majority of this abatement can



### Scenarios for deep F-Gas emissions reductions

Source: BEIS (2019) Final UK greenhouse gas emissions national statistics: 1990-2017, CCC analysis

be achieved in the RACHP sector, in which emissions will fall by 75% – from 12MtCO<sub>2</sub>e in 2017 to around 3MtCO<sub>2</sub>e in 2030 – according to the CCC.

The report also suggests that additional, cost-effective measures could be deployed in the RACHP sector that would deliver further reductions of 0.2MtCO<sub>2</sub>e by 2030.

However, the report warned that existing and future F-Gas regulations would only deliver the expected

abatement if appropriate compliance measures were in place.

It highlighted concerns raised by the Environmental Audit Committee about suspected non-compliance in the F-Gas sector, and has recommended increasing the number of inspections, expanding training for workers who handle refrigerants, and regularly reviewing the effectiveness of the compliance regime, including the impact of new civil penalties for F-Gas breaches.

# China still dominates as global air con market grows in 2018

The global air conditioning market grew significantly in 2018, according to Bsría's market intelligence study. It estimates global year-end sales of more than 141 million units and a value of more than US\$103bn (£82bn).

China continues to dominate the market, followed by the US and Japan. The Asia Pacific region – at 56% – accounts for the largest share of global value.

As earlier adopters of variable refrigerant flow (VRF) systems, China, Japan and South Korea remain the market leaders. The Americas and the Asia Pacific region showed moderate growth around the global average level of 3.8%, while the Middle East, India and Africa markets continued to pick up slowly.

Europe is relatively small as a sales region, accounting for 7% by volume and almost 12% by value globally, boosted by the hot summer. In the southern parts of Russia, meanwhile, sales continue to increase by 15-20% per year.

Economic and population growth, urbanisation and rising temperatures in countries such as Bangladesh, Brazil, Ghana, India, Indonesia, Kenya and Vietnam are the main drivers for increased demand for cooling.

In the European market, customers' preferences are shifting towards energy-efficient models, as well as inverter air conditioners with greener technology. The share of smart air conditioners, particularly in the commercial sector, is also increasing, as they enable a higher degree of monitoring and control of air quality.

## Elta Fans ERUs with enhanced filtration

Elta Fans has launched a new version of its Air Design Prema range of energy-recovery ventilation units in response to the updated ISO 16890 filtration standard for testing and classification of air filters.

The range is available in four sizes to give an airflow from 0.006 to 0.936m<sup>3</sup>·s<sup>-1</sup>. It is designed to maintain good indoor air quality and comfortable temperature levels by efficiently transferring thermal energy from the stale air to the incoming fresh air.

Units feature a fine particulate filter on intake as standard, with ISO ePM<sub>1</sub> 55% (F7) supply fine particulate filters fitted to remove pollutants.

The ISO 16890 standard, implemented worldwide in August 2018, redefines filter classification based on efficiency of particulate matter removal, to give a clear indication of the ability to filter different-sized particles.

# Sorted at Postmark

## Metropolitan saves on capital cost of heating and cooling network

District energy network specialist Metropolitan has been awarded the contract to adopt and operate the district heating and cooling networks for Taylor Wimpey's flagship 681-apartment Postmark residential development, in Farringdon, central London.

Metropolitan says early collaboration has enabled it to work with the developer and its consultants to streamline the design of the district heating and cooling infrastructure, significantly reducing the capital cost of the project.

The Postmark is in a prime location shared with the Royal Mail sorting office at Mount Pleasant. Modernisation of the 129-year-old mail centre in 2014 freed up land for the development.

Redesigning of the district heating and cooling network presented a number of

engineering challenges for Metropolitan. With the two phases physically separated by a public highway, the original intention was to have two energy centres and two distinct heat networks serving the new homes.

Installing pipework sleeves under the highway and eliminating the need for substations has rationalised the design, enabling a single gas-fired combined heat and power energy centre to serve the entire development. This has resulted in capital cost savings and reduced the infrastructure footprint.

Metropolitan also established that the most efficient design for providing cooling was via two electric chillers and two separate networks, each serving half of the development.

It estimates that this district energy networks solution will save more than 30% on carbon emissions compared with a traditional solution.



## Fujitsu adds to chiller line-up

Fujitsu General Air Conditioning has extended its UK range with the launch of its Clint and Montair liquid chillers. These new offerings are the result of its product development partnership with Italian group GI Holdings.

The new products cover air-cooled and water-cooled liquid chillers, with heat-pump and cooling-only models available. Air-cooled heat pumps range from a compact 15kW model for small commercial applications using inverter scroll technology, to 1.6MW screw-compressor models for large commercial and industrial projects – including options of producing hot water up to 60°C. Water-cooled heat pumps range from 49kW to 1.25MW, with cooling-only variants using Turbocor centrifugal technology to extend ranges to 3.9MW capacity.

Close-control applications are being supplied with Montair air-cooled, water-cooled and chilled-water variants, covering a range of 9kW to 155kW, including top and bottom discharge options. Integrated server cabinet cooling is also available.

Open-protocol communication is included across the range, with remote web-monitoring packages supplied as standard on Turbocor models. Dry coolers, hydronic modules and remote condensers complete the product line-up. For more details, visit [www.fujitsu-general.com/uk/](http://www.fujitsu-general.com/uk/) or email [sales@fgac.fujitsu-general.com](mailto:sales@fgac.fujitsu-general.com)

## Prepare now ahead of refrigerant ban warns Defra

End users have been warned by Defra to take urgent action ahead of looming bans on a range of widely used refrigerant gases.

Under new F-Gas rules, several gases – including R404A, R507 and the R22 replacement R422D – will be banned from use in many medium and large systems from 1 January 2020 because of their high global warming potential (GWP).

There will be a total ban on 'virgin' high (more than 2,500) GWP refrigerants in systems of 40 tonnes CO<sub>2</sub> equivalent or more in servicing and refilling systems where the charge breaches a certain limit – 10.2kg in the case of R404A. Smaller and hermetically sealed systems will be unaffected, however, and reclaimed or recycled refrigerant can still be used until 2030.

Regulators in England and Scotland have the power to issue civil penalties of up to £200,000 for breaches of the F-Gas regulations. Enforcement notices and fines can also be applied in Northern Ireland and Wales.

A leaflet – *Refrigeration and freezer equipment: Changes to refrigerant gases that can be used* – has been produced jointly by Environment Agency, Scottish Environment Protection Agency and Northern Ireland's Department for Agriculture, Environment and Rural Affairs. It is available at [bit.ly/CJJun19cooling](http://bit.ly/CJJun19cooling)



# Staying cool in the heat of Brexit

**Temporary chillers are being used to enable firms to stockpile food and medicine during Brexit uncertainty**

With the situation around Brexit still unclear, manufacturers have looked to insulate themselves against uncertainty by stockpiling products, including food and medicines.

This requires businesses to find additional storage space where goods can be kept at an appropriate temperature. A possible solution is temporary cooling systems and chillers to transform ambient-temperature warehouse space into chilled or cold storage. These low-temperature chillers and DX units range from 50kW to 1,500kW, and can carry out multiple processes depending on which products are being stored on site.

For example, to ensure the integrity of food housed in cold storage, rooms

are usually kept at -20°C or below. These products can be stored for a few days or a prolonged period of time, during which millions of pounds worth of stock will be held on site.

As well as cold stores, fresh products may need to be held in chilled storage, where air is maintained at 0°C or above to ensure these items remain at refrigeration temperatures. Any deviations in temperature can result in product loss.

Emergency refrigerated solutions can be used for cold- and chilled-storage operations, and can be installed with minimal disruption to existing site processes. A wide variety of chillers and DX units can be installed within hours of arrival on site.

Installing temporary chillers and chilled air distribution systems will also reduce strain on infrastructure when storage capacity needs to be increased, making a system breakdown less likely.

**Matt Watson** is a temperature control specialist at Aggreko



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# Why off-the-shelf heat recovery units can be the perfect fit

Since the introduction of the Energy-related Products directive, the need to improve the efficiency of air handling solutions has driven demand for commercial heat recovery units that can fit increasingly tight spaces, budgets and timescales. With these factors having an influence on purchasing decisions, **Jibin Kurian**, national product manager for air handling units at FläktGroup UK, discusses the benefits of 'off the shelf' solutions

**B**efore Energy-related Products (ErP) legislation was introduced, heat recovery technology was often an option to accompany air handling units (AHUs) in commercial applications. Now, the requirement to comply with energy-efficiency standards means that heat recovery units with air treatment capability are the norm. But as costs, timescales and space for new and retrofit projects become increasingly squeezed, specifiers are looking to off-the-shelf solutions to address these challenges.

## Simple and standardised

For projects where a simple, rather than bespoke, system fits the bill, it is possible to choose an off-the-shelf heat recovery unit, as long as the required airflow rate is known. This negates the need for a technical expert to get involved in the design stage, and for complex calculations and specifications, thereby simplifying the procurement process.

Lead times for standardised products are shorter, enabling manufacturers to deliver their units to fit tight project timescales. Once on site, installation is also much

easier. When a project is completed, system designs and project processes featuring the same standardised heat recovery unit can be replicated for similar developments further down the line.

FläktGroup offers a range of standardised heat recovery units to cater for 0.1 up to 6m<sup>3</sup>/s: the eCO PREMIUM, eQ PRIME, eQ TOP, eCO TOP and eCO SIDE. They all come fully packaged with controls that are compatible with any central BMS system; eCO units come with ISYteq mini controls, while more advanced controls are integrated with eQ products. They are all designed to 'plug and play', with no further programming required – so after the units have been installed, only air balancing and controls commissioning need to be carried out on site.

## Space saving

As lettable space increasingly becomes a premium in commercial buildings, architects and designers are coming under pressure to allocate minimal area for heat recovery units and their associated ductwork. This is where our eCO PREMIUM unit, with a

plate heat exchanger offering up to 85% heat recovery, comes into its own. Thanks to its compact design, it can be installed into ceiling voids and connect to existing infrastructure in that area.

**FläktGroup offers a range of standardised heat recovery units to cater for 0.1 up to 6m<sup>3</sup>/s**

With all-circular connections on the short sides of the unit, lifting devices, and the ability to fit through existing doorways, it makes light work of installation, to save project time as well as space.

Although our eCO TOP and eCO SIDE products are not designed to fit into ceiling voids, they have small footprints, with connections on the side or top to link easily to a spiro duct system.

The performance of our eQ PRIME product is Eurovent certified, and it, too, has a compact design. Available in eight sizes, it allows for quick and reliable installation, with integrated controls and mounted VSDs, and cables for fast start up.

Where there is no internal space for the heat recovery units, or when there is dedicated plant area on a building rooftop, products such as the eCO Premium and eQ PRIME are suitable to be located externally. These products come with high-strength, anti-corrosive mechanical



eCO Premium

construction, suitable for external mounting with a pitched roof.

### Low noise

Apart from space, other site requirements should not be overlooked. For example, educational institutions often require low noise levels to maintain an optimum learning and teaching environment. With a maximum noise level of 20dB at 3m, our eCO PREMIUM solution emits the lowest noise levels in the market.

### Conclusion

With energy efficiency and IAQ currently at the top of the regulatory agenda, it is important for HVAC professionals to stay up to speed with the latest developments. By specifying off-the-shelf heat recovery units, designers can deliver 'fresh' air even where natural ventilation is not an option, while meeting space and project timescale requirements.

- For more information on FläktGroup's range of heat recovery units visit [www.flaktgroup.com](http://www.flaktgroup.com)



# FläktGroup

DENCO HAPPEL SEMCO FLÄKT WOODS ILOXAIR



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**INTEGRATED CONTROLS**

**QUICK INSTALLATION AND OPTIMISED EFFICIENCY IN ALL CONDITIONS**

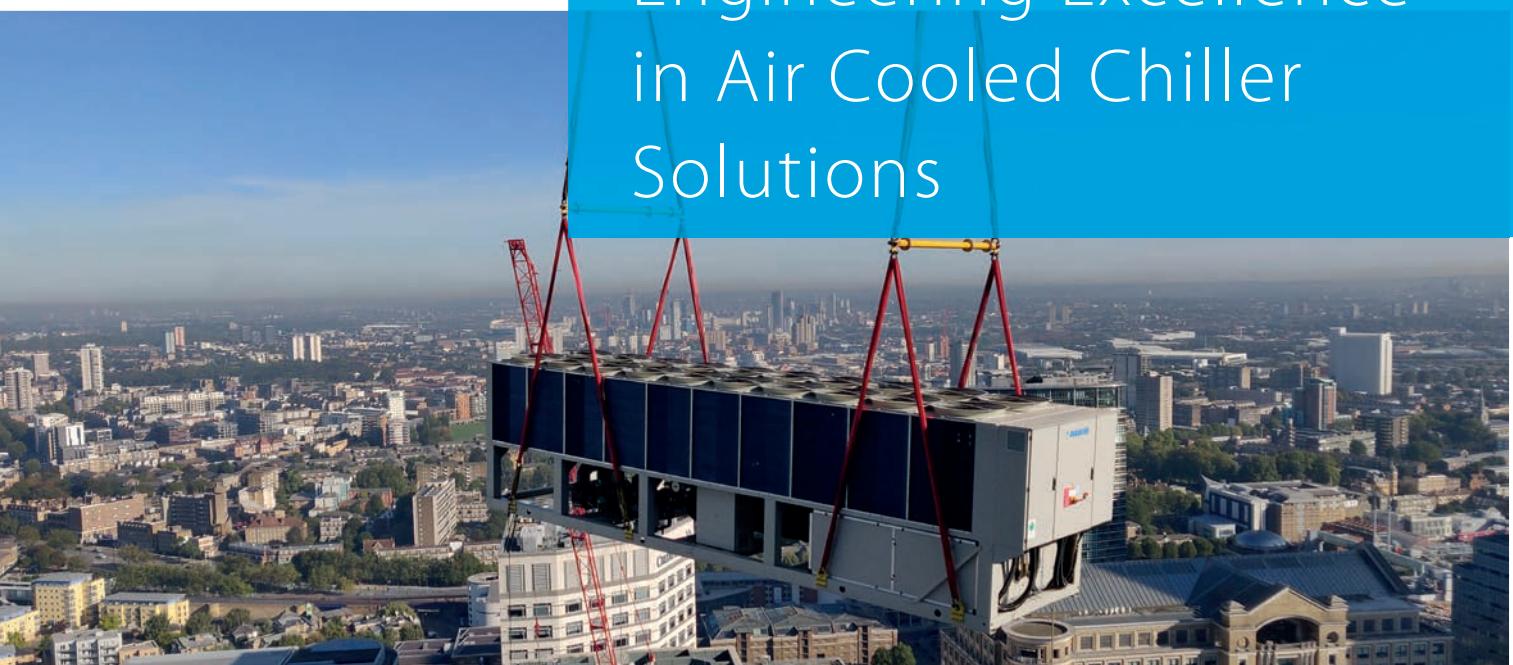
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# FläktGroup

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# Engineering Excellence in Air Cooled Chiller Solutions



## Energy Efficient Chiller Innovations

Air cooled chillers provide highly efficient comfort solutions for small retail projects to large commercial and district cooling schemes. Energy intensive and specialist industrial operations depend on air cooled chillers for precise control of process cooling and climate management. When combined with fan coil units for indoor heating and cooling, a chiller can also control the climate in your working environment. So when it comes to air cooled systems, one size certainly does not fit all.

Daikin Applied (UK) Ltd has a comprehensive range of air cooled chillers to meet every requirement, offering advanced technologies that optimise performance, whatever the environment.



[EWYD-4Z Chiller Series](#)

### Air Cooled Inverter Screw

#### Air - Water Heat Pump

Heating and cooling from  
400kW up to 1415kW



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### Air Cooled Inverter Screw

Cooling capacity: 170kW up to 1.8MW



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**CHILLERS**

**PROJECTS**

**SERVICE**

Initial planning allows for up to six new chillers to be installed in stages at the DCSG in Singapore



# SINGAPORE SLIM

Space constraints imposed on Hurley Palmer Flatt for a chiller upgrade at a Singapore data centre meant coming up with a vertical, Tetris-like solution that offered extra capacity at a reasonable cost. HPF's Michael Tang explains

**I**t is more than 20 years since the dot.com boom changed the way we do business forever, creating near-vertical growth in the everyday use of the internet for all of us. In the following years, data network providers rushed to install fibre networks in a bid to respond to the clamour for more information, more quickly.

Fast forward to 2019, and data has become a vital commodity that plays an essential role in our day-to-day lives. If 'information' is the fuel for the 21st-century economy, it follows that newer, better and faster data centres will need to be built and existing ones upgraded continually.

The recently upgraded Data Centre SG (DCSG) Singapore Facilities, at 7000 Ang Mo Kio Avenue 5, has full mechanical, electrical and plumbing (MEP) infrastructure. It had tenant status in the building, and wanted more autonomy from the landlord, which owned the incumbent chilled water infrastructure.

So DCSG decided to upgrade its system to give a higher level of redundancy for the mechanical plant, associated electrical supply and make-up water system, by reducing its dependence on the landlord's equipment and mitigating the loss of control over key issues associated with this. Building services and engineering



consultant Hurley Palmer Flatt was appointed as the lead consultant on the project, undertaking – with subconsultants – the design of the upgrading works, from site-feasibility stage through commissioning and construction of the system.

Initial planning allowed for up to six new chillers to be installed in stages. As well as being the cooling strategy of choice for DCSG, the use of water-cooled chillers is best practice for data centres with a cooling load greater than 500 tons of refrigeration (equivalent to 1.76MW). It is also a requirement of the Singapore Building and Construction Authority Green Mark Scheme, which seeks to create a more sustainable built environment in Singapore.

Stage one of the upgrade covered the addition of two modular, stackable chiller-plant systems that were stacked on top of each other, complete with cooling towers, water tanks, buffer tanks, pumps, and associated equipment. These met DCSG's requirement for an N+1 redundancy level.

The magnetic-bearing, oil-free, centrifugal-type water-cooled chillers – which have an average efficiency of 0.6kW/RT – were placed outdoors in a weatherproof enclosure.

Initial design detail was based on meeting an estimated end-state capacity of up to 4,500RT (15.8MW). However, the end-state detail design capacity was dependent on the final load analysis.

»



» At all stages of development, N+1 redundancy was achieved and maintained. The company wanted to sustain an Uptime Institute (UTI) Tier III classification for its data centre, making it concurrently maintainable. This allows for planned maintenance of power and cooling systems to be carried out without disrupting the operation of the data centre.

Now that the upgrade is complete, DCSG has control of its own system, and the landlord's system will only be used in the event of critical failure.

### Challenges

Unlike in the UK and Europe, where data centres are usually located in large, open warehouses, the high cost of land in Singapore and other parts of Asia means floor space is extremely limited. So Hurley Palmer Flatt had to think vertically.

The need to work within the existing floor space of the chiller plant at DCSG's data centre underpinned many of Hurley Palmer Flatt's solutions, which were supported by Revit 3D BIM software. There were also instructions not to alter floor-space ratios or interfere with traffic flow on site.

The contractor resolved all the clashes on Revit during the development of the drawings. For example, it adjusted the structure framing positions to allow room for the chilled water piping.

Another challenge was to level out a sloped ground surface. To

**Generators were placed on top of each other**

**"To stabilise the plant equipment, HPF built a supportive platform that could bear more than 300 tonnes"**

stabilise the plant equipment, Hurley Palmer Flatt built a supportive platform that could bear more than 300 tonnes. This would also accommodate future chillers. The platform was a significant feat of civic construction. Rather than build a utility bridge over the driveway on site – which may have presented traffic-height restrictions – Hurley Palmer Flatt built all connections into an underground trench.

Existing chilled water piping infrastructure was used on site – with modifications – to supply the two new chiller plants, offering cost savings to DCSG.

The company also installed a pump on the ground floor, stacking the cooling tower and condensing water heaters on top of it. The chilled water cooler and condenser were fitted in the space between the heaters, and the cooling towers stacked on top. Generators were also placed on top of each other, and the second storey of the chiller plant went as high as six metres.

Recycled water was used for the cooling tower make-up water. The source was NEWater – high-grade, reclaimed water produced in Singapore from treated used water, which is further purified using advanced membrane technologies and ultraviolet disinfection.

To minimise disruption on subsequent stages, all the foundations, with anchorage fittings for equipment, were constructed as part of stage one. This negates the need to bring intrusive piling equipment back on site for future expansions.

Hurley Palmer Flatt then installed four 25,000-litre underground diesel-storage tanks, which will help power the whole operation for 40 hours continually. Finally, a new substation was built behind the car park to support the upgrade, thereby providing two sources of power.

There is no operational data available at present as, initially, the chiller is meant to operate as backup to the landlord's supply. However, both DCSG and the current outsource company operating the plant say the new chiller is efficient and quiet. **C**

■ **MICHAEL TANG** is technical director at Hurley Palmer Flatt



**The tank for make-up water, sourced from high-grade reclaimed water produced in Singapore**

# Choose quality Choose performance



The **e-series** modular chiller range from Mitsubishi Electric offers a highly energy efficient solution, that's available in **90kW**, **150kW** and **180kW** sizes, with the ability for up to six individual modules to be connected together to provide a system capacity up to **1,080kW**.

Choosing a modular chiller system not only reduces plant space requirements, but makes installation easier. Available in cooling only and heat pump options, with built-in internal header pipe connectivity, the **e-series** has been designed to deliver maximum performance, increased reliability and optimal system efficiency.

Find out more about the **e-series** and our traditional range of chillers at:

[MEchillers.co.uk/cibse619](http://MEchillers.co.uk/cibse619)

THE COMPLETE  
**CHILLER**  
**SOLUTION**

# TOWERING SAVINGS

Big cuts in building water consumption can be achieved by using non-potable water in cooling towers, says Hilson Moran's **Andrew Russell**, who considers what water treatment solutions make the best savings

**W**ater consumption is a major consideration in large commercial buildings and, with world resources of drinking water at a premium, the need to look further to explore possible solutions for water conservation are much needed.

In recent years, the use of water by building occupants has been the focus, with improved design standards leading to more efficient water fittings and improved system design.

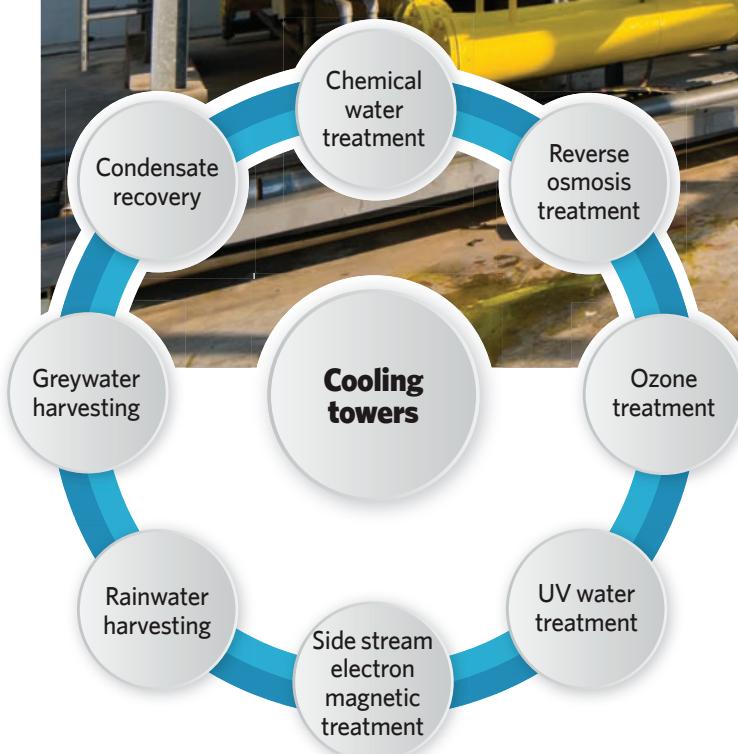
Water-recovery systems have also received attention lately, leading to more buildings incorporating rainwater and greywater recovery systems. However, the water consumed by building cooling systems has largely been ignored, relying on designers' perceptions of good practice to arrive at suitable and, hopefully, efficient solutions.

The water make-up use for cooling towers (CT) often has been overlooked with large volumes of potable water being wasted.

The main focus of this article is to show how a more sustainable solution can reduce potable water consumption and achieve additional credits for efficient water use within the project environmental assessments.

Most water-based efficiency measures can be analysed relatively simply and in isolation. This is not the case for CT water consumption, where a number of interrelated factors need to be considered to establish optimum solutions.

These include the combined effect of other water-recovery systems, the capital costs of cooling equipment and associated water-treatment systems, and the economic life of each system including consequential operating costs. By analysing these competing considerations holistically, an optimal solution can be achieved.



The water treatment options considered here include a number of water-treatment processes, which are widely used in the industry and have been considered for efficient treatment of the CT make-up water. They are:

1. Chemically treated CT with reverse osmosis (RO) treatment
2. Chemically treated CT with packaged side stream and membrane filtration treatment
3. Chemically treated CT with side stream separator and electromagnetic (EM) pre-treatment
4. Ozone treated CT
5. Ozone treated CT with RO pre-treatment.

A notional building with a fixed heat rejection load was used to allow analysis and comparison of the water savings with these solutions.

The notional building is very representative of many new large commercial developments currently being constructed, where CTs



provide the only viable means of rejecting excess heat.

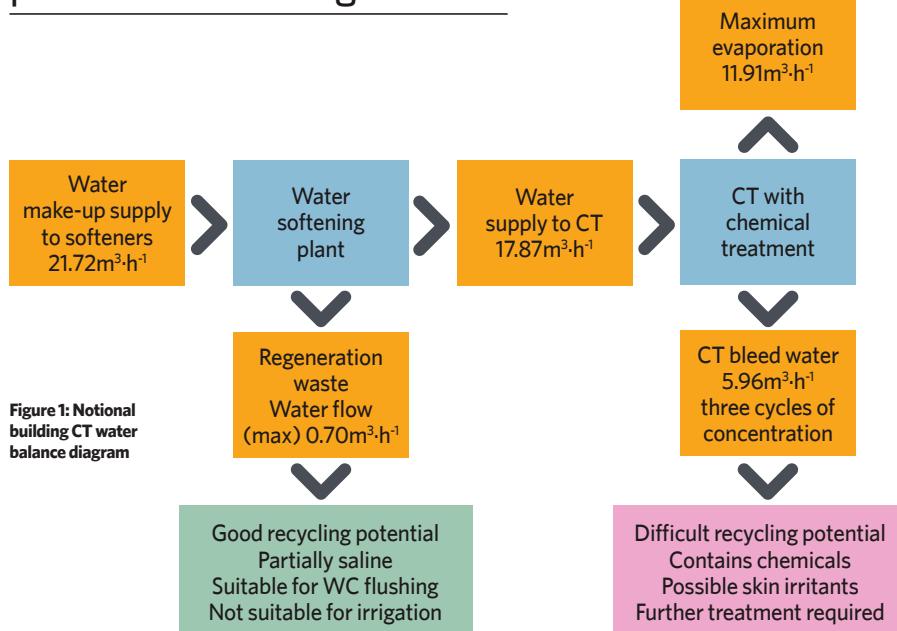
Typically, these buildings, because of the business activities required by tenants, have highly specified systems with large internal cooling loads that result in the building being in a cooling mode for the majority of the year.

Dynamic thermal modelling of the notional building cooling capacity allows for the assessment of the cooling capacity for every hour, 365 days of the year. From this raw data, annual profiles of the cooling load can be summarised to allow the water consumption to be assessed in more detail for each option.

The notional building cooling towers consume  $22\text{m}^3\cdot\text{h}^{-1}$  during a peak summer day with 261 work days that can be extrapolated as approximately  $45,936\text{m}^3\cdot\text{y}^{-1}$  without seasonal variations (Figure 1).

Table 1 shows the overall water consumption for the notional building and each option based on the maximum peak load excluding any water-recovery systems.

## "The water make-up use for cooling towers has been overlooked with large volumes of potable water being wasted"



It should be noted the CT bleed water figures highlighted in pink cells are not suitable for recovery due to the levels of chemicals present in the water.

In terms of recoverable waste water options, using ozone appears to be the most efficient, with option 6.4 being slightly more efficient resulting in the highest recoverable water figure of  $3.57\text{m}^3\cdot\text{h}^{-1}$ . This is a recoverable water saving of  $2.87\text{m}^3\cdot\text{h}^{-1}$ .

With further consideration of the use of water-recovery systems from other sources, such as rainwater, greywater and condensate, this saving can increase to 33%.

Table 2 shows the percentage savings against the overall annual water consumption for each option, with option 6.5 ozone with RO providing the highest saving of 33%.

The results have shown a potable water saving of 24% can be achieved on the notional building by using conventional chemical treatment for the cooling towers with the introduction of non-potable water for this process. Using rainwater harvesting, greywater recycling and condensate recovery can cut the cost of potable water supply and waste treatment by approximately £10-14,000 per year (see Figure 2).

However, other factors, such as water treatment and equipment costs, should be considered to get a balanced view of the water treatment options.

The results also show the importance of maximising the potential for water-recovery systems within the building, as this increases the options that can be used to maximise the water savings to gain additional environmental assessment points or credits.

Breeam and Leed are the two most widely recognised environmental assessment methodologies used globally in the construction today. Historically, Breeam has been used in the UK, but increasingly international clients are asking for the US Leed assessments to be used too.

It is not currently included specifically within any Breeam certification requirements to reduce or limit the volume of water used during this process. However, there are credits available for the reduction of water consumption (Wat 04 Water Efficient Equipment) for all major processes, but the onus is on the designer to identify these.

In addition to the water consumption credits, there are innovation credits available that may be gained if water consumption can be reduced due to the inclusion of alternative treatment methods that, together with the use of water-recovery systems, show exemplary performance levels.



➤ In contrast, the USGBC Leed certification requirements have included a specific water efficiency credit for CT water usage. The intention of the credit is to conserve water used while controlling microbes, corrosion and scale within the condenser water system.

One point is available if the following five parameters are not exceeded in the maximum concentrations up to a maximum of 10 cycles. This requires water analysis to be carried out, including measuring maximum concentrations.

Alternatively, two points are available under the following two options:

- 1) If a minimum of 10 cycles of concentration can be achieved by the CT by increasing the level of treatment
- 2) Meeting the maximum number of cycles with 20% recycled non-potable water.

A 20% water saving is significant when you look at the volume of water used for the evaporative cooling process.

To give consideration in terms of a single solution is difficult, due to the cost implications with the proposed treatment options, and the material selections required to suit, having impact on both capital and operating costs.

To summarise, there are a number of considerations to be taken into account when seeking the optimum solution, which will vary according to project requirements. Each water treatment option would be suitable for use as CT water make-up but, if combined with other water-recovery systems within the building, the overall consumption of potable water for mechanical uses can be reduced by approximately 22-33%.

Significant water savings are possible with the water treatment options considered, with annual water costs being reduced by up to £14,000.

It is worth noting the notional building analysis used UK weather data, and savings would be even greater in other regions such as the Middle East.

Additionally, all the options are above the minimum 20% recycled water figure required to achieve the additional Leed credit for water efficiency associated with CT water use.

Such solutions will become more common as the sustainability accreditation for new developments drive the need for these water-saving methods. A combined approach, which includes this water usage within the overall project water balance, will make a significant contribution to reducing overall water consumption in new buildings. **CJ**

**ANDREW RUSSELL MCIBSE MSOPHE** is a project director at Hilson Moran in Qatar and has an active role in the SoPHE Middle East regional group

Option	Treatment method	Total water supply use	Regeneration waste water	RO concentrate water	CT bleed water	Total recoverable waste water
		m³.h⁻¹	m³.h⁻¹	m³.h⁻¹	m³.h⁻¹	m³.h⁻¹
<b>Notional</b>	Chemical treatment only	21.72	0.70	Nil	5.95	0.70
<b>6.1</b>	Chemical with RO treatment	15.30	0.59	1.47	1.32	2.06
<b>6.2</b>	Chemical with packaged side stream and membrane filtration	16.47	0.62	Nil	2.03	0.62
<b>6.3</b>	Chemical with packaged side stream and EM treatment	19.87	Nil	Nil	7.95	Nil
<b>6.4</b>	Ozone treatment	15.49	0.59	Nil	2.98	3.57
<b>6.5</b>	Ozone treatment with RO pre-treatment	15.30	0.59	1.47	1.33	3.39

Table 1: Water use and recovery summary (excluding water use recovery systems)

Option	Treatment method	Annual water supply use	Recovered water contribution			Annual water use using recovered water	Annual water supply saving
			Annual rainwater harvested	Annual greywater harvested	Annual condensate harvested		
		m³	m³	m³	m³	m³	%
<b>Notional</b>	Chemical treatment only	37,347	3,029	5,505	576	28,237	24
<b>6.1</b>	Chemical with RO treatment	30,742	3,029	5,505	576	21,632	30
<b>6.2</b>	Chemical with packaged side stream and membrane filtration	33,125	3,029	5,505	576	24,015	28
<b>6.3</b>	Chemical with packaged side stream and EM treatment	41,526	3,029	5,505	576	32,146	22
<b>6.4</b>	Ozone treatment	31,140	3,029	5,505	576	22,030	29
<b>6.5</b>	Ozone treatment with RO pre-treatment	27,670	3,029	5,505	576	18,560	33

Table 2: Total water use and recovery summary (using water recovery systems)

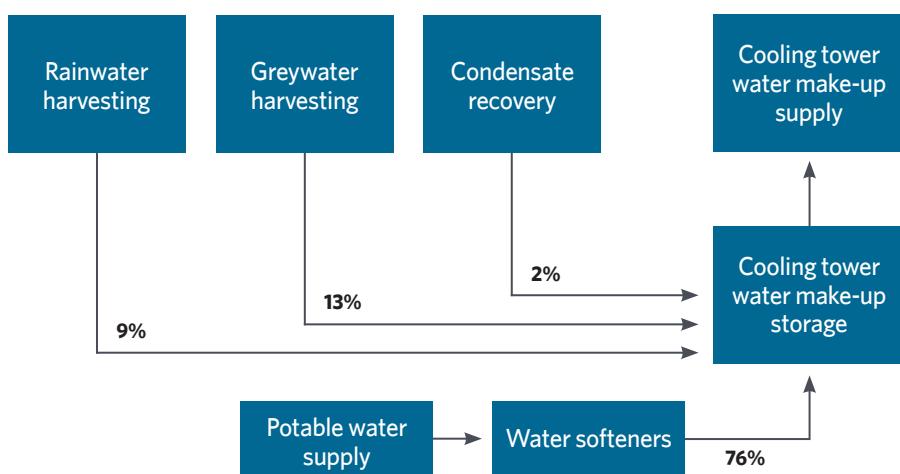


Figure 2: Typical combined water use recovery system



Reduces cooling costs naturally



The **EcoMesh** system for air cooled chillers, refrigeration, dry coolers and unitary units continue to meet with global success.

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Datacentres

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less electricity, more eco-friendly



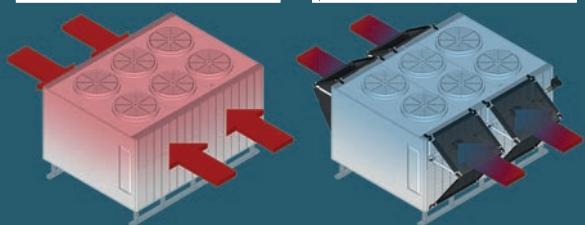
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BEFORE



AFTER



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**EcoMESH** extends compressor reliability and life.

### minimised water use

Spray is intermittent and only activated when required, hence it consumes 79% less water than any other wet systems.

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Eliminates health risks including Legionella from the use of coarse water.

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## Ensuring safe, environmentally sensitive refrigerants for building services applications

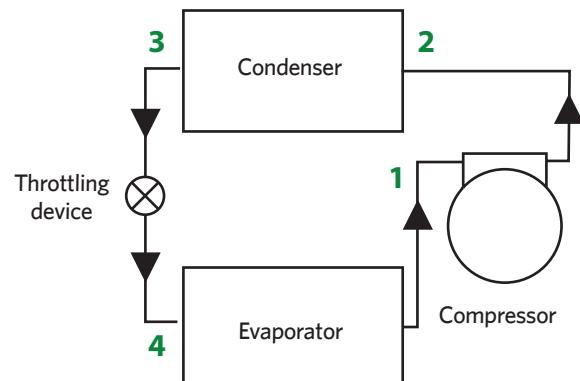
This module explores the demanding practical requirements for efficient and safe refrigerants and the application of lower-flammability refrigerants

Reducing the environmental impact of the built environment is driving technological changes in refrigerants as well as influencing professional and public realities of life-cycle risk assessment and moderation. This has generated renewed activity in the development and rediscovery of refrigerants that, in a world previously ignorant of the challenges of ozone depletion and global warming, would have not have been considered for HVAC system applications because of concerns about flammability.

This CPD article will consider the increasingly demanding practical requirements for efficient and safe refrigerants that are ushering in pragmatic acceptance of the lower-flammability refrigerants, and methodology to ensure their appropriate application.

The vapour compression refrigeration system is employed in the majority of building services systems' cooling applications, and is based on the basic simplified system as shown in Figure 1. (Although this article will refer to cooling systems, the same cycle and basic principles hold good for heat pump heating systems.) In a system, the cycle, as shown on the p-h diagram of Figure 2, will diverge from that of the simple cycle as indicated by the dotted line. This will depend on the specific system's components and control, as well as levels of wasteful evaporator superheating, frictional resistances, pressure losses and heat losses. However, the fundamental process remains the same. The refrigerant transfers thermal energy between the colder evaporator and the warmer condenser by changing state both at the upper and lower pressures, generated by the compressor and enabled by the throttling device. (The basic system is discussed more fully in *CIBSE Journal* CPD module 2, available at [cibsejournal.com](http://cibsejournal.com).)

The efficiency of the cycle can be described by the coefficient of performance (COP). The maximum theoretical efficiency is provided by the Carnot  $COP = T_c/(T_c - T_e)$  where  $T_c$  is the condensing temperature and  $T_e$  is the evaporating temperature, both in absolute temperature, Kelvin. The value of the evaporating temperature will have the most significant impact on the COP, since it affects both the numerator and



**Figure 1: Schematic of a notional vapour compression system**

denominator of the equation, but generally for high COP, the (colder) evaporating temperature should be as high as possible and the (warmer) condensing temperature as low as possible. The difference between the two temperatures is known as temperature 'lift'. In a real system, the COP is determined from the power ratio, (useful cooling, kW)/(compressor power input, kW) and is less than the Carnot COP due to the irreversibility of the pressure and thermal processes. The compressor power, described by the increasing 'concave down' curve 2-3, increases disproportionately with

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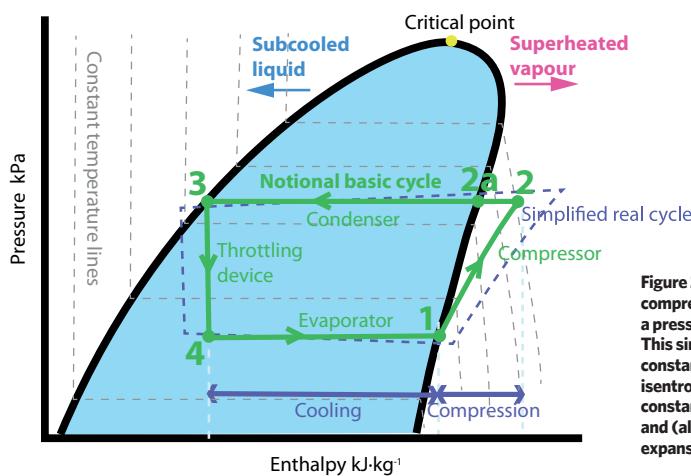
» lift, and so increasing lift has an increasingly significant detrimental impact on COP.

Practically, the operating temperatures are driven by the application so, for example, if a direct expansion (DX) cooling coil is employed in an air conditioning unit to cool air, the cooling coil (the evaporator) will need to be at a temperature below the required air temperature (the actual temperature will be dependent on the heat transfer properties of the coil). Equally, if the condenser was rejecting heat into summer outdoor air, the temperature of the condensing refrigerant must be greater than that of the air temperature. To provide the best practicable COP, careful consideration is needed to establish, and maintain, an appropriately low temperature condenser heat sink (typically air or water), as well as establishing the highest evaporator temperature that will still provide the cooling and, often, the dehumidification required by the application. (And, of course, the efficiency that matters to the end user is the whole-year energy use, and the best way of improving that is to manage the heat load on the system so that it is used as little as possible.)

So, the operating temperatures set the key conditions required of a refrigerant. In vapour compression refrigeration systems, the refrigerant is a fluid selected so that it readily evaporates and condenses at the required temperatures, at pressures that can also be practically delivered and maintained in the system. There are many fluids – both synthetic and ‘natural’ – that can be used for this purpose, and as manufacturing and piping technology advances, the opportunity to safely operate at more extreme pressures allows novel refrigerant applications.

There are a number of parameters that are considered when evaluating a potential refrigerant that, depending on the application, are likely to include:

- Appropriate thermophysical properties – so that the system operates at acceptable pressures with low compressor input power and high refrigeration effect
- Environmentally benign – low global warming potential (GWP) and zero ozone depletion potential (ODP), with high COP to minimise primary energy use and indirect emissions
- Low or zero toxicity to occupants (directly or indirectly)
- Acceptably low risk of flammability. And in addition there are key operational requirements:
- Remains stable within the system and be compatible with system pipework and component materials (including high dielectric strength for hermetic compressors)



**Figure 2:** The vapour compression cycle plotted on a pressure-enthalpy diagram. This simple basic cycle includes constant pressure evaporation, isentropic compression, constant pressure condensation and (almost) adiabatic expansion (throttling) process

- Self-lubricating (or at least compatible with lubricants)
- Easy and safe to handle and detect
- Acceptable cost.

The evaluation of suitable substances is complex and practically includes multivariate analysis that has been led by manufacturers and research teams, including a team led by McLinden at the US National Institute of Standards and Technology (NIST).<sup>1</sup> However, there are some fundamental properties that determine potential suitability.

The basic thermodynamic properties of a potential refrigerant are the normal boiling point (NBP) and the critical temperature. A NBP – the boiling temperature at atmospheric pressure – below the required cold temperature will ensure that the evaporator operates at a positive pressure, so reducing the opportunity for the leakage of ambient air, non-condensable gases and water vapour into the system (which would all reduce the system performance). However, an excessively low NBP will increase the condenser pressure and density of the refrigerant vapour, which will increase the work required by the compressor.

The critical temperature of a refrigerant is that above which the vapour cannot be condensed into a liquid, no matter how high the pressure. This will be constrained not only by the application but also the geographic location since, for example, warmer climates will not be able to use refrigerants with critical temperatures below that of the high ambient temperatures. However, that same equipment could operate (more efficiently) in temperate areas with different refrigerants that possess a lower critical temperature. So, the refrigerant critical temperature must be greater than the condensing temperature, and considering the critical point (as shown in Figure 2), it is evident that to gain most benefit from the rejection of heat as the refrigerant condenses, the critical pressure must be appreciably higher than the condensing pressure so as to ensure that the enthalpy difference between 2a and 3 is as large as practicable. However, an excessively high critical temperature will reduce the volumetric refrigerating capacity (refrigerating effect per specific volume of refrigerant) due to increased vapour-specific volumes, and so will increase compressor displacement.

The refrigeration effect (line 4-1 in Figure 2) is determined by the proportion of latent heat of evaporation that takes place in the evaporator. Refrigerants that have a more upright p-h characteristic curve will utilise a greater proportion of the potential latent heat of evaporation that – in conjunction with the specific volume of the

Flammability	A - Lower toxicity	B - Higher toxicity
1 - No flame propagation (considered non-flammable)	A1	B1
2L - Lower flammability	A2L	B2L
2 - Flammable	A2	B2
3 - Higher flammability	A3	B3

**Figure 3:** Standardised index of refrigerant flammability and toxicity

refrigerant vapour leaving the evaporator – determines the displacement (and mass flowrate) required from the compressor, and so the compression power. The heat transfer coefficient of a particular fluid, and its ability to move heat into the surfaces of the evaporator and condenser, will affect the area required for heat transfer, and so also impact the flow requirements and compressor power.

As well as meeting requirements to limit ozone depletion, the key environmental aspect that determines a substance's suitability as a refrigerant is the potential impact on global warming that results from direct and indirect emissions, both in operation and production. (These are encapsulated in the concept of 'life-cycle climate performance'.<sup>3</sup>) However, when considering the fundamental impact of a particular substance, GWP is the index that allows comparisons of the potential global warming impact of different gasses compared with CO<sub>2</sub> over 100 years, as shown in Figure 4. The GWP of refrigerants is being limited by diktats including the EU F-gas regulations<sup>4</sup> and the 2016 Kigali Amendment to the Montreal Protocol.<sup>4</sup>

This has constrained the available range of acceptable refrigerants, accelerating the development of refrigerants and increased application of 'natural' refrigerants – and, as suggested by the data in Figure 5, there is still some way to go.

The quest to employ environmentally benign refrigerants (that meet the foregoing thermophysical requirements) has intensified the need to examine and assess the risks of toxicity and flammability. Toxicity reflects the quantity or concentration needed to cause harm, and substances that pose a high risk in small quantity – even with short exposures – are regarded as toxic. Refrigerant flammability indicates its ability to burn or ignite, and will only occur if the volumetric concentration in the air is between the lower and upper bounds that provide conditions for flammability. The consequences of combustion depend on the burning velocity, heat released and byproducts of combustion. An index of risk of toxicity and flammability has been codified in international standards (including BS EN 378:2016<sup>5</sup>), which is used to categorise refrigerants using standardised tests, and is shown in Figure 3.

Figure 4: The GWP profile of current refrigerants (Source: Toshiba)

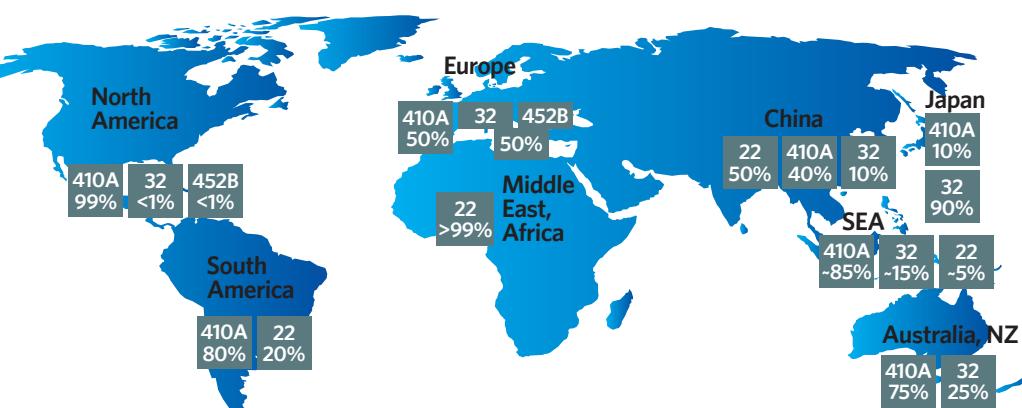
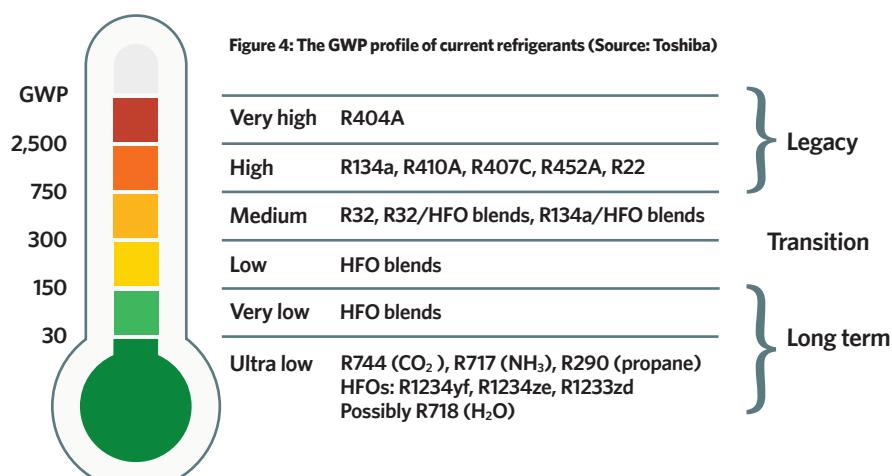


Figure 5: Estimation of current global refrigerant used in new systems, based on market reports (Source: ASHRAE webcast, 'The Future of Refrigerants' April 2019)

The chlorofluorocarbon (CFC), hydrofluorocarbon (HFC) and hydrochlorofluorocarbon (HCFC) refrigerants in use over the past 80 years have been safety flammability class 1. The flammability subclass 2L was recently introduced to provide better discrimination in the practical risk of flammability, specifically to provide scope for the application of refrigerants that would otherwise be categorised simply as class 2. Flammable refrigerants (class 2L and above) will not ignite if the concentration level is below their lower flammable limit (LFL). Legislation and standards define requirements that ensure concentrations remain below this in case of accidental leakage. In practical terms,<sup>6</sup> it is very difficult to ignite 2L gases, and extensive investigations 'have indicated that flammability of 2L refrigerants is acceptable for air conditioners and heat pumps'.<sup>7</sup> However, this does not preclude a proper risk assessment since, for example, at the point of leakage the concentration will always be above the LFL – so a proper one is always required.

To limit the risk of toxicity, flammability and asphyxiation a refrigerant concentration limit (RCL), in kg·m<sup>-3</sup>, is set by BS EN 378:2016, which is used to establish the maximum refrigerant charge that may be used in a particular application. The standard accepts that the maximum leakage into an occupied space is assumed to be not greater than a pinhole leak, and the maximum charge is calculated on that basis.<sup>6</sup> The calculation method accounts for normal and augmented room ventilation rates to maintain an acceptable RCL that are quantified respectively as the quantity limit with minimum ventilation (QLMV) and the quantity limit with additional ventilation (QLAV) – both in terms of kg refrigerant charge per m<sup>3</sup> of occupied space. The freely downloadable FETA publication, *An introduction to A2L refrigerants and their use in Refrigeration, Air Conditioning and Heat Pump applications*, provides some clear examples of how to evaluate acceptable RCLs for a particular room, in accordance with BS EN 378:2016. This accounts not only for the refrigerant toxicity and flammability, but also for characteristics relating to the specific application in the room.

Refrigerants with anything other than class 1 flammability should only be used in systems designed specifically to take account of their flammability characteristics. They should never be used to replace non-flammable refrigerants in retrofit applications without a full risk assessment and appropriate modifications.

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■ Turn to page 58 for references.

# Module 146

June 2019

» 1. Which part of the refrigeration process (shown in the p-h diagram) will provide the most significant cooling?

- A 1-2
- B 2-2a
- C 2a-3
- D 3-4
- E 4-1

2. Which of the following was not noted as a one of the preferred parameters or operational characteristics for a refrigerant?

- A Acceptably low risk of flammability
- B Appropriate thermophysical properties
- C Environmentally benign
- D Low critical temperature
- E Low or zero toxicity

3. Which of the following was shown as a likely transition refrigerant?

- A R12
- B R32
- C R404A
- D R452A
- E R718

4. What would be the appropriate designation for a lower-flammability, lower-toxicity refrigerant?

- A A1
- B A2L
- C A3
- D A3L
- E B2

5. What is RCL?

- A Refrigerant concatenated limit
- B Refrigerant concentrating limit
- C Refrigerant concentration limit
- D Refrigerant contamination limit
- E Refrigerant COP limit

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### Further information and reading:

The recent ASHRAE webcast provides an excellent overview of the current state and future of refrigerants at [www.youtube.com/watch?v=vTg7v4eSWqI](https://www.youtube.com/watch?v=vTg7v4eSWqI).

IoR presidential member Andy Pearson provides an accessible explanation on refrigerants in the one-hour webinar at [cibse.org/index.htm#RefChoice0217](http://cibse.org/index.htm#RefChoice0217).

The IIR published a useful guide that explains the methodology of establishing life-cycle impact of refrigerants at [www.iir.org/userfiles/file/about\\_iir/working\\_parties/WP\\_LCCP/08/Booklet-LCCP-Guideline-V1.2-JAN2016.pdf](http://www.iir.org/userfiles/file/about_iir/working_parties/WP_LCCP/08/Booklet-LCCP-Guideline-V1.2-JAN2016.pdf).

The flammability of refrigerants is clearly explained at [www.kth.se/en/itm/inst/energeteknik/forskning/ett/projekt/koldmedier-med-lag-gwp/low-gwp-news/nagot-om-koldmediers-brannbarhet-1.575938](http://www.kth.se/en/itm/inst/energeteknik/forskning/ett/projekt/koldmedier-med-lag-gwp/low-gwp-news/nagot-om-koldmediers-brannbarhet-1.575938).

For commentary on refrigerants, the general (commercial) US-based website [refrigeranthq.com](http://refrigeranthq.com) provides a good general resource.

CIBSE Guide B3:2016 – section 3.3.3.4 gives useful background (but pre-dates the 2016 changes to BS EN 378).

### References:

- 1 McLinden, M et al, *Limited options for low-global-warming-potential refrigerants*, Nature Communications 2017 DOI 10.1038/ncomms14476.
- 2 *Guideline for Life Cycle Climate Performance*, IIR, 2016.
- 3 EC Regulation 517/2014.
- 4 <https://ozone.unep.org/news/kigali-amendment> – accessed 11 May 2019.
- 5 BS EN 378:2016 *Refrigerating systems and heat pumps – Safety and environmental requirements*, BSI 2016.
- 6 *An introduction to A2L refrigerants and their use in Refrigeration, Air Conditioning and Heat Pump applications*, FETA 2017.
- 7 Makhnatch, P, *Understanding refrigerant flammability*, KTH Royal Institute of Technology, 2015.

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# PRODUCTS & SERVICES

## ▼ AET supplies comfort cooling to Blackheath High School



AET Flexible Space has supplied an underfloor air conditioning system to Blackheath High School, London, to provide comfort cooling for students in the new learning zone.

The school has recently invested £18m in developing its facilities, including a new library and resource centre. These are located on the lower ground floor, sunk beneath the existing site and the new courtyard area. Because of the underground location of the resource centre, air conditioning was required.

An underfloor system was specified by

consultant Hilson Moran so the ceiling space, featuring unique pyramidal skylights, could be left exposed.

Underfloor air conditioning makes use of the plenum beneath a raised access floor to distribute conditioned air. A single CAM-V33 direct expansion downflow unit serves the air conditioned zone, and the conditioned air is supplied by 14 TU4 fantesiles. The CAM-V receives spent air back for reconditioning via high-level transfer grilles. A major challenge was the 900mm-high underfloor void within the main resource area, requiring special modification to the CAM baseframe and raised floor substructure.

■ Call 01342 310 400 or email [aet@flexiblespace.com](mailto:aet@flexiblespace.com)

## Armstrong launches new controller for multi-pump installations with variable loads ▶

Armstrong Fluid Technology has released a new integrated pumping system, the IPS 4000 – an automation solution for commercial HVAC pumping stations of up to eight pumps and 16 zones.

It optimises multi-pump installations in a range of plant configurations. Providing sequences for variable primary, secondary or tertiary pumping system applications, it delivers significant energy savings, using Armstrong's patented parallel sensorless pump control technology. The IPS 4000 offers fast and simple setup, and is suitable for new installations and retrofit.

■ Visit [armstrongfluidtechnology.com](http://armstrongfluidtechnology.com)



## Mitsubishi Electric expands its IT cooling offering ▼

Mitsubishi Electric's new s-MEXT high-precision air conditioning systems have broadened the company's offering in the IT cooling market. The s-MEXT connects directly to Mitsubishi's direct expansion Mr Slim Power Inverter outdoor units, to create a full inverter split system. It is also the firm's first packaged computer room air conditioning (CRAC) unit.

In addition, the s-MEXT is the first Mitsubishi Electric hydronics and IT cooling systems product to carry the three diamonds, taking advantage of more than 50 years' experience within the IT cooling market of the RC brand, plus Mitsubishi Electric's quality standards.

The units are available in capacities from 6kW to 42kW and are ideal for applications where high sensible cooling and close control of temperature and humidity are required, such as small and medium sized businesses (enterprise data centres) with on-premise IT cooling requirements. They are also available in both upflow and downflow variants.

■ Visit [les.mitsubishielectric.co.uk](http://les.mitsubishielectric.co.uk)

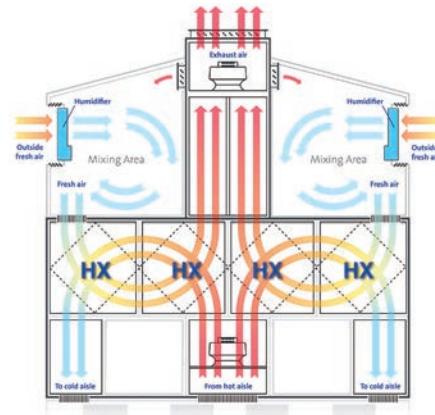


## ▲ Lochinvar launches stainless steel storage water heaters

Boiler and water heater manufacturer Lochinvar has launched a new range of stainless steel, gas-fired storage water heaters.

Both models in the EcoSable range are fully condensing and have hot-water recovery rates of 620 and 800 litres per hour, based on a temperature rise of 50°C. They each have a storage capacity of 186 litres. Key benefits of EcoSable water heaters are their ability to operate at temperatures up to 85°C, and with water pressures of up to 8bar.

■ Visit [www.lochinvar.ltd.uk](http://www.lochinvar.ltd.uk)



## ▲ Condair ME helps Edpac cool at Irish internet exchange

The Condair ME evaporative humidifier is providing adiabatic cooling, in an innovative indirect cooling system from Edpac, at the Cork Internet Exchange (CIX) in Ireland. Edpac's indirect air-to-air evaporative cooling system will maintain the temperature across CIX's data halls without using chillers and using 75% less energy than a traditionally cooled data centre.

The installation of the low-energy cooling system was part of a €6m (£5.29m) extension at the 2,800m<sup>2</sup> data centre.

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



## Lochinvar cleans up as hotel brings laundry back in-house

Lochinvar has supplied two high-efficiency, gas-fired EcoSword water heaters to the DoubleTree by Hilton hotel, at Stadium MK in Milton Keynes.

Its fully condensing, low-NO<sub>x</sub> storage water heaters were installed by contractor Professional Energy Solutions to supply a dedicated hot-water system for DoubleTree's new in-house laundry.

EcoSword water heaters are available in nine models with storage capacities from 163 to 388 litres, and rapid hot-water recovery rates from 210 to 540 litres per hour based on a temperature rise of 50°C. The 'cold zone' heat exchanger design ensures the unit operates in condensing mode for as long as possible and, with its fully modulating pre-mix burner, it achieves seasonal efficiencies of up to 98.2% (Building Regulations) and water heater efficiency of up to 94% (ErP).

The hotel expects to achieve considerable cost savings and reduce its greenhouse gas emissions by keeping the laundry service on site and using high-efficiency technology, such as the EcoSword.

■ Visit [www.lochinvar.ltd.uk](http://www.lochinvar.ltd.uk)



## York hospital sticks with Rinnai hot-water heating units

Clifton Park Hospital in York has again chosen Rinnai to upgrade its hot-water heating system to meet increasing demand, while being economical and environmentally efficient.

The new system features three Rinnai HDC 1200i units, plus a 500-litre cylinder. A Rinnai HD50i looked after the hot-water demand at the hospital for 10 years, but – as a result of expansion – a new, bespoke system was required. The Rinnai HDC 1200i continuous model is for use on high-demand sites, as it is capable of delivering 2,000 litres per hour.

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

## Grundfos stays in control at Glastonbury

As music festivals go, they don't get much bigger or better than Glastonbury. The logistics of putting on an event for more than 200,000 people is mind-boggling, and ensuring the availability and accessibility of sufficient clean water is just one aspect.

Grundfos Pumps will not feature on the Pyramid Stage or be listed on a programme, but it is proud to be playing a small role in delivering an important – if rather taken-for-granted – element: water.

After a site survey, attention was focused on improving the overall control and efficiency of the booster units. This is an important aspect, because energy use and sustainability are always high on Glastonbury's agenda. Coming up with a bespoke solution to this unique requirement, Grundfos put forward a coordinated approach that involved: the upgrade of the pump motors to more energy efficient versions; the incorporation of a new precision-dosing system; and a remote monitoring system that would mean a significant improvement in data exchange.

■ Call 01525 850000, email [grundfos-uk@sals.grundfos.com](mailto:grundfos-uk@sals.grundfos.com) or visit [www.grundfos.co.uk](http://www.grundfos.co.uk)



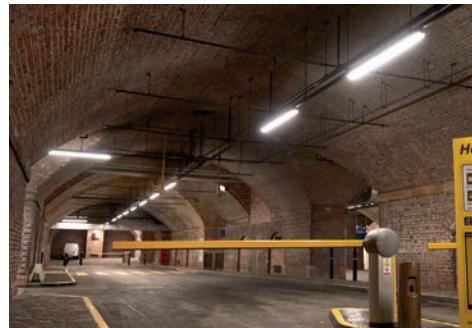
## Luceco lights Manchester Central Car Park

Manchester Central Convention Complex is an award-winning venue that has been an iconic feature in the city for more than 130 years. The complex was originally one of the city's main rail terminals.

With the capacity to handle large-scale conferences and exhibitions, good car parking and traffic management is of great importance to the venue. Luceco has recently supplied more than 550 Climate luminaires to relight the parking facilities. With cost-effectiveness in mind, while also striving to improve the complex's carbon footprint, ageing T8 fluorescent fittings were removed and replaced with energy-efficient, 6ft, twin-output LED luminaires. Luceco was chosen because of the Climate luminaire's performance and the significant energy savings that could be achieved.

Climate Extra is a robust LED IP65-rated luminaire, offering an efficacy of 140Llm/cW with increased performance for improved energy efficiency. Climate Extra is also available with Dali drivers and emergency back-up variants, including self-test.

■ Call 01952 238100, email [uk\\_sales@luceco.com](mailto:uk_sales@luceco.com) or visit [www.luceco.com](http://www.luceco.com)



## Condair expands dehumidifier range

The new Condair DA desiccant dehumidifier range now includes capacities from 0.6 to 182 litres per hour

– at 20°C/60% relative humidity (RH) – from its standard models, with customised units able to meet larger drying requirements. Features include the ability to operate down to -30°C and maintain an air humidity as low as 1% RH. Units can incorporate onboard touchscreen controllers and BMS connectivity. AC or EC fans are available and are positioned in a push configuration before the desiccant rotor on the regeneration airflow.

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





## ▲ Cosmogas MYdens: The new generation of gas condensing boilers

Gemtex, the UK partner of Cosmogas, successfully launched the MYdens boiler in the UK in 2018.

The robust, titanium heat exchanger has a 10-year warranty as standard, as does the burner. The Cosmogas designed and patented exchanger is 100% titanium stainless steel for high efficiency, durability and long life, and has an 11bar maximum operating pressure, making it suitable for high-rise applications.

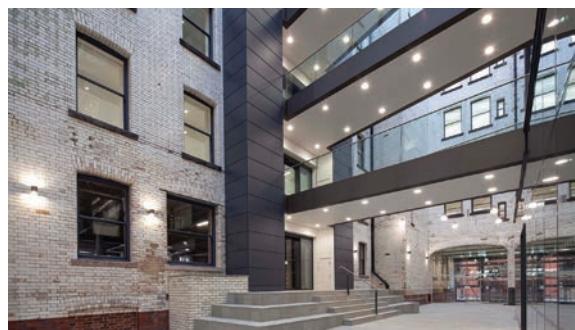
The exclusive design of the heat exchanger at the heart of the MYdens system is the result of intensive research and testing, combined with the know-how of Cosmogas, which has designed and patented heating boilers for 50 years. The exchanger has been designed to reach an optimal thermal exchange along the entire surface of each layer of the exchanger and display exceptional efficiency of up to 109%.

The patented Cosmomix air/gas mixing system gives a wide modulation range, with the MYdens 280T having a burner turndown ratio of 1:20. The ecologic premix Fecralloy metal fibre burner also enables ultra-low NOx levels.

For 280kW, the compact size requires only 0.42m<sup>2</sup>. Cascade header kits allow connection for four 280T as standard, offering full modulation from 14kW to 1.12MW, an impressive ratio of 1:80, giving high efficiency with security of supply from 16 burner modules.

It is compatible with all BMS systems, Modbus and BACnet, or can operate on its own with the standard built-in cascade controls. Each boiler has a built-in condense neutraliser in the base as standard.

■ Email [info@gemtex.co.uk](mailto:info@gemtex.co.uk) or visit [www.gemtex.co.uk/cosmogas/commercial-range/mydens-t](http://www.gemtex.co.uk/cosmogas/commercial-range/mydens-t) or [www.gemtex.co.uk](http://www.gemtex.co.uk)



## Mikrofill at Hounslow town primary ▾

A new five-form entry school, constructed by Jerram Falkus, has been built in Hounslow, West London, and the second phase of the build will include 284, mixed-tenure homes, including affordable housing.

Building services consultants Baily Garner delivered a fully designed M&E project that incorporated Mikrofill equipment. The school's LPHW/HWS demand was met by the selection of three Ethos FS 350kW, twin-burner condensing boilers. Installed by long-standing contractor R&H Building Services, the stainless steel boilers present a collective turn-down ratio of 60 > 1 (1,050 > 17.5kW), produce as little as 31mg/kW of NO<sub>x</sub>, and can be installed as close as 50mm from one another.

The domestic hot water demand throughout this large primary school is catered for by two WRAS-approved Extreme 500-litre loading cylinders.

The existing school continued operation during the site redevelopment, with the new school being occupied in September 2018.

■ Call 03452 606020 or visit [www.mikrofill.com](http://www.mikrofill.com)



and legislation, both current and pending. End users now expect to be offered service and maintenance plans – largely because of the domestic boiler market and other consumer appliances – and Rinnai has noticed increased demand and enquiries in recent years.

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

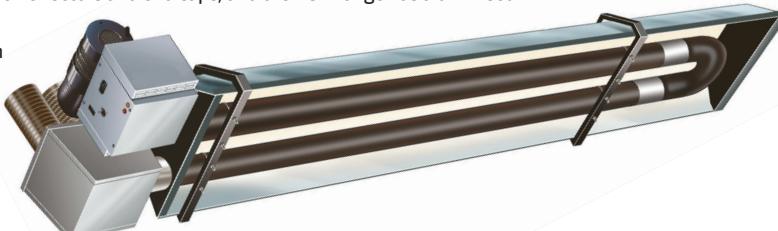
## Reznor Vision range offers exceptional performance ▾

Reznor, part of Nortek Global HVAC (UK), continues its tradition of manufacturing high-efficiency heating equipment with its ErP-compliant Vision range of radiant tube heaters, which deliver exceptional performance in terms of efficiency and the potential to reduce energy costs.

The foundation of this development is a high-efficiency advanced burner. The VS range comes complete with stainless steel reflectors and end caps, and the VSA range has aluminised reflectors and end caps.

Both ranges are available in U-tube, singular and double linear models.

■ Email [erp@nortek.com](mailto:erp@nortek.com)  
or visit [www.nortek-erp.com](http://www.nortek-erp.com)



## ◀ Historic city centrepiece refurbished with Kingspan's help

Kingspan products have been installed on the Grade II-listed Hanover at Noma, in Manchester, to give space-saving insulation. Kingspan Kooltherm Pipe Insulation achieves industry-leading aged thermal conductivities as low as 0.025W/m·K (at +10°C mean), so a reduced thickness of insulation can be used. Kooltherm Duct Insulation has been installed on the internal ductwork of Hanover, as it can achieve conductivities as low as 0.022W/m·K (at +10°C mean). On the external ductwork fabricated for the roof, Kingspan Therma Duct Insulation was fitted, as its high-performance core can achieve a conductivity as low as 0.023W/m·K (at +10°C mean). It has an operating temperature range of -20°C to 80°C.

■ Call +44(0)1544 388 601, email [info@kingspaninsulation.co.uk](mailto:info@kingspaninsulation.co.uk) or visit [www.kingspanindustrialinsulation.com](http://www.kingspanindustrialinsulation.com) and [www.kingspanductwork.co.uk](http://www.kingspanductwork.co.uk)

## Hamworthy boiler is commended at SEAI Energy Awards

Hamworthy's space-saving Upton boiler, with more than 1MW of output from less than 1m<sup>2</sup> footprint, has been commended in the Best Innovative Product category at the SEAI Sustainable Energy Awards.

Manufacturers from Ireland and the rest of Europe assembled at the two-day SEAI Energy Show in Dublin. The judges recognised the Upton's most distinctive features: a large output from a small footprint, with the ability to fit into small plantrooms, and a specially designed aluminium heat exchanger with rapid heat transfer, making it highly efficient.

■ Call 01202 662500, email [sales@hamworthy-heating.com](mailto:sales@hamworthy-heating.com) or visit [www.hamworthy-heating.com](http://www.hamworthy-heating.com)



## Floor-mounted pumping solutions brought to your desk

It is really useful to examine physically and discuss a product to ensure you make the right equipment selection.

For this reason, Pump Technology business development manager David Johnson regularly visits central London with a range of wastewater and sewage pumping systems.

It's a methodology that is working well with public health engineers, enabling them to see and understand, first hand, the products they are interested in specifying.

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



## Systemair configurator for Topvex units

Systemair's new product-selection platform is developed for present and future techniques.

The user-friendly interface allows you to find a Topvex air handling unit (AHU) in a quick and easy manner. Its features include: quick filtration to find the correct model; intuitive configuration functionality; technical product information in the configurator; a 3D view of AHUs and mounted accessories; CAD export in .dxf format; and the creation of technical reports.

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

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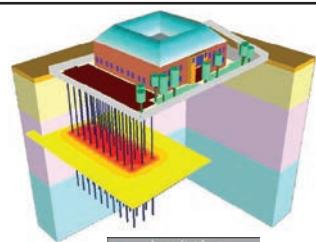
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## Public Health Engineer

**London, £45p/h**

I have a requirement for a Public Health Engineer to work on a temporary contract in the heart of London. You will provide designs through to completion on a large international commercial project. The work is detailed design on above and below ground systems. This is a long-term contract with an immediate start. Ref: 5488

## Intermediate/Senior Electrical Engineer

**North London, Up to £48k + bens**

A medium sized company renowned for delivering some of the most iconic commercial, residential, mixed use and master plan schemes across London, and overseas is looking to appoint an ambitious electrical engineer to join one of 4 MEP teams. Typical projects values range from £10million to £200million. Excellent benefits package offered along with continuous CPD opportunities and long-term career prospects. Ref: 5489

## Mechanical Design Engineer

**London, £40ph**

A contract mechanical design engineer is required for a leading design consultancy in London. You will be providing conceptual design to an exciting international commercial project. The work is predominantly conceptual with some detailed design on HVAC systems as well as client liaison. This is a long-term contract with an immediate start. Ref: 5407

## Senior/Principal Electrical Engineer

**London, £50k - £65k + bens**

Dynamic, innovative and creative. Does this sound like you? How about working for one of London's most pioneering and progressive MEP Consultancies? Successful candidates 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

## Public Health Engineer

**London, £35k - £58k + bens**

An opportunity to join a consultancy established for over 40 years with offices across the globe and currently employing c1500 engineers. Their work has been noted with numerous awards, commendations and a recent industry good employer guide mentioned them within the top ten firms to work for. The company work on a rich and diverse portfolio of projects ranging from art & leisure, scientific, urban developments, commercial and heritage schemes. Ref: 4786

## Intermediate Mechanical Building Services Engineer

**London, £35k - £43k + bens**

I'm working in partnership with a highly commended and award-winning practice who are actively looking for a talented and driven engineer. This is a fantastic opportunity for an engineer to join an international consultancy who have been established for over 25 years. Ref: 5490

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## New Basics of BIM Online Modules Released



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55 Bishopsgate, one of the properties managed by MJ Mapp



Carl Brooks

## The digital dividend

**The adoption of Demand Logic's data analytics across MJ Mapp's portfolio will help the property manager cut energy use and improve comfort, says Carl Brooks**

After several successful pilots over the past 18 months, which demonstrated substantial energy savings, property manager MJ Mapp has partnered with data analytics firm Demand Logic to evaluate real-time operational performance across its building portfolio.

MJ Mapp's building managers, management team and clients can view data remotely, to see which properties are performing well and which need attention. This allows building managers to assign engineers to issues that need to be fixed.

Demand Logic's software allows MJ Mapp to reduce energy consumption in its properties, facilitate condition-based maintenance, and control thermal comfort more closely. Future development will enable the use of health and wellbeing data to add value to the service provided for clients. Carl Brooks, head of sustainability at MJ Mapp, is overseeing the rollout of the technology.

### Why are you using data analytics on your buildings?

The primary objective is to make big gains in energy efficiency. We chose Demand Logic not only because it fulfilled the brief on saving energy, but because it also focuses on occupier comfort. In time the aim is to expand the number of data points to build a broader picture of internal environmental quality, monitoring CO<sub>2</sub>, humidity and air pollution among others. As well as improving energy efficiency and thermal comfort, we want the software to help maintenance engineers to work more effectively, delivering further cost savings.

### How many buildings are you monitoring?

Currently, four. We want to roll out the technology to around 60 multi-let offices over the next three years. There are two building types: those with a BMS in place, which are the subject of the first phase, from which Demand Logic can extract data; and those without a BMS, requiring technology based on sensors.

### How might you use environmental data?

As our use of the platform develops, by overlaying data onto a floor plan, we will be able to advise clients and occupiers on how buildings and spaces behave. We will see the areas that systems struggle to heat and cool, and use the results to inform space planning. For example, if an area is prone to overheating, you may not want to put desk-based teams there. In targeting health and wellbeing, we

may have to accept that the data requires some increase in energy consumption. If a building struggles with air quality, we may need to pump in more air, which will have a negative impact on energy consumption. The improvement in internal comfort should lead to productivity gains, but we must be upfront with clients about the impact on energy use.

### What is the cost to the client?

The energy savings are so high and it is fully funded by the savings; paybacks given to date are projected to be achieved in just six-to-eight months. We are trying to get the kit installed at the beginning of the service-charge year, so we can accrue the savings over 12 months, effectively making the software costs invisible. In one building, the energy savings have been £45,000 a year – an 8% saving on energy bills with a similar saving being achieved on maintenance costs.

### Can tenants access the data?

We have partnered with a company that supplies property-level microsites showing bookings, deliveries, budgets and so on, and we're exploring using this to give occupiers access to an energy dashboard. We want to show tenants how they are performing compared with the rest of the building, and possibly allow them to compare results with co-tenants. We want to nudge tenants by showing how they could save costs.

### What has been the response from building management teams?

Feedback from practitioners has been incredibly positive. Other systems are very much engineering tools, which appear quite dry and impenetrable to a lay person. Demand Logic has an engaging GUI. It can be assigned to engineers, and they can comment on actions. There is also a 'rogue finder', which enables you to pinpoint issues, take action, and see the results in near real time. It took a few months to bed in the pilot systems and manage feelings of negativity at first; its introduction implied that engineers had not been doing a good job. What we say is that a better tool will help you do a better job. Building managers on the pilot project are sharing what they have learned with those new to the software. This peer-to-peer approach has helped with subsequent buildings' adoption of the system.

# EVENTS

## NATIONAL EVENTS AND CONFERENCES

### Facilities Show

18 June, London

More than 12,000 facilities management professionals from around the world meet up to source cost-effective solutions across all sectors. Visit CIBSE on stand FM6244. [www.facilitiesshow.com](http://www.facilitiesshow.com)

### Build2Perform Live

26-27 November, London Olympia

The programme for the 2019 event will be announced in June. Register for your free place to CIBSE's flagship 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

### Variable flow water system design

3 June, London

### Energy Savings Opportunity Scheme

5 June, London

### Mechanical services explained

5-7 June, London

### Fire risk management systems: PAS 7 2013

7 June, London

### Understanding and application of psychrometric charts

10 June, London

### Building services explained

11-13 June, Manchester

### Below-ground building drainage

12 June, London

### Air conditioning and cooling systems

14 June, London

### HIGHLIGHT



Malcolm Atherton, Cundall, will speak at the SoPHE South West event on 10 June

## New training course: avoiding overheating

24 July, London

CIBSE and The Green Register have teamed up to present an afternoon seminar exploring the subject of overheating.

With increasingly high temperatures being experienced during the summer months, overheating is a growing concern and can, sometimes, be life threatening. With good design and communication, however, it can be avoided.

The half-day session in London will look at the causes of overheating and present solutions that can be easily included into the design of buildings.

It will cover definitions, regulatory framework and assessment methodology, early-stage design and detailed design guidance. [www.cibse.org/avoiding-overheating](http://www.cibse.org/avoiding-overheating)



### 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

### CIBSE GROUPS, SOCIETIES AND REGIONS

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

### West Midlands: Summer social

8 and 9 June, Shrewsbury

Loton Park, to see a variety of sports, classic and racing cars.

### South West: Wholesome water design and practical water-safety measures

10 June, Bristol

First in a series of new events to kick off SoPHE South West. With presentations from Malcolm Atherton, Cundall, and Daniel Pitcher, Water Hygiene Centre.

### The Society of Public Health Engineers AGM

11 June, London

Preceded by a technical presentation.

### ILEVE AGM

11 June, Birmingham

AGM of the Institute of Local Exhaust Ventilation Engineers.

### Lifts Group

12 June, Manchester

Presentations on The British lift by Michael Bottomley, and ampetronic, assistive listening in lifts by Pamela Gray; plus an update on codes and standards by Adam Scott.

### Home Counties

#### South West: Membership briefing

13 June, London

Routes into Associate and Member grades, and registration with the Engineering Council at Incorporated and Chartered Engineer level.

### SFE City Walk

18 June, London

Society of Façade Engineering walking tour around an area of London to discuss façades.

### Young Energy Performance Group: AGM

19 June, London

Plus an invitation to new members to join the steering group.

### South West: Summer ball

22 June, Cardiff

At the Park Plaza Hotel. A drinks reception, followed by a three-course meal, a live band and DJ.

### Home Counties North East: Engineering sustainable DHWA in modern building design

25 June, London

CPD seminar looking at innovation to future-proof hot-water systems, and how early adopters are benefiting from single-pipe DHWS.

### CIBSE closing date surgery

3 July, London

Opportunity for ACIBSE or MCIBSE applicants to speak to a professional interviewer and get tips on completing the Engineering Practice Report.



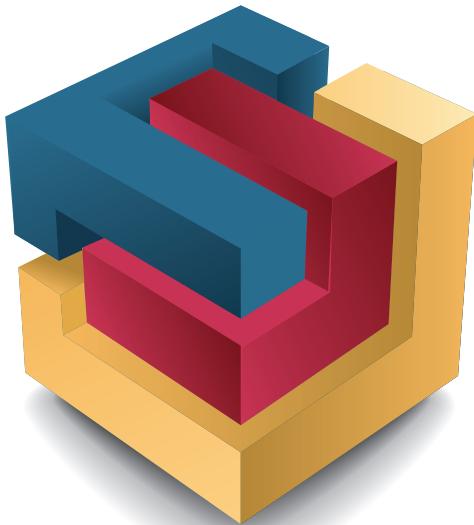
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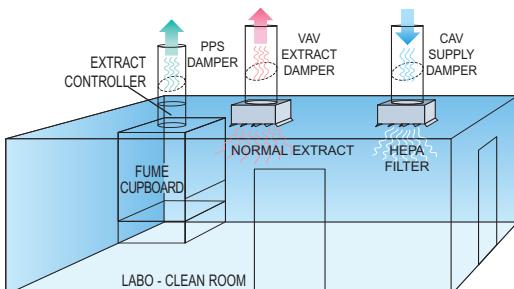


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