

**MEASURING NOX IN  
BIRMINGHAM**

**YOUNG ENGINEERS  
AWARDS SHORTLISTS**

**REUSING CONDENSATE  
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## **DOES HYDROGEN ADD UP?**

Overcoming the challenges  
of decarbonising  
Britain's gas network

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## Foot on the gas



With the UK committing to a legally binding target of zero emissions by 2050, the race is now on to develop the technology and processes that will enable us to achieve it. Alongside electrification, hydrogen is being touted as the best method to decarbonise Britain's heat. On page 26, we look at the challenges of replacing natural gas with hydrogen.

One of the biggest issues in producing hydrogen is dealing with the large volumes of carbon dioxide generated. A carbon capture use and storage infrastructure would have to be developed, unless larger volumes of hydrogen can be produced using low carbon sources.

One advantage of hydrogen is that it can use a significant part of the existing natural gas infrastructure and network. A trial at Keele University will soon start blending hydrogen with natural gas in its private gas network of 100 domestic and 30 commercial users. It hopes to increase the proportion of hydrogen up to a maximum of 20%, and CO<sub>2</sub> won't be a byproduct as the electrolyser used to manufacture hydrogen uses on-site renewable power.

Manufacturers are steeling themselves to the task and already one boiler, in Holland, has gone on trial. The challenge is to create hydrogen-ready boilers that can cope with natural gas until hydrogen is piped into the system. Of course, the best way of reducing the impact on the environment is to minimise buildings' energy loads by designing ones that work with nature to minimise the need for heating and cooling. BDP did just this at Northamptonshire County Council's new centralised offices – One Angel Square – which won the Project of the Year – Commercial/Industrial category at the 2019 CIBSE Building Performance Awards. The project was focused on passive design measures and BDP was keen to maintain a mixed-mode system, even when the contractors bidding for the contract said it couldn't be done at an acceptable price.

BDP's solution was to save money by removing the chilled beam system while, at the same time, using efficient lighting and thin client computers to reduce cooling loads – these were dealt with by a four-pipe heating and cooling system.

The project proved that being able to defend engineering options is one of the most important skills an engineer can possess. The ability of engineers to make persuasive arguments will be again celebrated at the annual CIBSE Young Engineers Awards, taking place on 10 October in London next month. Get along if you can but, if not, be sure to follow #CIBSEYEA on social media to find out who most impresses the judges.

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### Hywel Davies

What recent policy announcements reveal about the possible direction of upcoming Building Regulations



### Julie Godefroy

Why policy attempts to improve housing in the UK are being undermined by permitted development rights



### Jim Wild

Why local authorities are using Passivhaus to build the next generation of council homes



### Tim Dwyer

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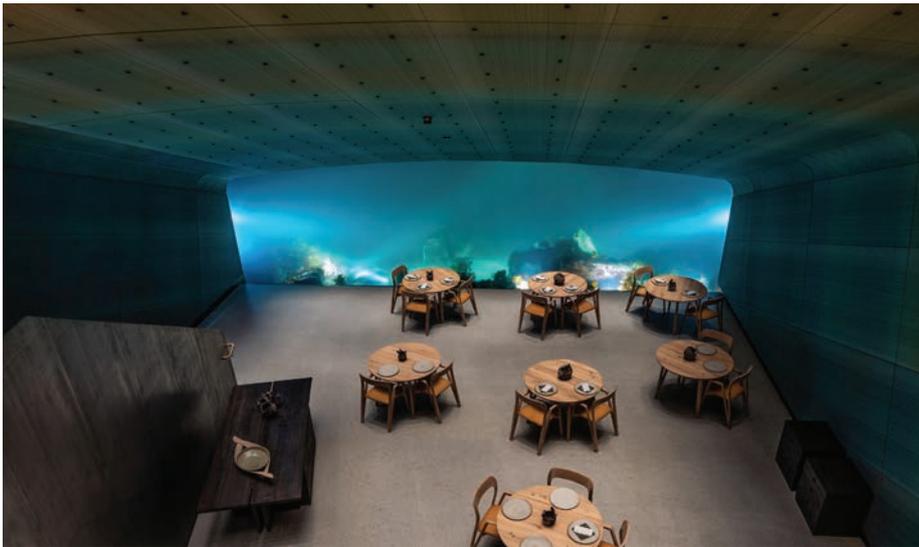


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## UNDERWATER RESTAURANT GETS SMART LIGHTING



An underwater restaurant has opened on Norway's southern coast. The building's imposing monolithic form rests on the shoreline, but is also partly submerged so it appears to become part of the marine environment.

The lighting scheme designed by AF Lighting aims to draw attention to the surroundings. It consists of 400 one-cell, recessed Laser Blade XS luminaires, which are concealed in the ceiling and focus light only on the tables.

The service lighting system has been reduced to a minimum, thanks to the use of tags that interact with the luminaires, which means they come on when waiters approach.

## Javid promises £30m decarbonisation fund



Javid pledged £30m to improve air quality

### Chancellor pledges to rebuild national infrastructure

The Chancellor Sajid Javid said he had 'turned the page on austerity' as he allocated a £30m fund for infrastructure decarbonisation schemes as part of a 'decade of renewal'.

Details of how the money would be spent will be set out in the new National Infrastructure Strategy, due to be unveiled later this year.

'The first priority of our new economic plan will be to rebuild national infrastructure,' said Javid. 'High-quality and reliable infrastructure is essential to how we live, work and travel; but the truth is that, over the past decades, governments of all colours have under-invested [in this area].'

He also announced another £30m for measures to tackle air pollution in urban areas, and committed £432m to deliver a 'safe and ambitious departure from the EU, while setting global standards

in protecting and harnessing value from the natural environment'. He announced a total of £13.8bn of expenditure for the forthcoming 'spending round'.

Reaction has been mixed: environmental groups say the commitments do not go far enough towards the goal of a net zero carbon economy by 2050.

'Measures to cut climate-wrecking pollution need far more than the financial crumbs offered by the Chancellor,' said Friends of the Earth head of policy Mike Childs. 'This announcement falls a long way short of the £42bn needed every year to tackle the planetary emergency.'

### Government reverses VAT rule change

Trade bodies have welcomed the government's decision to delay the implementation of its new Reverse Charge VAT rules until October 2020 – hailing the decision as 'a victory for SMEs in construction'.

The new accounting rules were due to come into effect from this month, but were widely condemned as putting too much of a burden on construction SMEs at an already difficult time.

'Many businesses were evidently not ready for the initial deadline,' said ECA director of Legal and Business, Rob Driscoll. 'Given the backlog of businesses requesting conversion from quarterly to monthly VAT returns, it seems neither were HMRC.'

The Reverse Charge system means that VAT-registered businesses no longer have to account for VAT. Instead, the customer will account for the VAT directly. Suppliers would have experienced a cash shortfall of 20% in the short-term.

## Sharp fall in new work reported

New work in the construction sector fell by its fastest rate in more than 10 years in August, according to the latest Construction Purchasing Managers' Index (PMI).

Business activity dropped back for the fourth consecutive month and at a faster rate than in July, with the commercial building sector suffering the most. Most respondents blamed Brexit and domestic political uncertainty for clients delaying project decisions.

The sector is also at its least optimistic since December 2008.

The IHS Markit/CIPS UK Construction Purchasing Managers' Index stood at 45.0 in August, down slightly from 45.3 in July and below the 50.0 no-change threshold for the fourth consecutive month.

'The sector fell deeper into contraction as continuing uncertainty and a weakened UK economy took a sizeable bite out of this month's construction activity,' said Duncan Brock, group director at CIPS. 'Inevitably business confidence followed suit, dropping like a brick to its worst since December 2008 and close to the lowest depth seen in the previous recession.'

Construction companies said new orders have dropped in each month since April and data showed the sharpest decline in new work since March 2009. Input buying dipped for the fifth consecutive month, which is the longest period of decline since the first half of 2013, according to the survey. However, the drop in demand for products and materials did ease the pressure on supply chains and reduced delivery delays. Input cost inflation fell to its lowest level since March 2016.

## Global group launches cooling challenge

The not-for-profit business network Climate Group has launched an initiative to help businesses improve the energy efficiency of their cooling processes and decarbonise air conditioning.

The Cooling Challenge was developed in partnership with the Alliance to Save Energy, and is part of the international network's EP100 energy productivity campaign. This requires signatories to either double their energy productivity, make their buildings net-zero carbon or implement an energy management system.

Each firm that signs up for the challenge will have access to building management technology and advice from Johnson Controls.

'With electricity demand from air conditioners alone set to more than triple by 2050, companies have an immediate opportunity to invest in energy efficient cooling that will lessen further climate impact and generate substantial financial savings,' said the Climate Group's chief executive Helen Clarkson.

'This is about preparing your business for the future.'

## Scotland's big plans for low carbon heat

All new homes in Scotland must use renewable or low-carbon heat by 2024, under plans unveiled by the Scottish Government.

This will be part of a 'fundamental overhaul' of the Building Regulations, aimed at increasing energy efficiency and the efficiency of construction from 2021, supported by a £30m investment in renewable heat projects.

This was one of the pledges contained in the SNP's legislative programme for the year, entitled *Protecting Scotland's future*, which puts the transition to net-zero emissions at the heart of the strategy for the Scottish National Investment Bank.

The government also said it would seek to unlock additional resources for projects to cut emissions through a Green Growth Accelerator that will bring forward a £3bn portfolio of projects, including renewables, waste and construction.

# Industry support for global climate strike

## Building services engineers join in worldwide day of action

Cundall, BurroHappold, Max Fordham, Etude, Inklings and Warm Low Energy Building Practice were among the many building services engineering, consultancy and architecture firms supporting the global climate strike on 20 September.

The practices allowed employees to join the day of action, in which millions of people participated around the world.

Many from the building services industry met at The Building Centre in

central London to join the UK Green Buildings Council (UKGBC) on a march to Westminster while, elsewhere in the UK, engineers and consultants from leading firms joined the protests, including Waterman, which joined the protest in Birmingham.

Fergus Anderson, senior sustainability consultant at BuroHappold, said: 'We are joining the climate action in support of the movement's aims, and we too have made our own - and industry-wide - commitments. These declarations acknowledge the twin crises of climate breakdown and biodiversity loss as the most serious issues of our time.'

'By taking action we wish to show solidarity and support to those supporting the action, as well as continuing with our own efforts to make meaningful and purposeful progress in this area.'

Members of Leti were also out in force in London, including CIBSE's current Engineer of the Year Clara Bagenal George.



## BBP Climate Change Commitment

A new initiative by the Better Buildings Partnership (BBP) has seen 23 of the UK's leading commercial property owners sign up to a commitment to tackle the growing risks of climate change through the delivery of net zero carbon real estate portfolios by 2050.

The BBP members signing the Climate Change Commitment are responsible for more than 1.2m tonnes of carbon emissions a year.

The commitment highlights the need for buildings to be net zero carbon by 2050 and commits signatories to publicly publish their own pathways to achieving this by the end of 2020. Signatories will also report annually on progress and disclose the energy performance of their portfolios. For more details, see [bit.ly/CJOct19BBP](https://bit.ly/CJOct19BBP)

- Coal now accounts for below 1% of all power generated in the UK, according to new data from BEIS. Low-carbon sources now make up more than half of the UK's energy mix.



## Introducing the Azure R32 range from Airedale International.

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## Worcester Park fire destroys 24 apartments

A number of families lost their homes in a huge fire that destroyed a block of flats in south-west London.

Flames quickly spread to all four floors of the building in Worcester Park in the early hours of the morning. It took 125 firefighters with 20 fire engines five hours to bring the fire under control. The building consisted of 23 flats in The Hamptons estate, an American-style complex of social and private housing, which was built on a former sewage treatment works.

No injuries were reported.

Chartered fire consultant Martin Kealy said:

'Looking at the pictures of the fire, it is difficult to imagine how this construction could have been so comprehensively destroyed.

'External walls have been required to resist the spread of fire for many years, and compartments to withstand fire for decades. But this fire also throws recent proposed changes to Building Regulations into sharp focus.'

CIBSE Guide E: *Fire Safety Engineering*, published earlier this year, gives comprehensive guidance for engineers and fire safety consultants on the design of buildings with regard to fire safety.

## Sprinklers to be fitted in more high-rise blocks

### ■ Home Office also setting up Protection Board to inspect high-risk buildings

The government has started a 12-week consultation – running until late November – on lowering the height of new blocks of flats that will be required to fit fire sprinklers from the current 30m (around 10 storeys and above) to 18m (six storeys).

Chartered fire consultant Martin Kealy said: 'The rationale for 18m is to align with the new Building Regulation 7(2), introduced in November 2018 to implement the ban on combustible cladding. This bans any combustible material from external walls of residential buildings over 18m in height. So to require sprinklers above that height is consistent with that requirement.'

The Home Office is also setting up a Protection Board with the National Fire Chiefs Council, which will provide building checks and inspections 'where necessary' on all high-risk residential buildings in England by 2021. The board will receive funding of £10m a year to help reassure residents of such blocks that any risks are identified and acted upon. It will operate until a new building safety regulator is established to oversee the new regulatory regime for buildings and legislation for a new building safety regime is introduced.

- The government has made a number of revisions to the 2019 edition of Approved Document B. The updated document is available at [bit.ly/CJOct19AppB](https://bit.ly/CJOct19AppB). A letter detailing the changes is attached to this story at [www.cibsejournal.com](http://www.cibsejournal.com)

## Government waters down late payment rules

The government implemented its promised ban on main contractors with poor payment records bidding for public works contracts from the start of September, but watered down the rules.

The Cabinet Office now requires all public sector clients to assess the payment behaviour of anyone bidding for contracts. However, the original plan to bar any contractor not paying 95% of invoices within 60 days was revised to 75% because of fears that most major firms would not be able to meet the criteria.

Firms can still bid if they show that 75% or more of invoices were paid within 60 days in at least one of the two previous six-month reporting periods. They will also need to show they have an action plan to meet the 95% standard in future.

This comes in the wake of new research that revealed almost a third of SMEs (31%) had experienced late payments costing their business at least £10,000 in the last 12 months.

According to Hitachi Capital, late payment has cost SMEs at least £51.5bn in the past 12 months and 27% have experienced a profit squeeze as a result; 12% said they had to defer staff pay.

## Creating good energi

Adam Fabricius, Product Manager - Danfoss

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Who will succeed Reanna Taylor (centre, top) as the CIBSE ASHRAE Graduate of the Year?

## Record number of entries for Young Engineers Awards

■ Eight on shortlist to win the prestigious CIBSE ASHRAE Graduate of the Year Award

A record number of entries for the CIBSE ASHRAE Graduate of the Year Award have been whittled down to eight finalists.

Each will present on the subject 'How can building services professionals find the right balance between the needs of the global environment, occupant health, wellbeing and productivity, and best value?' in front of an expert judging panel.

The winner will be announced at the annual CIBSE Young Engineers Awards event on 10 October, which also features the Employer of the Year Awards (see pages 13 and 24).

Chair of judges Tim Dwyer said: 'The need to nurture and encourage the emerging generation is an exciting responsibility for our profession. It is hugely encouraging to see a record number of entries for this year's Awards programme, showing an increasing recognition of the prestige and relevance of the award.'

Pre-register for the free event at [www.cibse.org/yea](http://www.cibse.org/yea)

● Follow the awards on social media via **#CIBSEYEA**

## Industry to take on more offsite specialists

Construction firm Kier expects to see a significant rise in the employment of offsite manufacturing specialists as use of factory-assembled components increases, but called for improvements to 'leadership, direction and management' across the sector.

'In the same vein that the industry has observed the creation of new roles in the digital environment, such as BIM managers, we anticipate the same for offsite manufacturing,' said Kier director Jamie Hillier.

He called on the industry's professional bodies to work together 'to provide structure around role definition, competency and accreditation' for offsite in a way that would work in harmony with the government's Construction Sector Deal.

Hillier added that a shift towards 'measured outcome; procuring for value rather than lowest cost' would require a 're-education of key stakeholders'.

He was speaking in the wake of a report, *The Choice Factory*, which examines offsite manufacturing 'through the lens of behavioural science'. It is named after behavioural scientist Richard Shotton's book *The Choice Factory*, which examines how behavioural biases influence the products people buy.

'The economic and technological benefits of offsite manufacturing have been widely publicised. What appears more interesting, however, is why a rationally beneficial solution has for too long been irrationally marginalised,' a Kier statement said.

## YORK AIMS FOR CARBON-NEUTRAL HOMES

City of York Council is accelerating its programme of new home building as part of its strategy to become carbon neutral by 2030. The aim is to build 600 homes in the next five years with around 40% available for social rent.

Building services engineering firm Leda, specialising in Passivhaus schemes, is part of the team led by Mikhail Riches selected to work on the project and aims to deliver low-energy design, renewable energy systems and lean building services engineering.

'This is the kind of project we dream about,' said a Leda statement. 'It is closely aligned with our desire to have a big impact on improving sustainability and deliver great low-energy buildings that are a joy to live in and use.'

See 'Passivhaus rules' on page 20.



## Health and wellbeing research aimed at social housing

### ■ How can technology be used to understand indoor environmental conditions?

Glasgow-based building performance technology company, arbnco, has been awarded funding by Innovate UK to explore how its technology could help to improve the health and wellbeing of tenants in social housing.

The project, which is being led by Leeds City Council and the City of York Council, is part of the GovTech Catalyst programme, which enables public sector bodies to harness new and emerging technologies. The academic partner in the project is The Mackintosh Environmental Research Unit at The Glasgow School of Art.

It will explore how technology could be used to understand indoor environmental conditions within council housing stock – such as poor air quality – and the effect it can have on tenant health and wellbeing. The aim is to help tenants make positive lifestyle and environmental changes where necessary, and equip the council with real-time information to aid property management and provide better quality accommodation.

'Air quality is rapidly becoming one of the biggest societal concerns of our time,' said Simon West, co-founder of arbnco. 'The impact of projects like this one could be critical in helping to reduce the harmful effects that can be generated from the indoor environment, and could help to alleviate strain on our health and social care systems.'

- A new website has been launched that reveals pollution levels according to postcodes in London. The site, [addresspollution.org](https://www.addresspollution.org) was created by not-for-profit campaign group Central Office of Public Interest (COPI). It uses data from King's College London to give nitrogen dioxide levels and compares them to WHO guidelines. COPI, which is made up of people in the media, said its campaigns were based on the latest scientific data and understanding.

## Housing must be part of infrastructure plan

The Federation of Master Builders (FMB) has called for housing to be given priority as part of new infrastructure funding announced by the Chancellor Sajid Javid.

'The housing crisis is undermining the British economy. If we are to increase productivity and improve our competitive edge on the world stage, then building more new homes must form part of the government's campaign to upgrade our infrastructure,' said FMB chief executive Brian Berry.

The FMB welcomed the announcement of £241m to be spent on the regeneration of high streets, town centres and local economies, but called for some of it to be focused on building homes and social housing, and on a retrofit strategy to reduce fuel poverty.

'An upgrade of our infrastructure, including building new world-class schools and hospitals, will require a strong construction industry. The skills shortage is highly concerning in this respect, with just under two-thirds of builders struggling to hire bricklayers and more than half of builders struggling to hire carpenters,' said Berry.

## Smart meter deadline missed

The government has admitted that the industry will not be able to hit the original deadline to fit smart meters in every home and business by 2020, so has pushed the deadline back by four years.

The cost of the rollout is now expected to rise to more than £13bn, and energy companies continue to warn that the technology is not ready. Consumers have also found that, in many cases, their meter does not work if they change supplier.

Customers are not obliged to have a smart meter fitted, but energy firms must have offered them to all UK households by the end of the new deadline in 2024.

## BESA mourns Brian Townsend

BESA has paid tribute to one of its most popular and influential figures, Brian Townsend, who died last month.

Brian was only the eighth person in the Association's history to be awarded its Distinguished Service Award for individuals 'who have rendered extra-special service to the Association and its activities' – effectively joining the BESA 'Hall of Fame'.

He was president during the centenary year of what was then the HVCA in 2004. Having first been elected to the organisation's council in 1992, he continued to serve until 2015.

He founded the commissioning specialist contractor End Systems in 1976, and the company continues to grow and thrive today under the directorship of his daughter Kay. Brian was also chair of the Commissioning Specialists Association (CSA).

'Brian was a champion of the industry and a true gentleman who will be sorely missed,' said current BESA president John Norfolk.

## CIBSE ANZ celebrates new talent

### Competition showcases the importance of façades in modern architecture

Nine students and young engineer finalists from across Australia and New Zealand gathered for the CIBSE Australia and New Zealand (ANZ) Young Engineers Awards, in September.

The awards, held at the Melbourne Museum, celebrated the rising talent across the region and were attended by more than 80 building services industry professionals.

Entries were received from 12 consultancies and three universities across Victoria, New South Wales, South Australia, Queensland, Christchurch and Auckland.

The young engineers and graduates were judged on their contribution to the industry, and their video submissions on what they believe to be the most novel, scalable and implementable ideas which could be applied to building services to reduce greenhouse gas emissions.

The Student of the Year award was presented to Mitchell Peatman, studying for a Bachelor of Engineering (Electrical)



Left to right: Mitchell Peatman, Tommy Sailing and Aaron Hoare

at University of Wollongong, and Northrop Consulting Engineers.

In his submission, Mitchell spoke of our responsibility to reduce greenhouse gas emissions holistically.

The CIBSE ANZ Graduate of the Year was named as Aaron Hoare, sustainability consultant at WSP. Aaron demonstrated strong service to the industry, displayed enthusiasm for his work and presented clear bottom up and top down implementable sustainable ideas.

The Young Engineer of the Year title was

awarded to Tommy Sailing, electrical engineer at Northrop Consulting Engineers. The judges felt Tommy demonstrated original thought, presenting a solution over the life of a building.

In line with the sustainability theme, the winners each received a bamboo trophy and framed certificate, as well as Aus\$1,000, courtesy of sponsors Aecom, Northrop Consulting Engineers and VOS Group.

The Young Engineers Awards are vital in helping CIBSE engage with students and young building services engineers seeking to make an impact in the industry and encourages them to become future leaders.

CIBSE President, Lynne Jack, speaking at the event, implored young engineers in the region to take advantage of all the opportunities that CIBSE offers, and welcomed a dialogue with members on how CIBSE supports its regions.

Thanks to event partners Acor, Arup, Aurecon, Conex Banninger, Constructive Recruitment, Daikin, Norman Disney & Young and Wood & Grieve Engineers, and sponsors.

● Visit [www.cibse.org/cibse-anz-young-engineers-awards/2019-winners](http://www.cibse.org/cibse-anz-young-engineers-awards/2019-winners)

### New lighting guide for healthcare premises

A new edition of Lighting Guide LG2: *Lighting for healthcare premises* has just been published by the Society of Light and Lighting (SLL).

The new edition, which replaces the 2008 edition, has been produced to ensure that guidance is up-to-date with modern lighting practice and to illustrate varying ways of lighting the modern hospital environment.

The key objective of the guide is to define the quantity and quality of light. Good design principles should always be followed with the priority given to daylight and complemented with electric lighting.

Although there has been an increased interest in lighting for health and productivity, this edition does not detail or focus on these. While the SLL acknowledges the importance of the non-visual effect of light on health and wellbeing, it warns that research in this area is still limited and any beneficial effects of changing colour or light level during the day is yet to be unequivocally demonstrated.

LG2 will be available on the CIBSE Knowledge Portal for members to download for free at [www.cibse.org/knowledge](http://www.cibse.org/knowledge)

## Raphael Amajuoyi wins Ken Dale Travel Bursary

### Former CIBSE Graduate of the Year won for research on gender equality

Raphael Amajuoyi is the winner of the 2019 Ken Dale Travel Bursary and will receive a bursary to travel while undertaking industry-relevant research.

Raphael, who was the CIBSE Graduate of the Year in 2017, won for his research on designing for gender equality.

His research aims to optimise key resources (including human, time and

financial) to explore this in the design of commercial offices across the globe, to understand the current scope of research on female occupancy thermal comfort in the professional workplace. This will be based on a comprehensive review of published literature factoring in key variables including office building types, weather and climatic conditions, as well as cultural influences.

Raphael plans to travel to San Francisco, Rio de Janeiro and Doha for his research, and will also conduct research in London

The judges said Raphael impressed with his confident presentation, which stood apart from the other submissions and challenged design norms. Judges said his subject matter, quality bid and presentation gave him the lead over the other entrants.

On his return Raphael will have to present a 5,000-10,000 word report to the CIBSE board.

The annual Ken Dale Travel Bursary offers between £1,500 and £4,000 to CIBSE members, in the developmental stage of their career, who wish to spend three to four weeks abroad researching aspects connected to their field of work.



Raphael Amajuoyi



## Census aims to support engineers

Engineers of all backgrounds, genders and disciplines are invited to take part in The Engineering Census, a major survey of engineers working in the UK.

The survey, led by the Royal Academy of Engineering and the Women's Engineering Society, aims to help understand the challenges faced by engineers and barriers to progression.

The results will help them develop tools to support engineers through their careers – and the more opinions and views, the more likely they are to be able to make a difference.

To complete the survey, visit [www.engineering-census.com](http://www.engineering-census.com)

Elementa  
was the 2018  
Employer of  
the Year

## YEN National Ball

The CIBSE Young Engineers Network will be celebrating at its National Ball in Cardiff on 12 October.

The black tie event is taking place at Cardiff Castle, and will feature live music and special guest Carwyn Jones, Assembly Member for Bridgend, and Sophie Howe, Future Generations Commissioner for Wales.

This will be a great opportunity to celebrate the achievements of the Young Engineers Network over the last year. For information and tickets, visit <https://sforce.co/2kstWZ0>

## #IamCIBSE

The #IamCIBSE campaign continues the drive to celebrate and shout about the work we do, highlighting the amazing array of talented, committed and dedicated individuals working in building services engineering.

We challenged you to describe being a building services engineer in fewer than 10 words and here are some examples of what you said:

'Making a difference everyone notices but doesn't realise they have' – Andrew Krebs, information management lead, Hoare Lea.

'Exciting, inspiring and challenging professional career bringing life to buildings' – Steven Peet, regional sales director, Frese.

'Engineering our built environments for people, places and planet' – Charlotte Mercer, principal engineer, Cundall.

Get behind the campaign at [www.cibse.org/building-services/iamcibse](http://www.cibse.org/building-services/iamcibse)

# Seven companies in running to win Employer of the Year

Winners will be revealed at CIBSE Young Engineers Awards on 10 October

Companies from across the building services spectrum are vying to be crowned Employer of the Year at the CIBSE Young Engineers Awards this month.

The awards celebrate the organisations with progressive strategies for recruiting, nurturing and empowering young people. There are three categories of award, for small, medium and large companies, with one overall winner.

The shortlisted companies are:

### Small company (under 50 employees):

- FairHeat
- Method Consulting

### Medium company (51-300 employees):

- Elementa Consulting
- Troup Bywaters + Anders
- TÜV SÜD

### Large company (more than 300 employees):

- Aecom
- Atkins

The awards will be announced at the CIBSE Young Engineers Awards, together with the Graduate of the Year award, which are sponsored by Andrews Water Heaters, Kingspan Industrial Insulation, Swegon Air Management and TamLite, and are supported by the CIBSE Patrons.

Kevin Mitchell, chair of the CIBSE Employer of the Year judging panel and the first winner of the Graduate Award, said: 'As an industry, we need both to celebrate the value of what we do and to invest in our new

talent. Recruiting, developing and supporting the rising stars is essential for our future.'

He added: 'This year's employer entries showed enlightened organisations providing varied career development routes for their graduates and apprentices. We also see more companies focusing on work-life balance for their trainees, more building-services-specific Stem activities, and new cross-discipline, cross-company exchange programmes.'

The winning companies will be announced at the Awards event being held on 10 October at the Institution of Mechanical Engineers, where the Graduate of the Year finalists will also give their presentations.

You can find out more about the shortlisted graduate finalists on page 24.

The awards event is free to attend, but pre-registration is required. Visit [www.cibse.org/yea](http://www.cibse.org/yea) for details.



## New members, fellows and associates

### FELLOWS

**Bull, Peter Patrick**  
Singapore, Republic of Singapore

**Wu, Siu Lam**  
Shatin, Hong Kong

### MEMBER

**Harding, Adam Lee**  
Solihull, United Kingdom

**Hanson, Andrew**  
Birmingham, United Kingdom

**Clifford, Gary Paul**  
Adelaide, Australia

**Wilson, Phillip James**  
Hull, United Kingdom

**Nayar, Suresh**  
Doha, Qatar

**Kapila, Sandeep**  
London, United Kingdom

**Lenartowicz, Matilda**  
London, United Kingdom

**Elliott, Derek**  
Morecambe, United Kingdom

**Tong, Yun On**  
Shau Kei Wan, Hong Kong

**Osama, Abdallah**  
Doha, Qatar

**Li, Yan Ki**  
Tau shui Wai, Hong Kong

**Luna Navarro, Alessandra**  
Cambridge, United Kingdom

**Cruz Cespedes, Maria Gador**  
London, United Kingdom

**Radu, Mihnea Alexandru**  
Birmingham, United Kingdom

**Tsoumi, Anna**  
London, United Kingdom

**Michetti, Federica**  
London, United Kingdom

**Bevilacqua, Daniele**  
St Albans, United Kingdom

**Emili, Antonella**  
London, United Kingdom

**Ng, Suet Fan**  
Kowloon, Hong Kong

**Othman, Malai Ali**  
Hanching, Brunei Darussalam

**Wong, Kin Yip**  
Tsuen Wan, Hong Kong

**Chong, Yeong Lip**  
Choa Chu Kang, Republic of Singapore

**Tam, Ka Yin,**  
Kowloon Hong Kong

**Yeung, Ping Yee**  
Sheung Shui, Hong Kong

**Leung, Wai Chun Jackie**  
Shau Kei Wan, Hong Kong

**Chow, See Lok**  
Sheung Shui, Hong Kong

**Baig, Mazherulla**  
Sharjah, United Arab Emirates

**Carpna, Laia**  
Bath, United Kingdom

**Condon, Patrick**  
Limerick City, Ireland

**Parker, Martin Paul William**  
Liverpool, United Kingdom

**Tsang, Yuen San**  
Pokfulam, Hong Kong

**Choi, Sze Yat**  
KLN, Hong Kong

**Souras, Ioannis**  
London, United Kingdom

**O'Reilly, Patrick**  
Sandyford, Ireland

**Mugford, John**  
Stroud, United Kingdom

**Lee, Shu Wing**  
Ma On Shan, Hong Kong

**Brouder, Cornelius Joseph**  
Limerick City, Ireland

**Qasim, Ayaz**  
Khobar, Saudi Arabia

**Rujubali, Mohammad Shameem**  
Saint-Pierre, Mauritius

**Tse, Wai Leung**  
Tuen Mun, Hong Kong

**Kenneally, Rory**  
Dublin, Ireland

**Benzies, Joe**  
Lucan, Ireland

**Dooley, Suzanne**  
Raheny, Ireland

**Tormey, Gary**  
Swords, Ireland

**Panzu-Nianga, Serge**  
Dublin, Ireland

**Maunder, Alistair**  
Bath, United Kingdom

**Gerrish, Tristan**  
Bath, United Kingdom

**Moore, Tomas**  
Trim, Ireland

**Chung, Ho Sum**  
Tsung Kwan O, Hong Kong

**McKellar, Stuart Daniel**  
Attleboro, United States

**Farrugia, Deborah**  
Manchester, United Kingdom

### ASSOCIATE

**Ingram, Lawrence Timothy**  
Tewkesbury, United Kingdom

**Mundow, David**  
Cardiff, United Kingdom

**Power, Darryn Robert**  
Cardiff, United Kingdom

**Priyatharsan, Sachchithanatham**  
Singapore, Republic of Singapore

**Rabaiotti, Anthony**  
Cardiff, United Kingdom

**Haskell, Joshua**  
Penarth, United Kingdom

**Childs, Andrew**  
Wigan, United Kingdom

### LICENTIATE

**Hydon, Jack Charles**  
Coventry, United Kingdom

**Orme, Shane**  
Cambridge, United Kingdom

**Austin, Lucy**  
Epsom, United Kingdom

**Rodrigues Gomes, Paulo Cesar**  
London, United Kingdom

**Thomas-Milne, Finley**  
London, United Kingdom

**Fan, Ka Wa**  
Shatin, Hong Kong

**Gee, Nathan**  
Manchester, United Kingdom

**Hughes, Patrick**  
Birmingham, United Kingdom

**Welsh, Cameron**  
Dundee, United Kingdom

**Order, Ryan**  
Bournemouth, United Kingdom

**Harper, Jack**  
East Molesey, United Kingdom

**Donnelly, Barry**  
Derry, United Kingdom

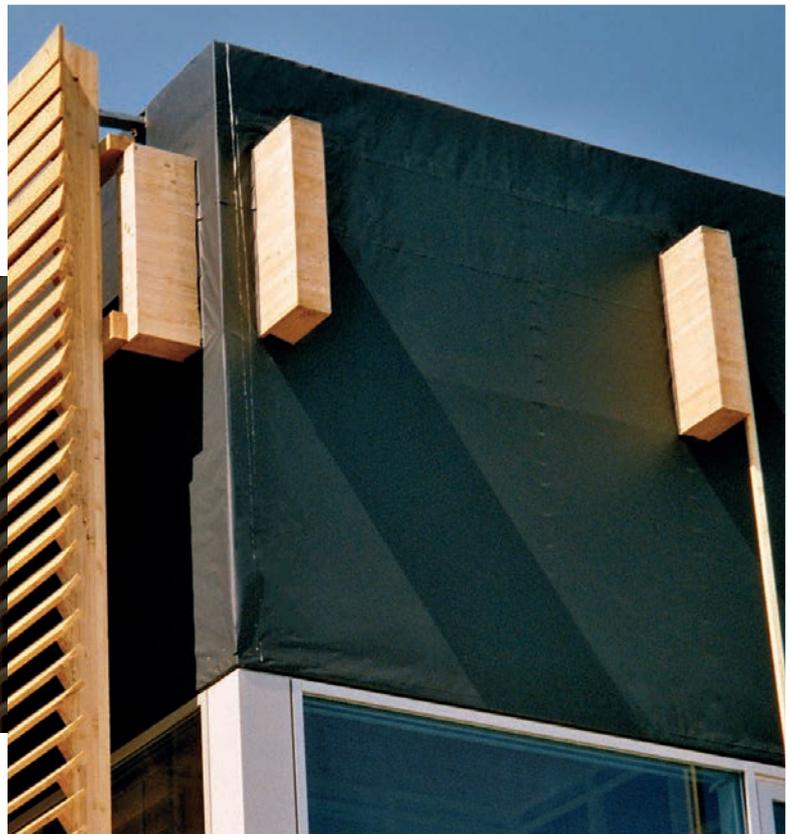
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# The policy clues

There has been a flurry of recommendations about the future for heating, cooling and energy efficiency in our buildings. Hywel Davies considers how they might influence the review of Parts L and F of the Building Regulations

Last December, the government committed to review Parts L and F of the Building Regulations, and to look at regulating overheating. Since then, the Committee on Climate Change (CCC) has called for gas heating in new homes to be phased out by 2025 and the government has committed to a new 'future homes standard' from that date.

The Business, Energy and Industrial Strategy (BEIS) Select Committee published a critical report on energy efficiency standards, especially in new homes. And then the Climate Change Act was amended to set a target of net zero carbon emissions by 2050.

This summer, government consulted on 'Building a Safer Future' – its proposals to reform the overall system of building regulation in England, following Dame Judith Hackitt's review after the Grenfell tragedy. It has issued a new version of Approved Document B (although it was, at the time of writing, temporarily withdrawn – see page 9 news) and introduced restrictions on the use of combustible materials in external walls of residential buildings over 18m high.

In early September, proposals were announced to require installation of sprinklers in such buildings, too (see page 9). Members can participate in CIBSE's response at [www.cibse.org/news-and-policy/policy/consultations/current-consultations](http://www.cibse.org/news-and-policy/policy/consultations/current-consultations)

So, what might all this mean for the review of Parts L and F? There appears to be a clear commitment to improve standards of energy efficiency in new homes. This is important to reduce heating demand in homes to assist the transition to low-carbon heating systems, such as heat pumps. The review of Part F suggests that the link between energy efficiency, airtightness of new homes and ventilation will be addressed in any proposals, which is welcome.

It is not so clear what might happen to energy efficiency in new non-domestic buildings at this stage. Nor is there any indication what is planned to improve the energy efficiency of our existing building stock, whether domestic or commercial. This is a real 'elephant in the room' issue. Some 80% of the existing stock will still be in use in 2050, so we need a plan, and action, to reduce emissions from these buildings. It is not easy,



**“Overheating in buildings will, if not addressed, cause 4,500 premature deaths per year by 2050”**

which is why it has been ducked in previous reviews. But the problem is not subsiding; it gets more pressing.

It is quite unclear what will be required in relation to overheating. This is perhaps of greatest concern. Europe experienced an unprecedented heatwave this summer, with the French health minister recently reporting that the 18 days of extreme heat in France led to around 1,500 premature deaths.

The Environmental Audit Committee was last year forthright in calling for Building Regulations to address overheating more effectively. This was reinforced earlier this year when the CCC progress report cited published peer-reviewed research from University College, London, suggesting that overheating in buildings will, if not addressed, cause some 4,500 premature deaths per year by 2050. Given the French experience this summer, that research needs to be taken seriously.

Current concerns about design, installation, compliance and enforcement that the Grenfell tragedy has so starkly exposed equally apply to other hazards as well as fire; they should include concern

about the growing threat of premature death from overheating buildings.

Annex B of the 'Building a Safer Future' consultation indicates a total of 1,550 fires involving fatalities (in some cases more than one) over the seven-year period from October 2011 to September 2018.

If we do not address the very real-life safety issue of overheating, but continue to build new dwellings that are not adapted to the changing climate, then we are not building a safer future. So while we must recognise the need to address the fire safety issues that Grenfell and subsequent events have exposed, we must also heed the clear warnings of the CCC, EAC and others that we need to better adapt our buildings to the future climate too.

We should be doing this in parallel with reviewing Part B. We need to achieve building safety in the round, embracing all relevant hazards and addressing all the relevant disciplines, not just fire expertise. As the government reviews other parts of the Building Regulations beyond Part B, we need to consider how those reviews can contribute to building a truly safer future.

# Ask



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# Passivhaus rules

City of York Council is the latest local authority to strive for Passivhaus housing. Leda's Jim Wild explains why the methodology is gaining traction

In September, City of York Council confirmed that its programme to deliver 600 sustainable low-energy homes in the next five years will be led by award-winning architect practice Mikhail Riches. It will be supported by a team including our Yorkshire-based building services and design consultancy cooperative Leda.

The first two proposed sites are about to go to public consultation, with York developing a design manual of five key principles including an emphasis on healthy homes and neighbourhoods, placing making, and energy use.

York is committed to making at least 40% of the homes affordable and retain 20% for social renting. All new homes must be built to the certified Passivhaus standard.

City of York Council declared a 'climate emergency', and made a commitment to be carbon neutral by 2030, joining many other councils in targeting carbon reduction as a priority. This ambitious housing delivery programme is a key component in demonstrating its commitment to achieving these aims. York wants to see the project achieve the highest environmental standards, and views Norwich City Council's multi-award winning Goldsmith Street Passivhaus scheme, designed by Mikhail Riches, as a great example.

## Why Passivhaus is important

For us at Leda, the compelling reason for adopting the Passivhaus approach is simple: the methodology is robust and able to deliver buildings that perform as anticipated.

From our experience of one-off houses, the rigour it places on the architects, structural engineers and contractors is very welcome in a world where site quality standards are usually seen as a robust finish.

As building service engineers, we are all aware that how a building performs is very much about what goes on under the building's skin. This is where the hidden problems with continuity of insulation and air tightness are hidden from view.

Certification, among other things, is a quality-assurance system for thermal performance. It considers the design, modelling, construction, commissioning and documentation with a rigour that Building Regulations or other standards don't come close to matching.

We've worked with the architects to come up with



**"Passivhaus is agnostic about the heating system and hot water, giving us the freedom to design the most appropriate system"**

a scheme for creating zero-carbon housing that fits well with the carbon-neutral commitment made by York. To deliver net zero carbon in use – including an allowance for unregulated energy – we see the Passivhaus methodology as the way to achieve the lowest-possible heating energy demands in a predictable way, allowing us to calculate reliably the renewables needed to offset these demands.

Initially, we see this as being accomplished with only a heat pump for hot water and photovoltaics (PV) for electricity, although the details of such solutions need to be thoroughly examined and the right balance of end-user simplicity, maintenance and energy use achieved.

However, if a big chunk of heating demand has been eliminated by the design, then the solution becomes simpler, and it is primarily the hot water load we need to meet in the most efficient and appropriate way. Passivhaus is mostly agnostic about the heating system and hot water, giving us the freedom to design the most appropriate system to meet the project needs.

## Ambitions

We want to demonstrate that York's aims of being carbon neutral can be achieved on any site, while ensuring good architecture and landscape design, too. It's also exciting and inspiring to be working with architects who push for the best in design and outputs for the clients.

With Exeter City Council, Norwich City Council and City of York Council committing to build Passivhaus-certified housing, it feels like there are changes afoot with new-build social housing.

We have worked with Leeds-based sustainable housing developer Citu and seen it go from strength to strength. However, more builders need to take on this ethos of building better homes, with energy and place making at the top of the agenda.

■ Leda's Little Kelham housing project won CIBSE Yorkshire Commercial and Industrial Project of the Year in 2017 (Mat Finish, *CIBSE Journal*, April 2018, [bit.ly/CJOct19Kel](http://bit.ly/CJOct19Kel)). The CIBSE Yorkshire Awards 2019 will take place on 15 November at the Royal Armouries, Leeds. Read about Exeter City Council's Passivhaus swimming pool on page 6 of this month's Hotel and Leisure Special

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# PASSING THE BATON

As she prepares to join the judging panel for this year's award, current CIBSE Graduate of the Year Reanna Taylor is thinking about who will follow in her footsteps, writes **Ewen Rose**



**B**uilding up her professional and personal network has been a major benefit for 2018 CIBSE Graduate of the Year Reanna Taylor, who has packed a lot into 12 months. As well as serving as an ambassador for the profession at home and abroad, she chaired BESA's Future Leaders group, was promoted by her employer NG Bailey... and got married.

'The award expanded my network at a rate second to none,' she says. 'I am able to call on people outside of my organisation to discuss issues and solve problems. I was honoured to speak at the House of Lords, to write numerous articles and share my story with the building services sector'.

Last year was just the second time in the award's 23-year history that the top three places were all filled by female engineers – and Taylor is only the second ever winner employed by a contractor. Building on these developments would be a fitting legacy for her year, she believes.

'Women are good team players and we are also very process-driven, which is just what the industry needs right now,' says Taylor. 'A team with a diverse membership is far stronger than one person trying to go it alone – and forging strong links between contractors and the design professions is crucial if we are to turn vision into reality.'

## Exchange

The graduate award is jointly awarded with ASHRAE, which gave Taylor the chance to exchange ideas with North American counterparts after she attended the Society's conference in Atlanta. (This year's winner will travel to Orlando, Florida, next February.) 'I was able to suggest some small changes that would help them, and I have managed to implement changes in my own company from what I learned over in the US – it was really interesting to see how they operate.'

She would have liked to become more involved with her local CIBSE region in the North West, but it clearly was not possible to cram everything in. However, it is now her ambition to work towards chartered engineer status, and hopes local CIBSE members will mentor her.

Taylor is an enthusiastic mentor and Stem ambassador herself and hopes that her experience





will inspire other young women to take up engineering careers.

'I get a tremendous amount of satisfaction from building something for the future – and want to pass that excitement on to others. If I have worked on a hospital, then I have helped to save lives... if we were part of the team delivering orthopaedic facilities then I have helped people to walk again. It is not just about the services, but what they do – and that is a powerful message to get over to potential recruits,' says Taylor.

She also believes more focus and investment into recruiting and retaining people with craft skills, such as plumbers, pipe fitters and electricians, is essential. 'Building services is an art that is currently lacking some of its artists,' she says.

'Craft skills are the heart of our industry, and we need to value the men and women who fulfil those roles more highly'

Taylor became interested in buildings at a young age when helping her grandfather in the family joinery business. She was fascinated by how things were put together and wanted to understand how building systems worked. However, she assumed the only professional route she could take that would be anywhere close to that was interior

**"I have spoken at the House of Lords, written numerous articles and made an abundance of friends – it has been an amazing year"**

design or architecture – until she stumbled across 'something called building services'.

She joined NG Bailey as a first-year building services engineering apprentice in 2011, and the company then sponsored her through a building services degree. During this time, she was also asked to be the lead electrical engineer on a large project.

She not only delivered the project on time, to a high standard and within budget, she managed to squeeze in securing a first-class Honours Degree from Leeds Beckett University. Taylor has now been promoted to senior project engineer and is the lead mechanical engineer on a prestigious project in Manchester city centre.

As chair of the BESA Future Leaders group, she focused on encouraging 12- to 13-year-olds to look at engineering, both in design, and on the tools. There are a large number who, she believes, are not even aware that engineering could be for them.

'We can offer them placements in the industry and show them what is possible,' she says. 'We can show them BIM, estimating and planning; how things work on site – and the opportunities in M&E.'

Inspired by her own experience with the NG Bailey apprenticeship scheme, Taylor wants to encourage more CIBSE and BESA members to offer work experience to young women in particular.

'If my experience can help to inspire the generation that comes after me – now that really would be something,' she says.

The CIBSE Young Engineers Awards – including Graduate of the Year, Employer of the Year and two Institution of Mechanical Engineers (IMechE) Awards – takes place at the IMechE on 10 October starting at 6pm. Attendance is free, but registration is required.

Details are available at [www.cibse.org/YEA](http://www.cibse.org/YEA)



Reanna Taylor, 2018's CIBSE Graduate of the Year

# Eight vie for Young Engineers Awards

Following a record number of entries, 2019's awards will be decided from a shortlist of outstanding young professionals

**E**ight graduates will be put through their paces at the finals of the CIBSE Young Engineers Awards on 10 October. These exceptional aspiring engineers have been shortlisted from a record number of entries, and the final selection process asks them to give a five-minute presentation in front of an illustrious panel of industry professionals.

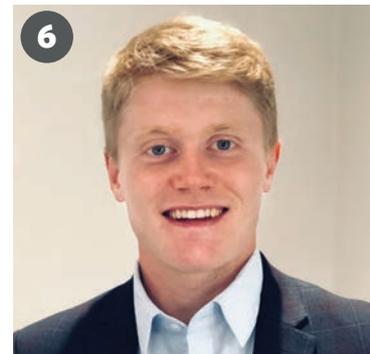
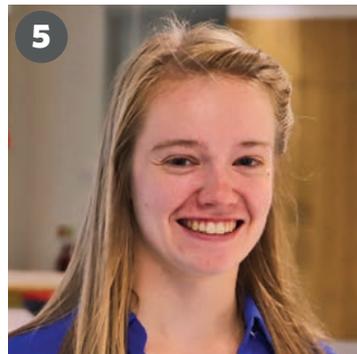
Each will present on the subject: 'How can building services professionals find the right balance between the needs of the global environment, occupant health, wellbeing and productivity, and best value?'

Now in its 24th year, the Young Engineers Awards celebrate the industry's best young engineering talent, recognising the individuals whose academic and professional achievements set them apart and identify them as up and coming stars of the engineering profession.

Employers of young engineers are also getting well-deserved recognition, with seven companies shortlisted for the Employer of the Year Award (see page 13).

Sponsored by Andrews Water Heaters, Kingspan Industrial Insulation, Swegon, Tam-lite and supported by the CIBSE Patrons, the programme culminates with the finals event at the London headquarters of the Institution of Mechanical Engineers (IMechE) on 10 October.

This year's graduate winner will enjoy a fully paid-for trip to the ASHRAE Winter Meeting in Orlando, Florida. The second and third placed graduates receive £600 and £300 respectively from the Rumford Club. Every other finalist receives £100 from the Manly Charitable Trust.



## Finalists for the CIBSE ASHRAE Graduate of the Year award are:

### 1 Chloe Coradetti - WSP and University of Manchester

Coradetti moved to the UK from France to study mechanical engineering at the University of Manchester. This included a year abroad at the National University of Singapore.

After graduating in 2017, she joined WSP's graduate programme as part of the Power System team, undertaking engineering design on large-scale, international data centre projects. Coradetti has since joined the energy solution team working in the field of district energy, gaining experience in the assessment and design of low carbon and renewable energy systems.

She says that, as an engineer, she feels a sense of duty towards mitigating the effects of the climate crisis and, by contributing directly to the decarbonisation of the heating industry, she is able to make a difference. She enjoys innovation being central to her team's work.

### 2 Felix Cox - Aecom and Queen Mary University

Having previously worked as a jazz clarinet/saxophone session musician and teacher, Cox completed a career U-turn in September 2018

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as a graduate mechanical engineer in Aecom's London head office.

He graduated in 2018 with a first-class BEng (hons) in mechanical engineering from Queen Mary University of London. During his studies he received several scholarships and recognitions including the prize for the highest score in mechanical engineering, the IMechE Prize and the third year principal's prize. He was also recipient of the Engineering Leaders Scholarship in 2017 from the Royal Academy of Engineering.

Cox has been a Stem ambassador for Aecom, and also visited secondary schools to deliver presentations when he was at university.

### 3 Sophie Hanson - Arup and Liverpool University

Hanson is a mechanical engineer in Arup's Liverpool office, having achieved a First Class (hons) MEng in engineering from the University of Liverpool in 2017.

Her interest in sustainability enables her to help tackle the climate emergency through low energy and carbon building design. In a recent project, she led a team of 20 engineers across five Arup offices while working on the Station Improvement Plan, which involved producing surveys and feasibility reports for 218 Transport for Wales stations.

She is currently involved with the Graduate Seminar Programme, a series of events hosted by graduates from Arup, Google and McLaren Automotive to share industry best practice, innovations and insights.

Hanson is a Stem ambassador and Social Mobility Foundation mentor, working with young people from disadvantaged backgrounds.

### 4 Ryan Hughes - Andrew Reid & Partners and City of Westminster College

Hughes is a commissioning manager for Andrew Reid & Partners, currently working on a fit-out project at 100 Bishopsgate for Overbury. He achieved his HNC in building services engineering at the City of Westminster College last year and was awarded a distinction.

He started his career in building services at the age of 18 by working for CML, commissioning air and water systems including high-profile projects such as the Bloomberg Building, 5 Broadgate and the Tate Modern extension. Hughes then moved to Andrew Reid & Partners to develop his managerial skills and overall knowledge of building services.

### 5 Laura Luckhurst - Cundall and Sheffield University

Luckhurst graduated from Sheffield University in 2018 and, since

starting in her role as a graduate mechanical engineer at Cundall, has worked on a number of prestigious projects including the 21 Moorfields development for Landsec.

She worked with the manufacturer of the software programme Cymap and developed a starter guide for other engineers in the firm. She is an enthusiastic user of digital tools to promote integrated designs.

Luckhurst helps to organise events for the Women's Engineering Society. She has also mentored a number of students, led Cundall's work experience placement programme and hosted an event for Year 10 children. She also authored an engineering-based children's book, which was used to support Stem learning in local schools.

### 6 Thomas Lusty - CPW and Coventry University

Lusty joined Couch Perry Wilkes as a trainee building services engineer in 2013. He was sponsored to further his education at Coventry University where, in November 2018, he graduated with a first-class honours degree in building services engineering.

In the same year, Lusty was runner up in the CIBSE President's Prize for his post-occupancy evaluation of a low carbon building project. Beyond academic research, he has worked on projects ranging from pharmaceutical facilities to mixed-use residential developments.

Having achieved his IEng through CIBSE, he is now working towards chartered engineer status. He is a firm believer in helping future generations in building services, currently mentoring both an apprentice and undergraduate.

7 Ryan Tough - Desco and University of Northumbria  
Tough joined Desco in 2015 as an electrical engineer where he furthered his academic qualifications by taking a degree in building services engineering, securing first-class Honours from Northumbria University last year.

In May, Tough was named Student of the Year for Higher Education in the Constructing Excellence Generation for Change Awards and, in June, he took the role of vice-chair of the CIBSE Young Engineers' Network.

He is a mentor for PlanBEE, which organises on and off-the-job training and lessons at Gateshead College, along with work placements. He is also a Stem ambassador.

### 8 Joe Wu - Red and London South Bank University

Wu is a senior project manager, responsible for commissioning management services at Red and has 12 years' experience in building services contracting. Following his mechanical craft apprenticeship, Wu completed a BEng (hons) in building services engineering at London South Bank University in 2017 and recently completed a part-time MSc in project management in Construction at the University of Reading. In parallel with his studies, Wu has held several managerial posts. These have included mechanical project engineer for a 20-floor commercial project, and a governance and auditing role for life safety services in a pharmaceutical complex.

Wu has a passion for promoting building services, shown by his contribution to professional committees and his mentoring of engineering apprentices. [CJ](#)

### Judging panel

Tim Dwyer CEng FCIBSE, UCL (chair)

Lynne Jack, CIBSE President

Darryl Boyce, ASHRAE president

Joe McGeouch, IMechE president

Reanna Taylor, CIBSE ASHRAE Graduate of the Year 2018



Hydrogen is being widely touted as a potential low carbon replacement for natural gas but, for it to succeed industry will need to address substantial challenges. **Andy Pearson** speaks to the pioneers in the sector to see what progress is being made

# IN THE PIPELINE

**O**n 25 June 2019, the world's first hydrogen-powered domestic boiler fired up in Rozenburg, the Netherlands. Developed by BDR Thermea Group, the high-efficiency condensing boiler uses pure hydrogen as a fuel to provide heat to a residential building – the first such real-life application.

The trial is significant because, now that hydrogen is being promoted as a potential low-carbon replacement for natural gas, it may soon become commonplace in the UK to help meet emissions commitments.

The Climate Change Act requires the UK government to reduce greenhouse gas (GHG) emissions to net zero by 2050. Heat currently accounts for around 50% of UK energy consumption and produces about one-third of its GHG emissions. If the government is to meet its obligations, it will need almost full decarbonisation of heat in buildings.

Producing hydrogen in low carbon ways and using it for heat in buildings has the potential to be an important part of the next stage of the UK's energy transition.

Hydrogen is already used, in both its gas and liquid forms, in the manufacture of chemicals, foods and electronics. According to the International Energy Agency (IEA), however, current methods of production are responsible for annual CO<sub>2</sub> emissions 'equivalent to those of Indonesia and the United Kingdom combined'. This is because the most economical process for producing large quantities of hydrogen is by reforming natural gas through the application of heat. The reforming process produces large volumes of CO<sub>2</sub>, so hydrogen's future as a fuel for large-scale deployment to homes and industry is dependent on the simultaneous deployment of carbon capture usage and storage (CCuS) infrastructure.

An alternative to reforming gas with CCuS

is to produce hydrogen through electrolysis by using power generated from low carbon sources, such as renewables. In the report *Transitioning to Hydrogen*, the Institution of Engineering and Technology (IET) says: 'In the longer term, it may be possible for larger volumes of hydrogen to be produced from low carbon sources, but it is unlikely to be within a timescale to support a sizeable contribution to the UK meeting its 2050 greenhouse gas targets.'

Assuming hydrogen can be produced in large volumes without emitting large quantities of CO<sub>2</sub>, its appeal to the UK government is that it is an easy win. It could potentially be rolled out at scale to homes and businesses using a significant part of the existing natural gas pipework and infrastructure. This is not an unrealistic proposition; after all, the entire UK transitioned from town gas to natural gas between 1967 and 1977.

According to the Committee on Climate Change (CCC), in its report *Hydrogen in a low carbon economy*, hydrogen has particular value as a low carbon replacement for natural gas – and, potentially oil – 'in applications where full electrification is very difficult, disruptive and/or expensive'.

The CCC sees hydrogen heat being used in combination with electric heat pumps for a low carbon heating solution. 'Our assessment is... that heat pumps, powered by increasingly low carbon electricity, offer the potential to provide heat efficiently most of the time,

## HYDROGEN-READY DEVICES

A number of organisations have started the process of developing prototype domestic hydrogen appliances for use in demonstrations in 2020. These companies are all part of the Hy4Heat programme's innovation competition to demonstrate the safe use of hydrogen as a fuel for heating, hot water and cooking. As well as developing appliances that can be used with hydrogen gas, the workstream (work package 4) will be providing important evidence regarding safety, in-use emissions, and functionality.

A draft report – *Understanding Industrial Appliances from Element Energy* – by Jacobs Consulting and Cardiff University has been presented to stakeholders at a workshop event at BEIS Conference Centre. This is a market research study into the variety of industrial appliances and the issues to be addressed.

ERM's study into commercial appliances is under way, looking at the variety of commercial appliances in use and the issues to be addressed in their conversion or replacement with hydrogen appliances. ERM is keen to hear from commercial appliance manufacturers to assist with the research. Contact ERM at [Hy4HeatWP5@erm.com](mailto:Hy4HeatWP5@erm.com)



## H21 CONVERTING THE GAS GRID TO HYDROGEN

In 2016, Northern Gas Networks, the gas distributor for the North of England, working with Cadent, SGN and Wales & West Utilities, produced the H21 Leeds City Gate feasibility study. This concluded that it was both technically and economically possible to decarbonise the UK's gas distribution networks by converting them to 100% hydrogen, based on a blueprint of the city of Leeds. After securing an additional £10m of funding, the organisations are now working to provide safety-based evidence for the conversion. Its report is expected in 2020.

with hydrogen boilers contributing mainly as back-up, to meet peak demands on the coldest winter days.'

The committee says if hydrogen is to play a substantial, long-term role, then 'progress towards deployment of low carbon hydrogen must start now', with a focus on 'applications that would not initially require major infrastructure changes (for example, power generation, injection into the gas network and depot-based transport).'

Chris Manson-Whitton, a director of Progressive Energy, envisages the transition to hydrogen in stages: 'I think we'll be blending hydrogen with natural gas first, alongside some large industrial consumers switching to hydrogen. This will be followed by some new-build housing schemes based on 100% hydrogen and then, finally, we will deploy 100% hydrogen to the remaining consumers.'

In the HyDeploy programme, Progressive Energy is working with Cadent, NGN, ITM Power, Keele University and the Health and

Safety Laboratory on a series of trials to establish how much hydrogen can be blended safely into the existing gas grid. Blending hydrogen will lower the grid's carbon intensity without the need to make major changes to the infrastructure or end-user appliances.

Currently, hydrogen is limited to 0.1% of grid gas; but, 2015 research by the Health and Safety Executive suggested it might be safe for the grid to comprise up to 20% hydrogen.

'The bar that we have to meet with HyDeploy is that the system is as safe with the proportion of hydrogen used as it is with 100% natural gas. This project will provide that evidence,' says Manson-Whitton.

Keele University's private gas network of 100 domestic and 30 commercial users will be used for the first trial. The electrolyser to manufacture hydrogen on site using renewable power has been installed; currently, the blender to keep the proportion of hydrogen constant as gas demand fluctuates is being installed. 'Over the coming weeks, we will gradually start to increase the proportion of hydrogen up to a maximum of 20%,' says Manson-Whitton. 'It will be a complete

"We will gradually increase the proportion of hydrogen... It will be a success if nobody notices any difference"

success if nobody notices any difference.'

After the Keele trial, two public trials are scheduled to take place. 'Blending allows us to reduce the carbon intensity of domestic consumers without any impact on them; if we rolled this initiative out across the UK, it would have more impact than the entire Renewable Heat Incentive has had in all of its history,' says Manson-Whitton. 'UK-wide, it has the potential to deliver around 30 terawatt hours of low carbon heat.'

The UK's annual domestic gas demand is about 300 terawatt hours. Clearly, blending hydrogen with natural gas will make a significant contribution to reducing carbon emissions, but more needs to happen if the UK is to meet its net-zero target.

Manson-Whitton says industrial users

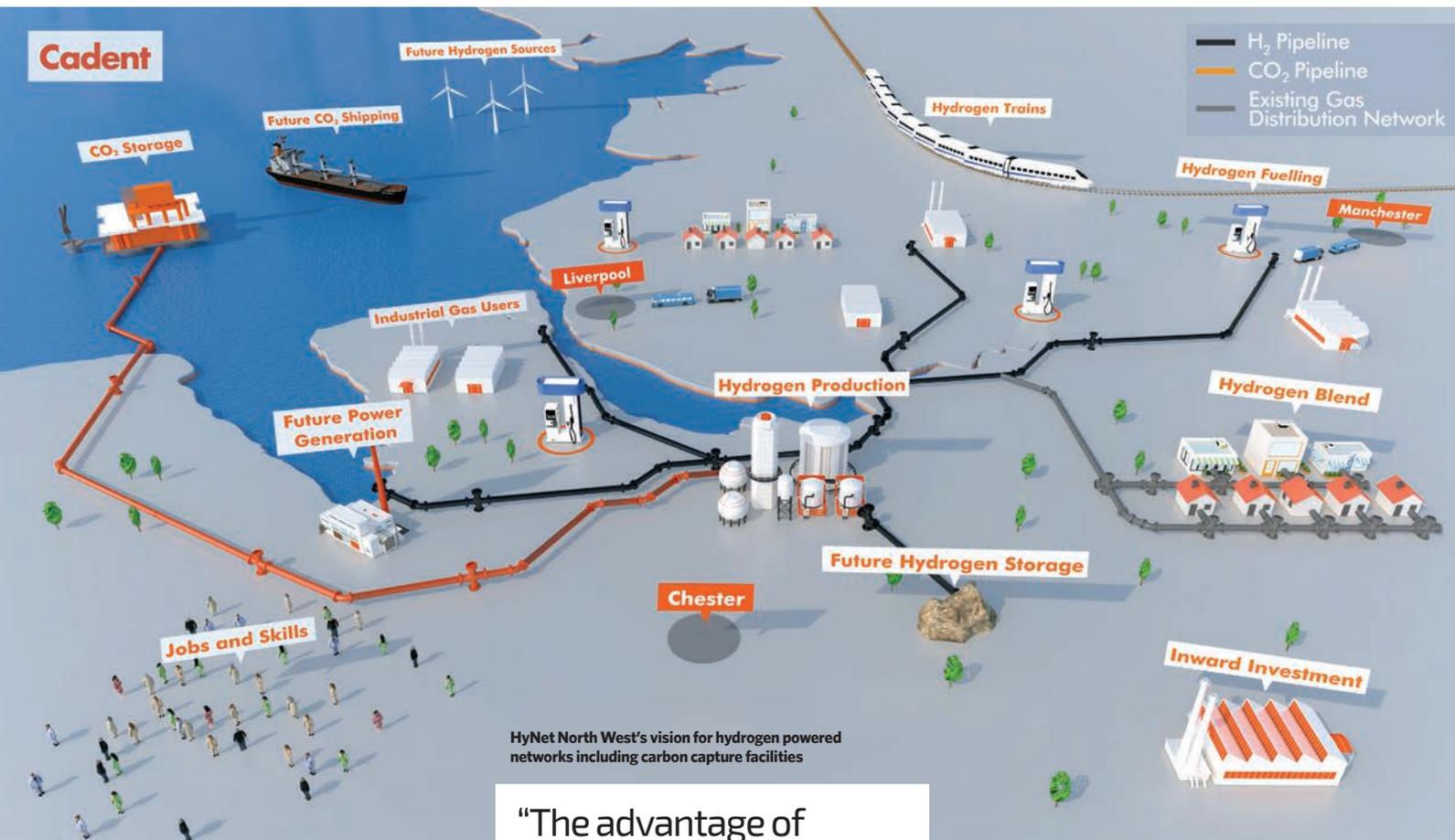
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BDR Thermea says its hydrogen powered domestic boiler in the Netherlands is a world first



The H21 hydrogen testing facility in Buxton. Results will be fed into a BEIS consultation document on low carbon gas



HyNet North West's vision for hydrogen powered networks including carbon capture facilities

**“The advantage of switching is that, once a boiler has been replaced, much of the heating system can be reused”**

» are the ‘low-hanging fruit’ on the journey to 100% hydrogen. ‘Some big industrial users are relatively straightforward to convert to hydrogen; you only have to convert one or two large industrial users and you’ll have the same impact as, say, converting tens of thousands of households.’

The HyNet project’s aim is to create the UK’s first CCuS infrastructure, to allow hydrogen to be produced from natural gas to facilitate the creation of a hydrogen-powered industrial cluster in the North West by 2025 (see 3D map of North West England above).

More generally in the industrial sector, the IET – in *Transitioning to Hydrogen* – states that some steam and hot-water boilers ‘can be converted to 100% hydrogen using existing technology’. Similarly, it says that, in the power sector and the combined heat and power sector, work is already under way to develop gas turbine combustion systems suitable for pure hydrogen.

But, the report warns that some existing CHP systems using reciprocating engines can only take a maximum of about 20% hydrogen by volume before they will have to be replaced. In addition, for some industrial applications – such as glassmaking kilns – the IET says it is less clear to what extent hydrogen can be substituted for natural gas ‘because of the different combustion characteristics’.

Work by Element Energy for BEIS, however, indicates that – with appropriate development and demonstration – there are no fundamental barriers to industrial use of hydrogen, which has informed BEIS’s Fuel Switching programme.

In contrast to HyNet’s industrial focus, the Hy4Heat project has been established primarily to deal with the use of hydrogen in domestic properties. This, and the H21 project, with its focus on the gas supply network (see box, H21 converting the gas grid to hydrogen), are looking at the feasibility of converting the gas grid and domestic properties to run on 100% hydrogen.

The advantage of switching from natural gas to hydrogen in the domestic sector is that, once a boiler has been replaced, much of the heating system, including the radiators and distribution pipework, can be reused.

According to IET, a major problem with domestic properties is that conversion of existing natural gas appliances to operate

on 100% hydrogen ‘is not viable’. This could mean up to 24 million boilers having to be replaced. The IET also says that there is ‘some uncertainty’ as to whether open-flame gas hobs and fires could be used, adapted or replaced.

Baxi Heating UK, part of the BDR Thermea Group, is part of the Hy4heat project, working on developing hydrogen combination boiler and system boilers. ‘We’re confident that we’ll be able to offer a like-for-like replacement for gas boilers for homeowners,’ says Jeff House, head of external affairs, Baxi Heating UK.

Until hydrogen replaces natural gas, however, gas boilers will have to be designed to be hydrogen ready, so they can operate initially with natural gas, but be capable of conversion to hydrogen in the future. This will help reduce the workload at the point of hydrogen conversion in the domestic sector.

‘We’re working to demonstrate the capability of hydrogen boilers, but when we go to full commercialisation and volume production in, say, five years’ time, we’re aiming to have a gas boiler that is hydrogen ready,’ says House. ‘All an engineer would have to do is swap a few key components and then recommission the boiler, and it would soon be up and running.’

However, the conversion of homes to hydrogen heating may not be as simple as swapping the boiler. There are concerns that the existing gas pipework within a home will

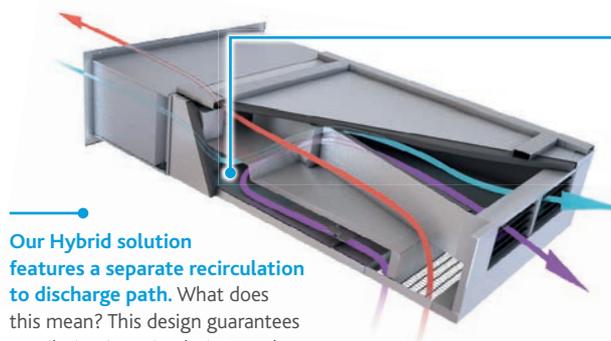
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» need to be tested and may have to be adapted or even replaced for use with a hydrogen boiler. In its October 2018 report *Logistics of Domestic Hydrogen Conversion* for BEIS, Frazer-Nash Consultancy says that in the case of homes in the UK, a home survey would be needed to assess the condition of the gas pipework, using a gas-tightness test and an inventory of gas appliances.

The test is important because hydrogen has a smaller molecular size than natural gas, making it 'much more prone to leakage through joints and component assemblies than natural gas'. However, the report does also point out that hydrogen tends to disperse and dilute more readily than natural gas, so leaks may be less of an issue.

The consultancy says that the pre-conversion tasks required for domestic gas pipework are not so certain because various different materials are used for domestic natural gas pipework including copper, steel and MDPE, in addition to various jointing methods. It highlights concerns about the ability of soldered copper pipes to carry hydrogen and calls for tests to confirm its suitability. It also raises the issue of inaccessibility of some domestic pipework for inspection – for example, where the pipe is ducted beneath a concrete slab – which may lead to some pipes having to be replaced.

#### What's Next?

The IEA in *The Future of Hydrogen* report offers seven recommendations to help governments, companies and others to seize this chance to enable clean hydrogen to fulfil its long-term potential:

1. National, regional and city governments should establish a role for hydrogen in long-term energy strategies
2. Stimulate commercial demand to create sustainable markets for clean hydrogen
3. Address investment risks of first-movers with targeted and time-limited loans, guarantees and other tools that can help the private sector to invest, learn and share risks and rewards
4. Support R&D to bring down costs and improve performance, including for fuel cells, hydrogen-based fuels and electrolyzers (the technology that produces hydrogen from water)
5. Eliminate unnecessary regulatory barriers and harmonise standards to help in sharing knowledge
6. Engage internationally and track progress towards long-term goals
7. Focus on four key opportunities to further increase momentum over the next decade:
  - Make the most of existing industrial ports to turn them into hubs for lower-cost, lower-carbon hydrogen.
  - Use existing gas infrastructure to spur new clean hydrogen supplies.
  - Support transport fleets, freight and corridors to make fuel-cell vehicles more competitive.
  - Establish the first shipping routes to kick-start the international hydrogen trade. [C](#)

# Ask



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# TAKING COUNSEL

Robust modelling and an intelligent redesign enabled BDP to retain natural ventilation in Northamptonshire County Council's new offices. **Andy Pearson** finds out how collaborative value engineering resulted in a CIBSE Building Performance Award



One Angel Square, Project of the Year - Commercial/Industrial at the 2019 CIBSE Building Performance Awards [www.cibse.org/bpa](http://www.cibse.org/bpa)

**'O**ne Angel Square is neither groundbreaking nor game-changing, but it demonstrates success through understatement and simplicity,' says James Hepburn, the building services lead at BDP, the scheme's multidisciplinary designer.

He says: 'It adopts best practice passive design strategies and combines them through an approach to deliver a highly efficient and highly comfortable building.'

What Hepburn might also have mentioned is that the scheme successfully demonstrates how to value engineer a project to deliver an impressively simple and robust scheme – and that the project so impressed the judges at this year's CIBSE Building Performance Awards that it won the Project of the Year – Commercial/Industrial category.

Value is a theme that has driven the design-and-build project from its inception. One Angel Square was developed as a key element in Northamptonshire County Council's (NCC's) drive to improve its operational efficiency. Its rationale was that a new city centre

**"The council was already using a thin client IT strategy, so we thought if we could reduce the lighting loads too, we might be able to get rid of the chilled beams" – James Hepburn**

office would allow 2,000 council workers to be relocated from 12 offices scattered around the town, improving operational efficiencies and generating savings on rent and maintenance. Moving the workforce back into the town centre would also help to reinvigorate the area.

When BDP won the competition to design One Angel Square, the brief for the building services was akin to that of a speculative office development: the council wanted mixed-mode ventilation with passive chilled beams and an integrated lighting solution throughout the office spaces. 'A very detailed brief had been set; it also required the building to be simple to operate,' says Hepburn.

BDP's architectural design for the office is based on two L-shaped, three-storey wings of office accommodation set around a central, covered courtyard. This form allows natural light into the heart of the building and ensures good connectivity between the floors and across the courtyard. 'The design provides a modern workspace that is flexible, efficient and promotes collaborative working,' says Hepburn.

The building's prefabricated façades incorporate vertical fins to offer shading to the floor-to-ceiling glazing. Building modelling optimised the shading design to ensure high levels of daylight without excessive solar gain.

The façades also have louvred panels next to the glazed areas, which conceal automated fresh air ventilators. The façade ventilators open automatically under control of the building management system (BMS), but they can be manually overridden using a button mounted on an adjacent mullion. 'This solution takes the ventilation element away from the window, so you don't end up with window blinds obstructing an open vent,' says Hepburn.

In natural ventilation mode, air enters the offices through the façade ventilators. After passing across the office floors, it rises up through the central void to exhaust through the high-level openings in the streets and through four wind towers.

When natural ventilation is not possible, high-efficiency AHUs provide mechanical ventilation from VAV boxes concealed



#### PROJECT TEAM

**Client:** Northamptonshire County Council  
**Architect:** BDP  
**Interior designer:** BDP/Consarc  
**M&E engineer:** Briggs & Forrester  
**Main contractor:** Galliford Try  
**Facilities manager:** NCC



» beneath the raised floors in the offices. Air supply is via floor-mounted displacement diffusers. ‘We have CO<sub>2</sub> sensors around the floor plates; if the window is open – or people choose to open a window – then the CO<sub>2</sub> levels within the space will reduce and the mechanical fresh air supply to those spaces will automatically ramp back,’ says Hepburn. ‘It’s a system that has been designed to look after itself.’

In the original design, passive chilled beams were included to provide cooling to the offices when the system was in mechanical ventilation mode. ‘When we developed the design, it was fully aligned with the brief,’ Hepburn says. When the original scheme was put out to tender, however, all three tenders were returned significantly over the project budget. The design team set about finding solutions to make significant savings, including to the building services.

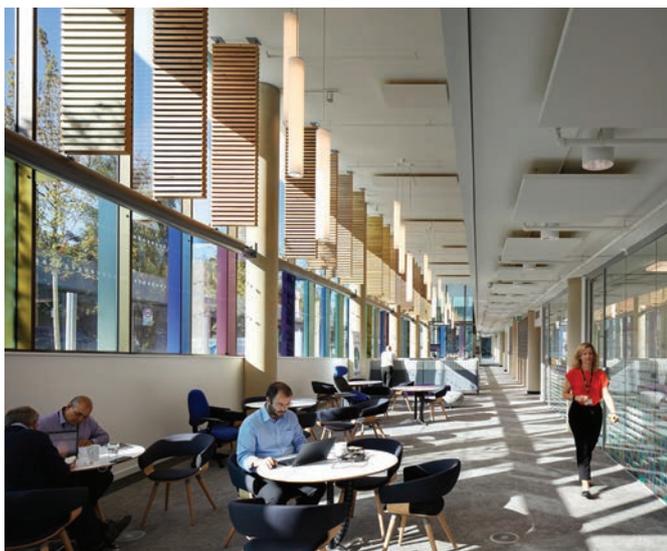
Hepburn says the contractor, Galliford Try, advocated a move away from a mixed-mode solution to a ‘sealed-building scheme incorporating fan coil units above suspended ceilings’. Rather than abandon the mixed-mode strategy completely, however, BDP set out to reduce costs by working with Galliford Try and the M&E specialist contractor, Briggs & Forrester, to remove the chilled beam system. ‘Our experience has been that making significant savings requires the removal of entire systems,’ says Hepburn.

BDP was helped in its quest to eliminate the chilled beams by NCC’s thin client IT strategy. This means almost all of the council’s office computers are connected to a remote server, which does most of the processing work, so the desktop computers on the office floor plates give out much less heat than conventional computers.

‘The council was already using a thin client IT strategy, so we thought, if we could reduce the lighting loads too, we might be able to get rid of the chilled beams,’ says Hepburn. BDP changed the lighting scheme from one based on delivering a uniform lux level from lamps integrated into the chilled beams to one based on the provision of task-focused LED lighting using floor-standing modules.

These up-and-down lighters provide 300 lux of light on the desks and 100 lux on the floor (and can be increased to 500 lux by users). The units incorporate integral controls for daylight dimming and include a presence/absence detection sensor, plus a switch enabling users to override these functions.

There was some trepidation about the proposed LED solution because the floor-standing luminaires were new to the market. ‘The contractor and its supply chain were keen to switch to more conventional pendant fittings, or adopt cheaper products that did not match the functional, operational and aesthetic performance



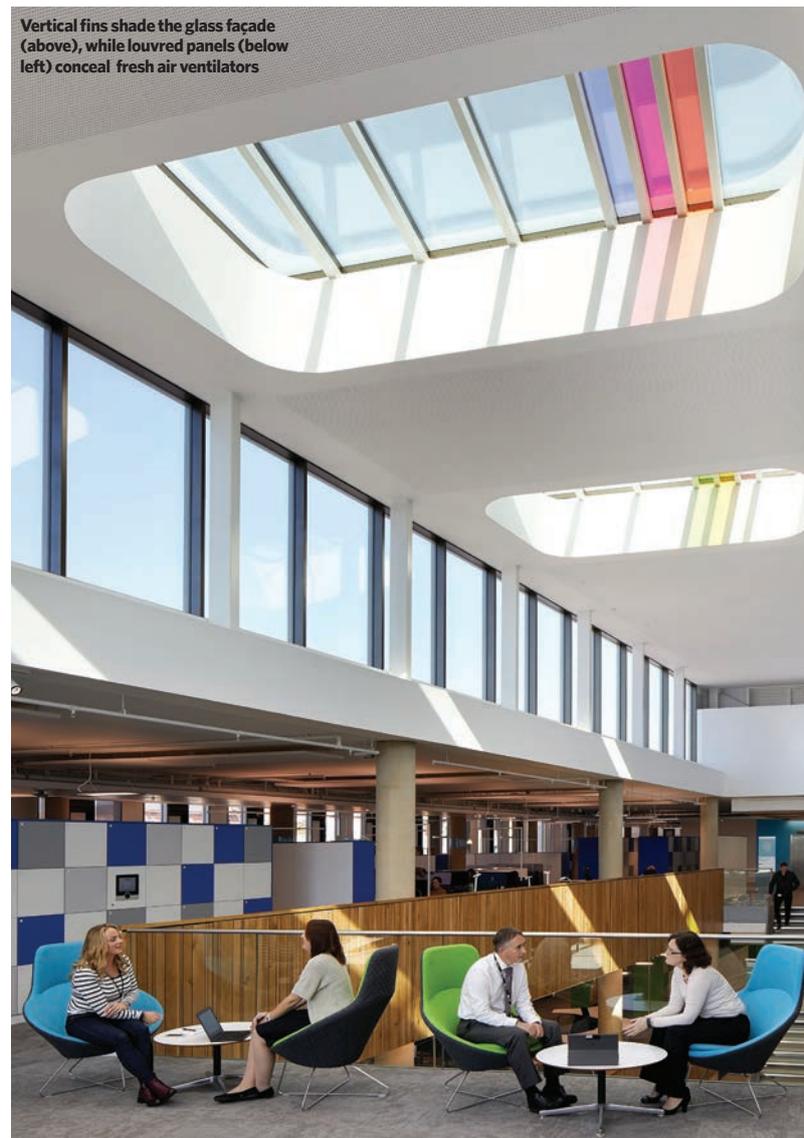
of the BDP proposals,’ says Hepburn.

To prove the solution offered best value, payback calculations were done using CIBSE TM54. These demonstrated a breakeven point after four years, confirming BDP’s selection.

‘The NCC’s thin client IT strategy, coupled with a new task-focused LED lighting solution, reduced internal gains to a figure significantly less than the cooling delivered by the chilled beams,’ says Hepworth. ‘This meant the project could move away from the chilled beam/integrated service modules, while retaining the mixed-mode strategy.’

An additional benefit of the innovative HVAC approach is that there are now very

»



Vertical fins shade the glass façade (above), while louvred panels (below left) conceal fresh air ventilators

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### FIT-FOR-PURPOSE PVS

The roof-mounted PV array was selected as the most suitable installation because of building orientation and a favourable payback period. Project budget pressures meant alternative means of funding the PV array were explored and local authority partner organisations were approached.

One of these provided the capital investment for a 1,200m<sup>2</sup> photovoltaic installation on the unshaded flat-roof areas of the building. The partner organisation benefits from the Feed-in Tariff (FiT), but One Angel Square enjoys onsite energy generation.

What's more, the PV array meets the entire electrical load of the building during summer weekends and delivers an annual operational saving of more than £15,000 for Northamptonshire County Council and a FiT contribution to the investor of more than £8,000 per year.



» few services at high level in the offices. This gives a minimal aesthetic, but – more importantly – the concrete soffits provide exposed thermal mass to help absorb daytime heat. Night-time cooling recharges the soffits ready for the next day. The solution has the advantage of extending the period that natural ventilation can be used before the demand-controlled ventilation system comes into operation. 'If you can take out whole systems, you get big value-engineering savings,' says Hepburn.

With the chilled beams gone, BDP – to help control solar gains – boosted displacement airflows to the central floor plates and switched the perimeter trench heating to a four-pipe heating and cooling system, served by roof-mounted, gas-fired condensing boilers and low-energy chillers.

BDP modelling proved the operational energy benefits of retaining the mixed mode/demand-controlled ventilation approach for the scheme. 'Our TM54 modelling and sensitivity analysis estimated a fan energy saving of 30% by retaining the mixed-mode solution,' says Hepburn. 'It is difficult to quantify the impact of this reduction in the actual building, but it is noticeable when visiting that the users enjoy the natural ventilation for a significant part of the year.' TM54 modelling was used to estimate the building's high, medium and low annual energy

use: the figures for these were 112kWh·m<sup>-2</sup>, 90kWh·m<sup>-2</sup> and 81kWh·m<sup>-2</sup> respectively.

'Our targets align with a good-practice, naturally ventilated, small cellular office and are half that of the benchmark for a general office in TM46,' says Hepburn. 'Our first year of energy-consumption data suggests the building is currently exceeding, slightly, the upper end of the TM54 prediction, at around 130kWh·m<sup>-2</sup> per year – but this is improving steadily through proactive engagement by BDP with the client and contractor teams, and regular site visits as the buildings settles down.'

The building also incorporates extensive smart (automatic) metering of electricity, including generation and export meters for the onsite electrical generation from the 1,200m<sup>2</sup> roof-mounted PV array, after the feasibility of various types of renewable and low and zero carbon technologies were assessed (see panel, 'Fit-for-purpose PVs').

In their citation for the award of Project of the Year – Commercial/Industrial, the CIBSE judges described the scheme as 'a good-quality design, delivered within a limited budget'. In particular, they liked the use of TM54 modelling 'to develop robust operational cost estimates to maintain value by defending engineering options in the design that would lead to better value outcomes'. **CJ**

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When reception staff at a central Birmingham office complained of a persistent smell of exhaust fumes, sensors were deployed to pinpoint the source of potential pollutants. Dr Peter Walsh, technical director at WSP, explains

# EMISSION CREEP

**R**eception staff in a ground-floor, city centre office in Birmingham had complained of the persistent smell of vehicle exhaust throughout the working day. The building entrance – a glass-fronted lobby with an automatic, wide-aperture, opening front door – had no double-door system, and there were gaps between the bottom and top of the front doors.

Elevated pollutants were suspected to be present within the reception area, as a result of intrusion of street-sourced pollutants via the front doors' continuous opening, and/or gaps around the bottom and top. The main source of the nitrogen dioxide (NO<sub>2</sub>) was suspected to be emissions from queuing taxis and other traffic immediately outside the reception lobby.

To determine whether reception staff were being exposed to a high level of pollutants, a short monitoring campaign was undertaken, examining the extent of any exposure and, potentially, identifying the source type.

## Workplace exposure limits air-quality guidance

Exposure to NO<sub>2</sub> is governed by the Control of Substances Hazardous to Health (COSHH) regulations; however, there is no workplace exposure limit (WEL) for NO<sub>2</sub> in HSE EH40/2005 *Workplace Exposure Limits Second Edition*. So, exposure to nitrogen dioxide should be kept as low as reasonably practicable, though current draft WELs have been applied in this instance.<sup>1</sup>

Ambient air-quality standards for NO<sub>2</sub> are applicable in the ambient atmosphere (external areas) where the public may reasonable gain access.

## Air-quality sampling

A continuous nitrogen dioxide monitoring device – a Zephyr, manufactured by Earthsense – was used to determine NO<sub>2</sub> concentrations in the New Street office. The device, an electro-chemical sensor, is capable of logging NO<sub>2</sub> concentrations every second. As an indicative monitor, its primary use was to provide a record of high-resolution trend data, and any inference of absolute nitrogen dioxide concentrations it provided was avoided. In the latter part of the survey, a series of diffusion tubes were deployed inside and outside the reception area.

Diffusion tubes are a reliable monitoring method, and their use helps validate absolute NO<sub>2</sub> concentrations. When combined with high-resolution data from the electro-chemical sensor, a comprehensive record of NO<sub>2</sub> concentrations and their variations can be obtained. To represent the exposure patterns of the reception staff, the electro-

Standard	NO <sub>2</sub> concentration	Comment	Guidance document
Occupational long-term exposure limit	955µg·m <sup>-3</sup>	Eight-hour time-weighted average	TFL - PR703 A1 HSE - CD283
Occupational short-term exposure limit (STEL)	1,910µg·m <sup>-3</sup>	15-minute average	TFL - PR703 A1 HSE - CD283
1hr mean in ambient air	200µg·m <sup>-3</sup>	1 hr mean; not to be exceeded more than 18 times per year	Air Quality Standards Regulations 2010
Annual mean in ambient air	40µg·m <sup>-3</sup>	Annual mean	Air Quality Standards Regulations 2010

Table 1: Air-quality standards for NO<sub>2</sub>



concentrations in the early morning, rising to a maximum between 8am and 11:30am. The magnitude of NO<sub>2</sub> concentrations varied across the sampling period, though this could be because of the sensor response, rather than an absolute reduction in NO<sub>2</sub>.

Diffusion tube concentrations obtained in the latter stages of the survey indicate that NO<sub>2</sub> concentrations were very high at the ground-floor office reception desk – between 67.7 and 72.6µg.m<sup>-3</sup>. This implies that the electro-chemical sensor underpredicted NO<sub>2</sub> concentrations by a factor of approximately 3.

The pattern of diurnal variation of NO<sub>2</sub> concentrations during midweek monitoring was often different from that observed at the weekend. Generally, weekend monitoring periods displayed a less distinct diurnal profile than midweek ones (see Figure 1).

Sample number	Sample location	NO <sub>2</sub> concentration (µg.m <sup>-3</sup> )
1	Inside building reception area	68.7
2	On building façade	75.2
3	On south lamp-post	85.3
4	On north, near lamp-post	83.6
5	On far north lamp-post	88.9

Table 2: NO<sub>2</sub> diffusion tube results Birmingham New Street office reception

chemical sensor was positioned immediately next to the reception desk, which is approximately 12m from the entrance – in turn, about 3m from queuing taxis.

### Nitrogen dioxide diffusion tube survey

As part of the NO<sub>2</sub> survey, Gradko nitrogen dioxide 20% triethanolamine (TEA)/water diffusion tubes were deployed as weekly samples were placed at five locations across the local site over four weeks between 24 May and 21 June 2018.

Diffusion-tube exposure periods are, typically, recommended to be between two and four weeks, but weekly sample exposure is considered valid by the supplier, and are within the recommended minimum exposure period. Weekly sampling periods were chosen in this instance to give as many data points as possible within the short study period.

Any influence this shortened sampling period may have had on the sample concentrations would have been common to all samples. The purpose of the study was largely to determine intrusion into the building via street-sourced NO<sub>2</sub>. Differences between the NO<sub>2</sub> concentrations of external and internal diffusion tubes were the primary parameter assessed in this instance.

### Results: Nitrogen dioxide concentrations over the survey period

Continuous monitoring of NO<sub>2</sub> in the ground-floor reception of the Birmingham New Street office indicated that concentrations followed a strict diurnal variation, with minimum NO<sub>2</sub>

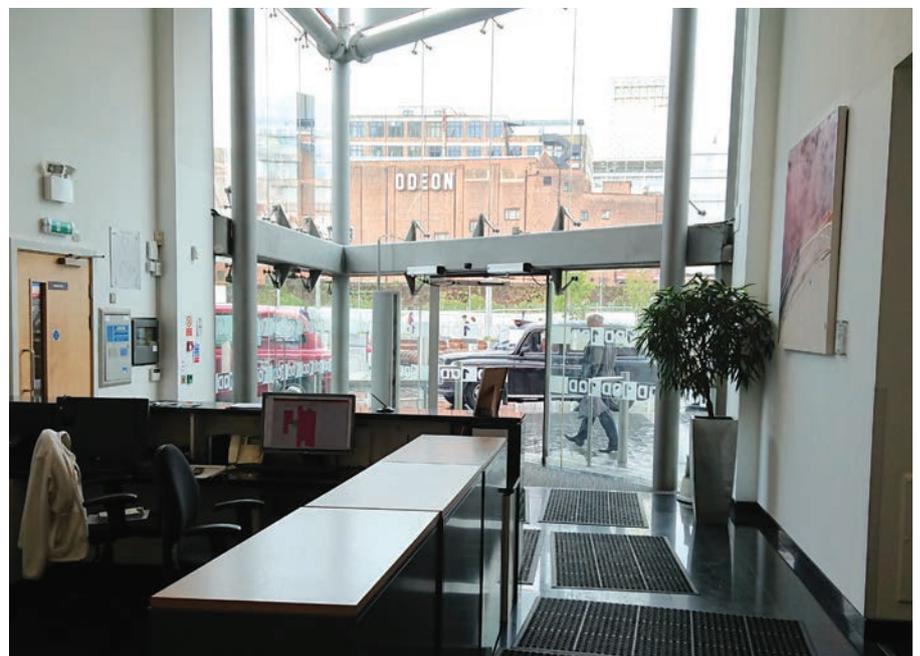
### Nitrogen dioxide daily variations

Averaged daily variations of NO<sub>2</sub> concentrations detected at the office reception desk confirm that peak midweek concentrations occurred around 8:30am, with a secondary peak around 4:30pm. Midweek NO<sub>2</sub> concentration minima were observed to occur around 3:30am. All of these periods coincide with local traffic flow, with both maxima coinciding with the morning and afternoon rush hour.

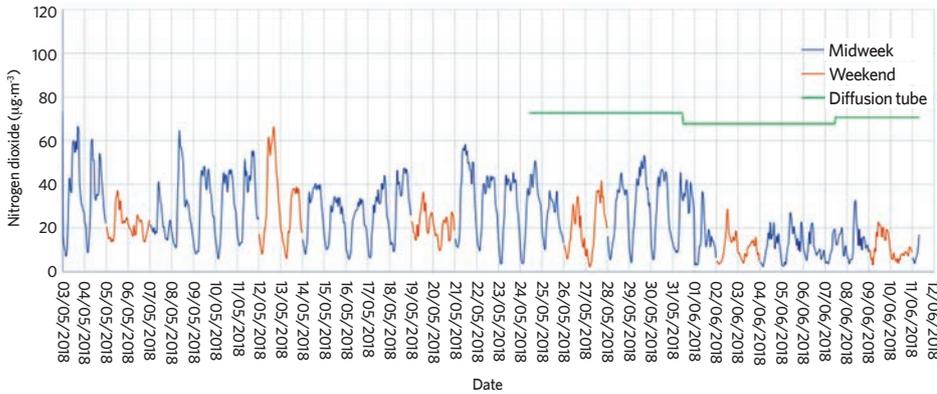
Averaged daily variations of NO<sub>2</sub> concentrations detected at the office reception desk on Saturdays, over the monitoring period, were distinctly different from those detected in midweek. Concentration magnitudes were slightly



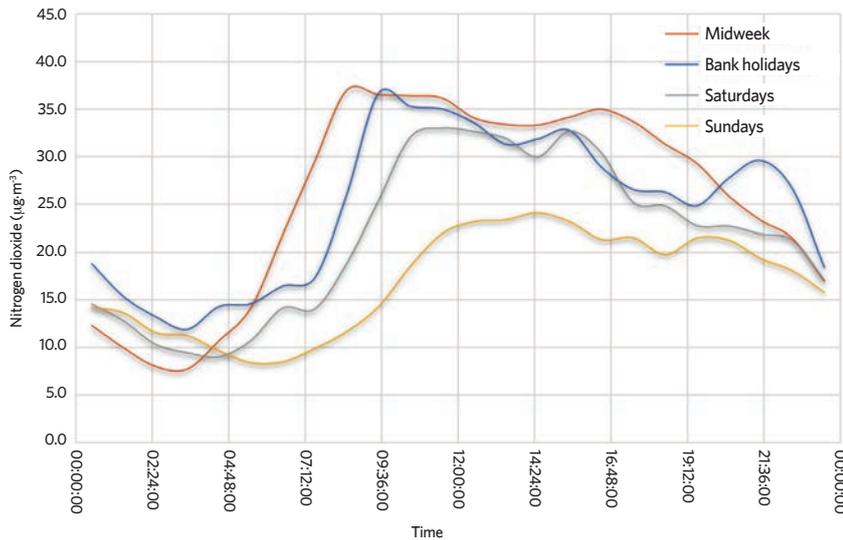
>> An electro-chemical sensor on the reception desk



The office reception area looks out on to a busy road near Birmingham New Street



**Figure 1: NO<sub>2</sub> concentrations Birmingham New Street office reception**



**Figure 2: NO<sub>2</sub> daily variation Birmingham New Street office reception**

**NO<sub>2</sub> diffusion tube**

Nitrogen dioxide diffusion-tube concentrations were highest at the three roadside sites, which were closest to queuing traffic. Concentrations of NO<sub>2</sub> were observed to drop away from the roadside, with the building façade sample indicating that concentrations were approximately 10µg·m<sup>-3</sup> lower than at the roadside location, a few metres away. NO<sub>2</sub> concentrations at the reception desk inside the building were approximately 7µg·m<sup>-3</sup> lower than those observed on the building façade.

**Conclusions**

Nitrogen dioxide concentrations were monitored at the reception desk of an office next to Birmingham New Street – and outside the office – between May and June 2018. Two separate methods of NO<sub>2</sub> monitoring were deployed – passive (used inside the reception and outside) and a continuous electro-chemical sensor (inside the reception).

NO<sub>2</sub> concentrations were observed to be elevated at all sites over the monitoring period, through greater-than-annual ambient air quality standards. These were well below occupational health standards, however.

NO<sub>2</sub> concentrations were observed to be elevated outside the reception, and increased at roadside-monitoring locations immediately outside the office.

Passive monitoring of NO<sub>2</sub> indicated that concentrations over the monitoring period were consistently greater immediately outside the office reception, and, increased again at monitoring locations closer to the roadside.

Passive sampling was a robust method, but the low data resolution (one sample per site per week) limited the source apportionment options. Monitoring of NO<sub>2</sub> by electro-chemical sensor provided high-resolution data, allowing for temporal analysis of concentration data, including associations with local traffic activity detected, and including diurnal variations.

A strong NO<sub>2</sub> concentration association with local traffic movements, plus elevated concentrations close to the roadside, strongly inferred that the principal source of elevated NO<sub>2</sub> concentrations inside the office reception area was local vehicle emissions.

High concentrations of street-sourced NO<sub>2</sub> were detected in the reception area during periods of high local traffic movements when the building was largely unused. This led to the inference that the principal pathway of NO<sub>2</sub> entering the building was through its permeable façade, including via the opening of – and gaps in – the front door during the building’s hours of operation, and via gaps in the front door outside hours of operation. **CJ**

» lower across the Saturday monitoring periods, with peak concentrations occurring later – at around 10:30am – with NO<sub>2</sub> concentrations dropping off after 3:30pm.

Averaged daily variations of NO<sub>2</sub> concentrations detected over the two bank holiday weekends were very similar to the diurnal variation observed on several Saturdays. The variation of daily NO<sub>2</sub> concentrations at the office reception desk on Sundays was characteristically different from all other periods. Concentration magnitudes were lower, and peak concentrations occurred later, at around 2:30pm, with NO<sub>2</sub> concentrations dropping off after 8:30pm.

The office reception is largely unused during the weekend and bank holiday periods, so the high NO<sub>2</sub> concentrations detected at these times occurred when the reception doors were mostly closed. From this, it can be inferred that the effective intrusion of NO<sub>2</sub> into the reception area was via the permeable building façade, as high concentrations of NO<sub>2</sub> were still observed, even though the front doors were closed (Figure 2).

■ A presentation based on this research was presented at the 2019 CIBSE Technical Symposium.

■ **DR PETER WALSH** is technical director at WSP

**References:**

- 1 ‘CD283 HSE Consultation document: consultation on implementing new and revised workplace exposure limits’ proposes that a 1ppm STEL and 0.5ppm TWA are to be adopted on 21 August 2018.



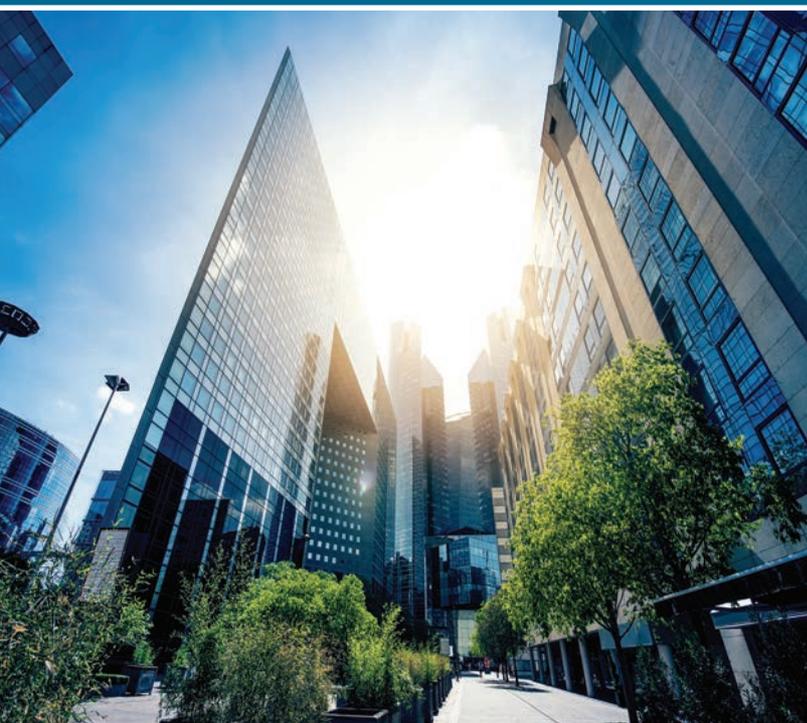
# Weather Data

**Weather data is an essential component of virtually every new building design and major refurbishment.**

CIBSE supplies the industry's standard weather data files used in building performance analysis and simulation. The new data files have been created to better represent our current climate and weather pattern.

Data set packages\* are available across 14 UK sites for the following:

- Test Reference Year (TRY) Hourly Data
- Design Summer Year (DSY) Hourly Data



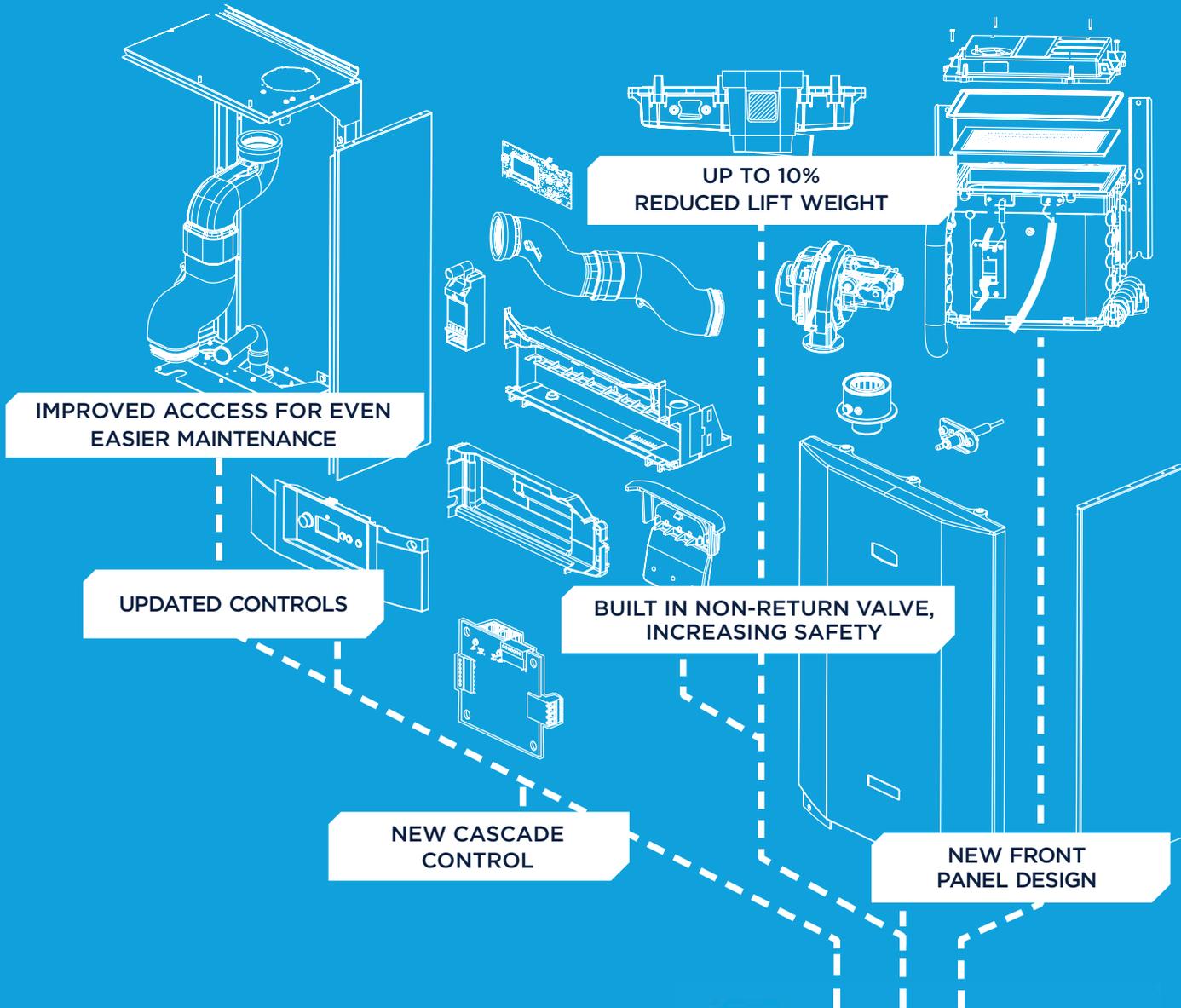
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# COOL SOUNDS

Limiting overheating and noise control must be considered in tandem if residential properties are to be comfortable, healthy homes, says Sweco's **Katherine Holden**, who suggests alternatives to mechanical cooling

**L**imiting overheating is a major issue in many new residential developments, particularly in the south-east of England, or in areas with noisy external environments, such as cities, town centres and near busy roads, railways and airports.

CIBSE TM59 offers guidance on limiting overheating in new homes, while BS 8233 deals with limiting noise ingress – but achieving the standards of both, simultaneously, is often challenging. Many planning authorities have requirements for limiting overheating and internal noise, but they are often not applied together.

Recent overheating analysis by Sweco shows that windows in a typical apartment block in London without mechanical cooling may need to be open for around one-third of the occupied hours in the summer to comply with CIBSE TM59. Even then, internal temperatures could exceed 30°C for up to 59 hours per year in living rooms and still comply.

With windows open, internal noise levels could be as much as 50dB, leading

to sleep disturbance, diminished quality of life and health issues. It is unreasonable and unethical to design new buildings for people to live in very noisy conditions for this amount of time.

A holistic industry standard that considers noise and overheating together is needed. This could include a time- or dose-dependent noise standard – such as a degree-day approach – with an absolute maximum, in a similar way to that used for limiting overheating in CIBSE TM52 and TM59.

## Noise guidance

The forthcoming *Acoustics Ventilation and Overheating (AVO) Residential Design Guide* adopts a risk-assessment approach to façade design for reducing noise from transport sources. It offers guidance on approximate external noise limits related to different background ventilation strategies from Part F of the Building Regulations. It does not give specific guidance on overheating strategies, however.

## Conflicting design factors

Many building design factors – some conflicting – need consideration. For example, the fabric energy efficiency (FEE) test in Building Regulations Part L1A tends to favour higher g-values to pass, as the notional building g-value is 0.63. This reduces the opportunity to limit overheating by reducing solar gains with high-performance glazing.

The FEE calculation method could be revised to give more weight to the impact of overheating and mechanical cooling relative to heating energy – for example, by lowering the g-value for the notional building in Part L1A.

The need for more glazing to meet daylight criteria can also oppose limiting overheating. This can be particularly critical where the home is overshadowed by adjacent buildings for part of the day. The daylight criteria could be reviewed to identify alternatives to average daylight factors, including climate-based daylight modelling.

## Drivers for natural ventilation

Natural ventilation is preferred for most developments in the UK because it is likely to be cheaper, simpler and more energy efficient. New developments in noisy areas, however, could require mechanical cooling to avoid unacceptable noise levels and overheating, unless they are carefully designed or the design criteria are changed.

As well as costing more and being more complex, installing mechanical cooling would create two vicious cycles:

- Increasing carbon emissions would increase climate change (see left)
- Heat rejection would increase the urban heat island effect.

## Building services overheating solutions for different noise risks

To limit overheating with natural ventilation in warmer parts of the UK, open windows in, our experience, typically need at least 1m<sup>2</sup> of effective free area per room. They would only provide minimal noise reduction, of around 7dB. Using attenuated windows with plenums or attenuated vents could be feasible for cooler parts of the UK.

If windows must stay closed because of high external noise levels, mechanical ventilation or cooling would be required. Homes in the South East would not pass TM59 with mechanical ventilation alone, however – mechanical cooling would also

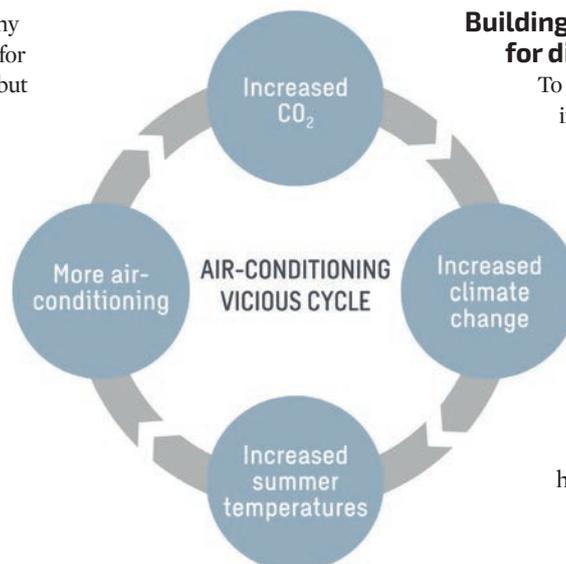
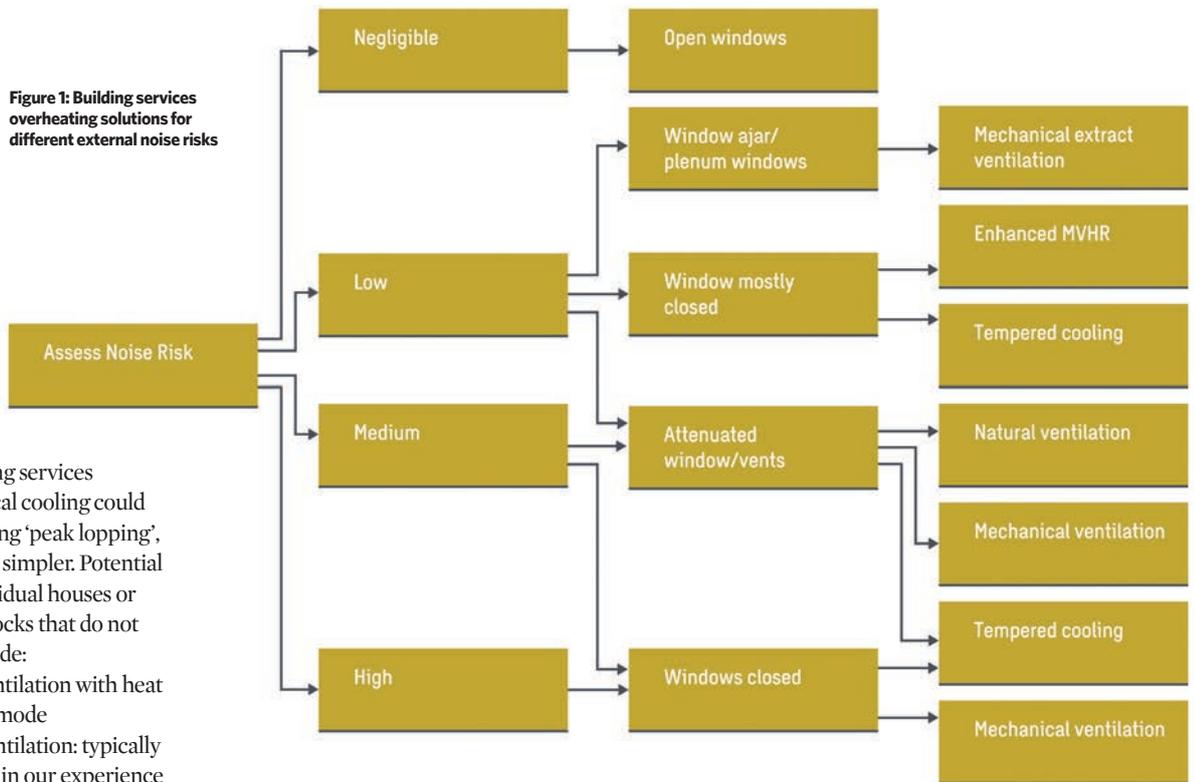


Figure 1: Building services overheating solutions for different external noise risks



» be necessary. Various building services alternatives to full mechanical cooling could limit overheating by providing ‘peak lopping’, as well as being cheaper and simpler. Potential standalone options for individual houses or apartments in residential blocks that do not require central cooling include:

- Enhanced mechanical ventilation with heat recovery (MVHR), boost mode
- Additional mechanical ventilation: typically four air changes per hour, in our experience
- Split/DX cooling units
- MVHR with dehumidification
- MVHR with mini-heat pump cooling.

If these measures are not sufficient for passing TM59 without closed windows, there are further options to offer tempered cooling with a central cooling system for apartment blocks. These remain cheaper than full mechanical cooling and use less energy. They are:

- Underfloor cooling
- Chilled ceiling panel cooling
- Cooling coil in MVHR supply air duct
- Mini-heat pumps with central condenser water loop
- VRV and fan coil unit (FCU)
- Central chillers and multi-zone FCUs.

With some of these options, however, certain rooms may still not pass TM59. In such cases, hybrid ventilation could be considered with a standard MVHR unit on boost mode, alongside enhanced attenuation, for cooler

parts of the UK, plus additional cooling for hotter parts. MVHR units of a size to meet Part F for boost ventilation could be used, but with enhanced acoustic attenuation. This would allow it to run for long periods in summer, limiting overheating.

**Conclusion**

To provide comfortable, healthy homes, developers, design teams and planners should design to limit overheating and noise together. Design teams should reduce solar gains and consider tempered cooling solutions to avoid full mechanical cooling. **C**

**RECOMMENDATIONS**

- Development of a recognised, holistic industry design guide, including overheating and noise.
- Base noise criteria in planning on a recognised standard, possibly time- or dose-dependent, with an absolute maximum noise level. This could be added to Part E of the Building Regulations to include internal noise levels.
- Revise the fabric energy efficiency calculation in Part L1A to take more account of cooling energy and limiting overheating.
- Consider alternatives to average daylight factors planning policy.

**KATHERINE HOLDEN**  
 MCIBSE is an executive engineer at Sweco. This article is based on an opinion paper she presented at the CIBSE Technical Symposium in April 2019 on ‘Limiting Residential Overheating in Noisy Environments’ [bit.ly/2kNpS6H](http://bit.ly/2kNpS6H)

Figure 2: Local tempered cooling solutions with closed windows, shown in order of increasing cost in complexity



Figure 3: Tempered cooling solutions with central cooling system, shown in order of increasing cost in complexity





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# COMPLETING THE PICTURE

The London Energy Map project tried to provide a clearer picture of building energy use in the capital by analysing the existing dataset. **Dora Ma** and **Ed Cremin**, of Etude, analyse the numbers

**T**he aim of the London Energy Map project was to use data to build a clear picture of how much energy each building consumes in London, and therefore establish a specific 2050 building level target.

The project, funded by Etude, focused on using public datasets. The motivation behind this was both from a practical aspect of being able to access the data, and to allow our findings to be published openly.

We carried out a comprehensive review of the public datasets available<sup>1</sup> that offer information on the energy consumption and building stock in London. A summary of the key databases used throughout our analysis are listed below.

Real energy data is available on only 0.01% of the whole domestic stock. The National Energy Efficiency Data-framework (Need) run by the Department for Business, Energy and Industrial Strategy (BEIS) matches real energy consumption with property attributes and interventions to better understand effects of energy efficiency measures.

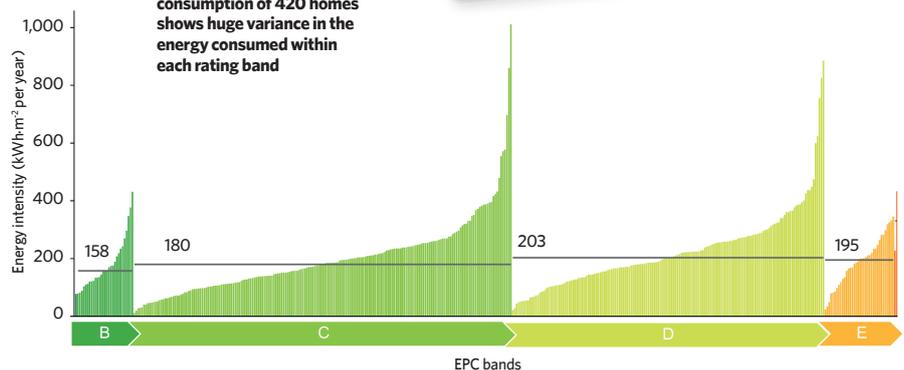
The Need team is doing much valuable work, but there has only been one publication of the anonymised data in 2014 (with updated public release data expected soon). It consisted of energy consumption data between 2005 and 2012 on a sample of 5,000 London homes. To ensure the anonymity of the households, the floor area was banded into large groups (for example, 50-100m<sup>2</sup>).

The dataset allows for some high-level interrogation of how different building characteristics correlate with energy consumption. This proved to be very useful in improving our understanding of which factors affect operational energy in existing dwellings.

Energy performance certificates (EPCs) cover almost half of London's domestic building stock, but it is widely acknowledged that the EPC band rating system is a poor reflection of actual energy use. In reality, large variance exists at both ends within each band, and there is little difference in median energy use



**Figure 1: A comparison of the EPC energy efficiency rating with metered energy consumption of 420 homes shows huge variance in the energy consumed within each rating band**



intensity between different bands, as illustrated in Figure 1.

We found the EPCs to be a comprehensive dataset for building stock information, but not as a source of energy data.

We created a new dataset by matching aggregated meter consumption with EPC certificates. Using BEIS's postcode-level consumption statistics ([bit.ly/2kGNpWN](http://bit.ly/2kGNpWN)), we matched the median consumption of six-meter aggregations to the corresponding EPC certificates, using their postcodes.

This provided us with a new dataset of around 5,000 entries, consisting of real energy consumption with building information. This works on the assumption that dwellings on the same street are similar and therefore have similar energy consumptions. We acknowledge this is not strictly true, but it's the best we have to fill the data gap.

Using this new dataset, we built a predictive model for estimating energy consumption in individual dwellings. The following inputs have been identified as being the most commonly accessible parameters, and statistically correlate with energy consumption for homes. Using these



**“We need much more collaboration between the public and private sectors, academia and NGOs if we are to help solve the climate crisis”**

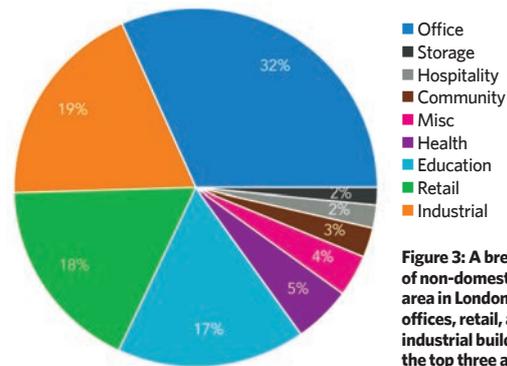
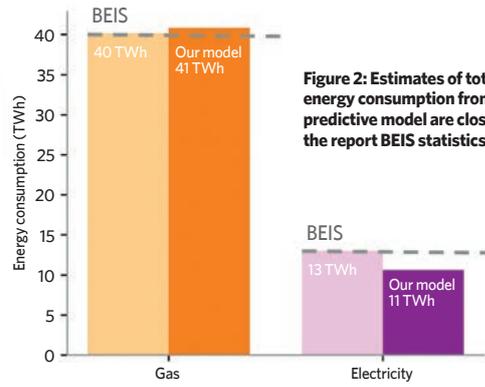
inputs, our model (multivariate regression) outputs the annual energy consumption (kWh per year) estimated for the property. The inputs were: floor area; number of rooms; property type and form; building age; and deprivation index.\*

When we applied our model to the whole EPC stock scaled to London, the total consumption for gas and electricity came close to the reported BEIS sub-national consumption statistics (Figure 2).

**Non-domestic buildings analysis**

Compared with the domestic sector, the analysis on non-domestic buildings was much more complex. There are two main reasons for this. First, the naming conventions of commercial buildings and company names in addresses makes them difficult to match between datasets, and second, the building use (for example retail, restaurants, schools and so on) are not standardised between datasets. For example, bars, restaurants and pubs may be grouped as one category in one dataset, but another dataset may have restaurants and cafes as one category, and bars and pubs as another category. Within this, there is also the added complexity of mixed-use buildings. Figure 3 shows the building categories with the biggest floor areas in London.

DECs are the only publicly available source of real energy data

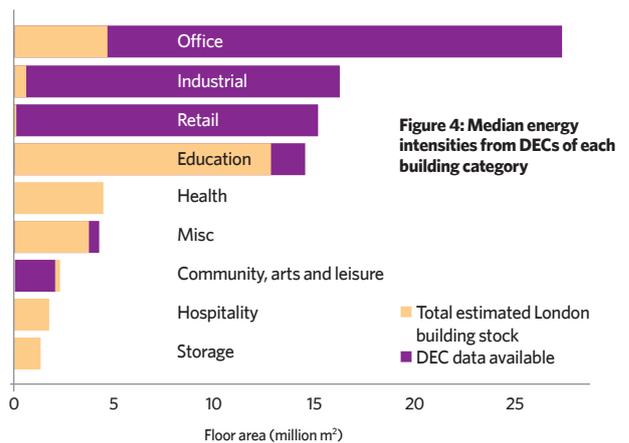


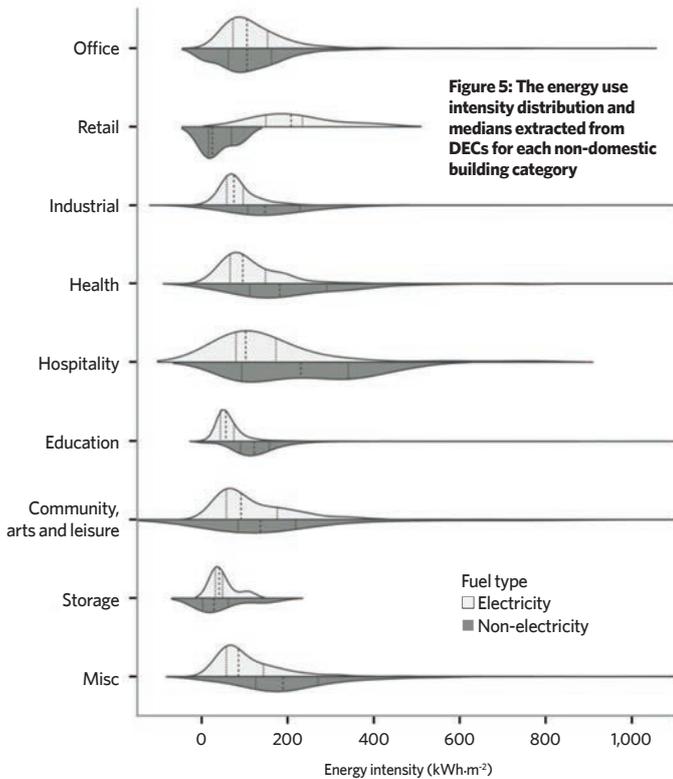
we have for non-domestic buildings, but it is not representative of London stock. Since DECAs are required only for public buildings, they are effectively under-sampled in certain building categories.

There is limited data about non-domestic buildings to be able to understand operational energy. To get a better picture of the non-domestic building energy consumptions, we extracted the median energy intensities from DECAs of each building category (Figure 4). This uses a similar approach to the recently released CIBSE benchmarking tool ([bit.ly/2mbgjjj](http://bit.ly/2mbgjjj)).

We then estimated the total non-domestic building energy consumption by multiplying the total floor area of the different building types with their median energy intensity (Figure 5).

Our estimates showed a significantly lower consumption when compared with the BEIS >>





» sub-national, non-domestic consumption statistics (Figure 6). We are fairly confident of our floor area estimates, and as far as energy benchmarks are concerned, those extracted from DECs are actually higher when compared with other building benchmarks (for example BEIS medians), both for electricity and non-electricity use. The question then turned to interrogating our ‘ground truth’ – the BEIS sub-national statistics.

The magnitude in discrepancy between our estimate and the BEIS statistics is simply huge, and the exact proportion of the reported BEIS statistics that is made up from operational energy from non-domestic buildings is unknown.

BEIS uses a combination of threshold consumption and its own algorithms to differentiate between energy consumption from domestic and non-domestic meters. If a meter

reading shows an annual gas consumption of 73,200kWh or higher, BEIS make the assumption that this meter is attributed to a non-domestic building. Any readings at a meter lower than 73,200kWh are assumed to be a domestic building.

The story is different with regards to electricity meters, where there are meter-profile classes that enable the BEIS team to more accurately differentiate between domestic and non-domestic consumers. But how much of this consumption is from operational energy in buildings and how much is from industry processes or data centres is still unknown.

When doing strategic planning work to help local boroughs develop zero carbon pathways, we are using the BEIS non-domestic consumption statistics as our gold standard reference. Evidently, a reduction in the BEIS statistics must be taken into account when carrying out analysis in buildings’ energy use though, but by how much?

One thing is for certain – non-domestic energy use needs to be much lower to meet climate targets. The city of Toronto’s Zero Emissions Buildings Framework has set energy performance targets for a range of building archetypes (for example, office, retail, mixed use, high rise and so on) in its efforts to reduce buildings emissions. When we compare the median energy uses extracted from DECs to Toronto’s phased targets, it highlights the massive amounts of work we need to do in improving energy performance in our non-domestic buildings (Figure 7).

Having tried to estimate energy consumption in London buildings, we are in awe at the work that has come before, as well as of the complexity of the problem. Perhaps more disappointing is that we had to repeat a lot of work rather than building on already existing knowledge and data. We need much more collaboration between the public and private sectors, academia and NGOs if we are to help solve the climate crisis.

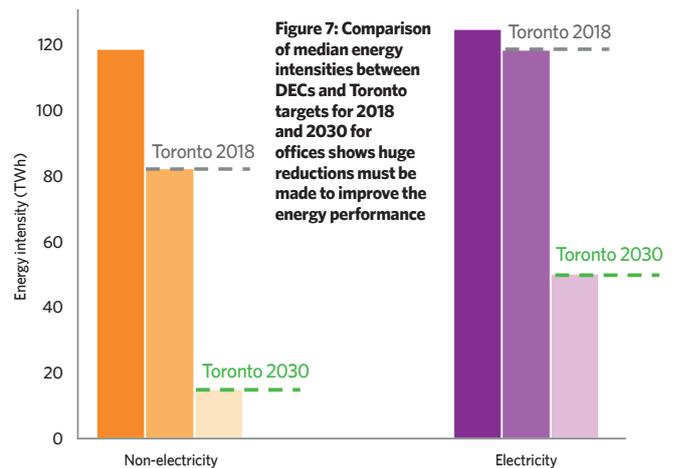
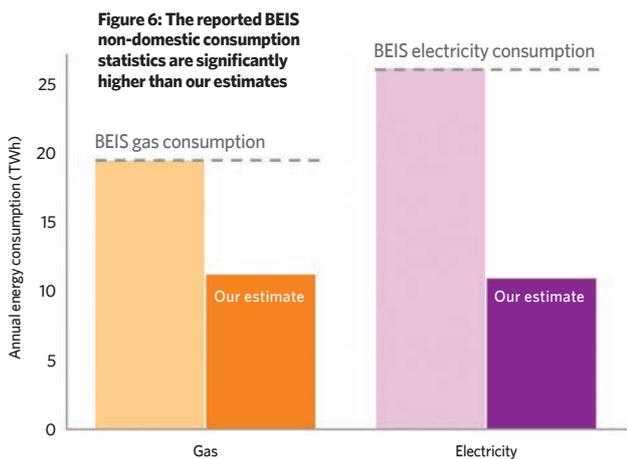
It is time for us in the building industry to embrace a feedback loop approach, meaning open data, and openness to admit what was done badly so we can collectively improve. How can we do better if we don’t acknowledge what our mistakes were? Now more than ever, climate change – correction, climate emergency – requires us to be open. **CJ**

**More information**

- London Energy Transformation Initiative (Leti): <https://www.leti.london>
- London Energy Map project: <https://energymap.london>
- Members of the project board: Dora Ma (Etude), Julie Godefroy (Julie Godefroy Sustainability), Clara Bagenal George (Elementa), Jonathan Taylor (London Borough of Tower Hamlets), Andy Stanton (Atkins) and John Palmer (Enhabit).
- \*Deprivation is found to inversely correlate with energy consumption. The more deprived people are, the less they tend to use. We combined public data on the index of deprivation (MHCLG) in different areas to our dataset.

**References:**

- 1 List of building energy databases, London Energy Map. [bit.ly/2IL7yLA](http://bit.ly/2IL7yLA)



# BEYOND THE MAGIC BOX

## CPD on the provision of on demand hot water in commercial sites measured by cost and fuel efficiency and whole of life costings

In the pursuit of the goal of a low carbon economy, engineered by increasing regulation and standards, the decisions governing the choice, specification and installation of different appliances and fuel sources are rapidly changing. The rise of electricity as a promoted 'less harmful' fuel source, in densely populated geographies is seen by many as a solution to reduce carbon and yield a 'greener' industry.

This CPD explores the robust modelling of student accommodation block, utilising a mixture of technologies. The question begs for an answer of multi-solution systems to deliver reduced operational energy, carbon and lifecycle costs.

The results and findings demonstrate that the deployment of multiple technologies may be a major step in the right direction when considering carbon, energy, lifecycle costing and operational expenditure.

## Lifecycle cost and operational carbon comparison of various types of heating systems

by Dr Michael Lim PhD, BEng(Hons), CEng, MIMechE and Simon Law (Hons), CEng, MCIBSE, both of AECOM LTD and Chris Goggin, BSc, MEnt of Rinnai UK Limited

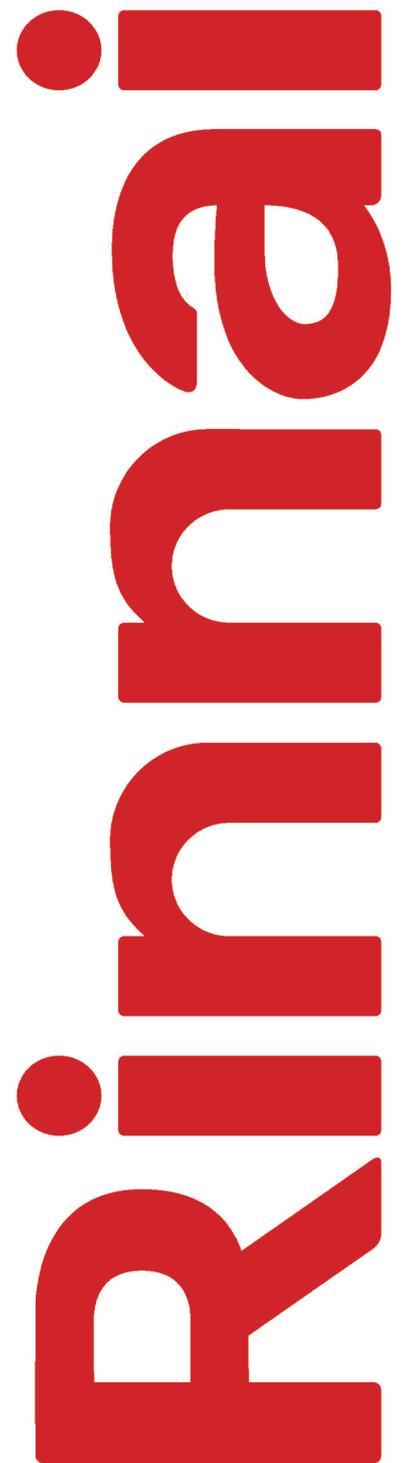
### Abstract

A real-life case study of a large student accommodation was carried out to investigate the combination of various gas and electricity heating solutions to determine the respective system capital costs and the lifecycle operational cost, fuel consumption and CO<sub>2</sub> emission over a 20-year period.

The study demonstrated that the combination of continuous flow hot water heating with a range of gas and electricity space heating results in a relatively more efficient solution in terms of cost, fuel and CO<sub>2</sub>. The study also highlighted that distribution and storage heat losses present an opportunity for improvement.

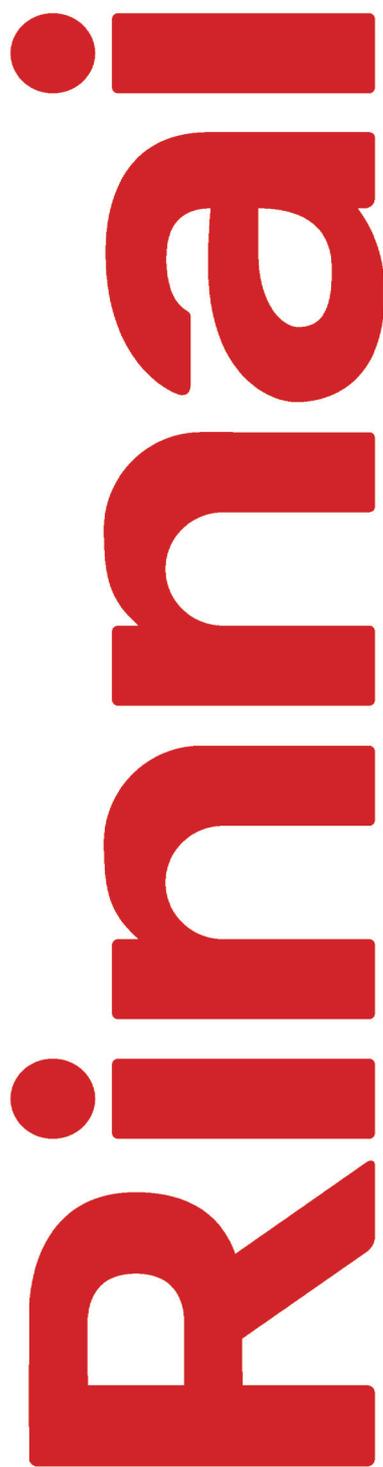
The study also includes the impact of projected grid decarbonisation and changes in energy cost going into the future, giving useful insight on the impact of solution choice on lifecycle performance of building heating systems.

*Keywords: Lifecycle, continuous flow system, grid decarbonisation, capital cost*



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## 1.0 Introduction

A study was carried out to revisit some of the widely-applied conventions of system solutions to identify opportunities for improvement. This paper describes a joint-study to review the various heating systems typically encountered in the industry today.

The study is based on a real life large

student accommodation where the application of various combinations of gas and electricity space heating and hot water systems were investigated to determine the respective system capital and lifecycle operational costs, fuel consumption and CO2 emission over a 20-year period.

## 2.0 Systems

The study compared the baseline system solution of Low Temperature Hot Water (LTHW) gas boiler for space heating and domestic hot water (DHW) generation against alternatives of

continuous flow water heaters, electric heating and air source heat pumps. Table 1 outlines the options that were considered.

Table 1 – Solution options investigated

	Space heating	Domestic hot water (DHW)
Baseline	LTHW with gas boiler	Indirect storage with gas boilers
Option 1	LTHW with gas boiler	Continuous flow water heater
Option 2a	Electric resistance	Electric resistance
Option 2b	Electric resistance	Continuous flow water heater
Option 3a	LTHW with air source heat pump	Air source heat pump
Option 3b	LTHW with air source heat pump	Continuous flow water heater

## 3.0 Building heating demand

The student accommodation block estimated space heating demand was generated using a dynamic thermal model, which equates to 445 MWh/pa excluding storage and distribution losses. The model was run with CIBSE Test Reference Year for London, and complies with the UK Building Regulations Part L 2013 requirements.

The pipe heat loss are applied to the corridors and risers and varied seasonally with the heating demand and adjusted for both mean corridor temperatures as well as for weather

compensation. The daily DHW demand is based on a usage rate of 70 l/person/day and a total of 643 persons, amounting to 1733kWh/day (55K lift).

The DHW demand varied seasonally corresponding to typical university term and the incoming cold water temperature is varied in-line with the average ground temperature at 1.5m deep. Overall the annual demand for DHW is around 536 MWh/year, before allowing for storage and distribution losses.



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# 4.0 Results

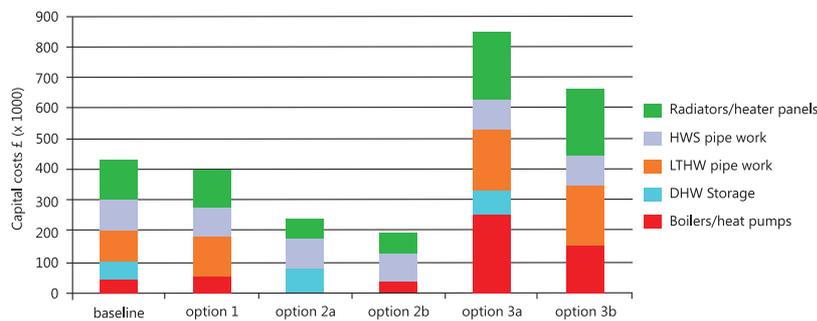
## 4.1 Initial and annual costs

Table 2 shows a high-level comparison of annual energy consumption and estimated capital and annual maintenance costs. The options have been ranked (in brackets) for best performance or most favourable solution (bold) and the

overall optimal solution is "green" highlighted. A breakdown of the capital costs is shown in Figure 1. Costs are derived from Spon's price book 2017 (1) and data from manufacturers.

Table 2 – High level comparison of annual energy consumption and costs

	Natural gas (MWh/year)	Electricity (MWh/year)	Initial capital costs	Annual fuel costs	Annual maintenance costs
Baseline	1,503	14.8	£432,051 (4)	£50,079 (3)	£875 (4)
Option 1	1,415	13.4	£399,315 (3)	£46,926 (1)	£850 (2)
Option 2a	0	1,178	£241,506 (2)	£148,323 (6)	£300 (1)
Option 2b	759	450	£198,474 (1)	£81,614 (5)	£850 (2)
Option 3a	0	609	£849,595 (6)	£74,273 (4)	£1,575 (5)
Option 3b	759	210	£698,773 (5)	£49,413 (2)	£2,125 (6)



## 4.2 Lifecycle performance

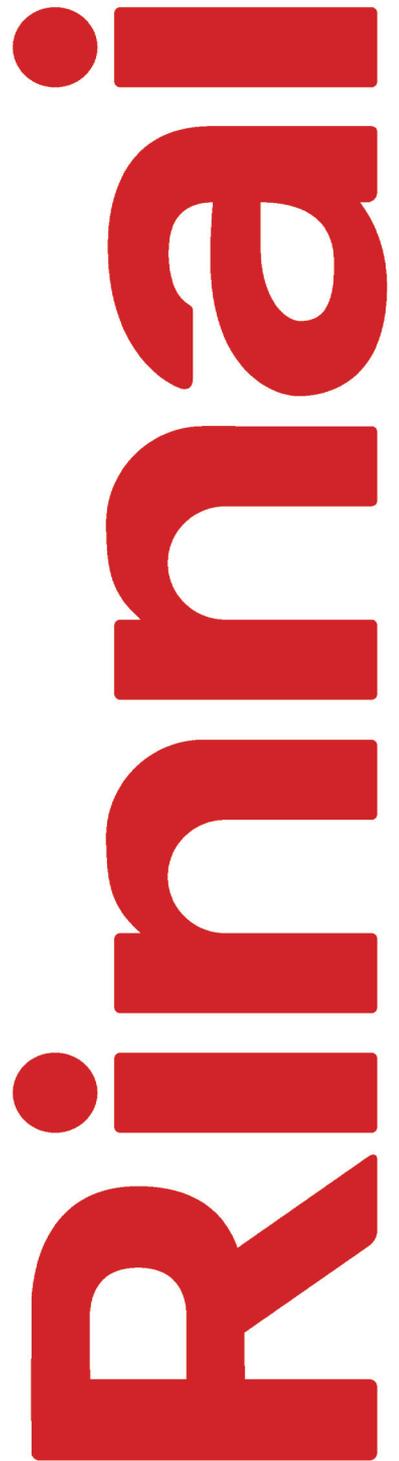
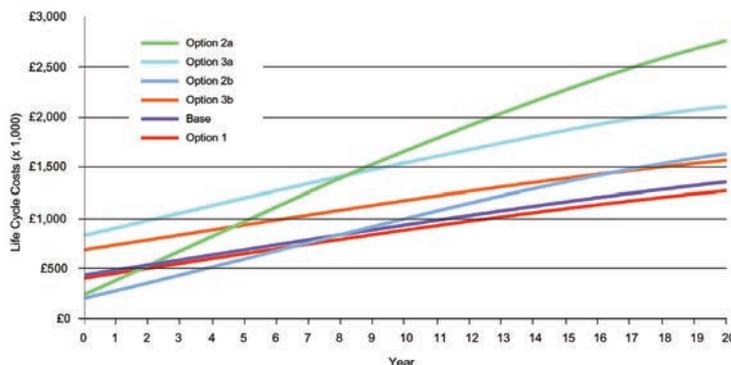
The lifecycle comparison was carried out for a 20-year period based on the expected system service life prior to any replacement. The net present value (NPV) calculation was based on a discount rate of 3.5% (The GREEN BOOK - HM Treasury) and an inflation rate of 2% for servicing costs. The analysis also used projected retail fuel costs and equivalent CO2 emissions factors (CO2) for electricity published by the Department of Energy and Climate Change (DECC).

As no reliable projections were found when carrying out this work, the equivalent CO2 emission factor for gas was fixed at 0.184

kgCO2/kWh, which is from the UK Government GHG conversion factors for company reporting. Table 3 compares the options in terms of lifecycle cost and operational CO2 emissions, where Option 1 has the lowest cost, while Option 3a has the lower CO2 emission by a significant margin. However, Option 3b with air source heat pump and continuous flow water heater is shown to be the optimal solution in terms of overall lifecycle performance. From cost point of view, a 24% uplift in lifecycle cost results in 34% reduction in lifecycle CO2 emissions.

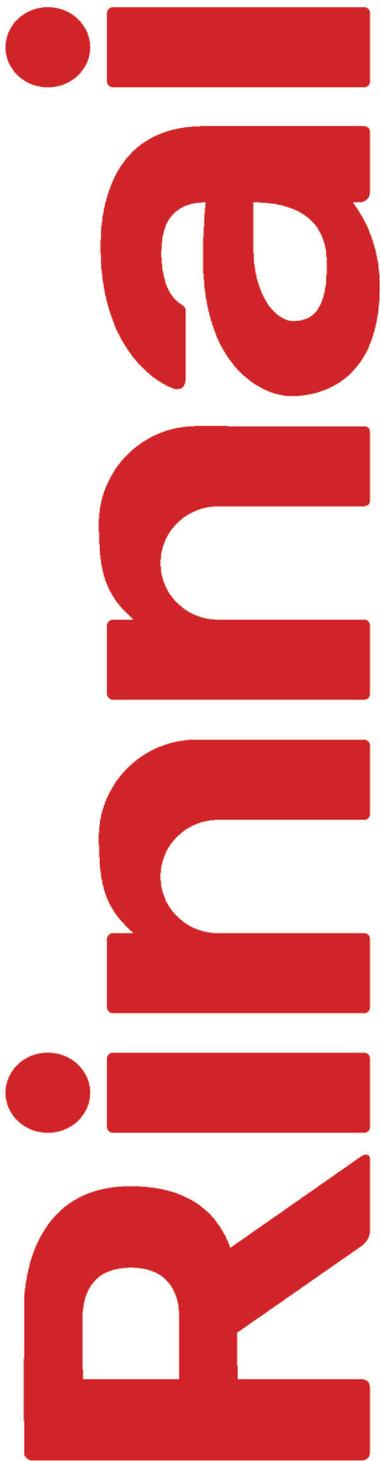
Table 3 – Net present values and CO2 emmissions over 20 years

	NPV	% savings	CO2 (tonnes)	% savings
Baseline	£1,356,096 (2)	0%	5,439 (6)	0%
Option 1	£1,265,765 (1)	-7%	5,102 (5)	-6%
Option 2a	£2,756,263 (6)	103%	3,943 (3)	-38%
Option 2b	£1,625,863 (4)	20%	4,299 (4)	-25%
Option 3a	£2,103,487 (5)	55%	1,974 (1)	-69%
Option 3b	£1,573,411 (3)	16%	3,443 (2)	-38%



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## 5.0 Discussion and concluding remarks

**Despite much lower capital cost, electric panels in Option 2a and 2b have led to high operational cost and hence higher NPV against baseline. In both cases of electric panel and heat pump space heating, Option 2b and 3b demonstrated improved NPV when using continuous flow water heaters instead of electric-based water heaters.**

In terms of energy performance and costs, separating the space heating and DHW allows each system to operate more efficiently. In both the base case and Option 1, there are modulating condensing boilers with weather compensation, but whenever there is simultaneous requirement for space heating and DHW, the base case boilers will not operate as efficiently because the DHW results in higher return water temperatures to the boilers.

The seasonal efficiency of the base case boilers doing both heating and DHW is around 89%, compared to the seasonal efficiency of the space heating boilers in Option 1 at around 91%, while the continuous flow water heaters is around 95% as these are optimised for hot water generation.

A similar effect is seen between the options with heat pumps, where Option 3a with heat pumps providing both space heating and DHW has a Seasonal Coefficient of Performance (SCoP) of around 2.4, compared with 3.1 in Option 3b where the heat pumps are only providing space heating.

The costs of distribution pipework generally dominates the capital costs, which is why the options with electric panel point heating have the lowest capital costs (at the expense of very high energy costs and overall lifecycle costs). Between systems with hot

water storage and those with continuous flow water heating, the capital cost is generally in favour of the continuous flow water heaters due mainly to the savings in the cost of the storage cylinders.

The operational CO<sub>2</sub> emissions over 20 years show dramatic differences between gas and electric based heat sources, with Option 3a generating around a third of the CO<sub>2</sub> of the base case with electric-based heating shown to be lower carbon over the medium/long term than gas-based solutions. The projected changes in CO<sub>2</sub> intensity seems fairly optimistic and would require continual investment and the uptake in renewable technologies over the longer term to deliver the projected grid decarbonisation, which is highly dependent on political and economic pressures.

Furthermore, in practice, there is unlikely to be sufficient capacity for major shifts in heating fuel from gas to electric due to the limited capacity of the national grid, unless this is supported by urgent aggressive investment in the relevant infrastructure.

The analysis of the annual heat losses in the distribution pipe work show that the heat loss through the space heating pipes is between 22% and 25%, while for DHW pipe work it varies from 35% to 39%. This indicated potential savings could be achieved through distributed instead of centralised generation, both in terms of energy and capital costs due to reduction of distribution pipework.

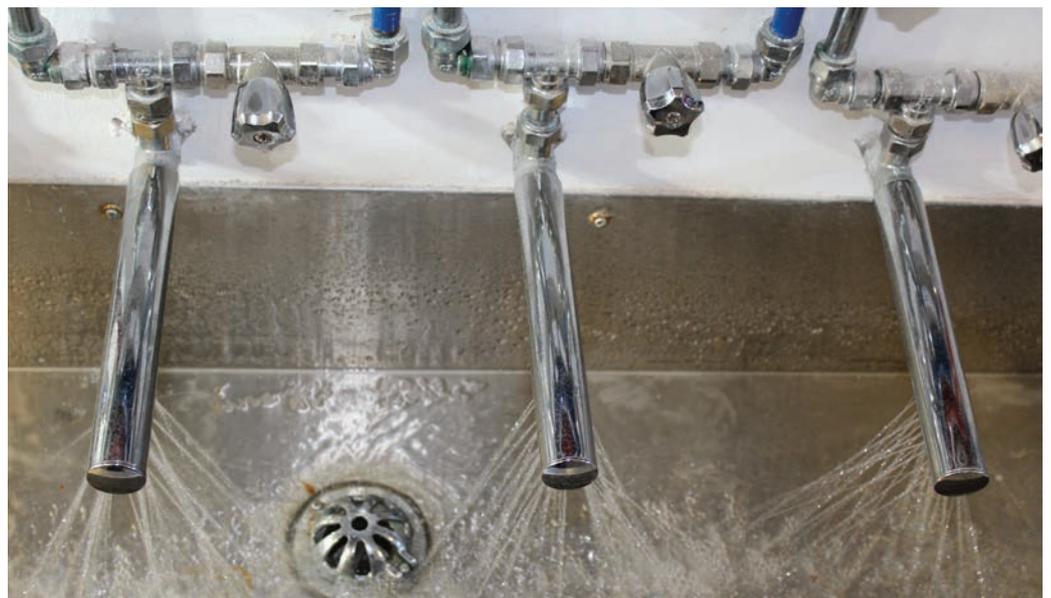
The study has shown that the various parameters considered vary significantly depending on system type and hence for a more informed view, a lifecycle approach is required. It is prudent to revisit and review the compatibility of current system solutions, accounting for lifecycle factors such as the projected shift in grid carbon content and energy costs, so to be able to make any noticeable improvement in the long term resource efficiency of the built environment.

**Full report available on direct request  
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## MEGAPRESS INSTALLED IN DEANSGATE



ViEGA's Megapress connection technology has been installed on a new £85m development in Manchester.

The connected thick-walled steel tube was used on 11 of the 12 floors at 125 Deansgate, which comprises 117,000ft<sup>2</sup> of offices above 12,000ft<sup>2</sup> of retail space

In total, approximately 7,000 Megapress connection joints were installed, with somewhere between 500 and 650 joints being used per floor.

The building is scheduled for completion in April 2020.

## BPF makes environmental case for plastic pipework

The British Plastics Federation Pipes Group (BPFPG) has launched a series of bulletins that aim to highlight the environmental credentials of using plastic piping systems in hot and cold water systems.

The first of the bulletins, which is now available, is an introduction to the process of evaluating the environmental impacts of hot and cold water supply systems in a building to aid product choice. It explains what environmental product declarations (EPDs) are, how have they evolved and why they should be used in the UK, summarising the main drivers for change.

Through the series of bulletins, the BPFPG aims to raise awareness of the environmental considerations for piping-system material selection in buildings.

The bulletins together seek to: set out the international and national commitments to reduction of greenhouse gases; explain the methodologies for determining the environmental impact of a material, product or system through life-cycle assessment (LCA); and show how LCA is presented in the form of an EPD.

Independently prepared and verified EPDs for plastic-piping systems inside buildings are used in the bulletins to demonstrate key features of an EPD and help readers to identify the right questions to ask when evaluating options.

The second bulletin, focusing on LCAs, is set to be released online at the end of September, with the rest appearing at about two-monthly intervals.

Read the guides at [bit.ly/CJOct19pip1](http://bit.ly/CJOct19pip1)

## Metal pipework guide out in new year

The British Metal Tubes and Fittings Association (BMTFA) is working on a best practice guidance document for the building services industry. This initiative comes about as a result of pipework issues with contractors who identified problems in the market.

The document is written for both experienced workers and those who have just joined the industry.

Expected to be available on the BMTFA website early next year, the new guidance is designed to ensure the correct system is specified from the outset, resolving potential issues between manufacturers, installers and specifiers.

To learn more, visit [www.bmtfa.org](http://www.bmtfa.org)

## Offsite-pump webinar goes live

The CIBSE webinar - 'Off-site build - a solid base for future developments' - is now available to view on the *Journal's* website.

Sponsored by Grundfos Pumps and chaired by *CIBSE Journal* technical editor Tim Dwyer, the webinar looks at how advances in materials and product-management process and organisations are offering more and more benefits for the building services sector.

It gives insights into off-site systems and how, by harnessing intelligent design, this modular build approach can offer versatile solutions that support the delivery of increasingly complex designs within a variety of sectors and applications.

To view the webinar, visit [www.cibsejournal.com/cpd/webinars/](http://www.cibsejournal.com/cpd/webinars/)



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# FLUID ASSETS

Appropriate material selection for pipework is essential if HVAC systems are to be fully optimised. At a roundtable sponsored by Geberit, experts from across the supply chain discuss the current issues around pipework specification. **Amanda Birch** reports

**T**here was a groundswell of opinion at *CIBSE Journals* roundtable that better education and training are crucial if improvements are to be made to the design and installation of sustainable pipework.

The event, which focused on the importance and appropriateness of material selection when specifying pipework, was sponsored by Geberit and held at the Royal Pharmaceutical Society in London last month.

The roundtable debated issues on the benefits of using multi-layer, plastic and metal pipework in different applications, the embodied carbon of materials and the issue of overheating. It also considered how divergent practices in pipe sizing, including reduced diameters to avoid stagnation and larger pipes to diminish pressure drops, can deliver safe system design.

Jonathan Gaunt, associate director at Cundall and chair of the Society of Public Health Engineers, said there is a nervousness in employing different systems and specifying different materials because there are so many aspects to consider.

'These days, we don't just have a straightforward domestic water supply, we have reclaimed systems, greywater, blackwater, rainwater harvesting and solar,' said Gaunt. 'There are more and more high-rise buildings, particularly in London, which emphasise the issues with pressurised systems, pressure regulating and managing those pressures, which leads to the pipework material and the jointing systems.'

'We've had rogue issues with pipework jointing systems, so we need to breathe some sanity into it so that people understand what the issues are and what the pitfalls are, to make sure the right systems are being used.'

Mark Davis, contracts director at Kylemore Services, agreed adding that the systems can't be blamed for these mistakes, it's often the installers not being given the right training. Davis said many apprentice plumbing and heating engineers have never been taught the basics, like soldering copper pipework, and suggested that there is too much emphasis on

price to the detriment of good training and getting the right skills.

'There should also be a separate training module on plastic pipework as there are a lot of different plastics on the market,' he added.

But it's not just improving the training of plumbing and heating engineers. Many young consultant engineers entering the workplace have little onsite experience. Davis said they often invite consultants and clients to training refresher days they organise, which have been very successful. Gaunt agreed that this is a good, forward-thinking idea.

'Young consultant engineers often come from a theoretical, academic background with little experience of onsite installation,' said Gaunt. 'Some consultants offer their employees four to six-week placements with contractors, and toolbox talks are also very helpful.'

Sponsored by

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The roundtable was chaired by *CIBSE Journal* editor Alex Smith, top



ROUNDTABLE PANEL

- 1 Caroline Ayres**, director of the British Plastic Federation Pipes Group
- 2 Antony Corbett**, product manager of Piping Systems at Geberit
- 3 Mark Davis**, contracts director at Kylemore Services
- 4 Jonathan Gaunt**, associate director at Cundall and chair of the Society of Public Health Engineers
- 5 Andrew Surtees**, head of Sales at Mueller Industries



“To ensure the right material is specified, establish whether a heating system is open or closed”  
 – Antony Corbett (above, left)

“Young engineers often come from an academic background with little onsite experience  
 – Jonathan Gaunt

Demystifying the specification process could also help and manufacturers are one obvious source of knowledge. Antony Corbett, is product manager of Piping Systems at Geberit, producer of pipework employing copper, stainless steel, plastic and composite multi-layer materials.

‘There’s a reliance on manufacturers’ advice. I don’t think that was the case 20 to 30 years ago when people knew their tools and the method they were using,’ says Corbett.

Geberit offers training courses on the latest product innovations and best practice installation methods at its Warwick head office.

‘With newer technologies and a claim environment, manufacturers are heavily relied on for not just selecting the right material, but also calculating information and providing guidance on expansion that would normally have been done by an engineer within the installation company.’

Corbett called on designers to tell manufacturers what was being specified [in a proprietary system], as well as when and why.





» 'Knowing what those specifications are going to be will give us the opportunity to give the most appropriate guidance on a material we think should be in that installation, whether it be pipework for marine, building services or commercial environments,' says Corbett. 'Sharing this information is key.'

Corbett says care should be taken when specifying metal pipework. 'To ensure the right material for the job is specified, always establish first whether a heating system is open or closed,' he said. 'In an open system there is oxygen, so avoid mild steels that will corrode over time. If it's a closed heating system, characterised by depleted oxygen, stainless steel is not recommended as it needs oxygen to repair itself.'

Andrew Surtees, head of sales at copper tube manufacturer Mueller Industries, suggested a new guide that goes back to basics and is being put together by the British Metal Tube Fittings Association, of which Corbett is on the committee, should help make specification as simple as possible (see page 53).

'It will help those youngsters straight out of university or college without any onsite experience,' said Surtees. 'It's a designer's guide to getting the right system, making sure it works, considering compatibility and, hopefully, it will eliminate this copy-and-paste mentality of specifying products and systems that are familiar.'

There was a general consensus that copper is still the most commonly specified material for pipework, particularly in high-rise projects.

But Davis said the fact copper is frequently stolen from project sites presented a serious problem – which is why he often uses plastic pipework, particularly for social housing

schemes. He said that plastic is employed for pipework below the ground because it doesn't corrode and is not visible. Above ground, copper still tends to dominate, particularly in high-rise projects because of the high pressures in the system. Aesthetics also plays a large part and architects prefer its appearance, he said.

To ensure entire units are protected from corrosion, Davis added that copper pipes now have to be protected from the surrounding phenolic foam insulation. To avoid pitting corrosion of the pipework, the phenolic foam insulation has to be separated from the copper tube. The solution can involve the installer wrapping black tape around the pipework. Davis warned that this additional task has proven to be incredibly time-consuming and has resulted in delays on site.

Davis said that plastic, which is often cheaper, is embraced more readily by the younger generation, but he argued that there is still a lot of ignorance around plastics and new systems.

Aspects that need to be considered when specifying plastic, said Corbett, are that it's not suitable for high-rise buildings, and the material can lose stiffness if temperatures become too high. Expansion is a big problem with plastics and temperatures can also be raised very slowly.

Corbett said that multi-layer piping systems are good alternatives. These systems employ an aluminium core with a plastic outer layer. The aluminium limits expansion better than plastic, and the guidelines on expansion tend to treat it similarly to copper. Aluminium is also used in multi-layer systems for stability purposes as it enables smaller sizes to be bent by hand more easily, making installation much quicker.

Gaunt added that the challenges he tends to face from contractors when using plastic are not to do with domestic water systems. More issues arise when using plastic for drainage.

'There is a drive forward to specify new plastic products that use polyvinyl chloride (PVC) or high-density polyethylene (HDPE),' said Gaunt. 'Plastic might be cheaper, but by the time all the extras, like the incorporation of additional insulation, fire stopping and acoustic

»

**"Hopefully, [the guide] will eliminate this copy-and-paste mentality of specifying products"**  
**– Andrew Surtees**



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“I would like to see the sharing of new technologies that will make the world a better place”

– Caroline Ayres

Gaunt and Davis added that plastics are, increasingly, playing a key role in offsite prefabrication and kit technology given the benefits of quality control and pressure testing. Gaunt said that three out of 10 Cundall schemes have a level of prefabrication.

Given these advantages, pod bathrooms are also growing in popularity. But, they still come with challenges. According to Davis, many pod manufacturers conceal pipework and components, which makes it very difficult for the installer. There is also the issue of compatibility – different companies are involved, each specifying their own material and size of pipework.

Gaunt said managing water temperatures for domestic water systems is also a challenge. To comply with Building Regulations, they need to be kept below 20°C. This is difficult in high-end residential schemes that are fitted with luxury monsoon showers featuring significant flowrates. These properties are often empty for several months and, in these cases, water can sit in the pipework system for some time, leading to water temperatures sometimes peaking at 37°C. Periods of these elevated temperatures means that bacteria can grow, such as legionella. When that water is discharged in a mist from showers or flushing toilets, the inhalation of that mist can have serious human-health implications.

‘Pipe specification and sizing is an issue and larger pipe sizes can lead to stagnation of water,’ said Gaunt. ‘As engineers we have to design to standards. Work is currently being undertaken by Heriot-Watt University and CIBSE called the Loading Units Normalisation Assessment (Luna) Programme, to develop more up-to-date pipe-sizing tools. We have the theoretical data but we need real-life water-flow measurements in residential buildings to help us understand water usage and how sites are working.’

In summing up, the roundtable members emphasised the importance of better education, training and the sharing of knowledge to improve competency when specifying the right materials and sizing of pipework.

‘I would like to see the sharing of new technologies that will make the world a better place,’ said Ayres. ‘Rainwater recycling, underfloor heating, district heating, there’s an awful lot out there that’s a bit niche. If it came into the mainstream that would be good.’ [C](#)

» properties are added it would be interesting to see the price difference.’

But has the specification of plastic piping not been affected by the crusade against plastic pollution led by renowned broadcaster Sir David Attenborough?

‘We haven’t found many people on the environmental or Attenborough side not specifying pipework because it’s plastic, it’s more to do with single-use plastics and packaging,’ said Caroline Ayres, director of the British Plastic Federation Pipes Group.

In response to an increasing environmental concern about plastic, Ayres said that The European Plastics Pipes and Fittings Association (TEPPFA), has produced environmental product declarations for nearly every material and application based on cradle-to-grave scenarios, which are available to specifiers and consultants (see page 53).

‘These declarations consider a wide range of aspects dictated by European standards from depletion of resources to carbon emissions to recycling to how much energy is used in manufacturing,’ said Ayres. ‘This means that the Breeam projects can look at these declarations and make judgements. It isn’t that plastics aren’t environmentally friendly, it’s more complex than that. Concrete, metals, cast iron all have issues with manufacturing and environmental impacts and they also need to be judged and assessed.’

“Plastic, which is often cheaper, is embraced more readily by the younger generation”

– Mark Davis



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# LIFETIME AWARD

Armstrong left its mark on the judges with its commitment to the reduction of carbon emissions over the life-cycle of its Tango Parallel pumping solution, the independently verified performance of which also impressed.



Left: Armstrong's Building Performance Award-winning Tango Parallel pumping solution

for the Tango Parallel pumping solution in a project for the National Grid.

'The evidential basis of the energy savings made was very clear,' they said.

The practice of specifying full duty/standby pump installations has become standard in the industry. On a day-to-day basis, one pump (sized for full duty) is operational, while another of the same size is out of action, simply there to accommodate 100% redundancy in the event of routine maintenance or pump failure.

While this approach is necessary for high-reliability installations, such as hospitals and data centres, there are far more sustainable, efficient and cost-effective ways of safeguarding pump operation in medium- and low-risk applications.

Armstrong Tango features two pump heads in a common casing with built-in parallel, sensorless pump control, integrated as standard. The pump heads can run simultaneously or individually, to provide the required flow in the most efficient combination.

An insertable blanking plate enables maintenance to be carried out effectively on one of the pumps while the other remains in operation. This offers an alternative to a 100% standby approach by making it possible to specify two smaller pump heads, each sized for as little as 50% of the design flow. This reduces first-installed and life-cycle costs, frees up space in the plantroom or energy centre, and reduces the embodied carbon for the installation.

As the Tango range has been developed using Armstrong's Design Envelope approach, energy efficient performance is achievable across a wider operating range than standard pump models.

The performance envelopes of Armstrong Design Envelope models are mapped to enable the most efficient pumps to be selected for 50% of the design flow rate, where variable flow systems operate most often. This ensures a building's hydronic pumping system consumes as little energy

»

The 2020 shortlist will be announced in November  
[www.cibse.org/bpa](http://www.cibse.org/bpa)

**A** commitment to reduce life-cycle carbon emissions, and robust evidence of performance, made Armstrong Fluid Technology the worthy winner of the 2019 CIBSE Energy Efficient Product or Innovation of the Year.

Its Tango Parallel pumping solution enables 100% standby pump installations to be replaced with parallel pumping in a number of applications, so a separate back-up pump is not required. As well as saving on duplicate kit, the pump has been redesigned to reduce the amount of material in the casing. The judges also praised an initiative to retrieve and reuse components when replacing Armstrong pumps.

'We were really impressed with the commitments made to reduce carbon emissions in manufacturing locations,' said the judges. 'Using the proceeds of recycling aged pumps via Armstrong's environmental sustainability initiative, Planet Proposition, for charitable causes also impressed us greatly.'

Judges at the CIBSE Building Performance Awards are always looking for evidence of manufacturer claims and they were pleased to find independent verification of Armstrong's performance claims

» as possible. In the case of the Armstrong Tango parallel pumping solution, the actual capacity of a single pump is far greater than might normally be anticipated.

A module with two pumps (each supplying 50% of the duty) will continue to deliver 70% of capacity if only one of the pumps is operational, to allow routine maintenance. In many applications, this eradicates the need to invest in full-duty standby (see Figure 1).

As the figure illustrates, if one pump is shut down for routine maintenance, requirements can be met with the single remaining pump. Even on the few days a year when demand exceeds 70% flow, it can be identified from cooling and heating coil characteristics, that approximately 95% of output from the emitters would still be delivered when using just a single pump. This means highly cost-effective and efficient parallel pumping configurations can be specified and installed, avoiding the increased financial outlay and space requirements associated with traditional full-duty standby.

### Improving environmental performance of buildings

Once installed and commissioned, Tango reduces pump energy consumption by approximately 30% compared with traditional multi-pump installations. These improvements can be attributed to several innovations. First, instead of using traditional capacity-based control, the Armstrong Tango models are designed for demand-based control, in which each component is operated at its most efficient point to meet the actual load.

The pumping solutions are controlled to adopt efficiency-based staging points, as opposed to staging points based on pump speed. With this strategy in place, the system ‘surfs’ across the top of the efficiency curves throughout the day, eliminating the wastage inherent in pump speed-based control approaches, where energy can be wasted by staging pumps on too late, or off too early. (See Figures 2 and 3.) Effective control of staging can deliver energy savings in the region of 30%.

Second, optimised hydraulic performance results in improvements in efficiency of between 3% and 6%. In addition, Tango incorporates iECMTM permanent magnet motors, with higher RPM and integrated drive and controls, delivering levels of energy efficiency in advance of IE3, and providing another 2% to 7% efficiency improvement.

Lastly, Tango features technology for maximising long-term pump performance

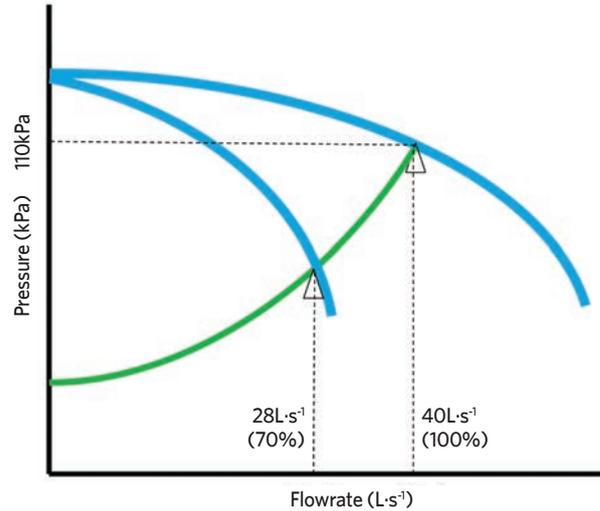
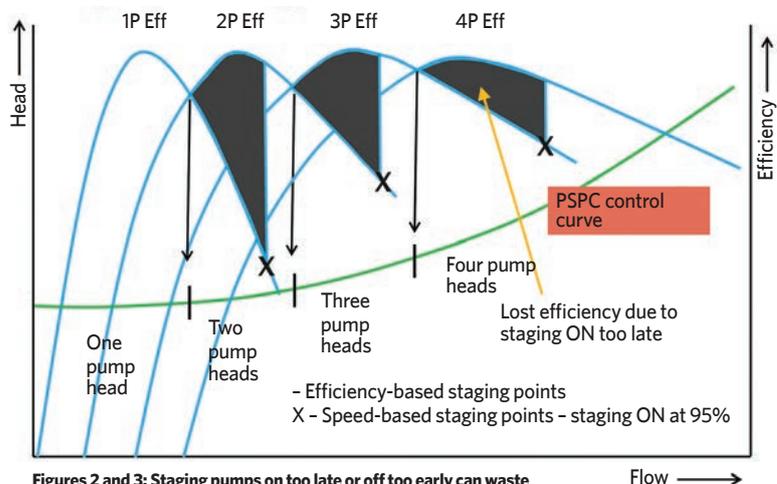
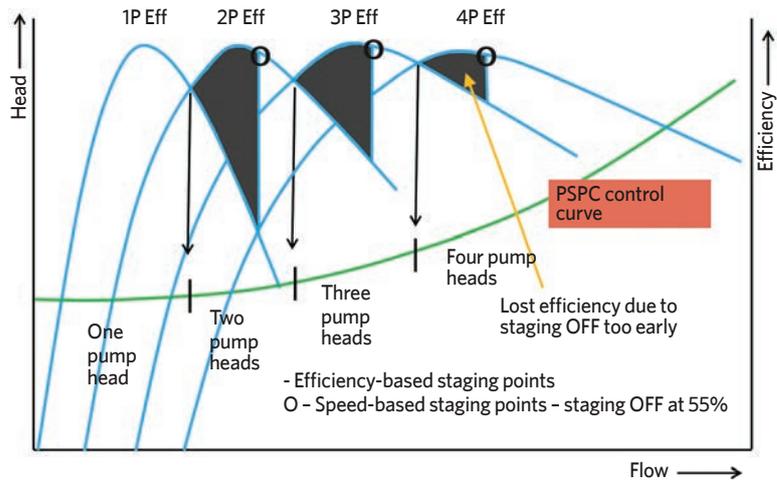


Figure 1: Lowest carbon footprint – two pumps in parallel, 50% flow each

### Energy performance implications of parallel pump staging strategy



Figures 2 and 3: Staging pumps on too late or off too early can waste energy – but effective control can bring energy savings of around 30%

after installation. Armstrong’s Pump Manager is a web-based service that uses the embedded intelligence and connectivity available in its design envelope pumps to give sustained performance and significantly enhanced reliability. Delivered as a secure, cloud-based application, it has wireless connectivity and onboard web services as standard.

### Actual energy savings

The award entry for Tango included details of a recent project for

National Grid (energy saving details have been independently validated via a Bureau Veritas report). The energy upgrade involved a three-storey office building belonging to National Grid in Solihull, UK, in which pump energy consumption was reduced by more than a third. Armstrong pumps were installed to replace six sets of twin-headed pumps that were 16 years old.

A new Tango parallel pumping solution installed on the heating system, after commissioning, reduced energy consumption by 42%.

In addition to the improvements in environmental performance, the installation of the offsite manufactured Armstrong Tango solution made it possible for the pumps to be replaced in one day over the weekend, reducing disruption for building occupants.

Throughout their lifetimes, the advanced control, performance management features and innovative design of the pumps have been developed to reduce the time and costs involved in routine maintenance, offering both best installed and best life-cycle costs.

**“Even on the few days a year when demand exceeds 70% flow... 95% of output from the emitters would be delivered when using a single pump”**

**Life-cycle sustainability**

The Tango has been designed to reduce the metal requirement of each pump set. A new casting procedure has made it possible to reduce the volume of material (ductile iron) needed to make the volutes. The design also requires less pipework and fewer connectors than a traditional installation, while preparatory work on site is also reduced, because there is no requirement for an inertia base or concrete housekeeping pad.

In energy upgrade projects, Armstrong Fluid Technology also reduces the carbon impact of the pumps to be replaced. For example, during the National Grid project, the legacy Armstrong pumps were dismantled and the materials separated, enabling them to be recycled. Around 3.5 tonnes of equipment were removed from the site and a Certificate of Sustainable Disposal was provided to the National Grid. Funds from the sale of the recycled materials are donated to Armstrong’s charitable causes, as part of its environmental sustainability initiative – Planet Proposition. **CJ**



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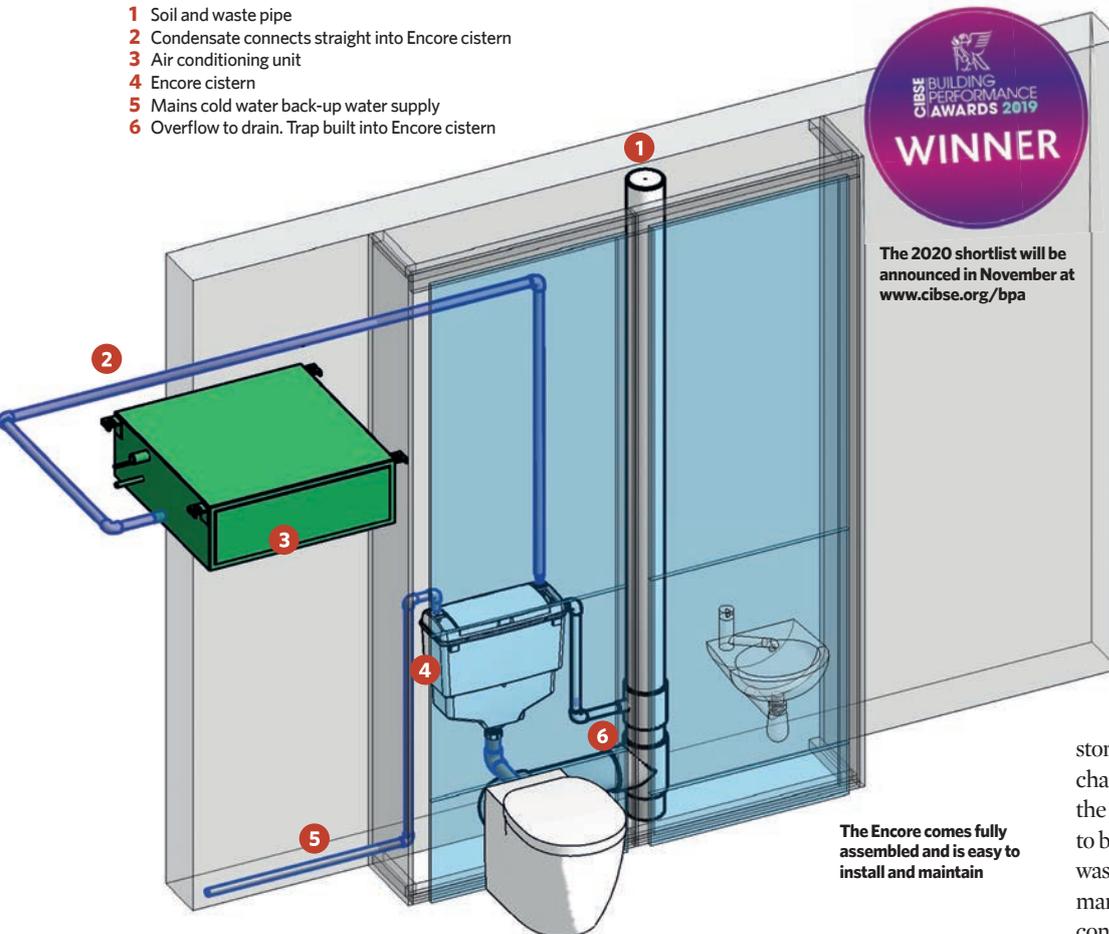
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**DUTYPOINT** SETTING THE BAR

# BUCKING THE CISTERN

The Encore cistern diverts air con condensate from a waste pipe to the toilet flush – a brilliantly simple idea that's won a CIBSE energy-saving product award. Amanda Birch reports

- 1 Soil and waste pipe
- 2 Condensate connects straight into Encore cistern
- 3 Air conditioning unit
- 4 Encore cistern
- 5 Mains cold water back-up water supply
- 6 Overflow to drain. Trap built into Encore cistern



Davis. 'We decided we should try to find a way to use the waste water for flushing toilets.'

Rigorous research and collaboration with plastics engineers and designers resulted in the Encore, which is now manufactured in Doncaster. Unlike a traditional toilet, which empties the cistern with each flush, the Encore stores the condensate by using a dual-chamber, 18-litre tank, which is three times bigger than a conventional cistern. This enables multiple flushes before drawing on the mains-fed backup.

The bottom chamber of the cistern is adjustable in half-litre increments and holds between 3.5 and 6 litres, to meet different international standards. When flushed, condensate in the bottom chamber empties and a communication valve opens, allowing stored condensate from the top, 12-litre chamber to be released into the bottom for the next flush. The upper chamber continues to be topped up with the air conditioner's waste water. If there is high demand, with many flushes in quick succession – or the air conditioning is not in use – the cistern can be filled using the mains water supply.

The Encore cistern, which uses plastics that can be ground up and reused for other products, comes fully assembled with an additional flush pipe and related washers, and can be wall- or frame-mounted. It can be operated by a single pneumatic flush button or a wave plate, and, apart from washing out a small filter tray once a year, little maintenance is required.

'We didn't want plumbers to have to undertake additional training to fit it,' says Davis. 'It had to be like installing an ordinary concealed cistern, the only difference being an extra filling connection to allow for a separate water source from the air-conditioning unit.'

The Encore can be specified for new-build and retrofit projects, and Davis anticipates it being suitable for a wide range of building types, including hotels, offices, restaurants, apartments and

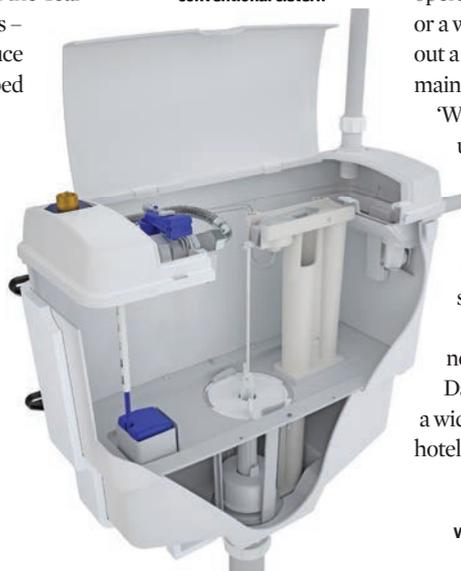
**A** revolutionary toilet cistern that uses condensate from air conditioning units for flushing could save millions of litres of water in drought-stricken areas of the globe.

The Encore, developed by Leeds-based renewable innovation company The Green Futures Initiative, won the 'Energy Saving Product or Innovation of the Year' category at this year's CIBSE Building Performance Awards – a prize that recognises building services solutions that reduce the amount of energy used in buildings. The judges described the product as 'a really innovative solution' that employs 'a range of potential applications, [and] that is suitable for retrofit and new-build.'

According to David Davis, director of The Green Futures Initiative, Encore is the only cistern of its kind, as conventional ones use mains drinking water. When he and his colleague, managing director Graham Kelly, first had the idea for their cistern five years ago, they were surprised that a similar product didn't already exist.

'Our background is in M&E building services and we had been asked by a supermarket chain how to get rid of the waste condensate from its refrigeration units,' says

**Encore's dual-chamber tank is 3x bigger than a conventional cistern**



leisure facilities. An added benefit in new-build projects is that the sustainable product automatically attracts Breeam and Leed credits. 'The trick is to get it specified at the early stages of a project, when Breeam is being considered,' says Davis. 'It's a cheap win. You might pay a bit more for an Encore cistern, but the Breeam points could offset more expensive ways to comply further down the line.'

Like any new product, it has to be tested to prove its effectiveness. Encore was rigorously examined at Thomas Dudley's in-house facility in the West Midlands, undergoing chemical endurance tests and a 200,000-cycle flush test.

It was then sent to Kiwa, experts in testing, inspection and certification, to prove its AB air gap. This is an arrangement of fittings where a complete physical airgap of 20mm is maintained between the lowest water-discharge point and the critical water level of a receiving vessel. Encore passed and was classified as a CAT (Category) 5 product. This means it can not only use condensate, but also other greywater sources, while protecting the water authorities' mains supply.

Encore cisterns were also installed in an office of a major utilities company in the north

## "We didn't want plumbers to have to undertake additional training to fit it"

of England. The mains water was metered to allow the condensate usage to be determined based on the number of flushes. The company was so impressed that it has specified a further seven cisterns for a food hall, after data showed mains-water savings of 50% over a year.

BRE is another fan of the product, installing a unit at its Willmott Dixon building to allow engineers and visitors to see how it works. Two Encore cisterns were also installed at a major hotel chain in Manchester, to trial the product and obtain data. One, in a bedroom, was monitored from 24 July to 25 August, during which time the toilet was flushed 426 times, equating to 1,917 litres of water. The water meter indicated that the Encore toilet had used only 1,250 litres of water, saving 667 litres of mains-fed water.

'Encore is performing far better than we anticipated,' says Davis. 'We've been speaking to Marriott and Hilton about installing Encore cisterns in their new hotels, because they have tough targets for saving water. We've already done some site surveys for them in Barcelona and Dubai, and we've met with the Dubai Electricity and Water Authority.'

It is in drier, water-starved regions – such as southern Europe, Africa, the Middle East and Australia, where there is greater reliance on air conditioning – that Encore should flourish. Even in the UK, with summers becoming hotter and more buildings using air conditioning, the Encore cistern could be a very efficient way to save water. **CJ**

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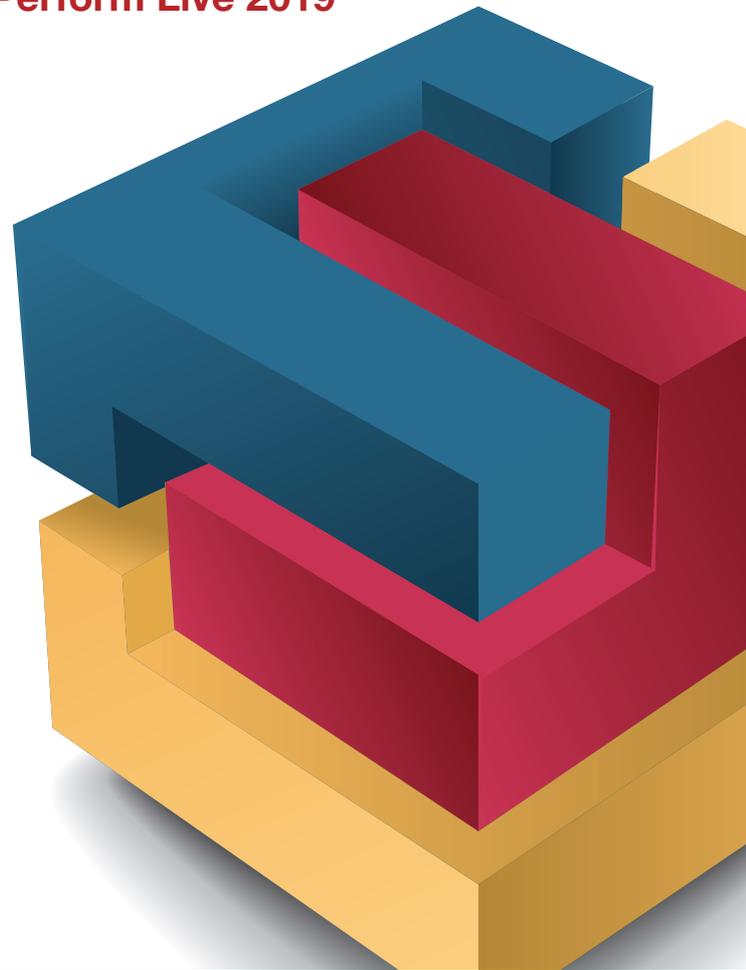
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# Hard choice

In mixed metal HVAC applications, it's important to understand when carbon steel is more appropriate than stainless steel, says Tata Steel's Stewart Jones

When specifying or installing building service pipework, particularly within heating, ventilation and air conditioning (HVAC) systems, it is essential that equal consideration is given to the selection of the pipework material.

Over recent years, there has been a change within the building services market, with specifiers and installers moving away from carbon steel pipes to those manufactured using stainless steel – possibly because of the latter's reputation for improved corrosion resistance.

Stainless steel has a high chromium content, creating an invisible protective layer on the metal which, in turn, prevents staining and corrosion. That said, carbon steel is less aesthetically pleasing and, while its higher carbon content makes it more malleable and durable, it does not have the same reputation for corrosion resistance as its stainless alternative.

However, it is vital to note that stainless steel's aesthetic appearance and corrosion performance does not automatically make it more suitable for use within commercial building service systems – especially as the widely held belief that the material does not corrode is not necessarily correct.

There are some applications in which stainless steel can be more prone to corrosion than alternatives such as carbon steel. For example, when brought into contact with dissimilar metals – particularly within a damp environment (such as that encountered during storage, transportation, installation, post-commissioning and in-service) – stainless steel can become contaminated. This affects the stainless-steel pipes and can degrade other metal materials in the pipework system, including more expensive metal components – a process called galvanic corrosion. In turn, this could impact on a system's overall service life and result in costly repairs.

## Corrosion risks

There is also the potential for other corrosion mechanisms to impact on a project, especially if there is a conflicting understanding of preventative practices. For example, installers may try to prevent high system oxygen levels in order to control corrosion risks.

However, stainless steel's protective layer – a result of its high chromium content – requires a constant supply of oxygen to maintain corrosion-resistance on the metal's surface. Unfortunately, while an oxygen-rich or open system would be beneficial to stainless steel, it could have



**“Stainless steel has a high tendency to react when close to metals”**

a negative effect if there are mixed metals – for example, non-stainless fittings or valves – within the same pipework system. This could potentially cause accelerated rates of corrosion.

Also, stainless steel has a high tendency to react when close to other metals. This can lead to further complications and practical issues on site, even prior to installation. For example, to avoid contamination, stainless steel requires specialist storage, completely separated from other metal materials, which can be problematic if space is restricted. Careful handling and dedicated tooling for fabrication and welding may be needed, all of which can result in expensive time delays and extra labour costs.

## Making informed choices

In order to support the industry and improve awareness of such issues, Tata Steel has been working with the Building and Industrial Services Pipework Academy

(Bispa) – a collaboration between industry and academic centres of excellence, such as the School of Architecture, Building and Civil Engineering, Loughborough University, and the Corrosion Group at Cranfield University.

Specifiers and installers should educate themselves on the characteristics of different metals to make informed product choices and help ensure the long-term satisfactory performance of their building services pipework. For example, for HVAC pipework within a building, traditional hot-finished carbon steel may be more appropriate.

Not only does it typically have thicker walls, making it more robust and better able to accommodate initial corrosion, it also has no heat affected zone (HAZ) – an area of weakness around the weld seam.

With its increased strength and durability, as well as its positioning within the galvanic series, carbon steel may be considered more complementary to other dissimilar metals – in turn reducing the risk of serious or accelerated corrosion occurring. It is also less prone to contamination during storage, fabrication and installation, and is far more malleable and ductile when compared with stainless steel.

Budget will always be a concern, and a hot-finished carbon steel tube, with its comparatively lower price and ease of handling on site, may often be the soundest choice.

While carbon steel as a standalone metal is perhaps not as resistant to corrosion as its stainless-steel alternative, it is more complementary and therefore more suitable for installation alongside other materials commonly seen within building services systems.

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## Moving UK air conditioning beyond the first decade of the Ecodesign Directive

This module considers the development of EU directives and their continued impact in a post-Brexit UK

As the UK moves towards a potential departure from the EU, the rules that have been developed under the EC Ecodesign Directive for energy-related products – which include the most significant technologies that contribute to the environmental control of buildings – are set to live on, and continue to develop for UK users and suppliers.

This article will consider the progression of the directives that have matured into their current form and looks forward to the continued impact of Ecodesign in the UK.

The EU began to develop regulation and legislation in product eco-design in the 1990s. And now, at the 10th anniversary of the inception of the Ecodesign Directive,<sup>1</sup> there is a dynasty of standards in place that has resulted from the consolidating Energy Efficiency Directive 2012/27/EU, setting a framework that aimed to lower the EU's 2020 final energy consumption by 20% – roughly equivalent to turning off 400 power stations.

The directives that furthered the objectives advanced by the Energy Efficiency Directive, in terms of buildings and building services, are notably:

- **Energy Performance of Buildings Directive (EPBD)** 2010/31/EU – amended by 2018/844/EU (formerly 2002/91/EC)
- **Energy Labelling Directive** 2017/1369/EU (formerly 2010/30/EU and 92/75/EEC)
- **Ecodesign Directive** 2009/125/EC (formerly 2005/32/EC).

The Ecodesign Directive covers all energy-related products sold in the domestic, commercial and industrial sectors, with the exception of transport, that is covered by other legislation. The Energy Labelling Directive complemented the Ecodesign Directive, and the requirements for product energy labelling are often adopted alongside Ecodesign measures.

Broadly, the Ecodesign Directive can be considered as addressing the supply side, while the Energy Labelling Directive focuses on the demand side.

The current Ecodesign Directive entered into force on 20 November 2009 and replaced the previous Ecodesign Directive 2005/32/EC, and in so doing extended its scope from the former 'energy-using' products (EuP) to the more encompassing 'energy-related' products (ErP), with a view to expanding the number of energy-efficient and environmentally friendly products available in the marketplace. The lifetime environmental impact of a product is practically determined during the design and construction phase, so it is particularly important to consider life-cycle impacts at the earliest stages of a product's development. So, the directive does not only cover the energy use of products, but also aims to reduce the overall environmental impact. The manufacturer or importer has the responsibility of ensuring that a product conforms to requirements, and then the national market surveillance authorities check the compliance of the products through random tests, which are overseen by the Office for Product Safety and Standards (OPSS) in the UK.

There have been, to date, three progressive Ecodesign workplans that have agreed groups of products (originally referred



» to as ‘lots’) where a study is undertaken to examine relevant market data and the technological aspects that influence the design, manufacture, operation and disposal of the product. The resulting, freely available, reports provide extensive and detailed information and – although sometimes difficult to track down – provide excellent sources of technical and market information (most are listed at [www.eceec.org/ecodesign/](http://www.eceec.org/ecodesign/)). There have been more than 25 product groups that directly impact building services engineering design, procurement and operation. (Some lots have, confusingly, been identically numbered but can be distinguished by the different prefixes that relate to the responsible EC Directorate-General – ‘ENER’ standing for the General Directorate for Energy and ‘ENTR’ for the General Directorate for Internal Market, Industry, Entrepreneurship.)

Following subsequent development and consultation (as more fully described in *CIBSE Journal CPD*, November 2012), the scope of the lots has been further consolidated, revised or upheld so as to evolve an appropriate set of European standards. Many of the lots have changed from their original concept, so it can be sometimes confusing to relate subsequent EU legislation to the original lots, as they may well have morphed into other areas. However, Figure 1 provides a useful interpretation of the resulting EU instruments that currently relate to active heating and cooling products.

The success of the Ecodesign project may be measured, in part, in the contributory influence on EU energy consumption. As reported earlier this year by Zangheri,<sup>2</sup> and based on the annual reports by EU member states over the five-year period to 2018, although both primary and final energy consumption have declined for almost all states since 2005, over the period 2011-2016 only 11 (out of 28) reduced final energy consumption by more than 1%. This was justified in part by colder climatic conditions during that period’s winter months, economic growth, population rise and increased travel and transportation. The EC recently reported on data sourced from Eurostat<sup>4</sup> showing that primary energy consumption was 5.3% above the 2020 targets in 2017 and final energy consumption was 3.4% above those targets. As a result, there is a stark realisation that although there have been clear benefits of the set of directives including ErP, ‘if energy consumption continues to increase in the coming year, the EU will not reach its 2020 target for both primary and final energy consumption’.

In December 2018, the revised Energy

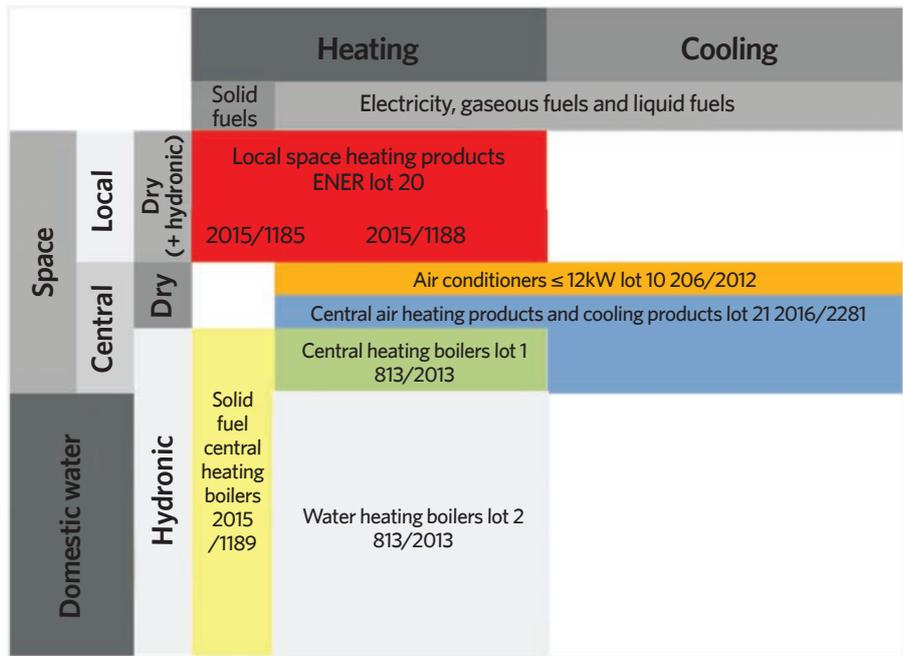
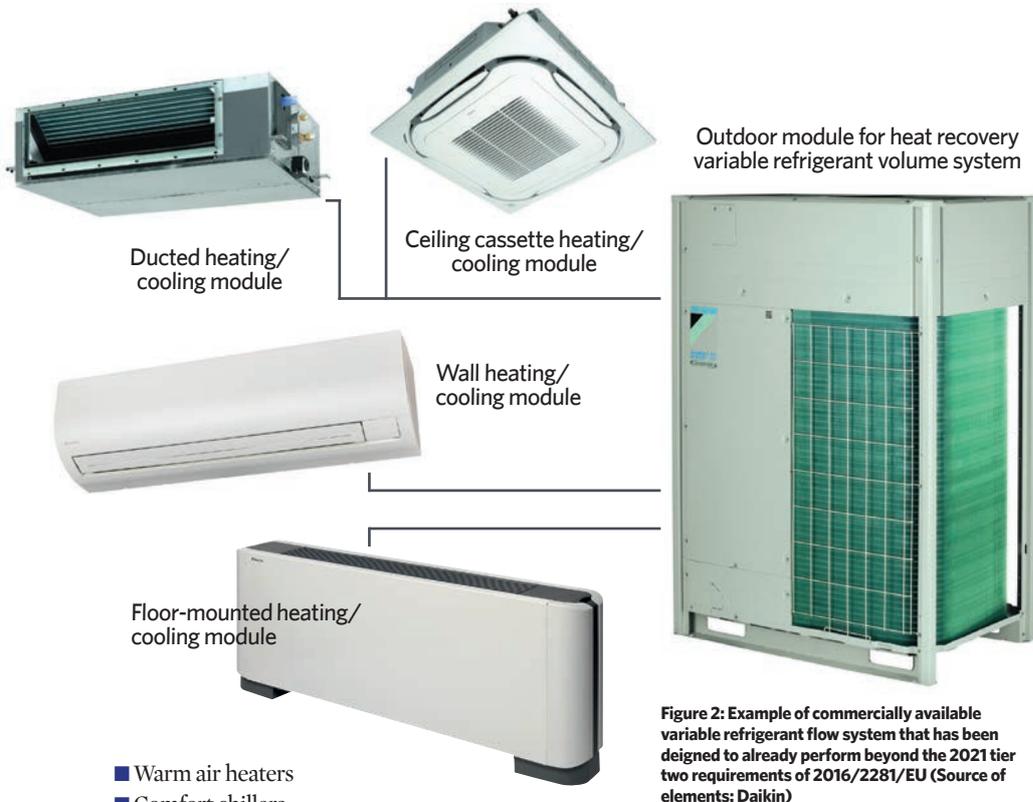


Figure 1: The Ecodesign regulations relating directly to heating and cooling systems (Source: Guidelines accompanying Regulation (EU) 2016/2281, EC 2018)

Efficiency Directive (2018/2002/EU) updated some specific provisions and introduced new elements but, principally, it established an EU energy target to improve energy efficiency by at least 32.5% by 2030 (compared with ‘business as usual’). The aim is for the EU to lead the world towards ‘climate neutrality’ by 2050.

The UK is set to leave the European Union on 31 October.<sup>5</sup> However, whatever the status of Brexit, the government has declared that there will be no immediate impact on UK or EU consumers with regard to Ecodesign and Energy Labelling standards.<sup>6</sup> There is wide-ranging support (in trade associations and professional institutions) that the UK should continue to cooperate with Europe on product standards, both to enable trade and to prevent the country becoming a ‘dumping ground’ for low-quality goods. In the case of a no-deal Brexit, preparations are ‘taking place across government to ensure that, in this case, regulatory continuity will be ensured’,<sup>7</sup> with suppliers required to ensure that relevant energy-using products placed in the UK (and the EU) market comply with minimum UK Ecodesign and Energy Labelling standards.<sup>8</sup> The UK is a full member of the European Committee for Standardization (CEN) and adopts harmonised standards as national standards (EN is transformed and implemented as BS EN), and leaving the EU will not affect that process. British Standards Institution’s (BSI) membership of the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) is unaffected by Brexit, and BSI is currently reviewing the CEN and European Committee for Electrotechnical Standardization (CENELEC) statutes to identify necessary changes and to ensure that BSI can continue its membership of both organisations on a permanent basis.<sup>7</sup> The UK’s introduction of regulation will include a new UK Conformity Assessed (UKCA) regulatory mark that will be affixed to products to support the authorities and provide clarity to manufacturers placing products on the market in the UK post-Brexit.<sup>7</sup> The concept of ‘harmonised standards’ will be transferred identically into the UK legal order to become ‘designated standards’. This was formally adopted in the UK parliament on 20 March 2019, and will enter into force on the effective date of Brexit in the case of no deal.<sup>7</sup>

An example of a significant product group that will continue to impact commercial applications in building services started life simply as ‘Lot 21 – Local room heating products’. Through the Ecodesign research, consolidation and development process, this has evolved and matured to create the ‘Ecodesign Regulation 2016/2281/EU’<sup>9</sup> for air heating products, cooling products, high temperature process chillers and fan coil units’ that relates to building services products that include:<sup>10</sup>



- Warm air heaters
- Comfort chillers
- Air-to-air air conditioners >12kW
- Water/brine-to-air air conditioners
- Fan coil units
- Air-to-air heat pumps >12kW
- Water/brine-to-air heat pumps.

There is little production of these types of units in the UK (with most being imported from EU or Asia) but, according to current UK government guidance, ‘the manufacturer, authorised representative or importer that first places a regulated product on the EU market (or puts it into service) is responsible for compliance’, and post-Brexit this would relate to the UK market. As commercial equipment, there is no requirement for an Energy Label; however, manufacturers are required to publish, through a free-to-access website, data on the product’s performance, including:

- Minimum heating and cooling efficiencies
- Maximum nitrogen oxide emissions
- Maximum sound levels
- Information about recycling.

To provide a common baseline across manufacturers, standardised testing and reporting processes are included in the regulation. Standards BS EN 14511<sup>11</sup> and BS EN 14825<sup>12</sup> define how the normal rating and the seasonal efficiency (see ‘Seasonal

## SEASONAL EFFICIENCY

‘Seasonal efficiency’ attempts to measure the true energy efficiency of heating and cooling devices using climate zoned, binned weather data. So, the seasonal (heating) coefficient of performance (SCOP) and seasonal (cooling) energy efficiency ratio (SEER) are evaluated by manufacturers using operating conditions that are representative of the binned weather data, which provides a common base for year-round performance and does not simply use the efficiency at the rated output. So, for example, a coefficient of performance (COP) value for each of the bins is found, and together these form the basis for calculating the average COP, the SCOP. For the purposes of checking compliance with the regulations, the following parameters are then calculated in accordance with BS EN 14825:2018:

$$\text{Seasonal heating efficiency (\%)} \eta_{s,h} = (\text{SCOP}/\text{CC}) - \Sigma F(i)$$

$$\text{Seasonal cooling efficiency (\%)} \eta_{s,c} = (\text{SEER}/\text{CC}) - \Sigma F(i)$$

where CC is primary energy conversion factor (set as 2.5 – an interpretation of the average power generator to end-user primary energy transmission efficiency as 40%);  $\Sigma F(i)$  (for air systems) is simply taken as 3% to represent control inefficiency.

efficiency’ box) of a system should be tested, and what calculation method should be used (to provide evidence of conformity with Ecodesign requirements).

So, for example, currently the minimum seasonal energy efficiencies of air-to-air heat pumps are  $\eta_{s,h} = 133\%$  (heating) and  $\eta_{s,c} = 181\%$  (cooling). On 1 January 2021, the requirements move to the second tier (level) of 2016/2281/EU so that the minimum  $\eta_{s,h} = 137\%$  and  $\eta_{s,c} = 189\%$ . Through legislation passed earlier in 2019, the UK government explicitly listed the relatively insignificant contextual changes required to bring 2016/228/EU into a post-Brexit UK, and so it is expected that these tier two requirements will be carried across to the UK designated standards.

As illustrated in Figure 2, some manufacturers are already able to supply systems that have seasonal efficiencies beyond the 2021 tier two requirements. The Ecodesign Directive provides a strong technical and economic driver for system development. For example, the system in Figure 2 has been designed with an entirely new compressor that delivers an average 15% increase in seasonal efficiency over previous systems from the manufacturer. When coupled with ducted and cassette systems, the resulting SEER is reported as being around 40% higher and, in heating mode, the SCOP is – on average – approximately 15% higher than previous systems.

It is important that designers and installers are able to compare the performance of alternative systems and technologies properly, otherwise there may be unrealistic expectations of what a system can deliver for a particular location. So, in the prospective post-Brexit world, it is also important to maintain the free-to-access websites holding the standardised manufacturers’ data.

The consensus process that underpins the Ecodesign regulations has, to some, seemed laboured and lengthy. However, the array of resulting legislation has benefited from the comprehensive investigative and consultative process. The transparency and increased availability of improved data has given designers, installers, operators and owners the opportunity to make a more informed choice about the most appropriate system to use for their project, based on more realistic efficiency information. The challenge is to maintain continuity in a potentially post-Brexit era, to ensure that standards and systems continue to advance both in the UK and across an increasingly global marketplace.

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■ Turn to page 74 for references.





# Module 152

October 2019

» **1. Who is responsible for oversight of Ecodesign compliance in the UK?**

- A BSI
- B CEN
- C CIBSE
- D EC
- E OPSS

**2. What is the Ecodesign regulation that relates directly to solid fuel central heating and boilers?**

- A 2015/1188
- B 2015/1189
- C 2016/2281
- D 2813/2013
- E 813/2013

**3. In the Energy Efficiency Directive (2018/2002/EU), what minimum percentage improvement in energy efficiency is required by 2030 (compared to 'business as usual')?**

- A 5.3%
- B 20%
- C 21%
- D 27.5%
- E 32.5%

**4. Which one of the following items of performance information is not required to be available on the free-to-access website of manufacturer's data to meet the requirements of Ecodesign Regulation 2016/2281/EU?**

- A Embodied energy from manufacture of unit
- B Information about recycling
- C Maximum nitrogen oxide emissions
- D Maximum sound levels
- E Minimum heating and cooling efficiencies

**5. In the illustrated example system, what is reported as the approximate increase in SEER compared with the previous generation of this manufacturer's systems?**

- A 15%
- B 20%
- C 30%
- D 40%
- E 50%

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### References:

- 1 Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for setting of ecodesign requirements for energy-related products, EC 2009.
- 2 Zangheri et al, *Progress in the Implementation of the EU Energy Efficiency Directive through the Lens of the National Annual Reports*, *Energies* 2019, 12(6), 1107; <https://doi.org/10.3390/en12061107>
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- 9 Commission Regulation (EU) 2016/2281 '... with regard to Ecodesign requirements for air heating products, cooling products, high temperature process chillers and fan coil units' 2016.
- 10 *Guidelines accompanying Regulation (EU) 2016/2281*, EC 2018.
- 11 BS EN 14511:2018 *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors*.
- 12 BS EN 14825:2018 *Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling – Testing and rating at part load conditions and calculation of seasonal performance*,
- 13 The Ecodesign for Energy-Related Products and Energy Information (Amendment) (EU Exit) Regulations 2019.



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# With the ESOS Phase 2 deadline approaching are you ready to advise?

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## Product of the month

### Watts announces innovative static balancing valve

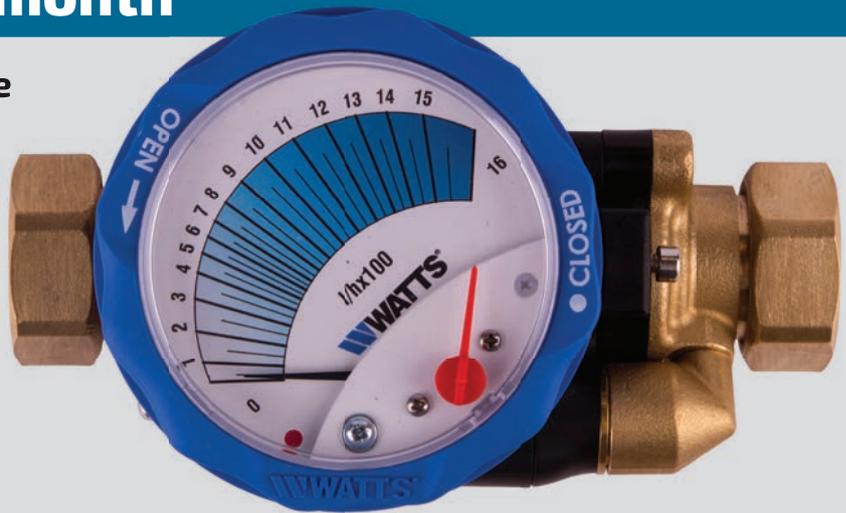
Patented technology used in new valve that promises easy installation and setting

**W**atts Industries UK has launched its new static balancing valve, Series CF. Developed by its R&D Innovation Centre in Italy, Watts claims that it is a UK first, thanks to its innovative technology. Part of the Watts iDROSET balancing valve family, Watts says that Series CF uses patented technology to deliver a superior performance.

Easy to install, adjust and designed to be responsive while saving customers time, it balances heating, cooling and drinking water distribution systems quickly and effectively.

UK sales director Kerry Harris says: 'Series CF is a UK first and a game-changer for the HVAC industry, thanks to its quick installation time and lack of special tools or training to use it effectively in a system. This innovation will save time for installers, as well as improve the performance of the heating and air conditioning systems it is connected to.'

'Over the coming months, we will be welcoming customers to our training academy to learn more about how this new product can improve their system's performance and



### "It delivers precise calibration that's straightforward to set"

optimise their installation processes. The training academy was opened in June this year, and we are pleased to be able to offer our customers opportunities to learn in this fantastic new facility.'

Watts says that whether it's a small or large system, the hydraulic balancing of heating and air conditioning systems is essential to distribute the heat where it is needed, maximising user comfort. Accurate balancing of the system reduces its energy use which reduces overall running costs as well. System balancing is recognised by European

and local directives as key to achieving energy savings, and Watts says the valve delivers this in a fast and easy way.

Utilising its patented, accurate technology, the user-friendly Series CF delivers precise calibration that's straightforward to set, and real-time information that's easy to interpret without any special tools.

The valve body is manufactured from brass and composite, featuring an ergonomic shape that allows the valve to be deployed in a range of ways with a multifunctional hand wheel that sets the flow rate.

■ Visit <https://wattsindustries.co.uk/SeriesCF/>

### Happy 20th anniversary, JS Air Curtains

Founded in 1999, JS Air Curtains is celebrating two decades of preventing doorway draughts across the UK.

In 1999, JS Air Curtains was formed as a sister company to JS Humidifiers. In 2011, humidification specialists, the Condaire Group, purchased the companies and subsequently rebranded.

Major milestones for JS Air Curtains across the past 20 years include helping design solutions for some of the UK's most prestigious buildings, including the Royal Albert Hall and the V&A Museum.

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



### Development of 20 new homes in Cambridgeshire includes Panasonic Aquarea air-source heat pumps

Spire View, a development of 20 new executive four- and five-bedroom homes in March, Cambridgeshire, has been equipped by Panasonic distributor Oceanair with renewable Panasonic Aquarea Monobloc air-to-water heat pumps to supply heating and domestic hot water to each home.

With sustainability and quality high on the agenda for this modern development, making the right choices through intensive research for all elements in the specification throughout the properties was very important to the developer.

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



### Rinnai 1600i gas-fired water heaters delivering energy and cost efficiency

Rinnai's low-NO<sub>x</sub> Infinity HDC 1600i models use the company's patented pre-mix burner technology, with a 14-1 turndown ratio - the largest on the market - of 58.4kW-4.05kW, with extremely quiet operation.

With up to 107% gross efficiency, the Infinity 1600i has condensing technology built in, and comes with an extended warranty, a top A-rating - exceeding the demands of eco-labelling legislation - and the knowledge that the HDC1600 is future-proofed against regulatory and legislative changes.

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





### ⬆ Grundfos is at the Heart of the action

With a rich history dating back 1874, Heart of Midlothian Football Club (Hearts) have been there to witness the many changes and advances that Edinburgh has experienced over the years. The Tynecastle Park club has continued to evolve, and its most recent investment has seen a new main stand being added that seats 20,000 people.

To maintain top-flight club status means collaborating with different partners to benefit from their expertise. Grundfos Pumps was delighted to work with RSP Consulting Engineers and contractors Livingston Mechanical Services on this latest project.

The pump solutions were chosen for their energy efficiency and their ability to deliver the project's required HVAC needs, as well as ensuring sufficient water is available to meet all the various demands. The final Grundfos solutions team included players drawn from the TPE family of single-stage centrifugal pumps, as well as from Magna3 commercial heating circulators.

Today, this club lives up to its name, playing a pivotal role at the very heart of a vibrant community. Grundfos is delighted to have been selected as part of the support network.

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

### Myson introduces all-new digital electric radiator range >

Myson is set to extend its heating solutions portfolio with a range of modern digital electric panel radiators.

The range - which consists of Rio Compact, Rio Plan and Rio Linea - is a stylish alternative to the traditional hydronic radiator, with unique and energy-saving features built in to the electronics. Myson claims all models offer superb temperature control via a clear visual digital display discreetly housed on the side panel.

The sleek, flat front panel design of the Rio Plan offers a contemporary alternative to the traditional Rio Compact radiator and the Rio Linea model takes this modern styling one step further with a decorative front panel.

All models are fully programmable, with several operating modes including open window function and frost protection, and an adjustable surface temperature that creates a comfortable, radiant warmth.

Myson claims the range is the perfect solution for renovation and extension projects where off-grid options are required, as well as retrofit replacement for products as night storage heaters.

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

### New developments in water monitoring >

Hevasure's groundbreaking water monitoring technology has been enhanced in order to show the real-time corrosion rate of carbon steel, as well as the total (cumulative) loss over a given timeframe.

These new modes of data collection have been designed to give facilities managers and building owners a better insight into corrosion issues of their important infrastructure, while avoiding knee-jerk reactions to 'normal' fluctuations in monitored parameters.

By expressing corrosion rates of steel in mm per year, as well as showing total metal loss in mm, end users have a much more meaningful way of understanding the effect of corrosion on their systems. As usual, all Hevasure results are available to view in real-time, but prior to this development, the long-term effects of corrosion were hard to quantify. Now, the Hevasure system can determine the cumulative value of certain parameters, such as oxygen and steel corrosion, between certain dates, saving money and time on interventions that are not always necessary.

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



### > Swegon launches space-saving indoor AHU



Swegon has launched another variant of its Global space-saving air handling units (AHU) with heat recovery, designed for light commercial and refurbishment projects.

The Global LP (low profile) units provide airflows of up to 3,720m<sup>3</sup> per hour (1,030l·s<sup>-1</sup>) from an extremely compact, low-noise product that is designed to be mounted horizontally in the ceiling. They operate at 85% efficiency, thanks to the use of a plate heat

exchanger for heat recovery, plus plug and play controls, low-energy consumption EC fans and high-performance DC motors.

The company has also developed increasingly effective control strategies with 'open' communication via Modbus, TCP/IP, BACnet and KNX.

Global LP ventilation units are supplied plug and play, with the basic functions pre-programmed and most of the accessories pre-installed, pre-wired and pre-configured in the factory. The units' generously sized doors ensure ease of access for maintenance purposes, and the new enlarged electrical cabinet introduced this year features an integrated safety switch and better access to the control board.

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



**Nittan helps protect iconic city church from fire >**

Nittan Europe, UK manufacturer of conventional and addressable fire detection products and systems, has had its Evolution analogue addressable fire detection system installed into St Nicholas Church in Bristol. The system was supplied and commissioned by Coomber Fire and Security Systems, which is a Nittan elite partner.

St Nicholas Church was built in 1769, and to protect this much-loved building, a Nittan Evolution analogue addressable fire detection system has been installed throughout.

■ Call 01483 769 555, email [sales@nittan.co.uk](mailto:sales@nittan.co.uk) or visit [www.nittan.co.uk](http://www.nittan.co.uk)



**Eaton's new sounder and sounder beacon range reduces the risk of downtime >**

Eaton has launched a new range of sounders and sounder beacons for the industrial process and control market that mitigates the risk of downtime from EMC discharge and overloaded loops on low-voltage systems. The X10 range is also able to withstand a jet wash of 5 bar at a temperature of 80°C.

The X10 operates in the most demanding environments, protecting people and property in temperatures as low as -40°C through to the extremes of 70°C heat and 100% humidity.

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



**< Product focus – UDSA**

Reznor, part of Nortek Global HVAC (UK), has a ongoing tradition of manufacturing high-efficiency heating equipment, among which is the highly efficient UDSA heating unit.

The UDSA units are a technically advanced range of gas-fired unit heaters designed to deliver outstanding energy, efficiency, performance and economy for reduced operating and life-cycle costs.

The heat exchanger achieves 92% (net calorific value) thermal efficiency, reducing energy and consumption and running costs.

UDSA units are fitted with a high airflow axial fan for free-

blowing applications, with model heat outputs ranging from 11kW to 146kW.

All units are available for natural gas (g20) as standard but, alternatively, can be specified for use on Propane (G31).

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



**< Toshiba VRF chosen for No 1 Great Central Square in Leicester city regeneration**

Toshiba's variable refrigerant flow (VRF) air conditioning has been chosen as the high-efficiency cooling and heating solution for No 1 Great Central Square, part of a £50m regeneration scheme in the heart of Leicester.

The four-and-half-acre development, being built by Morgan Sindall Construction, includes two new hotels, premium commercial offices and a new public realm area – Great Central Square – in Leicester's city centre. No.1 Great Central Square comprises 35,000ft<sup>2</sup> of open-plan office space over five floors, air conditioned by a high performance, heat-pump-based Toshiba SMMS-e system, installed by Ambivent.

Ten Toshiba outdoor units supply cooling and heating via 40 indoor cassettes installed across the building, with a heat recovery ventilation system in each wing further boosting efficiency and reducing end user running costs. A 12kW Toshiba split system, running on R-32 refrigerant, installed in the reception area completes the total building system. High-level control and monitoring is delivered by a Black Pear system. The project is due for completion later in 2019.

■ Visit [www.toshiba-aircon.co.uk/product/smmse-2-pipe-heat-pump-outdoor/](http://www.toshiba-aircon.co.uk/product/smmse-2-pipe-heat-pump-outdoor/)



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**Energy Efficiency**



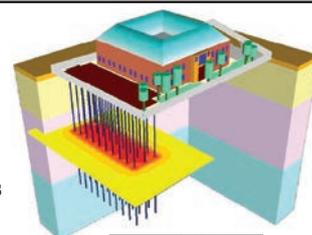
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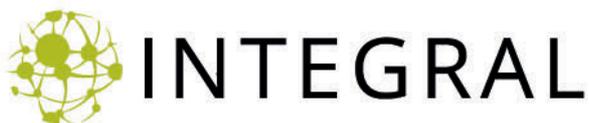


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### **Lead Mechanical Engineer** **London, £43p/h**

An independent consultancy has a need for a Lead Mechanical Engineer to work on a variety of projects across London. Suitable engineers need to have experience using Hevacomp and Revit. You will be split between the office, site, and working from home and will be required to provide design, review, and comment on contractor's working drawings. Immediate start, ongoing contract. Ref: 5637

### **Principal Electrical Engineer** **Central London, £50k - £65k + bens**

Our client is one of London's most pioneering and progressive consultancies in London. They are looking for a dynamic, innovative and creative engineer to work in partnership with the world's leading architects on some of the most iconic and complex projects in London and overseas. Ref: 5412

### **Intermediate/Senior Electrical Design Engineer**

**Manchester, £30k - £45k + bens**

My client has an exciting opportunity for an Electrical Design Engineer servicing blue chip clients. This is a permanent position located in their Manchester office with a strong focus on Critical Buildings, Data Centres, Banking/Finance, and Commercial projects. Responsibilities include attending meetings, making client presentations, and raising/promoting the level of technical excellence relating to electrical engineering within the team. Ref: 5436

### **Mechanical Associate** **Central London, £65k - £80k + bens**

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

### **Associate Electrical Engineer** **Dublin, €65k + bens**

Our client employs over 80 staff across a network of offices in the UK and Ireland. From the Dublin office alone they have worked on an impressive portfolio of projects across a variety of sectors including healthcare, mission critical, commercial, and local authority. Their work has been recognised with several industry awards and commendations. Ref: 5631

### **Senior Electrical Engineer** **London, £40p/h**

I have a requirement for an electrical engineer on a contract basis. You will provide electrical design for the shell & core in the fit-out arena. The work is predominantly LV, lighting, and power distribution. The contract will run for approximately 12 months with the possibility to extend. Similar experience is essential. Immediate start. Ref: 5558



Lucy Pemble carried out research in Zambia and South Africa

## Low carbon travel

**Energy consultant and Travel Bursary winner Lucy Pemble reflects on her experiences around the world and how she's bringing that learning home**

**A**warded the CIBSE Ken Dale Travel Bursary for 2018, Lucy Pemble journeyed to Zambia, South Africa, California and Wales to investigate photovoltaic (PVs), electric vehicles (EVs) and demand management in different development contexts. She is set to discuss the experience in her presentation 'Demand management: photovoltaics, electric vehicles and the strive for decarbonisation' at Build2Perform Live 2019 in November.

Pemble is an energy consultant at ICF, advising government and businesses on energy policy, and is currently helping to deliver the Industrial Heat Recovery Support (IHRS) programme for BEIS. Previously, she worked as a sustainability and energy consultant with Aecom, and has particular experience in district heating. Pemble has recently completed a scholarship for MSc Sustainable Engineering Management for International Development at Swansea University with the Prince's Foundation, and is co-vice-chair of the CIBSE Energy Performance Group.

### How did the Ken Dale Bursary help with your chosen area of research?

I researched demand management in the context of decarbonisation, EVs and PV. The Ken Dale bursary allowed me to explore impacts and practices in cultures that are much different to the UK. I travelled to Zambia, South Africa, and California in the US, as well as visiting Swansea in the UK.

I thought it was important to capture what we consider cutting-edge practice in the UK and compare that with other countries. I learnt about the practical challenges of demand management, EVs and PV. I also compared practices across different development contexts – Zambia (developing); South Africa (more developed); and California (almost hyper-developed).

### Could you give examples of what you learnt from other countries?

In California, I learnt some of the challenges of an EV car-share scheme for cities, including charging infrastructure, metering and billing and technological constraints. I also discovered the importance of different sectors communicating when developing policy – for example, the transport and buildings sectors. From Zambia, I learnt that PV can have a very positive affect on the lives of rural, subsistence farmers. The majority of construction in sub-Saharan Africa is informal. Policy is a driver of decarbonisation in California, but less so in Zambia. However, the importance of sustainability is known and drives decarbonisation efforts, even if informally.

Demand-side response and EVs in California are more prevalent than here in the UK, although they still encounter challenges in the sense of bi-directional charging. I learnt that, in order for this to be successful, it is not just the technological advances that matter, but also the motivation for sectors to work together to facilitate demand-side response – for example, in the automobile and buildings sectors.

### Were you able to share knowledge from the UK?

I visited Honda Smart Home in the US and shared my experiences of the 'Active Classroom' and 'Active Offices' built by Swansea University's SPECIFIC Innovation and Knowledge Centre. The two were designed for different climate contexts but had some similarities, including smart controls for integrated EV charging. I also shared UK practices with students and staff in Durban, South Africa, at the University of KwaZulu Natal. In California, I attended the World Climate Action Summit in San Francisco. I had some great conversations about the context of decarbonisation in the UK compared with the US, China, Australia and the rest of the EU.

### Has it helped with your current role?

The experience has undoubtedly helped my confidence. From writing the proposal to travelling around the world – it was an experience like no other. It has also given me first-hand insight into demand management, a topic of emerging importance to the building services industry. In my current role as an energy consultant at ICF, my research has enabled me to share learnings with UK and European policymakers. It's fulfilling that my research into technical challenges and benefits, examples from policy or lack of policy in other countries, can inform decision-makers.

### Should transportation and travel be part of a strategy to decarbonise?

Transportation can work with the buildings sector to decarbonise in a way that's sustainable and efficient. EVs are only one part of the transport solution, however, and it is important to share vehicles, take public transport and encourage walking and cycling. I'm conscious that the Ken Dale Travel Bursary often involves several flights. I was initially going to travel to Zambia as part of my MSc so, by combining the travel and flying to South Africa straight from Zambia, the purpose of my flights was doubly justified.

**LUCY PEMBLE** is an energy consultant at ICF

## NATIONAL EVENTS AND CONFERENCES

### Young Engineers Awards 10 October, London

Hear the young engineer finalists present, before the 2019 winner is crowned, and find out which companies have gone the extra mile in mentoring their staff, in the Employer of the Year awards. [www.cibse.org/yea](http://www.cibse.org/yea)

### YEN National Ball

12 October, Cardiff Castle  
Black tie event with live music, and guest speakers Sophie Howe, Future Generations Commissioner for Wales, and Carwyn Jones, Assembly Member for Brigid.

### Build2Perform Live

26-27 November, London  
The free event brings people together to learn about, discuss and collaborate on the issues vital for delivering better building performance. With more than 60 sessions from more than 90 speakers, and 70-plus exhibitors from manufacturers and suppliers. [www.cibse.org/b2plive](http://www.cibse.org/b2plive)

### CIBSE TRAINING

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### High Voltage (11kV) distribution and protection 1 October, London

### Low carbon consultant building operations 1-3 October, Birmingham

### Mechanical services explained 2-4 October, Manchester

### Running projects effectively 3 October, Manchester

### Emergency lighting to comply with fire safety requirements 4 October, London

### Building services explained 7-9 October, London

### Sanitary and rainwater design 7 October, London

### Fire risk management system: PAS 7 2013 8 October, London

### Below-ground building drainage 10 October, London

### Fire detection and alarm systems for buildings – BS 5839 Part 1 10 October, London

### Practical controls for HVAC systems 14 October, London

### Heating and chilled water pipe systems design 14 October, London

### Mechanical services one-day overview 15 October, London

### Energy Savings Opportunity Scheme 15 October, Birmingham

### Understanding smoke control 15 October, London

### Essentials of electrical systems and safety awareness 17 October, London

### Energy efficiency building regulations Part L 18 October, London

### Fire safety in the design, management and use of buildings: BS 9999 18 October, London

### Low carbon consultant design training 21-22 October, London

### Energy strategy reports 23 October, London

### Fire safety building regulations: Part B 24 October, London

### Standby diesel generator 25 October, London

### Electrical distribution design 28 October, London

### Electrical services explained 29-31 October, London

### Fire safety in purpose-built blocks of flats 30 October, London

## CIBSE GROUPS, SOCIETIES AND REGIONS

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

### SLL and CIBSE South West: Lighting and the Well Building Standard 2 October, Bristol 3 October, Exeter

Key lighting aspects within the Well Building Standard version 2, and what to consider when trying to achieve Well accreditation.

### YEN North West: CPD and social – odour and smoke control in kitchen ventilation 3 October, Manchester

The second CPD in the YEN Technical series, with presentation by Plasma Clean, and a social at Roxy ballroom.

### FM Group: Using building management system data to target maintenance 9 October, London

A joint CIBSE FM Group and BCIA event, with Tom Randall, FM group member and Jon Belfield, BCIA president.

### West Midlands: An introduction to plant room surveys 9 October, Birmingham

CPD presentation from Ideal Boilers' Richard Brown.

### Yorkshire: A study on 3-dimensional elevator systems 10 October, Leeds

Presentation by Dr Albert So from University of Hong Kong.

### North East: Water regulations 15 October, Newcastle-upon-Tyne

Presentation on backflow prevention, fluid categories, use protection and cold water storage cisterns by Malcolm Atherton, of Cundall.

### South West: Black belt negotiator 16 October, Bristol

Seminar with Tom Flatau, Teamworking International founder, helping you be a better negotiator and build better business relationships.

### Intelligent Buildings Group and CIB: Symposium on designing and operating buildings for people 17 October, London

Symposium organised by CIBSE Intelligent Buildings Group, CIB Intelligent & Responsive Buildings Commission, UCL and Middlesex University.

### Southern: Membership briefing 17 October, Chichester

Focusing on the routes into CIBSE Associate and Member grades and registration with the Engineering Council at Incorporated and Chartered Engineer levels.

### The 2019 Passive House Canada Conference 17-18 October, University of Toronto Scarborough

A two-day deep dive into the latest Passivhaus projects, best practices, and lessons learned from experts in high-performance building science. [phcc2019.com](http://phcc2019.com)

### HCNE: Energy management 22 October, London

Presentation by Stephen Squires, of Socomec.

### HVAC Group: Low carbon heating 23 October, London

Presentations by Clara Bagenal George, of Elementa Consulting; HVAC Group chair Phil Jones; Hamworthy; and Mitsubishi.

### Scotland: Hydronic closed-system optimisation with post-occupancy monitoring 29 October, Glasgow

CDP event featuring speakers from Geberit, HASL and IES.

### SoPHE annual dinner 7 November, London

SoPHE and SoPHE Industrial Working Group host their annual dinner, with guest speaker Laura Bingham.

## HIGHLIGHTS



Clara Bagenal George will speak at the HVAC Group event on 23 October



Sophie Howe, Future Generations Commissioner for Wales, will speak at the YEN ball on 12 October

## Society of Light and Lighting LightBytes series 2019-2020: People, space, time, place

The new series will be focusing on light and wellness, with presentations divided into four overarching sessions: people, space, time and place. Each speaker will deliver bite-sized, peer-reviewed presentations for each session.

This year's expert speakers are Martin Barclay, Soraa; Richard Caple, Thorlux; Roger Sexton, Xicato; Graeme Shaw, Zumtobel. They will be joined by guest speaker Dr Eleanora Brembilla, research associate in advanced building daylight modelling at Loughborough University, who will be exploring the relationship between daylight and the circadian system and health.



Dr Eleanora Brembilla

- 10 October, Birmingham
- 13 February, Leeds
- 21 November, Dublin
- 26 March, Bristol
- 30 January, Manchester
- 23 April, Glasgow
- 4 June, London
- [www.cibse.org/sll](http://www.cibse.org/sll)



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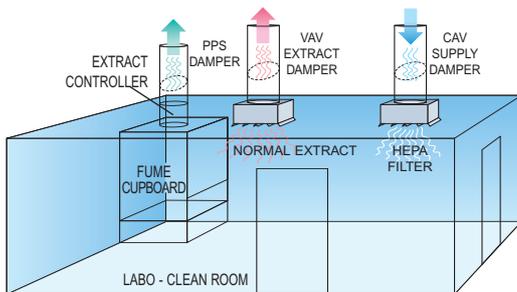


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