CIBSE JOURNAL

The official magazine of the Chartered Institution of Building Services Engineers

June 2016

CALIFORNIA SHADES IT

The story of the net-zero energy HQ that won CIBSE International Project of the Year

WEATHER WARNING
Avoiding overheating for future generations

FIELD DAY
New CIBSE President calls on engineers to make a stand

WITH THIS ISSUE *BIM Special*

www.cibsejournal.com

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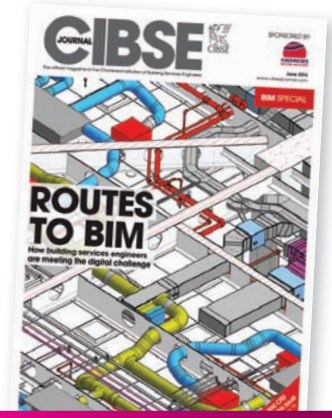

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BABYBOSS529/SHUTTERSTOCK

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LEARNING

CLASSIFIED

PEOPLE AND JOBS

CIBSE JOURNAL

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Decent exposure

John Field's inaugural address as President of CIBSE urged building services engineers to share their experiences to inspire the next generation of engineers. In his speech at the Royal Society, Field said that CIBSE members were influential in producing industry guidance and standards, but their excellent work often went unheralded in the wider building industry.

Field said the knowledge of CIBSE members was essential to ensure the energy efficiency of our future building stock, so it was vital architects and clients understood how key it was to get services engineers to input into project design at the earliest stage possible.

There are lots of examples of inspirational engineering in June's *Journal*, including a case study on the net zero energy Packard Foundation HQ in California, which was named International Project of the Year at the CIBSE Building Performance Awards. Impressively, the project team undertook a study to predict electrical plug-loads and recommended how these could be reduced. The services team made the design as energy efficient as possible, incorporating extensive solar shading, including the planting of mature trees that have helped bind the building into its Californian environment.

Designers are used to dealing with sweltering summers in California and, in the UK, it is now becoming a burning issue as homes become more susceptible to overheating. The impact of urban heat islands on building occupants is being exacerbated by rising global temperatures.

> Engineers' excellent work often goes unheralded by the wider industry

This means designers have to take into account higher predicted temperatures when devising services strategy. They have no choice in London, where Greater London Authority planning rules require buildings to be modelled using weather data files. These are published by CIBSE and contain three different hot summer scenarios that buildings have to be tested against using CIBSE's *TM52 The Limits of Thermal Comfort: Avoiding Overheating*. This is an example of why CIBSE is central to occupants' comfort and wellbeing – something Field says has to be more widely publicised.

Another ambition of his presidency is to broaden CIBSE's appeal. Dawn Bonfield, the chief executive of the Women's Engineering Society, says one way of ensuring inclusivity is to measure diversity in organisations to get a picture of whether things are improving. This is one helpful construction metric that I will be adopting for this magazine.

Alex Smith, editor
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NEWS

All the latest news from around the building industry

Movers and makers

Send your job moves to
editor@cibsejournal.com

Julian Sutherland FCIBSE has been appointed a partner at Cundall, where he will focus on building performance, Passivhaus and sustainable building design. Sutherland joined Cundall from Atkins, where he was director for environmentally sustainable design. He also spent nearly eight years at Arup, where he was associate director. Sutherland sits on the CIBSE Building Performance Advisory committee.

Willem Kok has been appointed head of IT and BIM at ChapmanBDSP. For the past five years, Kok was in the same role at Rogers Stirk Harbour + Partners, where he implemented a new overarching strategy and training programme to help the practice progress from legacy CAD tools and working methods to collaborative BIM, underpinned by a completely new ICT infrastructure.

Daniel Madden has been appointed director of S I Sealy & Associates. He joined the company in 2004 as a mechanical design engineer, after eight years working with ABB as a HVAC service and maintenance engineer. During his time at the practice, Madden obtained a first-class degree in building services engineering, and has become a chartered engineer and a CIBSE Low Carbon Consultant.

Horrific 'waste of talent and money' as employers spurn apprenticeships

● **Close to 50% drop-out rate from construction courses**

Only 12% of young people who start a training course in the construction sector go on to become apprentices, according to the Union of Construction Allied Trades and Technicians (UCATT), which labelled the numbers 'a calamity' for the industry.

After making a Freedom of Information request to the government's Skills Funding Agency, the trade union revealed that just 18,000 of 167,000 starters on industry training courses in 2014/15 went on to secure an apprenticeship.

Drop-out rates from apprenticeship courses are close to 50% – so, in 2013/14, only 8,030 apprentices completed construction apprenticeships. It was the fifth year in a row that apprentice training had fallen short of the government's target, said UCATT.

PHOVOIR / SHUTTERSTOCK

Only 8,030 people completed construction apprenticeships in 2013/14

'I'm horrified by these figures,' said the union's acting general secretary, Brian Rye. 'What a waste of talent and government money to take these young people through a course and then have them ignored by the construction industry.'

He accused construction employers of being 'complacent and self-serving'. 'We have a well-documented skills shortage in the construction industry, yet hundreds of thousands of young people who want to work in the industry – who have taken the first step into the industry by taking a course – are just left on the scrap heap,' Rye added.

The union called for major firms to talk to colleges, meet students and start 'giving them a chance'.

'In an industry that is crying out for skilled labour, we need to act now. It really isn't rocket science,' said Rye.

Field calls for industry to speak up

New CIBSE President John Field told the audience at his inauguration in London that building services engineers were among 'the most important professionals in the world', but did not have the status or influence to match.

He said CIBSE members helped billions of people deal with the fact that they spend, on average, 94% of their time in buildings and transport, but 'in many ways, our achievements remain behind closed doors'.

By speaking up as an industry, building services engineers can increase their influence in areas such as public policy and best practice in construction, to advance building performance for the benefit of the public, Field added.

'We are at the centre of everyday life. We make it work, and what we do betters the lives and health of billions of people around the world,' he said. 'What we do can be incredibly exciting and inspiring – we lead some incredible initiatives, work in amazing places and make a real difference.'

However, he said the profession was in danger of 'falling into a technology trap' and becoming 'slaves' to computers. 'We can't just chuck technology at problems', Field said, lamenting the fact that too many building technologies were not operating as well as they should. He urged the sector to focus on better commissioning and to avoid over designing systems.

Vice-president Paddy Conaghan said the performance gap Field highlighted was 'the great issue of our time'. 'If it was just a technical problem we would have solved it by now,' he said. 'It is about culture change and influencing the process, which requires different skills.'

Read our interview with John Field on page 20.

RIBA report hammers state of school buildings

POEs highlight competing design guidelines and unmanageable services

Overly complex building services are contributing to the poor performance of new school buildings, according to a report from RIBA.

Only 5% of 59,967 buildings – in 18,000 schools surveyed – were in top condition, performing as intended and operating efficiently, the report revealed. As a result, most schools are not providing conditions conducive to learning and are suffering from inflated operating costs. 'From damp, leaky buildings to serious issues such as exposure to asbestos, too many pupils are trying to learn in classrooms that are damaging to their health – and to their education,' the report said.

Almost all of the 500 teachers surveyed said good school buildings were crucial to improving children's learning and behaviour, but almost half said their schools were too small for the number of pupils, and a quarter rated the buildings as 'poor' or 'very poor'.

The report went on to look at specific failures in new-build schools and pinpointed significant problems with building services strategies.

'A lot of newer schools were driven to adopt overly complex strategies and systems, which overwhelmed school staff and quickly became unmanageable,' said Lisa Ann Pasquale, director at consultancy Six Cylinder, which carried out technical analysis of the post-occupancy evaluations (POEs) used to gather evidence.

She added that difficulties addressing multiple, competing design guidelines – such as acoustic and ventilation requirements – and a tendency to choose complex or 'maintenance intense' systems in a bid to improve SBEM or Breeam scores, had led to problems.

The report also noted that 'simple, robust, passive strategies, intuitive manual controls, and higher ceilings to absorb stale air' could create more comfortable conditions conducive to learning.

'Building services engineers could play a pivotal role by helping architects develop designs that minimise reliance on mechanical and electrical services, if they were brought into projects earlier,' said Pasquale.

Last year CIBSE published *TM57 Integrated School Design 2015*, which is aimed at the whole project team, not just building services engineers.

CIBSE Award Winner Wilkinson School: Only 5% of school buildings surveyed were in top condition.

Giant heat pump tackles fuel poverty

Glasgow Housing Association (GHA) has unveiled an industrial size air source heat pump that it believes could be a model for supplying low carbon heating and hot water across Scotland's existing social housing estates.

The 400kW/h unit – developed in partnership with energy consultants WSP Parsons Brinckerhoff, heat pump manufacturers Star Renewable Energy and Scottish Gas – is aimed at 'alleviating fuel poverty' in a 350-home, 1970s estate at Hillpark Drive, Glasgow. It is installed in an energy centre and connected to a centralised district heating network, which will deliver low carbon heat to six buildings plugged into the scheme.

The 8m-long, 10,000kg heat pump incorporates built-in controls to enable remote monitoring, and is expected to operate for more than 20 years.

The scheme partners say it can achieve higher water temperatures of 60°C, so allowing for regular radiators to be used in the homes, which currently have electric storage heaters.

GHA's energy and sustainability manager Colin Reid said the housing association had not even considered heat pumps at the outset, because it could not imagine them working on such a scale. 'However, this is a different beast,' he said.

Scotland has set a target to remove all carbon from heating systems by 2050.

Government struggling to fund building services

The government has invested lots of enthusiasm, but 'not much money', in the building engineering sector, Lord Martin O'Neill told CIBSE Patrons members and guests at their annual lunch in the House of Lords last month.

He said the government was also struggling to fund the apprenticeships it had promised adding: 'If we don't do something about that, we will not get anywhere near the government's targets for infrastructure and building.'

O'Neill, who is chair of the Building Services Engineering Employment Agency Alliance, said the industry had a 'major role to play' in ensuring plans for building new homes 'on a massive scale' go ahead.

'We need more imaginative ways of addressing the major challenges facing our political masters,' he told the gathering. 'For example, the glacial speed with which they are addressing the maintenance needs of this place (the Palace of Westminster) is extremely frustrating.'

US air con units 'could explode'

The US Environmental Protection Agency (EPA) has issued a warning that a large number of air conditioning units could explode because they have been retrofitted with illegal flammable refrigerant gases.

Hydrocarbon refrigerants are being used as substitutes for R22, which is being phased out. Using a propane-based refrigerant in equipment not designed for flammable refrigerants poses a threat to the user and the service engineer, the EPA said.

In a statement, it warned: 'Systems that are recharged with an unapproved alternative called "22a" can catch fire or explode, resulting in injury and property damage.'

The EPA also proposed a law that would list refrigerant products sold as 22a and all refrigerants identified as flammability Class 3 in ANSI/ASHRAE Standard 34–2013 as unacceptable for retrofitting residential and light commercial AC systems and heat pumps.

In brief

WIKI-STYLE GUIDE LAUNCHED FOR BIM

A free step-by-step guide to Level 2 BIM has been created by Designing Buildings Wiki and the consultancy PCSG.

It is an 'open access' site, with BIM users invited to contribute their experiences and information to help develop the tool, which is aligned to the standard PAS 1192-2 and the 2013 RIBA Plan of Work.

The site takes users through the Level 2 workflows, from storing project data to preparing the end user's information, and follows the NBS BIM Periodic Table and the BRE's terminology tool.

PCSG said the guide was not aimed at experts, but was designed to be helpful to employers, consultants, contractors and suppliers. It also has content aimed at building owners and facilities managers.

MOTT LAUNCHES BIM CARBON CALCULATOR

Engineering firm Mott MacDonald has launched a BIM 'carbon calculator', which it claims will cut the time to work out the carbon content of an individual project component from 15 minutes to 30 seconds.

The Carbon Portal allows users to drag and drop assets into the calculator, which then works out the lifetime carbon footprint.

The company believes this will make it easier for engineers to deliver more innovative solutions because the calculator focuses on the assets in the model rather than the materials – thanks to a digital catalogue containing each asset's embodied carbon.

Airtight new homes creating serious health problems

Evidence of poor ventilation in 200-home study

High levels of airtightness and poor ventilation are building up major health problems in new housing, according to a study by Glasgow School of Art's Mackintosh Environmental Architecture Research Unit (Mearu).

Researchers uncovered serious indoor air quality (IAQ) problems in a wide range of new homes that had been built to be 'airtight' and, as a result, were increasing instances of asthma and other respiratory problems in occupants.

Mearu studied 200 modern homes and found 'widespread evidence of poor ventilation, with bedrooms being a particular problem'. The unit has produced a public awareness film urging people to ventilate their homes properly by 'keeping vents or windows open when cooking, showering and cleaning; drying laundry near an open window; and opening windows at night'.

BRIZMAKER / SHUTTERSTOCK

'Poor indoor air quality is hard for people to detect,' said the head of Mearu, Professor Tim Sharpe, who added that people with chronic obstructive pulmonary disease and asthma were at particular risk. 'There are clear links between poor ventilation and ill health, so people need to be aware of the build-up of CO_2 and other pollutants in their homes, and their potential impact on health.

'Modern homes are increasingly airtight and can also contain a great number of pollutants and chemicals, many of which can have serious health effects.'

Hoare Lea partner, Ashley Bateson, said: 'The research shows the importance of ensuring occupants understand the impact of ventilation in a healthy home environment. Designers and builders also need to implement ventilation systems that are intuitive and easy to operate.'

Khan puts air quality at top of London agenda

In his first weeks as Mayor of London, Sadiq Khan has pledged to make tackling air pollution a priority. He is supporting a legal action against the government's record on air quality launched by the environmental law firm ClientEarth, which has been granted permission to present its case to the Supreme Court.

'The mayor was elected on a mandate to clean up London's air,' said a City Hall spokesman. 'As the mayor of the biggest city in the country, Sadiq Khan very much considers himself an interested party in the judicial review.' He will be setting out how and when he intends to take action on air pollution in the coming weeks, the statement added.

London breached its EU pollution limits for the entire year in only the first week of January, and evidence suggests poor indoor and outdoor air quality are responsible for 40,000 premature deaths in the UK every year. ClientEarth chief executive James Thornton said: 'This is an excellent opportunity for [Khan] to show leadership by setting out what action he will take and what support he will need from central government to achieve legal limits in London.'

Common metric seen as key to tackling the performance gap

- **UK-GBC report says output targets should be measured in kWh/m²**

The UK Green Building Council (UK-GBC) has outlined five 'key factors' that need to be addressed to improve building performance. They include adopting kWh/m² as a common metric to harmonise aspirations and improve communications across the supply chain.

A task group – sponsored by Buro Happold, Saint-Gobain, and Tarmac – has produced a 'delivering building performance' report, which outlines the measures that are needed to 'tackle the gap between building design and building performance'.

The task group recommends: a common aspiration, involving the use of a simple metric; collaborative contracting; designs for performance – not simply for compliance; a commitment to monitor and feedback, particularly during handover; and improved knowledge 'shared across the whole value chain'.

A performance target of 100kW/m² was set for the University of East London's Stratford library

UK-GBC chief executive Julie Hirigoyen said: 'The gap between the design intent of buildings and their performance in operation... means that, as an industry, we are not only failing to manage our carbon emissions, but also failing to manage our operating costs. In addition, we're compromising our ability to deliver other positive outcomes, such as health, wellbeing and productivity for occupiers.'

Hirigoyen said the report was an attempt to 'cut through the complicating noise around this issue', but added that the challenge was 'our willingness to change as an industry'.

Independent energy generation projects double in UK in four years

Onsite energy generation projects produced almost £100m worth of electricity last year and have doubled in number over the past four years, according to a report from the supplier SmartestEnergy.

Last year, 155 new projects were developed, with a combined capacity of 99MW, the *Energy Entrepreneurs Report* reveals. In total, 728 sites are now producing their own energy, accounting for 13% of all renewable projects and 6% of capacity.

'Energy entrepreneurs' outside of the traditional electricity supply sector invested £376m in more than 1,000 commercial-scale projects last year, according to SmartestEnergy, adding 2.4GW of new renewable energy capacity.

SmartestEnergy chief executive, Robert Groves, said: 'Energy entrepreneurs are small, nimble and innovative. They have attracted a global pool of capital to invest in Britain's renewable capacity and are taking advantage of technologies such as wind and solar, which are rapidly coming down the cost curve. They are starting to invest in battery storage, which will play a key role in our future energy system and offers exciting new business opportunities.'

The SmartestEnergy report highlighted an increase in independent solar generation of 83% in 2015, with 696 projects providing more than 2GW of capacity, despite numerous government cuts to subsidies that have supported the growth of the solar sector.

Groves insisted that investor confidence must now be restored. 'Government must ensure that the right framework is in place for continued investment in building our renewables capacity,' he said.

Government subsidy cuts to the Renewable Obligation (RO) scheme and Feed-in Tariff (FiT) has resulted in an unstable period for the UK's renewable energy sector.

Earlier this week, analyst EY reported that the UK's attractiveness as a destination for investment in renewable energy has reached an all-time low. It claims this is because of series of unexpected green policy U-turns and the ongoing uncertainty surrounding the role of renewables in our energy mix.

Lift off for energy storage

Speakers at an Energy Storage conference have predicted a bright future for the energy storage market, starting this year, but called for more health and safety guidance and legislation.

The audience at the BSRIA event, organised in association with CIBSE and ECA, heard that the cost of batteries is falling and manufacturers are poised to deliver new systems that – when integrated with renewable energy sources – could give the industry a major boost.

CIBSE technical director Hywel Davies presented on practical considerations when installing energy storage systems in buildings, and the need to design them for maintenance and replacement of potentially heavy components.'

Aecom's Ant Wilson urged the building services sector 'to tap into the sun' and reminded the audience that, with storage, it doesn't have to be a sunny day for systems to collect useful amounts of solar energy.

Gas network to play key heat decarbonising role

Converting the existing gas grids to carry hydrogen could play a crucial role in the UK's strategy for decarbonising heat.

A report by Imperial College, supported by the Energy Networks Association (ENA), says using 'green gas' in the existing grid network would reduce cost and minimise disruption, while also allowing consumers to continue using existing gas-fired boilers.

It calls for more pilot studies to be carried out to determine the feasibility of hydrogen production and distribution processes.

'This latest report demonstrates that – while there is no "silver bullet" for meeting our decarbonisation challenge – the gas networks will play a crucial role in ensuring security and affordability in a sustainable energy future,' said ENA director of policy Tony Glover.

The report is available at **http://bit.ly/1Tlm4lk**

Have you updated your CIBSE CPD records?

All members are required by the Code of Professional Conduct to maintain their professional competence.

CIBSE is due to undertake its annual audit requesting CPD records from 500 members across the world.

Many members already use the online CPD portal and we are pleased to see the range and breadth of activities members are undertaking.

The annual CPD audit selects members at random from a range of membership grades and locations around the world.

Carilyn Burman, director of membership, said: 'CPD is a long-term commitment to enhancing your competence, as required for CIBSE membership and Engineering Council registration.'

CPD is not limited to attending formal lectures and seminars. It can include a variety of activities including: on-the-job learning; private reading and study; CIBSE regional; group, society or network meetings; academic studies; professional institution committee work; supporting or mentoring others.

Find out more at **www.cibsecpd.org.uk**

#build2perform launched

A new hashtag for all Twitter content related to building performance has been launched by CIBSE.

As Arup's Fiona Cousins said in the CIBSE Annual Lecture: 'If we are going to save the world we have to go further than our own building performance to make that happen.'

The new hashtag will bring together all the knowledge and opinion CIBSE produces, helping to increase our collective knowledge and make it more accessible – and to shout about our industry achievements.

Technical report route to registration is no giant leap

Case studies detail career progression of Members

The CIBSE technical report route is for engineers working at a high level, who may not have the formal academic qualifications required to achieve engineering council registration.

Through this route, applicants apply for Associate (ACIBSE) or Member (MCIBSE) first. Once successfully elected, individuals can then proceed through the technical report process to gain IEng or CEng.

In the technical report, individuals are required to select a topic from their work experience, submit a technical report and sit an interview to demonstrate that they are operating at the level of an incorporated or chartered engineer. Individuals must demonstrate

their specialist knowledge to achieve engineering council registration.

We have recently updated our suite of case studies detailing the careers and the progression routes of a range of CIBSE members.

James Outram, former chair of the CIBSE South West Region, was elected MCIBSE and went through the technical report process in 2014. 'When I submitted the finished report, the interview with CIBSE was fairly straightforward because it was about the report and what I had learned.'

Wally Gilder (pictured) was elected Fellow in 2014 and will soon go through the process to gain his technical report.

He said: 'Once the stepping stones had been laid out, what seemed a giant leap became a few simple steps, requiring a few hours of form filling and digging into the past.

'I would recommend that anyone considering the process speaks to the membership department, gets involved with their CIBSE Region and mixes with the membership – there, they will find all the help and encouragement they need.'

Visit **www.cibse.org/membercasestudies** to view the complete case studies.

Contact us on **membership@cibse.org** or +44 (0)20 8772 3650 if you are interested in finding out more.

SLL HERITAGE PROJECT SCOOPS LIGHTING AWARD

The Society of Light and Lighting (SLL) has scooped the Heritage Project of the Year award for the Night of Heritage Light (NOHL) at the Lighting Design Awards.

NOHL saw nine UK Unesco World Heritage Sites illuminated by the SLL. The event aimed to promote lighting as an art form and a science, by creating a 'light map' across the country.

See 'Our Leading Lights' in November's *CIBSE Journal*.

New officers take CIBSE reins

From left: vice-president Paddy Conaghan; immediate past president Nick Mead; CIBSE President John Field; and vice-president Tadj Oreszczyn

John Field FCIBSE took up office as the new CIBSE President at the institution's AGM on 5 May, taking over from Nick Mead.

CIBSE also welcomed Peter Wong FCIBSE, as president elect, and senior officers, including:

- Immediate past president Nick Mead FCIBSE
- Treasurer Stuart MacPherson FCIBSE
- Vice-president Paddy Conaghan FCIBSE
- Vice-president Stephen Lisk FCIBSE
- Vice-president Tadj Oreszczyn FCIBSE

The newly elected board member is Lynne Jack FCIBSE.

Thank you to all who nominated and voted. See **www.cibse.org/board** for details. The full AGM minutes will be published in July's *CIBSE Journal*.

Read our interview with John Field on page 20.

ESOS certification briefing for Scottish contingent

- **Energy professionals updated at symposium**


Delegates at the CIBSE symposium

A CIBSE Certification briefing event, which coincided with April's CIBSE Technical Symposium, took place at the Carbon Innovation Centre, Edinburgh University.

As well as the ESOS to 50001 topic, the briefing covered some of the developing issues for energy professionals working in Scotland.

Richard Atkins, representing the Royal Incorporation of Architects in Scotland, gave an update on the development of a non-domestic certifiers of design scheme for Scotland Building Regulations, Section 6.

It will accommodate an accelerated application for individuals on the CIBSE Certification LCC (Scotland Design) Register.

Steven Scott, of the Scottish Building Standards Division, explained the Assessment of Energy Performance of Non-Domestic Buildings (Scotland) Regulations 2016 – a consequence of Section 63 of the Climate Change (Scotland) Act 2009 coming into effect in September.

This regulation also introduced the role of Section 63 Advisor, as well as Display Energy Certificates (DECs) for Scotland, with the side-effect of facilitating the use of DECs for ESOS compliance, where appropriate, in Scotland in 2019.

Lynne McNaughton, of the Scottish Environment Protection Agency, updated delegates on the agency's approach to ESOS compliance and enforcement.

The final presentation, by Andrew Geens, head of CIBSE Certification, explained how ISO 50001 could be used for ESOS compliance and how CIBSE's certification scheme – Low Carbon Consultant Energy Management Systems –complemented CIBSE's role as a certification body for Energy Management Systems (ISO 50001).

For more information go to the news link on **www.cibseenergycentre.co.uk**

In brief

UNDERGRADUATE PRIZE OPEN FOR ENTRIES

A reminder that applications are still open for the President's Prize 2016: The CIBSE Undergraduate Award.

The award, sponsored by Hays Building Services, is open to all final-year building services engineering (or related) BSc, BEng and MEng CIBSE student members.

To enter, you must submit a 2,000-word synopsis of your final-year project. The winner will receive £500 and a trophy, and two runners-up will receive £100 each. For more information and to download your application form, visit **www.cibse.org/awards**

The closing date for entries is 22 July.

CIBSE YORKSHIRE AWARDS

There is still time to enter the CIBSE Yorkshire Awards.

Held on 18 November, the event recognises the outstanding individuals, companies and projects within the building services industry in Yorkshire.

The event shares three categories with the CIBSE Building Performance Awards, and entrants can use the same entry, project and information for both.

For a full list of categories, and to enter, visit **http://bit.ly/1Z0VmPv**

The closing date for entries is 22 July, with the shortlist being announced on 9 September.

WOMEN IN ENGINEERING DAY

CIBSE will be supporting National Women in Engineering Day on 23 June by celebrating the contribution of its female members.

The UK-wide event was set up by the Women's Engineering Society (WES) to support, inspire, celebrate and raise the profile of women in engineering.

It also aims to draw attention to the varied careers in engineering available for girls and young people.

The theme of the day is Raising Profiles, and the list of 50 influential women in engineering will be released on the day.

WES has a resource pack available to download at **www.nwed.org.uk**

New members and fellows

FELLOW

Blair, Colin Ronald
Huddersfield, UK

Brannigan, James Gerard
Glasgow, UK

Cheshire, Steven
Southsea, UK

Cullen, Karl Alexis Patrick
London, UK

Dellow, Andrew John
Fowey, UK

Gomeseria, Ronald
Doha, Qatar

Logan, Conor
Havant, UK

Maxwell, Alan
Glasgow, UK

Shahid, Mohammed Rehan
Dubai, UAE

Smith, Rory Stephen
El Cajon, USA

MEMBERS

Ahmed, Abdullahi
Coventry, UK

Algharbawy, Hany
Doha, Qatar

Buxton, Kirk Paul
Leeds, UK

Chai, Vui Shin
Tampines, Singapore

Chan, Sze Lok
San Hui, Hong Kong

Chan, Kwok Wing
Tuen Mun, Hong Kong

Chan, Wai Kin
New Terriotries, Hong Kong

Chan, Wai Tung
NT, Hong Kong

Chau, Chun Wa
Kowloon, Hong Kong

Chau, Pui Kit
New Territories, Hong Kong

Cheng, Chung Nim
Des Voeux Road West, Hong Kong

Cheung, Wai Yan
Kowloon, Hong Kong

Cheung, Yat Ming
Kowloon, Hong Kong

Ching, Wai Tao
New Territories, Hong Kong

Choi, Foon Tin
NT, Hong Kong

Chu, Ho Yin
Fanling, Hong Kong

Chung, Mei Lin
Diamond Hill, Hong Kong

De la Coba, Manuel Santos
London, UK

Favoino, Fabio
London, UK

Fisher, Ryan
Dereham, UK

Fung, Kwok Hong
NT, Hong Kong

Hayes, William Patrick
Perth, Australia

Hoggard, Saul
Tauranga, New Zealand

Kozak, Magdalena
Berlin, Germany

Kwan, Hau Lim
N.T, Hong Kong

Kwok, Chi Wai
Shau Kei Wan, Hong Kong

Lam, Yan Kit
NT, Hong Kong

Lam, Ka Yan Dora
Shatin, Hong Kong

Leung, Wai Hong
Shatin, Hong Kong

Leung, Kwan Hao Andy
Shatin, Hong Kong

Leung, Pui Man
Sha Tin, Hong Kong

Lin, Chung Keung
To Kwa Wan, Hong Kong

Lin, Wan Fuk
Mei Foo, Hong Kong

Mak, Ka Kit
Shatin, Hong Kong

Ng, Shui Kwan
Cheung Sha Wan, Hong Kong

O'Connor, Padraic
Termonfeckin, Republic of Ireland

Papadopoulos, Paul
Walsall, UK

Pallet, Ian
Romford, UK

Pun, Siu Wo
Shatin, Hong Kong

Quail, Hugh
London, UK

So, Pak Yee Peony
North Point, Hong Kong

Sum, Wai Yeung
Happy Valley, Hong Kong

Tsang, Ka Yui
Quarry Bay, Hong Kong

Turley, Stephen
Essex, UK

Wong, Kar Lok
Kowloon, Hong Kong

Yan, Li
Kowloon Tong, Hong Kong

Yeung, Bik Wah
NT, Hong Kong

Yeung, Kwok Hei
Kowloon, Hong Kong

Yu, Lawrence
Dubai, UAE

Yuen, Tat Chi, Matthew
Tsuen Wan, Hong Kong

ASSOCIATE

Beaman, Mike
Manchester, UK

LICENTIATE

Blades, Nathan
Upminster, UK

Buk, Roman Stanislaw
London, UK

Chapman, Sean
Nottingham, UK

Donoghue, Richard
Rochdale, UK

Green, Steven
Edenbridge, UK

Howden, Colin Douglas
Edinburgh, UK

Lawrence, Chelsea
Birmingham, UK

Lawrie, David
Edinburgh, UK

Rowan, Allan
Paisley, UK

Wallace, Douglas
Dalkeith, UK

Wynn, Ashley
Birmingham, UK

Green MOVEMENT

After being inspired by 2015's Green Sky Thinking Week, CIBSE's **Sara Kassam**, was thrilled that the Institution contributed three events to this year's programme...

Engineering and ecology

The CIBSE Resilient Cities Group challenged industry and academia to create healthier, more sustainable and resilient offices by incorporating green infrastructure into their designs. The event took place at London South Bank University's Clarence Centre for Enterprise & Innovation, and was co-organised by the Adaption and Resilience in the Context of Change (ARCC) network and CIBSE.

The interaction of indoor plants with heating, cooling, acoustic management, air quality, staff productivity and wellbeing is an exciting and growing area of research. Rapid technical talks were given on: improving the human environment (John Dover, Staffordshire University); building services and facilities management (Dusty Gedge); the importance of plant choice (Tijana Blanusa, University of Reading and Royal Horticultural Society); and practical implementation (Alan Fogarty, Cundall). Some key messages were:

- Making the economic and social case to clients for green infrastructure can be tough
- Industry needs a guide to plants for building services engineers, outlining what different species 'do'
- Green infrastructure systems are increasingly sophisticated but maintenance is key to success.

Teams spent the week devising green infrastructure solutions for office space. The winning entry was Biospace, by Ceri Morrice and Rui Manuel Dias, from the Royal College of Arts, mentored by Rita Margarido from Canary Wharf Group.

All materials and presentations are now available at **http://bit.ly/1shiC1g** Find out more at **http://bit.ly/24SjomB**

An urban climate walking tour

This event, hosted by Julie Futcher of Urban Generation, was so popular that it was run twice. The purpose of the tour was to raise awareness of the interdependent relationship between aspects of the urban form – such as street dimensions and orientation – and function (transport and building cooling) that create indoor and outdoor climates.

The two-hours walk offered a different perspective of central London. From 'walls' of buildings that trap heat and pollutants, with no gaps for through-flow, to PVs on the Heron Tower being shaded by a new building opposite. It showed the importance of having the right building in the right place, and that architects need to consider building form as an energy management parameter.

Designing for health and wellbeing: practical experiences

Research by sustainability consultancy Greengage has shown that industry professionals believe a knowledge gap and a lack of quantitative evidence of the benefits are key barriers to incorporating health and wellbeing measures within the built environment.

Grosvenor's Barton Park scheme in Oxford, part of the NHS Healthy New Towns initiative, has adopted health and wellbeing principles from the outset, and could provide a test bed for measuring the outcomes of particular design intentions. NHS Healthy New Towns is an intriguing scheme aiming to create urban environments that promote health and wellbeing, prevent illness and keep people independent.

There was a seminar on 'Improving health and wellbeing in the workplace with sensory gardens', organised by the CIBSE Intelligent Buildings group, the Feeling Good Foundation and ARCC Network. This discussed how gardens can help reduce stress levels of workers and improve productivity.

The practical focus of Green Sky Thinking Week is its main strength, creating the space for a collision of ideas, people and activity that can improve our built environment. **CJ**

SARAH KASSAM is head of sustainability at CIBSE

> We need a guide to plants for building services engineers, outlining what different species 'do'

Feedback

A reader suggests that Brexit may be a solution, and CIBSE LinkedIn Group asks if we need new benchmarks

Global market can fill skills gap

The assertions made by Steve Hale ('Brexit is not the solution', *CIBSE Journal*, April 2016) need to be challenged. If we require a trained workforce, it should, ideally, be UK educated. However, if more people are needed from overseas, they can be found all over the world. Brexit does not mean they will be barred from entering, just that a UK government has the power to decide who can work here.

It is ridiculous to suggest that Brexit would exacerbate the skills shortage, when the reverse is the case. We will attract a quality workforce from around the world. For those not around before the EU, I can categorically state that we employed staff from outside the UK, holidayed in Europe, and many UK citizens lived on the Costa Del Sol.
Stephen Peliza MCIBSE

CIBSE LinkedIn Group members ask if DECs are still a useful benchmark

Matt Snowden
UCL doctoral student Sun-Min Hong blogs about his research on DECs. See his blog at **http://bit.ly/22f5cPu**

Stuart Gray
This is a great example of the power of acquiring data on scale. Could smart meter data be fed into benchmarking and design principles?

Tony Johnstone
Would be good – essential even – to take the initiative away from Whitehall.

John Field FCIBSE
I agree – it's with the government at present and they're not very interested, so it will continue to drift away from being useful. For example, not dealing sensibly with procedure changes for large sites. A whole process with incentives for the 'doers' is needed; market traction for the owners/occupiers (evidence of effectiveness and publicity); a link to design performance and an optional process for internal environment/occupant satisfaction. Then people will use it.

> Current Guide F and TM46 do not differentiate on building age

Graham Smith FCIBSE
Benchmarks are essential, and the more representative they are of the real world, the better. Current Guide F and TM46 do not differentiate on building age. Buildings can exceed their design energy use by a significant margin. Expectations can often be exceeded in that lead plant – such as CHP or biomass – is assumed to work at full capacity when there is adequate load. In practice, this is often not the case. I'm frequently asking for BMS data to analyse what is happening with a building, and it is clear that it is uncommon to do this.

CIBSE Journal welcomes readers' letters, opinions, news stories, events listings, and proposals for articles.
Please send all material for possible publication to: editor@cibsejournal.com or write to: Alex Smith, editor, *CIBSE Journal*, CPL, 1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PB, UK. We reserve the right to edit all letters.

CREDIT: DR DAVID STERN

A personal tribute to **Professor Sir David MacKay**

Max Fordham's **Joel Gustafsson**, who worked with the professor on the CUED building, remembers a 'great thinker and passionate achiever'

Physicist and mathematician David MacKay died of cancer on 14 April 2016, aged 48

I can vividly recall my secondary school physics teacher confidently proclaiming that Britain – as an island – could produce all of the electricity it could possibly need, just as soon as we understood generating electricity using the ocean's waves. It was a misconception I held onto for many years, until I read Professor Sir David MacKay's book *Sustainable Energy – Without the Hot Air*.

David's work is as accessible and clear as it is thorough and robust. As I read the chapter – and all its references – on wave power, I realised three things:

- I had been a fool not to question my teacher
- Similarly held misconceptions are rife
- The route to the sustainable use of energy was going to rely on reducing energy demand. The silver bullet of bountiful renewable supply isn't there.

I'm certainly not the only person at Max Fordham to have been inspired by this book.

Energy demand reduction is what I set out to achieve on all projects, and David shone a light on the importance of this aim. Not only does his book frame the issue of sustainable energy but, crucially, it also highlights the importance of robust quantification in addressing technical issues. Through applying David's method of thinking to my work, I came to know him in January last year.

The Cambridge University Engineering Department (CUED) was starting the process of moving to new buildings in west Cambridge. David was tired of new buildings receiving awards for their 'sustainability credentials' despite soaring energy demands. He was very keen to insert his clarity of thought and passion for arithmetic into the design and procurement process. So he approached us, and a number of other industry professionals, to work out how this could be achieved. After a number of workshops and discussions the 'Energy/Cost Metric' was created.

At a theoretical level, this is a simple equation that calculates five lifetime energy demands alongside each other – material production, material transport, reclaimable energy from recyclability, in-use energy and people transport.

Cost is a major component, reflecting an implicit understanding that every project works to a financial reality; energy-saving at a high cost premium might work for niche buildings, but cannot be expected to be widely applied when cost efficiency is a large driving force.

These equations helped answer questions, such as is it better to: spend more money on better glass to reduce heating loads; substitute concrete for cross-laminated timber to reduce embodied energy; or install a heat pump to reduce the imported energy for a given load?

Despite his diagnosis and ongoing treatment, I was fortunate enough to work alongside David, and many other CUED academics, implementing his ideas to their first engineering faculty building. This has been professionally challenging and refreshing.

Like so many others, I feel deeply saddened that David has died. He was a great thinker and a passionate achiever. His death, in April, is a loss to all who knew him, as well as those who didn't.

'I will be approaching Addenbrooke's to offer a feasibility study pro bono. I like to think that David would deem this an appropriate gesture for the positive influence he has had on me, those within our practice and the wider industry'

He'll never get the opportunity to quantify and communicate the outcome of his intervention into building design and energy efficiency. I feel it is our job to ensure that the work carried out is carefully followed through, to see the first CUED building showcased to the wider industry. This may well be the first step to building performance being embedded in legislation.

One of his final blog posts is an open letter to Addenbrooke's Hospital, where David spent his final days. In it, he issues a plea that the hospital invests in building refurbishment to reduce overheating, and the discomfort it causes to patients.

I will be approaching Addenbrooke's to offer a feasibility study pro bono. I like to think that David would deem this an appropriate gesture for the positive influence he has had on me, those within our practice and the wider industry.

He will be missed.

QUEEN'S SPEECH BACKS CLEAN TECHNOLOGY

The Queen's Speech marks a new session of parliament, setting out the legislative programme for the coming year. **Hywel Davies** looks at what it holds and reviews other recent developments

The Queen's Speech set out the government's programme for the next year. In contrast to recent years, it was almost silent on energy matters.

A 'Better Markets Bill' seeks to 'improve Britain's competitiveness... open up markets, boost competition and give consumers more power and choice and make economic regulators work better.' It promises to give consumers 'more power and choice through faster switching', give greater consumer protection when things go wrong, improve the way regulators operate and cut red tape. This addresses the manifesto commitment to increase competition and consumer choice in the energy market.

According to the government, enhanced consumer power will be a key element, seeking to encourage customers to switch providers and get a better deal, '[helping to] keep bills as low as possible'; there is no mention of using energy more effectively.

The Bill will seek to create more open markets by ensuring they are 'competitive to keep costs low and deliver for bill payers'. It will implement the Competition and Market Authority's recommendations to promote competition.

A 'Wales Bill' will devolve powers to the National Assembly for Wales over energy, transport and elections, giving it control over consents for onshore wind projects in the principality. In addition, Welsh Ministers will be able to give consent for other onshore and offshore energy projects up to 350 megawatts.

Finally, under the heading 'UK Role in the World', the government restates its commitment to 'reducing emissions and increasing investment in clean energy technologies following the Paris climate agreement'. The government is also 'using the transition to a low carbon global economy to maximise commercial opportunities for the UK in areas of British expertise'.

> There is no mention of reducing bills by using energy more effectively

These are the only references to energy in the speech. While the Markets and Wales Bills largely address supply and regulatory matters, the commitment to clean energy technology may be more relevant to some *Journal* readers; it remains to be seen how that commitment will be manifested in practice. Two signs of how this may pan out emerged in the past month:

The Housing and Planning Act 2016

This achieved Royal Assent on 12 May. Although some peers sought to reinstate a legislative commitment to zero carbon building, the government twice removed the amendments. A compromise was reached in the form of a review of the energy requirements of the Building Regulations.

Some may see this as a triumph for the dissenting peers but, under the Energy Performance of Buildings Directive, the government has to review its minimum energy efficiency requirements by 2018. It is not clear what the government has conceded, but it has conjured a face-saving formula from the European requirement.

Building Regulations

Updated versions of the four Approved Documents under Part L of the Building Regulations were published in April. There are no technical changes, with amendments principally reflecting withdrawal of Regulations 29 to 33 of the Building Regulations 2010 and their replacement by Regulation 7A of the Energy Performance of Buildings (England and Wales) Regulations 2012,[1] as well as revised wording of Regulations 24, 25, 26, 26A, 27 and 27A of the Building Regulations 2010.

The government says: 'The amendment regulations give, for the first time, a definition of the "energy performance of a building", and revise the definition of "operational rating" and amend the definition of "asset rating" in regulation 24 of the Building Regulations.' Readers may wish to review the change in detail,[2] form a view on whether they merely alter the wording without making any technical changes, and consider implications.

Part R – High Speed Broadband infrastructure

The amendments to the Building Regulations introduce a new Part R, which requires incorporation of physical infrastructure for high-speed electronic communications networks into new buildings. A new Part 9A (physical infrastructure for high-speed electronic communications networks) in the main Building Regulations covers application of Part R to buildings outside the scope of the Building Act 1984 (c.55), for interpretation, and for exemptions. A new Approved Document R: Physical Infrastructure for high-speed electronic communications networks, has also been published.

All Building Regulations changes came into force on 6 April 2016.

The final recent change is that to the Planning Portal, which provided a single source for all government planning and Building Regulations documents. It has now been absorbed into the gov.uk website; **http://bit.ly/1TpacNZ** facilitates access to a number of documents relating to the Building Regulations.

References:

1 Readers may note the irony of replacing aspects of the Building Regulations that apply in England with a new Regulation in the Energy Performance of Building Regulations that cover both England and devolved Wales.

2 For a comprehensive list of the changes, go to **http://bit.ly/22gXog6**

● **HYWEL DAVIES** is technical director at CIBSE **www.cibse.org**

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HOW DATA CAN HELP CLOSE THE GENDER GAP

While attending the CIBSE Presidential lecture last month, **Dawn Bonfield**, chief executive of the Women's Engineering Society, was struck by the low number of women in the industry. She believes measuring female participation in membership bodies is a vital step towards inclusivity

In 2015, I was commissioned by David Balmforth, the then president of the Institution of Civil Engineers (ICE), to write a report called *Disruptive Diversity*. I looked at how ICE could embed diversity into its five-year business plan, and some of the recommendations I make in the report may be useful to CIBSE and its President, John Field, who has put diversity at the top of his agenda.

The first thing to say is that change won't happen unless you really want it to – and if you really want it to, you need a plan.

To make a plan, however, you need the whole institution to own the idea; it needs to come from the top. This is not something that can be imposed as an add-on – it requires a complete change of mindset, and that mindset takes the form of 'inclusivity'.

Like health & safety and ethics, inclusivity is an overarching principle that needs to become embedded into the engineering sector so that it affects everything we do. It is like looking through a lens – and if you are used to ensuring all that you do is safe and ethical, it should be relatively straightforward to become inclusive.

And once you begin to see inclusivity – or, more often than not, the absence of it – you will never be able to 'unsee' it.

The concept of inclusivity is applicable to everyone; we can all be inclusive. Diversity, on the other hand, is often difficult to sell. It's hard to be more diverse than we are – after all, we can't turn ourselves into something we are not.

What we can do, however, is encourage diversity by having inclusive behaviours and putting in place plans that help to promote diversity. So what can be done to ensure inclusivity?

Growing influence: Lynne Jack FCIBSE, deputy head of the School of the Built Environment at Heriot-Watt University, has been elected onto the CIBSE board

> Inclusivity is the business of everyone – individual members, staff and the governing body

The first step is measurement. I don't mean the static headline figures that tell you how many members you have from a variety of under-represented groups, but the measures that give a real picture of what is happening.

When are women joining the industry and when are they leaving? Are they attending your conferences and events in the same proportions as men, and are they accessing the website or recording their continuing professional development (CPD) in the same proportions?

Is the journal you produce diverse in its use of images and contributors and do you have a diverse – and aspirationally proportional – range of speakers at your events?

These are the things you need to be aware of, to measure on a regular basis and report on as a standing item at board meetings. In this way, you will start to get a picture of how things are changing and whether things are improving.

You should also be aware of how diversity looks in your sector – from the number of university undergraduates there are to the number of professionally registered building services engineers in industry – and how these figures change with time.

This work, by the way, is not the role of your women's network: inclusivity is the business of everyone – individual members, staff and the governing body.

Once you have a good handle on what things currently look like, it will be relatively easy to come up with ways to make improvements. You will see where your industry is lacking and be able to discuss ways to make changes.

There are very many things that can be done. Some will be easy and quick wins, and others will be more difficult and take more effort – but the important thing is that you are aware of them, you are owning them, and you are moving, measurably, in the right direction.

Once you have started on this journey of inclusivity, and put on the inclusivity lenses, hopefully there will be only one way forward.

● To read the ICE Disruptive Diversity report go to **www.wes.org.uk/disruptivediversity**

● **DAWN BONFIELD** is chief executive of the Women's Engineering Society

'WE HAVE INFLUENCE, NOW WE NEED TO INSPIRE'

New CIBSE President **John Field FCIBSE** is keen to work with members to broadcast the excellence of the building services industry, and to capture the imagination of professionals working in every aspect of building performance. **Alex Smith** reports

'CIBSE is no longer just about the plantroom and thermostatic valves,' says CIBSE President John Field. 'We've got to take on wider issues, such as reduction of resource use and air quality.'

Field was speaking shortly after his presidential address at the Royal Society, where he told the audience that CIBSE had an opportunity to communicate well beyond its core building services audience. He said CIBSE was a growing institution, and that the expertise of its members was becoming increasingly important to building occupiers as their focus broadened from energy efficiency to factors affecting comfort, such as indoor air quality and good lighting.

According to Field, CIBSE was 'at the heart of buildings' in terms of design, construction and maintenance, and – in a memorable conclusion to his address – he described building services engineers as being 'at the centre of life' and in a prime position to make a real difference to billions of people's lives.

Field spelled out his vision for the Institution: CIBSE should build on its knowledge base and members' expertise to increase its influence for the public good. At the core of his speech was a call for engineers and CIBSE to inspire those around them.

Field is an urbane man, and eloquent speaker, who describes with clarity the issues affecting building services and the wider environment. He believes engineers have to learn to speak the language of the client, and minimise tech-speak when communicating with non-engineers.

He says CIBSE should raise its profile across the industry and broadcast its expertise to companies, regions, politicians, legislators and students. 'We spend our whole time in buildings, and services engineers make it work. People don't realise that,' says Field.

'There is a great opportunity for engineers to raise their profile. We have got influence, but we could be inspirational. We've got to speak up.'

Field says CIBSE has to 'make a noise' about issues that interest people, and be seen 'to be taking a stand' on matters such as indoor air quality.' It is also important to communicate how rewarding and inspiring the industry is, in order to attract new talent.

Field was drawn to it from the nuclear industry because building services was 'buzzy and lively', and he could see opportunity to be 'idealist' and work in a profession that was beneficial to the environment. One cutting-edge, low-energy project that Field became involved in was the Ideal Home solar house in 1981 – a groundbreaking building that he helped design and commission.

Field is still at the forefront of energy efficiency, in the area of energy performance contracting (EnPC). This has the potential to force project teams to collaborate more closely, to deliver guaranteed building performance – but it is a fiendishly complex form of contract. Field is one of the industry's foremost experts and is chair of the Energy Performance Contract Group at the Energy Systems and Technology Association. He drew up the energy performance clauses for the major services upgrade at Rampton Hospital in Northamptonshire, which involved a new energy centre and heat network upgrades. Without his financial, project and design engineering skills, the work would probably not have got off the ground. Field believes EnPCs are a great way forward, but says the industry needs to be simplified before it really takes off – it 'hasn't yet had an iPad moment'.

According to the new President, communicating its expertise and enthusiasm with its own membership is another priority for CIBSE. He has pledged to work closely with the Institution's regions, groups and societies, and to do a tour of the regions. 'They are the heart of the Institution and a lot of members only see CIBSE through them,' he says. 'The groups are often where the technical aspects of the Institution are crystallised and where real progress is made.' Field believes a vibrant and relevant network of groups, regions and societies is vital to attracting younger engineers to CIBSE.

He is also keen to make CIBSE more inclusive. In his address, Field highlighted a Victorian photograph of members of CIBSE's predecessor, the Institution of Heating and Ventilation Engineers. He noted that the men in the picture all looked the same – even down to the shape of their moustaches – and said that a similar picture of CIBSE now, 120 years later, would not be much more diverse. 'We need to move it on,' says Field, who is delighted that Lynne Jack FCIBSE has joined the CIBSE board – but he believes a greater representation of women is needed.

The next year promises to be an exciting one as Field attempts to push the Institution further into the limelight. 'CIBSE should have more of a presence around debates on the built environment,' he says. 'We need to show how we are making a difference.'

ABOUT THE PRESIDENT

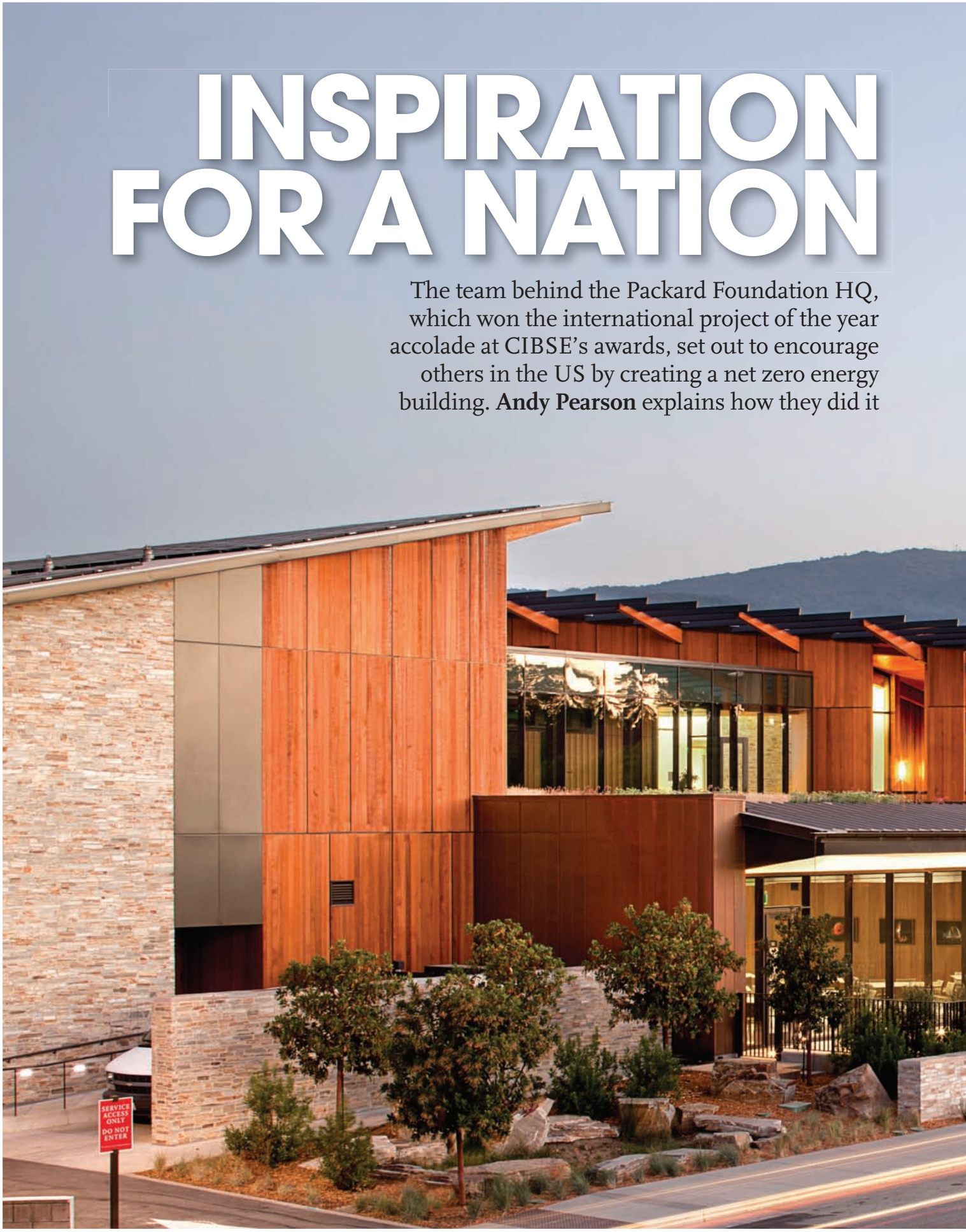
John Field is founding director of energy management consultancy Native-Hue, and has been at the heart of UK energy management developments for 30 years, having founded Target Energy Services in 1985. He joined Power Efficiency as a director in 2007 and built up an energy and carbon management team that moved, with Power Efficiency, to Balfour Beatty in 2011. As energy services director at TEAM (EAA Ltd) from 2012 to 2014, Field developed the renewable heat business and supported major energy performance contract projects for large-scale energy improvements at hospital trusts. He is chair of the Energy Performance Contract Group at the Energy Systems and Technology Association.

> A vibrant and relevant network of groups, regions and societies is vital to attract younger engineers to CIBSE

WATCH NOW
Watch John Field's presidential address at **www.cibse.org/president**

INSPIRATION FOR A NATION

The team behind the Packard Foundation HQ, which won the international project of the year accolade at CIBSE's awards, set out to encourage others in the US by creating a net zero energy building. **Andy Pearson** explains how they did it



The Packard Foundation was set up by David Packard, co-founder of Hewlett Packard, and his wife, Lucile, to give grants to not-for-profit organisations, including those working to conserve and restore the Earth's natural systems.

Given its remit, it will come as no surprise that the organisation – when looking for new headquarters in Los Altos, California – used the opportunity to inspire others to build more sustainably.

The Foundation wanted its HQ to be a net zero energy building, one that would generate as much energy over a year as it consumed. To achieve this, it worked with a design team that included MEP engineer Integral Group – whose San Jose office was the first certified net zero energy building in the USA – and EHDD Architects.

The £25.5m facility the team designed opened in July 2012 and, nine months later, the scheme had met its net zero energy target. In fact, by the end of the year, the scheme had generated 67MWh more energy than it had used. This outstanding achievement was recognised by the judges at this year's CIBSE Building Performance Awards, where the scheme won the Project of the Year – International category.

Underpinning the Packard Foundation headquarter's net zero energy credentials is its low-energy design, which minimises the amount of energy needed to maintain a comfortable working environment.

CIBSE BUILDING PERFORMANCE AWARDS 2016

WINNER

Entries for the CIBSE Building Performance Awards 2017 are now open. The deadline for entries is Thursday 15 September. Visit **www.cibse.org/bpa**

ENERGY USE

- **Designed/simulated:** 277MWh
- **Actual:** 351MWh
- **Annual electricity generated:** 418MWh
- **Net energy use:** -67MWh

The architect, engineers and contractor worked together to complete a climate and weather analysis, and a daylight and sun-path analysis. They also initiated a study to predict electrical plug-loads, and made recommendations as to how these could be reduced. 'You have to start by designing a building to minimise all envelope loads,' says Eric Soladay Solrain, managing principal of Integral Group.

The analysis-driven design for the 4,500m² scheme has resulted in two slender, two-storey wings of offices flanking a central courtyard incorporating mature trees. This courtyard is enclosed by smaller blocks – housing meeting rooms and communal spaces – at each end, linking the office wings.

To minimise the building's visual impact, the architect has orientated it to align with the local street grid, so the long façade of the building faces south west, 40 degrees from due south. 'The orientation created a challenge from an energy-use and comfort perspective; we'd have preferred to orientate the building with its long façade facing due south, to control solar gain,' Solrain says.

The weather and sun-path analysis informed the solar-shading design to prevent unwanted heat gains. As a result, the scheme includes an overhanging roof, balconies on the upper floor, strategically planted trees, interior blinds, and even motorised exterior blinds on all of the courtyard windows.

Site and sun-path analysis also informed the design of the courtyard and narrow floor plans, to optimise the use of daylight to ensure the majority of spaces were fully day-lit. Extensive daylight modelling helped inform the triple-glazed window placement and the amount of shading to prevent excessive glare. Ambient light levels are dimmed in response to daylight levels, while task lighting is all low-energy LEDs.

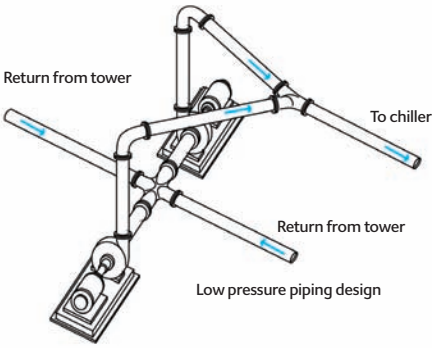
The design embraces the benign Californian climate with a mixed-mode ventilation solution. 'We have a very mild climate, with mild heating and cooling needs,' says Solrain. 'If you work with our environment it's beautiful, and you can maximise the California quality.'

For most of the year, occupants have access to openable windows and the landscaped courtyard for informal meetings. Rainwater to irrigate the plants is collected from the roofs and stored in an underground tank.

The openable windows allow the building to be naturally ventilated for up to nine months of the year 'to enable people to connect to the environment', says Solrain. For peak summer – August/September – a highly efficient chilled beam system helps keep conditions comfortable while minimising the demand for the energy generated by a large roof-mounted photovoltaic array.

The courtyard features mature trees

Low pressure piping design



The cost of different low-energy servicing solutions was measured in the context of the contribution they would make to reducing the size – and, hence, the cost – of the solar array; the smaller the energy demand, the less the area of PV required to offset that energy. The two-pipe active chilled beam system aligns with this strategy.

Active chilled beams operate by delivering tempered ventilation air to each space through linear nozzles; the jets of air induce room air to move across chilled water coils within the chilled beam diffuser, which cools the room. Air is induced at a ratio of three parts room air to one part supply air. A dedicated thermostatic valve for each chilled beam, linked to a wall-mounted controller in each office, gives control to users.

The use of chilled beams also enables the supply of fresh air to be decoupled from the cooling needs of the space, with the cooling load met simply by increasing or decreasing the flow of chilled water to the beam.

PROJECT TEAM

- **Client:** David and Lucile Packard Foundation
- **MEP engineer:** Integral Consulting
- **Architect:** EHDD
- **Contractor:** DPR Construction
- **Structural engineer:** Tipping Mar
- **Civil engineer:** Sherwood Design Engineers
- **Landscape architect:** Joni L Janecki Associates

Ambient light is dimmed in response to daylight levels

Fresh air is supplied from a dedicated outside air ventilation unit. The volume delivered is varied to meet a target CO_2 level of 700ppm, so the system typically operates with airflows less than design ventilation rates, although airflows are maintained to exceed ASHRAE minimum requirements of healthy indoor air by 30%.

The temperature of the ventilation air to the chilled beams is typically 20°C during the cooling season. To prevent condensation on the chilled beams at times when the outside air dew point is above 14.5°C, air source heat pumps will dehumidify the ventilation air.

The chilled water for the system is produced by plant designed to exploit the summertime diurnal temperature swings in Los Altos. Cool night air is used to 'free cool' a two-cell 1,700W cooling tower, which chills the water to 14.5°C, without the need for a compressor. This chilled water is stored in a 190,000-litre storage tank for use during the day.

Outside air is also used to heat the building. The HQ does not have a separate heating system; a system of hot water pipes to deliver heat to the chilled beams was considered, as was a perimeter heating system, but both were rejected in favour of spending the money on enhancing the thermal efficiency of the building envelope.

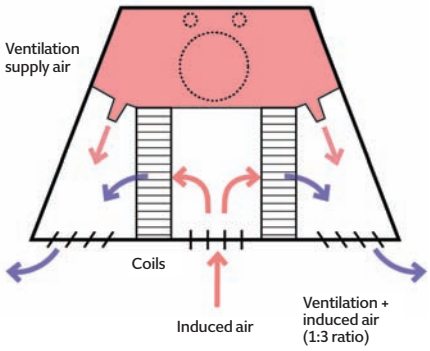
Upgrading to triple-glazing resulted in £50,000 first cost savings by eliminating the need for a £100,000 perimeter heating system and a £200,000 PV system downsize, coupled with smaller and fewer pumps and fans.

The façade upgrade enabled morning warm-up during the heating season to be accomplished using the dedicated outside air ventilation system alone, by simply heating the fresh air to 25°C using heat produced by a 250kW air source heat pump and stored in a 2,100-litre buffer vessel. 'Normally, gas heat is used in California but, to meet the net zero goal, we had to use electricity,' says Solrain. Once up to temperature, internal loads are sufficient to maintain temperatures for the remainder of the day. The use of thermal storage and the morning warm-up cycle also shifts energy use away from peak-use times, when utility rates are highest.

Energy waste is further reduced by a considered layout of pipework and ducts. Friction in ducts and pipes causes a pressure drop in the fluid being transported, which is reflected in the increased size of the systems' pumps and fans. The corresponding energy required to push the fluid through the system varies by the square of the pressure drop in the fluid – so even a small reduction in pressure drop can reap big energy savings.

To reduce friction, the scheme uses generously sized ducts and pipes throughout

Chilled and hot water piping



Lessons learned

1. There were problems with some building controls not working, resulting in condensation occurring on the chilled beams
2. Getting electrical plug-loads under control was key to minimising the size – and, hence, cost – of the PV array. Using low-energy office equipment and simple controls reduced the cost of the PV system by £117,000
3. Two of the four heat pumps failed in the first year as a result of manufacturing defects when temperatures were close to freezing
4. The manually operated natural vent system worked best when users were given clues at their desks, instead of in communal areas. This was achieved by a simple software fix
5. Although the chilled beam system came at a 10-20% premium over a less efficient VAV system, it made it possible to lower the cost of the PV system by £137,000. The elimination of perimeter heating saved a further £102,000
6. Chilled beams, designed correctly and incorporating waterside economisers, use significantly less energy than VAV systems
7. Over the first two years of operation, the building engineer was key to reducing energy use by an additional 5-10% through tuning and understanding the dynamics of the building, including setting optimal times to turn HVAC equipment on and off, and further plug-load reduction opportunities.

and, wherever possible, 45° fittings, as opposed to 90 degree elbows.

The benefit of highly insulated walls, energy efficient building services and distribution systems is that this building uses 46% less energy than a typical Los Altos office, even before the building's 301kW rooftop PV array is considered. In total, the PV system capital cost saving was £3,230,000 (64%) at £5,800/kW in comparison to the size necessary to offset the energy use of a traditional office. These savings more than paid for building efficiency upgrades, with an incremental cost premium estimated at £620,000. Using the PV watts approximate annual energy cost savings of £34,000 per year, an estimated simple payback for building upgrade incremental premium costs is 18.5 years.

An additional benefit of downsizing and simplifying the mechanical systems is a significant reduction in maintenance needs. Fewer pumps are used; the thermostatic valve and wall-mounted sensor for the chilled beams require no electrical or central control system connection. Equipment operating hours are reduced by exploiting natural ventilation and optimised daylighting, extending equipment life and reducing maintenance needs. The use of variable frequency drives on the motors also helps to prolong their life.

The system is connected to a BMS and Building Dashboard. System-level metering provides accurate energy consumption data. Individual branch-circuit monitoring is used so that each load can be pinpointed and equipment that consumes large amounts of power identified.

This monitoring is accomplished using electric panel-boards specifically designed for the task. Data can be extracted from the panel-boards' integrated data logger. The 15,000 monitoring devices and control points are connected to the building supervisory control and data acquisition (SCADA) system. 'We became the commissioning agent in addition to design engineers; we would do weekly and monthly monitoring to ensure the design intent was being met to make sure the energy use was what we expected,' says Solrain.

Optimising the performance of some systems was not without its challenges, however (see box, 'Lessons learned'). 'One thing we learned in the building's first year of operation was that the California energy guidelines overstated how much cooling is required, and understated the amount of heating energy required because we were misusing the cooling,' says Solrain. 'We have cheap gas so people use it in the middle of summer to reheat air that has been overcooled – it's akin to driving with one foot on the accelerator and the other on the brake.'

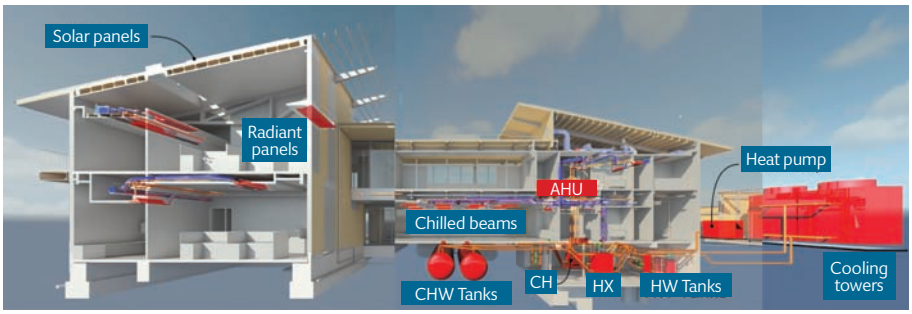


Figure 2: Building mechanical system

There is no simultaneous heating and cooling of the Packard Foundation building – it is only ever heated or cooled as required.

The net positive energy building has achieved the Packard Foundation's goal of creating a building that is attractive, innovative, healthy and comfortable. Surveys of the 120 occupants have reported superior comfort, acoustics, healthy indoor air, abundant natural light and an overall pleasant environment. In fact, post-occupancy feedback shows overall occupant satisfaction at 97% and thermal comfort satisfaction in the 96th percentile, proving that it is possible to design and construct a net zero energy building without sacrificing comfort.

In addition to CIBSE, the Packard Foundation HQ has been recognised by a host of other organisations. It has earned Net Zero Certification through the International Living Future Institute, a Leed Platinum rating from the US Green Building Council, and the ASHRAE Award of Engineering Excellence – only the fourth such building to do so – all of which makes it an inspiration to others. **CJ**

> Post-occupancy feedback shows overall occupant satisfaction at 97% and thermal comfort satisfaction in the 96th percentile, proving that it is possible to design and build a net zero energy building without sacrificing comfort

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WEATHER ALERT

Climate change means CIBSE's updated weather files are imperative for building energy and overheating risk analysis. **Liza Young** explains the new data sets and finds out whether the methodology for applying them is up to the task

Two summers ago, *CIBSE Journal* received a memorable letter from Ben Cullen about life in his sweltering flat in Milton Keynes. He described how his single-aspect apartment became so hot that the 'killer views' alluded to in the sales brochure were more likely to come from his clothing, which consistently breached broadcasting standards. (See 'Tickled pink', *CIBSE Journal*, September 2014).

His letter was a vivid illustration of how prone to overheating modern homes can be and Cullen's experience is echoed in a report by the Zero Carbon Hub. *Next Steps in Defining Overheating* estimates that there are 2,000 heat-related deaths per year in England and Wales, and this could rise to 7,000 by the 2050s.

To help mitigate the risks of future overheating, CIBSE publishes weather data files that enable designers to test their building models against a variety of weather scenarios. These have just been updated for 13 UK locations, to account for climate change. The data includes predictions for UK summer temperatures up to the 2080s, so designers can ensure their projects will be habitable for generations to come.

There are two types of weather files for building simulation at the design stage – Test Reference Years (TRYs) for energy modelling, and Design Summer Years (DSYs) for thermal performance modelling.

CIBSE published weather files for 14 UK locations in 2005 and, last year, updated those for the capital in *TM49 Design Summer Years for London*. Working with the University of Exeter and University College London (UCL), it has now updated the files for the other 13 locations, and developed 'future' weather datasets for modellers.

To assess whether building designs lead to unacceptable overheating, CIBSE's TM52 methodology is used. *The Limits of Thermal Comfort: Avoiding Overheating in European Buildings* defines the acceptable internal temperature levels based on adaptive thermal comfort criteria, and includes upper temperature limits and the number of hours that temperature can exceed a comfortable level. (See panel, 'TM52 Criteria').

However, some modellers say TM52 is not always appropriate for certain building types, and can be complicated to use and explain to clients. So CIBSE and leading modellers from organisations such as Arup, Inkling and UCL are working on a more usable methodology.

New files

The new version of the weather data includes TRYs for energy analysis and DSYs for overheating analysis. Produced in association with the Met Office, the datasets are based on historical data collected from 14 sites around the UK since the early 1980s. This is combined

Visit **www.cibse.org/weatherdata** for details and to purchase the files, available to CIBSE members at a discounted rate

New weather files

The updated TRY weather files – comprising average months selected from a historical baseline – represent a typical year and are used to determine average energy use in buildings. They use a 30-year – rather than the previous 21-year – baseline, with the average months selected from 1984 to 2013.

DSYs are used to simulate the effects of overheating in buildings in each location. Recently, probabilistic DSYs were developed for the London area, outlined in TM49.

Using the same methodology, the DSYs have been updated in 13 other UK locations. The warm years are selected from a 30-year baseline (1984-2013) and the methodology for selecting the warm years is the same as in TM49. Three DSYs are available per location, representing summers with different types of hot scenarios (see Table 1). These include:

- DSY1 – moderately warm summer, with a return period of seven years
- DSY2 – short, intense warm spell, about the same length as the moderate summer year but with a higher intensity
- DSY3 – long, less intense warm spell, which is less intense than the high-intensity year, but longer and more intense than the moderate summer year.

with the latest climate-change projections to produce weather files up to the 2080s.

Met Office statistics show that the eight warmest years in the UK since 1910 have occurred within the past 14 years, so the new files take account of rising temperatures, as well as changes in wind speed and direction. (See panel, 'New weather files'). Dr Anastasia Mylona, research manager at CIBSE, says: 'Using this data, engineers will be able to design buildings that take into account the latest information about local weather conditions. This means buildings can be designed to be more sustainable and resilient to current and future weather conditions.'

Mylona says the TRYs now include temperature differences brought on by climate change, which could result in cooling demands increasing and heating demands decreasing. The new DSYs use candidate years that have warmer, more severe heatwave events, allowing designers to test the upper limits of their thermal design. With the least severe DSY likely to be warmer than previous DSYs for each location, overheating analysis across the country will be affected.

The London pilot in practice

In 2014, CIBSE released TM49 as a pilot for the new weather files. The Greater London Authority (GLA) has since adopted it for its Energy Planning guidance, and now requires new developments – particularly housing – to be assessed against all three weather files for London, using the TM52 methodology.

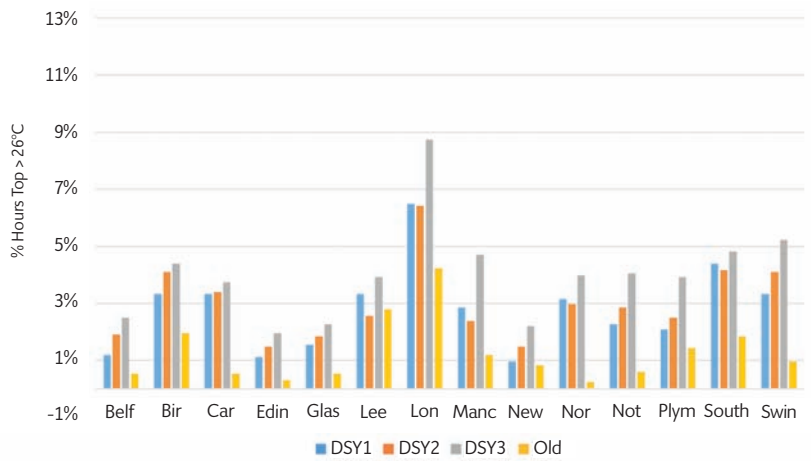
The TM49 dataset contains each of the London weather years – 1976, 1989 and 2003 – for three London sites (urban, suburban and rural) to take account of the varying urban heat island effect. For buildings with long-service lives, or where overheating impacts are more critical – for example, hospitals or care homes – it is suggested that the building is also modelled using future weather data.

But TM52 is based on offices and daytime occupancy, says Inkling partner Susie Diamond. 'We're not sure how well it applies to domestic developments and occupancy patterns.' Although the methodology is useable, Diamond says the threshold it sets for the percentage of hours that the temperature can be exceeded needs to be addressed. 'The GLA requirement to use all three weather files implies that it should pass all three,' she says. 'This is difficult unless you only include night-time hours, when it's naturally a bit cooler. But that doesn't feel like a very robust thing to do.'

Hareth Pochee, senior engineer at Max Fordham, says one of the main design challenges is that, at times, the target temperature is a few degrees cooler than the external temperature. The only simple way to resolve this passively is through night ventilation and thermal mass, but this has limitations – if it doesn't get cold enough at night, the thermal mass cannot be cooled.

'Designs can be developed to meet all TM52 criteria, with both 2003 and 1976 datasets, but it requires an exceptional standard of passive design,' says Pochee, who cites a Max Fordham project – a mixed-use development in Camden, with a nursery and youth club. This can be developed to meet all TM52 criteria, if designed with appropriately sized and positioned glazing, external shading, solar control glazing, cross ventilation, low-energy lighting, and avoidance of other internal heat gains, such as heat losses from district heating pipework. As well as high thermal

Dwelling uninsulated – bedroom



Percentage of hours that operative temperature (Top) is greater than 26°C – comparison between old and new DSYs for each location

DSYs for all locations

Location	DSY1: Moderate	DSY2: Intense	DSY3: Long	Old
Belfast	2003	2006	1995	1999
Birmingham	1989	2006	1995	1989
Cardiff	2013	1995	1976	1988
Edinburgh	1989	1975	2006	1997
Glasgow	2003	1975	1976	1997
Leeds	1989	1990	1995	1995
London	1989	2003	1976	1989
Manchester	1997	1990	1995	1999
Newcastle	1996	1990	2006	1999
Norwich	1997	1990	1976	2004
Nottingham	1996	1990	1976	2002
Plymouth	1984	1990	1976	1990
Southampton	1989	2003	1995	1982
Swindon	2013	2003	1995	1999

Table 1: Probabilistic design summer years for all locations

> Modelling can be a helpful part of the solution, but nothing more. It's our job as designers to use our skill and judgement to develop design that works in reality

mass and secure, reasonably rain-resistant night ventilation, the occupancy pattern must be factored in because, on hot days, half the children will be playing outside.

'The conditions are onerous,' says Pochee, 'and, consequently, the designs need to be exceptional.' In some cases, this might be deemed impossible because these design aspects could conflict with other user, client or architect needs. They could, for example, be too complex or expensive, or it might be impractical to leave vents open at night.

In some cases, rather than using a purely passive strategy, Max Fordham has incorporated fans to bring in outside air or recirculate internal air. 'We support raising the standards for this type of work,' says Pochee, 'but it does present technical, procurement and project management challenges, because the cost is likely to increase – so it can be met with resistance.' It can be difficult to get architects to accept and integrate advice from DSY modelling, he adds. 'Even if they accept it in principle, getting the work done at an early enough stage for it to be worked into a programme effectively is a challenge.'

TM52 criteria

Developed for commercial buildings, TM52 is based on BS EN 15251:2007. It sets three criteria against which designs should be assessed:

1. Hours of exceedance sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1K or more during the occupied hours of a typical non-heating season – 1 May to 30 September – (3%)

2. Daily weighted exceedance deals with the severity of overheating within any one day, the level of which is a function of temperature rise and its duration. It sets a daily limit for acceptability (weighted exceedance ≤6)

3. Upper limit temperature sets an absolute maximum daily temperature for a room. The internal operative temperature must not exceed the external running mean by more than four degrees ($\Delta T \leq 4K$).

Complexity

CIBSE Guide A recommends assessing overheating in terms of the percentage of annual occupied hours in which a threshold temperature is exceeded – generally 26°C for bedrooms and 28°C for other areas.

Becci Taylor, Arup associate director, says the TM52 procedure is much more complex – with a design having to pass two of the three criteria – and takes much longer. 'It means you end up with almost too much information, which can be difficult to explain to clients and architects.' Although the industry is used to using such modelling techniques for commercial projects, it is a relatively new concept for the domestic sector, hence the added cost and complexity.

Pochee adds: 'If you tell someone it's likely to be 28°C for so many hours, they understand that. But if you start talking about running means, or percentage exceedance, it can become an opaque procedure. It's gone from something a technical person can understand to something only an expert can fathom.

'The fact that the assessment procedure is so complex means it is very easy, either by accident or – if you're that way inclined –

on purpose, to set up and run a model that demonstrates a particular performance that isn't achieved in practice.'

Pochee adds: 'Modelling can be a helpful part of the solution, but nothing more. It's our job as designers to understand this and use our skill and judgement to develop a design that works in reality.'

A new method

The 2015 CIBSE Guide A recommends an 'adaptive' approach, allowing for people acclimatising to warmer outside temperatures during warm spells, and so becoming more tolerant of higher indoor temperatures.

Diamond says such an approach generally makes compliance easier with future weather files, compared to the fixed 'hours above threshold' criteria, as the maximum allowable internal temperature increases with warmer outside temperatures. 'Our designs for overheating should reflect that we can get used to warmer temperatures,' she says. 'We don't want to get to the stage where there's no option other than mechanical cooling.'

At the pre-planning stage, carrying out an overheating risk assessment on a significant sample of flats, using three current weather files and assessing future years, is an onerous task – especially if multiple design iterations, for which all the tests need to be run, are being considered, Diamond adds. 'You get an explosion of results that can cloud the outcome of the study, which is not necessarily what the GLA intended. It wants to do the right thing, but there are all these consequences.

'We're considering whether the recommendation should be to pass the 1989 file, and use the other two for information only. We also need to review the TM52 thresholds for the three criteria for domestic occupancy – potentially 24/7 – and consider bedrooms and the point at which sleep is impaired. It's a judgement call as to what's reasonable to feed into the methodology and where to set the pass/fail points.'

Pochee says a more effective method would be to reduce the complexity of the assessment procedures, making them more transparent and robust, as well as easier to check and enforce. 'That might mean accepting that the method will work for 80% of cases but not the other 20%.' As for the new datasets, he says they are incredibly useful for various aspects of environmental design. 'One can go a long way in developing a building's environmental strategy just by analysing climate data without doing any calculations.'

Inkling, with Arup, CIBSE and UCL, are currently testing the London weather files on a block of flats with different occupancy patterns, including 24-hour use. They are hoping to come up with a relevant domestic overheating risk assessment methodology that reflects how dwellings are occupied, and balances speed of execution with robust and useful results. **CJ**

COMBINED PROCESSING POWER

Data centre projects involve a large number of disciplines, whose operators are often unfamiliar with each others' roles. Workshops that bring stakeholders together at an early stage help ensure design briefs are fit for purpose, say **David Cameron**, **Sophia Flucker** and **Robert Tozer**, from Operational Intelligence

The construction project cycle involves the contribution of several stakeholders in its various stages, and its overall success depends on how well knowledge is communicated between these parties.

A collaborative workshop approach that has been developed for data centre projects has proven particularly effective when used to develop the design brief and optimise existing facilities. The data centre industry has the additional difficulty of bridging ICT and facilities management (FM) disciplines. The workshops allow stakeholders to gain a common understanding of the issues. As most failures are caused by human error, awareness and learning are essential to improving reliability.

Case studies indicate where these programmes have enabled operators to make significant operating cost reductions with short paybacks.

Cost of failure

Traditionally, investment decisions are based on capital expenditure, with little consideration of operating costs and risk. For a data centre supporting electronic trading, for example, a one-hour service outage could cost the business £10m, excluding reputational damage. If this occurs every 10 years, the annual cost to the business is £1m per year.

Analysis of failures from a broad range of industries has found that a universal learning curve applies – as organisational and operators' experience increases, failure rate decreases (see graph 'Data input', *CIBSE Journal*, April 2013). The risk of failure is lower for a facility that addresses operational vulnerabilities effectively through organisational processes and procedures, and ensures staff have the right knowledge, experience and attitude.

In addition, opportunities to improve energy efficiency are not exploited because of

a lack of awareness (see Figure 1, 'Total cost of ownership').

Key problems

Lack of detail in the brief

A brief tends to focus on maximum design loads and standard redundancy arrangements. This means many items with minimal capital cost and significant savings potential in terms of reduced downtime or energy consumption – such as labelling, supplier selection, graphical displays or metering – are often not implemented.

Lack of scrutiny of the design before sign-off

The design consultants and operations team should review the brief. Suppliers can be specified in these documents, but it is important to be aware that a consultant will tend to specify companies that engage with and support them during the design stage. An operations team will select a supplier based on operational support and costs.

The tender process

This is a cost-focused procedure and is the first point at which the design can be challenged. It is important to understand the impact of any cost reductions on energy and risk performance. Agreed changes can be implemented and recorded in the design brief, tender documents and contract.

Commissioning phase

This phase of the project offers the biggest opportunity for learning and knowledge transfer between the design/construction and operations teams. Often this opportunity is missed because of a lack of engagement by – or the late appointment of – the operations team. The facility is often tested to demonstrate the achievement of contract deliverables at full load only.

Operations

The commissioning engineer should transform the design brief into the basis of design, which describes what is installed and how the systems should operate. After handover to the operations team, the basis of design should be updated for reference.

Reluctance to change

In most cases, there is a lack of engagement between the operations and design/construction teams. The operations team can then be reluctant to make changes to critical systems, as they are unaware of how it was intended to work; this results in equipment being replaced on a like-for-like basis. It is common to find facilities that have undergone a major replacement of chillers, with no thought given to improving the energy efficiency of the system.

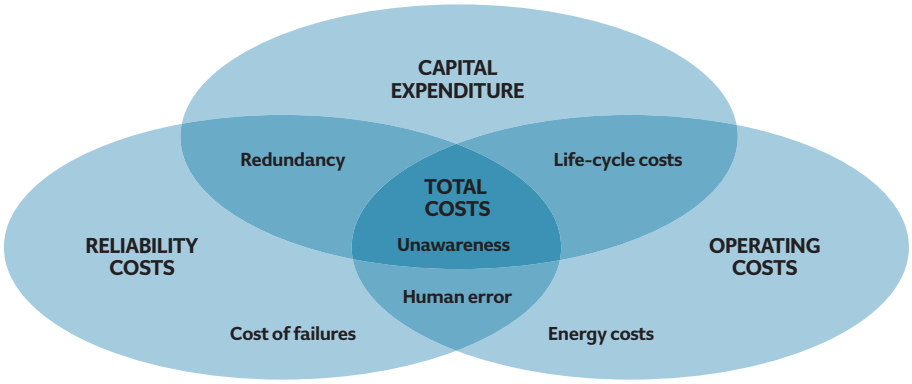


Figure 1: Total cost of ownership

Stakeholders and learning

Educational theorist David Kolb describes effective learning as a continuous cycle of reflection, theory, practice and experience. This applies to individual and organisational learning (See Figure 2, 'Kolb learning cycle').

However, in the construction industry, different stakeholders are responsible for each area: the client reflects on their requirements; the consultant applies theory to create a design; this is then implemented in practice by an installer; and, subsequently, left to the operations team to experience. A design consultant without site operational experience may be more likely to create complex designs that are difficult to operate and maintain.

At each boundary is an exchange of knowledge and information from one group to the next. How effectively this transfer occurs is crucial to the successful delivery of the project. A design brief/basis of design helps to ensure the consultant creates a design that fits the client's needs. A detailed specification helps ensure the installation team builds the project in line with the design. Site handover, including comprehensive commissioning and integrated systems testing for mission-critical environments, helps demonstrate that the systems operate as required.

This is even more challenging in the data centre industry, which includes IT stakeholders who may have limited experience with the project process or mechanical and electrical systems' design and operation. (See Figure 3, 'Data centre stakeholders').

Collaborative approach

The authors have developed a site-based workshop programme to help data centre

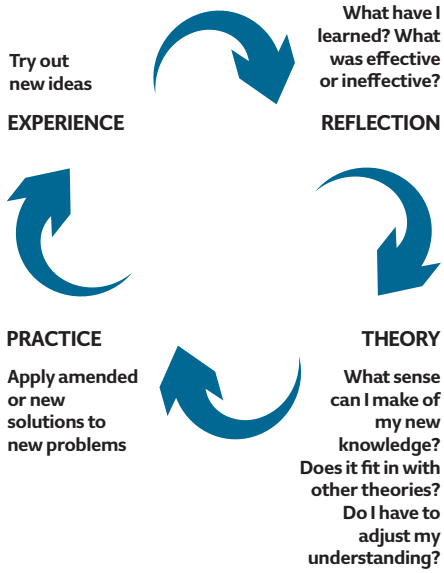


Figure 2: Kolb learning cycle

> A design consultant without site operational experience may be more likely to create complex designs that are difficult to operate

operators identify and reduce their risk and their energy consumption by removing stakeholder barriers. Participants gain practical experience in the application of theoretical principles on site, and the operations team then present their conclusions to their management.

The facilities under review are live data centres, so require all changes to be carefully managed to mitigate risk. Many of the improvements identified have a positive impact on reliability, as well as in reducing energy consumption. For example, air management helps to remove server inlet temperature hot spots. It is a common misconception that energy efficiency can only be achieved at the expense of reliability.

A similar approach has also been applied to develop client requirements for new data centre builds. Project stakeholders (internal and external) participate in workshops to define the design brief /basis of design, with particular focus on cooling systems. Stakeholders from different teams, departments and management levels need to be included to ensure their support.

> It is a common misconception that energy efficiency can only be achieved at the expense of reliability

Resistance to training and collaboration

Not all operators embrace the ethos of investment in training/workshop-based problem solving. Common concerns and counter-arguments include: 'What if I train all my staff and they leave?', although experience has shown this promotes job satisfaction and assists staff retention. Also: 'We're replacing all our plant with more efficient plant, so it's not worth doing'.

We contend that the workshop approach is compatible with any other energy-saving initiatives and allows their full potential to be realised.

Conclusions

This workshop approach facilitates communication between different parties, gives them a better understanding of the project, and assists with ownership. Participants work towards a common goal and are motivated by a sense of achievement.

To date, risk and energy reduction programmes for operating data centres have enabled average energy savings of 12% with an eight-month return on investment. **CJ**

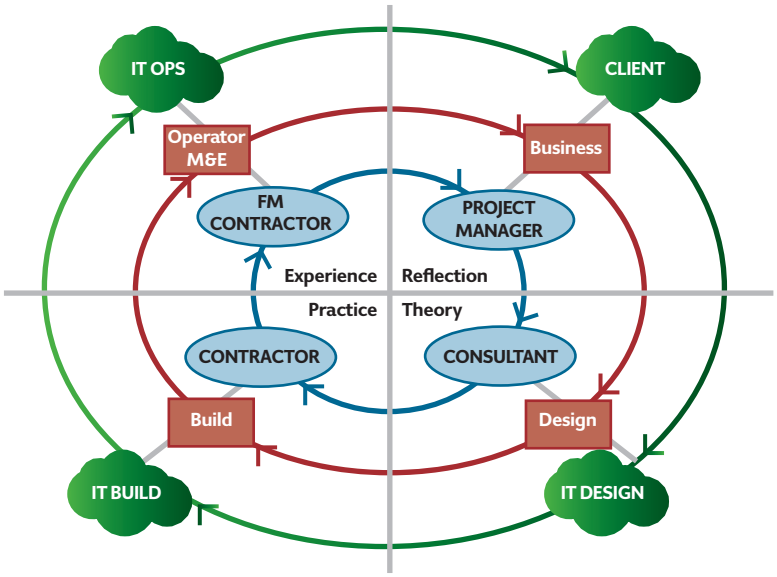


Figure 3: Data centre stakeholders

The authors won the CIBSE Building Performance Training Award for Training in 2015, for their work with Entel, a Chilean data centre operator

References:

1 *Managing Risk: The Human Element*, Duffey R and Saull J, John Wiley & Sons, 2008.

2 *Thermal Guidelines for Data Processing Environments*, Fourth Edition, 2015, ASHRAE

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This month: High efficiency chillers link with aquifer thermal sources to meet needs of upmarket Battersea flats, and AHUs in innovative services for new Herzog & De Meuron landmark

LIGHTENING THE LOAD

Air conditioning in Battersea's Riverlight development will be provided by a ground source district cooling and heating scheme and three large chillers. IFTech director **Nick Boid** explains how it works

Three chillers are driving the cooling for a major ground source district cooling and heating scheme in Battersea, south London.

The Riverlight development is located on the Thames, close to the new American embassy, and is being developed by regeneration specialist St James, a member of the Berkeley Group. It comprises 812 residential apartments – including 116 shared-ownership units – retail sites, restaurants, bars, leisure facilities and a children's day-care centre.

Designed and installed by IFTech, the open loop ground source project will supply 100% of the development's cooling demand, which is 2.9MW at 10°C/18°C flow and return temperature respectively. A smaller 1.8MW of heating is provided at 45°C/35°C flow and return, although this is not 100% of the heat load for the development.

Three 500kW screw chillers manufactured by Carrier – each operating with 130kg of refrigerant R134A – supply six multi-storey buildings with comfort cooling and hot water from a central plantroom linked to a series of boreholes. This enables the transfer of cooling and heating energy to and from aquifer groundwater, boosting efficiency and reducing carbon emissions significantly.

The scheme comprises eight new deep-water wells, linked to the chillers and heat pumps. We already had extensive experience drilling in the chalk aquifer in the London area, so knew what to expect. You can face longer drilling periods when you are trying to get through the London Clay, which can be very hard. The large Battersea site meant there was plenty of space for the drilling area and rig.

The water comes from the confined chalk aquifer, which starts about 70m below ground level, and is returned to the same aquifer. When it is abstracted from the warm or cold wells, it passes to the central plantroom and through plate heat exchangers within pre-assembled plant units, known as skids. The heat or the coolth is transferred to the building circuit and water is then pumped back into the warm or cold wells and the chalk aquifer.

Feasibility studies were done early to review the geology and hydrogeology of the site. Thermal modelling was used to look at the effect of the heating and cooling discharge on the aquifer and surrounding areas, and there were discussions with the Environment Agency during the consent process for the first test borehole in 2011.

The pumps and injection valves in the boreholes are located about 60m below ground level, within the casing of the borehole. The rising mains in the boreholes are stainless steel and the pipework that takes the water to/from

the boreholes to the energy centre is medium density polyethylene (MDPE) plastic.

Heating and cooling

The homes are cooled by fan coil units fed at the chilled water network flow temperature.

The underfloor heating systems are supplied by local heat interface units (HIUs) fed from the LTHW heat network. A 60,000-litre central thermal store provides the source for the distributed heating systems through a series of intermediate plate heat exchangers. The store integrates the heat generated from the ground-sourced heat and the site's CHP. The chiller controls optimise the system operation to produce hot or chilled water most effectively. These are integrated with the site's building management system.

The chillers operate in three modes:

- In heating mode, the screw compressor-based water-cooled liquid chillers produce hot water up to 45°C, and can operate with a COP of more than 6.5
- In cooling mode, the system produces chilled water for comfort cooling, using ground water as a condensing medium and transferring energy via compact brazed plate heat exchangers
- In mixed mode, the system provides cooling for the building, while also catering for the domestic hot water requirements.

Use of three operating modes ensures performance and efficiency are optimised across the chillers' range, and comfort conditions are maximised for occupants.

The coefficient of performance (COP) of 6.5 in heating mode is possible because of the high-performance water-cooled chillers and the availability of warm water ground source.

By drawing from the cold well, the cooling EER will be about 10. When used, direct cold well water (with no chilling) provides an equivalent cooling energy ratio that is likely to exceed 25. When a chilled water supply temperature of around 10°C is required, a large amount of direct cooling from the wells may be used – alongside some heat pump power – but will still deliver a combined EER of 10.

The system has a warm buffer vessel and a cold buffer vessel. These have a 8m³ volume and provide short-term storage – their primary use being to smooth out the demand on the heat pumps and well pumps.

The system consists of the wells, the components in the wells, the field pipework, the skid units, two buffer vessels and the heat pumps. The development energy centre – which includes the system – has been taken over by SSE under an Energy Service Company (ESCo) contract. IFTech now maintains the system for SSE, undertaking twice-yearly visits. Life expectancy of the wells can be more than 50 years, and about 12 years for the M&E components. The energy centre and ground source system were recently completed and commissioning is taking place as the buildings come online as part of the phased development. **CJ**

AquaSnap chillers were used during the Battersea Power Station redevelopment (see below)

Minding the gap

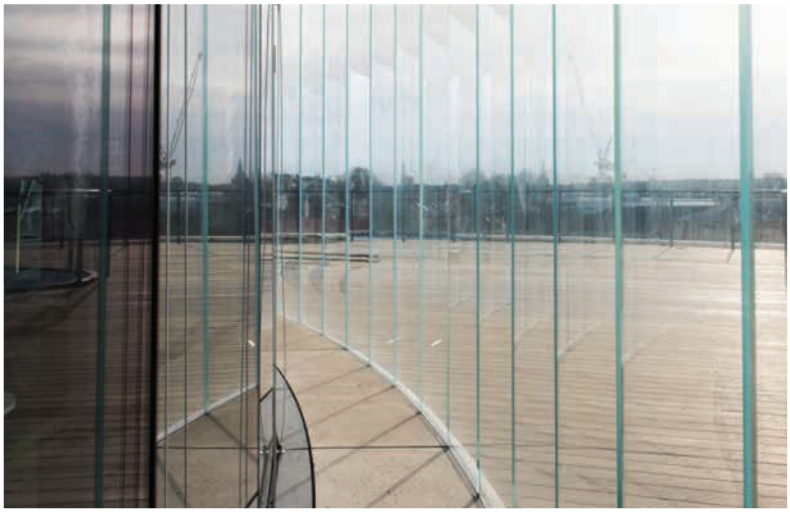
Another major district cooling and heating scheme in Battersea is renting temporary chillers and heating plant until the permanent heating and cooling systems are up and running.

Carrier Rental Systems has installed 40 chillers and 20 electric boilers for temporary heating, domestic hot water (DHW) and cooling for hundreds of premium apartments at the Battersea Power Station redevelopment. The eight multi-storey apartment blocks include parking, and retail and leisure facilities, served by a district heating and cooling scheme that provides underfloor heating, hot water and air conditioning.

The year-long contract sees the installation of a fleet of 160kW-rated chillers, each operating on R407C refrigerant, plus new electric boilers, each rated at 300kW.

The equipment is in a basement, alongside the permanent plantrooms, and connected to the piped services mains for the district heating and cooling scheme. It will provide full comfort cooling and heating, plus DHW, while construction work is going on, to allow sales and marketing of the apartments to proceed.

Once the development is finished, the temporary plant will be decommissioned and the permanent systems switched on.



NATION BUILDING

Herzog & De Meuron's sleek, minimal design for a University of Oxford school of government meant Hoare Lea's mixed-mode ventilation system had to be discreet, as well as technically savvy. Executive mechanical engineer **Richard Brimfield** explains how the consultant worked within the architect's design parameters to ensure the building performed well

The Blavatnik School of Government is a visually striking building, situated in a prominent corner of the historic Radcliffe Observatory Quarter in central Oxford. The new £55m building, designed by Tate Modern architect Herzog & De Meuron, uses a naturally ventilated double-skin façade, mixed-mode ventilation and a ground source energy system, with on-site electricity generation by photovoltaic arrays. The mechanical, electrical and public health (MEP) engineers, Hoare Lea, have a hot-desk in the building, from where they now provide an aftercare service to help occupants and facilities management staff make the most of its sustainability features.

The building ensures a permanent home for the school, which was established in 2010 to improve, inform and support better public policy and government around the world . The architectural concept uses floor-to-ceiling glass as a metaphor for transparency in public life, and an open forum space with sweeping staircases to promote communication. The engineering solution needed to integrate with the high-quality finish and enable the architect's vision for full-height glazing, while meeting the client's brief for natural ventilation, an Energy Performance Certificate A rating and a comfortable internal environment through a range of current and predicted climate scenarios.

To make things even more challenging, a planning condition prevented heat-rejection plant from being installed on the roof, because of its prominence in the historical cityscape.

Thermal comfort strategy

The central forum, complete with glazed roof, extends from the basement to the fifth floor, and promotes a 'stack effect' for natural ventilation while admitting daylight into the centre of the building.

At the very top of the stack, buoyant exhaust air accumulates at ceiling level. The building management system (BMS) controls consider the internal and external air temperatures to determine the optimum exhaust-air strategy. In winter, this warm exhaust air is extracted by the air handling units (AHUs) for heat recovery, while, in summer, it is exhausted through motorised dampers, which double up as the airflow path for smoke extract fans.

The thermal comfort strategy employs night cooling, using the thermal mass of extensive, fair-faced concrete soffits and walls. However, the absence of ceiling voids and the high-quality finish resulted in very limited routes for high-level extract ductwork. So, working with the architect and contractor, Hoare Lea's designers and acousticians

PROJECT TEAM

- **Client:** University of Oxford
- **Architect:** Herzog & De Meuron
- **MEP engineer/acoustics/daylighting/lighting/sustainability and performance optimisation:** Hoare Lea
- **Structural engineer:** Pell Frischmann

CREDIT: Ivan Baan and, right, Will Yeong

Naturally ventilated double-skin façade, left, and atrium for stack ventilation, right

developed exhaust-air paths consisting of bespoke, acoustically attenuated slot details. These allow airflow from individual rooms into circulation spaces, while maintaining acoustic privacy between rooms and corridors.

The building envelope consists of a glazed double-skin façade with integral motorised blinds and natural ventilation panels. This façade harvests solar energy in winter by heating the air in the void, reducing the energy required to heat the building.

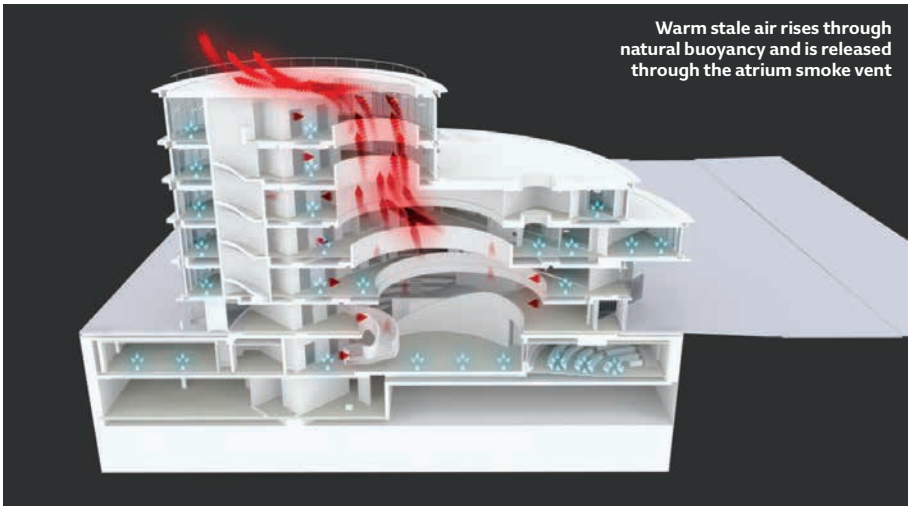
Overheating is mitigated by glazing coatings and external solar control blinds. These automatically deploy on a zone-by-zone basis, when the solar gain into a particular area of façade exceeds a set threshold.

A 'mixed mode' ventilation strategy keeps the building cool in summer and prevents simultaneous heating and cooling. The bespoke natural-ventilation panels in the façade open outwards, like casement windows, into the annulus of the double-skin façade to provide a full-height opening. They were carefully designed, with acoustically absorbent internal insulation and a perforated inside face, to attenuate cross-talk between adjoining naturally ventilated rooms.

The mixed-mode strategy closes the natural ventilation panels and uses mechanical underfloor displacement ventilation for summer cooling, and for heat recovery during low outside air temperatures. The displacement ventilation is provided by a central variable air volume (VAV) system, supplied by four parallel AHUs in the basement, which connect into common header ducts.

The parallel AHUs are sequenced by the BMS to spread the load across as many units as possible, to reduce the internal pressure drop through the AHUs at part loads and reduce fan power consumption. To make further energy savings, the AHU fan inverter speeds are controlled on a variable volume, variable pressure strategy. This uses feedback from the VAV terminal unit actuator positions and determines when the air pressure set points in the supply and extract ducts can be reduced, and when they need to be increased to meet the VAV demands.

The post-handover monitoring to date has shown this variable pressure strategy typically halving the AHU pressures in relation to their maximum design pressures, resulting in a halving of AHU fan power.



Warm stale air rises through natural buoyancy and is released through the atrium smoke vent

In addition to the measures to reduce the mechanical heating and cooling loads, energy-in-use predictions were used in the design of a ground source energy system, which provides all of the building's mechanical cooling and a significant proportion of its heating.

During early conversations with the client, it was agreed that the building should be resilient to future climactic variations, including a predicted Oxford 2040 design summer year.

Hoare Lea did extensive energy in-use thermal modelling, and ground source energy specialist GI Energy came in to carry out the ground loop design modelling. It became clear that the building cooling load over a hot summer would exceed the heat-rejection capacity of the ground under the building. The site boundary and foundations precluded a larger footprint for the borehole array, and the presence of the Oolite aquifer underneath Oxford limited the depth of the boreholes. Planning constraints on rooftop plant also precluded the use of external chillers. These factors left the designers highly constrained.

Cooling the ground loop

Their first concept used ducted chillers to supplement the ground source cooling during high fresh-air cooling loads, with the chillers rejecting heat into the exhaust air header duct of the main ventilation system. However, analysis of the predicted cooling load profile showed that this solution was unable to provide the full balance of cooling capacity in future climate scenarios. This was exacerbated by the use of variable air volume control on the main ventilation system, as the airflow would also have needed to be controlled to the dictates of the chiller condenser fans and the minimum run time on chiller compressors.

After exploring several options, the designers arrived upon a novel solution. A simple AHU was employed as a dry air cooler, to cool the ground loop. This solution 'decoupled' the supplementary heat rejection from the operation of the main ventilation system, so that they are not required to run at the same time. This extended the availability of heat rejection to 24 hours per day, and removed the need for a constant airflow to serve heat rejection. By allowing the ground loop to absorb heat during the day – when the main ventilation system requires cooling – then reject that heat into relatively cool air at night, the cooling capacity and energy efficiency were improved drastically.

The AHU has ducted connections into the mechanical ventilation exhaust and fresh air ducts, controlled by motorised shut-off dampers. An algorithm in the ground source supervisory controller calculates a comparative measure of heat-rejection capacity in the fresh air and exhaust header ducts, using sophisticated thermal dispersion airflow-rate and duct-temperature sensors. The algorithm then determines whether to open the AHU dry air cooler to the fresh air intake or exhaust air duct.

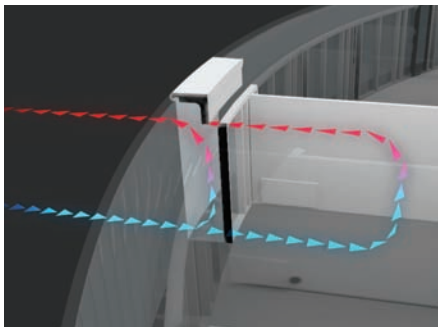
The ground source energy system also features a plate heat exchanger for passive cooling of the chilled water system when the ground loop is cool. This is anticipated to occur in winter, when the balance of energy flow is heat dominated, when there is a net flow of heat out of the ground, to produce a cooling effect on the ground loop water.

A small simultaneous heat pump is sized to the year-round IT cooling base load – while rejecting heat into the heating system – to increase the global heating/cooling energy efficiency of the ground source system.

The building's space heating is supplied by radiators on a compensated circuit, with underfloor heating in the forum, while fresh air heating and domestic hot water (DHW) pre-heat is provided by a constant temperature circuit with 45°C/35°C flow and return temperatures. Each secondary heating circuit

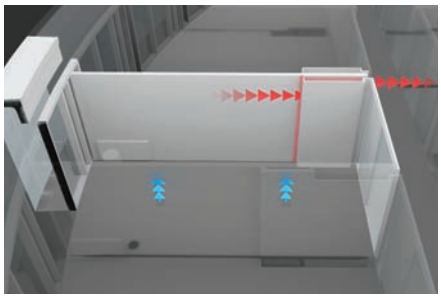
> The post-handover monitoring to date has shown this variable pressure strategy approximately halving the AHU pressures

Mid-season
Perimeter rooms are naturally ventilated through automated slots in the double-skin façade

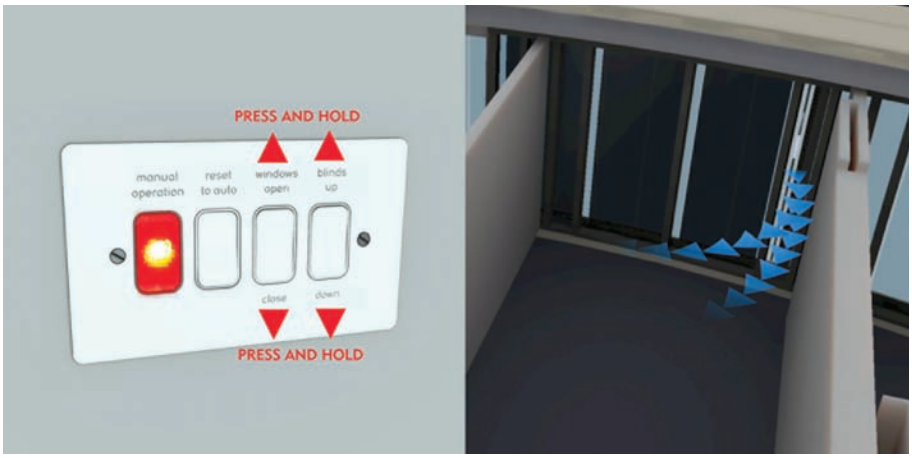


Double-skin façade natural ventilation

Winter/summer
Fresh air is supplied through the floor via displacement ventilation

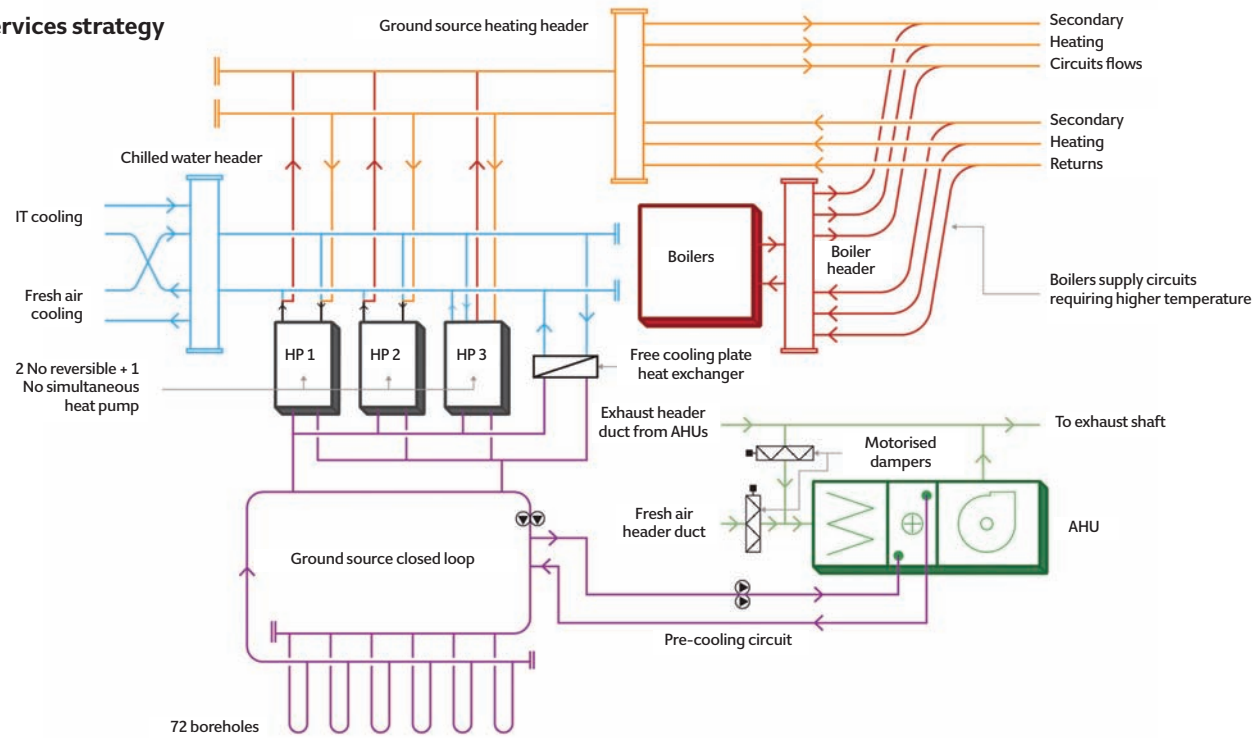


Exhaust slots



Using manual controls will disable automatic control, indicated on the control panel by the red light

Building services strategy



is connected to both the boiler and ground source heating headers, with 3-port switch-over valves to select the appropriate heat source.

During mild weather, the compensated radiator circuit calculates a lower flow temperature demand and switches onto the ground source, and the boilers become a 'backup' heat source to each circuit. During cold outside conditions, the compensated radiator circuit calculates a higher flow temperature requirement and switches onto the boiler header. The constant temperature circuits remain connected to the ground source header and only use the boilers for backup, or for a short-term temperature boost on AHU start-up or DHW pasteurisation.

The ground source energy system can connect into a future site-wide ground source structure, which will allow different buildings to share capacity and recover heat.

Soft landings

The project is the culmination of the University of Oxford's long-term commitment to delivering soft landings. Hoare Lea has paid particular attention to the commissioning and handover process, with user-engagement presentations, an interactive, electronic building user guide – based on CGI animations – staff training, and extensive testing of the building systems. The project is now regarded by the university's Estates Services as the benchmark for all future building handovers.

From its hot desk in the business school, Hoare Lea experiences the building from a user's perspective. This arrangement is anticipated to yield deeper insights into how occupants feel about their environment, and how this relates to the design and commissioning of the building systems. Hoare Lea will also hold 'refresher' sessions with the users to recap on building operation through different seasons.

Hoare Lea's MEP, building performance and engineering visualisations teams have collaborated with the occupants and facilities managers to create an interactive building user guide hosted on the client's FM intranet. This allows users to navigate a 3D virtual model of the building, and click on points of interest. Animated 3D videos help users become familiar with the control systems.

The team is currently undertaking an 18-month performance optimisation service after full occupation of the business school. This will help users make the most of the building's environmental control systems and optimise energy efficiency in use.

During this period, Hoare Lea will recover data from the building management system and from the electric, heat, gas and water meters. It will then analyse this and compare it with the Energy In Use model that was developed for the building.

Hoare Lea will use this data analysis to identify opportunities for further energy savings, and then quantify the impact after the implementation of any changes. The learnings will be fed back into the design of future buildings. **CJ**

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Understanding building performance for effective boiler selection and operation in commercial applications

This module explores some of the room factors that may be overlooked when assessing a potential boiler installation for a commercial building

Through the world of modelling, simulation, CAD and BIM, there are great opportunities not only to evaluate and optimise, but also to provide – and maintain – practical, energy-efficient and environmentally responsible systems that meet the user's needs. No matter how wonderful the digital representation of the building, however, its operational effectiveness will be dependent on having an appropriately selected and operated system.

This CPD will consider some of the room factors that may be neglected when assessing a prospective boiler installation for a commercial building, including the impact on installed capacity resulting from the intermittent use of a building.

The sizing of commercial building heating is becoming more exacting as modern standards and regulations reduce heat losses from buildings. Outdated 'rules of thumb' can promote improperly sized systems and – even when calculations are properly undertaken – inappropriately applied past experience can encourage unreasonable 'safety factors'. This can produce design loads that, at best, will mean that the capital costs will increase, as the boilers and distribution systems can become oversized, while, at worst, the operational effectiveness of the resulting system may be reduced – so increasing environmental emissions and operating costs for the whole installed lifetime of the system.

Figure 1: Example modular boiler system with fully modulating gas boilers that consistently operate at high efficiency with local control (as shown here) and/or by integration with the building energy system. This ensures return water temperatures are cool enough to allow boilers to operate in condensing mode (Source: Vaillant)

The application of modular boiler systems (such as those shown in Figure 1) will allow high-efficiency, part-load operation, since separately pumped boilers are brought online only as the load demands. The calculated total peak load will determine the capital cost of boiler modules, distribution networks, emitters and space requirements.

The route to an appropriate boiler size might look complex (Figure 2). However, it is the very interdependencies of a holistic approach – considering the whole set of building 'systems' – that will provide an installed boiler capacity based on the real requirements of a building. For many designers, heating loads are generated at the press of a button, or from a few entries in a spreadsheet; however, it is worth reviewing how these loads would compare with those produced considering the factors discussed in the 2015 revision of CIBSE Guide A, as a check on these everyday methods. This article will focus on the assessment of the individual space heating load for typical commercial buildings with typical 'office hours' occupation.

The relatively simple CIBSE steady-state calculation is appropriate for normal commercial applications, to evaluate room heat losses that will typically combine – together with potable hot water loads – to determine the boiler size. As identified and discussed in the recently updated Section A5 of the CIBSE Guide[1], reliable input will be required for the specific project, including:

- Thermal properties of materials – specifically U value, admittance (see CIBSE Guide A3)
- Internal design conditions – principally dry resultant temperature and the period of occupation (see CIBSE Guide A1)

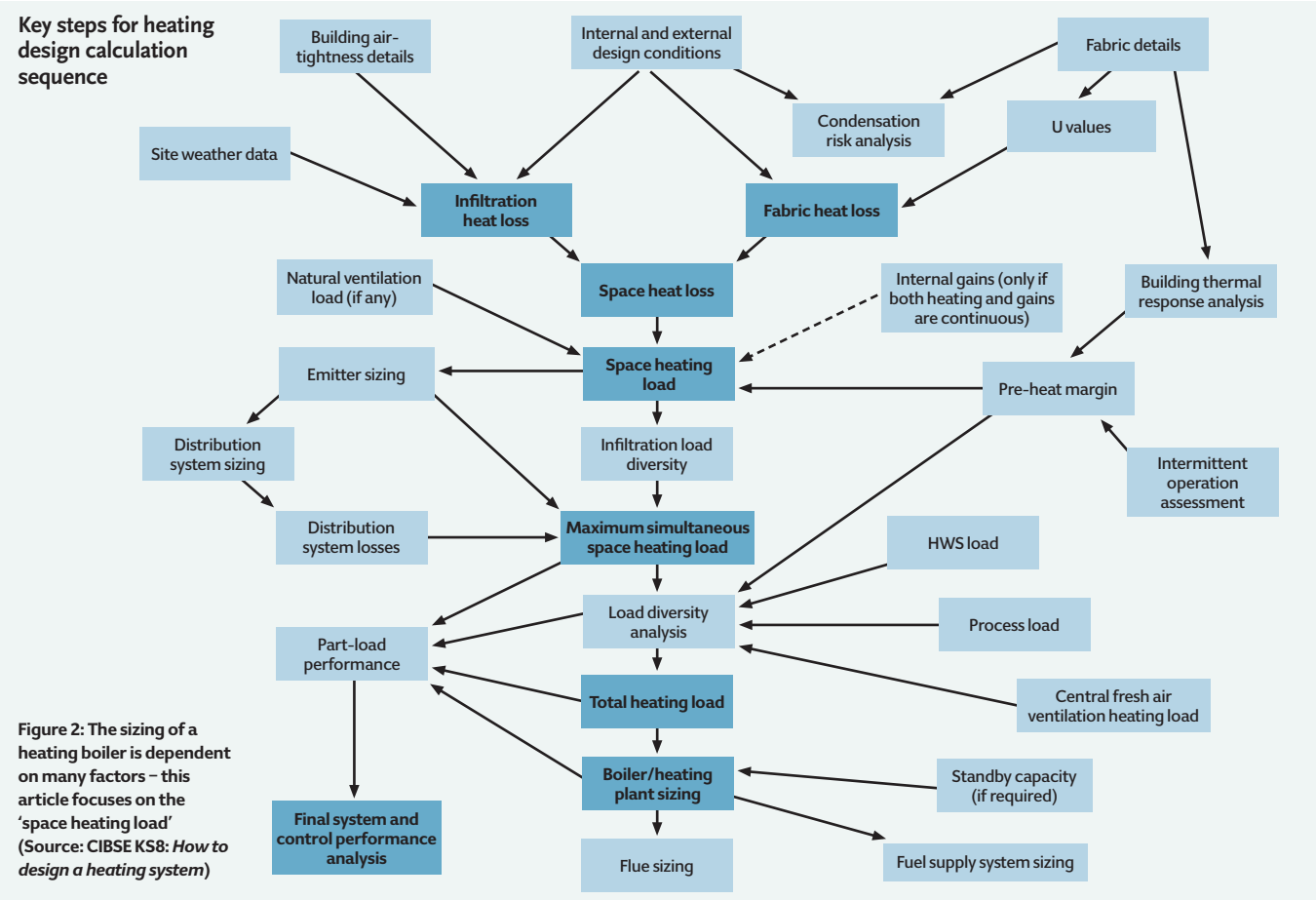

Figure 2: The sizing of a heating boiler is dependent on many factors – this article focuses on the 'space heating load' (Source: CIBSE KS8: *How to design a heating system*)

- Outside air requirement to deliver required indoor air quality – the relative significance of heating the ventilation air increases as the heat flow through the fabric is reduced (see CIBSE Guide A1 and A4)
- Internal gains – intermittent gains may normally be ignored for determining peak loads; however, it is important to determine these, as they will be required for subsequent energy modelling (see CIBSE Guide A6)
- External design conditions – for heating loads this is normally dry bulb temperature, although extremes of other climatic parameters, such as wind and rain, might affect fabric thermal properties (see CIBSE Guide A2).

The size of a heat emitter will be determined from the steady state heat loss from the space, based on the concepts developed for the 'admittance method'. This gives the room total heat loss equation as:

Room heat loss (W) = [F_{1cu} x general thermal transmission coefficient + F_{2cu} x ventilation heat transmission coefficient] $(\theta_c - \theta_{ao})$

θ_c is the operative temperature at the centre of room (°C) and θ_{ao} is the outside air temperature (°C). F_{1cu} and F_{2cu} enable the use of $(\theta_c - \theta_{ao})$ in the above equation for both the environmental heat transfer for the surfaces (that includes radiant and convective modes of heat transfer), as well as pure convective heat transfer from the ventilation components. As derived in appendix A2 of CIBSE Guide A5

$$F_{1cu} = \frac{3(C_v + 6\sum A)}{\sum(AU) + 18\sum A + 1.5R[3C_v + \sum(AU)]}$$

$$F_{2cu} = \frac{\sum(AU) + 18\sum A}{\sum(AU) + 18\sum A + 1.5R[3C_v + \sum(AU)]}$$

$\sum(AU)$ is the sum of the product of each surface where there is heat flow (for example, to outside or significantly cooler rooms), multiplied by its thermal transmittance ($W \cdot K^{-1}$); $\sum A$ is the sum of all the internal surface areas in the room (m^2); C_v is the 'ventilation heat transmission coefficient' ($W \cdot K^{-1}$) and is obtained from $C_v = 0.33N \cdot V$ where N is the ventilation and/or infiltration rate of directly incoming outdoor air (h^{-1}) and V is the room volume (m^3). R is the heat emitter radiant component, ranging from fully radiant heaters R=1 to warm air heating where R=0.

The value of N will be dominated (ideally) by the designed 'fresh' air required to maintain appropriate indoor air quality. Since the leakage of air into a building will tend to alter with wind direction, CIBSE Guide A5 notes that, when considering a boiler to heat a number of rooms in a building, 'the total net infiltration of outdoor air is about half the sum of the rates for the separate rooms. This is because, at any one time, infiltration of outdoor air takes place only on the windward part of the building, the flow in the remainder being outwards', and refers to CIBSE Guide A4 for more detail.

As insulation standards have significantly improved since the original development of this simplified application of the admittance method, the effect of thermal bridging has become more significant when considering the overall performance of a room. Hence the 'general thermal transmission coefficient', H_x, should take account of the normal heat flow through the surfaces, as well as additional heat flow through thermal bridges. Thermal bridging is likely to be more significant in smaller rooms and spaces, and those where there are generally high levels of insulation. So, the general thermal transmission coefficient is given by $(\sum(AU) + H_\Psi)$ where H_Ψ is the sum of thermal transfer coefficients for linear and point thermal bridges (see CIBSE Guide Section A3.3 for more details of thermal bridging).

There may be a case, where the value of H_Ψ is significant (compared with $\sum(AU)$), that the values of F_{1cu} and F_{2cu} should be reassessed, with $\sum(AU)$ being replaced by $(\sum(AU) + H_\Psi)$.

Individual U values (for use in the $\sum(AU)$ calculation), may be adjusted for those surfaces that are adjacent to other, cooler, indoor spaces (not outside walls) at a temperature of θ'_C,

$$\text{using } U' = \frac{U(\theta_C - \theta'_C)}{U(\theta_C - \theta_{ao})}$$

There is a simple worked example of a steady state heat loss in appendix A6.1 of section A5 – but note that a typographic error carries an incorrect value of $\sum(AU)$ forward from Table 5.A6.3 as provided in the example.

The type of heating system will not only affect the heating requirement because of its mode of heat transfer, but also by its location. With a 'radiator'-type system, with a surface temperature θ_H and rear area of A_H, there will be an additional heat loss from the back of the radiator through the wall (U_w) on which it is mounted. This additional loss can be estimated from $(\theta_H - \theta_c)U_w \cdot A_H$. For traditional 80°C/60°C system, that would mean, practically, around 12 watts per square metre of rear radiator surface. Modern systems are likely to operate with lower mean water temperatures (for example, 45°C, so as to allow condensing of flue gases in the boiler), and hence the additional loss from the rear of the radiator would be nearer 6 $W \cdot m^{-2}$.

For the simple heat loss calculation, a uniform temperature is assumed across the height of the space. Figure 3 represents the temperature profile across the height of a room – such as an office – for two common types of heating systems. It is clear that there is a significant variation in temperature for the high-level heated air inlet system. This will affect the heat loss, since the average room temperature will be higher than that with, for example, the radiator system. The actual temperature gradient will be dependent on the height of the space, and to accurately predict the effect on the heat loss would require some detailed analysis. CIBSE Guide A provides some guidance (in Table A5.11) that, broadly summarised, would mean, for an office of 3m height, the additional heating required for a heated air system (either low and high level supply) would be up to 5% higher than for a system using radiators. As the space increases in height, the additional percentage heat loss will also rise.

The other significant effect addressed in the CIBSE Guide that is relevant to sizing of heating requirement for a commercial space, is intermittent operation, where the boiler and heating distribution is switched off when occupants leave, and turned on before the next period of occupancy. The required preheat period (as shown in Figure 4, time t2 to t3) will depend on the thermal characteristics of the building (and its systems), the occupation time and the external conditions. In many cases, the unoccupied requirement may simply be that the internal temperature should not fall below 10°C (as a reasonable precaution to ensure that the air does reach its dew point, thereby preventing condensation).

A longer preheat period will increase the overall heat loss but will require a smaller heating system, and vice versa, so a balance must be struck. This proper assessment is no simple matter, since the variables are dependent not just on the building thermal performance, but also on the heating system costs and part load performance – this is a case where software modelling can usefully be exploited (see CIBSE TM41[2] for an excellent discussion of the underlying issues). Since the detailed methods in TM41 tend to predict excessively long preheat times, CIBSE Guide A5 suggests that a very simple multiplying factor, F_3, may be used to adjust the steady state heat loss (where preheat times are greater than one to two hours) to allow for a building that is occupied H hours a day where $F_3 = 24 \dfrac{24fr}{Hfr+(24-H)}$ and fr is the response factor (as used to determine the thermal inertia of a building) given by $fr = \dfrac{\sum(AY) + C_v}{\sum(AU) + C_v}$ where $\sum(AY)$ is the sum of the product of each surface area multiplied by its thermal admittance ($W \cdot K^{-1}$). A high value of F_3 indicates that it might be preferable to extend the operating period or potentially operate continuously, rather than greatly oversize the plant capacity. Highly insulated buildings (with controlled ventilation) and/or those with short unoccupied periods are likely to have high values of F_3, and there may be a case for continuous operation with no setback and no additional allowance on the system load. Pragmatically, the CIBSE Guide notes that if the calculated value of F_3 is less than 1.2, that its value be taken as 1.2 'to ensure that the customary safety margin of 20% is maintained'. The additional preheat load will increase the required boiler heating capacity. However, it might not necessarily require physically resizing the heating system, as this can be achieved by, for example, increasing the flow water temperature and/or ensuring the ventilation openings are closed during preheat and/or unoccupied periods.

As can be seen from the brief discussion in this article, there are clearly opportunities where applying dynamic thermal simulation tools will be ideal. However, in many cases this will not be feasible or available. It is, therefore, important when using the simpler methods of heating load assessment that the wider considerations should be understood and properly considered, to ensure that appropriate boiler selections are made to meet the ambitions of the predicted building performance to satisfy the demands of the user.

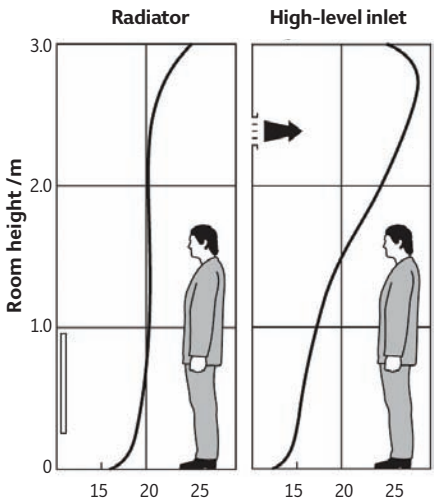

Figure 3: Influence of room heat emitter on temperature in space (Source: selection from CIBSE Guide A Fig 5.19)

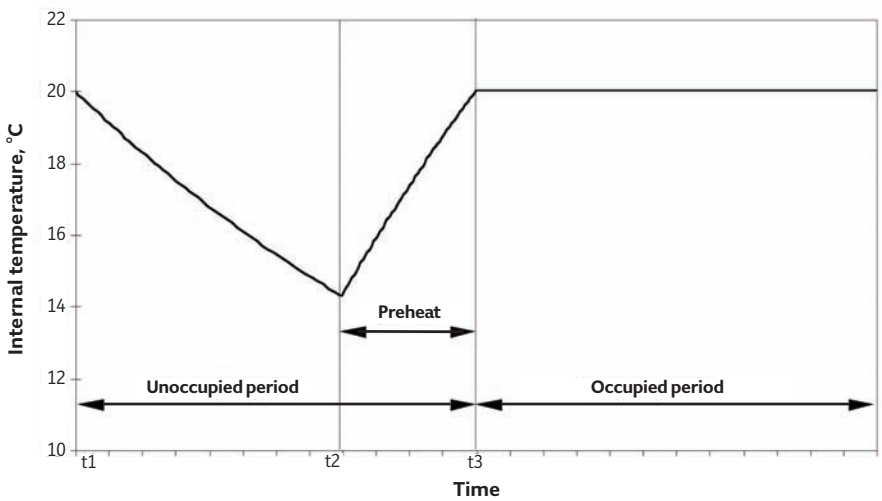

Figure 4: Internal temperature variations in an intermittently heated building (Source CIBSE TM41)

References:

1 *CIBSE Guide A5 Thermal design, plant sizing and energy conservation*, CIBSE 2015.

2 *CIBSE TM41 Degree-days: theory and application*, CIBSE 2006.

Turn over page to complete module

Module 95

June 2016

Vaillant

1. What is suggested as a source of information for determining appropriate external design conditions for heat loss calculations?

- ☐ A CIBSE Guide A1
- ☐ B CIBSE Guide A2
- ☐ C CIBSE Guide A3
- ☐ D CIBSE Guide A4
- ☐ E CIBSE Guide A5

2. A test room in the middle of an open field has a height of 2m, and a width and length of 5m, with an average surface U value of 0.25 $W \cdot m^{-2} \cdot K^{-1}$ and an outdoor infiltration rate of 0.5 air changes per hour. If the room is being heated completely by warm air, what is the value of F_{2cu}?

- ☐ A 0.98
- ☐ B 0.99
- ☐ C 1.00
- ☐ D 1.01
- ☐ E 1.02

3. A 0.75m x 2m radiator of an average temperature of 50°C is fixed to an outside wall with a U value of 0.2 $W \cdot m^{-2} \cdot K^{-1}$, in a room where the average temperature is 20°C. Approximately how much extra heat loss through that wall is there likely to be (above that of normal room losses) due to the radiator?

- ☐ A 3W
- ☐ B 6W
- ☐ C 9W
- ☐ D 12W
- ☐ E 15W

4. When applying heated air systems, as opposed to 'radiator' systems, what is the effect on heat loss for a 'typical' 3m-high office, as suggested by this article?

- ☐ A Heat loss would be up to 10% less than that for a radiator system
- ☐ B Heat loss would be up to 5% less than that for a radiator system
- ☐ C Heat loss is approximately the same as for a radiator system
- ☐ D Heat loss would be up to 5% more than that for a radiator system
- ☐ E Heat loss would be up to 10% more than that for a radiator system

5. What might suggest that a continuously operated heating system (and limited boiler oversizing) could be appropriate, as opposed to having a significant period of setback and preheat?

- ☐ A High value of $(\sum(AU) + C_v)$
- ☐ B High value of f_r
- ☐ C High value of F_{2cu}
- ☐ D High value of F_3
- ☐ E High value of R

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FDS secures £250m Brighton Marina development

Smoke ventilation contractor Fire Design Solutions (FDS) has been appointed for the first phase of a new £250m mixed-use development at Brighton Marina.

The project, by The West Quay Development Company Partnership, will include 853 residential apartments, a three-level car park, and more than 2,000m² of retail and leisure space.

Main contractors Midgard initially appointed FDS's sister company, FDS Consult, to create a full fire strategy and computational fluid dynamics (CFD) modelling for the residential area and car park. FDS has now received a further appointment, from Ark M&E, to supply and install the smoke ventilation and environmental systems, to ensure the development meets all of the required Building Regulations.

FDS will design, install and commission several systems, including a corridor environmental system and a mechanical smoke ventilation system.

Work on site started in January 2014, and the development is set to be completed by July 2016.

● **Visit www.firedesignsolutions.com**

Competitive quotations from Aircon Installations

Specialists in major air conditioning plant replacement since 1992, Aircon Installations offers all insurances, including £5m professional indemnity. Competitive quotations are available for the installation of water chillers – air cooled, water cooled and any make – plus air handling units, cooling towers, condensing units, pumps, power cables, steel structures and acoustic enclosures. With crane lifts and heavy shift experience in difficult locations, Aircon Installations would be pleased to submit its best price to your specification.

● **Call 0845 006 1403, email info@aicrs.co.uk or visit www.aicrs.co.uk**

Ceremony for Distech Controls' new European headquarters

Distech Controls, provider of energy management solutions, held the official ceremony for its new European headquarters in Brignais in April.

The 2,500m² building, which replaces the current headquarters, located in Brindas, is scheduled to open at the end of 2016.

The new building will create a technological showcase for Distech Control's energy efficient solutions, and will allow the company to better support its clients throughout all of Europe and 44 countries within Africa.

● **Visit www.distech-controls.com**

New Thision S Plus hits top gear at Land Rover dealership

Elco has supplied a 53kW Thision S Plus boiler with low loss header to Yeovil Land Rover, Somerset. One of the first installations of the new boiler in the UK, the unit is supplying highly efficient heating and hot water to the pre-delivery inspection area adjacent to the main showroom.

The boiler has been installed on a new system, as part of ongoing developments of the dealership's buildings, and was specified and installed by Dorset-based M&E contractors United Mechanical.

● **Visit www.elco.co.uk**

Precision heat metering made simple with Danfoss

Combining ultrasonic technology with advanced control, the new Danfoss SonoSelect makes precision energy metering easy for properties on a district heat network or communal heating system.

SonoSelect offers simple installation and commissioning via smartphone, using the Danfoss SonoApp. Water and dust protected to IP65, Class 2 MID approved, and with no in/outlet restrictions or moving parts, it ensures reliable operation, even in harsh ambient temperature conditions.

● **Call 0845 121 7400 or visit www.heating.danfoss.co.uk**

Atlantic Boilers offers more heat exchanger options

Atlantic Boilers has expanded its range of plate heat exchangers for domestic hot water (DHW), chilled water, pool and seawater. There are now 16 frame sizes available, from 19m³/h to 730m³/h max flow rate.

The RS Turboflow exchanger plates are made of austenitic 316L stainless steel with ethylene-propylene-diene-terpolymer high-grade gaskets, ensuring long life and pristine condition. They are designed for minimal pumping loss, and have been used in scores of applications across the UK, from swimming pools to historic buildings.

● **Email technicalsales@atlanticboilers.com or visit www.atlanticboilers.com**

CP Electronics taking safe route to success

Designer and supplier of lighting controls solutions CP Electronics is celebrating the award of a prestigious international safety standard.

The London-based company is believed to be the first lighting controls manufacturer in the UK to become accredited to British Standard (BS) OHSAS 18001-2007.

The award follows a rigorous audit process, spanning 12 months and covering a variety of areas, from risk assessment and legislative compliance to welfare policies and staff awareness of health and safety issues.

● **Call 0333 900 0671 for UK and international enquiries**

Kingspan Kooltherm FM Pipe Insulation prescribed for new Glasgow hospital

Kingspan Industrial Insulation's Kooltherm FM Pipe Insulation has been used at the new Queen Elizabeth University Hospital in Glasgow – a 1,109-bed facility that covers an area the size of 11 football pitches.

Specialist subcontractors Lagwell Insulation and McNicol Insulation installed Kingspan Kooltherm FM Pipe Insulation on the hot and cold service pipework across the site. The system achieves thermal conductivities as low as 0.025W/m·K, which helped to streamline the installation process at the hospital.

● **Call +44 (0) 1544 388 601, email info@kingspaninsulation.co.uk or visit www.kingspanindustrialinsulation.com**

Bridport United Church – a Jaga case study

The 19th-century Bridport United Church, in Dorset, has undergone a major renovation.

Churches are notoriously difficult to heat effectively, but Worldwise consultants identified Jaga as the manufacturer that could provide the best, all-encompassing radiator specification and supply service. Jaga's technical estimator, Justin Vicarage, took time to understand the project's specific needs before visiting the site.

The Jaga Maxi LST Continuous DBE was chosen as the primary heat source, accompanied by a range of additional solutions.

● **Call 01531 631 533, email jaga@jaga.co.uk or visit www.jaga.co.uk**

Curry and Moulsdale join Hamworthy

After the retirement of two of its sales managers, Hamworthy Heating has welcomed two new faces to its team. Anthony Curry (pictured right) is area sales manager for the South and West Yorkshire, including Sheffield and Leeds, while Dave Moulsdale is looking after South West England and South Wales.

The two new appointments further strengthen Hamworthy Heating's technical sales team.

Stuart Turner, national sales manager, said: 'We're excited to have Anthony and Dave join the Hamworthy family.'

● **Call Sam Boshier on 01202 662 510 or email pr@hamworthy-heating.com**

Battersea makes a powerful start with Grundfos

After many false starts, this year finally sees dreams for the redevelopment of Battersea Power station realised. The coal-fired power stations with their four iconic chimneys and art deco interiors have become even more famous as a London landmark since they ceased operating in 1983.

With Phase one opening, the site will come to life, as people take up residence in the initial 865 homes and offices, cafés, restaurants and shops open for business.

Working to support the energy centre, HVAC, water and boosting demands are a small army of energy efficient Grundfos pump products and solutions. These include 65 Grundfos TPE in-line and CRIE multistage pumps, five Grundfos Hydro MPCE booster sets, a range of pressurisation sets – all of which are supported by BACnet, a data communication protocol. Over the next 20 years, six more development phases will take place, ensuring Battersea Power Stations' key role in the London skyline.

● **Call 01525 850 000, email grundfosuk@grundfos.com or visit www.grundfos.co.uk**

Oventrop heating and hot water solution in Leamington Spa

Villiers House, a new development by Spitfire Bespoke Homes, will benefit from Oventrop systems. Specified by Greenway and Partners, and installed by Daly Engineering Services, apartment heating and domestic hot water are provided by Oventrop Regudis W-HTU Duo twin plate heat interface units (HIUs). Primary heating and boosted cold water services (BCWS) are supplied from a central plantroom, with the HIU capable of up to 15kW of heating and 17 litres per minute of domestic hot water.

● **Call 01256 330 441, email info@oventrop.co.uk or visit www.oventrop.co.uk**

New pressing tools for Geberit Mapress and Mepla

The new generation of pressing tools from Geberit Mapress and Geberit Mepla supply systems feature lighter-weight and faster pressing actions – as well as extra comfort and more power.

The battery-operated ACO 203, and the mains-operated ECO 203, are more compact than ever before.

Though lighter than previous models, the tools are 10% more powerful. This speeds up the pressing process and makes the tools ideal for carrying out work overhead.

● **Call 01926 516 800 or visit www.geberit.co.uk**

Silavent heat recovery systems for Greenwich regeneration schemes

Silavent Green Line HRX2 mechanical ventilation with heat recovery (MVHR) systems, from Polypipe Ventilation, are being installed in two apartment schemes at London's Greenwich Peninsula – one of the largest regeneration projects in Europe. Specified by Wates Construction, the HRX2 offers a heat exchange efficiency of up to 95% and reduces demand on the central heating system.

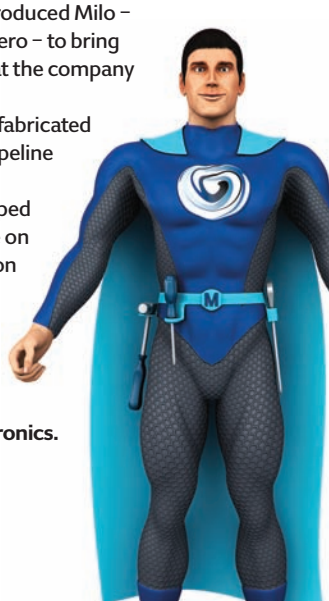
● **Call 03443 715 523 or visit www.polypipe.com/ventilation**

Introducing Milo

As customers look to save time, money and energy in their water-distribution projects, Marflow Hydronics has introduced Milo – the knowledgeable superhero – to bring to life the many savings that the company can offer.

Through its range of prefabricated products, control valves, pipeline valves and energy valves, Marflow Hydronics has helped customers reduce the time on site, speed up the installation and commissioning processes, cut costs and improve energy efficiency in their water-distribution systems.

● **Visit www.marflowhydronics.co.uk/milo**



Telephone: 0207 880 7633 **Email:** greg.lee@redactive.co.uk

Wavin launches breakthrough Revit piping packages

Wavin, supplier of plastic pipe systems and solutions, has launched its new building information modelling (BIM) content packages for plumbing and drainage.

Built in Revit, these content packages contain intelligent assistance to help the Revit modeller arrive easily at a full 'as built'. This development makes it possible to benefit from the time and cost savings for piping systems in BIM projects.

To support users, Wavin has created tutorials, a downloadable training manual and training options for Revit modellers.

● **Visit myportal.wavin.co.uk/bim-centre**

RDM extends capabilities of flagship products

Resource Data Management (RDM) has released two major product updates for DMTouch, the intelligent control system front-end, and the Intuitive TDB programmable logic controller.

The updates enhance and extend the products' capabilities for use in applications such as heating and ventilation, energy management, process control, lighting, refrigeration and building energy management systems (BEMS). Software v3.0 for the Intuitive TDB features a new web graphical user interface, upgraded display features, new unit measurement controls, and live maps integration.

● **Call 0141 810 2828 or email sales@resourcedm.com**

Vent-Axia's Sentinel Kinetic Advance commended at the Energy Show 2016

Ventilation manufacturer Vent-Axia has been commended at the Energy Show 2016 Product of the Show Awards in Dublin, Ireland.

The company gained recognition in the Best Energy Efficient Product category for its 'best in class' Sentinel Kinetic Advance mechanical ventilation with heat recovery (MVHR) unit.

The energy efficiency and app control of the system impressed the judges. Designed for airtight, thermally efficient new-build residential and light-commercial properties, the Advance offers near silent, energy efficient and high-pressure operation.

● **Visit www.seai.ie/EnergyShow**

Retirement housing development to benefit from Polypipe Ventilation's MEV solutions

Polypipe Ventilation's highly efficient Silavent CMX mechanical extract ventilation (MEV) units, with Domus Radial duct systems, have been specified for a new retirement housing development in Fleet, Hampshire.

Building service engineers Heatcare specified the Silavent system for the Keble Court development because of its performance and slimline design. With a depth of just 125mm and weighing only 3.25kg, the CMX is one of the most compact and lightweight MEV units on the market.

● **Call 03443 715 523 or visit www.polypipe.com/ventilation**

Hackney Council installs 24 Remeha boilers

Remeha boilers are providing reliable, energy-efficient heating as part of a communal heating scheme in eight residential tower blocks owned and maintained by Hackney Council.

David Manuell, at building services consultancy Promode, specified three Remeha boilers in each of the plantrooms, ranging from Gas 210 4-section 120kW Eco Pros to Gas 310 8-section 500kW Eco Pros. The boilers, with Remeha buffer vessels and pressurisation equipment, were installed before the tower blocks were moved across to heat interface units.

● **Call 0118 978 3434, email boilers@remeha.co.uk or visit www.remeha.co.uk**

Sitting comfortably with the Comodo heated bench-seat convector

Verano UK has developed 1m and 1.5m-long heated bench seats, giving outputs of up to 1,400W and 2,250W respectively. A fan-assisted version of the Comodo is also expected to be launched during 2016.

They are ideal for changing rooms, shopping centres, public waiting areas or airports, and logos can be placed in the toughened glass-panelled ends.

The standard seat is oak, but other hardwoods may be available on request.

● **Visit www.veranoconvector.co.uk**

Sanha's product catalogue refreshed for 2016

Sanha, manufacturer of Press Fit Systems, has updated its extensive product catalogue.

It contains Sanha's range of piping systems, with comprehensive information on products, from fields of application to properties of the system and operational conditions.

The NiroTherm and NiroTherm Industry series – a stainless steel installation system that reduces costs and labour time in a variety of applications – feature in the catalogue.

Both digital and printed versions of the 2016 product catalogue are available.

● **Call 01628 819 245 or visit www.sanha.com/en**

Diffusion and Vent-Axia join forces

British heating and cooling equipment specialist Diffusion has been acquired by the Volution Group, which supplies ventilation products to the residential and commercial construction market in the UK and northern Europe.

Volution completed the acquisition in December, and Diffusion joins some of the group's top brands, including UK ventilation company Vent-Axia. Having the two companies in the same group means both brands – and their product portfolios – can be accessed together, making specification simple.

● **Visit www.theairsolution.co.uk and www.diffusion-group.com**

Jaguar secures Nova, Victoria

Jaguar Building Services has been appointed by Land Securities as MEBF provider for the Nova, Victoria development, which will create a vibrant new link between London's Victoria Station and Buckingham Palace. It will provide 897,000ft² of office space, high-quality apartments, and a cluster of restaurants and bars.

In keeping with the project's environmental sustainability goals, the energy centre incorporates a combined heat and power (CHP) scheme that is capable of generating 3MW of electricity to supply the Nova, Victoria development and export to the grid, saving up to 6,500 tons of carbon dioxide.

Paul Roberts, Jaguar's MD, said: 'We are delighted to be partnering with Land Securities on this development. We will be doing all in our power to establish a best-in-class culture that puts the customer first.'

● **Visit http://jbs-ltd.co.uk**

Mikrofill supplies plantroom upgrade at Leasowes High School

After a dilapidation survey by Dudley Metropolitan Borough Council, it was decided to upgrade the low pressure hot water (LPHW) and hot water systems (HWS) equipment at Leasowes High School, in Halesowen.

Atmospheric heating boilers were replaced with six Ethos 130kW wall-mounted condensing boilers. The new installation has a modulation of 60 > 1 (780 > 13kW) ensuring the buildings heat load is accurately achieved. An Extreme 500-litre loading cylinder and Mikrofill 1,200/2 pressurisation package were also installed.

● **Call 03452 606020 or visit www.mikrofill.com**

THE BRITISH ASSESSMENT BUREAU ISO9001

Adcock continues to excel through its high industry standards

Adcock Refrigeration and Air Conditioning has been accredited with ISO 9001 certification, from The British Assessment Bureau, for installation, service and maintenance of refrigeration and climate-control equipment. The company also recently gained OHSAS 18001 accreditation, while its health and safety standards were recognised earlier this year, with Health and Safety League winner certificates for work on the Elm House project.

● **Visit www.adcock.co.uk/accreditations**

DIRECTORY Your guide to building services suppliers

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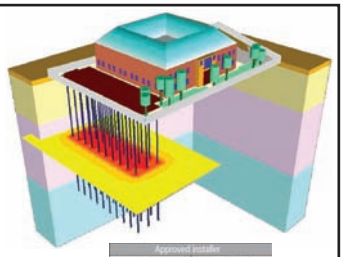

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Green Ventilation

THE ETHOS OF ESOS

Sustain's **Tilly Shaw** describes her experiences as an ESOS Lead Assessor and the savings some of her clients have made as a result of implementing the recommendations from their assessments

Tilly Shaw is a CIBSE low carbon consultant and ESOS Lead Assessor. She heads up the energy management team at Sustain, a UK energy and carbon management firm providing efficiencies for private sector organisations. Sustain has carried out 47 assessments for ESOS compliance and is still picking up a few latecomers. Shaw, a physics graduate, is working towards a Master's in sustainable building services engineering.

Can you name some of your big clients?

They include Colliers International, Sega, Orange, Hargreaves Lansdown and Autoglass. The range of organisations affected by ESOS is very broad, from large, single-site industrial operations to complex corporate groups. We've audited a variety: firms making anything from sweets to car seats; warehouses; workshops; theatres; shopping centres; offices; datacentres; healthcare wards; and casinos.

Which ESOS project has produced the biggest savings?

Unite Students presented the biggest savings for us simply because the size of their built estate makes it possible to roll out measures on a large scale. We also found that, for large commercial vehicle fleets, measures such as route planning or driver training have huge potential for cost savings.

How do you persuade board-level directors to carry out ESOS recommendations?

I've had some lively debates with directors about their ESOS reports and it's great when they engage with the energy agenda. My top tip would be to make sure the facilities and operations staff support your ideas. Directors often turn to them to confirm the feasibility of a project. Remember, directors get appointed because they grow firms, so talking about competitive advantage or efficiency can be more effective than discussing 'savings'.

> Before we start to discuss whether buildings are performing as they should, we need to get the real numbers

Are companies keen to act on your recommendations?

Some have characterised ESOS as an administrative headache and nothing more. A few are correct, of course, because they are managing their energy effectively anyway; more believe current energy management practices are cutting-edge, when they are not; some simply have more pressing strategic priorities. But, on the bright side, I would estimate that 40% of our ESOS clients are actively considering their findings or implementing measures.

What advice has offered the fastest payback for firms?

The best paybacks are from practising planned maintenance and monitoring performance of equipment; providing training for equipment users; and ensuring that the building management system (BMS) or other system controls are set properly. Optimising a BMS to reflect the actual occupancy and building characteristics, instead of assumed values, can make a building much more pleasant and cut overheads.

Are more companies looking into ISO 50001 as a compliance route?

Unfortunately, the way ESOS was introduced meant that ISO 50001 was not taken up as widely as it might have been. Because it can take six to nine months to achieve ISO 50001, many clients just did not have time before the deadline. By the time the Environment Agency (EA) announced that additional time would be available to implement the standard, many companies had already rejected it. However, I expect there will be bigger take-up in 2019.

What is the most innovative project Sustain has worked on?

For me, it's the ESOS assessment for Western Power Distribution, the company responsible for electricity distribution in the Midlands, South West and Wales. It has a complex energy footprint, including numerous sites, local generators, and a helicopter fleet. Added to this, the EA requested that electricity distribution losses should be included in the assessment. This meant the results centred on their network of 220,000km of cables and 185,000 transformers.

What have your audits shown?

My chief observation is the failure of energy suppliers, brokers or managers to collect accurate and comprehensive energy data across large estates, even where automated meter reading (AMR) is installed. Despite our best efforts, almost all our assessments have required some form of data estimation. Additional issues exist around the supply of energy data from landlords to energy end-users. So before we start to discuss whether buildings are performing as they should, we need to get the real numbers.

- For more on ESOS and becoming a Lead Assessor, visit **www.cibse.org/ESOS**

TILLY SHAW is a consultancy project manager at Sustain

Events & training

NATIONAL EVENTS AND CONFERENCES

Building Performance Awards (BPA) launch
22 June, Liverpool
Launch party for the 2017 BPA, and site visit of the 2016 Building Performance Champion
www.cibse.org/bpa

Built Environment Exchange: Energy efficiency v wellbeing
30 June, London
Debate: Energy efficiency has tended to dominate sustainability activity, but a more holistic interpretation is gaining focus – one that considers wellbeing and the measurement of the workability and liveability of spaces. Is the built environment sector ready to take on this broader agenda? Join industry experts to debate the issue.

CPD TRAINING

For more information, visit **www.cibse.org/mcc** or call **020 8772 3640**

High voltage (11kV) distribution and protection
2 June, London

Energy surveys
3 June, London

Variable flow water system design
9 June, London

Building services overview
9 June, Manchester

Understanding and application of psychrometric charts
17 June, London

Energy efficiency building regulations
21 June, Manchester

Mechanical services explained
21-23 June, London

Fire safety in purpose-built blocks of flats
23 June , London

Energy management system ISO50001 (ESOS compliant)
24 June, London

Building services explained
28-30 June, London

Electrical services explained
28-30 June, London

Introduction to combined heat and power
28 June, London

Introduction to heat networks and code of practice
29 June, London

Power system harmonics
1 July, London

Practical controls for HVAC systems
1 July, London

Lighting and energy efficiency
5 July, London

Energy efficiency Building Regulations: Part L
5 July, London

Designing water efficient hot and cold supplies
8 July, London

Emergency lighting to comply with fire safety
8 July, London

Energy strategy reports
12 July, London

Mechanical services explained
12-14 July, Manchester

Wiring regulations (including July 2015 update)
14 July, London

Gas safety regulations (designing for compliance)
15 July, London

Air conditioning and cooling systems
15 July, London

Building services explained
19-21 July, Manchester

Electrical services explained
26-28 July, Manchester

ENERGY ASSESSOR TRAINING

For more information visit **www.cibse.org/events** or call **020 8772 3616**

LCC design and EPC
7-8 June, London

Heat networks
8-9 June, Leeds

Air con inspection
13 June, London

LCC building operations and DEC
13-15 June, London

Heat networks
22-23 June, Glasgow

LCC design and EPC
22-23 June, Manchester

LCC building operations and DEC
28-30 June, Manchester

Heat networks
6-7 July, London

LCC design and EPC
12-13 July, London

LCC building operations and DEC
18-20 July, London

CIBSE GROUPS, REGIONS AND SOCIETIES

For more information, visit **www.cibse.org/events**

Northern Ireland golf day
1 June, Belfast

Lifts Group: Evening meeting
7 June, Manchester
With speakers Michael Bottomley, of Movveo, Dr Gina Barney and Adam Scott.

SoPHE: Air-to-water heat pump, sizing, selection and integration with DHW systems
7 June, London
A talk by Lochinvar.

Daylight Group technical event and AGM
8 June, London
Two papers by Michael Donn, from Victoria University, Wellington, NZ, titled *The Sun is your enemy* and *Teaching climate-based daylight modelling*.

Scotland Region: Trench heating seminar
8 June, Glasgow
Seminar sponsored by Kampmann UK.

Yorkshire Region: Implementing ISO55000 – challenges and lessons learnt
8 June, Leeds
A joint event with Green Vision and IHEEM Yorkshire to learn about ISO55000, and the wins that Sodexo has achieved for itself, its clients and its people.

Society of Façade Engineering: City walk and lecture
15 June, London
Walking tour around Canary Wharf, preceded by three talks on the area.

HCNE & SLL: Lighting Technical Presentation
21 June, London
Presentation by Friedrich Bremecker, DIALux.

HCNW: The Future? Intelligent buildings, a surprising introduction
21 June, Letchworth Garden City
Presentation by Professor Derek Croome, chair of the CIBSE Intelligent Buildings Group.

HCNW: Work, career and inclusivity: Bullying – ditch the label
30 June, London
With speaker from charity Ditch the Label.

Facilities Show

21–23 June, ExCel London

Facilities Show 2016 returns to ExCel London for a third year, and is set to be bigger and better, with a host of exciting new features and a complimentary seminar stream running across the three days.

The show will bring together facilities management (FM) professionals from all sectors with suppliers, advisers and specialists, as well as exhibitors showing the latest innovations, products and services to assist end users.

As well as more than 300 exhibitors, the show will host a seminar steam, which – this year – includes inspirational speakers Kate Adie OBE (pictured), Colonel Tim Collins OBE, and James Cracknell OBE, headlining.

Visit the CIBSE Facilities Management Group on Stand N1400 at the show and catch up on all the latest FM news, events and services that CIBSE has to offer.

Geoff Prudence, chair of the CIBSE Facilities Management Group, will also be presenting the session 'Leading effective maintenance strategies' in the FM Operational Excellence Arena, from 1.20pm-1.50pm on 21 June.

To register visit **www.facilitiesshow.com**

CIBSE BUILDING PERFORMANCE CONFERENCE AND EXHIBITION

CIBSE CPD

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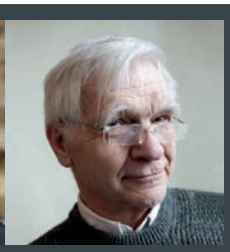
www.cibse.org/conference

CONFIRMED SPEAKERS:



Patrick Bellew
Founding Director, Atelier Ten

Max Fordham
Founder, Max Fordham

The Anniversary Interviews – Patrick Bellew and Max Fordham – their visions of our future built environment.

Two of the most influential and well-known building services companies are celebrating significant anniversaries. Atelier Ten celebrated their 25th anniversary in 2015 and in 2016 Max Fordham LLP will be 50 years old.

The practices are led by iconic figures in building services engineering. Patrick Bellew, Atelier Ten, and Max Fordham at his eponymous company. These two giants of the industry will be interviewed together at the CIBSE Building Performance Conference 2016. Two of the industry's most influential environmental engineers will share their visions and aspirations for the next 50 years in building services.

Other speakers include:

Casey Cole
Managing Director, Guru Systems

Paul Davidson
Director, Sustainable Energy, BRE

Matt Fulford
Inspired Efficiency

Andy Green
Director, Faithful & Gould

Neil Lewis
Managing Director, Waterman Building Services

Robin Nicholson
Partner, Cullinan Studio

Ted Pilbeam
Building Services and Sustainability Director, VolkerFitzpatrick

Marine Sanchez
Building Physics Engineer, Enhabit (formerly Green Tomato Energy)

Performance. Inspiration. Aspiration.

For more information please contact Michelle Michelucci today on 01892 518877 or email conference@cibse.org

17-18 November
2016
QEII Centre
Westminster, London
@CIBSE #CIBSEconf

The CIBSE Conference and Exhibition will inform and inspire building services professionals including consultants, designers, facilities managers and engineers, and offer up to 10 hours of CIBSE CPD.

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Join some of the biggest names in the industry...

2016 Exhibitors:

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Fast and accurate controls to drive high speed dampers or invertors. Full PID stand alone controls with BMS interface.

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Metal Damper

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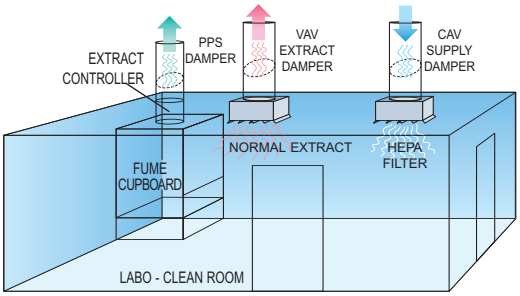

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