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January 2017

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Hold your breath



After 12 months of political upheaval, the construction industry looks set to face a period of uncertainty in 2017. No-one yet knows what the full impact of Brexit will be on the UK, but some apprehensive property investors have already put developments on hold. As a result, market analysts at Glenigan estimate that the value of project starts on site fell by 4% in 2016, and a similar decline is expected in 2017 (page 20).

You don't need a crystal ball to foresee rising costs of HVAC plant. The fall in the pound means raw materials have become more expensive for UK manufacturers, and these higher costs will be felt

further down the supply chain as we move into the new year.

The economic uncertainty caused by the Brexit vote has been magnified by the election of Donald Trump – no-one is sure how much of his protectionist rhetoric will be carried through into US policy and affect global trade. His election also brings into question America's commitment to combating climate change. A surge in share prices in the US – the 'Trump bump' – is partly caused by the significant rise in the price of oil and mining stocks. Investors here expect Trump to turn his back on clean energy and focus on fossil fuels. This has been reinforced by the appointment of ExxonMobil CEO, Rex Tillerson, as Secretary of State, and Scott Pruitt – who questions whether the climate change debate has been settled – as head of the Environment Protection Agency (page 6).

More positive trends for 2017 relate to wellbeing and performance. On page 30, we report on a new research project – backed by Innovate UK – that attempts to uncover scientific evidence linking indoor environments with productivity. On page 17, Anastasia Mylona outlines CIBSE's plans in the same area.

Energy reduction in buildings remains a priority – industry has a long way to go before it successfully delivers buildings that perform as engineers intended. Poor performance is being addressed in the heat network sector by a new testing regime for heat interface units. This will allow designers to see, for the first time, the impact that a specification has on network performance. It will not only force manufacturers to supply appropriate units, but also make consultant engineers and contractors more accountable for their designs and installations.

As you will have noticed, the *Journal* has a fresh new look for 2017 – we hope you like the design. Look out for more content in the new year, too, including in-depth interviews and analysis, plus all the latest technical insight from our dynamic, ever-changing industry.

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The Hoare Lea partner looks at the impact of the emerging demand-side response market



Liza Young

Our deputy editor speaks to Gold Medal winner Doug Oughton and visits Harrods' refurbished lobby



Tim Dwyer

Our technical editor addresses indoor air quality and natural ventilation in his latest CPD

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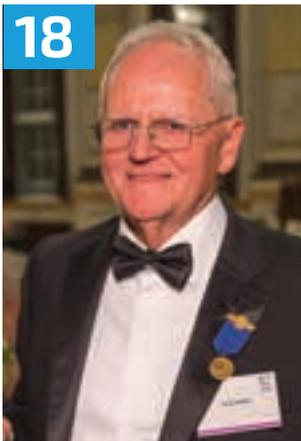
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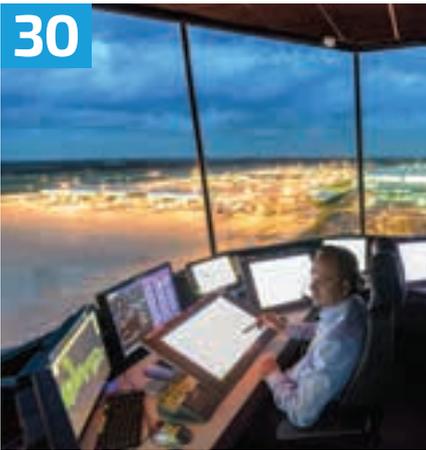
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IN BRIEF

Construction growth fastest since March

There was a sudden speeding up of UK construction activity in November, but rising costs are squeezing profit margins, according to economists.

Workloads and new orders in the private sector grew at their strongest since March, according to data from research firm Markit. This was partly explained by delayed projects restarting after June's EU referendum result.

The IHS Markit/CIPS construction purchasing managers' index rose to 52.8 in November. A score of 50 and above indicates growth. However, the data also showed that the sharp fall in the value of the pound had hit costs, which were rising at their fastest rate for five years.

UK achieves wind-power record

Wind-farm turbines generated more than 10,000MW of electricity for the first time in December – a new record output for the UK.

National Grid figures show that 10,104MW was generated from onshore and offshore wind between 2pm and 2.30pm on 7 December, equivalent to 23% of the country's electricity demand for the day. Wind farms also set records in 2015 by generating 11% of the UK's electricity – up from 9.5% the previous year.

New exams could address skills crisis

Main contractor Laing O'Rourke has called for the introduction of construction GCSEs and A levels to tackle the industry's skills crisis.

Only 42 out of 3,401 state secondary schools offer design, engineer and construct (DEC) courses – and the qualifications are not recognised by many universities. Introducing full GCSE and A level courses 'would boost the appeal of the sector to schools, students, parents, universities and higher education institutions'.

Laing O'Rourke also called for a speeding up of the 'Trailblazer' apprenticeship standards, and the creation of a single construction and infrastructure skills body.

BEST FAÇADES REVEALED AT GLASS SLIPPER EVENT



Two very different buildings in London and Amsterdam have won the top accolades at the 2016 Façades Competition, organised by the Society of Façade Engineering. Arup won Façade of the Year in the refurbishment category for its high-quality, tightly curved, glazed façade at 10 New Burlington Street in London. The winner of the Outstanding Façade Innovation went to TU Delft & ABT Consulting Engineers, for the Crystal Houses in Amsterdam. The façade – for luxury retailer Chanel – is made of glass bricks held together by a transparent, high-strength glue. Towards the upper storeys, the glass bricks merge with the original terracotta brickwork. The awards were presented at the annual Glass Slipper event in London last month.

Trump chooses climate change critic to head US environmental agency

US President-elect Donald Trump has chosen an outspoken critic of President Obama's climate change policies to head the Environmental Protection Agency (EPA). Oklahoma Attorney General Scott Pruitt, 48, has been instrumental in several legal challenges to EPA regulations, is part of the fossil-fuel lobby, and has been called a 'climate-change denier' by environmentalists.

During his presidential campaign, Trump accused the EPA of spending 'taxpayer dollars on an out-of-control, anti-energy agenda that has destroyed millions of jobs'. He said Pruitt would 'reverse this trend and restore the EPA's essential mission of keeping our air and our water clean and safe'.

Pruitt sued the EPA over Obama's Clean Power Plan, which he described as 'an unlawful attempt to expand federal bureaucrats' authority over states' energy economies, in order to shutter coal-fired power plants'. He has also been quoted as saying the climate change debate is 'far from settled' and that scientists 'disagree about the degree and extent of global warming and its connection to the actions of mankind'.





Government urged to mandate heating controls

Consultation looks to improve standards of domestic boilers

The Department for Business, Energy & Industrial Strategy (BEIS) has launched a consultation on the future of heat in domestic buildings.

It is seeking the industry's views on options for raising domestic boiler standards and closes to submissions on 27 January. The government is also seeking evidence on the costs and benefits of wider domestic and non-domestic central heating system performance improvements.

The Heating and Hot water Industry Council (HHIC) has recommended that time, temperature and weather compensation controls become a mandatory part of any new boiler installation, and are enshrined in the Building Regulations.

It said changes to the regulations in 2005, which mandated condensing boilers, was 'one of the most successful

government interventions into the residential energy market' and that action on system controls could prove 'equally successful'.

'We install 1.6 million new gas boilers per year and, if each of these was accompanied by a full suite of heating controls, the carbon and monetary savings made would be substantial,' said HHIC director Stewart Clements.

Boiler manufacturer Viessmann said the domestic heating market was ready to deliver fuel-bill and carbon reductions 'using available technology, such as weather compensation', and congratulated the government on identifying 'gains that could be achieved through regulation rather than subsidy'.

The consultation is a key opportunity for *Journal* readers to guide future policy on domestic heat and, in particular, on the provision of usable effective controls.

Visit www.gov.uk/government/consultations/heat-in-buildings-the-future-of-heat

Weather compensation controls could become mandatory

Policy and design changes needed to support heat pump rollout

Heat pumps could play a crucial role in helping the government achieve its low-carbon heating targets, but would need radical policy and design changes, according to the Committee on Climate Change (CCC).

In its report, *Next Steps for UK Heat Policy*, the CCC called for all future housing stock to be highly energy efficient and able to work with low-carbon and low-temperature heat sources, declaring: 'Improved building efficiency is an essential part of effective heat pump rollout. Deployment of low-carbon heat cannot wait until the 2030s.'

The CCC said the goal of installing around 200,000 heat pumps between 2015 and 2020 was 'consistent with the announced funding to 2020 available under the Renewable Heat Incentive'. However, the Heat Pump Association said it was not convinced the target was possible under the existing regulatory framework, because the Building Regulations do not 'make reasonable allowances' for the future provision of low temperature heat emitters, so future retrofitting costs are too high.

Call for quality mark to improve housing stock

The government should create a quality mark for domestic renewable and energy-efficiency measures, according to the long-awaited review on housing retrofits by BRE chief executive Dr Peter Bonfield.

Each home counts calls for an overarching framework for the green retrofitting of housing, to ensure appropriate measures are taken to improve housing stock.

Bonfield said there were 'too many instances of poor-quality installations being made by companies who do not have the skills, quality levels or core values required to operate responsibly in this market.'

The review recommends that installers, designers and assessors be certified by an approved body.

Other suggestions include the creation of a 'data warehouse' to share information on refurb, robust monitoring, and making sure all qualifications and training courses are underpinned by building physics.

Housing association in deal with China to build modular homes

A UK housing association has signed a £2.5bn contract with a Chinese state-owned construction company to build 25,000 modular homes over the next five years.

Your Housing Group has formed a joint venture with China National Building Material Company (CNBM) to build the homes, alongside renewable energy company WeLink.

Five pilot schemes are set to deliver 2,000 homes this year, with production ramping up to 25,000 homes per year by 2022. The first scheme – in Liverpool – is expected to receive planning permission this month.

The agreement aims to introduce a modular housing type, constructed off site and then transported to its final location, resulting in a quicker and cheaper building process.

Volition Group acquires Breathing Buildings

Cambridge-based Breathing Buildings has been bought by ventilation products company Volition Group.

Breathing Buildings specialises in the design and manufacturer of hybrid and natural ventilation products for commercial projects, and will form part of Volition's ventilation group division.

Founder and CEO Shaun Fitzgerald FCIBSE said: 'Becoming part of the Volition Group will enable us to keep our focus on growth through product development and the provision of a more comprehensive offer to our client base.'

IN BRIEF

CITB has 'failed to promote' training in smaller businesses

A survey of 500 construction employers claims the CITB has failed to promote training among smaller firms, with only 9% of the industry's small- and medium-sized enterprises (SMEs) receiving funding from the organisation.

The research, carried out by YouGov on behalf of Hudson Contract, also showed that only half of the 9% received the full cost of training. Hudson said SMEs pay twice as much levy as larger firms, yet have less power to influence the CITB.

YouGov also reported that 60% of levy payers provide training without CITB grant funding, so many question the need for a levy and grant system.

Steve Radley, CITB director of policy, said the organisation was aware that it had to make its support 'more accessible to firms of all sizes', but that the Hudson survey did not 'tell the full story'.

Breeam and Well standards join forces

The Breeam and Well building standards have signed a collaboration deal to recognise both sustainability and wellbeing best practice in buildings, in response to demand from prime office developers.

BRE and the International Well Building Institute will now offer 35% of credits on each other's certification schemes.

Industry urged to focus on people's health and wellbeing

Sector urged to stop using standardised design data just to comply with Part L

The building engineering industry does not focus enough on human health, wellbeing and productivity, according to speakers at the latest Building Services Summit.

Held at the British Library in central London, the summit challenged the sector to make better use of the huge quantity of data that is now accessible to address failing buildings and stop using 'standardised design data' just to comply with Part L of the Building Regulations.

Organised by the Building Engineering Services Association, the BCIA and the ECA, the summit heard that the Internet of Things was an opportunity to capture data much more effectively. 'Part L calculations are not energy-performance calculations – they use arbitrary or

standardised data because real data is complex, messy and hard to replicate in a simple equation,' said Remi Suzan, design director at Gratte Brothers. 'Variables like dynamic weather conditions are very hard to predict... and the big one is unregulated energy use.'

Arup associate Stephen Hill said health and wellbeing had 'shot up the agenda in the last five years' and that bringing energy and the wellbeing issues together was 'very powerful from a client's perspective'. 'We are getting more data out of our buildings,' he added. 'However, this creates a risk, because the tenants get a better understanding of what is happening in their buildings and can now see more clearly what's going wrong.'

Hill said the building services sector needed to position itself as part of a wider solution that involved occupant satisfaction.

TWISTING ECO TOWER NEARS COMPLETION



The Agora Garden 'twisting' towers development in Taipei, Taiwan, has 'topped out'.

Designed by Vincent Callebaut Architecture, the luxury residential development was inspired by the structure of DNA and is said to absorb carbon thanks to the use of vegetation throughout.

Close to the Leed Platinum Taipei 101 skyscraper, the Agora tower will feature on every floor plants, vegetable gardens and trees, capable of absorbing 130 tonnes of CO₂ annually.

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Conference calls on UK to keep Euro climate laws



Businesses don't want pick-and-mix legislation after Brexit

The government must retain all EU climate legislation post-Brexit, and use its planned Industrial Strategy to align policies to the low-carbon agenda, according to a powerful lobby of parliamentarians and the private sector.

Low carbon growth should act as a 'thread' throughout the strategy, rather than being seen as a separate aspect of the business agenda, according to the vice-chair of the Committee on Climate Change, Julia King.

'The very strong message from businesses is that they don't want government to start choosing what gets put into UK legislation from the EU - they want all of the climate change regulation because they are familiar with it,' she told a *Financial Times* conference.

DLA Piper's UK head of environment, Teresa Hitchcock, told the event that 'political clarity' was the most important issue for businesses and should be supported by stronger regulation because many companies were feeling 'nervous'.

'It's a long time since we've been given the opportunity to shape some of these controlled measures and, whether we want to be in this position or not, we have to embrace the opportunity,' she said. 'I think regulation can be stronger to give more certainty and it must be matched by enforcement. Enforcement is creating an unnatural, rather than a level, playing field at the moment.'

Speakers at the event said they had been 'disappointed at the lack of focus on energy' in the Chancellor's Autumn Statement and there was growing confusion among private sector energy professionals. They called for a 'long-term vision for energy policy'.

EU energy efficiency plans could boost sector jobs and production

The European Union has announced a 10-year package of measures aimed at meeting the commitments made by member states in the Paris Agreement. It aims to improve energy efficiency levels by 30% by 2030 - primarily through a far-reaching building-refurbishment programme - and to create a more 'decentralised' energy system, as part of its strategy for delivering on the promise to cut emissions by 40% by 2030.

'Our proposals provide a strong market pull for new technologies, set the right conditions for investors, empower consumers, make energy markets work better and help us meet our climate targets,' said the EU's head of climate change, Miguel Arias Cañete. 'With these proposals, the Commission has cleared the way to a more competitive, modern and cleaner energy system. Now we count on the European Parliament and our member states to make it a reality.'

The European Commission (EC) has allocated €2bn for research into energy storage and demand-response measures through its Horizon 2020 programme. A separate €5-10m fund has been set aside to support advances in nearly-zero energy building design, community-based energy trading and social innovation in energy or transport for cities. The EC said the annual €27bn fund for public and private research could lead to increased production in the construction sector by up to 5% - leading to 700,000 additional jobs in construction and 230,000 in engineering.

'Hard' Brexit could turn skills gap into a gulf

The construction sector could lose 215,000 vital workers in the event of a so-called 'hard' Brexit, turning the current skills gap into a skills 'gulf' as the number of workers from the European Union (EU) falls between now and 2020.

According to research by the consultant Arcadis, extending the points-based system in place for non-EU migrants to workers from the EU would be particularly hard on construction, because it employs a lot of unskilled and semi-skilled migrant workers.

Even a 'soft' Brexit could lead to a loss of 135,000 workers, the research showed. Arcadis said the industry must speed up efforts to modernise and accelerate use of technology and off-site manufacturing to plug skills gaps.

'The British construction sector has been built on overseas labour for generations, and restrictions of any sort will hit the industry,' said James Bryce, Arcadis director of workforce planning. 'If we cannot import the right people, we will need to ramp up training and change the way we build.'

Leaks force demolition of zero carbon school

The failure of a rainwater-harvesting system has led to the demolition of one of the UK's first zero carbon schools, seven years after it opened.

Dartington Primary School, near Totnes, Devon, has been torn down because mould and water damage caused by leaks from the roof-mounted rainwater system was uneconomic to repair, with costs estimated at around £7m.

The school used the rainwater for flushing toilets, but classrooms were damaged by water leaks soon after it opened in 2009. A report found that the scheme's design was probably at fault, and highlighted complexities and issues relating to the materials used in the system.

It is thought that the chestnut cladding on the roof warped, which led to rainwater leaking into the building. A replacement school building, designed by Atkins, is due to be built this year.

BSI launches BIM Kitemark

BSI has launched a Kitemark for BIM, which aims to build on the verification scheme of PAS 1192-2.

It involves sampling completed projects and assessment of customer satisfaction through ISO 10004 and other standards.

Balfour Beatty, BAM Ireland, BAM Construct UK, Gammon Construction, and Skanska UK are among the first to achieve the certification, which is for the capital/delivery phase of construction projects. It is available to firms that have already achieved verification stage and are certified to ISO 9001.

Giant battery scheme could transform energy grid

Leighton Buzzard facility backed up grid for more than 7,500 hours

An £18.4m grid-scale battery system in Bedfordshire has proved the technical and commercial viability of energy storage in the UK after a two-year trial, according to the facility's operator.

UK Power Networks claims that the automated 'big battery', based in Leighton Buzzard, can store enough electricity to power 6,000 homes for 1.5 hours at peak times. This model, it says, could transform the energy grid – especially as the cost of battery storage continues to fall.

The Smarter Network Storage (SNS) facility has backed up the grid for more

than 7,500 hours and fed the local electricity network on more than 180 occasions, the operator said.

'The trial has drawn attention to the fact that the UK's regulatory framework needs to evolve to help exploit its full potential,' said UK Power Networks director of safety, strategy and support services Suleman Ali.

'For example, energy storage currently incurs a double carbon levy – both when it stores energy and when it releases it.'

Ali added that it was vital that the country got this right because 'all eyes are now on energy storage' and its role in moving the UK onto a low carbon energy system.

Business leaders call for rethink on PV 'tax'

More than 150 large companies have written to the Chancellor, Philip Hammond, urging him to scrap scheduled tax increases on solar PV.

Major retailers – including Sainsbury's, Ikea and Kingfisher – plus non-governmental organisations (NGOs), politicians and academics, say the inclusion of 'self-consumed' solar power in business rates from April 2017 is 'uneconomic' and will disrupt efforts by small businesses to meet renewable energy targets.

They estimate that tax for users of solar power will rise by six to eight times current levels under the changes, with the set rateable value going up from £8/kW to between £48 and £62/kW. Small commercial users with onsite schemes are likely to be the worst hit, as public sector users and those who receive their supply from a separate supplier are exempt.

The Solar Trade Association said the new tax rate would push up the annual tax bill charged on a 100kW rooftop solar system from £397.60 to £2,733.50. 'For many small firms, this is an extra financial burden that they will struggle to cope with,' said Mike Cherry, from the Federation of Small Businesses.

Cryogenic storage plant is next leap forward for UK renewables

Manchester is to host the world's largest cold-energy storage plant. Sited next to a landfill gas-generation facility, the 5MW plant will have the capacity to power up to 5,000 homes for around three hours.

It works by harnessing renewable or off-peak power to chill air to -190°C, at which point the air turns into liquid and is held in an insulated tank. The liquid is then warmed when power is needed and, as it expands – by a factor of 700 – it drives a turbine to generate electricity.

The scheme developer, Highview Power Storage, said the technology could be scaled up for long-term use with a range of green energy sources, as part of the UK's strategy for supporting the grid with large-scale storage systems.



Industry 'missing the mark' on efficient homes

Bsria has published a guide to building performance evaluation (BPE) in domestic buildings. The association claims the industry is still 'missing the mark' in its attempts to develop energy efficient homes.

Its guide sets out to explain to clients, designers, developers, contractors, housing associations and social landlords how BPE can be used to understand the performance of residential buildings and to address problems.

Building performance evaluation in domestic buildings guide (BG64/2016) is available to BSRIA members in hard copy for £30 and is free to download from www.bsria.co.uk

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IN BRIEF

Ready, steady... light!

Entries are now open for the 2017 Ready Steady Light competition, held in partnership with Rose Bruford College, Sidcup, where it will be held on 21 March.

Teams will compete to design and set up temporary exterior installations, with a limited range of equipment, in just three hours.

The competition is always popular, so entry is restricted to one team – of up to five people – per organisation, with first-timers particularly encouraged to enter. Each team must be led by a Society of Light and Lighting (SLL) member.

Entry costs £150, and prizes will be awarded in three categories.

If you would like to register your interest in entering a team for this event, email sll@cibse.org



Esteemed lighting designer and industry 'gentleman' dies

It is with great sadness that CIBSE has learned of the death of Ernest Wotton FCIBSE FSELL, who died peacefully in his home in Toronto on 14 November.

Wotton was an esteemed lighting designer and consultant, a university lecturer and a writer.

Described as a gentleman by his peers in the industry, Wotton leaves behind his wife, Sally, and son, Christopher Charles, as well as two sisters in England.

He joined the Illuminating Engineering Society – the forerunner of the Society of Light and Lighting (SLL) – in 1948, and received the 2010 SLL President's Medal, as well as a CIBSE Silver Medal in recognition of his significant contribution to the industry. Wotton was completing a book on church lighting at the time of his death.

Tolia takes lighting title with street-smart highway study



Left to right: Aisha Robinson, Sofia Tolia, Eleonora Brembilla and James Duff

Lighters tested on presentation skills

Lighting engineer Sofia Tolia has been named Society of Light and Lighting (SLL) Young Lighter of the Year 2016, for her work on energy saving in road lighting.

Her paper, *Variable lighting levels for highways: A different approach*, was delivered in a 15-minute presentation – alongside three other finalists – before a panel of judges at the LuxLive exhibition.

Based on research on the Greek port of Piraeus for her Master's diploma thesis, the paper examines the current methods used to

save energy by dimming road lighting when traffic is predicted to be low, and suggests an alternative methodology.

Richard Caple, SLL vice-president and Young Lighter of the Year judge, said: 'The judging for 2016 has been particularly tough because of the exceptional quality of the four finalists, each topic being unique and applicable, and each finalist giving outstanding presentations.'

'Sofia's choice of topic, succinct written paper and engaging presentation meant she lifted the overall trophy. I would like to congratulate her and all the finalists.'

The best presented paper prize was won by James Duff for *A journey towards change*. The other finalists were Aisha Robinson – *A visible light communication scheme for use in accent lighting* – and Eleonora Brembilla, *Applicability of climate-based daylight modelling*.

The Young Lighter of the Year awards are designed to test not just the finalists' academic ability, but also their presentation skills, which can make a big difference in the communication and implementation of theoretical ideas on a lighting design project.

The competition offers a unique platform for young lighters to raise their profile within the industry. All finalists received a cash prize, plus a year's free membership of the SLL.

Lighterman win Teambuild 2016

A team of young professionals from companies across the construction industry solved a real-life construction challenge to win Teambuild 2016.

The Lighterman team joined eight other cross-discipline squads – representing 24 companies – to compete in the annual event, which challenged members with a rapidly developing scenario based on a high-quality healthcare and biomedical research facility.

The competitors – each with less than six years' industry experience – planned, designed and presented hypothetical proposals based around the New Papworth Hospital, a development on Cambridge Biomedical Campus.

Skanska and HOK provided the teams with real site information, which formed the basis of their competition scenarios.

Roll of honour

Winners (£2,000, sponsored by the Worshipful Company of Constructors): Miles Christoforides (IStructE, Eckersley O'Callaghan); Claire Hicks (WSP Parson Brinckerhoff); Ahmad Khattab (ICE, WSP Parson Brinckerhoff); Richard Laplanche (CIOB, Kier Construction); Conor Maguire (ARB, Hawkins/Brown); and Matthew Vice (CIBSE, Hoare Lea).

The Procurement Strategy Prize (£1,500, Worshipful Company of Chartered Architects): We Built That, from Bam Construction, Eckersley O'Callaghan and HTA Design, including members of the BCU, CIBSE, IStructE, RIBA and RTPI.

The Judge's Prize (£1,250, most improved team over the weekend): Optima, from Buro Happold, Jestic + Whiles and Wates, including members from ARB, CIBSE, IET and RICS.

Excellence in Construction Prize (£1,000, Considerate Constructors Scheme): Omnia, a team from Aecom, Eckersley O'Callaghan, Hawkins/Brown, Mayer Brown and Sweco UK, with members from RIBA, ICE, CIBSE, Law Society of England/Wales and CNI (Italy).



The Large Consultancy of the Year Award was presented to Hoare Lea

LEDA leads the way in Yorkshire Region Awards

More than 300 attend inaugural event organised by CIBSE Region

Leeds Environmental Design Associates (LEDA) won the Project of Outstanding Performance accolade for the Keyes Building, at the 2016 Yorkshire Region Awards (YRAs), held in November.

More than 300 people attended the event at the Royal Armouries in Leeds. Replacing the traditional annual dinner, the YRAs are the only services-specific awards outside London.

Simon Owen, region chair, said: 'I wanted to create an opportunity for the Yorkshire building services family to gain recognition for its achievements.'

Trophies were given to those with the highest continuing professional development (CPD) hours, as well as the more traditional 'of the year' awards for: project; small and large consultancies; students; manufacturers; and facilities management teams.

Guest speaker Chris Gorse, from Leeds Sustainability Institute, discussed climate change and the role of building services engineers in educating clients and creating solutions. He issued a call to action, saying: 'As services engineers - the most powerful environmental engineers in construction - we have to innovate to help

sustain the things we have grown to love.'

As well as the awards, the event showcased and celebrated positive community impact. Alison Watson, from Class of Your Own (Coyo), launched her crowdfunding appeal to build a school in Parabongo, a region in Uganda. Search **#BuildParabongo** on Twitter for more information.

The school was designed by Helen Vardy - a design and technology teacher at Eggbert School, Sheffield - as part of a Coyo competition, with detailed design input from Arup and costing information from BAM.

Pledges were also made to give time and skills to the Real Junk Food Project and Coyo.



The Facilities and Energy Management Award was won by the University of Bradford



Sharib Yousuf, of Atkins, received the individual CPD Award



The Collaborative Working Partnership Award was presented to SES for the Sheffield Custody Suite

Yorkshire Awards 2016 winners

Project of Outstanding Performance (sponsor: Silcock Leedham Consulting Engineers)
LEDA, Keyes Building

Building Performance Training Programme of the Year (Hoare Lea)
Waldeck, Pinnacle

Small Consultancy of the Year (Anderson Green)
Silcock Leedham Consulting Engineers

Large Consultancy of the Year (Vexo International)
Hoare Lea

Project of the Year Commercial and Industrial (SES)
Waldeck Consulting, Bentley Works

Project of the Year Public Use and Leisure (Mitsubishi Electric)
Arup, The Diamond

Project of the Year Sports Buildings (MRB Consulting Engineers)
Anderson Green, University of Derby

Chair's Choice Award, (CIBSE Yorkshire)
Energy Jump, Mulberry House

Collaborative Working Partnership (Leeds Beckett University)
SES, Sheffield Custody Suite

Facilities and Energy Management Team Award (Asset Wisdom)
University of Bradford

Manufacturers Award (Arup)
Goodwin Development Trust & 21c EcoEnergy, The Oxypod

CPD Award (Toshiba Air Conditioning)
Sharib Yousuf, Atkins

Student Award (Calibre Search)

■ Matthew Biggs, Silcock Leedham Consulting Engineers, University of Northumbria

■ Richard Leese, Leeds College of Building, Leeds Beckett University

■ Ido Popper, Arup, University of Leeds

■ Calvin Sargeant, Ramboll, Leeds College of Building

Northern Ireland Region celebrates 50 years

Members receive certificates for long-standing support

The Northern Ireland Region celebrated its 50th anniversary with a dinner in Belfast on 4 November. John Field, CIBSE President, joined the regional chair, Jonathan Grimshaw, and regional dinner secretary, Richard Gilpin, to commemorate the half-century.

Also present were; Michael Dennison, ECA branch chair, David Browne, Institute of Energy regional chair; and Kevin Munson, managing director of Ruskin Air Management – the event's main sponsor.

The CIBSE President presented Certificates of Commendation for long-standing and continued support for the Northern Ireland Region to:

■ Brian Harvey who, through his company, The Harvey Group, has been a patron of CIBSE for

17 years and has provided additional specific support for the region. Harvey Group continues to support the annual Students Awards at the University of Ulster, Jordanstown

■ Eddie Simpson – formally of Williams & Shaw, now retired – who has been a long-term supporter of CIBSE and the Northern Ireland Region. He has served as vice-chair, chair and, more recently, as regional almoner. Simpson is currently a trustee of the CIBSE Benevolent Fund

■ Denzyl Dinsmore, of Cogan & Shackleton, Coleraine, who has been a long-term committee member, treasurer and one of the region's auditors. He was present at the first meeting of the Northern Ireland Region and is still involved today.

Table – and other industry – sponsors supported the raffle, raising £800 each for the CIBSE Benevolent Fund and Children in Need.



Brian Harvey (left), Eddie Simpson (centre) and Denzyl Dinsmore receive their certificates from CIBSE President John Field

Be quick! Closing date is looming for membership application

UK-based professionals who want to apply for the Associate (ACIBSE) and Member (MCIBSE) grades are urged to submit their applications by 1 February 2017.

To ensure your application is complete, please include:

- Application form, signed and checked by your sponsor
- Relevant fees
- Work experience listing/CV
- Organisation chart
- Engineering practice report
- Qualification certificates, if required, signed by your sponsor.
- Development action plan

Visit www.cibse.org/membership for full details of the requirements and application processes.

If you are looking to gain IEng or CEng registration – but are unsure whether you satisfy the requirements – get in touch with details of your qualifications and we can advise the best route for you. If you do not have academic qualifications, you can still gain IEng or CEng by completing a technical report or undertaking further learning.

If you need further help and guidance, CIBSE offers a wide range of support for applicants, from regional briefing sessions to webinars and online guidance. Visit the applicant help pages at www.cibse.org/applicanthelp for examples of engineering practice reports, development action plans, interview guidance and presentation samples. Details of upcoming member briefings and webinars can be found at www.cibse.org/briefings

If you have any questions or need more information contact us at membership@cibse.org or +44 (0)20 8772 3650.

IN BRIEF

Price bows out after clocking up half a century of service

The Southern Region sadly bid farewell to its longest-serving committee member, Douglas Price FCIBSE, last month.

An inaugural member of the region, Price has contributed considerable amounts of his time over the past 52 years.

He has been an active member of the committee since he joined in 1964, including as vice-chair, and then as chair from 1974–76. He was made a CIBSE Fellow in 1981, given a Bronze Medal award in 1997, and extended the Southern Region to include Brighton members in 1990.

Price has organised numerous technical events for the region, including half-day, low-cost seminars on energy-related topics during the late 1990s/early 2000s. The last event he organised was a presentation by one of the founding designers on 'Engineering effects of dark skies', in the South Downs Planetarium in December.

Price has been a true asset and will be greatly missed. The region and CIBSE extend their thanks to him for all his time, commitment and hard work.

Nominations for officers, board members and council members: correction

The December 2016 issue of the *Journal* included the board's nominations for officer, board member and council member vacancies arising at the 2017 AGM.

Unfortunately, one name was omitted from the listing in error. The board's nominations for members of the board are as follows:

Members of the board: Ashley Bateson FCIBSE, **Adrian Catchpole** FCIBSE **Susan Hone-Brookes** FCIBSE, **Kevin Mitchell** MCIBSE.

All other details and arrangements remain as set out in the December 2016 *Journal*. We apologise for this oversight.

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Lack of knowledge about safe storage may cost lives

Since 2002 there have been at least nine fatalities in Europe caused by carbon monoxide poisoning after people have gone into wood-pellet storage areas. Hywel Davies reviews a report by the HSE aimed at preventing such tragedies

Wood-pellet and wood-chip boilers are increasingly being used in homes, businesses and community buildings as an alternative, renewable energy source to oil- or gas-fired boilers. They are also being considered more often for use in large-scale power generation.

There have been concerns, though, for some time that the risks associated with the storage of wood pellets – particularly the release of carbon monoxide (CO) and absorption of oxygen – are not well understood.

An HSE Safety Notice was issued in 2012, warning manufacturers, suppliers and installers to control the potential risks. However, there are fears that the hazards associated with wood-chip stores are still inadequately understood.

After a number of fatalities in Europe related to wood stores, the Health and Safety Executive commissioned a study of the potentially dangerous atmospheres that may be generated in wood-pellet and wood-chip stores. It aimed to obtain information on how wood and chips are stored before use, how the buildup of CO is controlled in fuel stores, and what health and safety information suppliers and users have on the storage and use of wood pellets and chips.

The researchers also set out to measure the levels of CO and other relevant gases in wood stores, and to compile an initial view on best practices and procedures for the industry, to help control and manage the risk of dangerous atmospheres.

They visited six sites with small-scale wood pellet- or chip-fuelled systems, and one with a large-scale pellet store to study procedures, risk-management systems and controls, and to measure ventilation rates, levels of gases and vapours in the stores, and the microbiological content of the fuel.

Laboratory research was also carried out into carbon monoxide and carbon dioxide emissions – and oxygen depletion – from wood pellets and chips.

The site visits and laboratory tests found that:

- Potentially dangerous atmospheres may be generated in wood-pellet and wood-chip stores



“Staff must be trained in safe working practices and emergency procedures”

- Wood pellets produce CO and carbon dioxide (CO₂), and deplete oxygen in the store
- Wood chips produce CO₂ and some CO, and deplete oxygen
- Dangerous atmospheres in fuel stores may also arise because of poor exhaust ventilation of boiler combustion gases
- There was limited knowledge of the hazards associated with wood pellets and chips at sites with small boiler systems, and a greater level of knowledge at the large pellet store
- There was limited communication – of the health and safety issues relating to wood-fuel storage – between the companies supplying and maintaining the boilers, those manufacturing and supplying the fuel, and the users of the systems.

The 2012 HSE Safety Notice raised general awareness of the problems, but not all of its recommendations had been implemented at individual sites.

There are several simple measures that can be implemented to improve awareness of the hazards associated with the storage of wood chips and pellets in confined stores. *Journal* readers should be aware of these and ensure that any installation with which they are associated incorporates them.

On any site that falls within the scope of the Construction Design and Management Regulations, there is an obligation on the principal designer to address these issues. The Confined Space Regulations 1997 may also apply.

The potential risk of exposure to hazardous atmospheres should be controlled by restricting access to the stores and displaying clear warning signs. Carbon monoxide alarms will provide warning of dangerous levels of this gas. Where chips or pellets are stored in a confined space, staff who are authorised to work in the area must be adequately trained in the appropriate safe working practices, and made fully aware of the emergency procedures to be followed in the event of any incident in or around the fuel store.

While unplanned ventilation within store rooms may reduce the buildup of dangerous toxic atmospheres,

the industry is wary of employing increased ventilation because of the potential for ingress of moisture and deterioration of the fuel.

However, appropriate planned ventilation will help to control the buildup of hazardous gases. This should also take account of ambient temperature and humidity, as these affect the rate of off-gassing (the buildup of toxic gases).

The HSE recommends that minimum ventilation standards should be determined to prevent significant off-gassing during fuel storage. It also says that wood pellet and wood chip fuel suppliers and distributors should produce and distribute comprehensive and consistent guidance about storage for end users; this guidance which should include material-safety data sheets.

Given the ongoing interest in biomass installations, safe design of fuel storage is a key element of such systems, and readers should be aware of the latest HSE findings – whether in the UK or elsewhere – as the science and health impacts are the same around the world.

References:

Safe storage of wood-pellet and wood-chip fuel, a report by the Health and Safety Executive bit.ly/2hDgPBb

HSE (2012) Safety Notice OPSTD 3-2012 *Risk of carbon monoxide release during the storage of wood pellets* bit.ly/2h6Zd1K

HSE (1997) *Confined Space Regulations 1997 Approved Code of Practice, Regulations and guidance*. HSE Books, 2nd edition (2009)

ISBN 9780171662333 bit.ly/2hDidnu

Storage of wood chips and pellets is not without risks



A healthier new year, one and all

Anastasia Mylona explains CIBSE's plans for addressing workplace comfort in 2017

Occupants' health and comfort has always been a consideration of building services engineers. However, there is now a growing, wider interest around the impact of buildings on people's health and productivity. Clients and property professionals are asking how buildings can facilitate wellbeing, while performance tools – such as the Well Building Standard – are raising the profile of workplace comfort.

Following the University College London and CIBSE conference on health, wellbeing and productivity in non-domestic buildings in November, CIBSE is preparing guidance on a more human-centric approach to design and the wider aspects of occupant wellbeing. It plans to revise and expand *TM40 Health issues in building services* to cover the wellbeing aspects that building services engineers can influence, with appropriate technical references. It will also map out current standards and legislation.

TM40 will define wellbeing and the environmental factors that affect it, and cover: the implications of wellness on human health and productivity; applicable regulations, legislation and standards; and guidance on thermal, visual and auditory comfort, water and waste management, and indoor and outdoor air quality.

CIBSE Resilient Cities Special Interest Group is also holding a series of events on this topic, including one on the 'urban microclimate' on 6 January, at London City Hall. It will review and debate our understanding of the relationships between high-density urban typologies, urban climate, energy management, green infrastructure, and the health and wellbeing of urban dwellers. Visit bit.ly/2hPQhL6 for more information and to book a place.

CIBSE, with the Adaptation and Resilience in the Context of Change (ARCC) network, is also planning a design competition, challenging entrants to consider green infrastructure as a building service for healthier, productive and sustainable offices.



"Clients are asking how buildings can facilitate wellbeing"

DR ANASTASIA MYLONA MCIBSE
is research manager at CIBSE

STANDARDS BEARER

During his 56 years in the industry, **Doug Oughton** FCIBSE – the latest recipient of the CIBSE Gold Medal – has made it his mission to promote building services to the next generation. **Liza Young** speaks to the former CIBSE president

Doug Oughton is passionate about building services. ‘It’s a super career,’ he declares after serving more than half a century in the industry.

As well as working on some of the most high-profile projects, Oughton has co-authored five editions of the Faber & Kell standard-setting reference book *Heating & air-conditioning of buildings*. His broader industry achievements have also been plentiful: he became a Fellow of the Royal Academy of Engineering in 1995 and an Honorary Fellow of CIBSE, of which he was president in 2002-03.

Throughout his career, Oughton has striven to promote the industry to the younger generation and get them excited about choosing engineering as a profession. ‘After so many years, I genuinely believe building services to be a great career choice, despite many challenges along the way,’ he says. ‘Building services is in constant development and the environmental impact of what we do has a relevance to modern-day thinking.’

Starting out with Oscar Faber in 1967, Oughton’s first design project was Belfast City Hospital and, in 1975, he was promoted to associate. Since then, he has worked on galleries at Buckingham Palace, the British Museum and Somerset House, a major refurbishment at London’s Royal Exchange, and designed arenas in Belfast and Sheffield. One of his most memorable moments during the post-fire restoration project at Windsor Castle was being interrupted mid-morning during client meetings by the changing of the guard.

Early career

In 1960, aged 18, Oughton joined contractor Matthew Hall – now Spie Matthew Hall – as an apprentice. ‘I always wanted to be an engineer, but had no idea what discipline to go for,’ he says. After a stint in the nuclear department, he transferred to the mechanical and electrical division, where he felt most at home, and was awarded the Higher Diploma in environmental engineering at the National College.

Seven years later, Oughton joined Oscar Faber & Partners – the forerunner to Aecom – in its Belfast office, before transferring to the company’s headquarters in St Albans. He became a partner in 1981, a director in 1983 and, after retirement, a consultant in 2004. ‘It was an enjoyable place to work,’ he says. ‘I’ve always had an interest in developing technical standards and it had a strong technical bias.’

Indeed, Oughton’s technical input within Oscar Faber soon became apparent beyond his own projects through the distribution of in-house ‘technical snippets’ and papers presented at conferences. In 1979, he became Oscar Faber’s technical leader for mechanical engineering and was awarded an MSc from the University of Bristol after presenting a research paper dealing with energy consumption and energy targets

for air conditioned office buildings. During this period, the firm had set up Faber Computing for Engineering and Technology (FACET), of which Oughton became a director in 1984.

Throughout his career, Oughton’s biggest lesson was learning how to keep up and cope with changes in technology. ‘When I started, we had no technical aids such as computers; we carried out manual calculations, used slide-rules and old-fashioned typewriters, and all the drawings were done by hand, on linen or tracing paper.’ But, he says, Oscar Faber was at the forefront of change, with Oughton providing engineering input for software development in computer programming in the 70s and 80s.

‘It was difficult to pick up on technologies that you were not totally familiar with, but it was an interesting challenge – and interest is what makes the job worthwhile.’

As well as the shift from imperial to metric, Oughton has had to deal with an ever-evolving construction industry. Changes in contractual arrangements have demanded the biggest adjustment, he says. With closer integration of designers and contractors – and the introduction of fee bidding in the 1980s – consultants have had to become much better at factoring time and cost into their work. ‘The industry rose to that challenge and dealt with it,’ he says.

Organic route

Oughton’s five-year apprenticeship with Matthew Hall gave him a broad background to the industry.

‘Most of my vintage got into the industry through contractors’ apprenticeships, which are the best way of learning what the industry is about,’ he says. ‘You get the opportunity to work on the tools and





“I am very passionate about the industry and I want to tell young people what a great career it is”

including the Engineering Council and the Royal Academy of Engineering. ‘This was one of the few occasions when all the professional engineering institutions were working together and speaking with one voice to government and industry,’ he says.

‘I am very passionate about the industry and I want to tell young people what a great career it is. But to get good-quality people into the industry, you have to invest in young people and get them trained.’

One of the upsides to the industry is that every day is different. ‘The continual technical developments add to the variety in our work, contributing to the environmental impact of our day-to-day decision-making.’

Industry focus

When selecting systems in the 1960s, cost was king. Now, carbon and energy use are at the forefront, says Oughton.

‘This has been a significant change for the industry and it began in the 1970s with the miners’ strikes and the three-day working week, signalling the danger of fuel shortages and energy price rises, prompting architects and engineers to work together more closely on ways to reduce energy consumption.’

This ethic has moved the industry forward, adds Oughton. ‘Our focus should be working together with other designers, architects and contractors, and with those who maintain and operate buildings.’ Teamwork is crucial, he says, as is an understanding of what each party is trying to achieve.

‘I am lucky to have done what I have as an engineer, and I thank my colleagues for their support. Building services is a rewarding career – it has served me well.’ **CJ**

Oughton worked on the post-fire restoration project at Windsor Castle



witness, first hand, the practical problems of installing and the all-important commissioning.’

By learning in a different way and getting site-management experience, Oughton says apprentices can better visualise, for example, the scale of equipment and plan both for its installation and access for maintenance. ‘Graduates coming into design offices these days are missing out on understanding the practicality of installation and commissioning. The organic way in is best.’

The next generation

As highlighted in his presidential address in 2002, Oughton believes encouraging young people into the profession is still one of the most important tasks of the supply chain.

Having set up and chaired the CIBSE Careers Panel for 10 years, Oughton went on to become the inaugural chair of Education for Engineering – an alliance of 36 professional engineering institutions,

Industry experts predict the trends that will dominate building services in 2017

Last year, people voted for change, but how much will the aftershocks of the vote to leave the EU be felt by the building services sector? We asked industry figures to outline their key trends for 2017 – and their answers reveal it's not all about Brexit.

The health and wellbeing discussion will bubble up and building performance will continue to dominate industry headlines. Energy performance data started to stream in from buildings and systems in 2016, and clients were awakened to shortcomings in design and commissioning. Quantified performance will be the next step, one energy consultant predicts – clients will become savvier about measuring outputs to ensure they get what they want.

Alan Fogarty, partner, Cundall

The health and wellbeing conversation is likely to dominate much of the industry discussion in 2017. Poor air quality in our major cities will also get increasing attention. Health and wellbeing will become mainstream because most issues can be dealt with through considered design and as more products become available.

It appears the BRE and the International Well Building Institute will align their standards – Breeam International and Well – for compatible credits. Well references ASHRAE standards, which have lower requirements for fresh air compared with CIBSE, and referencing any standard for comfort is not a guarantee that it will be achieved, unless it is regularly monitored. Fortunately, real-time monitoring is on the increase, which will force employers and landlords to improve their game.

Paula Kirk, energy and climate change leader, Arup

Cities must act now if they are to achieve peak emissions by 2020 and net zero carbon emissions by 2050. These targets are ambitious, but achievable. We need to adopt new ways of working to help cities understand what they can do in practical terms; to ensure new infrastructure is



Cundall's One Carter Lane has achieved Gold Well standard

designed and engineered in a way that puts – and keeps – them on the right path.

Large-scale energy performance retrofits are a priority for residential and commercial buildings, plus innovative solutions for improved performance monitoring. We have the opportunity to show the world the practical steps that can be taken to ensure climate change can be averted.

Casey Cole MCIBSE, managing director, Guru Systems

The big trend for 2017 will be quantified performance. Armed with clear requirements, clients will be more specific about what they want, and use measurement and verification to ensure they get it.

This will have huge implications for the industry. M&E consultants won't be able to protect themselves by oversizing any more and contractors won't achieve practical completion until systems have been properly commissioned and operate as designed. Increasingly savvy clients will start to flex their muscles and hold their project team to account. It's going to be painful at first, but – over the course of 2017 – it will start to be business as usual. And our buildings will be much the better for it.

George Adams, UK engineering director, Spie

Brexit raises questions about the UK's energy, environmental and construction improvement policies, and the overall challenge of engineering skills and resources over the next few years.

We are already suffering a skills gap, and 400,000 people will leave the UK engineering industry within 10 years. As a market, we need to put our efforts into

CHANGING

20

The Brexit vote will start to have a bigger impact in the new year

17 TIMES

designing buildings, including low initial price and running costs, and flexibility for reuse.

Of course, expected levels of temperature, lighting, fresh air and other measurable parameters must be accounted for.

In 2017, CIBSE must set out its priorities to encompass sustainability and wellbeing, as well as energy, and offer members appropriate guidance.

Hywel Davies, technical director, CIBSE

Minimum Energy Efficiency Standards (MEES) – which come into force in 2018 – will be at the top of the agenda for landlords this year.

The government's continued backing of MEES for privately rented, non-domestic properties implies a commitment to retain Energy Performance Certificates (EPCs) and the associated requirements. This at least gives a tangible clue that EPCs are set to have a life and a role beyond the European Union. MEES are required by the Energy Act 2011, so they are a domestic – not a European – requirement.

Dwight Wilson, digital engineering manager, Imtech

BIM will truly mature in the marketplace this year; clients are becoming more informed about the benefits of implementing it on their projects.

Increased accessibility of virtual reality (VR) and augmented reality (AR) technologies will have a big impact on the communication process in the tendering stages of projects. Being able to immerse clients in design proposals will be a big player in the year to come.

The big winners will be those who use BIM to embed healthy digital and data practices within their businesses so they can prove the benefits of digital construction.

Economic forecast

Construction research firm Glenigan anticipates that the overall value of project starts in the UK will suffer a similar decline in 2017 as in 2016, when it was down by 4%.

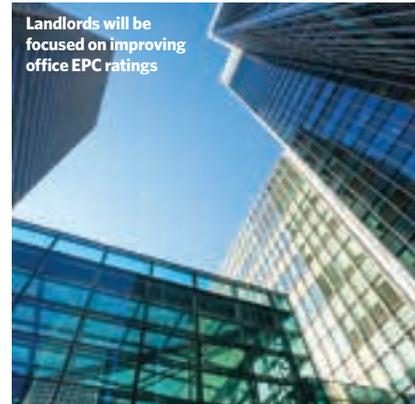
There will be little change in housing market activity and private housing starts, it states, while the restriction on government capital funding for social housing will feed into a 17% decline in project starts during the new year.

The prospects for the hotel and leisure sector are more positive; project starts are forecast to grow by 7% in 2017.

Investment in higher education facilities is expected to remain another growth area, but statutory education projects will be dampened by funding restrictions.

Suppliers are starting to increase prices in response to the drop in the value of the pound. In the air conditioning sector, for example, the cost of single and multi-splits has risen by 4%, according to Bsria. **CJ**

Landlords will be focused on improving office EPC ratings



BIM will be used to prove the benefits of digital construction



M&E consultants won't be able to protect themselves by oversizing any more

attracting fresh talent – partnering with schools and colleges, supporting students and taking on apprentices.

The question is whether Brexit will cause further losses from our skills pool. In the UK, we tend to engage local skilled workers, and a recent survey identified that 71% of the largest contractors are not dependent on EU workers. This is surely good news and should allay unease in the long term.

John Field FCIBSE, President, CIBSE

As key players in the design, construction and operation of buildings, we need to establish our priorities in the work we do and the effort we should put into building performance.

Energy – with its effect on costs, emissions and resource use – has been top dog for some time, and has become mainstream, albeit still with too big an energy-performance gap. But the focus is shifting to include occupant health and wellbeing, and wider sustainability issues. The latter is replacing carbon as the bigger picture to worry about, as it encompasses resource use, environmental impact, the wider community and the whole life-cycle. Occupant health and wellbeing will continue to rise up the pecking order in 2017, as it dawns on us that staff costs typically represent 90% of a building's life costs. We must also not forget the other priorities when



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- Compact footprint
- Site surveys for replacement

HEAT NETWORKS: CHANGE BY DEGREE

New codes and tests designed to root out poorly performing heat networks are shining a spotlight on the supply chain. **Alex Smith** reports on a new test for heat interface units that will have far-reaching consequences for designers and suppliers

Analysing data to shine a light on building performance may be in its infancy, but it is already identifying significant issues that affect the efficient operation of heating and cooling systems. In one study, by energy consultant FairHeat, an analysis of energy meter readings revealed the extent of poor performance in heat networks, resulting in large heating bills for occupants and untenable costs for energy service companies (Escos) (see 'On a mission', *CIBSE Journal*, May 2016).

FairHeat's study showed that one of the key factors affecting heat networks was the performance of heat interface units (HIUs). A single, poorly commissioned HIU could be responsible for the underperformance of an entire network, its data shared. Problems included poorly controlled valves, and oversized and inefficient plates.

To improve the situation, a new HIU test regime has been launched in the UK, with the aim of ensuring units are specified, installed and operated appropriately for the heat network. 'HIUs have a major

impact on the overall performance of heat networks,' says Gareth Jones, managing director at FairHeat, which has been overseeing the development of the test regime. 'If HIUs perform poorly, it is very difficult to limit network losses and achieve a low cost of heat.'

The UK HIU test regime has the full weight of industry behind it, from manufacturers to Escos, as well as the government department responsible for heat. Its steering group includes experts from CIBSE, BESA, BEIS, E.ON, SSE, and Carbon Alternatives. For the first time, the test allows manufacturers to evaluate the performance of HIUs, and gives designers the opportunity to see the impact of a particular unit on networks.

The test regime works in parallel with the CIBSE/ADE CPI Heat Networks Code of Practice, which sets out minimum specification and design standards for heat networks. New CPI Client Checklists enable operators to assess performance through the development process, and include HIU performance

THE UK HIU TEST REGIME

The regime tests HIU performance characteristics when:

- Meeting given space heating loads (1, 2 and 4kW)
- Delivering domestic hot water under changing loads
- » ■ There are periods of no load ('keep warm' mode)

In addition, the HIUs are tested for:

- Domestic hot water delivery time
- Domestic hot water temperature stability

- Maximum operating pressures.

Two temperature regimes are tested - one consistent with heating systems with radiators and one with underfloor heating systems. The outputs are measured in VWART and cover domestic hot water, space heating, keep warm, the annual volume for heating and non-heating periods, and total annual volume.





» targets. They are supported by a new Code of Practice Compliance Scheme, which will check that the HIUs and heat network are complying with the code at design, commissioning and operation stage.

The new regime will mean contractors can no longer change the specification of the HIU without considering the impact on performance, says Jones. 'Before these tests, there was no way of knowing what an equivalent unit was when the specification

stated "equal" or "approved". Now you do,' he adds. Richard Hanson-Graville, technical manager at Thermal Integration, agrees: 'Nobody had any figures to judge performance – that is why the district heating industry has ghastly installations over the past 10 years. It's all been about specifying cheaper HIUs.'

Creating the test regime

In creating a new standard, the project team looked to Sweden, where HIUs are required to be tested. 'We took the Swedish standard and modified it to suit typical heat network operating parameters here in the UK,' says FairHeat's Tom Naughton, co-author of the testing regime. 'Aspects of the Swedish regime don't apply. For example, there is no requirement to test to 120°C, as UK heat networks do not typically operate to these temperatures.'

The test regime, based on the testing of six HIUs in Sweden, has four objectives: to allow developers to evaluate HIU performance against design requirement; to generate operating data on expected performance; to provide a framework for HIU manufacturers to evaluate their performance; and to provide data on the impact of different design and installation choices on HIU performance. (See panel, 'UK HIU test regime', for test summary.)

The performance of HIUs is measured in volume weighted average return temperatures (VWART), which are used in FairHeat's test. These reflect the expected impact of the HIU in different operating modes, mimicking the demands they might experience across a year in a typical new-build development. The VWART calculation can also

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be used to identify inefficient operation when the heat network is on standby – or ‘keep warm’ – typically 85% of the time. If valves allow a large volume of hot water to pass through the HIU during standby, it will make a substantial contribution to heat losses in the system. A high VVART figure can help flag up the issue.

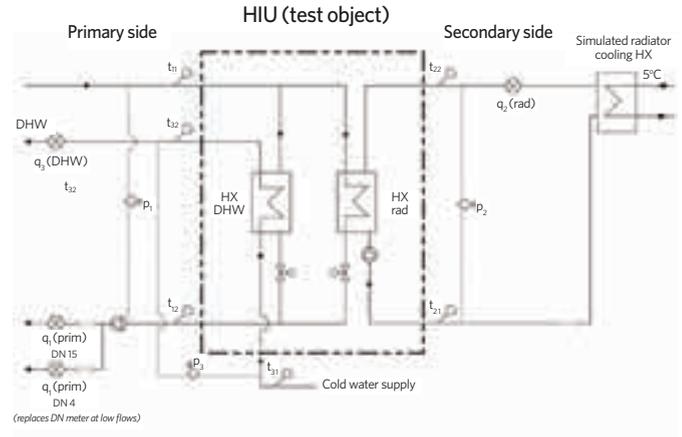
The tests in Sweden revealed that lots of HIU space-heating plates were oversized. New-build apartments with 1-2kW typical heating loads, with a maximum of 4kW, had plates sized for 15kW. Flows were so low that the flow regime through the plate heat exchangers in the HIU was not turbulent. ‘Some performance went off a cliff when loads went down to 1-2kW with larger plates,’ says Jones.

Jones says that manufacturers have responded positively to the tests. ‘It’s created a lot of excitement and angst – but the big positive is that manufacturers are going back to retest their HIUs to try to improve performance. There has been a lot of R&D activity.’

BESA technical director Tim Rook says manufacturers will get to grips with tests. ‘They know their own product, but they have no comparison with others. They like robust feedback and it gives them the opportunity to improve their products,’ he says.

Jan Hansen is a director at SAV, which had an HIU tested in Sweden. He hopes the UK market will become as rigorous as in Denmark, where there are penalties for networks that don’t perform. ‘If you don’t achieve 30°C ΔT, then the company that supplies the heat can bill you,’ says Hansen.

The HIU testing regime will become a BESA Standard in the new



Schematic of the test HIU rig in Sweden

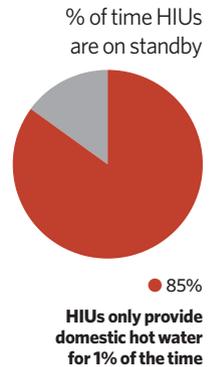
“Nobody had any figures to judge performance – that’s why the district heating industry has ghastly installations over the past 10 years”

year. Large Escos are part of the steering group, which will soon also feature social housing providers and developers. CIBSE is represented by Paul Woods, head of Energy Partnerships East London at Engie and vice-chair of the CIBSE CHP group steering committee – who says: ‘The results of these tests ensure much-needed transparency and will greatly assist designers, builders and operators to make informed design and procurement decisions – delivering better-performing networks for the future.’

Hansen believes HIUs are only a part of the issue in the UK. ‘An HIU cannot compensate for radiators not balanced properly, or if the radiator primary flow and return have been plumbed the wrong way round. The HIU can’t do magic.’

The specification and design of other components – such as controls, boilers, CHPs, pumps and pipes – could soon be under the spotlight. The FairHeat analysis revealed that many networks were grossly oversized and that clients could have saved 25-30% on their capital expenditure if they have been appropriately sized.

Jones is confident that HIU performance targets laid out in the Client Checklists will be adopted by industry. ‘Quite a few clients are specifying on the basis of the tests. If manufacturers don’t get HIUs tested, there’s no way they would be specified on these schemes. That will change the status quo.’ CJ



A Thermal Integration heat interface unit on the test rig in Sweden

CONTRACTING FOR PERFORMANCE

There is a shift in the industry towards contracting for performance, says Jones, with the CP1 Client Checklist a prime example, as it is based on a performance-target approach. ‘Performance targets for a development should be set at the start. Then the key question during feasibility and design is “will these targets be met?” – changing to “have these targets been met?” during commissioning,’ he says.

Jones gives an example of a client putting in an overriding target of 70W/dwelling losses for the network (c.610kWh pa), with a requirement for <100W/dwelling losses (c.880kWh pa). There is a cascade of KPIs, with targets against them, to ensure these overriding targets are met.

There is now a relatively straightforward assessment of whether a HIU meets specified performance requirements, says Jones. If a contractor wants to use a HIU that doesn’t meet these, at least the impact on performance can be assessed. ‘The key point is that there is a framework for assessing decisions, with the testing data enabling decisions to be made based on information, as opposed to gut feeling,’ says Jones.



HALL OF FAME

Harrods' entrance hall has been refurbished in time for the new-year sales. Liza Young finds out how modern services fit with the store's heritage

With 447 departments spread over more than 93,000m² of floor space, Harrods is considered the jewel in the crown of London's department stores. Selling everything from Jimmy Choo shoes to teddy bears, the store's motto is *Omnia Omnibus Ubique* – 'Everything for everybody, everywhere'.

This year, shoppers searching for their January sales bargains will be in for a treat when they enter the Knightsbridge store through its newly refurbished grand entrance hall. With a £20m investment from its Qatari owners, the store spent most of 2016 returning the Hans Crescent escalator hall to its former glory. Harrods' owners wanted to bring back the glamour of the early 1900s by restoring original elements, including luminaires and the façade.

A key part of the client's brief was to ensure the building services design matched the architectural finish.

'We're making all the architectural features work quite hard so we can keep the space in line with the original history of Harrods – everything we do goes back to the history,' says John Allcock, senior building services project manager at Harrods. 'We have a modern building, but we want to keep it looking like the Harrods people know and love.'



The grand entrance hall in 1939

PROJECT TEAM

Client: Harrods
Architect: Make Architects
Building services engineer: E+M Tecnica
Lighting: Nulty
Main contractor: Jaysam Contractors
Vertical transportation: WSP Parsons Brinckerhoff
Fire consultant: Affinity Fire

The design team had to marry the new and the old seamlessly, using sympathetic techniques such as concealing ventilation ductwork behind decorative aluminium grilles installed in the 1930s, opening up original windows, and redesigning a glass roof dome to allow customers to gaze at the sky from the ground floor. A total of 16 escalators have also been installed – between the lower ground and the fifth floors – in one of the most complex refurbishments attempted in the Grade II-listed building.

Going up

Harrods debuted the UK's first escalator – a woven-leather conveyor belt, with a mahogany and silver, plate-glass balustrade – in 1898. To calm their nerves after the experience, customers were offered a stiff drink at the top. More than a century later, Harrods has kept up the tradition of bringing innovation to its store. 'Charles Henry Harrod did something that had never been seen before – and that has stayed with the brand over the decades,' says Allcock. 'In creating the grand entrance, it was important to make the best possible first impression.'

This meant changing the positions of the up and down escalators to create a more expansive space and ensure better vision for customers entering the store. The ground-floor escalator – which was cantilevered off a newly constructed column – now appears to be floating, allowing views into the lower-ground floor. Inverter drives have been fitted so the speed of the escalators may be reduced when they have no passengers.

The biggest challenge during construction was actually installing the escalators, which had to be carried in manually at ground-floor level and winched up inside. At night during a four-week period, the escalators – the largest of which weighed five tonnes – were delivered, craned off the lorry, wheeled along the pavement and craned into the hall, before being winched up into position.

The decision to swap the escalators around instigated a whole host of structural works after upstanding foundations were discovered at lower ground-floor level. Almost 30 piles had to be buried 23 metres into the ground so the original foundations could be removed and the escalators re-sited.

Separate electrical supplies feed the two sets of escalators, so customers can still



The architectural element above the door houses nozzle diffusers

“We're making all the architectural features work quite hard so we can keep the space in line with the original history of Harrods”

move around if power is lost to one side. This meant finding a suitable route for the 250m-long cables supplying electricity from the main sub-basement switch room, located at the opposite end of Harrods. 'It was quite an extension lead,' says Adam Heselden, technical director at E+M Tecnica, who spent a day surveying the routes.

To avoid excessive volt drop in such a long run, the size of the cable had to be increased. 'The longer the run, the more copper you need to introduce and the larger the cable size gets to ensure appropriate voltage is supplied to the escalators,' says Heselden.

To keep the size of the power leads down, each supply was split between two cables, placed in parallel.

Ventilation strategy

Air is distributed throughout the hall using a plenum arrangement connected to architectural-finished grilles. The general extract is at high level in the roof-dome area. Conditioned ventilation air is transferred from the rooftop air handling plant down the building through three ventilation shafts – converted light wells from the days before electric lighting – at a temperature of 14°C all year round.

The cooling strategy is a constant temperature, variable volume system, with control dampers at each floor. When additional cooling is required, the dampers open to allow a larger volume of air into the space. When cooling is no longer required, the damper will ramp down to its minimum setting to maintain the fresh-air requirements. Air is fed into supply plenum boxes – located at each landing – hidden behind vertical aluminium grilles that run up the walls from the lower-ground to the fifth floor. These architectural strips were incorporated into the original design of the hall in the 1930s, serving a purely decorative purpose. Now they are used as service vents for displacement ventilation to introduce cooling into the space.

As well as maintaining Harrods' heritage, the strategy addresses a key element of the brief – to mask the services. 'The services strategy >>



» had to align to the original 1930s concept, so it was a case of marrying together the historical and the modern,' says Ben Otiko, mechanical engineer at E+M Tecnica.

Between the ground and first floors, ventilation is supplied through nozzle diffusers incorporated into the restored architectural element on the front of the façade – another feature of the original building. The feature is, in essence, a set of openable doors, behind which sit the nozzle diffusers and the fibre-optic lighting boxes that need to be easily accessible.

Temperature sensors on each floor and landing monitor the conditions, allowing the building management system to adjust the control dampers according to the amount of cooling needed. Plenums at the top of the roof dome are connected to Harrods' existing extract system to remove the vitiated air.

The LED video wall at the back of the hall is served by an additional extract system that directly removes 50% of that heat load.

Lighting up the hall

Indirect lighting has been used throughout the escalator hall to highlight its heritage characteristics, says Emilio Hernandez, associate at Nulty.

Linear LEDs have been installed in a coffer, directing the light towards the ceiling and wall surfaces, which reflect diffused light back into the space.

Because the hall is not a retail space, the team could be more restrained when setting light levels – the floor surface is maintained at 250-300 lux – but the use of a lighter colour palette on the walls and ceiling ensured enough light could be reflected off

the surfaces, says Ida Evensen, lighting designer at Nulty. 'We focused on highlighting interesting architectural details to celebrate the building's architecture because – even with high light levels on the floor surface – a space can still appear underlit if the walls and ceiling are dark,' adds Evensen.

Vertical details are emphasised by uplighting, with wall grazing used for metal grilles and stonework, and backlighting on reeded glass. The illuminated coffers also draw the eye upwards and make the space appear taller. To bring natural light into the space, the roof dome – added in the 1980s refurbishment – has been redesigned and repositioned. External lighting was omitted and, instead, the fritting on the dome has been illuminated directly from below the glass element. Previously frosted – like a church window – the roof dome is now clear, offering more light penetration and views to the outside.

On the second and fourth floors, there are fibrous-plaster, uplit ceiling coffers, centered over the skylight, which allow customers in the hall to look up and see through the roof dome. The extensive glazing on the front of the façade has also been opened up, while two original chandeliers and the mid-1940s, rectangular, ceiling-mounted luminaires have been restored and upgraded to use LED lamps.

Weekly meetings and workshops were held during the design period. 'You couldn't sit in isolation and do your little bit, and hope the contractor sorted it out – we had to work together,' says Heselden.

Design and construction lasted 19 months, with the world's first corner LED screens installed at the last minute, having just come off the production line. But for a shop that once hired a cobra to guard a pair of diamond- and sapphire-encrusted sandals worth £62,000, only the best will do. **CJ**

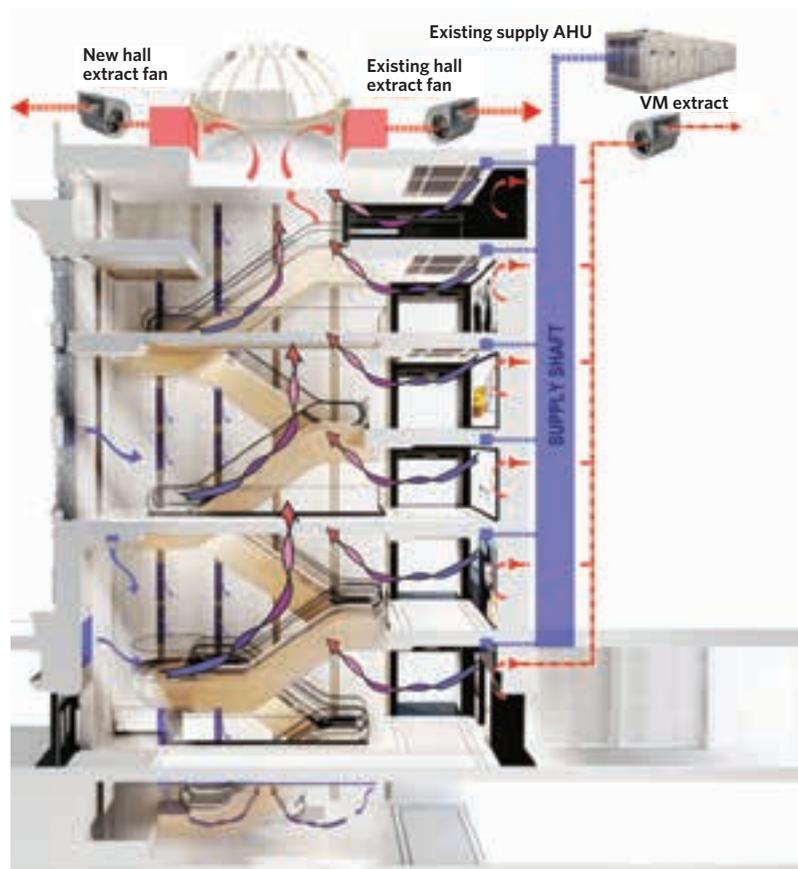
FIRE STRATEGY

The old point-detection system has been replaced with beam detectors at three locations: the base of the roof dome, and within the cut-out 'lozenges' on the second and fourth floors.

The width and height of the fire doors that lead off the escalators had to be increased, which meant losing the fire compartments during construction. 'We spent a lot of time trying to work out how we could phase the project in such a way that we could still keep people walking through the escalator hall while retaining our fire strategy,' says Allcock.

Hoardings – made of fire-rated plasterboard, with built-in lighting, smoke detection and cameras – were installed. At night, these were dropped, and the portals onto the escalator hall were blocked with a series of temporary fire and smoke screens while the contractor carried out works. This was done each night for the duration of the project, and flipped back again ready for trade at 10am.

'The hall is such a thoroughfare from one side of the store to the other, that we couldn't allow it to be shut, so several hours each night were spent taking the hoardings down and putting them back up again,' says Allcock.



E+M Tecnica's ventilation concept



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CLEAR FOR TAKE-OFF

A new real-time study is seeking to find evidence that links productivity to indoor environmental quality. **Tom Cudmore**, of LCMB, explains how the Whole Life Performance Plus project aims to close the knowledge gap

Most designers, developers and users would agree that a high-performing building should be energy efficient and have optimum indoor environmental conditions for the occupants. However, research highlights a lack of consensus on the optimal conditions for a healthy and productive workplace (see panel 'Existing research').

The Whole Life Performance Plus (WLP+) research project is examining how sustainable buildings can also enhance productivity and wellbeing. Organisations involved in the study include NATS, the UK air traffic navigation services company, which handled 2.3 million flights in 2015.

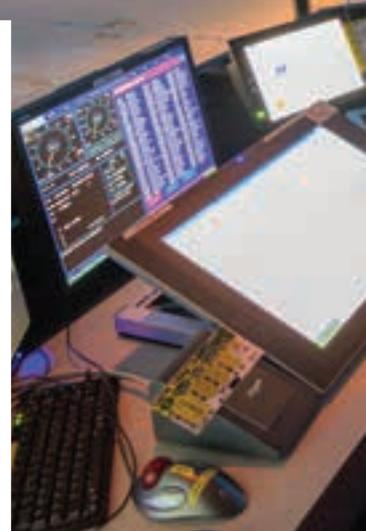
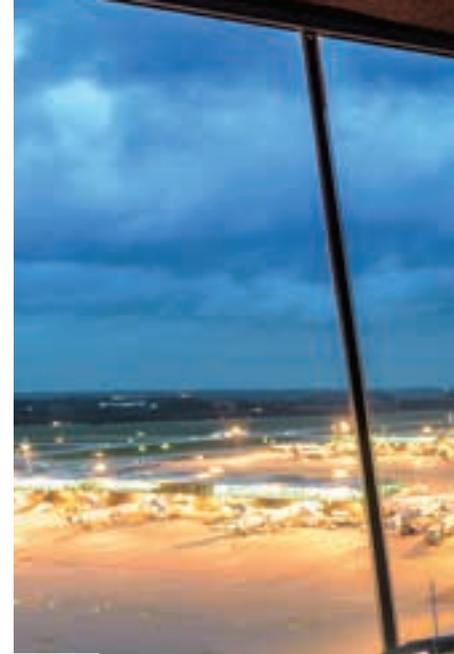
A consortium of partners led by LCMB, in collaboration with the Low Carbon Building

WHY NATS MATTERS

The air traffic control company NATS is taking part in the trial and will work with facilities management (FM) company Emcor UK to understand how buildings can be operated to optimise workers' environments.

'We have known for some time that people react differently to environmental conditions based on factors such as temperature, ventilation and natural light,' says Dan Clark, head of central services and assurance for NATS FM. 'However, there has been no guidance detailing the correlation between variance in these conditions and productivity.'

Steve Dolan, strategic director at Emcor UK, says FM for organisations such as NATS had been asset-focused, concentrating on cost efficiency while optimising service levels. 'It is a great opportunity to provide a real-world application for the theories and models being developed, as well as an interesting learning curve as to what makes our building users more productive and feel engaged with their place of work,' he says.



Group of Oxford Brookes University, obtained funding for the WLP+ project. Its objectives are to better understand the relationship between indoor environmental quality (IEQ) and people's productivity. It aims to develop a methodology for increasing workplace productivity by 10%, while reducing building-energy use by 30%. The research is supported by Innovate UK's Building Whole Life Performance (BWLP) programme and the Engineering and Physical Sciences Research Council (EPSRC).

For this project, IEQ encompasses factors such as lighting, temperature, fresh air levels, noise and indoor pollutants, plus other less obvious factors such as the use of biophilia in the workplace.

Changes to IEQ are often reactive, based on feedback such as the thermal discomfort of building users. There is limited real-world research on how environmental changes impact on productivity – and even less is known about how the impact varies depending on factors such as task behaviour, time of day and outside weather conditions. Most office environments operate around fixed set points based on industry guidance. The WLP+ project will create a benchmarking tool and software model that can optimise office environments in real time.

Rajat Gupta heads the Low Carbon Building Group at Oxford Brookes University, and is the academic lead on the project. After a six-month review of existing research, Gupta and his colleague Adorkor Bruce-Konuah identified that existing research had focused on specific activities in controlled conditions that were not representative of the real world. Studies had also used self-reporting of work environments and productivity, rather than independent measurement (See panel 'Existing research').



One of the WLP+ trials will take place in an air traffic control building

WLP+ involves gathering real-time data from live offices. Property developer Argent, King's College London and facilities management company Emcor UK have offered buildings for the trials that represent three models: managed by developer; managed by owner-occupiers; and managed by property managers/FM contractors. One trial will take place in air traffic control buildings run by NATS. (See panel, 'Why NATS matters').

Indoor environmental quality

IEQ data will be monitored through the building management system (BMS), supported by stand-alone data loggers. Parameters to be measured will include temperature, relative humidity, CO₂ concentration, light levels, noise levels and airflow rates. In naturally ventilated case-study buildings, the use of windows will also be monitored. Workers in the case-study buildings will participate in surveys and simulated tasks. The surveys are designed to record perceptions of their working environment and their productivity, while the simulated tasks are designed to assess their performance in the current environmental conditions.

After the baseline measurement period, recorded environmental conditions will be assessed against recommended standards for best practice. Parameters that fall short of the benchmarks present an opportunity for intervention – for example, increasing fresh air supply to reduce CO₂ concentration. After the interventions, IEQ will be monitored, and occupant surveys and simulated tasks repeated.

Productivity in the intervention period will be compared with that in the baseline period, to assess the interventions' effectiveness. The outcomes will be used to develop tools to improve and manage workplace productivity, including measures to benchmark existing buildings, and dynamic algorithms to control indoor environments in real time. The two-year project is due to be completed in 2018.

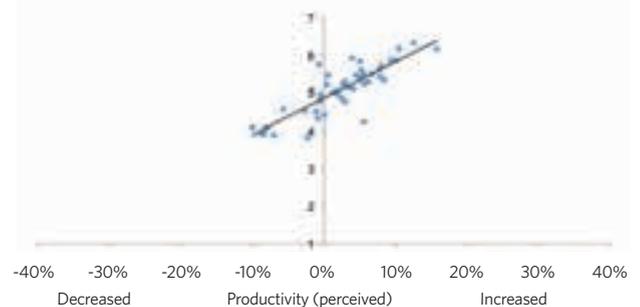
'The outcome from WLP+ will help define how organisations can configure their buildings to make their most important and

EXISTING RESEARCH

Findings from a review of existing research by Rajat Gupta and Adorkor Bruce-Konuah

- Previous studies on the effect of IEQ on workplace productivity have focused on individual parameters of the environment and performance in specified activities – for example, a 21% decrease in cognitive function when indoor CO₂ is increased from 550ppm to 945ppm¹ – rather than the complex interactions we see in workplaces
- Most of these studies have been conducted in controlled, static conditions, which are often not representative of the real world
- Studies have used self-reported assessments of working environments and productivity to quantify a relationship between IEQ and productivity, rather than independent measurement
- A new meta-analysis, a statistical review of Innovate UK's previous building performance evaluation project database, showed comfort explained 72% of the perceived productivity variation (Figure 1)

Figure 1: Comfort overall – unsatisfactory 1, satisfactory 7



expensive assets – their people – perform at their best,' says John O'Brien, founder and managing director at LCMB. Producing the evidence that office environments can increase people productivity has the potential to create a compelling case for investment, and to improve the operation of services in existing buildings and new developments. Visit www.wlplus.com for more details. [CJ](#)

■ **TOM CUDMORE** is a senior consultant at building performance specialists LCMB

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■ SPECIAL FEATURES RENEWABLES, IT AND SOFTWARE

DESK RESEARCH

Low-cost web technology could give workers full control over their office environment, according to research being carried out by Arup. **Andy Pearson** takes a seat at the desk of the future

Smart organisations understand that the effectiveness of their people is key to commercial success. One of the key factors influencing an employee's performance is the extent to which they perceive they have control over their physical work environment.

This is a particular challenge in open-plan offices, which are great at encouraging collaboration and making efficient use of floor space, but come at a cost to workers' ability to influence their immediate physical environment. This could be about to change with a research project undertaken by consultant Arup.

The 'All about the desk' study uses low-cost mobile and sensing technology – combined with open-source software – to allow employees to control task lighting and, in the future, temperature too. Their desk could also save energy by detecting when they are not sitting at it and so turning off the lights and computer monitors, or even turning down the ventilation fresh air supply.

The concept was born out of the frustration of Arup engineers, who were unable to control the environment around their desks in the open-plan office. Their annoyance was compounded by the fact that apps on their mobile phones allowed them to control almost everything else in their lives, including the temperature and lighting of their homes.

'The project was a way to focus the discussions people were having in the office about how to modernise our approach to building services design for commercial buildings to catch up with the technology changes that people are seeing in other areas of their lives,' says Arup electrical engineer Adam Jaworski.

With the Internet of Things (IoT) Desk,

the designers have assumed that the future of building services controls will be based on web standards. 'The technology that has been built for the web is very impressive; it is streets ahead of what traditional building services infrastructure is built around,' says Jaworski.

Fundamental to the success of the project is enabling building services systems to communicate using web-speak – or, as Jaworski puts it: 'Building services systems will present a representational state transfer (REST) application programming interface, to allow them to communicate using the standards that have been developed for information services on the internet.'

He says a web developer would understand the signals they need to



"CO₂ is a good proxy measurement of occupancy in an area. We think this will become an important control input for all sorts of things"



A sensor in the footwell can detect when someone is sitting at the desk



The desk is designed for building services controls based on web standards




60W

The amount of direct current power that each of the four Ethernet cables can deliver to the prototype desks

send and receive from the building services system – for example, to raise or lower the light level or temperature – without having to understand how the system works. ‘They could then easily make a web page with the right commands to drive the lighting or the fan coil units.’

The system is being trialled in Arup’s London offices, on a bank of six prototype desks – one of which is Jaworski’s. In a nod to contemporary manufacturing techniques, the prototypes have been designed using SolidWorks and then fabricated from sheets of plywood using rapid-manufacturing technology.

The desks incorporate a service zone beneath their work surface, to make it more flexible and adaptable for trialling technologies than a conventional office desk. They also include a goalpost-like structure – mounted at the rear of the work surface – to support a monitor display and house the LED task lights and uplights (see panel, ‘Local lighting’).

Power is supplied to the desk using Power over Ethernet (PoE). All the desktop electrical devices use DC power, so the LEDs, a monitor, a laptop charger and a USB socket – which can be used to charge a smartphone – are each connected to a dedicated Ethernet cable.



Power is supplied to the desk by Power over Ethernet



A service zone sits beneath the desk’s work surface

» At the end of the cables is a splitter, to separate power from data, with electrical power delivered via a 12V DC socket, which is the same as the device socket fitted to cars. Three sockets are used in the same way as car-accessory sockets; the fourth is hard-wired into the lighting system.

'In a normal office desk you would have 13-amp sockets at the back of the desk, with devices connected to them via AC adaptors. All we have is structured cabling that delivers PoE from a cabinet, which is fed from a single 13-amp socket,' says Jaworski.

Using PoE enables interaction with – and control of – a device directly. For example, it allows power to the monitor to be turned on and off digitally. Information can also be extracted from a device – such as, its power consumption or a measurement from a temperature sensor.

'Each of the four Ethernet cables can deliver up to 60W of direct current power, while allowing the devices to communicate using the same systems and protocols that are used to access information on the internet,' says Jaworski.

Other advantages of using extra-low voltage DC in an office are that it is less hazardous to employees than AC power and – when installed as part of a coherent building solution – can be delivered directly from renewable energy sources. It also has the advantage of being stored more easily.

The prototype desks are fitted with a low-cost sensor system manufactured by TinkerForge. The sensors measure

temperature, humidity, ambient light and mean radiant temperature on each desk, offering much better comfort control than by simply measuring air temperature. In addition, the desks have an occupancy sensor in their footwells, so the system knows when they are in use.

The sensor allows the desk to be set up so the task light comes on at a pre-set level and the monitor powers up when someone is sitting at the desk, and turns off when they leave. 'To achieve this control on a regular desk is uneconomic, but it is easy to do once you have a web interface,' says Jaworski.

OpenHab open source software is used to control the desk's different systems. 'It allows you to drive many different building services legacy protocols, such as Modbus and BACnet, and the newer-generation devices that natively speak web languages,' Jaworski explains. The software includes a framework for designing user interfaces that can be described easily in text files, to enable devices to be linked. 'Because it is a single platform, it means we don't have to have a controls sub-system sitting below the top level.'

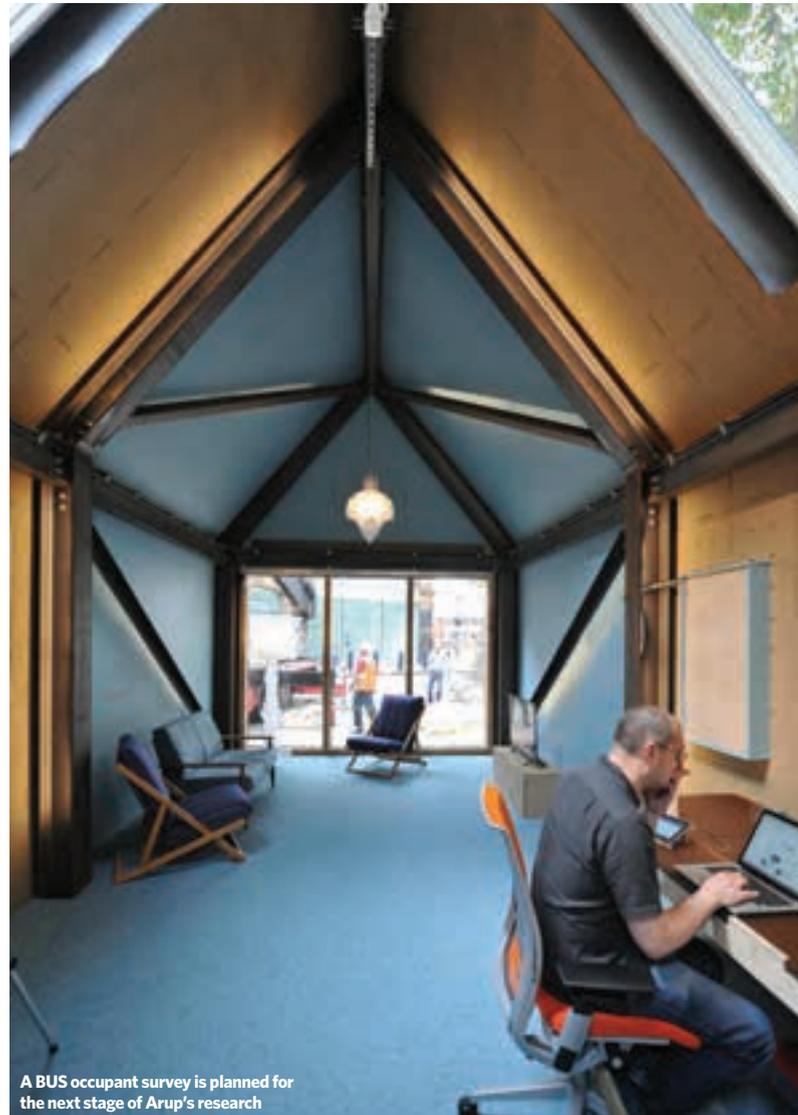
Carbon dioxide (CO₂) and particulate sensors have also been fitted to the group of desks to enable measurement of indoor air quality. Jaworski says the sensors have shown how the concentration of CO₂ can vary when viewed over the course of a day – rising in the morning, dipping at lunchtime as people leave the building, and then climbing back up again. 'CO₂ is a good proxy measurement of

LOCAL LIGHTING

Quality of lighting can have a significant impact on workers' wellbeing. There is evidence that the ability to adjust lighting locally – in response to the demands of different tasks – can have a positive impact on employees' physical and psychological health. Most have little or no control over their task lighting; instead, they sit in an office lit to a uniform Lux level, which, at best, might vary in response to daylight levels adjacent to the windows.

The prototype Arup desk is designed to vary light levels and to give people control over their light. Each desk incorporates a series of upward-facing LEDs that illuminate the office ceiling. These uplighters are managed as a group; they are designed to allow the colour and intensity of light in the room to be varied throughout the day under the control of a circadian algorithm, to emulate variations that occur in the natural environment. The LEDs are controlled so that, in the morning, the lighting has a higher blue component, while – in the afternoon – its red component is increased.

Task lighting is from a series of downward-facing LEDs. While the colour of the downlight is fixed, users can control the intensity of the light. 'We supply the light with power; we tell it what to do, and we use a new-to-market native driver to set the brightness and to make the light go on and off,' says Jaworski.



occupancy in an area. We think this will become an important control input for all sorts of things,' he says.

A Building Use Studies occupant survey is planned to get a more structured user response to the desk environment in the next phase of research, which will involve another set of desks and different engineers, sitting in another area of the office.

These desks will be integrated with a new-to-market fan coil unit system to provide heating and cooling to the office. 'It is not feasible to have one fan coil unit per desk, so we're looking to introduce desk fans as a form of comfort control and then use the fan coil to provide a general target temperature,' Jaworski says.

It is early days for the project; over time, the research is expected to influence the way Arup designs offices and help it to gain a better understanding of the particular benefits of giving employees more control over their office environment. **CJ**



Electrical power is delivered via 12V DC sockets, which are the same as the device socket fitted to cars



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FOOD FOR THOUGHT

Used cooking oil from London restaurants is powering two PwC office buildings. It is a pioneering approach to sustainability, but threw up challenges that required innovative thinking and strict maintenance. ChapmanBDSP's **Darren Coppins** explains

One Embankment Place is among London's most prominent examples of post-modern architecture. The 11-storey office building, by architect Terry Farrell, has been sitting above Charing Cross station since 1990, and is now an established part of the cityscape.

In 2010, as the building approached its 20th year, the occupiers – accountancy firm PricewaterhouseCoopers (PwC) – decided on a major refurbishment. While the aluminium and granite façade had stood the test of time, the interior was in need of updating. Deep floor plates meant offices were deprived of daylight, for example, and the dark atrium created an unwelcoming entrance. The building compared unfavourably with PwC's new light-filled offices at More London, near Tower Bridge.

A team – including project manager Turner & Townsend, architect TP Bennett and building services engineer ChapmanBDSP – was tasked with breathing new life into One Embankment Place. Prime among the design objectives was improving the building's environmental performance and achieving the highest possible Energy Performance Certificate (EPC) and Breeam ratings. Initial investigations revealed that an EPC B rating and Breeam Excellent



Adsorption chillers stacked within a vault

PROJECT TEAM

Project manager: Turner & Townsend
Architect: TP Bennett
MEP and sustainability consultant: ChapmanBDSP



could be achieved by implementing energy efficiency measures. However, to attain the highest ratings, the team calculated that a significant amount of renewable energy generation would be required.

Numerous scenarios were analysed, including recladding the barrel-vaulted roof with photovoltaics, installing wind turbines on the turrets, and using biofuel as the main energy source. PwC had recent experience of the latter; it had pioneered the use of biofuel within a combined heat, power and cooling plant (CHPC) – or trigeneration plant – at its More London office, and decided to use the same source of fuel for One Embankment Place.

The biofuel used by PwC could not be more locally sourced; used cooking oil (UCO) from London restaurants is refined in railway arches in Southwark. The use of UCO has been innovative, but not without teething problems. It is more corrosive than other fuels and PwC's building operators have had to work closely with engineers to ensure that the performance of the CHPC is not compromised by the fuel's properties.

Other issues associated with More London were low loads and high exhaust temperatures from the absorption chillers. The team at One Embankment Place was able to learn lessons from this and improve the efficiency of the plant. The biggest change was the move from an absorption chiller to adsorption chiller, which the team calculated could save £240,000 in maintenance and replacement costs. (See panel, 'Chiller life-cycle assessment').

Originally, the plan was for the base build installation to run on virgin-crop biofuel – unused oil directly from crop that would usually be intended for use in the food chain – but, according to Jon Barnes, head of building and technical services at PwC, this was not sustainable enough: 'Taking crop from the food chain is something PwC would not do.'

With a view to finding a sustainable source of biofuel, PwC approached Uptown Oil, which – as well as supplying new cooking oil to the company – recovers waste oil from the kitchens of its central London offices.

At the time, Uptown Oil was refining waste oil into fuel not far from PwC's proposed new office near Tower Bridge. Its proximity was attractive; biofuel delivered from further afield would have incurred a heavy carbon cost in terms of transporting it from a collection site, via a remote refinery. 'We were pioneering in what we were doing,' says Barnes. 'At the time, there was virtually no knowledge on UCO in HVAC systems – but, despite this, PwC opened its 7 More London office with a trigeneration system powered by UCO.'

UCO had been used at More London for just a few months when One Embankment Place also investigated employing the fuel source. This meant there was an opportunity >>



£240,000

The maintenance and replacement costs that potentially could be saved by moving from an absorption chiller to an adsorption chiller at One Embankment Place

» to learn from the earlier installation and the issues it encountered. Injector and fuel-pump failures – and high exhaust temperatures caused, partly, by variable fuel quality – were the main challenges of using UCO. The generators at More London soon began to suffer from its corrosive effects, made worse by biofuel remaining in the fuel lines and engine components overnight.

‘The biofuel is actually very aggressive. If left in contact, it will eat through rubber seals in no time,’ says Mick Hunt, building engineer at PwC.

So the project team at One Embankment Place enabled the generators to be started and stopped on red diesel. This facilitated a much easier start-up and flushed the engine fuel lines, fuel pump and injectors, to ensure the corrosive biofuel was not shortening the life of these components while standing idle.

This improvement resulted in the loss of the Breeam innovation credit for the system, because there was concern that it could be run on red diesel at any time. During actual operation, this has not been the case; PwC’s fuel-consumption figures at One Embankment Place reveal that only 3,000 litres of red diesel is used in a year, compared to the 4,000 litres of biofuel used every day.

Experience at More London showed that biofuel degrades quickly, so smaller tanks were installed to ensure that turnover was high and storage periods minimised.

The team spoke with generator and engine manufacturers to determine the best systems to operate with the proposed fuel. Suppliers with older engine technology demonstrated how lower injector and pump pressures were able to cope with the alternative fuel.

 **3,000l**

The amount of red diesel used at One Embankment Place in a year, compared to 1.46 million litres of biofuel (4,000 litres used every day)

CHILLER LIFE-CYCLE ASSESSMENT

Lifespan, cost and maintenance were factored into a life-cycle assessment of the intended life of the fit-out. The adsorption chillers – at more than double the cost of absorption chillers – could be demonstrated to have potential savings in maintenance and replacement costs of more than £240,000. This excluded the potentially reduced downtime and better turndown ratio allowing more heat energy to be used from the generators at part-load. This reduced the overall installation and maintenance cost over a 15-year period from an estimated 2p/kWhc to 1.3p/kWhc.



There was a clear need to improve the consistency and quality of the UCO and – with the engine manufacturer pressing for it to achieve EN14214 standard – a sample of the fuel from More London was sent away for testing. A number of issues were found, including high moisture and methanol content.

A Knowledge Transfer Partnership study with London South Bank University followed. Working with Uptown Oil, the fuel-refining process was improved to pass the independent testing to EN14214 and to achieve a high level of consistency in fuel quality. This was completed before the new trigeneration facility at One Embankment Place went on line.

The fuel is checked for EN compliance every three months, with each batch tested for ethanol content, which causes the most issues for the system.

The fuel deliveries being achieved are consistent and of EN quality, but it remains a very aggressive substance to store and use. Fuel-pump seals and injector failures are still common, with fuel pumps replaced regularly at More London and One Embankment Place.

Daily inspections are carried out, with the emphasis on looking for leaks caused by the failure of seals on the fuel-delivery systems. PwC has installed leak detection, with alarms affording early alerts. This allows quick shutdown and minimises the cleanup required to enable parts to be replaced and the plant put back in service.

Choice of chiller

Reliability and overall life-cycle of the plant were key considerations for PwC. A study was undertaken to compare the use of silica gel and water chillers – known as adsorption chillers, and manufactured by Weatherite – against absorption chillers using lithium bromide (see panel, ‘Chiller life-cycle assessment’).

The study concluded that adsorption chillers offered a much lower



The use of used cooking oil has been innovative, but not without teething problems – it is more corrosive than other fuel sources

installation and maintenance cost over a 15-year period, and these were specified for One Embankment Place.

Three years on, the silica-gel chillers have performed almost flawlessly – the replacement of an air compressor for the pneumatic controls on one of the chillers has been the only failure.

Maintaining water temperature from the generators to the chillers has been a challenge, with the exhaust heat exchangers seemingly less than ideal in terms of size. This has resulted in insufficient heat being extracted to maintain the required 82°C for full output of the chillers. The silica gel chillers are more controllable across a wider operating range compared to lithium bromide absorption chillers and so the output can be modulated more accurately to meet demand than with lithium bromide absorption technology.

Biofuels burn less cleanly than diesel resulting in fouling of the heat exchangers, reducing their performance and so exacerbating the lack of heat transfer to the water. So the heat exchangers are cleaned on a three-monthly cycle, after which the improved heat transfer can increase LTHW flow temperatures by up to 10K.

At More London, the trigeneration plant is connected on the power side to the tenant's small power and lighting load. This means the plant has limited operating hours outside times of peak occupancy because of the low electrical loads for the office floors when unoccupied. To maximise run hours at One Embankment Place, connection was prioritised so that whole-building loads, including landlord plant and common parts, could be served.

The More London absorption chillers operate in two stages, from the engine jacket water and from the hot exhaust gasses passing through the chillers. High exhaust temperatures frequently resulted in crystallisation of the solution within the absorption chillers, causing reduced output and, ultimately, the shutdown of the system.

To better control the heat entering the cooling-generation system, it was decided

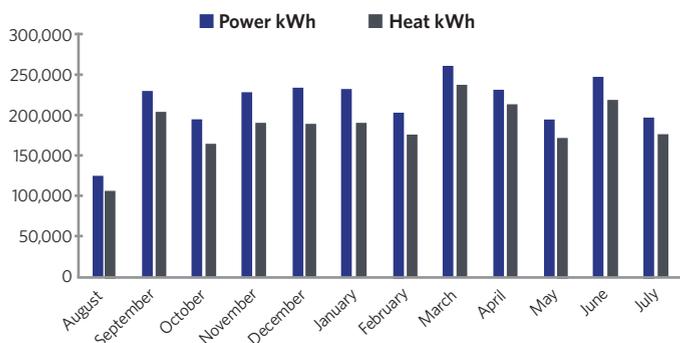


Red diesel and biofuel meters



Stainless steel pipework is used for biofuel

Generator output August 2015 to July 2016



In 12 months to July 2016, 2,565MWh of electricity and 2,227MWh of heat was generated



» that water-based chillers – rather than exhaust-gas versions – would be used at One Embankment Place. This would result in a potential reduction in the chillers' coefficient of performance (COP) – so they would be less efficient – but improved reliability compensated for this.

One Embankment Place has very deep floors and a high floor area to external envelope. This, along with the associated internal gains, means the building needs cooling all year round.

The output of the chilled water systems, while metered, has not been recorded. In this cooling-led building, the facilities management (FM) team, led by Hunt, reports that its cooling load can be met during winter by the CCHP system alone.

The only time when the CCHP system is reduced in operating hours is during periods of very hot weather. The condenser water circuit is shared with the main chillers.

During periods of very high cooling loads and high ambient temperature and humidity, the electric chillers are prioritised to ensure the full cooling load of the building is met. This is uncommon, and is monitored and implemented manually when the condenser water temperatures rise.

In the 12 months to the end of July 2016, the system generated 2,565MWh of electricity and 2,227MWh of heat, with output reasonably consistent, despite regular maintenance being undertaken.

Each generator has a red diesel and a biofuel meter at the fuel inlets to the enclosure, which allows the use of each fuel to be assigned to a particular generator. While the generators have the ability to start and stop on red diesel, this accounted for only 0.66% of the total fuel used in 2015.



Conclusion

Scalability and adaptability of UCO for application to other buildings is low. There is insufficient waste oil available for many more buildings to use this type of technology and its application may be better suited to waste-processing plants outside of London.

In terms of installation and maintenance, this was far from easy, fit-and-forget technology. It has taken considerable dedication to install and maintain a system that works well on a daily basis.

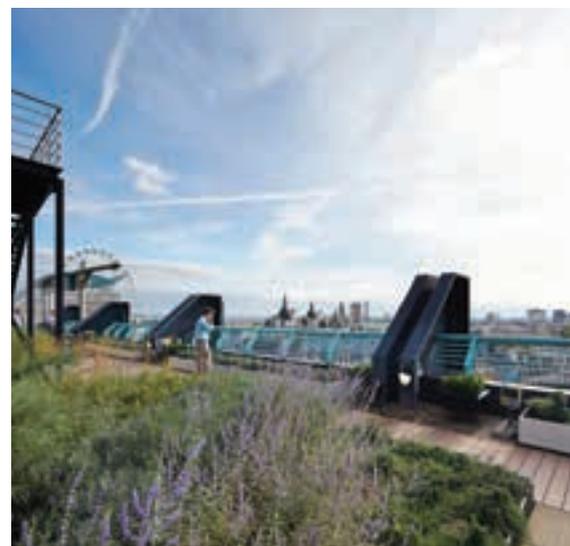
What this installation proves is that, with effort and intelligent engineering, it is possible to deliver what might have been considered a risky venture.

The benefits to the environment should not be underestimated – PwC is now using around a seventh of London's waste cooking oil. A considerable achievement. **CJ**

Special thanks

The following assisted in the writing of this article: ChapmanBDSP; Jon Barnes, PwC; Steve Smith, PwC; Mike Hunt, PwC; Adam Bushell, PwC; Ross Cruikshank, Honeywell Building Solutions; Mike Trkulja, Honeywell Building Solutions

DARREN COPPINS MCIBSE is an independent mechanical engineer and environmental design consultant. For this project he was acting head of sustainability for Chapman Bathurst (now ChapmanBDSP)



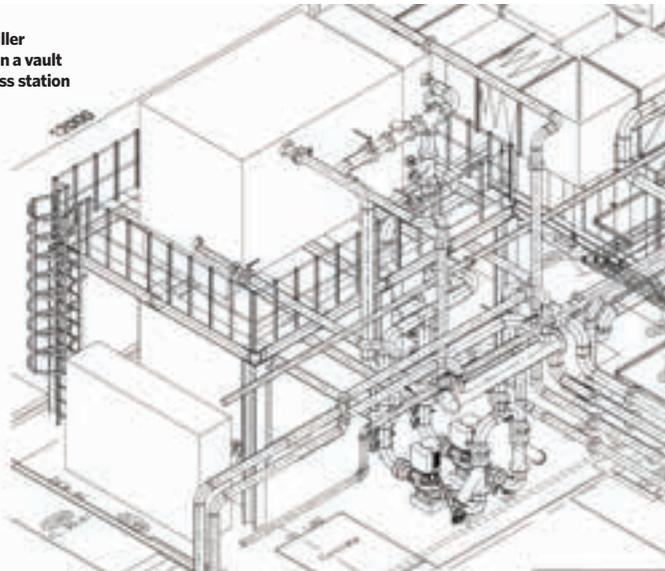
INSTALLING THE PLANT

One Embankment Place was the largest air-rights building in the UK at the time of its construction over Charing Cross station. This means its main entrance and the plant are located in the vaults below the station – giving the designers the logistical complication of moving gas, heat, power, cooling and people up through the station level to the main function areas of the building above.

Two vaults below the station were identified for the trigeneration installation, and then began the space planning for fitting in the generators, exhaust systems, ventilation systems and – by far the largest items – the two adsorption chillers.

The resulting arrangement had the two generators located side by side in one acoustic enclosure, with a central walkway between the engines and the two adsorption chillers stacked within the vault.

The adsorption chiller arrangement within a vault below Charing Cross station





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STAYING POWER

In an emerging electricity market, bidders can offer various services to the grid to help balance the network, says Hoare Lea's Nick Cullen

Electricity is now generated at many different points in the supply network, rather than from massive power stations. Regulations, cheaper renewables and energy-efficient combined heat and power systems have encouraged distributed power systems, which can facilitate an electricity open market that will respond to the changing supply and demand. But such a system needs smarter controls; some local networks can no longer accommodate the amount of electricity being offered and – until the infrastructure is reinforced – building developers' low carbon strategies are being curtailed.

According to the *Digest of United Kingdom energy statistics 2016*, the average generation capacity used across the year is 39GW, compared with a total capacity of 81GW. The 42GW difference represents a huge underused investment in plant and associated infrastructure.

So rather than maintaining this 'peak capacity', should we not be investing in technology that averages out demand by reducing peaks and raising troughs?

The 'demand response' market is emerging as a key driver for investment in new technology and innovative control strategies. This is being encouraged through balancing mechanisms, introduced by the National Grid to manage the smaller margin between generation and demand, and to enable an increase in investment into novel



and efficient technology and smaller dispersed electricity generators. As a result, the electricity network is becoming technologically and economically smarter, and a market is emerging in which bidders can offer the grid various services to help balance the network.

Balancing act

At its most basic, demand-system response (DSR) balances supply and demand. This was previously achieved by bringing generation capacity on- and offline according to electricity demand, using a mixture of historic understanding of behaviour, a mix of plant that could respond quickly – such as the Dinorwig pump storage facility in North Wales – and industrial users able to reduce demand on request.

The new smart system opens this market up to many more participants. The network will continue to respond by bringing capacity on- and offline, while encouraging other technologies and mechanisms, including battery storage.

If they have onsite generation or are able to control demand, building owners can earn money through participation in the following mechanisms:

- **Short-term operating reserve (STOR)**, which gives participants four hours' notice to supply power for at least two hours
- **Capacity market (CM)** which ensures sufficient capacity to meet the winter peak. Participants must provide their contracted capacity when requested
- **Static, dynamic or enhanced frequency response (FR)**, for which participants must respond to changes in the grid frequency within a matter of seconds and maintain supply for up to 30 minutes. Static FR has two response times: 10 seconds and 30 seconds. Dynamic FR



42GW

Difference between
UK average generation
capacity and total capacity



requires participants to monitor grid frequency and adjust demand or supply up or down to maintain the frequency in real time. With Enhanced FR, participants must respond in less than one second

- **Dynamic turn up** requires participants to turn up demand for as long as two hours upon request
- **Peak-charge avoidance** is for those who can avoid using electricity during peak-demand periods – or ‘red zones’ – reducing their distribution network charges significantly.

Each mechanism – intended to ameliorate different problems faced by the grid – is procured at commercially competitive rates, including through the use of auctions.

Taking part

Participation in the mechanisms offers the opportunity to operate existing plant and equipment in a more efficient manner – reducing bills and, potentially, carbon – as well as to invest in new technologies and control systems to generate income. It is possible to enter into contracts for each of the mechanisms and build up a portfolio of income streams – making the diesel generator available to the grid through one or more mechanisms, for example. A capability to respond quickly with hot standby generators or through interruptible processes may be required, as well as a commitment to reduce demand when requested by switching off equipment such as chillers or fans.

Batteries are also getting cheaper. A large building’s integrated photovoltaic array could use a battery system to store power in summer and displace expensive grid electricity across the day. In winter, those same batteries could be used to store grid electricity for use as part of peak avoidance or the enhanced-frequency response.

Future building design

Buildings are becoming part of the energy infrastructure. So a broader perspective on designers’ hierarchy – fabric first, then systems and renewables – can extend it to include the infrastructure upon which the building depends.

This means:

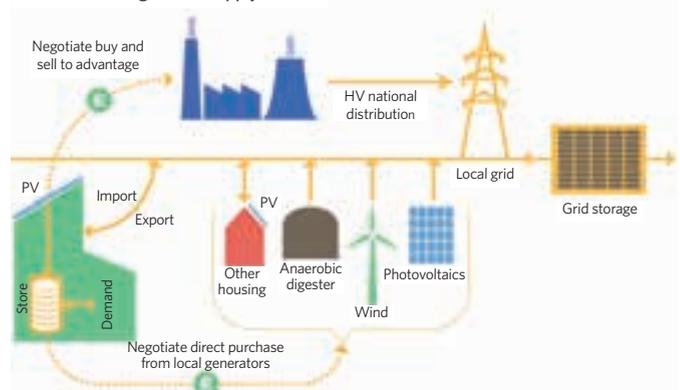
- Integrating energy storage to maximise the self-use of onsite-generated electricity, whether it applies to heat or waste heat
- Integrating smart controls to enable DSR through storage and system ‘pause’, and peak lopping strategies
- Engaging with occupants and operators to encourage energy-saving behaviour
- Enabling energy-procurement competition through data collection, analysis and aggregation
- Ensuring vehicle charging at buildings is controlled as part of the building-energy control strategy.

The building has to become part of the electricity network, allowing its energy demand to fluctuate in response to the needs of the grid. Battery storage, coupled with aggregation and a sophisticated control system, becomes an important building-system component, linked to onsite generation, grid supply, building supply and, potentially, vehicle charge.

The use and procurement of energy becomes a complex interconnected process, with the ultimate aim of reducing consumer bills and enabling low carbon energy production. What we see emerging is an internet of energy.

■ **NICK CULLEN FCIBSE** is a partner at Hoare Lea

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Predicting and delivering good building IAQ using natural ventilation

This CPD module explores how natural ventilation can be used to maintain indoor air quality, and its application for school buildings

School buildings are often built and operated within tight financial constraints but, at the same time, require high standards of indoor air quality (IAQ) to promote good learning and health. This article will reflect on the application of natural ventilation as a method of maintaining IAQ, and consider the application and control of natural ventilation for school buildings.

As discussed more fully in the December 2016 CPD article *Hybrid ventilation for schools*, ventilation in buildings can be broadly categorised as natural, mechanical or hybrid ventilation. All three ventilation types have appropriate applications; however, determining whether there is an opportunity for natural ventilation would be the normal starting point for a project.

Natural ventilation in buildings will be driven by the velocity of the wind impinging on the building's fabric, as well as by the pressure differences developed through air temperature variations, and the resulting 'buoyancy' effect.

CIBSE Guide A4 and application manual AM10 provide detailed methods and examples for assessing the practical potential for natural ventilation that are based on networks of airflow paths through openings (including cracks) in the building fabric, and the available driving pressure. The driving wind pressure (Pa) is related to the velocity pressure $p_v = C_p \cdot (0.5 \cdot \rho \cdot v^2)$, where ρ is air density (typically taken as $1.2 \text{ kg} \cdot \text{m}^{-3}$) and v is the undisturbed wind velocity measured (in $\text{m} \cdot \text{s}^{-1}$) as if there were no buildings or other obstructions at an appropriate height. C_p is the pressure coefficient, and will depend on the shape of the building and the direction of the wind. The value of C_p will vary across the building's surfaces, as illustrated in the 'flattened' rectangular building in Figure 1.

So, for example, for the building represented in Figure 1, the effective pressure being felt in the centre of the short windward wall, for a windspeed of $5 \text{ m} \cdot \text{s}^{-1}$, will be $0.9 \cdot (0.5 \times 1.2 \times 5^2) = 13.5 \text{ Pa}$. Values of C_p are typically determined using wind tunnel tests (as well as computational methods). There are tabulated average face values of C_p for a selection of common building aspect ratios and heights in CIBSE Guide

A4. Wind pressure will, of course, be variable and is subject to interference at ground level from obstructions.

For stack ventilation, the pressure difference is caused by the difference in mass between the air in the building and that of the air outdoors. Pressure (Pa) at the base of a column of fluid (such as air) is simply $9.81 \cdot \rho \cdot z$, where z is the column height (m). By including a relationship that determines the value of air density at a specific temperature, the available pressure for driving ventilation between two openings in a building can be determined. If one opening is at height z_2 (m) and the other at z_1 (m), with inside air temperature θ_{ai} ($^{\circ}\text{C}$) and outside air temperature θ_{ao} ($^{\circ}\text{C}$), the driving pressure difference is given by

$$\Delta p = -3,455 (z_2 - z_1) (1/(\theta_{ao} + 273) - 1/(\theta_{ai} + 273)) \text{ Pa.}$$

So, for example, the available pressure between two windows – one 3m above the other in a room with air temperature 21°C when outdoor temperature is 1°C – would be $-3,455 \times 3 \text{ m} \times (1/(1^{\circ}\text{C} + 273) - 1/(21^{\circ}\text{C} + 273)) = -2.57 \text{ Pa}$ (the minus sign indicating that the flow would, in this case, be from top to bottom).

Both wind and stack will provide a



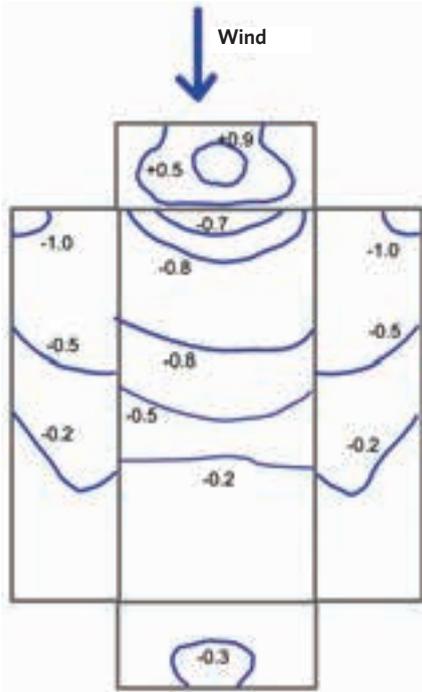


Figure 1: A 'flattened' representation of a rectangular building showing example pressure coefficients for a particular wind direction

» pressure differential that will cause air to flow through openings – by design and fortuitously (fortuitous flow being termed 'infiltration' or air leakage). Flow will vary approximately with the square root of pressure difference – so a doubling of driving pressure would provide $\sqrt{2} = 1.41$ times the natural ventilation.

As shown in the preceding calculations, the available pressure to drive natural ventilation is likely to be relatively small. For comparison, in a mechanical ventilation system a clean panel filter is likely to require a minimum of 40 Pa and a standard louvre will need around 20 Pa to pass a desired airflow.

Applying natural ventilation

The methods by which spaces are naturally ventilated may be split into four groups.

Single-sided ventilation – as discussed by Plesner¹, this is a complex mode of ventilation driven by wind pressure, the fluctuations in wind pressure and the stack effect. Typically, windows would provide the openings, and this mode is likely to be effective up to a room depth of approximately twice the room height. For building façades with separate upper and lower openings – as in traditional sliding sash windows – this can be effective for up to a room depth of two and a half-times the room height. For cross ventilation to be successful, a pressure differential is needed

between two openings on opposing faces of a room, which would normally mean that both sides have to be open to the outside air (some have an open side into a building atrium or ventilation chimney). If the openings are subsequently closed on one side, the ventilation system will revert to a single-sided system. As the air moves across the space, it will pick up heat and pollutant from the internal environment before it leaves the room. This can provide effective ventilation for a room width of up to four-to-five times the room height. **Stack assisted ventilation** provides a more reliable opportunity for natural ventilation, as it depends on the temperature – and so density – differences in air. In simpler applications it may be from a low-level window, or louvre, on one side of the room to a high-level window or louvre on the same side, or on the opposite side of the space. This can provide air flowrates during hot, still days – and work in deeper plan spaces. Systems can include chimneys (possibly solar or waste-heat assisted) that are used to increase the stack effect, and windtowers that use the wind's velocity to induce airflow using the 'venturi' effect. **Top-down ventilation** (as shown in Figure 2) takes advantage of both wind-driven and buoyancy-driven ventilation. However, it is not completely reliant on either. Stack-driven buoyant air rises within the space and, as it leaves through a purpose-made ventilation tower, is replaced with outdoor air that enters the tower through the positively pressured windward side. The leeward faces of the ventilation tower have a lower pressure that helps to extract the buoyant, stale, warm air from the space below.

Air introduced from high level is typically less likely to carry airborne pollutants, and less prone to noise pollution compared with ground-level sources. These systems can ventilate deep plan areas that do not otherwise have direct access to outdoor air, and are not affected by the depth of the room.

Whichever method is employed, the 'ventilation effectiveness' should be considered. The system will only be successful if the supply air not only removes the pollutants and heat, but also provides fresh (as opposed to stale or already contaminated) air to the occupants. It is this consideration that will affect the practical effective depth of a naturally ventilated space. The complexities of airflow movement within the space and the building itself mean that computational fluid dynamics is often required to evaluate properly the patterns and resulting effectiveness.

Modelling natural ventilation

It is challenging to forecast properly natural ventilation because of the multiple variable parameters, including: wind speed; wind fluctuation; ambient temperatures; opening sizes; internal pathways; and flow characteristics. And, as the wind direction changes, so does the whole pattern of flow paths through the building, as the pressure coefficients alter across the building surfaces. As discussed

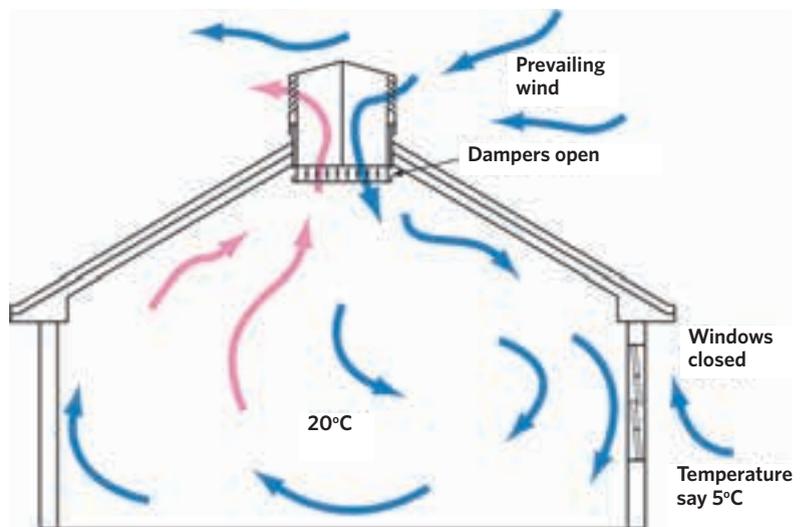


Figure 2: Integrating a ventilation tower to provide top-down natural ventilation (Source: Monodraught)

earlier, the practical driving pressures are likely to be small, and so require particularly careful consideration to determine the flow through appropriately low resistance networks of openings.

There are models (such as Liddament's simple but effective AIDA algorithm²) that can provide predictions for simple natural ventilation networks. As discussed in the December *CIBSE Journal* CPD article, there is great opportunity to use the computational fluid dynamics (CFD) and dynamic thermal simulation software to provide a model. However, as reflected in that article, CFD still requires expert input to provide credible output. Manufacturers of natural ventilation systems have joined with simulation software suppliers to produce robust tools that require fewer inputs than normal commercially available simulation tools. This can provide a useful tool for sizing natural ventilation systems, particularly during the early stages of a project, when full details of a building are not always readily available.

Libraries of predefined objects are also increasingly available for dynamic thermal simulation software (as shown in Figure 3) that provide both a geometric representation and functional parameters. These are likely to become more common as building information modelling (BIM) methods further permeate the industry. This allows the assessment of performance to investigate the capabilities of a potential scheme within a standard modelling environment.

Controls for natural ventilation

Ventilation controls may be used to monitor CO₂, temperature and humidity. They can typically be linked into the building management system so that they can be integrated into wider building monitoring and control, with the operational data collected and processed for system management. For example, this allows time zoning of the building to accommodate periods of occupancy and times when 'night cooling' may take place, and to provide frost protection control. They can be linked in to hybrid systems (see December 2016 CPD article) to maximise opportunities for introducing larger volumes of lower enthalpy outdoor 'fresh' air.

The use of accessible linked visual display interfaces can help educate end users about how the systems operate so that they may better maintain a comfortable, productive environment with minimum energy use.

An example of applying a windtower-driven natural ventilation system

A natural ventilation system was used as part of the building system for a French school renovation that subsequently received a Green Building Solutions Award from the Construction 21 Network for Health and Comfort.³ The Simone Veil nursery and primary school wanted control of its year-round energy consumption, and to ensure low carbon emissions, while maintaining high levels of IAQ (and acoustic environment) for the health and comfort of its pupils and teachers. Located close to Lyon, south-east France, the ambient temperature is typically 3 to 4K warmer in summer and 2 to 3K cooler in winter than London.

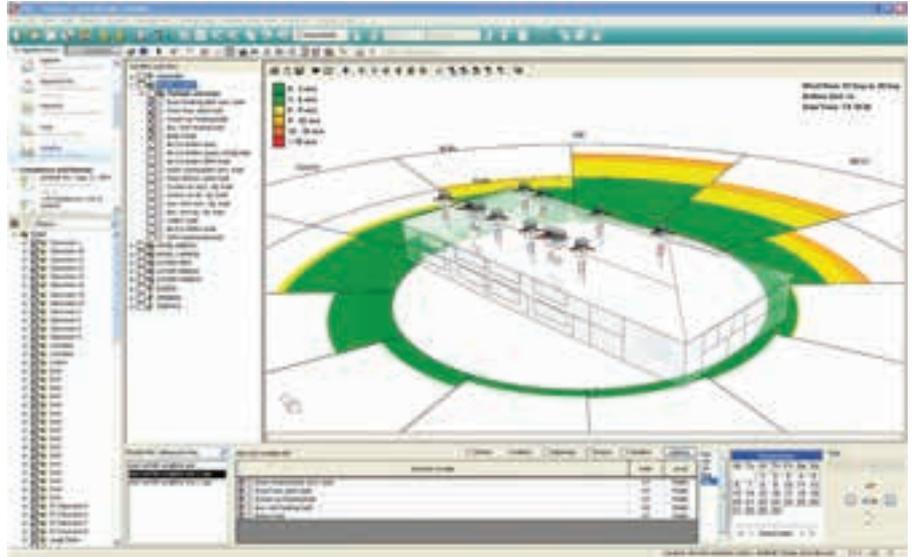


Figure 3: Windtower components that include both geometric and functional parametric information can be 'dropped in' to a standard modelling environment (Source: Monodraught/IES)



Figure 4: The windtowers pass through the roof of Simone Veil nursery and primary school, near Lyon, France (Source: Monodraught)

The building system was designed so that it could maintain appropriate conditions in both summer and winter, and be capable of limiting the maximum temperature to 26°C without any active cooling system, following three consecutive summer 'heatwave' days, and with an occupancy of 30 students per class. The thermally heavyweight, carefully constructed fabric of the two-storey buildings was designed to minimise solar gains. The natural ventilation system consists of external static louvres and internal active louvre arrangements, which vary the opening and free area through the louvre face. The natural ventilation is driven with 16 windtowers above individual classrooms.⁴ The system monitors CO₂ levels to actuate the louvre units, and has successfully provided a minimum ventilation rate of 7 L·s⁻¹ per child during operation. The system provides 'free-cooling' and offers night ventilation, while requiring almost no maintenance compared with mechanical ventilation systems. Levels of indoor air quality and measured CO₂ levels have readily met design requirements.

New UK guidelines⁵ on ventilation, thermal comfort and indoor air quality in schools are soon to be published. An appropriately designed and controlled natural ventilation system should be considered as a potential option to meet these requirements as, in many applications, it is possible to maintain IAQ levels while meeting the comfort requirements with low energy consumption.

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Turn to page 50 for further reading and references >>



» Module 107

January 2017

1. Based on the data in Figure 1, what would be the approximate wind pressure exerted in the middle of the downwind short wall for a wind speed of 6 m·s⁻¹?

- A -13.5 Pa
- B -6.5 Pa
- C -0.65 Pa
- D 0.65 Pa
- E 6.5 Pa

2. Which of these is least likely to be true for top-down ventilation using a ventilation windtower?

- A Does not need low-level louvres
- B Partly driven by wind forces
- C Partly driven by buoyancy forces
- D Limited to room depths of five times the room height
- E Draws ventilation air from high level

3. What simple algorithm can be used to determine simple natural ventilation flowrates?

- A AIDA
- B ALBA
- C ALTA
- D DATA
- E IATA

4. What minimum ventilation rate was maintained in the French school example?

- A 5 Ls⁻¹ per child
- B 7 Ls⁻¹ per child
- C 9 Ls⁻¹ per child
- D 11 Ls⁻¹ per child
- E 13 Ls⁻¹ per child

5. Which of the following is least likely to form part of a modern integrated natural ventilation system?

- A Visual display interface to control and inform users
- B Ventilation rate control
- C CO₂ control
- D Air dry bulb temperature monitoring and control
- E Active dehumidification

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Further reading:

For key guidance on natural ventilation CIBSE Applications Manual AM10⁹ and the recently revised CIBSE Guide A Section A4² are both excellent references, featuring practical examples.

References:

- 1 Plesner, C. et al, *Calculation methods for single-sided natural ventilation - simplified or detailed?* CLIMA 2016 - proceedings of the 12th REHVA World Congress, May 2016.
- 2 CIBSE Guide A 2016, Appendix 4.A3
- 3 www.construction21.org/case-studies/fr/kindergarten-and-primary-school-group-simone-veil.html - accessed 30 November 2016.
- 4 www.monodraught.com/projects/featured-projects/windcatcher-x-air-and-suncatcher-classic-installed-in-award-winning-french-school-building - accessed 30 November 2016.
- 5 <https://consult.education.gov.uk/capital/bb101-school-design-iaq-comfort-and-ventilation> - accessed 30 November 2016.
- 6 *Natural ventilation in non-domestic buildings* CIBSE Applications Manual AM10, 2005.

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◀ Here East is here and now

About to join the London 2012 legacy ranks is the former Olympic press centre, which is currently being reconfigured into a tech and media hub called Here East. The original plan of the centre included 'green' office space with four storeys of workspace.

Grundfos was chosen as the sole pump provider and the final pump solutions were supplied on inertia bases. This involved more than 70 NBE energy efficient pumps, all of which were pre-bolted and pre-wired on inertia bases. Ten pressurisation sets and six Hydro MPC-E booster sets were also supplied.

The building was designed to be easily adapted after the Games, and will be fully operational by 2017. It will support 500 on-site organisations with state-of-the-art facilities.

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

Stunning 33 Glasshouse Street ▶ features underfloor air conditioning

AET Flexible Space has completed commissioning on 33 Glasshouse Street in London, after supplying to Emico early this year. Space-saving underfloor air conditioning has been specified by consultants WPP and architects Buckley Gray Yeoman. Fully conditioned air is fed into the plenum by zonal downflow units, and then supplied into the workspace via fan terminal units. Users can adjust fan speed and temperature to suit their own comfort.

■ Call 01342 310 400 or email lucy@flexiblespace.com



✔ HygroMatik's new temperature sensors let facilities managers take control

A spa is a space where guests are immersed in pure relaxation. To create a calm and comfortable environment, precise temperature and steam control are necessary. HygroMatik's new TF105 and TF106 temperature sensors are designed to suit all steam generators, and guarantee close monitoring of steam generation, offering peace of mind to facilities managers and visitors alike.

■ Call 02380 443 127, email info@hygromatik.co.uk or visit www.hygromatik.com



◀ Ten-year success for biodiesel boilers at royal residence

Two Atlantic R22 series super-condensing boilers were installed at the London home of the Prince of Wales in 2007. The combination of efficient boilers, burners and plate heat exchangers has halved the energy bill over those 10 years, giving exceptional payback. The first boiler is equipped with alternative gas and B100 biodiesel burners; the second has a natural gas burner; and both have a seasonal efficiency of more than 94% GCV or 104% NCV.

■ Visit www.atlanticboilers.com



Simply saving energy ▶ with Danlers high-bay PIRs

Danlers high-bay PIR occupancy switches are ideal for energy-saving lighting control in areas such as warehouses and factories. There are versions for simply switching the lighting load on/off, and others for DALI, DSI or 1-10VDC ballasts that automatically dim or brighten the lights in response to changes in ambient light level. Products come with manual adjustment or as programmable versions, using Danlers' free 'EasyZAPP' or 'ControlZAPP' apps.

■ Call 01249 443 377, email sales@danlers.co.uk or visit www.danlers.co.uk



✔ Passive cooling thermal energy storage (TES)

TES is the temporary storage of thermal energy for later use, bridging the gap between energy availability and energy use. Overnight cool energy is stored in the form of 20-27°C phase change material (PCM)-filled containers and later used to absorb the internal and solar heat gains during the day for an energy-free passive cooling system. This technology offers environmentally friendly maintenance and an energy-free cooling solution, and can be applied to new or existing buildings.

■ Call 01733 245 511 or visit www.pcmproducts.net



◀ Park hospital stays green with Kingspan Kooltherm

Kingspan Kooltherm FM pipe insulation is set to provide long-term energy savings for a new children's hospital, built entirely within a Liverpool park.

Alder Hey in The Park offers a new vision for healthcare provision. It aims to become 'the most sustainable hospital in the UK', so limiting energy loss from building services was a key consideration. As a result, Kingspan Kooltherm FM pipe insulation was specified for pipework across the facility.

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



✓ **Oventrop makes an entrance at Torbay Hospital**

Oventrop UK has helped Totus Engineering to design efficient and effective temperature control for the new 14-bed critical care unit and main entrance at Torbay Hospital. It supplied differential pressure control valves and partner commissioning valves for the heating and chilled water systems, to give pressure-controlled stability within these systems. Oventrop also supplied Aquastrom thermal-balancing valves for the hot-water circulation.

■ Call 01256 330 441, email info@oventrop.co.uk and visit www.oventrop.co.uk



✓ **Weatherite provides specialist packaged plantrooms at hospital isolation rooms**

Weatherite has designed and manufactured two air handling units (AHUs) to create 'controlled' conditions in isolation rooms at Raigmore Hospital, Glasgow. Both units offer 100% run and standby capability, and can be swapped over in operation during maintenance and service work, to ensure continuity of room conditions.

Weatherite worked with Glasgow-based consultants Pick Everard to meet the stringent infrastructure and design requirements. The design incorporated several elements essential to ensuring isolation of contaminated air, including negative air pressure, bespoke high-efficiency filtration systems and high-grade H10 HEPA filters. The AHU system includes a 'bag in, bag out' arrangement for removing contaminated particulate filters and gas absorbers in hazardous environments. Other features include low temperature hot water heating coils.

■ Visit www.weatherite-group.com



▶ **Lochinvar unveils latest in flexible boiler technology**

Lochinvar has launched a new range of floor-standing commercial boilers, comprising eight models offering outputs from 41kW to 221kW.

Each model in the Herald range features a 316-litre stainless steel heat exchanger, which greatly improves resistance to corrosion and is supported by a 10-year warranty. The boilers also offer very low NO_x emissions of 39mg/kWh, which means they qualify for the maximum three Breem points.

Capable of working at high operating pressures of up to 11bar, Herald boilers are particularly suitable for high-rise buildings. They also deliver temperatures up to 88°C and a delta T of 30°C.

At 394mm-wide, they are narrow enough to fit through a standard doorway and the largest model - at 228kW output - has a footprint of less than 0.5m².

With a maximum height of 1,080mm, the boilers can cope with most headroom restrictions and fit into the tightest of plantrooms.

■ Visit www.lochinvar.ltd.uk



◀ **Reasons to install Rehaus district heating pipework**

Rehaus pipework uses 10% less material than steel and has fittings that are up to 50% quicker to fit, with no hot works. The duo form of the pipework is available in 400m lengths, so needs fewer joints, and - in the Rauthermex version - it has the best lambda value of any pre-insulated pipe available in the UK.

There are specific benefits to consultants and contractors working with Rehaus, including its UK sales and technical support team.

■ Call 01989 762 600, email Jo.Trotman@rehau.com or visit www.rehau.co.uk

✓ **Polypipe ventilation's Silavent fans installed in former Harrogate police station**

Polypipe ventilation has had its Silavent sapphire decentralised mechanical extract ventilation (dMEV) centrifugal fans specified and installed in a former police station in Harrogate. Energy efficient heating and ventilation has been put in, including Silavent Sapphire dMEV centrifugal fans for continuous ventilation to bathrooms. The range features the award-winning HRX MVHR and compact mechanical extract ventilation appliances.

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



^ **Great chemicals come in small packages**

More efficient lifetime protection from corrosion and limescale in commercial heating and cooling systems is now available, thanks to sentinel commercial's 'triple power' water-treatment chemicals. Able to dose systems more than three times larger than the previous award-winning formulations could, sentinel's triple-power X100 Inhibitor, X300 cleaner (for new systems), and X400 cleaner (for older systems) chemicals offer market-leading performance, with one litre treating around 20% more system volume than the next best competitor product.

■ Visit www.sentinelprojects.com



^ Vent-Axia staff celebrate 80th anniversary

Vent-Axia has continued its 80th anniversary festivities with a staff celebration at its head office, at Manor Royal in Crawley. Employees enjoyed lunch and cake to mark Vent-Axia's eight decades and a formal photograph was taken to record the occasion. Each member of staff was given anniversary mementoes and a framed copy of the photograph. Similar celebrations also took place in Vent-Axia's Dudley manufacturing facility.

■ Call 0844 856 0590 or visit www.vent-axia.com



^ Viega expands its sales team, building on UK success

Viega prewall and drainage solutions has expanded its experienced UK team.

With its innovative and practical product portfolio gaining traction in the market, this latest investment is part of the company's overall commitment to delivering the highest-quality service.

As national sales manager, Paul Taylor will oversee the UK sales operation. He has more than 25 years' industry experience and joins the team from a national sales role at Cistermiser.

■ Visit www.viega.co.uk

Waterloo delivers 'VAV VAV vroom' through variable air volume

Waterloo air products offers the ability to control air flow in the same way using variable air volume (VAV) for long-term energy efficiency benefits. VAV monitors temperature and humidity and adjusts the air volume automatically to maintain an environment suited to the needs of the specific room. That means keeping a room comfortable no matter how many people are in it, or preserving the conditions vital to protect materials in server rooms, hospitals or laboratories.

■ Call 01622 711 500 or email enquiry@waterloo.co.uk



^ New exposed terminal air conditioning system

Why hide the services when they can be showcased by removing the false ceiling? Advanced Air has developed a new range of fan coil units (FCU) specifically aimed at this niche market requirement.

With exposed systems, the fan coil has to be streamlined to match the high aesthetic standard required. All pipework and electrical connections are located in one place, at the rear of the unit, to shorten the distance between the fan coil and the centralised distribution network of pipes and cables.

The outer casing of the fan coil gives smooth lines to the unit and can be painted any colour or given a metal polish finish. The unit incorporates all of the standard components and includes an acoustic inbuilt attenuator and condensate pump. It can be supplied with internally mounted EPIV or PICV 2 port valve hook-up sets and BACnet FCU controller.

■ Visit www.advancedair.co.uk



^ Press thick-walled steel pipes quickly and securely with Megapress

Viega has introduced the innovative Megapress to the UK market. The carbon steel press-fitting system offers a fast, effective alternative to traditional methods, such as welding. A highly effective pressing method, Megapress connections can be made in less than seven seconds – helping to achieve a 60% reduction in installation time.

Compatible with heating and cooling systems, the system is an effective tool for pressing pipework, and achieves a cleaner and safer method of connection

■ Visit www.viega.co.uk

^ Heat network regulations update announced

Since the Brexit vote and the appointment of the new Prime Minister, changes have been announced that affect the Heat Network Metering & Billing Regulations for district and communal heating systems. The regulations were previously enforced by the Department for Energy and Climate Change with the National Measurement and Regulations Office, which have both now been integrated into the new Department for Business Energy and Industrial Strategy.

The regulations apply where a payment is made for the supply of heating/cooling. It is the responsibility of building owners, developers and housing associations to install meters in each dwelling to accurately measure energy usage for residents. Evinox Energy offers various metering and billing solutions for heat networks and can provide advice and assistance with the regulations.

■ Call 01372 722277 or visit www.evinoxenergy.co.uk



Martindale Electric moves in the right direction

As part of its development and growth, Martindale Electric has relocated to new, larger premises, which will enable the company to enhance its customer service.

Less than 100m from its previous location, the new building provides new calibration, repair and training facilities, which will allow Martindale Electric to offer higher levels of customer service, while building on its leading position in safe isolation and electrical safety.

■ Visit www.martindale-electric.co.uk



London industrial park storms ahead with Graf UK system

To comply with the local authority's run-off requirements, and to ensure reliable flood prevention, Graf UK specified, designed and installed a 900m³ EcoBloc Inspect Flex system at the new Crabtree Manorway North estate in Belvedere.

The EcoBloc tanks have a gross volume of 205 litres, and are made from 100% recycled plastic with a heavy-duty lorry-bearing capacity of up to 60 tonnes.

■ Call 01608 661 500 or visit www.grafuk.co.uk



Swegon's new Gold generation

Swegon is launching a new generation of its flagship Gold air handling units. 'The most immediate change you notice is the new grey colour of the unit's finish. But, naturally, the real innovations are more than "skin-deep";' said Dene Kent, sales director and head of ventilation.

Beyond the surface finish, the casing design has been modified to increase its airtightness and eliminate cold bridges, to minimise energy losses. Inside, there is a whole new product platform, which enables the unit's modules to be combined more freely than in previous generations.

The product quality, level of performance and streamlining that have hallmarked Gold over the past two decades has not been compromised. The new platform makes it easier to find the right unit for each project, without any customisation, which saves time and design effort.

■ Visit www.swegon.co.uk



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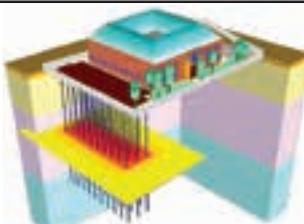
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Senior Public Health Engineer

£40 - £42 p/h, London

As an international consultancy that is at the forefront of high performance buildings with a focus on sustainable design; an opportunity has arisen for a Senior Public Health Engineer to join the well-established team in London. You will have the opportunity to work on some of the most iconic buildings across the globe that will push the boundaries of design within the built environment. Ref: 4005

Principal Mechanical Engineer

London, £55 - £60k + bens

An exciting and rewarding opportunity for an ambitious engineer seeking to join a high profile consultancy, working on a wide range of challenging projects has become available. You will be an established Principal with excellent client facing, team motivation, technical and design skills. With the potential to progress to Director level this role will suit a forward thinking and determined person who wants to work for a multi award winning company. Ref: 4047

Senior Electrical Engineer

London, to £55k + bens

My client is one of the largest privately owned UK Building Services consultancies and is looking for a senior electrical engineer. The successful candidate will be responsible for a range of projects across varying market sectors, and for delivering services from inception/feasibility through detailed and fully-coordinated design information to installation quality. Must be Degree or HNC qualified. Ref: 3227

Public Health Design Engineer

City of London, £60 - £70k + bens

A top 10 international multi-disciplinary consultancy with a number of offices in the UK and overseas are looking for a Public Health Design Engineer to join their growing team and take over as the lead engineer. Projects vary from healthcare and laboratory, to commercial, pharmaceutical and other major projects where design M+E values are regularly in excess of £50m. You will be rewarded with excellent pay, package and promotion to Associate Director. Ref: 3906

Electrical Engineer

London, £35p/h

I have a requirement for an electrical engineer to work on a long-term contract in London. You will provide designs from conception through to completion on high end commercial projects. The work is predominantly low voltage, lighting, electrical power distribution and alarm system designs. Similar experience is essential. Immediate start. Ref: 4051

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Design Manager - Electrical | Central London

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A large international main contractor is looking for an Electrical bias Design Manager to work in a client side role, managing external consultants to deliver best practice. This is a fantastic opportunity for a senior level engineer to gain experience working for one of the largest engineering firms in the business, gaining experience on large projects where you will be involved heavily in the use of BIM.

Associate Mechanical Design Engineer | Oxford

Up to £60k + Excellent Benefits

This award-winning consultancy focuses on value engineering, and they are now looking for a technically astute Mechanical Design Engineer to join their newly opened Oxford office. This is an excellent opportunity to develop your own team working on projects primarily within the residential, commercial, logistics and retail markets. The role offers a rare opportunity within a dynamic and emerging consultancy that would suit a strong Principle or Associate Engineer.

We are looking for engineers from Graduate to Director throughout the UK - please do contact us for further information

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Capital Programmes Team, Transformation, John Radcliffe Hospital, Oxford

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Project Managers
(2 posts)

Job Ref: 321-JC-047-EST-PM
Band 8a £40,028 - £48,034 pa Hours: f/t 37.5pw

In this role, you will manage challenging developments across our four sites, from inception to completion with responsibility for managing all elements of the design and construction process and ensuring programmes and costs are met. The Trust is entering an exciting period where strategic and operational visions are being formalised from which exciting projects will emerge.

You will have extensive design and construction project management experience within the NHS, excellent technical and communication skills and the ability to work on your own initiative and as part of a team.

In addition, the ability to simultaneously manage a series of projects with multiple workstreams at any given time is essential. In return we offer an excellent benefits package.

Project Officer

Job Ref: 321-JC-048-EST-PO
Band 6 £26,302 - £35,225 pa Hours: f/t 37.5pw

As an important part of our Capital Programme team, you will support our Project Managers in managing challenging developments across our four sites, as well as be responsible for managing and delivering smaller projects.

With experience of project-based work within the NHS, you'll be able to deliver projects to agreed budgets and timescales. In addition, you'll have the ability to communicate at all levels and to work with minimum supervision. The ability to manage priorities and plan workloads at any given time is essential.

In return we offer an excellent benefits package.

For more information or to arrange an informal visit please contact either: Pauline Bagnall, Head of Capital Programmes on 01865 227615, email: pauline.bagnall@ouh.nhs.uk or Craig Merrifield, Senior Project Manager on 01865 740321, email: craig.merrifield@ouh.nhs.uk

Closing date: 31st January 2017

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NATIONAL EVENTS AND CONFERENCES

BIM Roadshows

18 January, Birmingham
31 January, London
23 February, Bristol

From pre-concept to completion, presenters will use a project case study to demonstrate the real-world application of digital technologies and workflows. Tour dates continue to May.

CIBSE ASHRAE Technical Symposium

5-6 April, Loughborough University

Booking is now open for the 2017 Technical Symposium, themed 'Delivering resilient high-performance buildings'. More than 60 peer-reviewed papers will be presented over the two days.

www.cibse.org/symposium

CPD TRAINING

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

Practical controls for HVAC systems

13 January, London

Mechanical services explained

24-26 January, Birmingham

Electrical services explained

24-26 January, London

Power system harmonics

26 January, London

Air conditioning and cooling systems

27 January, London

Implementing energy management system ISO50001

3 February, London

Fire sprinkler systems: Design

8 February, London

Energy efficiency building regulations: Part L

9 February, Birmingham

Building services overview

10 February, London

Designing water efficient hot and cold supplies

21 February, London

Mechanical services explained

21-23 February, Manchester

Building services explained

22-24 February, Birmingham

Standby diesel generator

23 February, London

Emergency lighting

24 February, London

ENERGY ASSESSOR TRAINING

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

LCC design and EPC

17-18 January, London

LCC design and EPC

24-25 January, Leeds

ISO 50001

31 January-2 February, Bristol

Heat networks code of practice

1-2 February, London

Air conditioning

8 February, London

Air conditioning inspector

8 February, London

ISO 5001

28 February-2 March, London

LCC building operations and DEC

28 February-2 March, London

CIBSE GROUPS, SOCIETIES AND REGIONS

For more information about these events visit: www.cibse.org/events

South Wales: Membership briefing session

9 January, Wales

The main focus will be on applications for the Associate and Member grades and registration with the Engineering Council at the Incorporated and Chartered Engineer levels.

North East: Technical meeting

10 January, Newcastle

With speaker Andy Alpin.

East Midlands: Water regs, Kemper and water treatment

10 January, Derby

West Midlands: CPD technical seminar on TM30

11 January, Birmingham

CPD seminar on TM30, with speaker Peter Raynham, from University College London.

Webinar: How to start your engineering practice report

11 January

A CIBSE membership webinar to help you get to grips with the competence criteria for ACIBSE & MCIBSE.

HCNW: Institutions and international collaboration

11 January, London

Joint event with IHEEM, with speakers Julian Amey, Institute of Healthcare Engineering and Estate Management (IHEEM) chief executive; Christopher Northey, IHEEM past president; and John Crawford, IHEEM London branch past chair.

Debate: Is air conditioning for comfort cooling necessary in the UK?

12 January, Solihull

Joint meeting with Institute of Refrigeration and CIBSE ASHRAE Group, with ASHRAE presidential member Richard Rooley.

Republic of Ireland: CIBSE membership briefing session

18 January, Dublin

Presentation by Gillian Francis, of CIBSE Membership, explaining the various grades available with CIBSE and how to achieve chartership.

Society of Public Health Engineers: Blue/green roof technologies

18 January, Manchester

Presentation by Phil Henry, of Polypipe Terrain.

Merseyside and North Wales: Human reaction to LED

19 January, Liverpool

West Midlands: Technical seminar on BIM – legal

25 January, Birmingham

CPD seminar with Tim Willis, of Trower & Hamlins

SLL masterclass

26 January, Birmingham

Continuing the Society of Light and Lighting knowledge series, focusing on human responses to light.

North East: Technical meeting

7 February, Newcastle

With speaker Gareth Kane.

East Midlands: Boiler factory visit

7 February, Newark

West Midlands: Variable air control

8 February, Birmingham

Technical seminar with speaker Steve Law, from Trox.

COMING SOON



Helen Loomes, Trilux SLL Masterclass, 26 Jan



Carl Collins, CIBSE BIM Roadshow, 18 Jan

CIBSE Building Performance Awards

7 February, London



The shortlist has been revealed for the 14 categories of the 2017 Building Performance Awards, which - this year - will be celebrating a decade of showcasing the best in building performance. During this time, CIBSE has presented more than 130 accolades to people, products, projects and initiatives that have demonstrated engineering excellence in the built environment.

Join host Matt Dawson MBE (pictured) on the night to celebrate achievements in building performance, and to

network with more than 700 guests from across the built environment sector.

Don't miss your chance to see who will take home the awards. Book your place now at www.cibse.org/bpa

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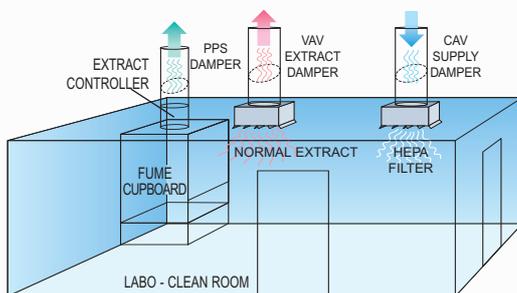


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