

CIBSE

JOURNAL



The official magazine of the Chartered Institution of Building Services Engineers

June 2015



Electric Avenues

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Electric dreams

The announcement by electric car maker Tesla that it is intending to sell its battery technology into the home is not a first. There are other potential storage systems available, but they are not as small and compact as Tesla's Powerwall Unit, and they don't bring the same level of publicity to the concept of the electric home.

Battery technology has the potential to revolutionise energy networks. The ability to store electricity – generated by domestic photovoltaics – could allow home occupiers to power their own electric vehicles and avoid buying electricity from the Grid during peak periods, when the price is at its highest.

There is interesting work on smart grids taking place at the moment, not least in Wiltshire where, in an ongoing pilot scheme, a group of consultants and academics are looking at the benefits, and barriers to linking homes with means of electric generation across a local network (page 28). A combination of battery storage, PVs and a clever control algorithm is indicating that homes could make energy savings of up to 27% (that's assuming the removal of regulatory barriers keeps up with the rate of technology advances).

In another article Ian Billington looks at the increasing amount of DC distribution in homes and the efficiencies and savings DC generation deliver. Billington points out that electric cars use DC loads and calculates the size of a PV array required to fully charge a standard size electric Renault (page 32).

The opposite of smart is the state of the UK's 4 million km of pipes and cable underneath our streets. Researchers are

now looking to find way of mapping our buried infrastructure, so that it can be maintained, repaired and upgraded in the most sustainable and efficient way possible (page 34).

Finally Hywel Davies, follows up last month's election analysis with a prediction of the likely direction of travel of the new government. There are new faces in the key departments responsible for the built environment. Two of the new incumbents – Amber Rudd and Sajid Javid – have experience in the Treasury, which will be crucial as they lead the Departments of Energy and Climate Change and Business, Innovation and Skills into a Spending Review that will determine how deeply cuts are felt in our industry.

Alex Smith, editor

asmith@cibsejournal.com



In brief

£3M FOR BUSINESS INNOVATION

Innovate UK has announced a £3m fund to 'underpin the development of high-value products and services' in four key technology areas: advanced materials; biosciences; electronics, sensors and photonics; and information and communication technology.

The national public body believes these areas will be the main drivers of future economic growth and its fund is available for feasibility studies – led by small or micro businesses – into innovative projects in all four areas. For more information, visit <http://bit.ly/1Jg3HJ8>

FUNDING ANNOUNCED TO TACKLE 'ENERGY TRILEMMA'

Businesses are being invited to apply for a share of £10m from the government's Energy Catalyst fund, for projects that address challenges in the energy sector.

The Energy Catalyst is open to firms and researchers with projects that address the so-called 'energy trilemma' – the three major issues facing the industry: reducing emissions; improving security of supply; and reducing cost.

The scheme's operators said UK businesses were well placed to take advantage of the 'major global opportunities' created by this trilemma.

For more information, visit <http://bit.ly/1GbuJR8>

ENERGY IN BUILDINGS: RECEPTION FOR MPs

CIBSE – together with a number of organisations – will hold an event promoting energy in buildings for MPs on 3 June.

It wants to push for a White Paper that promotes and accelerates cost-effective energy measures, including energy efficiency, more efficient use and production of energy in and from buildings and community energy. This should be drawn up after public consultation involving independent experts. CIBSE is encouraging all readers to make their MP aware of this event.

Visit <http://bit.ly/1Q0JgzX> for more information.

ARUP GETS SENTIMENTAL

The 'Sentiment Cocoon', in Arup's head office in London, is an interactive installation designed by architect Moritz Behrens and lighting designer Konstantinos Mavromichalis. It seeks to capture people's sentiments and reflect them in LED lights.

It was the winner of Arup's annual competition to highlight innovative new designers and emerging architectural practices.

Arup employees are being encouraged to share their sentiments via dashboards on each of the five office floors, using individual swipe cards. These are then digitally projected into a light field created by LEDs that form the spine of the cocoon.



Industry against energy labels

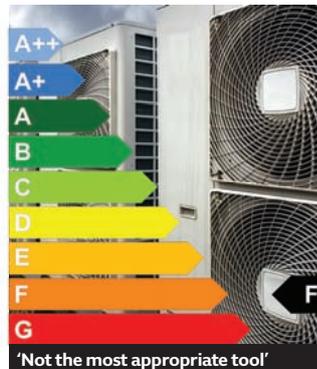
● EU proposal deemed an 'inappropriate' tool for professionals

Building services contractors and manufacturers have attacked the EU's plans to introduce mandatory energy labelling.

The proposed Energy Labelling Directive, which will apply the same rating system used in the TV and white goods markets to refrigeration, air conditioning and heat pump (RACHP) products, has been denounced as inappropriate.

The European Commission is currently reviewing the directive with a view to publishing its findings this summer.

Manufacturers' association EPEE has launched a campaign with contractors' associations



AREA and AIE – and engineering association GCP Europe – to lobby against the plans. In a joint statement, the bodies said: 'We have strong concerns about the extension of the Energy Label to the area of B2B equipment.' They said it was 'not the most appropriate tool for providing

information to professional users' and could, in fact, 'be counter-productive'.

'A professional product will work differently depending on the size of the application... RACHP systems are very complex assemblies and often designed for specific customer needs,' the statement added.

Graeme Fox, AREA past president, said the system worked well with white goods because they are 'single plug-in' items, so 'the rating you see will be the rating you get'. 'However, if this crosses into commercial territory, the contractor may be held to account for meeting the listed energy consumption,' he added. 'As systems using RACHP products vary in size and scope, this approach is not suitable.'

ALIKSANDAR TASEVSKI / SHUTTERSTOCK

SolarEdge links with Tesla on battery

Photovoltaic (PV) component manufacturer SolarEdge Technologies is to collaborate with Tesla Motors to provide an inverter to link Tesla's Powerwall home energy-storage solution to a PV system and the network.

The Powerwall will allow householders to store more of the electricity produced by their PV arrays, and will be available by the end of this year.

SolarEdge's DC-optimised inverter is already being used in the automotive sector, and the link with Tesla allows the company to take the technology into the residential market.

'The collaboration between Tesla and SolarEdge brings together leading companies in two fast-growing markets: solar energy and energy storage,' a Tesla statement said. Turn to page 20 for more.

Rudd steps into DECC hot seat

● Conservative MP given Ed Davey's climate change brief

The industry has given a cautious welcome to the appointment of Amber Rudd MP (right) as the new Secretary of State for Energy and Climate Change in place of the Liberal Democrat Ed Davey, who lost his seat at the election.

Rudd, who is MP for Hastings and Rye, has been promoted from Parliamentary Under Secretary of State at the Department of Energy & Climate Change (DECC). Lord Bourne of Aberystwyth will serve as Parliamentary Under Secretary of State and Andrea Leadsom is the new Minister of State at DECC.

The Energy Secretary faces a full in-tray, including how to manage the diminishing budget for renewable energy through the Levy Control Framework. Taxpayer subsidies have been used



up more quickly than the previous administration expected, leading to the possibility of a spending cap. This would restrict funding for large-scale projects and further reduce payments under the feed-in tariff scheme.

The Green Deal is also in disarray and Rudd must decide whether to scrap it or reinvent the scheme to improve take-up by the public. She

will also have to tackle problems with the Renewable Heat Incentive (RHI), which is still largely funding biomass installations and has been criticised by the heat pump industry for failing to support its market growth.

Davey was popular with green lobbyists, many of whom are suspicious of the new government's commitment to renewable development. However, Prime Minister David Cameron has defended the Conservative's record and said they had stayed true to their commitment to be the 'greenest government ever'.

Greenpeace UK's chief scientist Doug Parr begged to differ: 'The Tories' double standards and ideological bias are embarrassingly obvious. They'll champion localism when it comes to wind farms, but run roughshod over local people's concerns when it's about fracking.'

DAVID FOWLER / SHUTTERSTOCK

Economist Jim O'Neill to drive powerhouse plan

Chancellor George Osborne has put economist Jim O'Neill in charge of delivering his 'northern powerhouse' initiative, which is aimed at devolving more economic growth and infrastructure investment to cities outside of London.

O'Neill has also been made a life peer and given the title of commercial secretary to the Treasury. His brief includes public sector infrastructure projects and attracting private sector investment in UK infrastructure. He will also influence competition policy and regulation.

A City Devolution Bill will be announced by the government in the Queen's Speech.

O'Neill, the son of a Manchester postman, spent 16 years at Goldman Sachs, where he worked as chief economist and is credited with coining the phrase BRICs to describe the emerging market powerhouse economies of Brazil, Russia, India and China.

UK facing record fines for air pollution

The European Supreme Court has given the UK's new government until the end of this year to come up with an action plan for tackling the nation's air pollution, or face fines running into hundreds of millions of pounds.

Lawyers acting for the European Commission (EC) said the UK's failure to act on air quality was 'perhaps the longest running infringement of EU law in history'.

The country has exceeded the EU's nitrogen dioxide (NO₂) pollution limit since 2010, leading the EC and environmental lawyers to launch separate legal action that could lead to potential fines of £300m a year.

The UK government said it expected Greater London, the West Midlands and West Yorkshire to remain in breach of the EU law until beyond 2030. It has also admitted that Tyneside, Liverpool, Nottingham, Sheffield and Bristol – all previously expected to be in compliance with NO₂ levels by 2015 – will now not be compliant until 2025.

Poor air quality in urban areas is said to be a factor in 29,000 premature deaths in the UK every year – more than obesity and alcohol combined, according to Public Health England. Studies have also linked NO₂, which is often found in petrol and diesel emissions, to higher rates of lung cancer and heart failure.

Vulnerable

The building engineering industry has pointed out that outdoor air pollution was also leading to serious

problems inside buildings – particularly those with vulnerable occupants, such as schools and hospitals.

'Politicians and members of the public can grasp the seriousness of outside air pollution, but seem to have more difficulty understanding what this means for the indoor environments where we spend more than 90% of our time,' said Giuseppe Borgese, chairman of the Building & Engineering Services Association indoor air quality strategy team.

'Many building managers have not taken the necessary steps to protect occupants from the effects of outdoor air pollutants entering the building.

'Poorly maintained ventilation systems, clogged or missing filters, dirty ductwork and ageing air conditioning systems are all contributing to a huge health and wellbeing problem inside buildings.'



ALEXANDER MAZUREVICH / SHUTTERSTOCK

Plans to cut £10bn worth of red tape

Plans to cut red tape for businesses by at least £10bn over the next five years, have been set out in Sajid Javid's first speech as Business Secretary.

Javid said the planned Enterprise Bill will include measures to support small businesses with stricter prompt payment rules and a conciliation service to help settle disputes over late payment practices.

He has also committed to a further £10bn worth of deregulation, which will extend to 'independent regulators' for the first time.

Read more on what a Conservative win means for the industry, on page 18.

Clarification

Last month we said that Allen Williamson had been appointed director-in-charge of the Norman Disney & Young (NDY) London office. To clarify, he was appointed in March 2014.

Public consultant bodies merge

Societies representing architects and building services engineers have merged to form the Society of Public Architecture, Construction, Engineering and Surveying (Spaces).

The new organisation said budget cuts had resulted in a decline in local authority design work and that the creation of a multidisciplinary society reflected smaller, cross-disciplinary, in-house teams.

Spaces is holding an inaugural event at Birmingham City University on 19 June. Visit www.thespaces.org.uk for more information.

Funded scheme to cut cost of solar PV

Kingspan ESB, a joint venture between the insulation manufacturer and Ireland's largest energy company, has launched a scheme to slash the cost to businesses of installing solar PV.

Funded Solar is designed to encourage Northern Ireland firms to take advantage of a potential £320m saving in electricity costs over the next 25 years by reducing the capital investment. Kingspan ESB will design, install and maintain the solar PV system, and the electricity generated will be used on site and purchased by the customer at lower rates than grid-generated power.

New look for CIBSE awards

The CIBSE Building Performance Awards 2016 are open for entries.

The awards celebrate the best in innovative engineering and the finest examples of how building services firms are working to narrow the 'performance gap'.

There are six new categories this year, which will recognise new-build or refurbishment projects that most effectively demonstrate high levels of user satisfaction and outstanding performance in the following sectors: commercial/industrial; international; leisure; public use; residential; and retail.

Meanwhile, there are three renamed categories: Facilities Management Team of the Year; Energy Management Initiative; and Building Performance Champion of the Year.



2015 award winners

The building performance champion is chosen from the category winners, and will be presented to the team, project or product that judges feel has made the most outstanding contribution and commitment to achieving improved building performance.

M&G Real Estate was crowned

Carbon Champion at the 2015 awards for slicing energy use across 500,00m² of its shopping centre portfolio, while Beca's artisan heating and cooling system at Christchurch Airport won the international project title.

Full details of how to enter can be found at www.cibse.org/bpa

Specialist skills crisis at 14-year high

The number of specialist contractors struggling to recruit skilled labour is at its highest for 14 years, with many being forced to turn down work as a result, claims a new survey.

Researchers at the National Specialist Contractors Council said the squeeze is being felt most strongly now because of an increase in enquiries and orders after the recession. During the first quarter of this year, 65% of specialist sub-contractors reported an increase in enquiries, while 54% reported a rise in orders. However, nearly half (47%) had experienced more difficulty in recruiting skilled

labour this year, compared with just 2% who found it less difficult.

A record 54% of respondents experienced an increase in tender prices in the last quarter, which has doubled since this time last year, while suppliers' prices also rose, with most contractors having to absorb these.

The skills shortage is having an impact across the industry. Employee benefits company ECIS surveyed 200 tradespeople, including plumbers, builders and electricians. Almost a quarter said they had struggled to find skilled people in the past year. As a result, half said they had turned away

work, and 19% admitted using unskilled labour to meet demand.

'This survey underlines how serious the skills shortage has become,' said Phil Scarrett, sales and marketing director for ECIS. 'However, with demand outstripping supply, tradespeople may be in a more powerful position when negotiating contracts, which is perhaps why only 15% have considered a change of career in the past year.'

Scarrett warned that, with so many firms resorting to using unskilled labour, there was a real danger of an increase in 'workplace risks'.



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Engineers urged to ‘stick heads above the parapet’ to reduce performance gap

● CIBSE President Nick Mead makes inaugural address

Incoming CIBSE President Nick Mead called for greater collaboration between construction industry professionals in his inaugural address, which was given at the Royal Academy of Engineering after the institution's annual general meeting.

He told his audience that it was a ‘great time to be a building services engineer’, and urged the industry to ‘blow its own trumpet’ and celebrate its ‘heroes’.

However, he said the industry also had a ‘significant professional responsibility’ to improve the long-term performance of buildings. Engineers, Mead added, must ‘stick their heads above the



CIBSE President Nick Mead called for greater collaboration among industry professionals

parapet’ and avoid short-term, siloed thinking.

‘Too many designs still do not consider lifetime operation and there is no joined-up thinking between the various members of the supply chain.

‘I often wonder if the designer really understood how the system was to be controlled.’

Mead lamented the fact that energy-efficient and low-carbon

products were often used in a way that didn’t allow them to operate to their full potential. He called for a collaborative approach, led by professional institutions and trade bodies – ‘not individual companies’ – to address the ‘energy trilemma’. This, he said, requires engineers to improve security of energy supply, reduce running costs and cut carbon emissions at a time

when ‘public expectations of buildings... are greater than ever’.

Lochinvar managing director David Pepper said manufacturers would play a vital role in creating the ‘joined-up’ industry Mead was calling for by helping building services engineers produce properly integrated designs. ‘Our specialist knowledge of energy-saving technologies is absolutely central to everything CIBSE is trying to achieve,’ said Pepper, who is also a member of the CIBSE Board.

‘We must work more closely than ever with design engineers – from an early stage in the project process – if the industry is going to narrow the performance gap that leaves many building owners frustrated and out of pocket.’

The complete transcript of Mead’s inaugural presidential address can be found at www.cibse.org/president

Presidents join forces to call for collaboration

The presidents of CIBSE, B&ES and RIBA have called for more collaboration between members of the construction supply chain.

Nick Mead, Andy Sneyd and Stephen Hodder shared a platform at Westminster Central Hall – at an event organised by the CIBSE Patrons – to urge professional institutions and trade associations to campaign for better communication and integration among project teams.

Mead said the industry needed ‘genuine collaboration to achieve energy reduction’ and added that CIBSE members could not deliver better building performance on their own. ‘We need to work with others... and the building needs to work as a complete system, not a collection of products.’

Sneyd warned that if the industry did not start to collaborate more successfully, others would come in ‘to take our place’. He



RAMPIKELV/SHUTTERSTOCK

called on the industry to embrace the digital revolution, but not to lose its ‘gut instinct’ for making good engineering decisions.

Hodder believes there is a huge misconception about what collaboration is: ‘This is not just about sharing knowledge; it’s about a whole new culture.’ He said working with other professions should be instilled in young architects during their education, but that ‘silo working’ was still the norm.

EDGE report demands transparency and change

Institutions must do more to prepare professionals for working in a multidisciplinary environment, according to a report from the EDGE Commission. *Collaboration for Change*, written by Paul Morrell, says professional bodies must break out of their separate spheres and work together.

The report analyses some of the threats and pressure for change faced by institutions and their members. ‘If not yet existential, they are real and profound, and demand change’ it says, and makes a series of recommendations on which ‘it is both necessary and realistic to collaborate’, including:

- Create a shared code of conduct/ethics across the built environment

- Conduct a cross-disciplinary review of the silo nature of the education system, and improve the guarantee of professionals’ expertise through a public feedback system, such as TripAdvisor
- Establish a joint think-tank to pool the institutions’ resources and develop and research policy for the industry
- Collaborate on major challenges including industry reform.

CIBSE chief executive Stephen Matthews said relevance was an important issue for the construction sector, in which old practices were being swept away. He said: ‘We are all products of the past, but we must face the future with a determination to embrace change.’



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In brief

MEMBER APPLICATION DEADLINE LOOMS

The next closing date for applications for Associate (ACIBSE) and Member (MCIBSE) grades for those based in the UK is 3 August. For full details of the requirements and application process visit www.cibse.org/membership

Don't forget to look at the applicant help pages, which can be found on the CIBSE website www.cibse.org/applicanthelp. Here you will find examples of engineering practice reports and development action plans, as well as interview guidance and presentation samples.

If you have any questions or need more information, email membership@cibse.org or call +44 (0)20 8772 3650.

KNOWLEDGE PORTAL HITS RECORD HIGH

Downloads from the CIBSE Knowledge Portal have hit a record high. More than 43,000 users visited the site in March 2015 and downloaded 18,994 documents. This brings the total number of downloads made since the launch of the new site last year to just less than 140,000.

The Knowledge Portal offers members access to the full portfolio of CIBSE published guidance, plus complimentary titles from leading publishers and a list of relevant British standards.

For more information, visit www.cibse.org/knowledge

CIBSE FELLOWS NETWORK

A new CIBSE Fellows Network was launched by out-going CIBSE President Peter Kinsella at the AGM in May.

The network is designed to capitalise on the knowledge of the institution's most skilled and experienced members in the development of industry guidance, and to promote the ethos and benefits of CIBSE.

The Fellows Network will be chaired by Geoff Prudence, who also chairs the CIBSE FM Group. For more information, visit www.cibse.org/fellowsnetwork

Building services hits half-century at Northumbria



Buro Happold's Gavin Thompson

University celebrates 50 years of building services engineering education

Northumbria University was due to host a public lecture by Gavin Thompson, of Buro Happold, on 27 May, to mark five decades of academic excellence in the subject.

The lecture – entitled 'Drawing Relative Humidity: the craft of the building services engineer and its future influence on our society' – was expected to be attended by a range of high-profile guests, including alumni, current students, staff, employers and partners.

Steve Hodgson, former dean of the school of the built and natural environment, was asked to return to the university to share some memories from the early days of the diploma through to his retirement in 2012. Rolton Engineering, was also expected to present a 50th anniversary prize of £1,500 for the best built environment renewable/low carbon integration project.

The diploma in heating, ventilation and air conditioning was launched in 1964, followed by the BSc building services engineering in 1976; the BEng (Hons) building services engineering in 1984; and the MEng in 2010.

Today, the degree sits within the mechanical and construction engineering department – a UK top-35 engineering research department, with 79% of its outputs ranked as world-leading or internationally excellent according to the latest research assessment exercise (REF2014, UoA15).

Mechanical and construction engineering at Northumbria is in the top quartile for world-leading publications among UK universities in general engineering, while its building services engineering consistently meets the needs of business and employers.

However, the planned event was not just about the degree's impressive longevity, but a celebration of Northumbria University's long-standing reputation for academic excellence and the outstanding experience it has provided for its students.

Sixth-form visit helps to fly the flag for careers in engineering

CIBSE member Eddy Warren recently visited Mildenhall College Academy Sixth Form, in Suffolk, to raise awareness of career opportunities in building services engineering.

Warren organised the visit and made a presentation, with fellow CIBSE member, Mike Malina, to an audience of 180 16- to 18-year-olds. The feedback was very positive, with several students asking for more information.

Warren believes such visits are an important way of trying to inspire students to investigate engineering as a potential career or to specialise in building services engineering.

He recognises the benefits this could bring to the country's economy and export drive, and says his career has taken him to many corners of the world.

You too could help encourage young people to

seek out careers in engineering through the science, technology, engineering and maths (Stem) ambassadors scheme. This aims to raise awareness among young people of the opportunities that studying Stem subjects can bring, and of the variety of careers in engineering.

More than 100 CIBSE members are currently Stem ambassadors. Find out more at <http://bit.ly/1e5xCYL>

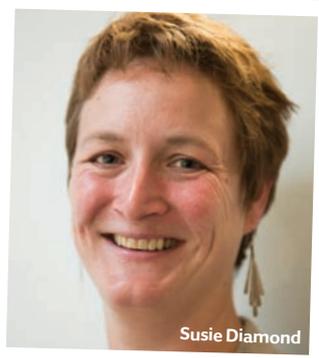
UK event to throw spotlight on women in the industry

● Females urged to choose career in built environment

National Women in Engineering Day is to be held on 23 June, giving CIBSE a chance to celebrate the contribution of its female members.

The UK-wide event was set up by the Women's Engineering Society (WES) to celebrate its 95th anniversary. According to the WES March 2015 newsletter (<http://content.1el.ftf>), an estimated 22,000 qualified women have not returned to the engineering sector after a career or maternity break. Considering the skills gap the industry is currently facing, these are people we cannot afford to lose.

CIBSE members have played a key role in encouraging women to develop careers in the industry by establishing Women in Building Services Engineering (WiBSE). The group was set up by Sarah Davis and Susie Diamond (pictured, above) in 2012 to increase the number of women choosing a career in the built environment, and to



Susie Diamond

support those already in the industry to achieve their goals.

Laura Dunlop became WiBSE chair in February, and the group holds a wide range of events and peer-to-peer mentoring evenings, as well as having a very active LinkedIn group.

In 2012, Gay Lawrence Race – CIBSE Fellow, board member and vice-chair of WiBSE – started the informal

CIBSE female fellows group, which now has 25 members. It aims to mentor colleagues and encourage greater participation within the institution through committees and initiatives such as STEM ambassadors. Jennifer Bousfield – a CIBSE Fellow and interviewer, who was shortlisted for *Building Magazine* Woman of the Year at the 2015 Building Awards – said: 'The group has given me the opportunity to speak with other women within the industry. I have found this network to be extremely supportive.'

For more information, visit www.cibse.org/wibse and www.nwed.org.uk

Help to shape CIBSE's future guidance

CIBSE is seeking new members for its Knowledge Programme sub-committee (KPSC).

The Guides, Codes and other guidance material that CIBSE publishes are internationally recognised as authoritative, and set the criteria for best practice in the profession.

The key group behind this is the Knowledge Management Committee (KMC), which oversees content development and research for the Knowledge Portal. The KPSC is responsible for developing a prioritised timetable for reviewing and updating this content, and for identifying new content needs.

It's an important and fascinating task, which has far-reaching consequences for our members and the wider building services industry.

We are looking for practitioners who can take a strategic view of future needs and who are keen to see the wider impact of their contribution. The committee meets four times a year.

If you are interested in joining it, please contact Sara Kassam (skassam@cibse.org) to find out more.

SoPHE award open for entries

Entries are open for the Society of Public Health Engineers Young Engineers Award 2015.

The challenge is to come up with an innovative and affordable solution for:

promoting the moringa plant and the cactus for household water treatment and safe storage in deprived communities; or developing a cheap, mobile biosand filter

for river/hand-dug well-water filtration.

Teams of up to three people, aged 18-35, should submit their ideas on one A1-size poster. Visit www.cibse.org/sophe

New members, fellows and associates

FELLOWS

Bradley, Andrew
Cleveland, Australia

Chan, Wing Leung
Tseung Kwan O, Hong Kong

Elliott, David John
Wells, UK

Lau, Kwok Cheong
Yuen Long, Hong Kong

Olsen, Roger Hoys
Sevenoaks, UK

On, Hing Lung
Tsuen Wan, Hong Kong

Smith, Warwick Alexander
London, UK

MEMBER

Al-Saegh, Salam Naji Abduljalil
Edgware, UK

Atkinson, David Joseph
Sale, UK

Bradbury, Paul Christopher
Perth, Australia

Chan, Ching Yuk
Lai Chi Kok, Hong Kong

Choi, Chi Wai
Hong Kong, Hong Kong

Cradden, Kathryn
Hampshire, UK

De Wilde, Pieter Jacobus Cornelis Jan
Plymouth, UK

Denikiewicz, Darren Lee
Dubai 12166, UAE

Donnelly, Edel
Dublin 18, Republic of Ireland

Dunne, Gabriel John
Tempo, UK

Fanfani, Martino
Edmonton, Canada

Harden, David Richard
Pontypridd, UK

Hayden, Derek
Dublin, Republic of Ireland

Hickey, Timothy Noel
Cork, Republic of Ireland

Ho, Pui Chung
Kowloon, Hong Kong

Ho, Wing Hung
Kowloon, Hong Kong

Hung, Wing-hing Jacob
Kowloon, Hong Kong

Kung, Yu Man Helen
Diamond Hill, Hong Kong

Kwan, Chi Wa
Yau Ma Tei, Hong Kong

Kwok, Hei Yin
Sai Wan Ho, Hong Kong

Lai, Po Ting Alvin
Ma On Shan, Hong Kong

Lee, Pak Wing
Kowloon, Hong Kong

Lui, Wun
Tuen Mun, Hong Kong

Man, Yun Fu
Hong Kong, Hong Kong

Ng, Kwan Ting
North Point, Hong Kong

Tatham, Bryan David
London, UK

Tsiang, Shin Wai
Kowloon, Hong Kong

Tsoi, Chun Lung
Kowloon, Hong Kong

Wan, Tsz Kwong Martin
Homantin, Hong Kong

Wealend, Edwin Wallace
Pudong, China

Wisniewski, Karol
London, UK

Wong, Chi Fai
NT, Hong Kong

Wong, Chi Wai
Hong Kong, Hong Kong

Wong, Man Fei
NT, Hong Kong

Yates, Daniel
Herdsman, Western Australia

Yick, Chung Hin
Hung Hom, Hong Kong

Zhong, Shuai
Tseung Kwan O, Hong Kong

LICENTIATE

Baldwin, Dominic
Northampton, UK

Dakin, John
High Wycombe, UK

Freedman, Alan Walter
London, UK

Lane, Ian Thomas
Grays, UK

Newby, Jonathan
Ilford, UK

Rabaiotti, Anthony
Cardiff, UK

Salmon, Samuel
London, UK

Search begins for firms with eye on the future

The CIBSE Employer of the Year Awards – which form part of the Young Engineers Awards – are open for entries.

The awards will be presented at the Institution of Mechanical Engineers on 8 October, and will recognise companies that have done most to recruit, retain and encourage young engineers.

There are three categories – for small, medium and large firms – plus one overall winner, and entries are open to CIBSE members and non-members.

The top employer will receive a trophy and £1,000 worth of CIBSE training vouchers.

The overall winner in 2014 was Kaizenge Design, for its outstanding record in the education and progression of young engineers. Company director Rob Hunter said: 'We are very grateful for the recognition



of our investment in, and development of, our engineers.'

The awards not only showcase those companies that go the extra mile to invest in the engineers of the future, but also demonstrate to prospective employees what a great career building services is, helping to attract talent to the workplace.

For more about the awards, visit www.cibse.org/yea

New officers elected to the CIBSE ranks

Nick Mead FCIBSE took up office as the new CIBSE President at the institution's AGM on 7 May, taking over from Peter Kinsella. CIBSE also welcomed John Field MCIBSE as president elect, and the senior CIBSE officers, including:

- Immediate past president: Peter Kinsella FCIBSE
- Treasurer: Stuart MacPherson FCIBSE
- Vice-president: Paddy Conaghan FCIBSE

- Vice-president: Professor Tadj Oreszczyn FCIBSE
- Vice-president: Cathie Simpson FCIBSE

The newly elected board members are:

- Janet Beckett MCIBSE
- John Packer FCIBSE

Thanks to all who nominated and voted. Further details and biographies can be found at www.cibse.org/board and the full AGM minutes will be published in July's *CIBSE Journal*.



Nick Mead received his medal of office from Peter Kinsella

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@ Feedback

This month, groundwater source heat pumps, the specific heat capacity of a chicken and the industry's inspirational engineers



ANDREA LEHRKUH / SHUTTERSTOCK

Engineers don't just have to consider heat gains from humans

Follow T5's lead for London

I was reading about heat pumps for London in the *CIBSE Journal* (Products Special, May 2015).

Several years ago, I visited British Airports Authority and met Liz Southern, its engineer working on Terminal 5 (T5).

We discussed the cooling for T5 and I mentioned groundwater source cooling. I believe she employed this and it was copied in a few London Underground stations as well.

The basis of this is that all water in the UK below 11m is at 11°C during winter and summer. If a pump is employed to lift the water and pass it through an air-to-air heat exchanger, the resulting flow of air is at least 18°C, and substantial cooling results.

When T5 applied for permission to abstract water from London Water Authority, they were given permission and even get paid to abstract the water because of the rising water table – so they get their cooling for free.

The pump and the fans can easily be run from PV panels.

Why should this not be replicated in the London area?

Tony Marmont FCIBSE,
Loughborough

CIBSE's LinkedIn group ponders the specific heat capacity of a chicken

Lee Parker

I'm working on a project in a food factory, where one of the rooms is used for handling temperate chicken carcasses, so I need to calculate a heat gain from the product.

Marcos DeCastro

You'll need a lot of air through this room to remove the smells. It's highly likely that this air volume will – by far – be the most significant aspect of your load. Indeed, it may be impossible for you to determine how much heat the chicken loses as it passes through the space and undertakes its process. So using its heat gain is pointless because it's not in a steady state, which means air is travelling over it and you don't know how much heat it is losing from its processed (original) condition.

Rob Farman MCIBSE

I agree about 'post title' of the year. I am emailing this discussion to my Arkwright Scholarship Trust

Engineers don't just have to know about maths and physics, but the other sciences too, such as biology

mentee as an example of how esoteric engineering can be and the fun that lies ahead in an engineering career. For Stem events, it is also a good example of how engineers don't just have to know about maths and physics, but the other sciences too, such as biology.

Lee Parker

The solution agreed with the client was to 'trim' the temperature rather than control to 18°C with five air changes per hour of fresh air because they were prepared to accept an increased temperature in this part of the process to offset what would have been a phenomenal cooling load that they could not support.

We were able to obtain a transit time for each bird, a typical weight and a total tonnage per hour, circa 10,000 birds per hour! Measurements were taken on their existing line of entering and leaving temperatures of the carcass > 7°C drop. We were then able to calculate the thermal load imparted by a 'wet and warm' chicken carcass.

Rob Farman MCIBSE

Purely for amusement – and only because it has the word chicken in common – to test aircraft canopies, the following occurs: 'An eight-inch barrel is just wide enough to hold a 4lb chicken carcass (thawed), purchased from a local farm, and a powerful blast of gas propels the poultry projectile towards its target at up to 1,400 ft per second.' British Aerospace has a similar gun and once forgot to thaw the chickens with devastating results, but I don't believe it could fire 10,000 birds per hour.

LinkedIn members discuss the most inspirational engineers

Alan Ashby

Isambard Kingdom Brunel. If you wear a stove-pipe hat and smoke cigars while doing what you do, you get my vote.

Derek Clements-Croome

In our field of HVAC – Andre Missenard, who is also a philosopher.

Tony Thurgood

It has to be Leonardo da Vinci, quickly followed by Brunel, Barnes Wallis and RD Mitchell. The list is almost endless. There were – and are – many unsung heroes within the engineering industry.

Nick Skemp

Nikola Tesla for his development of AC poly-phase HV/LV power distribution – a world-changing contribution. For his work on high-frequency AC, the Tesla Coil, which formed the basis of modern surgical techniques using ‘bloodless knife’ techniques. Because he wasn’t commercially successful, he is not given the accolades he deserves.

Victor Hanby

Thomas Tredgold took the cutting-edge heat-transfer science of his day and used it to develop early building heat-transfer calculations. He also organised and defined the Institution of Civil Engineers. I’ve always had a lot of time for the polymath, a species that seems to be disappearing.

Mike Barker

Grace Hopper or Ada Lovelace. I believe these women would have studied engineering had it been socially acceptable in those days. Hopper pulled alarm clocks apart when she was six – that’s a good start for any engineer.

Liz Meddings

Dame Caroline Haslett, founding member of the Women’s Engineering Society and designer of the first ‘all-electric house’.

CIBSE Journal welcomes readers’ letters, opinions, news stories, events listings, and proposals for articles.

Please send all material for possible publication to: editor@cibsejournal.com, or write to Alex Smith, editor, CIBSE Journal, CPL, 275 Newmarket Road, Cambridge, CB5 8JE, UK. We reserve the right to edit all letters.



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WHAT A CONSERVATIVE WIN MEANS FOR REGULATION

Now that the votes have been counted and the new government announced, Hywel Davies considers what we can expect over the next five years... other than an EU referendum

◀ We have a Conservative majority in the House of Commons, the end of coalition government and new leadership at the departments responsible for energy, Building Regulations, and construction education and training.

Amber Rudd replaces Ed Davey at the Department of Energy & Climate Change (DECC), while Sajid Javid replaces Vince Cable at the Department for Business, Innovation & Skills (BIS). Eric Pickles is no longer Secretary of State for Communities and Local Government, having been replaced by Greg Clark, while James Wharton has been appointed to the Building Regulations brief, among his other responsibilities.

These are notable promotions, with Rudd progressing from being Davey's minister in the coalition. She and Javid have previously served as parliamentary private secretaries to Chancellor George Osborne, and can be expected to have a reasonable understanding of the requirements of the Treasury. This will be very important as they lead their departments into a Spending Review that promises to be savage, especially in the 'unprotected' departments.

The budgets for health, education and overseas development are ring-fenced, while the one for defence looks set to be the subject of heated debate. So those responsible for local government, energy and business – as well as environment, work and pensions, culture, transport and justice – will have to deliver substantial cuts to their budgets.

Javid has set out plans for an Enterprise Bill, which will include measures to support small businesses through stricter prompt-payment rules and a conciliation service to help them to get their money on time. He has also committed to a further £10bn worth of deregulation, which will extend to 'independent regulators' for the



DAN KIRKWOOD / GETTY IMAGES

Setting the agenda: the new Conservative cabinet meets for the first time

“The focus on BIM may sharpen as 2016 approaches and the need to cut public funding intensifies

first time – although exactly who that includes remains to be seen.

The government's 'one in, two out' approach to new regulations continues, with rigorous impact assessments undertaken – using the Treasury Green Book rules – to determine the cost of these to business. While the coalition excluded EU legislation, such as the Energy Savings Opportunity Scheme, from this process, that may change.

The government is seeking to 'scrap needless burdens at home and in Europe', while the European Commission has also announced proposals to cut red tape. Under the Conservatives, regulation really will be the last resort.

The drive to adopt building information modelling (BIM) – and require Level 2 BIM for all centrally procured government construction projects from April 2016 – seems certain to remain, and the focus on this may well sharpen as the deadline approaches and the need to cut public sector spending intensifies.

The full detail of the Queen's Speech was not due to be revealed until after the *Journal* went to press, but top priorities will undoubtedly be the EU referendum, devolution, housing, welfare reform, security and countering 'extremism'. We also know that the government is keen to revisit subsidies for onshore wind generation, has still to conclude the contract for Hinckley Point C nuclear power station, and has the Paris Climate Change Conference to negotiate at the end of this year.

Announcements are anticipated on several policies that will affect CIBSE members and their clients on a day-to-day basis. We do not know how, but the Green Deal must surely change significantly. What will the 'zero carbon' homes policy finally look like? Will it entail further changes to Part L? How will the legislation contained in the Infrastructure Act, enabling 'Allowable Solutions', be delivered? Will the 2016 'zero carbon homes' target be met – and will that be when the policy comes into force, or at the date of introduction



of the legislation (rather like the 2013 changes to Part L, which were made in 2013 and came into force in April 2014)?

And what about non-domestic buildings? The most recent policy statement dates from 2010, when the coalition committed to 'zero carbon' buildings by 2019. However, the Energy Performance of Buildings Directive was then recast, creating an EU requirement for all new buildings to be 'nearly zero energy' from the end of 2020, and from 2018 in the public sector.

We need to know what 'zero carbon' and 'nearly zero energy' actually mean. As both policies are due to come in at about the same time, we should expect questions about whether we need both. Does the UK's zero-carbon policy also satisfy the EU's 'nearly zero energy' requirements, especially if it relies on off-site carbon abatement via allowable solutions?

And what are the implications for Part L? Will there be changes in 2016 or will they be left until 2019? How significant will they be, and will they affect dwellings and non-domestic buildings? Do we really understand the enormity of delivering 'zero carbon' or 'nearly zero energy' buildings? What are we going to have to do differently, and what are the implications for the way we recruit, train, develop and update the people who deliver them?

There are many unanswered questions. Uncertainty will not help the government to achieve its goals of fostering economic growth, supporting smaller businesses and exporting UK expertise, so early clarity for the industry is important.

Uncertainty over the requirements for new buildings will hold back developments – and the surest way to undermine business confidence and investment is indecision in Whitehall.

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



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TESLA'S POWER SHIFT IS A SMART MOVE



The announcement that Tesla has developed a domestic battery gives smart grid technology a high-profile boost, says ECA's **Bill Wright**, who calculates payback rates of about 8-10 years

There was a storm of media interest when electric car manufacturer Tesla announced that it was to start producing batteries for the home. Its Powerwall unit, priced at US\$3,000 (£1,916), is able to store 7kWh of power generated by a local photovoltaic (PV) system.

The use of storage for such systems is not new, but this device uses the lithium-ion battery developed for Tesla's vehicles for a domestic and small commercial market. Similar storage could be provided by other systems, but they would be much larger and heavier than the one marketed by Tesla.

So, what does Powerwall do? As PV systems can only generate electricity during daylight hours, without storage the power not used in the connected building is exported into the local electricity power system. On small systems in the UK, this is paid for using an estimation that 50% of the potential power is exported, and this attracts a small premium, paid for by whichever grid-electricity supplier the building owner has a contract with.

Some PV installers can already provide a battery storage system at a premium, while other products will come onto the market shortly.

However, one thing these systems

and the Powerwall cannot do is supply electricity to a building in the event of a power cut. A different inverter from the one used in the majority of PV systems would be required, and an isolation system complying with the distribution codes must be installed. Any marketing has to be careful not to mislead customers into thinking that, by fitting storage devices, they are immune from power outages.

If we assume that the price of Tesla's Powerwall will be the same when it is launched in the UK, we can calculate whether it will be economic to install.

A typical household uses about 13kWh of electricity per day. If the occupants work outside the home, most

Storage systems have the capacity to transform the way we use and distribute electricity

of this – perhaps 10kWh – will be used in the evening or overnight, outside of daylight hours.

It is difficult to give an accurate estimate of the power generated by a PV system without knowing its direction, shading, mounting angle and so on, but let us assume a 4kW peak system is installed, and that it generates 3000kWh annually – although this will not be evenly spread throughout the year.

If this averages out at 8kWh per day – and 3kWh is used within the building during the day – the remaining 5kWh could be stored for later use. This could displace electricity use during the evening and save 5 x 15p (an approximate unit domestic price) = 75p per day, or nearly £200 per year. This would give a 10-year payback for the system – although, with energy prices rising, this will shorten.

As the usual paybacks for PV systems are around 8-10 years, the use of storage on small-scale systems gives a similar return on capital, depending on the installation cost. If a larger PV system, which could use the full capacity (7kWh) of the Powerwall is installed, this return drops to around 7.5 years. The battery warranty is 10 years, so the system is very viable if the same financial criteria are applied to the battery as to the PV system.

Battery storage with PV systems could reinvigorate the industry and, if used on a large scale, could make a major contribution to smoothing out the demand profile for the country. It could give the distribution companies a few headaches because their systems are not designed for this type of local generation and storage, but it may be worth adjusting the systems to cope with this.

Storage systems have the capacity to transform the way we use and distribute electricity and the Tesla system has highlighted the potential of using well-proven technology. The Powerwall will become available later this year.

BILL WRIGHT is the head of energy solutions at the Electrical Contractor's Association



The system uses the lithium-ion battery developed for Tesla's vehicles



Tesla's Powerwall in the media spotlight

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PUTTING IT SIMPLY

The theme of the 2015 CIBSE Technical Symposium questioned whether complex services design was contributing to poor building performance. **Liza Young** reports on a thought-provoking range of ideas

6 Making buildings nearly zero carbon is an easier challenge than adapting to a temperature rise of two degrees – *Tadj Oreszczyn, CIBSE vice-president*

‘Simple buildings are better buildings.’ That’s the opinion of Danish architect Sergio Fox, who won the award for most effective delivery of material at the 2015 CIBSE Technical Symposium, held at University College London (UCL) in April.

Fox, founder of Architecture without Engineers, introduced the symposium theme of ‘Simple buildings, better buildings’ by describing how there had been a ‘back to basics’ approach to design in Denmark since 2010, and that this had resulted in a reduction in the country’s energy consumption. He left the 200 delegates with plenty of food for thought and, over the next two days, more than 50 other speakers presented papers and case studies on how building design and operation could be optimised for better performance.

By overcomplicating buildings, Fox said, consultants were ‘destroying our professional credibility’ by becoming lost in a world of simulation and standards. ‘Our own profession is putting up barriers to doing things simply.’ He added that building services in Denmark in the 1980s were significantly less complex than in the UK at that time. Danish building regulations in 1986

encouraged a vernacular, intuitive, empirical, ‘Danish Design’ approach, and comfort cooling was prohibited by law until regulations changed in 1996.

In the 1990s, buildings started to get more complex, with passive systems becoming the exception. However, national energy consumption statistics did not match expectations, said Fox. By the 2000s, building services design had been caught up in a ‘virtual reality’ world of simulations and standards. Anything calculated or simulated got the status of reality, said Fox, ‘as if Hans Christian Andersen’s fairy tale *The Emperor’s New Clothes* was coming true in the building industry’.

The symposium’s welcoming address was given by CIBSE vice-president Tadj Oreszczyn. He told delegates that 2015 would be critical for determining what will have to be done over the next 50 years to meet the challenges of a minimum 2°C rise in temperature as a result of climate change.

‘The task of making buildings nearly zero carbon is an easier challenge than adapting to a temperature rise of two degrees,’ said Oreszczyn, who emphasised the need for research and the importance of putting this into practice. ‘We have to be much better at



Delegates at the Roberts building at UCL, and the mock arbitration, right



bridging the gap between the design intention of buildings and their actual performance,' he said. 'We need to change the way we undertake research, and move at a faster pace to secure that research and its delivery into practices.'

Lessons learned

The best way to analyse whether buildings are working properly is to look at real-life performance, and the symposium offered plenty of case studies identifying causes of poor performance.

Michael Lim, of Aecom, and Steve Harper, of Galliard Homes, talked about a two-year, post-occupancy performance evaluation of apartments within the Seager Distillery development, in London. Their paper, which won the most significant contribution accolade, compared the actual performance against the design intent of the apartments and the communal district heating system.

As well as design issues with the heating system – which experienced significant distribution-pipe losses – the project suffered

low MVHR ventilation rates and inefficient external shading, said Harper. CHP and biomass boilers heat was wrongly designed to feed into the gas boiler, he added, while the pellets for the biomass boiler – which was on for 1,300 hours a year – deteriorated too quickly. In addition, only 7% of energy from the plantroom was reaching the flats.

Rajat Gupta, of Oxford Brookes University, compared the actual energy performances of a community centre and a public library, and highlighted how building management is key to achieving sustainable buildings. He said the data revealed similar performance issues relating to: poor as-built records and drawings; poor handover and guidance; problems with integrating and maintaining new technologies, including heat pumps, biomass boilers and solar thermal; and lack of sub-meter calibration.

However, the actual energy use of the community centre was similar to the design prediction, while the library's was almost double the prediction. This was because the community centre management team overcame issues through continuous engagement and interest in the building's performance, whereas the library's FM team – which changed six times – failed to engage with energy management. This resulted in the biomass boiler and the solar thermal system not being used. 'There was complete disengagement – no internal training, no understanding of the BMS, and a conflict of responsibilities of those managing the [library] building,' said Gupta. 'It's about investing in people and processes, not products.'

Phil Draper, senior technical and sustainability manager at Broadgate Estates, gave an insight into how the property company



Craig Ferguson spoke about the ventilation strategy at AHMM's new London office

SYMPOSIUM 2015



My Symposium:
Tom Walton
My highlight was the mock arbitration event in which I participated, with Emelia Targonska, of

Hoare Lea, playing the contractor, Matthew Needham-Laing and Lisa Bull, from Stevens & Bolton, playing the lawyers, David Arnold, of TB&A, as the expert witness, and Victoria Russell, from Fenwick Elliott, playing the part of the arbitrator. The script was written by Richard Rooley and I acted the part of a design consultant.

The session highlighted how important it is to ensure that nothing in a project is left to chance; everything should be recorded and filed to back up the reasoning behind the design. The audience saw how easy it is for someone in the dock to incriminate themselves. This gives the prosecution an angle by which they can discredit the person under questioning. The event overran slightly, so there wasn't an opportunity for the audience to decide who was at fault, but I'll give you a subtle clue – it was the contractor.

Tom Walton is a mechanical engineer at Aecom



My Symposium:
Sara Kassam
Isabel Why, from Cocreate Consulting, gave an excellent session on using school buildings as

tools for learning, with students collecting simple post-occupancy data. Her combined background as a building physicist and qualified science teacher allowed her to try out this intriguing occupant-awareness project, with fantastic results. The children learned valuable techniques and principles, which linked back to the curriculum, while potential improvements to school buildings were identified.

Matthew Bacon, from The Conclude Consultancy, has been modelling occupancy presence in an acute hospital, and has identified that engineering designers are often obliged to make substantial assumptions about use, which can then affect building energy performance. This could, of course, apply to any kind of building; how staff really use space is complex, and in-depth investigation and modelling can lead to all kinds of discoveries that could help to improve building performance.

Sara Kassam is head of sustainability at CIBSE



CIBSE President
Nick Mead



SYMPOSIUM 2015



My Symposium:
Gillian Menzies
What struck me was the friendly nature of the conference; small enough to have the opportunity to talk to

most people, yet large enough to incorporate professionals, industry representatives, academics and research students.

Of particular interest to me were those sessions covering the gap between 'as designed' and 'as occupied' buildings. Discussions were held on the accuracy of thermal modelling tools, the commissioning and handover of construction projects, soft landings, BIM, and communications among design team members. A recurring theme was the need for more effective commissioning and handover.

Gillian Menzies works in the Royal Academy of Engineering Centre of Excellence in Sustainable Building Design at Heriot-Watt University. She presented a paper on embodied carbon and whole-life costs.

is cutting energy use across its estate. He said heat pumps installed at 350 Euston Road were achieving large savings as they were able to cool and heat simultaneously in winter. The introduction of variable speed drives on fans had also cut energy use, as had reducing the sizing of replacement plant.

Benchmarking performance

A number of speakers discussed rating and benchmarking schemes that could enable building operators to compare their like-for-like performance with industry peers.

Malcolm Hanna, technical director at the National Energy Foundation, discussed a new scheme for office buildings called voluntary display energy certificates (VolDecs), which he said provided a simple way of rating landlord and tenant energy performance separately.

Meanwhile, Luke Ramsay, environmental sustainability manager at Julie's Bicycle, introduced benchmarking data for the cultural sector. He said the dataset had been greatly expanded since 2012 with the inclusion of organisations funded by Arts Council England

that are required to report their annual energy and water use.

Speakers suggested ways that existing resources could be used to provide heating and cooling. Gareth Davies said there were opportunities for using data centres, and that reuse of waste heat from a 3.5 MW data centre could result in savings of 4,000 tonnes of CO₂.

Graham Maidment, professor of air conditioning and refrigeration at London South Bank University, revealed research looking at the potential use of the Thames Water ring main for heating and cooling. He said local delivery networks amounted to around 13,000 miles of mains distribution.

In a well-attended session on natural ventilation, Martin Liddament, chair of the CIBSE Natural Ventilation group, drew attention to new sections in CIBSE Guide A on indoor air quality, ventilation control and calculation of ventilation rates.

Malcolm Cook, professor of building performance analysis at Loughborough University, said industry knew how to design natural ventilation, but there was an issue over the three Cs – control, commissioning and client understanding. Meanwhile, Sean Fitzgerald, CEO of Breathing Building, said natural ventilation should only be used when appropriate, and that fan-assisted cooling was often necessary for such schemes.

He described how Houghton Primary Care Centre's fan-assisted night-time cooling helped reduce the temperature in the thermal wall by 2°C – a cooling strategy that will be explored in a future issue of *CIBSE Journal*. The lesson from Fitzgerald's presentation is that the concept of naturally ventilated buildings may be simple, but the airflow and temperature modelling is far from straightforward. CJ

● Download the presenters' technical papers at www.cibse.org/symposium



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THE SKY'S THE LIMIT

Professionals from across the built environment discussed how sustainability could be integrated into design at Green Sky Thinking Week. CIBSE's Sara Kassam picks her highlights



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Crown Fountain,
Millennium Park,
Chicago

6 We need simple, intuitive, open-source software that makes it easier for users to understand and operate their buildings – an Esperanto for the built environment

Green Sky Thinking Week included a programme of more than 40 London-wide events that focused on how sustainability can be designed into the built environment. Hosted by a variety of organisations, the events were broadly grouped under the themes of green infrastructure, social sustainability and intelligent design. I attended four stimulating sessions on my current interests of post-occupancy evaluation, resilient cities, people in buildings, and integration of green infrastructure.

1. POEs, ECD Architects

Performance gap is a widely recognised phenomenon, in terms not just of a building's energy consumption, but also of its usability and occupant satisfaction. It's great to see a company making very visible, practical efforts to redress this. ECD Architects has invested in post-occupancy evaluation (POE) of the offices it has been in since 2005. It used different tools, including the BUS Methodology

questionnaire, monitored temperature data, staff focus groups, and energy consumption analysis. By going through the process itself, ECD has helped to demystify POE for the practice and foster a better understanding of building performance, while looking at ways of improving user satisfaction for its own staff.

We need to learn from all buildings – 'good' and 'bad' – because proper understanding of how they are used will help prevent repeating mistakes and improve performance.

2. Making cities work, Arup

Arup brought together 12 speakers to provide a concise and fast-paced presentation of their insights into a range of topics, from more holistic, city-wide energy infrastructure to rethinking building briefs to focus on delight.

The idea that stood out for me was building language translation. Buildings are increasingly filled with technology, but the assumption that this leads to better performance clearly isn't true in practice. Reams of data from environmental sensors, half-hourly energy-consumption data from sub-meters and a reliance on BMS just aren't doing the job.

We need simple, intuitive, open-source software that makes it easier for users to understand and operate buildings – an Esperanto for the built environment. This was created as an easy-to-learn, politically neutral language that could transcend nationality and foster peace and international understanding. Perhaps we need something that can transcend disparate systems and technologies in buildings, to foster excellent performance and improve understanding among users.

3. Social engineering, Max Fordham

This event provided some real brain food on how designers can integrate insights from sociology and psychology into architecture and engineering. Professor Elizabeth Shove, from Lancaster University, focused on how people and buildings shape each other, so it's a mistake to talk about 'users' as a completely different entity. For example, comfort is a dynamic configuration rather than a finite achievement.

It's an outcome of many social practices, so there's no optimum answer, no uniform temperature, despite our attempts to set out guidelines or recommend ranges. Designer and researcher Dr Dan Lockton reinforced this by saying we can't treat people as components with predictable properties that can be incorporated into a system.

People simply don't behave in the ways that designers expect. Rather than looking at

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Sustainable drainage system in Portland, Oregon



Green wall by Biotecture at New Street Square in London

should be working with people, rather than for people.

4. The role of living walls within sustainable cities, Biotecture

With a view out to a stunning living wall at 20 Fenchurch Street, comprising 52,000 plants of 20 species, we discussed the future of such walls in the wider context of green infrastructure. Traditionally, living walls have been aligned to the horticultural industry. However, when their interactions with heating, cooling, air quality and wellbeing are considered, there is an argument for green infrastructure to be closely aligned with building services. Plants are more variable than the usual building components, and the design, implementation and maintenance of living walls is intricate – but then the same can be said of successful HVAC systems.

It will take time for living walls to become the norm, and there is a need for their performance and benefits to be quantified. This data is now being produced and the experience of firms such as Biotecture is being shared, but we need to shift our mindset and think about green infrastructure as an essential component of buildings. **CJ**

➤ needs-orientated design, perhaps we should be looking at practice-orientated design.

These are great observations, but how can we incorporate them into our work? We need to design to some kind of standards; otherwise, where would we even begin on a project? I think the first step is at least to be aware of the complex interactions between buildings and people, and work out how to manage expectations. If humans are so unpredictable, we can't design and operate our buildings to cater for every eventuality, but we can be flexible and remember that we

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STREET SMART

Local electrical power networks have the potential to slash household energy bills by half, but are being held in check by regulations on domestic energy management. A pilot project in Wiltshire is showing how modern controls, clever algorithms and more enlightened legislation could transform UK energy supply. Encraft's **Matthew Rhodes** and **Paula Quintela**, of e2E Services, explain

Empower is a new approach to optimising energy performance in domestic buildings. It works by managing energy demand and supply across a community or portfolio of connected buildings, rather than merely optimising energy demand and supply in individual properties.

The technology is being developed and piloted by a consortium led by telecommunications software company e2E Services and energy specialists Encraft, supported by the University of Nottingham, and Bath & West Community Energy (BWCE). An initial pilot project in Wiltshire is being part-funded by Innovate UK.

The theory is simple (see Figure 1). As all energy managers know, smart building controls and management systems can often unlock significant benefits for individual buildings. However, if you can connect multiple buildings, new opportunities emerge – for example, supplying electricity or heat generated on one site directly to another, or storing energy in one location knowing there will be demand in a neighbouring building in the near future.

At the moment, most of these optimisation opportunities are lost in the UK energy market, because the system is designed from the top down and controlled centrally.



It simply cannot cope with the complexity of optimising energy performance at multi-building – or community – level.

Even greater opportunities emerge when we move beyond instantaneous optimisation of energy use to consider the potential benefits of targeted investment in energy technologies, such as battery storage, local generation and demand management (step 3 on Figure 1). Easy access to energy data from across a community of buildings can show where investments in these technologies add most value and, hence, improve the economics and benefits. The kind of practical improvement unlocked by community energy management is illustrated in Figure 2.

Currently, it is entirely possible that a household with a solar PV system installed can be exporting to the grid and being paid less than 5p per unit for its electricity, while



NEIL MITCHELL / SHUTTERSTOCK

PVs are now a common site on UK housing estates. (This one is not the Empower pilot project)

– within a few metres – another household without solar is paying up to 28p per unit, in the worst cases, but typically 15p. If the two households could connect, it should be possible to do a deal that benefits all – for example, Mr Jones agrees to buy electricity from Mrs Smith at 12p per unit.

Of course, this is only the simplest potential revenue stream; if communities get organised, they could, theoretically, access national markets for demand and frequency response – switching off appliances at times of peak demand to help avoid the need to dispatch more generation, much like large industrial customers do.

Customers and communities able to access the commercial energy market can also benefit by shifting demand to times when energy is cheaper and dispatching local energy generation when prices are high.

However, there are three main reasons this kind of arrangement is not yet happening:

- The costs of the IT and controls to manage these arrangements are too high
- Regulations prevent efficient commercial arrangements
- Householders may be sceptical about engaging with systems that take a degree of control over their energy use.

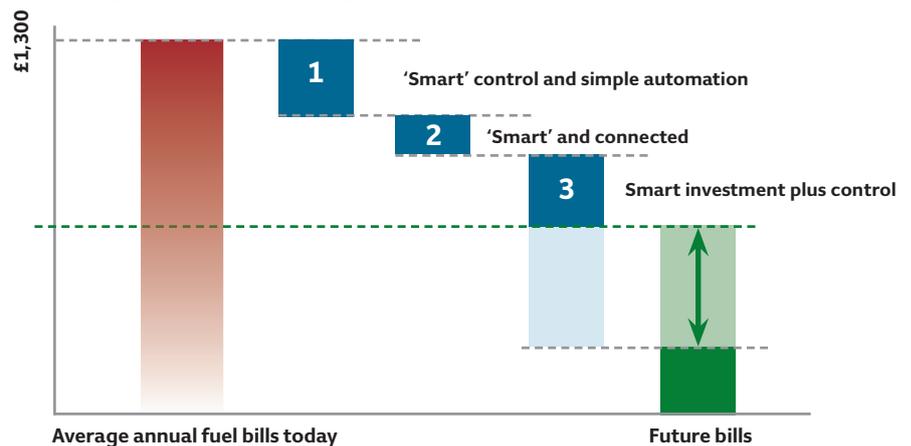
The Empower pilot project is challenging all of these obstacles. Working with the University of Nottingham, e2E Services has developed a control algorithm that takes data from cheap ‘off the shelf’ monitoring devices in homes. This data is then used to send control signals to a selected subset of devices in individual properties across the community that have ‘opted in’ to the service (Figure 3). This cuts the cost of the control solution and makes community-level optimisation economic.

The initial results of this simulation have been very encouraging (see Figure 4, page 31). Modelling at the University of Nottingham demonstrates 18%-27% savings for a group of five houses – all with solar PV and batteries – over a week in February, using real weather and energy-price data for the period, with the range of savings dependent on the (user-set) constraints on appliance switching.

Initially, Empower is focusing on demand shifting and trading electricity within the community via a local intermediary, but there is no reason why later versions cannot include demand-and-frequency response capabilities.

Encraft is working with BWCE to develop and test business models and commercial arrangements that enable individual households to benefit from the technology and these potential savings. There are major regulatory issues, however, because any

Three stages of smart technology – how fuel bills could be halved



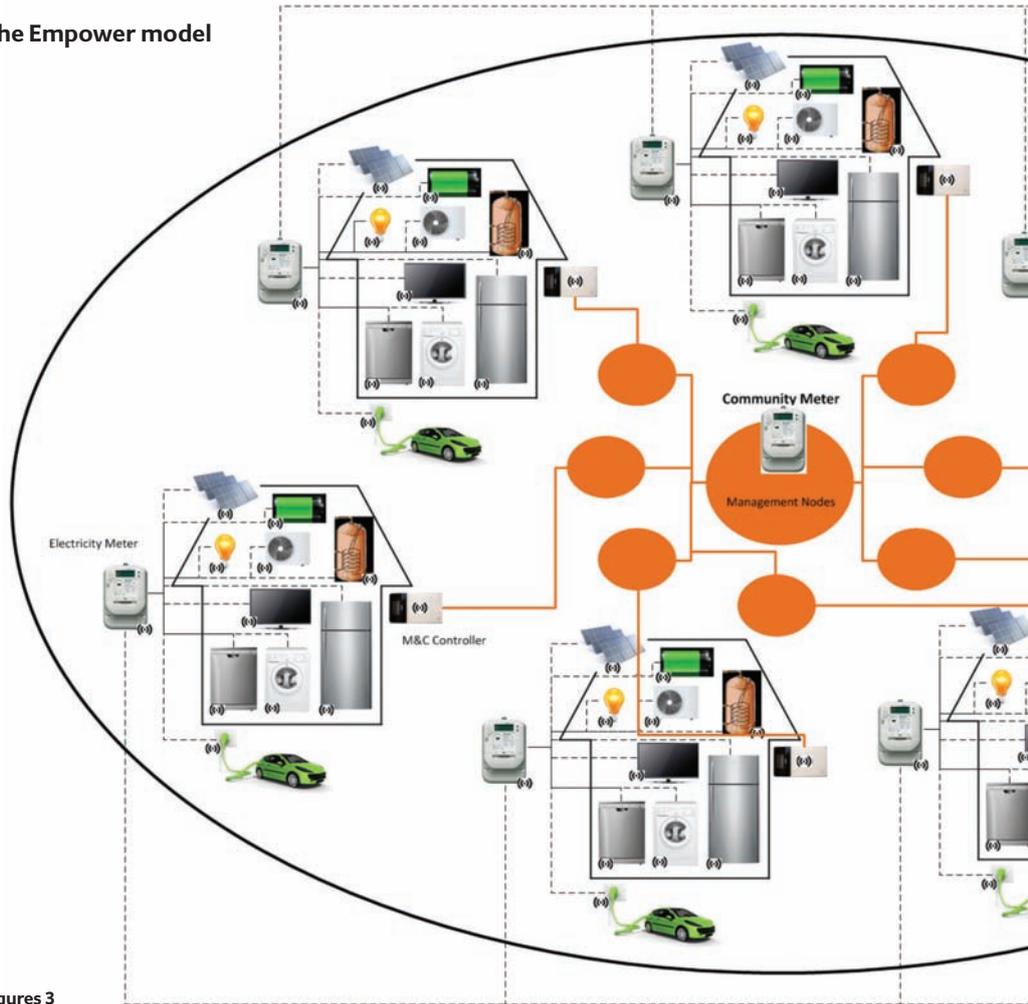
Figures 1

The principle is simple...



Figure 2

The Empower model



Figures 3

Houses (below and opposite) are on the pilot project. This older building has PVs facing away from the street



6 The economics of the model depends on the willingness of customers to delegate control of selected devices to Empower – typically, solar PV systems and batteries

organisation needs an electricity supply licence to bill householders for energy, and this is expensive. However, Encraft has demonstrated that, with such a licence – which also gives the community access to the commercial energy market and half-hourly electricity prices – further savings of 8-25% are possible on individual annual fuel bills.

Access to the half-hourly market and the ability to bill customers enable the management solution to establish dynamic

local tariffs, which can be used to drive control algorithms and incentivise customer behaviours. The economics of the model depends on the willingness of customers to delegate control of certain devices to Empower; typically, these will be significant items such as solar PV systems, batteries, and appliances for which the time of use is not critical, such as tumble driers.

Clearly, the inclination of householders to opt in is vital to the success of this kind

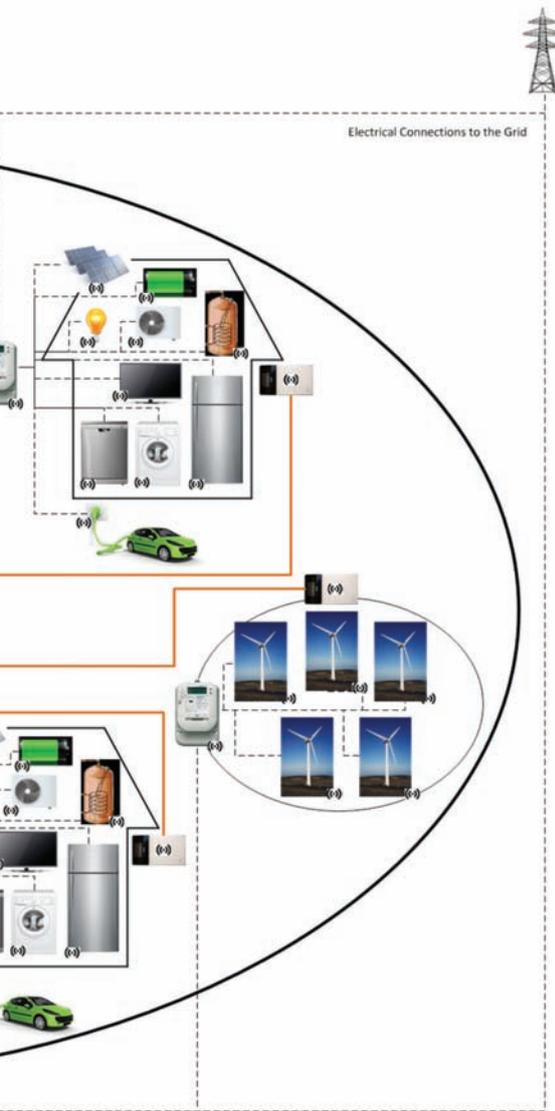


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of solution. For this reason, the project is piloting Empower across 12 buildings (10 houses and two commercial buildings) for three months this summer. The pilot will not only demonstrate if the simulated outcomes are replicable in reality, it will also be an opportunity to get behavioural feedback and start to gauge customer reaction to this kind of approach.

There has been no difficulty in finding volunteers for the pilot, but the initial view of the project team is that local community engagement and leadership – above all trust – are vital to this kind of project and technology, which is why the support of BWCE has been so important.

The major regulatory challenge will lie in reconciling this need for local trust and leadership with the costs and risks associated



with acquiring an energy supply licence. Encraft has carried out extensive research into viable models for running community energy companies in the UK and has concluded that a minimum of around 25,000 customers is necessary to support the costs of obtaining and maintaining a full retail energy supply licence. It is possible, without a full licence, to manage domestic supplies collectively on a smaller scale for defined situations – for example, apartment blocks or small private wire networks – but there aren't enough situations like these to support the costs of the development and marketing of a potential mass-market technology such as Empower.

Of course, the problem with running a community energy solution for 25,000 customers is that the levels of trust and engagement that characterise smaller communities are long gone with projects of this scale. The challenge, therefore, is to find ways of building trust across much larger numbers of customers or to bring down the cost of complying with regulations. The good news is that there are signs that the latter is beginning to happen.

The government and the UK energy regulator, Ofgem, have made limited attempts to make the process cheaper – for example, they published a Community Energy Strategy in January 2014, which included the concept of a 'licence lite' for community-based energy companies. More practically, the continued entry of new players into the energy market is resulting in greater willingness by incumbents to innovate. Ovo and First Utility, for example, have interesting offers to communities – including 'white label' community energy models – and on using smart energy technology.

Meanwhile, the team behind Empower is already thinking beyond its Wiltshire pilot to a world in which community-level optimisation of energy systems is the norm.

Encraft and e2E have just started a second project – also funded by Innovate UK through the Energy Catalyst scheme – to develop a sub-station-level control algorithm that will make it possible for the distribution networks to manage multiple community energy schemes across a city or sub-region.

The emerging world of smart networks and smart grids is creating significant opportunities for technical and commercial innovation across the world. **CJ**

Simulation results -overview

	Unmanaged	Managed	Change	%
Imported (kWh)	327.62	350.99	23.37	7.13%
Exported (kWh)	39.88	62.95	23.07	57.86%
Net (kWh)	287.75	288.04	0.30	0.10%
ESCO spend (pence)	1806.16	1358.09	-448.07	-24.81%
Managed devices (kWh)	123.55	109.85	-13.70	-11.09%
Production (kWh)	62.21	62.21	0.00	0.00%
Battery IN (kWh)	0.00	55.82	55.82	-
Battery OUT (kWh)	0.00	41.82	41.82	-
Background (kWh)	226.41	226.41	0.00	0.00%

Figure 4

● **MATTHEW RHODES** is managing director of Encraft.
 ● **PAULA QUINTELA** is project technical lead for Empower at e2E Services.

FOR THOSE ABOUT TO DOCK

The installation of PV panels means more UK homes are moving from AC to DC generation. This makes electrical distribution more efficient, says **Ian Billington**, since most electricity demand in households – such as LEDs, digital devices and, in future, electric cars – are DC loads

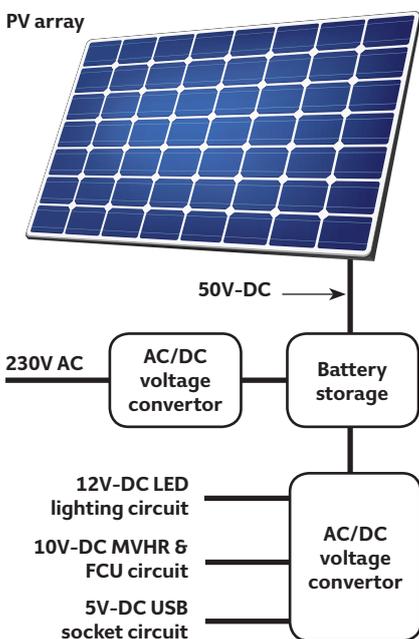


Figure 1: Schematic arrangement of domestic DC system – mechanical ventilation with heat recovery (MVHR) units and fan coil units (FCU)

Since the early 20th century, AC has been the common source of supply and load within buildings, although there have always been elements of DC load, such as fire-alarm systems and emergency lighting. In recent years, there has been an increase in demand for other elements that require a DC supply – such as LED lighting and, on the generation side, photovoltaic panels – and there are more on the horizon, including fuel cells (generation) and electric cars (supply). This increase has been recognised by the IET with the publication of a Code of Practice on DC distribution in buildings.

With digital devices such as mobile phones and laptops all requiring DC power, the 'base' electrical load in most new homes is now mainly from DC loads. DC fan coil units – used for space heating and cooling – are typically 50% more efficient than AC versions; they offer seamless change in fan speed and operate on a 0-10V DC supply. Mechanical

ventilation with heat recovery (MVHR) units also generally use DC fan motors with 0-10V input (see panel, 'Typical voltages').

The motor outputs on fan coil units and MVHR need to vary to control the speed of the fan motor. With AC, the variable voltage input to the motor is achieved by adding a resistor in the supply circuit, so electricity use at full and low speed is very similar. With a DC motor, the AC/DC or DC/DC voltage conversion can vary the voltage to the DC motor to control the fan speed – so, halve the speed and you roughly halve the electricity use.

DC generation and storage

PVs have been around for a considerable time generating DC power, but only during the day, with their output dependent on the solar density. In the UK, this results in a typical load factor (percentage of continuous rated output against actual output for a typical year) of about 8%. This does not preclude the use of PVs as a source of electricity generation if

there is battery storage, but it does impact on their economic viability.

Many DC loads in buildings do now match the period when PVs may be at peak output; a battery can then be charged, and discharged later to supply the DC load. However, the cost of a battery in addition to PVs makes the system more expensive than grid electricity.

Fuel cells that generate electricity output at DC are a potential game-changer. Research spending on this technology has increased greatly in the US and Japan over the past few years – with a view to developing electric cars – and this has driven down the cost of generating power in this way. According to the US Department of Energy, the price has gone from \$124/kW in 2006 to \$55/kW in 2014, with a target of \$40/kW by 2020 and \$30/kW in the longer term.

There are several types of PVs and these are arranged with individual cells configured into arrays, which are then joined together to produce the output voltage at the point of connection. This can be up to 600V (before inversion) for large PV sites with multiple arrays. Fuel cells broadly fall into two camps: high-temperature cells (200°C to 1,100°C) giving greater power output, typically 100MW or more; and low-temperature cells (20°C to 100°C), with outputs of 100kW or less.

The low-temperature fuel cells can be configured to give a set voltage output with a constant input to the fuel cell. By controlling the input – ie storing the gas – you can control the electricity output to suit demand.

A number of storage options are available, the most common being ‘chemical conversion’, such as in static batteries or fuel cells. As these are both DC, they can accept direct connection from PV arrays or store the gas input to the fuel cell, where the gas acts as the storage medium.

A fuel cell gives output at the same time as it receives the gas input, which can be stored so you can time the output to suit the load.

Voltage conversion

An AC transmission and distribution network is in place, with standards harmonised across Europe at 230V (single phase) and 400V (three phase). All electrical equipment is currently designed to suit an AC connection, with DC loads connected mainly via a switched mode power supply unit, which converts AC to the required DC voltage. These power supply units are often less than 80% efficient, although several bodies offer approval schemes to encourage improved efficiency.

By removing the need to convert from AC to DC, several stages in the voltage-conversion



Sue Roaf's home in Oxford generates electricity that either feeds into the national grid or charges the batteries on her electric car. Roaf is professor of architectural engineering at Heriot-Watt University

By removing the need to convert from AC to DC, several stages in the voltage-conversion process are removed, thereby increasing the conversion efficiency

process are removed, thereby increasing the conversion efficiency – from an efficient AC/DC voltage conversion of 85% to closer to 90% with DC/DC conversion. The need to change between the generated and required voltage of the DC load is unlikely to be removed in the near future, because generating voltages are significantly higher than most commercial or domestic DC load items – with the potential exception of electric-car charging.

DC in the home

Given the efficiency gain in DC-to-DC step-up or step-down voltage conversion – where DC

generation is located close to the served DC load – there is a benefit to DC distribution between the PVs or fuel cell and the DC load being supplied; as would be the case with the storage of DC-generated electricity with batteries. A study – part-funded by the Department of Trade and Industry, in collaboration with Moixa Energy – was carried out into the use of battery storage to supply DC lighting and 5V DC USB outlets (for portable devices such as tablets and phones) in a typical residential dwelling.

Figure 1 adds a PV array to the scenario. The battery allows the variable output of the PV to balance with the various DC loads within the apartment, with direct DC/DC conversion from a typical 50V PV array output to 12V for the LED lighting and 5V for the USB circuit. With the MVHR also connected to the system the whole house is lit and ventilated using power generated by the PV.

There are two significant changes on the horizon – electric-car charging and fuel cells. Currently a typical electric car – based on a Renault Zoe, four-door family car – needs 22kWh of charge for a 100-mile journey, which requires either a rapid one-hour charge (61A at 360V DC) or, more typically, a longer seven-hour charge (8.7A at 360V DC).

For one house, 92m² of PV (8m² per 1kW peak with a capacity factor of 8%) would be needed for a full 100-mile car recharge each day, over seven hours, with battery storage to align the PV output to when the charging is required – most probably overnight. The fuel-cell voltage is more likely to be matched to the electric car and would be more viable in terms of the space needed in the home.

Conclusions

PV costs have dropped significantly in a very short space of time, with the Solar Association claiming a reduction in price, including installation, of 60% in the past five years.

While the AC supply to buildings from the national transmission and distribution network is unlikely to change any time soon, there will be benefits for buildings with DC generation from PV arrays and fuel cells because of the conversion efficiency of DC to DC and DC distribution within buildings. CJ



Typical voltages

- Mobile phones and tablets (5V)
- TV and PC screens (24V)
- PCs (typically 500 to 900 watts rating with 100V to 240V AC in, 12V DC out)
- Motors (MVHR, fan coil unit, typical 0-10V)
- Electric vehicles (330V for Mitsubishi i-MiEV; 360V for BMWi3 and Renault Zoe)



EXPOSING THE UNDERWORLD

The mass of underground services buried beneath our streets is a major hurdle to creating smart, resilient cities, say **Nicole Metje** and **Dexter Hunt**, who consider sustainable methods of managing 4 million km of buried infrastructure in the UK

The UK has a vast network of utility and local authority infrastructure buried beneath its highways and footpaths. The combined network of water, sewer, gas and electricity services extends to more than 1.5 million km.

Data for telecommunication cables and local authority infrastructure, such as street lighting cabling and highway drains, are less widely known, but it is estimated that – when included – the total length of buried infrastructure is in excess of 4 million km – 10 times longer than the country's road network.

To repair, maintain and upgrade this vast network, the utility industry carries out two million streetworks each year with about the same number undertaken by the highways authorities.

Currently, the most widely adopted solution for accessing these networks for repair, maintenance or upgrading is open excavation, which has changed little in 200 years, despite exponential growth in urban development and the number of utilities.

In addition, not knowing precisely where existing infrastructure is located can result in the digging of dry



holes or inadvertent damage to other underground assets. This leads to delays, extra costs, disruption to the public and possible adverse effects on the environment.

Now factor in more than 100 utilities potentially digging up the road at the same time, and you have a hugely dysfunctional system. It's uneconomical, socially disruptive and has an impact on the environment – in other words, unsustainable. Part of the solution is either to make the current situation more sustainable or to consider other ways.

Research started in the UK in the 1990s to develop technologies and techniques to show and accurately locate buried assets. Mapping the Underworld (MTU) started with the 'bodyscanner' vision (see Figure 1) and grew from much earlier activity funded by the Engineering and Physical Sciences Research Council (EPSRC)¹ and industry², culminating in the 2002 international workshop.

International interest

The 2004 Ideas Factory seeded an initiative that created wide national and international interest, and spawned both Vista, the MTU location project and the Oxems spin-off company³, which makes remotely detectable asset tags for new and repaired pipes. Importantly, it brought together an expert team that

is now acknowledged to be the leader in geophysical techniques.

However, it is not only the location that is of interest when managing a buried asset, but also the condition of the asset. The latest initiative, known as Assessing the Underworld (ATU) advances the MTU initiative into a new sphere of influence – part of a 25-year vision to make streetworks more sustainable.

It builds upon two existing MTU research themes, aiming to develop the means to locate, map in 3D and record the position of all buried utility assets without the need for excavation. The idea is to integrate this information with utility service company records into a

“Streetworks using traditional trenching techniques disrupt, and often significantly damage, transport infrastructure”





pipeline – maybe because it is fractured, laterally displaced, corroded or holed – will give a response to the geophysical techniques different from that of a pristine pipe.

Similarly, wetting of the adjacent soil, or voids created by local erosion, caused by leakage from a water-bearing pipe, will result in a different ground response to unaltered natural soil or fill. Furthermore, a deteriorated road – which might be cracked, rutted, or suffer from a softened, waterlogged foundation – will give a different response from intact, coherent, properly drained road structural layers.

Deterioration of the physical infrastructure occurs at rates dependent on many factors: the loading it receives; time; the materials from which it is formed; and local environmental conditions, including climate, weather, water conditions and so on.

One of the key problems is that the utility infrastructure is unseen and one way to overcome this is to consider an alternative solution in the form of a multi-utility tunnel (MUT) where all of the utilities are housed together in an urban underground conduit.⁴ (See figure 2, on page 37).

Whatever solutions are ultimately adopted it is important to assess them in relation to sustainability and future resilience.

Assessing whether they will still work in the years ahead, depends on how we define and measure sustainability in the context of how utilities are provided, and what the future has in store. The former is being considered as part of ATU and the latter by the Urban Futures project (2008-2012), which developed four plausible futures scenarios against which the resilience of these solutions could be assessed.⁵

This resulted in the BRE publication of

➤ single, integrated, searchable 3D model.

Streetworks using traditional trenching techniques disrupt, and often significantly damage, the transport infrastructure and ground on which it is sited. As a consequence, the ground and physical infrastructures – the utility service and surface transport – have an interdependent relationship. Intervene physically in one, and the others are almost inevitably affected in some way, either immediately or in the future.

The physical condition of these assets is of crucial importance in determining what, and how severe, the impact on each of the other infrastructures will be.

The relationship needs careful consideration. For example, a deteriorated

6 The physical condition of these assets is of crucial importance in determining what, and how severe, the impact on each of the other infrastructures will be

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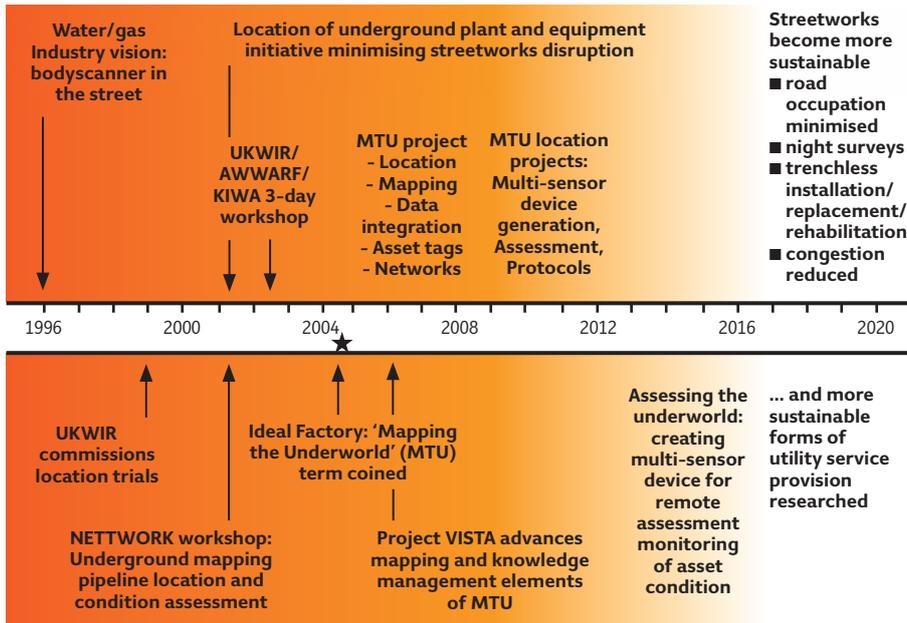


Figure 1: Mapping the underworld initiative – 25-year timeline

the Urban Futures method called Designing Resilient Cities.⁶ Current research, as part of the Liveable Cities project (2012 to 2017), looks at transforming the engineering of cities in a variety of ways and considers a range of outcomes – taking into account the physical solutions and the governance and policy requirements that allow us to get there. These may have a number of barriers to overcome, depending on where they are used.^{7,8} These are pertinent when considering alternative ways of utility placement, including trenchless techniques and MUTs, within the context of a car-driven or car-free future city environment.

While the solutions described above are largely for the future, we still have to deal with traditional infrastructure designs. One key element of the work to date on detecting buried infrastructure has been the need for the development of standards.

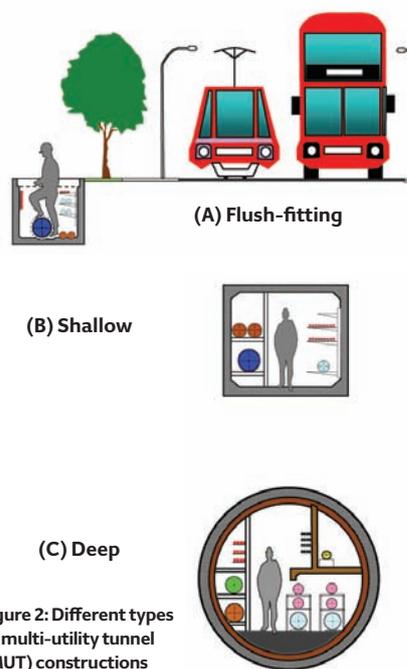


Figure 2: Different types of multi-utility tunnel (MUT) constructions



PAUL WISHART / SHUTTERSTOCK

In this respect, The Institution of Civil Engineers led the development of a Publicly Available Specification (PAS) through the British Standards Institution (BSI), resulting in the publication of PAS128: *Specification for underground utility detection, verification and location.*⁹

The aim of PAS128 is to classify different levels of utility survey, ensuring a consistent standard across the industry. This will allow those people involved in such surveying to tender for jobs on a level playing field – beneficial to both clients and the wider industry sector. This standard will help increase market confidence about not just the definition and delivery of the Subsurface Utility Engineering process, but also the further professionalism of the industry. **CJ**

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 ● **DEXTER HUNT** is Birmingham research fellow at the School of Civil Engineering, University of Birmingham



A POWER OF GOOD

A new energy-demand research centre – which focuses on occupant behaviour as well as technology – has secured funding for 60 studentships. **Liza Young** speaks to its first graduate to find out more

The cheapest unit of energy is the one that you do not use, says Jenny Love, a consultant on the buildings team at low carbon engineering company Element Energy. She understands that governments and businesses need to focus on the other side of the energy equation: how to use less, rather than make more.

Love is the first graduate of the London-Loughborough Centre for Doctoral Training (LoLo CDT) in Energy Demand, and says the subject has assumed new importance in recent years. As we learn more about the factors that have an impact on energy consumption, subjects such as psychology, sociology, politics and economics start to play a bigger part in the field, she adds.

Love spent four years completing the LoLo CDT, which comprises a one-year Master of Research in Energy Demand Studies (MRes EDS) and a three-year PhD on energy demand reduction in the built environment. The commercial sector is now benefiting from her research and knowledge through her work with Element Energy.

One of the firm's recent high-profile projects was at the historic Banqueting House, in London, where it devised a low-carbon strategy to safeguard valuable ceiling paintings that were threatened by high humidity (see panel on page 40,

'Putting lessons into practice').

Energy demand has many human and social dimensions – including energy-dependent ageing populations, rising prices that could plunge more people into fuel poverty, and summer overheating.

As more buildings that can both produce and consume energy are created, the line between energy supply and demand will blur; researchers will be under greater pressure to come up with ideas that lead to lasting, large-scale solutions. The new UK Centre for Research in Energy Demand – run as a partnership between University College London and Loughborough University – attempts to facilitate and nurture those ideas.

Communal focus

The need for energy-demand research has never been greater, says Love. 'We know we have a problem – we [the UK] have an 80% carbon reduction target to meet by 2050, but we have old, leaky building stock that's mainly powered by gas boilers.'

Despite awareness and labelling campaigns, the energy use of households has risen steadily. The UK's housing stock may be 30% more energy efficient than in 1970, but consumption of fossil fuels in our homes has also gone up by 30%.

Heat is a massive energy user, as is air conditioning, which is becoming

increasingly pervasive in the UK. 'The best way of moving away from fossil fuels is to reduce demand as much as possible, and offset the remainder with renewable heat,' says Love.

Our priority, she adds, should be treating existing, inefficient dwellings, not designing shiny, new buildings: 'It's also about having a communal attitude [to energy use] and changing the perception that "an Englishman's home is his castle".'

A district heating scheme, for example, would require householders to use low carbon fuel, energy companies would have to access these homes remotely, and even the times of day at which people could access energy may change.

To pinpoint how energy savings can be made, says Love, it's important to look not just at the technology, but also at how people interact with it.

The social housing paradigm

Love, who studied physics at the University of Oxford, completed her LoLo CDT in energy demand in 2014.

The course was still being developed when she enrolled in 2009, but it has recently received a second round of funding to deliver up to 60 additional studentships over the next eight years.

Research topics will address new challenges within five themes: technology



PETE SPIRO / SHUTTERSTOCK



The Centre for Doctoral Training is run from University College London (left) and Loughborough University (above)



It was like someone handing over the baton, so the next generation can carry on and fight the good fight

and systems; energy epidemiology; urban-scale energy demand; building performance and process; and unintended consequences.

The MRes EDS aims to provide the scientific skills and knowledge necessary for students to undertake research in the field of energy demand. It equips them with a solid grounding in thermodynamics, energy systems in the built environment, modelling and analysis, social science methodologies, energy law and policy, and economics.

Students who are awarded an MRes can then progress to do a PhD. Love's thesis – *Understanding the interactions between occupants, heating systems and building fabric in the context of energy efficient building fabric retrofit in social housing* – looked at how retrofitting social housing influenced the tenants' energy use.

'There is a theory – derived from the rebound effect – that says when you make something more efficient people will use more of it, because it's cheaper,' she says. 'If the house is insulated, it's cheaper to heat, therefore people will turn up the thermostat and undo the energy savings that you brought about.'

However, Love's research found the opposite: although the indoor temperature of the homes increased because of their improved building fabric, the householders

acted to reduce their heating demand.

'This was difficult to predict with physics models – which demonstrates that the way we try to predict energy use is wrong,' says Love. 'You can't predict energy savings when you don't know how occupants are using it in the first place.'

You've got to have faith

Despite being daunted by the prospect of entering the private sector after graduation, Love says she found Element Energy had 'really low-carbon values at heart'.

The company helps businesses to get new technologies – such as alternative fuels for vehicles – off the ground, and works with utility companies to develop financially viable carbon-saving products. 'Energy companies know that fossil fuels are doomed and low-carbon equivalents have the potential to make money, but it's a question of persuading the boards,' says Love. 'I remain passionate because I want to see this become a reality.'

So, is energy demand research going to make a difference? Love is optimistic that it will and says it's important to have faith in your work. 'It was amazing to be taught by those at the top of their profession. It was like someone handing over the baton, so the next generation can carry on and fight the good fight.' CJ

Putting lessons into practice

Jenny Love says the LoLo CDT programme helped to prepare her for work at consultancy firm Element Energy, where she has been employed for a year.

'Most of our work is extremely novel; no-one knows the answers to the questions. We make our own models and projections of energy demand and supply, and create models for technology start-ups, finding new markets for them.'

Love says being exposed to a wide range of stakeholders in the field prepared her for presenting in front of influential policy people and housebuilders.

'Knowing what robust data and analysis are extremely important because, when you're advising clients, it's your neck on the line,' she says.

One of her most high-profile projects has been the historic Banqueting House, in Whitehall, London, the ceiling of which is covered in Rubens paintings.

'The art was deteriorating because the conditions in the space were not favourable for the paintings, with the fluctuations in temperature and humidity that caused the plywood to weaken,' says Love. 'There was a danger that, in a few years, the paintings wouldn't be there any more.'

Historic Royal Palaces, the charity that manages the space, asked Element Energy to come up with a low-carbon solution that would make conditions more favourable for the paintings without compromising the comfort of the building's occupants.

The challenge was to help preserve the paintings and keep up to 700 people comfortable as they feast and drink, while maintaining the building fabric.

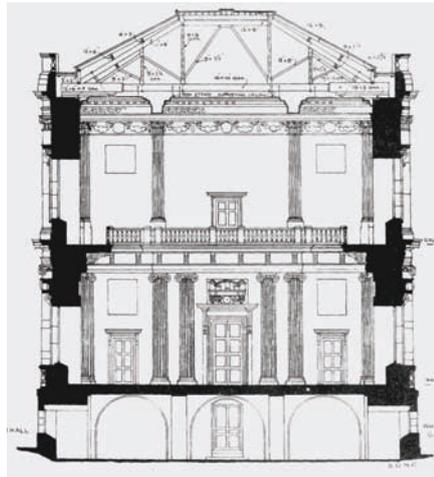


IMAGE / BRITISH HISTORY ONLINE

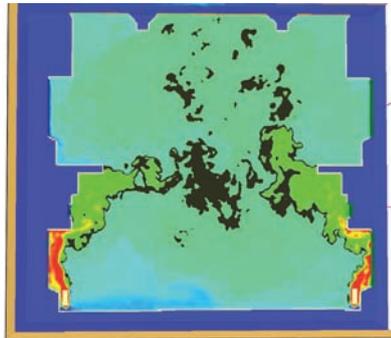


IMAGE / SHANE SLATER (ELEMENT ENERGY)

A cross-sectional drawing of Banqueting House (top) and a CFD model of thermal plumes rising from the radiators



IMAGE / HTTP://COMMONSWIKIMEDIA.ORG/WIKI/CATEGORY:INTERIOR_OF_THE_BANQUETING_HOUSE#/MEDIA:FILE:BANQUETING_HOUSE_801.JPG

The ceiling of Banqueting House, in London, is covered by Rubens paintings

'My job was to recreate this existing building in the model and simulate different interventions without trading one aim off against another,' says Love.

Using temperature and humidity data, she was able to model different solutions that were best for the paintings.

'We recommended a layer of insulation installed two metres above the paintings,

and combining this with underfloor heating,' Love says. 'We showed that it was possible to decrease the amount of fluctuations around the paintings without compromising occupants' comfort.'

She adds: 'At Element Energy, we want to find the most practical solution that works on the ground. If something is not financially viable, we won't recommend it.'

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"Energy conservation is the foundation of energy independence"

HIGHER BY DESIGN

The electro-technical industry needs a higher level apprenticeship to bridge the current gap between the NVQ level 3 qualification and electrical engineering degrees says Jim O'Neil, Technical Director at the Electrical Contractors' Association.

Changing market

The contracting market is changing. The majority of contracts in the public sector – one of the key clients for our industry – are now 'design and build' and electrical contractors are being required to contribute to the design stage of the project rather than becoming involved solely at the installation stages.

In addition, the rise of modular building and off-site construction methodologies means on-site supervisors need to have a higher level of skill to oversee, manage and troubleshoot these types of projects.

Workable designs

Electrical contractors will be required to assume responsibility for the design aspect of projects which has historically been carried out by consultant engineers. Fewer and fewer of these consultant engineers have practical industry experience and many enter consultancy practices directly from university after completing electrical engineering degrees. As a result it is not uncommon for project designs to need revising and redrawing in order to be workable, which results in time and money being lost.

This is creating an increasing need for electrical contracting businesses to employ higher skilled staff who can oversee the design process and work with external designers to ensure designs are right first time.

Bridging the gap

There is currently no means for someone with a level 3 qualification to continue their professional development without going to university full time. However, the electrical engineering degrees offer a tremendous amount of theory but don't provide the practical experience of an apprenticeship.

There is therefore a need to develop an apprenticeship that bridges the gap between further and higher education among electro-technical trainees.

This new apprenticeship would provide a bridge between the level 3 'Eng Tech' qualification and 'Incorporated Engineer' at levels 4 to 5.

It could be delivered as a two year sandwich



Photo courtesy of JTL – the industry's charitable training provider that works closely with the ECA

course, in partnership with a university. Candidates could undertake a period of mentoring combined with block release and residential study, allowing them to develop 'on the job' competencies alongside an experienced professional and also learn the academic side of the role.

Higher!

With the way the market is developing, there is a strong case to suggest we may need more people at Higher Technician level rather than Craft level in the future.

The 'Higher Apprenticeship' could be one way of ensuring our workforce and our

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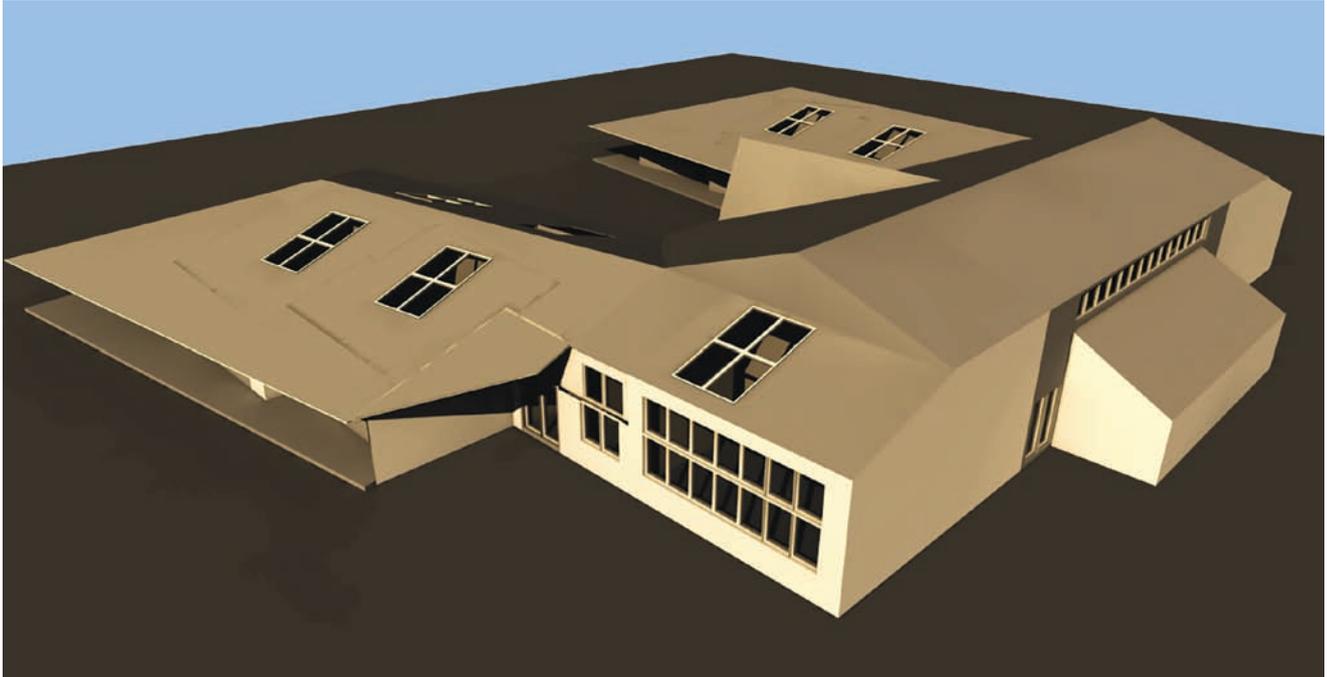
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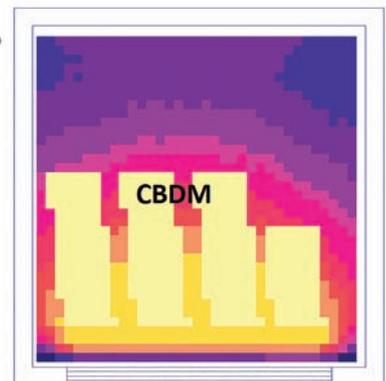
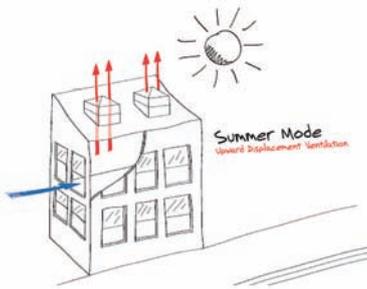
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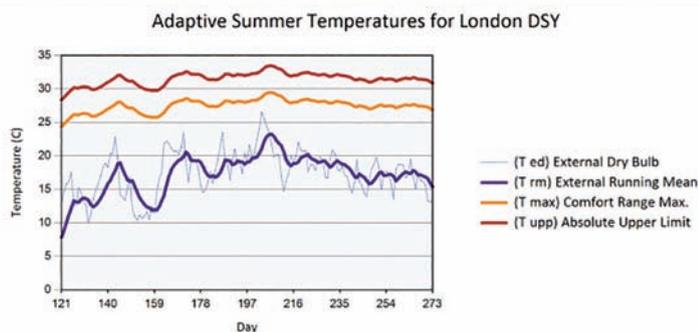


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This month: Land Securities' space saving specification at a Ludgate office, plus Airedale's CIBSE Award Winner

IN FOR THE CHILL

Airedale International grabbed the Energy Saving Product of the Year gong at the CIBSE Building Performance Awards 2015 for its TurboChill chiller using R1234ze refrigerant. **Andrew Brister** finds out why



Legislation continues to drive innovation in refrigeration and air conditioning equipment. From the Montreal Protocol to today's F Gas Regulations, refrigerant restrictions force manufacturers to develop new equipment in order to stay one step ahead of the phase-out of gases.

HCFC gases, otherwise known as F gases, have been banned since 1 January 2015, and restrictions on the use of hydrofluorocarbons (HFCs) are expected to take effect in 2017, with total phase-out by 2030. The days of traditional refrigerants, such as R410A and R134a, are numbered given the increasing focus on low or zero global warming potential (GWP) refrigeration – but manufacturers are rising to the challenge.

Airedale International's TurboChill is the first BSI-approved range of high-performance chillers available from a British manufacturer to use the low GWP refrigerant R1234ze – and it was a deserving winner of the Energy Saving Product of the Year category at the CIBSE Building Performance Awards 2015. Available in capacities of 200-1200kW (air-cooled TCC range) and 200-1360kW (free-cooled TCF range), the chillers have proved a hit with eco-minded clients such as John Lewis, in the UK, and Orange, in Switzerland.

R1234ze is a hydrofluoro-olefin (HFO) refrigerant. Recent studies by the Intergovernmental Panel on Climate Change (IPCC) have indicated that it has a GWP of less than one, which is better than CO₂. By way of comparison, R410A and R134a have GWPs of 2,088 and 1,430, respectively.

Airedale undertook a detailed research and development programme to offer the market a chiller range that incorporates a low-GWP refrigerant and – after successful implementation – to extend the alternative gas to other products within the range.

'Airedale worked closely with industry partners Honeywell and Danfoss to determine suitable replacement refrigerants from the HFO family,' says Mike Peachey, Airedale's new-product development manager. 'R1234ze and R1234yf have been identified as the two main isomers to have real application in the cooling industry as a replacement for R134a.'

Although of the two alternatives R1234yf has a marginally shorter reactive lifetime – just 10.5 days as against 16.4 days for R1234ze – it is more complicated to manufacture. At an average cost of £40/kg versus £16/kg





➤ for R1234ze, it was also a less cost-effective solution for large-scale production and use in high-capacity equipment, such as chillers.

‘A thorough analysis and testing of R1234ze was conducted to understand its safety and performance characteristics, and its commercial viability,’ says Peachey. This involved taking into account factors such as: GWP; upper and lower flame limits; combustion temperatures; burning velocity; ignition energy; flammability for handling and storage; toxicity; availability; costs; ease of adoption; and on-going service and maintenance requirements.

‘Despite cooling capacities around 25% lower than those achieved with R134a, R1234ze requires 27% less power input, which results in a better coefficient of performance (COP) ratio of around 3%,’ says Peachey. ‘Further modelling and testing was conducted to maximise air flow and heat exchange, including integrating sub-coolers with intelligent controls logic, to ensure that the highest energy efficiency ratios and cooling power per footprint are achieved.’

After a detailed risk assessment, a number of safety measures were also integrated.

These include: automatic leak detection; sensitivity to flammability concentration levels; location and isolation of high-voltage power electronics; isolation of refrigerant; and incorporation of ATEX-rated ventilation fans to each compressor enclosure.

Advanced performance

At the concept stage, advanced design techniques – such as computational fluid dynamics (CFD) – were used to analyse a range of coil types and orientations to maximise the heat exchange area and airflow. The TurboChill incorporates a number of advanced features:

- High-efficiency flooded evaporator – the use of flooded evaporators with built-in suction gas heat exchangers improves compressor energy efficiency by up to 15%
- EC fans – these incorporate electronically commutated DC motor controls. With their highly efficient, backward-curved aerofoil impellers, EC fans reduce power by as much as 70% compared to equivalent AC fans, both at full and modulated speeds
- ‘V’ block microchannel heat exchangers – the modular ‘V’ block arrangement and use of microchannel coil technology provide an efficient surface area for refrigerant heat exchange, allowing cooling capacities to be increased and lower condensing temperatures to be achieved within a smaller footprint
- Head pressure set-point management – optimised head pressure control significantly improves efficiency and minimises noise
- Actuated ball valves – the use of fast-acting ball valves eliminates the staging effect of solenoid valves, delivering smooth, rapid and safe refrigerant isolation when necessary
- Oil-free centrifugal compressor technology – the intelligent, self-optimising compressors provide variable speed control (between 30% and 100%) for tighter set-point management and substantial energy savings at part-load
- Integral high-efficiency inverter-driven pump – provides precise water-flow control and excellent part-load efficiencies
- Concurrent free-cooling capabilities – this saves energy, particularly when room temperatures are high. Concurrent free cooling further decreases energy consumption by reducing the need for mechanical (DX) cooling, and maximising the part-load efficiencies of components such as EC fans, inverter-driven pumps and centrifugal compressors



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TurboChill offers a European seasonal energy efficiency ratio (ESEER) of up to 5.99 and Class A energy efficiency ratio (EER) of up to 4.12 – at 7/12°C water and 35°C ambient – and is said to deliver industry-leading energy efficiency per footprint available from a centrifugal-based free-cooling chiller.

Airedale claims the TurboChill FreeCool offers up to twice as much free cooling as a thermosiphon free-cooling system, and can deliver free cooling for up to 95% of the year. This means potential energy savings of up to 50% compared with a conventional chiller. The company says TurboChill significantly exceeds the energy performance of rival screw chillers, reducing annual operating costs by up to 23% at part-load.

‘The addition of R1234ze means that TurboChill automatically receives two BREEAM points in recognition of its low global warming impact,’ says Peachey. ‘By contrast, R134a TurboChill TCC and TCF variants qualify for one BREEAM point. HFOs readily break down in the atmosphere within a very short lifetime: R1234ze in just 16.4 days compared with 14 years for R134a.’

The environmental benefits have led to the chillers being specified by John Lewis – a business known for its commitment to sustainability – for its York store, which opened in April 2014. Two 450kW TurboChill FreeCool chillers with R1234ze have also been supplied to Orange, in Switzerland. Expect more to follow as restrictions on refrigerants start to bite. **CJ**



Shortlisted finalists

m10 LED fire-rated luminaire, Aurora

Aurora claims the m10 is the world’s most advanced LED fire-rated luminaire. It offers 40,000-hour life to L70, has a five-year warranty, insulation coverage and no separate driver.

Demand Logic building energy analysis platform, Demand Logic

Demand Logic is a web technology that identifies carbon and performance savings opportunities in commercial buildings by streaming and analysing thousands of data points from the building management system.

Kooltherm FM pipe insulation, Kingspan Tarec Industrial Insulation

Kooltherm insulation can be fitted on pipework and equipment operating at temperatures between -50°C and 110°C. It has zero ozone depletion potential (ODP) and low GWP.

Q-Bot underfloor insulation, Q-Bot

Q-Bot’s process allows a house to be insulated from beneath using a remote-controlled robotic

● The days of traditional refrigerants are numbered given the focus on low or zero GWP refrigeration – but manufacturers are rising to the challenge

device. One skilled operative can install the insulation in a day.

The Radical, Stelrad Radiators

The UK’s first serial-fed radiator. The front panel heats up first, followed – if required – by the back panel. The result is 23% more radiant heat from the front panel than from a standard panel radiator, and a panel that heats up 8% quicker.

EKF kitchen box fan, Vent-Axia

The catering industry is a large consumer of energy. The EKF uses high-efficiency EC motors and backward-curved impellers to reduce energy costs by up to 44% compared to AC motor fans with transformer speed control.

The Wetherby Epsitec system, Wetherby Building Systems

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SOUND CHOICE



Limited space and strict noise requirements led to a compact, enclosed chiller being specified for an office scheme at 1 and 2 New Ludgate, in central London. **Phil Thompson** reports on the latest in chiller technology

The strict noise requirements of Land Securities' commercial development at 1 and 2 New Ludgate, in London, helped to determine the specification of the chillers for the project.

Air conditioning manufacturer Carrier worked closely with the client, consultant and contractor, SRW, to develop a compact, energy efficient design that enabled the chillers to be located in a restricted space.

As a result, the chillers could be mounted on the rooftop, rather than in the basement, which was where the plant was located in the original design. This gave Land Securities more usable commercial space.

The chiller manufacturer designed and built a custom package to enclose the chillers and reduce the amount of noise. The condensers are specifically configured to resist damage from hailstorms that can otherwise create significant, accumulating, impact damage to the coils and will reduce their performance.

Air conditioning for the buildings is supplied by six 930kW (nominal) chillers with VSD-controlled screw compressors, alongside six smaller chillers with scroll compressors.

The project included a bespoke pump, control and chiller sequencing package.

'The software was programmed in-house and designed to maximise energy efficiency and air conditioning performance, as well as extend the working life of the chillers by careful run-time sequencing,' says Danny Lear, specification and solutions manager at Carrier UK.

'We were able to carry out full witness testing of working chillers at our facility in France, ensuring the solution met the specification fully.'

After installation, Carrier's service team will, under a full-maintenance contract,

6 The constant control of the onboard intelligent control system, claims Carrier, enables the chiller to operate with very good part-load efficiency



1 and 2 New Ludgate



The Carrier chiller underwent testing in France

➤ ensure the chillers are maintained at peak performance level.

The six screw compressor chillers are supplied with integral control that combines variable-speed condenser fans with variable-speed screw compressors, enabling close matching of cooling output to current load conditions.

The constant control of the onboard intelligent control system, claims Carrier, enables the chiller to operate with very good part-load efficiency.

With the ability to vary both condenser fan speed and compressor speed in response to constantly changing demand, the chiller can continue to operate in its 'sweet spot' in terms of performance and energy efficiency.

Carrier asserts it delivers a full energy efficiency ratio (EER) of up to 3.4 and a European seasonal energy efficiency ratio (ESEER) up to 4.9.

Through a control system, building owners can monitor and log performance data from the chiller via a web browser.

Newly introduced software optimises use of compressors, fans and cooling circuits. It does this by constantly calculating the most efficient fan speed and water-flow rate, based on the current load and ambient conditions, and controls them to main appropriate refrigerant operating pressures through continuous feedback and adjustment. **CJ**

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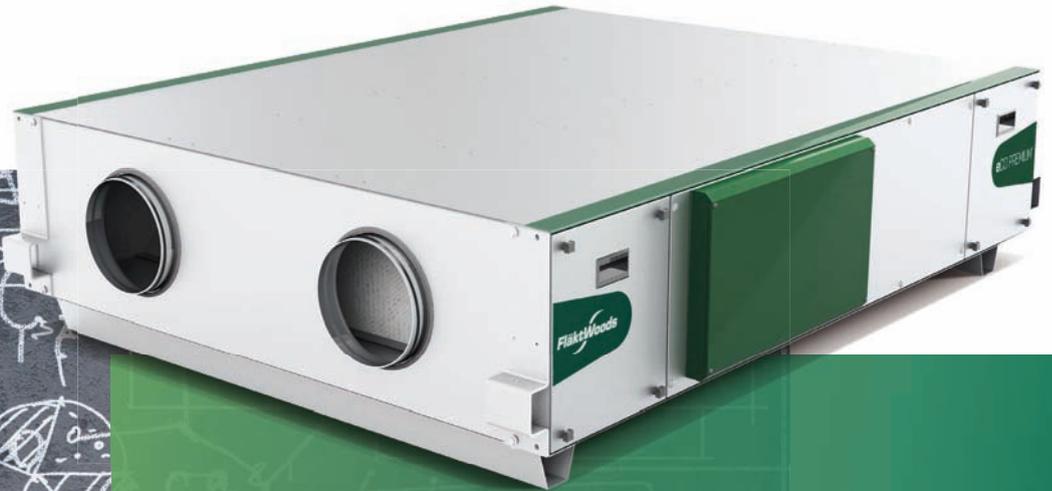


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Simply study the module and complete the questionnaire on the final page, following the instructions for its submission. Modules will be available online at www.cibsejournal.com/cpd while the information they contain remains current.

You can also complete the questionnaire online, and receive your results by return email.

Assuring good-quality ventilation in schools

This module considers updated standards affecting requirements for ventilation in teaching spaces, drivers for mechanical ventilation and the benefits of independent equipment certification

The provision of good-quality ventilation to a school is required to ensure that the internal environment is comfortable and conducive to effective learning. Traditionally, UK schools have been designed with large, opening windows and appropriate room aspect ratios to enable the properly educated user – often the teaching staff – to maintain reasonably ventilated conditions. However, because of their siting or use, many new or refurbished schools will require part, or full, mechanical ventilation – together with heat recovery – and it is important that such systems have life-cycle performance that provides effective, energy-efficient operation.

This CPD will consider the recently updated standards that determine the requirements for ventilation in teaching spaces; the drivers for applying mechanical ventilation; and how equipment certification can provide essential evidence that mechanical ventilation products are fully fit for use.

As discussed in the recently published CIBSE TM57 *Integrated school design*, a poor internal environment can affect the performance of both teaching staff and students. The principles for a 'good quality' environment require that the internal contaminants are appropriately diluted with

outdoor air, the spaces are neither overheated nor too cold, and that there is reasonable air movement, with an absence of cold draughts. The location of modern schools, the density of occupation and the associated heat gains and CO₂ produced by the occupants may not always be conducive to the application of natural ventilation, so suitable mechanical methods are often required.

There is a good amount of guidance available to the designer to assist in the design and selection of appropriate ventilation methods. In the UK, the Education Funding Authority (EFA) produces the baseline requirements for schools and sets the standards under the Priority School Building Programme.¹ The guidance, including BB101 *Ventilation of school buildings* and BB93 *Acoustic design of schools – performance standards* have evolved in recent years to meet current expectations and reflect improved understanding of the impact of internal environmental quality on teachers and students.

ClassVent² and ClassCool³, the freely available calculation tools that may be used to undertake simple modelling, are now recommended for early assessment stages and – although still useful – are no longer promoted as Building Regulation compliance

tools. ClassVent produces preliminary sizes for ventilation openings for a variety of ventilation strategies, and ClassCool can be used at the early stages of design to consider ways to prevent summertime overheating.

The EFA ventilation design standards have recently been updated in the form of the Baseline designs ventilation strategy³, to meet the recommendations of CIBSE TM52 *The limits of thermal comfort: avoiding overheating in European buildings* and follow the guidance of CIBSE KS16 *How to manage overheating in buildings*.

The EFA plans to update BB101 this year with new guidelines for ventilation, thermal comfort and indoor air quality so that it reflects standards in the 2013 edition of the Facilities (Services) Output Specification⁴ and the associated ventilation strategies. The UK Building Regulations documents refer to BB101 as being an acceptable means of meeting the energy efficiency and legislated ventilation requirements.

When assessing the risk of overheating, the updated requirements consider adaptive comfort (as per EN15251⁵) and apply operative temperature – accounting for radiant and air temperatures – as well as considering the variability in outdoor temperature.

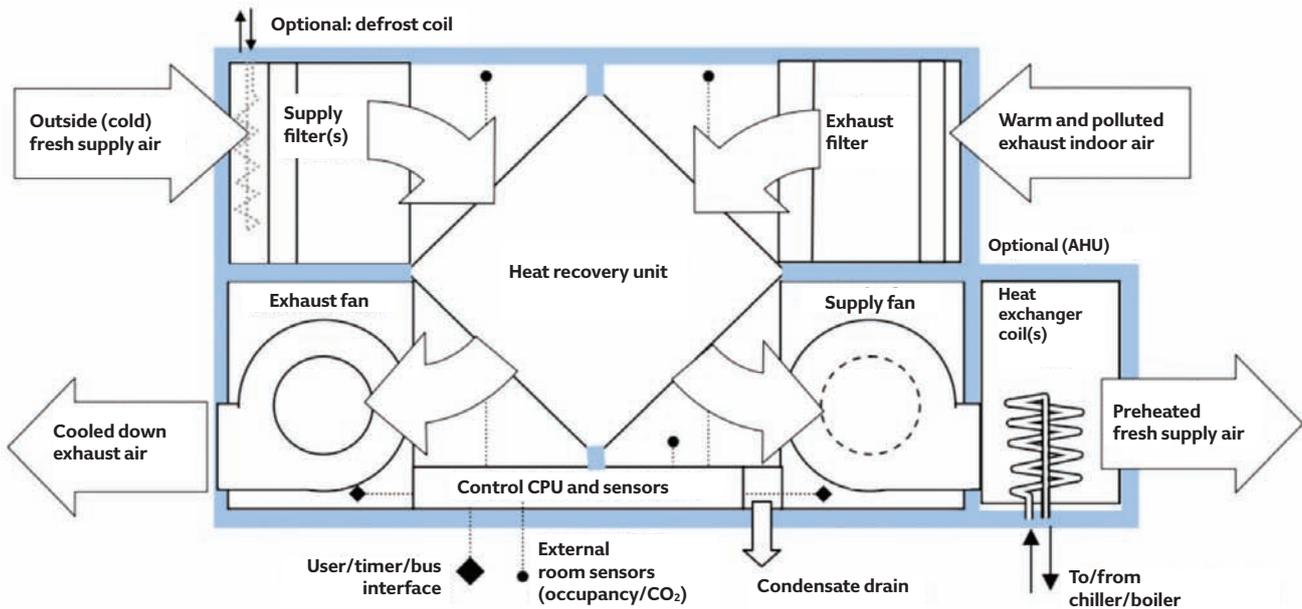


Figure 1: An example of a typical MVHR unit^a

The measure of indoor air quality, in terms of maximum CO₂ levels under any conditions, is now set at 1,500 parts per million (ppm) for mechanical ventilation, and 2,000 ppm for natural ventilation for no more than 20 minutes during the school day. Operationally, the normal target is 1,000 ppm for mechanical ventilation and 1,500 ppm for natural ventilation. The rationale for this is that CO₂ level, in the absence of any other major pollutants, is a reasonable indicator of ventilation performance for the control of indoor air quality in an occupied building. In any case, an increase in normal CO₂ levels has been associated with poor performance – potentially having an adverse effect on the productivity of pupils and teachers.

There are many other contaminants, both particulate and gaseous, that will affect indoor air quality in schools. Some pollutants will be generated through indoor activities such as cooking (particles, carbon monoxide, nitrogen oxides) and cleaning (volatile organic compounds [VOCs]), while others are emitted from building, furnishing and consumer products – such as carpets, adhesives, paints, houseplants and toiletries – particularly when they are new. Some of these, and particularly particulates (for example, PM_{2.5}), may well be introduced into the space through unfiltered outdoor air infiltration and ventilation.

BB93 section 1 was very recently updated, superseding the previous version and the 2013 Acoustic Performance Standards for the Priority School Building Programme, as well as the acoustic requirements of BB101.

It now provides the performance required for compliance with Part E4 of England and Wales Building Regulations – *Acoustic conditions in schools*. Acceptable background noise levels in teaching and learning spaces are defined by the tabulated values of design ‘indoor ambient noise level’ (IANL) to ensure clear communication of speech between teacher and student – and between students – and to allow learning and study activities. If a room is naturally ventilated, the IANL is calculated and measured with ventilators or windows open, as required to meet the ventilation standard. If a room is mechanically ventilated or cooled, the plant is assumed to be running at its normal operating duty.

A design guide is set to accompany the new BB93 in the near future.

Meeting the ventilation need

Traditionally, natural ventilation has been a preferred route to meeting the ventilation needs of schools, employing operable windows and trickle vents or other purpose-made openings. Although natural ventilation may be the right option for appropriately designed new-build projects, it is very likely that many refurbishment projects and some new buildings will require different thinking.

As illustrated in the research underpinning the EU EcoDesign Directive on air-conditioning and ventilation⁷, mechanical ventilation can often provide a more suitable solution for modern buildings that meet local building codes. The reasons cited were:

- Excessive heating loss in natural ventilation

(caused by limited opportunity for heat recovery)

- A healthy indoor climate for the inhabitants can no longer be guaranteed without mechanical ventilation – for example, to achieve adequate levels of ventilation, windows may need to be opened wide for long periods of time, creating additional noise pollution and security issues
- Comfort – for example, inhabitants will not tolerate the cold draughts from natural ventilation, and by blocking air intakes (to reduce draughts) they can create an increasingly unhealthy living environment
- Mechanical ventilation was determined as being economically attractive. For example, in modern well-insulated dwellings, the natural ventilation heat losses can make up more than half of the heat losses.

By considering a number of scenarios – and even applying optimistic values for natural ventilation – the analysis showed payback periods for the mechanical equipment to be well within its operational life.

However, as demonstrated in CIBSE TM57, there are also many applications where natural or hybrid ventilation systems can work effectively in northern European applications.

Application of mechanical ventilation and heat recovery in schools

Mechanical ventilation and heat recovery (MVHR) systems (as illustrated in Figure 1) are already often applied where effective

natural ventilation is not possible, or as part of a hybrid system. MVHR works by extracting vitiated air from inside the school and replacing it with outdoor air. At times of heating need, the system utilises heat from the outgoing air to warm incoming air, via an air-to-air heat exchanger mounted within the MVHR unit.

By January 2016, to meet first-tier EcoDesign requirements for non-residential ventilation units (EU regulation 1253/2014), all such units will also include a ‘thermal bypass unit’ that will operate when heat recovery is not advantageous, such as in summer and times of high room heat gains, where the ventilation is used to provide ‘free’ cooling.

Modern MVHR systems are capable of recovering 85% of thermal energy, and can readily adjust automatically to changing demands within a room. For example, presence detectors may be used to switch the system on when the room is occupied and off again when it’s empty, while CO₂ sensors can be applied to adjust the air supply proportionally to the number of people in the room. This is particularly useful in areas with transient occupation, such as gyms, that are often populated for a few hours during the day and will, otherwise, utilise a continuously running heating and ventilation system.

When appropriately specified and procured to meet relevant standards, MVHR can ensure new schools will meet Building Regulations and the EFA ventilation guidelines, while also improving the predictive energy ratings – Standard Assessment Procedure (SAP) and Energy Performance Certificate (EPC) – as well as the actual operational energy efficiency.

Assuring performance of MVHR products

The energy consumption of an MVHR unit is principally determined by:

- Temperature efficiency – how well it is able to recover heat
- The air velocity in the internal sections of the unit, and so the pressure drop, particularly through the heat recovery unit and filter(s)
- The efficiency of the motor, drive assembly and fan
- The effectiveness of the cooling and heating coils
- The liquid/fluid pressure drop through the heating and cooling coil
- Any effects caused by the installation of the unit.

However, neither BB101 nor BB93 explicitly

identify which standards the manufacturers should follow. A reputable independent product certification process will include the testing of both the mechanical and performance characteristics so that it at least meets the required standards, as well as typically providing additional information that allows more meaningful life-cycle assessments. Such certification physically verifies that manufacturers’ data are correct through independent testing, and only certifies products if they meet the relevant European standards.

Mechanically, this would encompass testing to EN 1886⁹, including such items as: casing strength; casing air leakage; filter bypass leakage; casing thermal performance; and acoustic insulation (by measuring sound insertion loss).

The operating performance, tested as specified in EN 13053¹⁰, would include: available external total pressure; air volume flow rate; electrical power input to the fan motor; heating and cooling coil output; coil pressure losses on the liquid side; heat recovery and air leakage between air streams in the heat recovery device; and duct and casing emitted sound power levels. The performance of some component parts, such as fans and filters, are assured by cross-referencing of EN 13053 with other relevant standards. Others, such as humidifier sections, have specific performance tests included in the standard.

The appropriate calculation and assessment method for ‘specific fan power’ (SFP) necessary to comply with local codes is included in EN 13779.¹¹ This standard also identifies that a filter grade ‘F7’ (or MERV13) results in ‘moderate’ IAQ (99% arrestance and 80-85% efficiency). In some MVHR units, the filtering effectiveness has been compromised by using coarse filters such as G4/MERV6 (90-95% arrestance and 20-30% efficiency) to reduce their SFP. G4 filters provide IAQ that can be below that defined as low IAQ in EN 13779.



Figure 2: An example of an MVHR unit that is constructed to meet appropriate standards (Source: Fläkt Woods)

So an independent product-testing and evaluation process (such as that provided by BSRIA) will assure relevant standards so that MVHR units (such as the unit in Figure 2) are directly comparable, including relative life-cycle appraisals. Such systems can provide an effective solution, both independently and in hybrid systems, to ensure a well-ventilated and productive school environment with a low life-cycle cost.

© Tim Dwyer, 2015.

Further reading:

For a more extensive discussion of the requirements for ventilation in schools, comparison of design solutions and case studies, see the newly-published CIBSE TM57.

References:

- 1 UK Government Priority School Building Programme, www.gov.uk/government/collections/priority-school-building-programme-psbp, accessed 4 May 2015.
- 2 ClassVent and ClassCool: school ventilation design tool, www.gov.uk/government/publications/classvent-and-classcool-school-ventilation-design-tool, accessed 4 May 2015.
- 3 Education Funding Agency (EFA), Baseline designs ventilation strategy – December 2014, www.gov.uk/government/uploads/system/uploads/attachment_data/file/388149/Baseline_designs_ventilation_strategy_Dec_2014.pdf, accessed 4 May 2015.
- 4 EFA, Priority School Building Programme (PSBP), Services Output Specification – June 2013, www.gov.uk/government/uploads/system/uploads/attachment_data/file/276993/psbp_sos_june_2013.pdf, accessed 4 May 2015.
- 5 BS EN 15251:2007 *Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics*.
- 6 Satish, U, et al, *Is CO₂ an indoor pollutant? Direct effects of low to moderate CO₂ concentrations on human decision-making performance*, LBNL 2012.
- 7 <https://circabc.europa.eu/sd/a/eff114ed-8c66-4425-9824-8951f9c5947e/Lot%206%20ENTR%20Ventilation%20units.zip> Task 6, Section 5, accessed 4 May 2015.
- 8 EC ENTR LOT 6, Final executive summary for ventilation systems.
- 9 BS EN 1886:2007 *Ventilation for buildings – Air handling units – Mechanical performance*.
- 10 BS EN 13053:2006 *Ventilation for Buildings – Air handling units – Rating and performance for units, components and sections*.
- 11 BS EN 13779:2007 *Ventilation for non-residential buildings. Performance requirements for ventilation and room-conditioning systems*.

Turn over page to complete module ➤

Module 78

June 2015



1. What is the most recent CIBSE publication on *Integrated school design*?

- A BB101
- B BB93
- C Part E4
- D TM52
- E TM57

2. Which standard will provide guidance on adaptive comfort?

- A BS EN ISO 9001
- B BS EN13053
- C BS EN13779
- D BS EN15251
- E BS EN1886

3. What is the operational target value of indoor CO₂ for mechanically ventilated teaching spaces that will be incorporated into the upcoming BB101?

- A 500 ppm
- B 1,000 ppm
- C 1,500 ppm
- D 2,000 ppm
- E 2,500 ppm

4. What's the maximum thermal energy recovery that would be available in a good-quality modern MVHR unit?

- A 55%
- B 65%
- C 75%
- D 85%
- E 95%

5. What filter grade is able to provide IAQ defined as moderate by BS EN 13779?

- A G2
- B G4
- C F5
- D F7
- E F9

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Aquatech Pressmain introduces energy-efficient AquaSpill pressurisation units



AquaSpill's AS series is designed for large district heating or cooling systems, where high system contents or operating temperatures rule out conventional sealed expansion vessels.

The modularised design means standard configurations of pump, buffer and tank modules can be used. When system temperatures rise, the expanding water is spilled automatically into open-format tanks and, as the system cools, the water is automatically pumped back into it.

● Call 01206 215121

Marflow enhances online information



Marflow Hydronics has improved the product section on its website as a result of customer feedback. Essential information and product comparisons have been made available via the relevant product page, while – for ease of navigation – all the items have been broken down into Marflow Hydronics' four product categories: prefabrication, pipeline valves, control valves and energy valves.

Chris Forbes, managing director, said: 'We intend to keep adding more to the catalogue to ensure it remains a very strong tool.'

● Call 07896 777 207 or email lindsay.woodward@marflow.co.uk



Condair humidifiers for Wellcome Trust

Condair has supplied and installed three Condair HP high-pressure spray humidification systems at Wellcome Trust's headquarters in London's Euston Road. The humidifiers are maintaining the humidity levels in the building's atrium, for the health, comfort and wellbeing of staff and visitors.

Located in three AHUs, the humidifiers provide low-energy, hygienic humidity by introducing atomised sprays of pure de-ionised water into the airstream. These rapidly evaporate to moisten the air and give the desired 50% relative humidity.

● Call 01903 850 200, email uk.info@condair.com or visit www.condair.co.uk

Grundfos in-line to improve performance

Since its launch in the UK in 2003, the TP family of in-line Grundfos pumps has proven itself in a huge variety of applications.

There are many reasons for this success, but a significant part of it is that Grundfos has continued to invest, expand and improve this range of pumps. Today, it offers the ideal solution for applications, including heating and cooling in commercial building services, as well as in industrial processes and water supply systems.

Grundfos has upgraded the electronically controlled TPE family. The new TPE2 and TP3 models deliver efficiencies and a wide range of upgraded intelligent functions that allow for the customisation of their operation to suit customers' specific needs. They frequently eliminate the need for pump throttling valves.

In addition, these models offer configurable relays and analogue inputs, and are supplied complete with wireless multi-pump technology capacity.

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



Knauf SFS speeds construction



The final phase of Crest Nicholson's development of new homes in Portishead, Bristol (pictured above), was built using SFS infill panels from Knauf.

Knauf SFS infill system has advantages over alternative SIPS and traditional SFS systems because it can meet performance specifications for structural, thermal, fire and acoustic levels, and remain competitively priced. It is lightweight, flexible in design, and can accommodate differing external finishes without compromising core performance levels. The SFS can be installed from the inside of the building without the need for external scaffolding.

● Call 01795 424 499 or visit www.knauf.co.uk

EcoMESH offers better cooling

EcoMESH is a unique mesh and water-spray system that improves performance of air cooled chillers, reduces energy consumption, eliminates high-ambient problems, is virtually maintenance free and provides return on investment in one cooling season.

It intermittently sprays water onto a mesh in front of the heat-reduction surface. This reduces power consumption by 30-40% and improves the performance of air cooled chillers, dry coolers and condensers, and refrigeration plants.

● Call 01733 244 224 or visit www.ecomesh.eu





Centre stage for CP Electronics
Vitesse Plus and RAPID lighting control systems – from energy-saving controls firm CP Electronics – have been installed to control the lighting in Newcastle-

under-Lyme College's newly constructed, BREEAM Excellent-rated Performing Arts Centre.

With lighting so key to the centre, CP Electronics' RAPID system was installed to provide each area with the desired level of illumination. It is fully addressable and networkable, combining state-of-the-art technology with a simple graphical user interface.

● Call 0333 9000 671 or visit www.cpelectronics.co.uk



Super-quiet heat pump from Elco

Elco UK has launched Aerotop S – a new air source heat pump that features remarkably low noise emissions of just 46dB(A) and is specifically designed to be sited within a property.

The new heat pump is available in five models (5kW, 7kW, 9kW, 12kW and 15kW), which can deliver COPs up to 4.77. Flow temperatures up to 65°C can be achieved thanks to the use of enhanced vapour injection. Operating noise levels are limited to that of typical household appliances.

● Visit www.elco.co.uk

Mikrofill at Kent nursery

Oaks Nursery is a new building situated on the University of Kent's Canterbury campus. Sussex-based mechanical services consultant Hamson JPA specified Mikrofill LPHW production equipment within its plantroom design. This included two Ethos 50kW condensing boilers complete with Mikrovent low loss header/air and dirt separator and a pressurisation package. The HWS requirement was covered by an Extreme 200-litre loading cylinder and unvented kit. In turn, the loading cylinder encourages maximum boiler efficiency when producing HWS.

● Visit www.mikrofill.com



Center Parcs turns to Jaga heating products

Jaga recommended a combination of the cost-effective Strada radiator and the unobtrusive low-H₂O Mini Canal trench heaters at Center Parcs' £250m village in the 362-acre Woburn Forest, Bedfordshire. The decorative Jaga Twine was also installed in various public reception areas, and the Sentinel LST in numerous stairwells, bathrooms and medical-consultation facilities.

Jaga radiators are compatible with renewable heat sources and their modish design allows them to blend naturally into contemporary surroundings.

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



Atlantic boosts efficiency of university's ring main system

University College London (UCL) has installed new boiler plant in its Torrington Place building. The plant, supplied by Atlantic Boilers, of Lancashire, operates

at 95°C flow and 75°C return, and contributes to the UCL ring main that serves scores of buildings. It leads all other ring main plants running at 95/75°C and raises the overall efficiency. The system was specified by Fowler Martin, of Ingatestone, and installed by Fredericks, of Dartford.

● Email info@atlanticboilers.com or visit www.atlanticboilers.com



BIM in cast iron

Hamworthy Heating has recently added new objects to its BIM library for the Purewell VariHeat cast-iron condensing boiler range.

Available to download free from Hamworthy's website, the latest BIM objects join the recently updated Fleet floor-standing and wall-hung boilers, Wessex ModuMax mk2 boilers, and Dorchester DR-FC Evo condensing water heaters.

Sam Boshier, senior marketing executive, said: 'We have also improved the current BIM objects to make sure they are kept up to the highest industry standards.'

● Call 01202 662 510 or email pr@hamworthyheating.com

Toughest challenge for Ecodan team

Mitsubishi Electric has sponsored a team of four men to complete the Talisker Whisky Atlantic Challenge. The crew will row 4,800km across the world's second-largest ocean in a boat named after one of the company's heating systems, Ecodan.

James Timbs-Harrison, crew member and Mitsubishi Electric heating product manager, said: 'If you take into account the fact that only 500 people have rowed across the Atlantic, but more than 4,000 have climbed Everest, you begin to see how tough this challenge really is.'

● Visit www.allbeansnomonkeys.com



Pegler Yorkshire launches HVAC tool

Pegler Yorkshire, UK manufacturer of plumbing and heating solutions, has created a tool that no HVAC installer should be without. The Tectite Tube Straightener, exclusively supplied by the company, has been launched for 15mm pipe sizes.

The lightweight, handheld tool can be used instead of a pipe decoiler. It leaves installations looking totally professional, while logistical pressures are eased because pipe coils can be used to achieve the same result as straight lengths.

● Visit www.pegleryorkshire.co.uk



Rinnai goes solo

Rinnai, the continuous-flow, gas-fired water heater manufacturer, has introduced the Infinity Solo Re-Circulator water heater.

The Infinity Solo condensing and low-NOX condensing water heater is the first Rinnai product for the UK to combine the technology of its wall-mounted, continuous-flow water heaters with a stainless steel storage cylinder.

The larger Infinity Solo model will act as a high-efficiency alternative to gas-fired storage appliances that exist in today's market.

● Visit www.rinnaiuk.com



Prysmian Group sponsors Hampshire Cricket

Prysmian Group has announced a major sponsorship deal with Hampshire Cricket as part of its programme to support its local community and build international brand awareness.

As part of the sponsorship deal, Prysmian Group played a key role in providing the cable system for the new 171-bedroom four-star Hilton at the club's Ageas Bowl, Southampton. The company's branding will now feature on the Shane Warne stand and on Hampshire's Royal London One-Day Cup playing shirts.

● Call 023 8047 5624 or email jamie.hopkins@ageasbowl.com

Remeha commercial at the Facilities Show

For the latest in heating technology, don't miss the Facilities Show, from 16 to 18 June at London's Excel. Visit Remeha Commercial on Stand M1380 for a sneak peek at the new Remeha Aqua – designed to meet high hot water demand of commercial, residential and industrial buildings. Remeha will also showcase its new CHP range, from 20kWe up to 400 kWe, and condensing boilers, including the Quinta Pro cascade and Gas Eco Pro range.

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



Remeha boilers deliver saving for charity



Remeha Quinta Pro replacement boilers have saved spinal injuries charity Aspire £7,000 in energy costs since they were installed at the Aspire Leisure Centre, in Stanmore, six months ago. Heating contractors PHD Mechanical recommended installing seven Quinta Pro 115kW replacement boilers in cascade. These maintain the water temperature in the swimming pool at a constant 31°C.

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

Daman Tower in Dubai adopts AET underfloor air conditioning

The impressive 52,000m² Burj Daman, in Dubai, was completed at the end of 2013. It is part of the 'Buildings by Daman' project at the Dubai International Finance Centre and incorporates AET Flexible Space underfloor air conditioning.

The AET underfloor systems use the plenum beneath a raised floor as the ventilation duct, eliminating the need for ceiling-based ductwork, potentially reducing the height of new-build construction by up to 10%.

● Call 01342 310 400, email lucy@flexiblespace.com or visit www.flexiblespace.com



S&P UK opens new extension at UK headquarters

S&P, a global manufacturer of fans and ventilation units, has opened a new customer service and accounts office, along with a technical fan test facility, at its UK headquarters on Ransomes Europark, Ipswich.

The building extension – which was officially opened by local MP Ben Gummer (pictured above) on 22 April – represents a significant investment in the local economy and will enable the company's ambitious expansion plans, while providing full-time jobs in the area.

● Call 0845 4700 074, email ahowie@solerpalau.com or visit www.solerandpalau.co.uk



Safety comes first with the low surface temperature radiator from Purmo

The Purmo Safety Radiator is a two-part system consisting of a high-efficiency panel radiator and a highly durable outer casing, easily removed for regular cleaning.

With surface temperatures not exceeding 43°C, it is

perfect for installation in places such as nurseries, hospitals, nursing homes and anywhere that safety is key. It is also highly reliable and comes with a quality guarantee of 10 years.

● Call 0845 070 1090, email uk@purmo.co.uk or visit www.purmo.com/en

Topvex FC a new compact heat recovery unit from Systemair

Topvex FC is a 'plug and play' compact air handling unit with integrated controls and high heat recovery efficiencies.



At nominal airflow, the dry efficiency is >80%. Energy efficient EC fans, combined with low internal pressure drop, secure low specific fan power (SFP) values. Counter-flow heat exchangers are used where it is necessary to separate extract and supply air. The compact construction enables the unit to be ultra shallow. Topvex FC is available in three sizes, with airflow ranges from 0.2-1.00m³/s.

● Call 0121 322 0850, email info@systemair.co.uk or visit www.systemair.co.uk

More design capabilities with Tridonic

Tridonic has reached a milestone in lighting design with the introduction of its DC String LED solution.

The new TALEXengine DC String system supports the trend towards reducing the overall size of LED luminaires to increase design possibilities and make installation easier.

In Tridonic's solution, the AC/DC converter is installed at a higher-ranking location, from where it can supply LED light sources with a total output of up to 150W, without taking up space.

● Call 01256 374 300 or visit www.tridonic.com

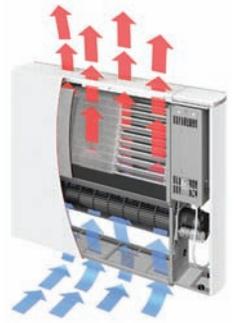


Myson's iVector – a new generation of intelligent fan convectors

The iVector combines all the advantages of a fan convector with a range of new features made possible by using the latest in energy efficient heating technology.

Its high heat output means the iVector is much smaller than traditional radiators, saving valuable space. It is also the quietest fan convector Myson has produced. This – along with its intelligent controls and modern design – makes it one of the most attractive products on the market.

● Call 0845 402 3434, email sales@myson.co.uk or visit www.myson.co.uk



Put Weatherite to the test

Weatherite Group has installed a performance – testing facility at its Midlands manufacturing plant.

The new centre will provide Weatherite's customers with a unique opportunity – the chance to see their chosen cooling equipment in operation before installation.

Being able to view the cooling system in real time from the enclosed viewing gallery will give Weatherite's clients an insight into the system's functionality, allowing them to see how the equipment operates and performs under full test conditions.

● Call 0121 665 2266, email rboswell@weatheritegroup.com or visit www.datacentre-cooling.com



Toshiba and BL Refrigeration join forces

Toshiba Air Conditioning joined forces with installer BL Refrigeration to host a two-day training event for consultants at Toshiba's new training centre in Manchester.

The aim was to provide an update on Toshiba's expanding range of systems and control technology, and develop the joint hosts' support for key specifiers in the Belfast and wider region.

The combined network of 13 Toshiba training centres have the capacity to train around 2,000 engineers each year.

● Visit www.toshiba-aircon.co.uk



PEL's maintenance web portal

PEL Services – one of the UK's providers of commercial fire, security and communication systems – offers an online maintenance web portal to complement its service and maintenance agreements.

The portal enables customers to access unedited information about their accounts from anywhere in the world, in real time, 24/7. It provides them with valuable information – including the products installed, service call reports, maintenance schedules and site attendance details – at a glance.

● Call 0333 123 2100 or visit www.pel.co.uk



PRODUCTS & SERVICES

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Taking a weight off your mind

A Kingspan Insulation report has shown that pre-insulated ductwork – fabricated from the Kingspan KoolDuct system – can provide a weight saving of up to 75% compared with traditional ductwork systems. The insulation core of the KoolDuct panels allows the ductwork to achieve the required thermal performance with an insulation thickness of just 30mm. This is further enhanced by the thin aluminium facing and lightweight coupling options available with the Kingspan KoolDuct system.

● Call +44 (0) 1544 387 384, email info@kingspaninsulation.co.uk or visit www.kingspaninsulation.co.uk



IFSEC launch for Dorma's new access control system

Dorma will showcase its new Matrix Air access control system at IFSEC International 2015.

With this latest addition to its product portfolio, Dorma can provide visitors to the exhibition – being held at London's Excel from 16-18 June – with a multitude of door and access control solutions.

The Matrix Air access control range has the thinnest profile on the market to enhance the aesthetics of a modern interior design scheme, and is hassle-free to use.

● Visit www.dorma.com or follow @DORMAUK

Toshiba launches flagship touch-screen air conditioning controller

Toshiba Air Conditioning has introduced its long-awaited flagship touch-screen air conditioning control solution. The new seven-inch colour touch-screen controller offers unprecedented power and ease of use. It enables engineers and end users – even those unfamiliar with air conditioning – to manage systems and optimise performance and indoor comfort.



With the ability to control up to 64 indoor units via a unique capacitive touch screen, it is a departure from conventional air conditioning controls

● Visit www.toshiba-aircon.co.uk

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Allow us to introduce ourselves

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To find out more contact Recruitment Partner **Heather Douglas** (Ph +64 9 300 9136) or visit www.becabuilding.com

We will be visiting London in June and July so feel free to get in touch.



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[linkedin/company/beca](https://www.linkedin.com/company/beca)



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Mechanical Design Engineer Hertfordshire, £40 - 50k + personal/ company performance bonus

You will be part of a multi-disciplined team working on large scale data centre builds, a top 5 University £50m project and projects with FT 100 companies. Involved in concept/feasibility stage, conduct initial and detailed designs, HVAC calculations and liaison with architects, clients, structural engineers and contractors. Opportunity to progress and lead projects. BAR2038/MO

Mechanical Design Engineers London, £44p/h

Two Mechanical design engineers are required to join a growing consultancy that is celebrating a 25% profit increase in the last 6 months. You will be working on prestigious projects valuing around £120m M&E in London. To be considered you must have 10 years consultancy experience and be fluent in the use of Hevacomp. BAR2634/MA

Electrical Design Engineers London, £38 - £50K + benefits

You will be working on large scale UK and international projects across the rail, infrastructure and stadia sectors. With over 5 years' experience and preferably working towards chartered status this is an opportunity to join one of the world's leading consultancies on high profile globally recognised projects with excellent opportunities to progress to Principal / Associate level. BAR2579/CB

Senior Public Health Engineer London, £45k - £49k + benefits

We are working alongside an international award winning multi-disciplinary consultancy who have worked on some of the most high profile and innovative projects both in the UK and across the globe. This a great opportunity for a driven and well-presented engineer to continue their progression and development and to expand their project experience on varied and technically challenging projects. BAR 2553/JA

Senior Electrical Engineer London, £38 - £40 p/h

BAR are currently working alongside a well established building services consultancy with a global presence and reputation for project delivery and engineering excellence across a range of sectors including Residential, Commercial, Data Centres and Hospitals. The role at hand will be working on specific hospitals, pharmaceutical and laboratories projects. You will be expected to utilise previous healthcare project experience to hit the ground running. BAR2665/KB

Senior Electrical Engineer Dubai, To 35000 AED PCM + benefits

We are currently working alongside one of the largest building services consultancies with a global presence and reputation for project delivery and engineering excellence across a range of sectors including Residential, Commercial, Data Centres, and Hospitals. BAR2606/OE

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**Project Director - Mechanical
Hampshire, nr Aldershot**
£65,000-£70,000 Plus Benefits

A multi-disciplined engineering consultancy is looking for a mechanically bias project director to work out of their modern offices in Hampshire, to lead a team of mechanical building services engineers. This company are renowned in the industry for working on some of the most prestigious projects in the world, adopting pioneering techniques whilst employing some of the best engineers available. This is a great opportunity to lead a team on well publicised projects.

**Principal Mechanical Design
Engineer
Warrington**
£42,000-£45,000 Plus Benefits

A fantastic opportunity has arisen for a mechanical design engineer to join a building services consultancy that is growing at an exponential rate. With the office having secured a substantial project workload for the next two years, you will lead and mentor a team of junior and intermediate engineers, as well as provide a full project management function. This consultancy can offer one of the best remuneration packages in the sector, with the opportunity to be promoted to a very senior level with the growth of the office.

**Senior/ Principal Mechanical &
Electrical Engineer
Birmingham**
£45,000-£50,000 Plus Benefits & Car Allowance

An award winning multi-disciplined engineering consultancy is looking for Senior/ Principal engineers to join their expanding team in Birmingham. This consultancy is renowned for working on some of the most famous projects in the UK, and you will help lead project design teams on similar projects. This is a great opportunity for someone looking to work in an exciting environment within a dynamic team.

**Revit Technician
Liverpool**
£25,000-£35,000 Plus Benefits (DOE)

An up and coming building services consultancy is looking for an experienced Revit MEP technician to join their office, based in the heart of Liverpool. You will be working with a team of leading engineers boasting many years of experience, and you will have the ability to build your own team around you.

**Mechanical Associate
Leeds**
£50,000-£55,000 Plus Benefits

A well-known building services consultancy operating in Yorkshire and the North East is looking for an associate within their Leeds office. Being of a mechanical bias, you will be an expert in healthcare projects looking to help build this office. Possessing strong leadership skills you will lead your own team and go out and win new business to keep the orderbook full with exciting and innovative projects.

**Principal Electrical Design
Engineer – 12 Month Contract
Newcastle**
£35 to £40 per hour (Ltd)

One of the most instantly recognisable names within the industry has won a selection of exciting and innovative hotel and leisure projects throughout the Middle-East. If you have experience leading projects within these sectors, you have the opportunity to secure a position with one of the best!

**Principal Mechanical Design
Engineer
London, Holborn**
£55,000 Plus Benefits & Car Allowance

An award winning engineering services consultancy with offices in the Holborn area is recruiting a Principal Mechanical Engineer to lead commercial and mixed use projects in Central London. This consultancy is renowned in the commercial office fit out industry and boast an enviable client base. This role comes with the opportunity to be promoted to Associate within 6 – 12 Months.

**Associate Director - Electrical
Hertfordshire**
£60,000 Plus Benefits Package

A well established engineering consultancy with an office in Hertfordshire is looking for an Associate Director to lead MEP Building services projects. This is a challenging and rewarding role, where you will be given full autonomy to manage projects and deliverables whilst managing your successful electrical team. Candidates will ideally have experience in the residential, commercial and leisure sectors.

**Lead/Senior Mechanical Design
Engineer – 18 Month Contract
Warrington**
£38 to £42 per hour (Ltd) plus accommodation

One of the country's leading building services consultancies is looking to recruit a Lead/Senior Mechanical Design Engineer, to work on a range of AWE/MOD and Commercial projects. With a predicted 18 months' worth of work, and a package including travel and hotel if you need to relocate, this is a rare and exciting opportunity for the right person.

**Senior Mechanical Design Engineer
(Critical Systems)
City of London**
£50,000 Plus Benefits

An international multi - disciplined engineering consultancy is looking for a Senior/ Principal Mechanical engineer to join their specialist critical systems group in London. Highly regarded in the industry, this consultancy works with renowned companies in the banking, insurance and internet industry. An award winning employer with a reputation for being a first class place to work!

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For more information about any of these positions, please contact george@conradconsulting.co.uk or call **0203 1595 387**

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STUDENT LEADER

The National Union of Students, which reaches more than 300,000 students across the UK, is driving the green agenda in the education sector. Its head of sustainability, **Jamie Agombar**, explains



Over his 10-year career at the NUS, Agombar has helped to develop strategic partnerships that resulted in more than £10m of grant-funded sustainability projects delivered by the organisation.

Agombar was responsible for greening the students' union supply chain through its purchasing consortium, before developing NUS Services' supplier assessment and development process, and – more recently – Green Impact and the Students' Green Fund.

From its BREEAM excellent HQ, the NUS now delivers individual and institutional sustainability projects into 100 universities and colleges, embedding education for sustainable development into curriculums.

What initiative are you promoting at the moment?

NUS runs three main national programmes for students and staff. Green Impact is our departmental environmental accreditation scheme run at 64 universities and colleges, comprising 1,120 teams and departments, reaching 50,000 staff. Student Switch Off is our inter-dormitory energy competition for 60 universities, engaging students in 130,000 hall bedrooms. And Student Eats has set up organic allotments and polytunnels at 30 universities and colleges to reconnect students with their food. In addition, the £5m Students' Green Fund helps students provide leadership on sustainability issues.

What has been your most effective campaign?

All our campaigns are impactful because we spend time evaluating

If you are going through a moment of change in your life, it's the perfect time to break old habits and form new ones

them. Student Switch Off has saved £1m worth of energy for universities since we set it up. Through Green Impact last year, teams and departments completed 70,000 greening actions – 40,000 as a result of the scheme. We tend to run pre- and post-intervention attitudinal and behavioural surveys, and we regularly shift target behaviours with swings of 15%. We also run Snap it Off, which allows students to upload photos of lights that are on unnecessarily in the daytime. This provides a way for universities, train operating companies and local authorities to check their time clocks and sensors, while empowering and motivating students to take action.

Is it important to engage with students about sustainability?

According to the habit discontinuity hypothesis, if you are going through a moment of change in your life, it's the perfect time to break old habits and form new ones. The transition to independent living – when students leave home for the first time to go to university – offers the perfect opportunity to instil pro-environmental attitudes, behaviours and habits, ensuring that cohort after cohort of students leave university being able to live sustainably.

Do you work with energy managers at colleges?

We work closely with estates teams in colleges and universities; they provide us with funding to engage the students and staff on their campuses. Through Green Impact, we help them to develop an institution-specific workbook that creates a framework for staff to green their workplaces. We also work with them to ensure Student Switch Off

helps them with carbon targets, and Student Eats supports their landscape and grounds teams and strategies.

How do you ensure graduates continue with this mindset?

It is great to see many students we have worked with go on to positions of authority in business, education and politics, and progress sustainability as part of their jobs. We know from our NUS/Higher Education Academy survey that more than 60% of first-year students want to learn about sustainability, and more than half would sacrifice £3k from their starting salary to work for a company that is environmentally and ethically sound. We are just completing a new survey of employers to see what sustainability skills they may need from graduates in the coming years.

What sustainable features are in your Gray's Inn building?

We have tried to make our London office as green as we can, with solar PV on the roof, solar hot water, air source heat pumps, rainwater harvesting and voltage reduction. We also have a native green wall and the UK's first pay-per-lux, cradle-to-cradle lighting system that we developed with Philips. We rent the LEDs over 15 years, with Philips having a financial incentive to help us minimise energy use through good practice. The result is we have £120k of state-of-the-art LED lighting and controls, including a lighting management system – something we would not have been able to afford if we had to pay for it upfront.

● **JAMIE AGOMBAR** is head of sustainability at the NUS

Events & training

NATIONAL EVENTS AND CONFERENCES

Facilities Show 2015

16-18 June, ExCel, London
Visit CIBSE on stand R990, where members of the certification team will be available, with the CIBSE Facilities Management Group, to provide a wealth of advice and knowledge on building services and energy management.
www.facilitiesshow.com

CPD TRAINING

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

Energy surveys

3 June, London

Overview of current fire legislation

4 June, London

Wiring regulations (incl. update applicable 1 July)

4 June, London

Inspection and testing of electrical installations

5 June, London

Energy strategy reports

11 June, Manchester

Variable flow water system design

11 June, London

Air con - understanding psychrometric charts

16 June, London

Preparing FM and maintenance contracts

16 June, London

Energy building regulations: Part L

17 June, London

Lighting design: principles and application

19 June, London

Mechanical (HVAC) services explained

23-25 June, London

Building services explained

24-26 June, London

Fire detection and alarm systems

25 June, London

Energy management system 50001 (ESOS-compliant)

26 June, London

Electrical services explained

30 June - 2 July, London

ENERGY ASSESSOR TRAINING

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

LCC Design (EPC training)

2-3 June, London

CPD Writing an air conditioning report

8 June, Birmingham

Air conditioning inspectors training

15 June, London

LCC Design (EPC training)

15-16 June, Birmingham

Energy Savings Opportunity Scheme (ESOS)

22 June, London

LCC Operations (DEC training)

23-25 June, Manchester

LCC Operations (DEC training)

1-3 July, London

CPD Lighting and energy efficiency

7 July, London

Energy Savings Opportunity scheme (ESOS)

13 July, London

CIBSE GROUPS, REGIONS AND SOCIETIES

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

ANZ Region - NSW Chapter: Shedding some light on illumination challenges

2 June, Sydney

An evening seminar to coincide with the Vivid Light Festival.

SoPHE award presentation and AGM

2 June, London

AGM, with a presentation of the winning SoPHE 2014 Young Engineers Award project.

Institute of Local Exhaust Ventilation Engineers AGM

2 June, East Midlands

www.cibse.org/ileve

WIBSE: Peer-to-peer mentoring - how to be heard

3 June, London

With speaker Sarah Davis.

Yorkshire Region: Lean and BIM - why 30% savings are within reach

4 June, Leeds

Combining lean construction thinking and BIM on projects can enable big reductions in time, cost, waste and stress. Martin Brown will discuss how achieving the 30% construction strategy cost-saving target is within reach.

Merseyside & North Wales Region: Annual golf day

5 June, Southport

East Anglia Region: Golf day

5 June, Bury St Edmunds

Southern Region: Yacht rally 2015

6 June, Portsmouth

The event is open to all connected with building services and will take place in the eastern Solent, following a challenging course from around the Cowes area to Portsmouth Harbour.

WIBSE role-model series: Part 2

8 June, Glasgow

CIBSE membership briefings

10 June, Gamlingay

11 June, London

These briefings will focus on applications for the Associate and Member grades, and Registration with the Engineering Council at Incorporated Engineer and Chartered Engineer levels.

www.cibse.org/briefings

IPL International Year of Light lecture

10 June, London

Lecture by IPL in celebration of the Unesco Year of Light.

Yorkshire Region: What has building physics done for us?

18 June, Leeds

With speakers Susie Diamond and Claire Das Bhaumik, from Inking. Bring your questions.

NW Region: Building services cost drivers

18 June, Manchester

A YEN event, with presentation by Turner & Townsend.

HCNE Region and SLL: Computer-aided daylight planning

23 June, London

A seminar by Friedrich Bremecker, from DIAL, on measurement and calculation for computer-aided daylight planning.

WIBSE - Leadership part 3: what kind of leader are you?

24 June, Manchester

With speaker Imelda O'Keefe.

WIBSE - Personal effectiveness: dealing with stress

25 June, London

With speaker Dr Helen Zarod, executive and personal performance coach, NLP practitioner.

Hong Kong Branch: Joint symposium: Building Technologies - An Epoch of Enlightenment

26-27 June, China

CIBSE Hong Kong Branch, ASHRAE, HKIE and the Polytechnic University of Hong Kong, join forces to host a two-day symposium to promote the development of building services engineering between mainland China and Hong Kong SAR.

ANZ NSW Chapter: Staying alive - infection control

7 July, Sydney

Building Performance Awards 2016 launch

M&G Real Estate, winner of the 2015 Carbon Champion of the Year award, will help launch this year's Building Performance Awards with an event at its London premises on 9 June.

Hywel Davies, CIBSE technical director, will announce the new categories for 2016 and will provide an insight into what the judges will be looking for in the entries.

Nina Reid, responsible property investment director at M&G Real Estate, will present the firm's shopping centre portfolio, which earned them the title of carbon champion in 2015.

Places at the event are limited and you will need to register if you would like to attend. For more information, visit www.cibse.org/events

For those who don't make it, visit www.cibse.org/bpa for more information on the Building Performance Awards, including a full list of 2016 categories and entry criteria. Don't miss your chance to showcase your projects and get the recognition they deserve.



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The CIBSE Building Performance Conference and Exhibition will empower the industry to deliver better building performance from design through to operation by combining the knowledge and skills of the industries foremost leaders together with best practise examples and the most up to date legislative guidance.

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- Keynote speakers informing and debating on the issues facing building services including lighting performance & wellbeing, cyber security, BIM, legislative changes, resilience to climate change and new innovations.
- Best practice case studies from the 2015 CIBSE Building Performance Award winners

3-4 November
2015
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Westminster, London



www.cibse.org/conference

For more information please contact the event organisers on 01892 518877 or email

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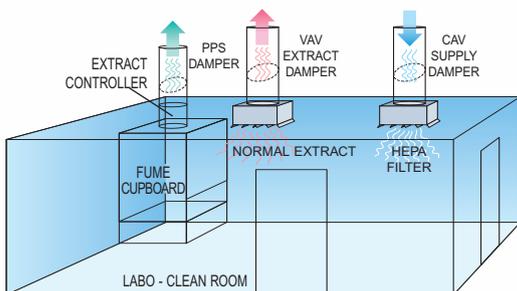


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Accurate air flow measurement with the unique CMR Venturi built into the airtight shut-off damper to control room pressure or constant volume.



Metal Damper

PPS EXTRACT DAMPER

Poly-propelene control and shut off valve incorporating the CMR Venturi Nozzle. This is essential when dealing with corrosive extract air especially from fume cupboard systems.



PPS Damper

PRECISION COMPONENTS FOR VENTILATION AND PROCESS CONTROL

CMR CONTROLS

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