CIBSE JOURNAL

CIBSE

The official magazine of the Chartered Institution of Building Services Engineers

November 2016

PLAIN SAILING

Portsmouth HQ flies the flag for Sir Ben Ainslie's America's Cup challenge

SOUND PRINCIPLES
Acoustic design hits right note in music venue

HEAT OF THE DEBATE
Decarbonising the UK heating supply

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Cover image: Harry KH/Land Rover BAR

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Change of tack

Brexit might mean Brexit, but as far as emissions are concerned, leaving the EU doesn't affect Britain's requirement to meet carbon reduction targets set out in the 2008 Climate Change Act. This commits the UK to reducing emissions by at least 80% in 2050 from 1990 levels.

This target was based on advice from the Climate Change Committee (CCC) report *Building a low-carbon economy* and, last month, the CCC published a new report – *Next steps for UK heat policy* – that considers the best ways of decarbonising the heat used in our buildings. The report concludes that a combination of hydrogen, heat pumps and heat networks will help deliver the necessary cuts in carbon. However, it concedes that there are plenty of barriers to overcome, including the development of large-scale carbon-capture and storage technology if hydrogen is to succeed.

Our debate on page 34, between consultant Phil Jones and WSP Parsons Brinckerhoff's Barny Evans, offers some excellent insight into the issues around each technology. One thing is clear – it's not an electricity versus gas debate. It's much more nuanced than that; for example, the gas grid is still likely to be an important part of our heat energy mix, but it will be carrying decarbonised gas in the form of hydrogen or biomethane.

> One thing is clear – it's not an electricity versus gas debate. It's much more nuanced than that

The CCC report warns that the targets will not be met unless we improve the energy efficiency of existing and new buildings. One standard bearer of energy efficiency is the headquarters building of the Land Rover BAR sailing team, which is taking part in the America's Cup in Bermuda next year. The team was founded by multi-Olympic gold medal winner Sir Ben Ainslie, and he has put sustainability at the heart of his challenge – not just in terms of energy use and resource efficiency, but also when it comes to giving local people opportunities to work in marine technology, and in promoting STEM subjects as widely as possible to young people.

The new HQ building in Portsmouth encapsulates the team's philosophy, with natural ventilation to the main workshop, extensive use of renewables, and provision for adding seawater cooling and CHP in the future. What you can't see is how quickly the building had to be designed and built, and this could only be achieved in time for the first America's Cup heats through close collaboration between the team members, and extensive use of BIM. It's a good sign for the team's chances next year.

Alex Smith, editor
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NEWS

All the latest news from around the building industry

MAX FORDHAM ENGINEERS' SOUND AND VISION FOR RIBA PRIZE WINNER

Building engineers at Max Fordham played a key role in the design of this year's RIBA Stirling Prize winning building. Damien Hirst's Newport Street Gallery, in Vauxhall, London, was designed by architects Caruso St John to house the artist's private collection.

Max Fordham designed the environmental engineering, the acoustics and lighting for the refurbishment of three listed former theatre-scenery workshops and the addition of extensive gallery space. The building's saw-tooth roof was positioned to allow indirect sunlight into the galleries, and natural daylight was used wherever possible. However, the roof design also meant most of the M&E plant had to be installed in the basement.

The building is next to a busy railway, so particular attention had to be paid to the acoustic design, with high-performance sound insulation and low-noise air conditioning used.

Digital tech not big in construction

Building engineering companies are not taking full advantage of digital technologies, according to accountants KPMG. Its Global Construction Survey 2016 found that just 8% of respondents could be described as 'cutting-edge visionaries' and only about 20% were radically changing their business approach as a result of digital tech – primarily, they say, because they lack the necessary skills and resources.

KPMG analyst Geno Armstrong suggested most firms were 'content to follow rather than lead'. 'Many lack a clear technology strategy, and either adopt it in a piecemeal fashion, or not at all,' he added.

Spanish star hits Vegas jackpot

Antoni Sapina Grau has been crowned CIBSE ASHRAE Graduate of the Year 2016. Grau, who works for WSP Parsons Brinckerhoff, is the 21st winner of the annual award and the first Spanish graduate to secure the top prize. He wins a trip to the ASHRAE Winter Meeting, which next year takes place in Las Vegas.


Antoni Sapina Grau

Grau completed his MSc in building services engineering with sustainable energy at Brunel University, London, having completed a BEng in architectural engineering at the Polytechnic University of Valencia. He is a qualified Breeam Associate and Low Carbon Consultant, and was part of the team that won this year's Teambuild Construction Competition.

Atkins' Katie Ewing, who graduated from the University of Bath, was runner-up in the competition, with Scott Mason, of Lochinvar and the University of Northampton, in third place. The other finalists were Samantha Carlsson, Cardiff University and Hoare Lea; Richard Garthwaite, the Royal School of Military Engineering; Monica Madrigal, Universidad Politécnica Madrid/ Foster & Partners; Farai Mwashita, Loughborough/Hilson Moran; and Samima Saqib, Heriot-Watt (Dubai).

Ewing received £500 and Mason £300 from The Rumford Club, while the Manly Trust made a presentation of £100 to each of the other five finalists.

The graduate prize was part of the CIBSE Young Engineers' Awards – including the Employee of the Year awards – held at the Institution of Mechanical Engineers last month. To find out the winners, see page 15.

Movers and makers

Send your job moves to **editor@cibsejournal.com**

Philips appoints Nicholl

Philips Lighting has named David Nicholl as its CEO for the UK and Ireland. He succeeds Peter Maskell, who will be retiring at the end of this year. Nicholl joins from Rockwell Automation, where he was country director for the UK and Ireland, having previously spent 13 years with Schneider Electric, where he held senior positions in the UK, Romania and Sweden.

Dickinson moves to TSP Projects

John Dickinson has been appointed business development director of TSP Projects, based in Manchester. He has held senior operational and business development positions with Aecom and, most recently, Hoare Lea. A chartered electrical engineer, Dickinson has 30 years' experience in sectors such as health, education, rail, process chemicals, pharma, commercial and retail.

Rehau appoints Ng

Rehau has appointed Vincent Ng as specifications manager, specialising in heating and cooling systems, including underfloor heating, thermally activated building structure (TABS) and chilled ceiling solutions. Based at the Rehau hub at the London Building Centre, Ng will advise on integrating the firm's systems into new-build and refurbishment projects. He will also deliver Rehau's RIBA- and CIBSE-accredited CPD seminars to specifiers.

Act now to secure future of UK heat, report warns MPs

● **Politicians must decide what role hydrogen will play in hitting climate targets**

Hydrogen could be used instead of natural gas to heat UK homes, according to a Committee on Climate Change (CCC) report.

Next steps for UK heat policy, published last month, identified replacing natural gas in the UK's grid as one of the main options for decarbonising heat supplies.

The committee also said heat pumps and heat networks could, potentially, be the biggest generators of low carbon heat. It said heat pumps would be most suitable for areas that are off the gas grid, while heat networks are suited to cities. They can use waste heat, large-scale heat pumps that draw warmth from rivers and, potentially, hydrogen, said the CCC.

According to the report, policy needs strengthening now to increase the implementation of low carbon measures in the next decade. The CCC's scenarios include around a 15% reduction in energy used for heating existing buildings by 2030, through efficiency improvements.

Lord Deben, CCC chair, said: '[Improving energy efficiency] has to be done if you are going to meet your targets... It is for government to decide the mix between regulation and incentives.'


CCC chair Lord Deben

The government will have to decide what role hydrogen will play by 2025, if it is to implement its chosen plan in time to hit its 2050 climate targets, the CCC said.

Hydrogen could be produced using spare renewable electricity from biofuels or from fossil fuels. For the latter to represent a low carbon fuel source, the carbon dioxide would need to be disposed of using carbon capture and storage (CCS) technology – but ministers cancelled a flagship CCS policy abruptly last November.

Distribution grid owner Northern Gas Networks has proposed the use of hydrogen, which would require new household appliances, but could be distributed in existing gas grids. It has drawn up plans to convert the city of Leeds to run on hydrogen, as a precursor to a £50bn national rollout.

The government has earmarked £320m for investment in heat networks up to 2020. And to decarbonise heat using heat pumps alone, the current 20,000 installations per year would need to rise 50-fold, to one million, from the mid-2030s, the CCC said. It would also require investment in additional zero carbon electricity-generating capacity.

CIBSE CHP/District Heating Group chair, Phil Jones, said: 'This is a significant change – almost a U-turn – from the single magic bullet of 100% electricity and heat pumps, which was the policy thinking over the past five years. Now we need to install heat networks with even stronger local planning to integrate them into the built environment.'

Read our 'future of heat' debate on page 34.

'Get a move on' with energy storage and demand response, ministers told

The UK government has been advised to give as much support as possible to energy storage and demand-response innovation, at the expense of new power generation.

In the final report produced by the Energy and Climate Change Committee (ECC), ministers were urged to redesign the UK's Capacity Market to send out a 'clear signal' that demand response is a preferred option to diesel generation plants. They were also advised to remove the regulatory barriers faced by energy storage quickly.

'The government must get a move on and encourage the energy market to embrace smart technological solutions such as energy storage and demand-side response,' said Angus MacNeil, chair of the committee, which has now been disbanded following the closure of the Department for Energy and Climate Change (DECC).

'There is an incredible opportunity for the UK to become a world leader in these disruptive technologies. Yet our current energy security subsidies favour dirty diesel generation over smart, new, clean tech solutions,' he added.

'Getting demand response right will empower consumers, reduce bills, ease pressure on the grid, and lower carbon dioxide emissions.

'Energy storage is a vital keystone in building a clean electricity system. It will mean we won't have to wait for the sun to shine or the wind to blow to get our energy from renewables.'

In brief

HEAT NETWORK FUNDING ON OFFER

The government has released the first part of a £320m fund to upgrade heating in towns and cities using networks supplying low carbon and recycled heat.

The Heat Networks Investment Project (HNIP) will be rolled out over five years to help build more networks and improve the efficiency of existing low carbon schemes in England and Wales – but it is kicking off with a £39m pilot project.

The department for Business, Energy and Industrial Strategy said heat networks could reduce heating costs – in some cases by more than 30% – by recycling waste heat from factories, power stations and even the London Underground, as well as CHP and biomass schemes.

For details of how to apply for the HNIP pilot project finance, visit **hnip.salixfinance.co.uk**

SOLAR POWER OVERTAKES COAL

The UK generated more energy from solar power than coal-fired power stations in the past six months. Analysts Carbon Brief said an estimated 6,964GWh of electricity was produced from solar cells, 10% higher than the 6,342GWh generated by coal, and equivalent to solar providing 5.2% of UK electricity demand, compared to 4.7% for coal.

The researchers did point out the significant seasonal effect, with less demand for energy in the spring and summer months. Solar power generation overtook coal for the whole month of May and for a whole quarter from June to September.

SHAPE UP TO GET THE MOST EFFICIENT BUILDINGS

Energy demand in new homes could be halved if more focus is put on the shape and form of housing, claims the NHBC Foundation. Its latest report shows that, for the same floor area, mid-floor apartments may have less than half the energy demand of detached homes and bungalows. Further improvements in energy efficiency can be demonstrated for simply-shaped – rectangular, rather than 'L' or 'T' shaped – buildings. For more details, visit **www.nhbcfoundation.org**

Client satisfaction hits new high

More projects are being finished on time and to budget, according to a new survey by the research group Glenigan.

Its 2016 UK Performance Report for the CITB included feedback from more than 1,000 people involved in projects completed in 2015. The results showed positive scores against most key performance indicators (KPIs), including the fact that 64% of projects came in on budget, an 8% improvement on 2014.

Overall satisfaction with the finished product was rated at or above eight out of 10 by 85% of clients, while contractor satisfaction with the performance of their client and consultancy teams also rose, to 74%.

However, rising labour and material costs meant industry profitability took a dip, from 2.8% to 2.5%.

IAQ expert offers 'smart' answers

The world-renowned indoor air quality (IAQ) expert Max Sherman will address a UK seminar and webinar on 9 November, starting at 6pm.

The senior scientist at the Lawrence Berkeley National Laboratory, in California, will be speaking live from the US about the challenges engineers face when trying to balance a healthy IAQ with lower HVAC power and energy consumption.

The event – being hosted by the Building Engineering Services Association (BESA) and organised by the CIBSE ASHRAE Group – is free to attend.

Sherman, an ASHRAE Distinguished Lecturer, is a board member of the Air Infiltration and Ventilation Centre, an annex of the Brussels-based International Energy Agency. He believes a more harmonious relationship between IAQ and energy consumption can be achieved by being 'smarter' about how and when ventilation occurs.

The session will be chaired by BESA technical director Tim Rook, and a limited number of 'physical' places are available in London for anyone wanting to join the discussion in person. For more details, email: **ewenrose@btinternet.com**

Construction must reform its 'dysfunctional training'

- **Report proposes levy on those who don't commission in a 'more responsible way'**

SPEEDKING2 / SHUTTERSTOCK

Clients should be penalised if they employ contractors who fail to invest in training and research and development, according to a hard-hitting, government-commissioned report.

According to the Farmer Review of the UK Construction Labour Model, the industry has a 'dysfunctional training model', lacks innovation and collaboration, and faces 'inexorable decline' unless drastic changes are made.

'If you buy a new car, you expect it to have been built in a factory to exacting standards, to be delivered on time, to an agreed price and to a predetermined quality,' said the author, Mark Farmer. 'This needs to happen more in construction, so that the investors, developers or building owners hiring construction firms dictate the use of modern methods of delivery and invest appropriately in the skills agenda.'

There are more similarities between manufacturing and construction than people are led to believe, said Farmer, who proposed a levy on clients equal to 0.5% of a scheme's construction cost, which could be avoided by commissioning in a 'more responsible way'.

'Carrying on as we are is simply not an option,' he added. 'With digital technology advancements in almost every other industry, and with the construction labour pool under serious pressure, the time has come for action.'

DESIGNING TO EXTREMES IN CENTRAL ASIA

Aecom has designed the services for a university campus in the Krygyz Republic that experiences temperatures ranging from -30°C to 30°C. The University of Central Asia campus opened last month in Naryn, which – as well as having extreme weather – lies in a seismically active, mountainous region, isolated from the rest of the country. Aecom developed a ground source heating and cooling system, which uses the aquifer beneath the campus as a low-grade energy source. Local people usually resort to burning coal or dried animal waste in the winter because of the lack of infrastructure and utilities.

Cities' energy independence vital

Arup has advised city governments to take more responsibility for their energy, in a report for the 23rd World Energy Congress. The global engineering consultant said local authorities could not afford to rely on centralised energy generation and should take greater control to meet demand, as cities expand to consume more than 50% of the world's power.

Arup said new technologies, innovative financing mechanisms and political changes were opening up opportunities for cities to secure their own energy using developments such as advanced power electronics, smart metering and local generation.

It urged urban planners to invest in 'transactive energy', which combines economic and control mechanisms. This would allow cities to develop more integrated and lower-cost networks, capable of handling a much greater share of renewable sources, as well as district heating and hydrogen gas networks.

In brief

WSP ACQUIRES MOUCHEL CONSULTING

Kier Group has sold its Mouchel Consulting arm to WSP Parsons Brinckerhoff for £75m.

Kier acquired the Mouchel Group in June 2015, for £265m, but announced earlier this year that it intended to dispose of the consultancy part of the business, which employs around 2,000 staff.

Last year, Mouchel Consulting reported £125m in revenue and an operating profit of £8m. Its gross assets were valued at £29m.

FLÄKT WOODS AND DENCOHAPPEL JOIN FORCES

Air movement specialist Fläkt Woods has merged with the air conditioning and filtration manufacturer DencoHappel. The combined company, which will operate under the FläktGroup name, is owned by Triton.

In 2015, the companies had combined revenues of €700m and employed 3,800 people.

SWEGON BUYS RUSKIN

Swedish indoor climate control manufacturer Swegon has acquired air distribution, fire and smoke control, and ventilation manufacturer Ruskin Air Management from Johnson Controls International.

Ruskin has operations in Whitstable, Kent, and Bridgnorth, Shropshire, and the company employs 220 people.

'This acquisition gives us a very strong local presence and identity in the UK, through the well-known Ruskin brands,' said Swegon CEO Hannu Saastmoinen. He added that Swegon was also gaining a new area of 'competence' through Ruskin's 'extensive fire and smoke product knowledge'.

'As a long-term industrial investor, our aim is to reinforce and further develop the local manufacturing base in Whitstable and Bridgnorth,' said Saastmoinen.

Ruskin managing director Kevin Munson said the deal was 'a perfect match'.

HFC deal hailed, but critics say it's too little too late

Accord could help to prevent half a degree of warming

Almost 200 countries have signed an agreement in Rwanda to reduce the amount of global-warming refrigerant gases used in air conditioning systems.

The complex Kigali Agreement is an amendment to the Montreal Protocol and states that developed countries will begin removing HFCs from use in 2019. Developing countries will start to restrict use in 2024 and begin reductions in 2029 – although, confusingly, this second category includes China, which is the world's largest manufacturer and consumer of HFCs.

Several other countries – including India, Kuwait, Pakistan, and Saudi Arabia – will cap consumption in 2028 and start making cuts in use in 2032.

The agreement was hailed by US President Barack Obama and his Secretary of State, John Kerry, but it was labelled a 'fudge' by some scientists, who said it would start too late to make any real difference to global warming.

As the use of air conditioning has increased worldwide, so consumption of HFC gases has soared, but climate change campaigners say their use threatens the aims of the Paris Agreement, signed last year by 195 countries. The global-warming potential of HFCs is thousands of times greater than carbon dioxide.

President Obama called the deal 'an ambitious and far-reaching solution', and Kerry called it 'a monumental step forward'. However, UK negotiator Clare Perry, of the Environmental Investigation Agency, said 'compromises had to be made'.

She pointed out that 85% of developing countries had committed to the early schedule, starting in 2024 – 'which is a very significant achievement' – adding that 'according to our initial calculations, this deal will avoid more than 70 billion tonnes of CO_2-equivalent emissions by 2050, which will be close to avoiding a half a degree of warming'.

PHOTOHOUSE / SHUTTERSTOCK

BRA insists flammable gases will be needed to achieve F-Gas targets

The European F-Gas Regulation, enacted to reduce the amount of global-warming gas in the atmosphere, will not be workable unless increasing amounts of flammable alternatives for air conditioning and refrigeration projects are used, claims the British Refrigeration Association (BRA).

Its president, John Smith, told a briefing at the British Library that to achieve the 'significantly lower' global warming potential (GWP) targets in the legislation, the industry must 'face up to the need to make use of these fluids and understand the implications [of using flammable substances]'.

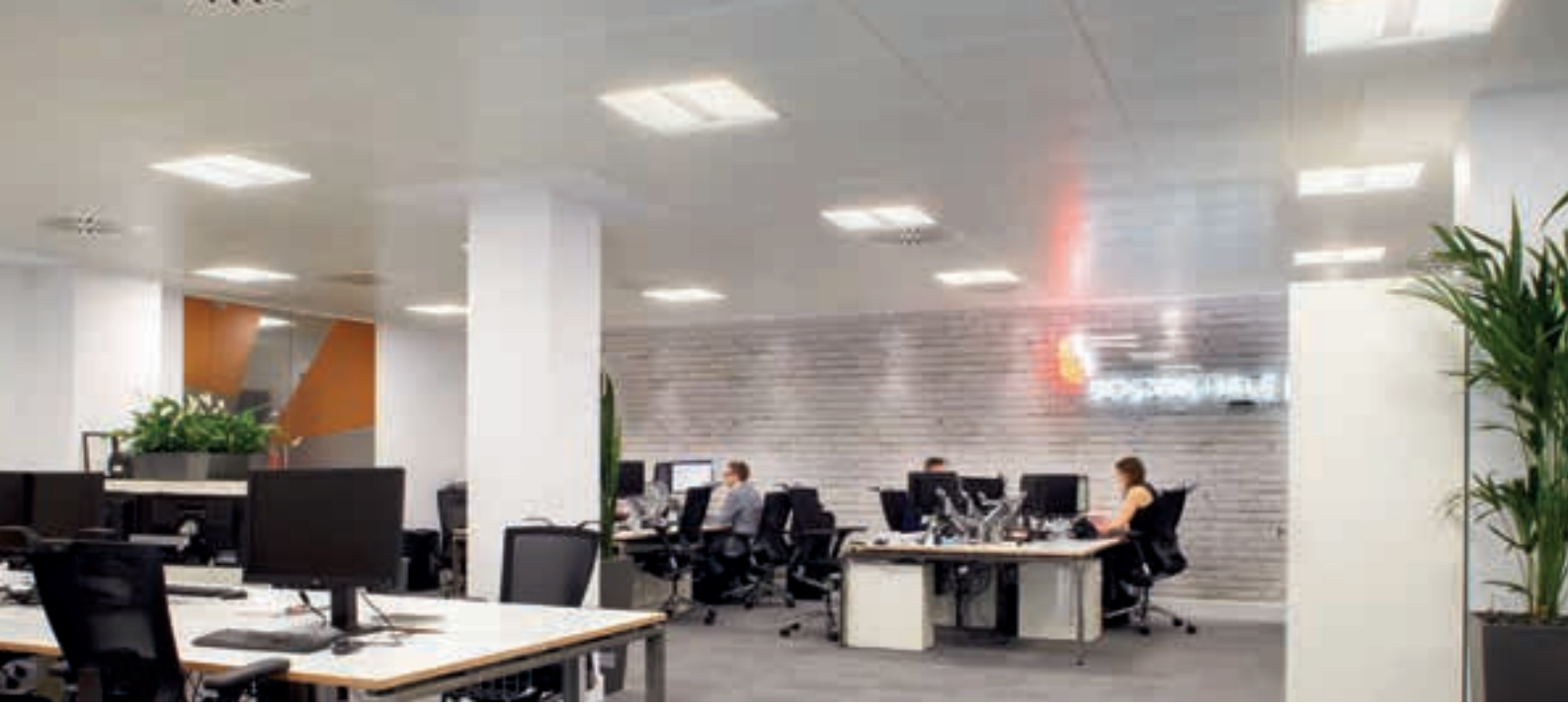
Discussions are under way with the Health and Safety Executive (HSE) to clarify safety concerns about the use, storage and transportation of these gases. A new refrigerant classification – A2L – has also been created to differentiate between levels of flammability.

Smith explained that hydrofluoroolefins (HFOs) were the only pure compounds with a very low GWP, and 'significantly less flammable than current Class 2 and Class 3 refrigerants'. 'The F-Gas regulation will require the use of refrigerants with significantly lower GWP to meet phase-down requirements,' he said. 'While HFO blends can be made non-flammable, there will always be a GWP penalty.

'The F-Gas Regulations will not work without the introduction of A2L refrigerants – and the biggest challenge will be in air conditioning, where there is no non-flammable alternative to [popular gas] R410A.'

Many manufacturers now offer A2L refrigerants as alternatives to most HFCs – the subject of a major global phase-down announcement (see above).

However, Smith pointed out that A2L refrigerants were not suitable for retrofit applications, so end users would have to invest in new equipment and the industry – develop new skills.



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BSERT Journal focuses on U-values and overheating

The difficulty of predicting overheating and the consequences of making the wrong assumptions about U-values are two of the issues addressed in the latest issue of the *Building Services Engineering Research & Technology (BSERT) Journal*.

A paper by M E Eames demonstrates a method of creating probabilistic design summer years (DSYs), containing overheating events, that can be used to inform designers of the overheating risk.

The paper on retrofit solutions for solid-wall dwellings in England, by Loucari et al, found that uncertainties in the solid-wall U-value could lead to a gap between anticipated and actual energy performance.

BSERT is available free to CIBSE members at **www.cibse.org** The journal covers energy and environmental services in buildings, including: heating, ventilation, air conditioning, electrical services, acoustics, water supply and sanitation, and vertical transport.

Podcast tackles indoor air quality

This month's Build2Perform podcast focuses on indoor air quality: what is it, why it's important and what engineers can do about it.

The podcast features sustainability consultant Julie Godefroy and Alan Fogarty, of Cundall, both experts in air quality, and you can access it from the CIBSE soundcloud at: **soundcloud.com/cibse-admin**

The latest CIBSE blog features Mat Colmer, built environment specialist at the Digital Catapult Centre, and Nick Winser CBE, chair of the Energy Systems Catapult. Both will be speaking at this year's CIBSE Building Performance Conference. Visit **www.cibseblog.co.uk**

CIBSE and ASHRAE sign historic joint agreement

Organisations mark 40th anniversary by agreeing greater collaboration

ASHRAE president Tim Wentz (left) and CIBSE President John Field

CIBSE and ASHRAE have signed a partnership agreement to mark the 40th anniversary of their relationship.

The organisations met in London to implement a range of initiatives, including: working together strategically on projects in each other's regions; creating a staff-exchange programme; encouraging collaboration between regions, groups and chapters; and mutually promoting the publication of new codes and standards.

CIBSE and ASHRAE have worked closely together for four decades, but this is the first time they have committed to a joint approach to promoting their mutual global interests, and agreed to a range of activities and goals to promote a more sustainable world.

As well as a commitment to improve knowledge sharing – including jointly presenting work to industry, members and legislators – the organisations have agreed to work at a grass-roots level. This includes encouraging cooperation between ASHRAE chapters and CIBSE regions, coordinating the programmes of similar groups – such as Women in Building Services Engineering (WiBSE) and Women in ASHRAE (WIA) – aligning activity for young engineers, and working together on topics such as legionella, resilience and cyber security.

John Field, CIBSE President, said: 'This is an unprecedented opportunity to spread the benefits of our work together, through every level of our organisations.' Tim Wentz, ASHRAE president, added: 'Collaboration and sharing of knowledge are key to advancing the built environment industry.'

For a report on the CIBSE/ASHRAE seminar marking the 40th anniversary of their relationship, see page 32.

Institutes come together to promote excellence in industry

CIBSE has signed a memorandum of understanding with the Institute of Refrigeration (IoR). The document forms an agreement to commit to working together to develop and promote excellence in the refrigeration, air conditioning and heat pumps aspects of building services.

CIBSE members who register on the IoR website will get access to specific publications at IoR member rate, and an open invite to attend national, regional or special interest group events, also at IoR member rates.

The organisations will also cooperate on new publications, and develop joint publications.

CIBSE and the IoR also signed a registration agreement, which enables eligible members of the IoR to join the Engineering Council (EngC) register, at the appropriate level, via CIBSE's license from the EngC.

(Clockwise, from left) John Field, CIBSE President; Miriam Rodway, Institute of Refrigeration chief executive; Stephen Matthews, CIBSE chief executive; Stephen Gill MCIBSE, Institute of Refrigeration president

TÜV SÜD Wallace Whittle shines at Employer of the Year awards

Beverly Quinn accepts the Employer of the Year award from CIBSE President John Field on behalf of TÜV SÜD Wallace Whittle

Anthony Bursey picked up the small employer award for Method Consulting

Sarah Pusey accepted the large employer accolade on behalf of Atkins

IMechE president Jon Hilton (left) and Doug Ward

Firm has staff development scheme involving school-leavers and graduates

Atkins, Method Consulting and TÜV SÜD Wallace Whittle were recognised for their exceptional commitment to supporting and mentoring newly qualified engineers at the Employer of the Year Awards 2016. The winners of the accolades were announced to a full house at the Institution of Mechanical Engineers (IMechE) in October, as part of the wider CIBSE Young Engineers Awards.

Atkins won the large employer category, showing its commitment to young engineers with the 300 graduates and 80 apprentices who joined them last year. Employees in the early stages of their career are supported by several staff members, and encouraged to drive their own development through training and work opportunities.

Last year, more than 500 of Atkins' STEM ambassadors interacted with over 350 schools, hosting a building services after-school club.

TÜV SÜD Wallace Whittle came top in the medium-sized employer category, and took the overall champion crown. The firm aims to ensure young engineers – who are each allocated a mentor – work on a variety of projects and cover a range of technical learning skills. It also sponsors up to four juniors each year to undertake further education – covering fees and supporting study time – employs students for summer placements and provides work experience for upper school-aged children.

Method Consulting claimed the small employer category. The firm puts young engineers at the heart of its business, believing training and support are necessary to maintain skills, and to increase staff motivation. Employees are encouraged to dedicate a day each year to a project that improves their community or to run a charitable event, and Method has two STEM Ambassadors.

'The firm draws from the widest possible range of candidates'

TÜV SÜD Wallace Whittle's programme earned it the overall prize. The judges said: 'It demonstrated excellent community engagement and proved it draws from the widest possible range of candidates.'

The Employer of the Year Awards are sponsored by Andrews Water Heaters, Ruskin Air Management and Waterloo Air Products, and supported by the CIBSE Patrons.

The IMechE Construction and Building Services Division award was given to Doug Ward FCIBSE.

The Employer of the Year award winners and sponsors

New members and fellows

FELLOW

Horn, Steven
Member,United Kingdom

Hunter, Stephen Raymond
Member, United Kingdom

Ma, Wing Lung
Member, Hong Kong

McLean, Kenneth Ronald
Member, United Kingdom

Pang, Cheun Kit
Member, Hong Kong

Thorns, Peter
Member, United Kingdom

MEMBERS

Borwick, Carl Stanley
Hampshire, United Kingdom

Chen, Siu Hung
Wanchai, Hong Kong

Etasse, Darren Karl
Guernsey, United Kingdom

Joyram, Chrishnan Singh
Vacoas, Mauritius

Kershaw, Joseph
Dartford, United Kingdom

Leung, Lei Ming
Hong Kong, New Territories

Moffat, James
Doha, Qatar

Moloney, Conor
Co Kildare, Republic of Ireland

Monk, James
Essex, United Kingdom

Moreland, Mark
County Antrim, United Kingdom

Nowicki, Pawel
NSW, Australia

Orlu, Erkan
Dorset, United Kingdom

Riyaaz, Mohamed Hanifa Mohamed
Dehiwela, Sri Lanka

Smitten, Barbara
Staffordshire, United Kingdom

Statham, David
Glossop, United Kingdom

Sy, Mei Fun
New Territories , Hong Kong

Wan, Chi Ho
New Territories , Hong Kong

ASSOCIATE

Baber, Mark
West Midlands, United Kingdom

Ray, Simon
East Kilbride, United Kingdom

LICENTIATE

Alvarez Arregui, Jose
Surrey, United Kingdom

Bucknell, Andrew
Cambridgeshire, United Kingdom

Garrett, Julius Dorian
Orkney Islands, United Kingdom

Headley, Luke
Warwickshire, United Kingdom

Johns, Geraint Rhys
Devon, United Kingdom

Kitcher, Tom
Hampshire, United Kingdom

Littler, Andrew John
Devon, United Kingdom

Mundy, Nicholas
Guildford, United Kingdom

Parsons, Tom
London, United Kingdom

Smith, Jocelyn
Bristol, United Kingdom

Wainwright, Andrew Mark
Lancashire, United Kingdom

CIBSE puts the call out for volunteer referees

The Technical Symposium team will shortly commission around 70 authors to submit papers or posters – all of which will need to be peer-reviewed – so CIBSE is seeking volunteer referees to help with this task.

Any members or fellows willing to review papers should contact us, and include a few words about their areas of technical expertise.

As well as helping to ensure the papers to be presented are of a high standard, referees will have a chance to find out about some of the developments that will be presented at the event.

If you are interested, please email **symposium@cibse.org**

The CIBSE ASHRAE Technical Symposium will take place on 5 and 6 April 2017 at Loughborough University. For more information about the event, visit the website **www.cibse.org/symposium**


2016 symposium

Feedback

Why a cost-benefit analysis should pay more attention to impact on the environment – and CIBSE's LinkedIn Group responds to Geoff Prudence's #Build2Perform blog on building performance

Numbers game

I've recently read texts from outside the building services mainstream – including *Post-Capitalism* by Paul Mason and *The limits of Neoliberalism* by William Davies – and it got me thinking about economics and cost-benefit analysis, and whole-life costing of different technologies.

When I was doing these calculations I thought I was just dealing with numbers – and, as an engineer, I love numbers. But in economics, numbers don't play by the rules of physics; they play by the rules of the market, which is neither constant nor unbiased.

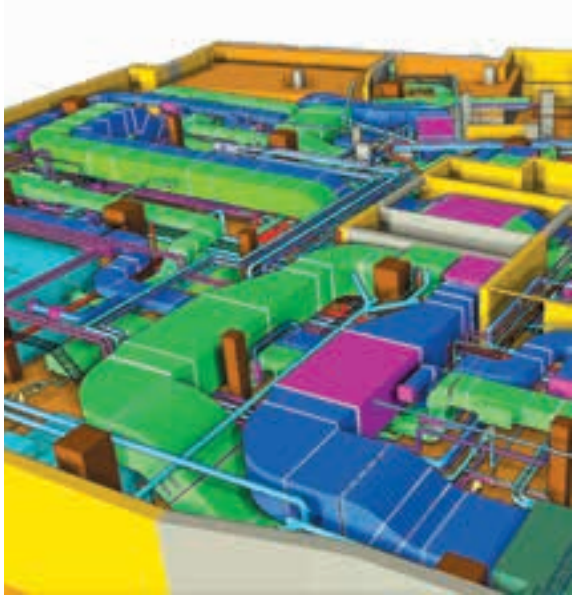
Here is a thought experiment: What if an oil company discovered an oil field that was very expensive to access, but contained an infinite supply of oil. Would it drill?

I think it would have the following qualms: If the supply is infinite, won't the price of oil tend to zero? How would it recoup its investment in getting it out? What would it do to the profitability of all its other oil wells? If everyone knows its an infinite supply, won't they get a bit antsy about a corporation declaring control over it?

I think the company would pretend it had never found the field, and make sure nobody else could.

This seems to be our global attitude to renewable energy as generated, ultimately, by the sun, which guarantees an almost infinite supply (four to five billion years).

Economic modelling can't handle disruptive technology or the concept of an infinite supply – infinite growth of demand being the lifeblood of our economy – therefore pricing renewable energy so it is comparable to oil or gas when we are planning to frack even Yorkshire is an impossibility.



Geoff Prudence: BIM would back up the FM's decisions with actual data

When I was carrying out my cost-benefit analysis of installing renewable energy technology for building projects – and calculating the future cost-savings clients could make – I wasn't thinking about this. Nor about how politically charged the numbers I was using were (renewable energy costs being based on government subsidies and conventional energy costs being based on stability – or the lack of – in the Middle East, and how much we are prepared to frack in our own backyard) and how useless it rendered the numbers I generated.

In discussions with clients, I wish I had explained how nonsensical it is to try to compare renewable energy and conventional energy costs. Maybe that would have stopped them from focusing so much on their bottom line, and got them to select building solutions on the basis of their environmental and health benefits instead.

Lara Gill

> In economics, numbers don't play by the rules of physics; they play by the rules of the market

On point with Hinkley Point C

In a topic with as much vested interest and spin around it as this, choose your words wisely. Hinkley Point C will meet 7% of Britain's electricity needs, not 'energy needs' (*CIBSE Journal*, October 2016). It will meet just over 1% of primary energy demand. Quite a difference.

Steven Wallman, engineer at Skelly and Couch

CIBSE LinkedIn Group discusses the case for FMs as guardians of building performance (from #Build2Perform blog **bit.ly/2cejz6D**)

Geoff Prudence FCIBSE

As the people running the building many years after it is finished and handed over, facilities managers (FMs) are the guardians of its performance throughout its life. The FM knows the management strategies they favour to get the most out of a building, so they should be implementing these at the very start of a project, rather than working around what already exists when they move in.

A fantastic tool that can be used to make this dream a reality is building information modelling (BIM). Nobody knows the day-to-day realities of running a building better than FMs, so they should be pushing to have much more input into the model – making sure it is designed for every day of the next 60 years, not just for handover. FMs also need to ensure that the information being fed into models is what they need – for example, standard classifications for plant items and the maintenance that

they require. In this role, the use of BIM would back up the decisions of the FM with actual data, which could be used to inform changes to the complex, interdependent and ever-changing needs of the building.

Randolph Lemke

Approximately 20 years ago, I was challenged with duties that were not within my contractual remittance. In Britain, there is an expectancy that people with the knowledge to complete projects will need to input time, which may or may not be paid.

Graham Smith FCIBSE

In my experience, there are few FMs with the technical experience to analyse building performance and select the most appropriate replacement plant. I'm sure there are exceptions – before I upset all FMs – and FMs can delegate. Plant characteristics change and, often, the devil is in the detail, which may be buried in the depths of the installation instructions.

Ongoing BMS data analysis and good housekeeping can be very beneficial in maintaining building performance, but cannot resolve more fundamental issues.

Controllability is one of the fundamental reasons for poorly performing buildings in my experience, but it is not well understood and there is little published guidance. Often, causes are poor hydraulic system design and inappropriate plant selection. If the system is uncontrollable, it will not work effectively, no matter how good the BMS/controls are.

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THE DECADE WITH A FLAIR FOR INNOVATION

The 1970s was not just about slide rules and clunky LED calculators, says **Mike Holmes** FCIBSE, but an age of innovation that led to the development of the software tools we use today

I believe the article 'History lesson' (*CIBSE Journal*, October 2016) hardly reflects the real 1970s [from a technology point of view]. The PC may not have arrived, but the industry was using computers, albeit slow mainframes driven by punch tape and card terminals. Some firms possessed in-house machines, whereas others used agencies. At Bsria, for example, I was doing an investigation into numerical methods for the simulation of HVAC systems using the computer power available through Honeywell.

Desktop calculators were also more sophisticated than suggested; at Bsria, Steve Adams and I used a programmable handheld Hewlett Packard calculator to develop a numerical model of the dynamic response of cooling coils (program and data stored on small magnetic strips).

This was the decade in which today's software tools first emerged. Funded through a Scientific and Engineering Research Council programme, Professor Joe Clarke developed ESP-r at the University of Strathclyde – I believe one of the researchers was a young Don McLean. At Cranfield University, meanwhile, an early version of TAS was being developed.

Industry was also active. At Oscar Faber, John Quick and Steve Irving were working on a program called APACHE – now evolved into part of the IES suite. At Arup, the late John Campbell was developing programs to size plant and calculate the energy consumption of complete buildings. Because of the time required for such analysis, Campbell used an innovative application of what was then the Institution of Heating and Ventilating Engineers (IHVE) admittance method. At the same time, in the USA, DOE2, Blast and Trace came into being. Energy+ is a direct descendent of DOE2 and Blast.

> Excluding visualisation, the only analytical tool not available in the 70s was CFD

There was concern over the accuracy of these tools – a cause taken up by the International Energy Agency through its Building and Community Systems programme.

The first investigation was an international collaborative project, Annex 1, to compare predictions made by numerical simulation tools. Perhaps with the exception of TAS, all the previously mentioned programs were examined. Unsurprisingly, there were large differences. This led to further investigations, including comparison with the performance of a real building in Glasgow. Without the sophisticated data-logging equipment that is available today, however, this task proved over-ambitious.

The Building and Community Systems programme is still with us, involving researchers and industrialists from numerous countries. I believe they are up to Annex 40-something.

In the 1970s, there appeared to be little interest in these activities within the IHVE, which was developing a manual technique for the calculation of building energy consumption. This was to become the CIBSE Building Energy Code and could be thought of as a forerunner of the Simplified Building Energy Model (SBEM).

IBM 1402 punch-card reader

Aside from the widespread use of computers, I suspect the other significant difference between now and then is that – in the 70s – the design was much 'closer to the numbers'.

The need for standardisation of weather data was apparent and, after some studies I carried out at Bsria, the CIBSE weather data panel was set up. This was again driven by industry – British Gas, W S Atkins, Oscar Faber and Bsria – and has resulted in the CIBSE Test Reference Years and Design Summer Years used today.

Excluding visualisation tools, the only significant analytical tool not available in the 70s was computational fluid dynamics (CFD) although the seeds for its widespread use were being set through the Teach-T tool developed by Brian Spalding at Imperial College. This code was available to all and formed the basis of many developments in the following years.

The zonal – or network airflow – model did exist, however. At Bsria, the late Nigel Potter was predicting the general movement of air through hospital wards located around courtyards. The approach will be familiar to many today in that a wind tunnel model was used to obtain surface-pressure coefficients, allowing prediction of the combined wind- and buoyancy-driven airflow pattern within the building.

The 70s was a time when significant research projects were being undertaken by academia and industry, and when the development of the tools we now use was in its infancy. One has the feeling that there are few developments taking place now that will have the same impact in 40 years' time, and that industry no longer has the appetite to drive the research.

MIKE HOLMES Hon FCIBSE is a consultant at Arup

ZERO LONDON

There was much angst last year when the Cameron government abandoned its commitment to zero carbon homes. However, since last month, the London Plan requires new residential developments in the capital to be zero carbon. **Hywel Davie**s discusses the impact

The Housing and Planning Act made changes to legislation covering local authority and social housing, and addressing rogue landlords, with the aim of improving the supply of homes. There was also an unsuccessful attempt to attach a new commitment to the 2016 trajectory for 'zero carbon' homes – first adopted in 2007 – which attracted many headlines. But changes to carbon emissions targets in the London Plan – which now requires major new residential developments to be zero carbon – have attracted far less comment.

The Plan has been in place for some time, but it – and the more recent supplementary planning guidance, published in March 2016 – may have slipped past some, unnoticed.

David Cameron's government abandoned the zero carbon homes policy in June 2015, but recent reviews of the London Plan have tested the continued inclusion of this requirement in the document, and it has been shown to meet the necessary viability requirements. So, for the capital at least, 2016 is the year of zero carbon housing.

Planning Policy 5.2 requires development proposals to make the fullest contribution to minimising carbon dioxide (CO_2) emissions in accordance with the following hierarchy:

- Be lean: use less energy
- Be clean: supply energy efficiently
- Be green: use renewable energy.

It also commits the Mayor of London to 'work with boroughs and developers to ensure that major developments meet the following targets for CO_2 emissions reduction in buildings'. The target for residential buildings is zero carbon from 2016. The policy requires major development proposals to include an energy assessment demonstrating how the targets are to be met on site, with at least the following details:

Could the GLA affect national policy?

XIUFU CHEN / SHUTTERSTOCK

> London, arguably, drives the UK economy in many ways. So will the London Plan become the driver of Building Regulations?

- Calculation of energy demand and CO_2 emissions covered by Building Regulations and, separately, from any other part of the development, including plant or equipment not covered by the Building Regulations, at each stage of the energy hierarchy
- Proposals to reduce emissions through energy efficient design of the site, buildings and services, through the use of decentralised energy – such as district heating and cooling, and combined heat and power (CHP) where feasible – and to cut emissions through use of onsite renewable energy technologies
- Where it is clearly demonstrated that the specific targets cannot be fully achieved onsite, any shortfall may be provided offsite or through a 'cash in lieu' contribution to the relevant borough, to be ring-fenced to secure CO_2 savings elsewhere. Guidance is available on offsite carbon offsetting, based on a report for the Greater London Authority (GLA) by the National Energy Foundation.[1]

Zero carbon homes form part of major development applications in which the residential element achieves at least a 35% reduction in regulated CO_2 emissions relative to Part L 2013 through onsite measures, and the remaining emissions are off-set through a cash payment to the relevant borough. This will be ring-fenced to secure delivery of CO_2 savings elsewhere.

Technical implementation of this policy should be in line with the Mayor's *Energy Planning: GLA Guidance on preparing energy assessments* (March 2016). The Mayor's Housing Standard's Viability Assessment assumed a carbon offset price of £60 per tonne of CO_2 for a 30-year period and, if this figure is used, it will not be necessary to carry out a further viability assessment of the policy approach – or is that possible?

The supplementary guidance also addresses overheating, noting that more energy efficient homes may be at greater risk of this, and that an assessment of the risk is required. The guidance explicitly references CIBSE publications TM52 *The limits of thermal comfort and* TM49 *Design Summer Years for London*, saying they 'can assist designers to take these considerations into account, alongside other industry guidance'.

With Building Regulations already devolved to the four home countries, it is arguable that the London Plan offers a fifth devolved set of regulations in all but name. The capital drives the UK economy in many ways – so will the Plan become the driver of Building Regulations, especially if Wales and Scotland seek to follow the GLA – and not the English – regulations in future? In this area, we already live in interesting times.

References:

1 *Review of carbon offsetting approaches in London*, the National Energy Foundation, June 2016. **bit.ly/2dDHADP**

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

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BUILDING ON BREXIT

The consequences of the EU referendum risk our ability to deliver a sustainable and innovative built environment. **Julie Godefroy** presents her manifesto for a post-Brexit low carbon Britain

Have you heard of the UK's Building Renovation Strategy? I had not until recently. It is a requirement under the EU Energy Efficiency Directive, which is part of a plan to decouple energy consumption from economic growth and achieve a 20% reduction in energy use by 2020.[1] The UK's first version of the strategy, in 2014[2], was considered to be less than satisfactory. It should be revised by April.

Meanwhile, the EU Circular Economy package was expected to start having a positive impact on the construction sector, which is responsible for half of the UK's total waste.[3] It includes proposals for waste recycling and diversion from landfill, as well as for waste reduction at source through efficiency and product design. However, because of Brexit its UK implementation is now in doubt.

EU legislation is not perfect. Some perceive it to be forced onto member states, poorly written and difficult to implement. Sometimes it is behind UK best practice – but it illustrates the benefits of long-term objectives. In the context of the past few turbulent months, it is difficult to imagine such a trajectory of stability, especially as the Prime Minister has not been shy in revisiting her predecessor's positions – on Hinkley Point and grammar schools.

The consequences of Brexit are uncertain, ranging from limited – with the UK remaining in the European Economic Area and having to abide by many of its rules and legislation without influencing them – to a complete separation. This is where some of the risks to sustainability lie. Environmental and health and wellbeing improvements often rely on long-term objectives, where policy is developed to take account of needs and interests beyond short electoral cycles. Some issues are local; others need wider geographical action and collaboration. What we know can be summarised as follows:[4, 5]

- The UK is often credited with being a driver of EU policy on carbon emissions. The 2008 Climate Change Act legally binds government to an 80% reduction by 2050, which goes beyond EU policy. The Fifth Carbon Budget was adopted as one of the last decisions of David Cameron's government. However, the EU has led on renewable energy and energy efficiency, and Brexit may affect this
- The EU is considered to have had a positive influence on environmental topics, including air and water quality, and habitats. The problem is often with national implementation. The UK is being taken to court for failing to develop a satisfactory air-quality strategy to meet EU objectives.[6, 7, 8]

Two other issues likely to affect our ability to deliver a sustainable and innovative built environment are:

- Long-term R&D strategies: The UK is the second-largest participant – and has the four largest recipient universities – in the EU's Horizon 2020 research programme.[9] The, financial shortfall will need to be addressed
- Skills: EU nationals represent about 5% of the UK population[10], but make up about 20-30% of the workforce in construction and design firms. We need to attract students to engineering degrees and develop apprenticeships if a future supply of EU workers cannot be relied upon.

> We need to attract students to engineering degrees if a future supply of EU workers cannot be relied upon

CIBSE is responding to the inquiry into the implications of Brexit on energy policies[11] and we should make our views heard. Here is my wish list:

- Post-Brexit regulation to take account of our environment and quality of life. These should be seen as an opportunity to remain competitive in Europe and beyond rather than as a barrier to short-term growth
- Retained long-term carbon objectives, with intermediate targets to hold successive governments to account
- Reinforced energy efficiency strategy; retained MEES, which have started to drive improvements; DEC expanded to commercial buildings; reduced VAT for refurb and energy efficiency works – the discrepancy can no longer be blamed on EU rules
- Action on air quality – for example, new buses to be electric, restrictions on diesel generators, and provisions in Building Regulations. Air quality is estimated to contribute to at least 40,000 deaths, and cost £8-20bn, per year.[12] This is more than £350m per week – which could, in part, be saved for our NHS. This just happens to be close to THAT campaign bus slogan.

References are available at **www.cibsejournal.com**

Look familiar? Better air quality could save the NHS £350m a week

JACK TAYLOR / GETTY IMAGES

JULIE GODEFROY is an independent sustainability consultant

ENGINEERING OUR POST-BREXIT FUTURE

Four months after the EU referendum, **Peter Rolton**, chair of Rolton Group, urges the UK engineering sector to face the post-Brexit challenges head on

Theresa May's message that 'Brexit means Brexit' couldn't be clearer. The UK Prime Minister's words signalled an end to the limbo period that surrounded the EU referendum and encouraged a move towards a more proactive phase, in which we need to take control of our own destiny.

As the government edges closer to triggering Article 50 of the Lisbon Treaty – which will begin a two-year countdown to the UK's exit from the EU – where does this leave the engineering industry? It is going to have to come to terms with new regulations and standards, if those set out by the EU are no longer to be adhered to. For building services engineers, the level of legal complexity prompted by Brexit is unprecedented – especially in the areas of environmental and energy-management law – with an estimated 40,000 items of legislation affected.[1]

The UK must remain mindful of how EU legislation may affect its dealings with our continental neighbours. Any new UK-centric legislation must also be forward thinking, to ensure we do not lose our place among the global elite for innovation and technology. Research and development could suffer without EU funding, so the UK's strategy should include actions to counter this probable negative effect. Although the government has promised that any EU funding secured before Brexit will be covered, this is a huge undertaking.[2]

> We must grasp this opportunity to cement our place in the global economy and establish our own rules and agenda

Leaving the EU may also restrict our attractiveness to global manufacturers, many of whom have regarded the setting up of operations in the UK as an opportunity to tap into our engineering excellence, and as a gateway to business with the rest of Europe. There is little to prevent engineering giants from moving to mainland Europe, to continue receiving the benefits they had previously enjoyed in Britain.

To counter this, the UK must stay competitive among its peers so that it remains a leading destination for new manufacturing facilities. Another issue is the shortage of skilled labour in the engineering sector. We have an annual shortfall of 69,000 workers[3] and this may be exacerbated if there are restrictions on people's freedom of movement.

There have been mixed post-Brexit results across the construction, manufacturing and services sectors from the Purchasing Managers' Index. After the initial productivity slump, manufacturing production increased during August at its fastest pace for seven months, according to the latest figures. But infrastructure spending has reduced by 20% since the referendum.

David Davis and the Department for Exiting the European Union will need to produce a holistic strategy that integrates industry and business into the wider plan for our exit from the union. The building services engineering sector will need to play its part in reinventing the UK for this new economy, to secure the resources it needs for future success. We must grasp this unique opportunity to cement our place in the global economy and establish our own rules and agenda.

The UK is still a significant player and a major part of Europe. By maintaining positive and open relationships with our continental neighbours, we can ensure the engineering industry continues to thrive, while retaining our place on the world stage.

References:

1 *The meaning of Brexit*, July 2016, CIBSE Journal, **http://bit.ly/2eddwiF**

2 *Brexit: Government guarantee for post-EU funds*, August 2016, BBC **http://bbc.in/2eAKojn**

3 At a glance, Engineering UK Report 2016, EngineeringUK, **http://bit.ly/2eOq6Xq**

● **PETER ROLTON** is chair of engineering consultancy Rolton Group

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WINNER TAKES IT ALL

Antoni Sapina Grau, of WSP Parsons Brinckerhoff, impressed the judges with his show of juggling to be named Graduate of the Year 2016 and win a trip to Las Vegas

Antoni Sapina Grau, of WSP Parsons Brinckerhoff, has been named the 2016 CIBSE ASHRAE Graduate of the Year. His talk on digital engineering was voted the best presentation by a panel of five judges at the CIBSE Young Engineers Awards, held at the Institution of Mechanical Engineers (IMechE) headquarters in central London. Grau's prize is a trip to Las Vegas for the 2017 ASHRAE Winter conference.

The Employer of the Year Award winners were also revealed at the ceremony, with the overall accolade going to TÜV SÜD Wallace Whittle. It also won the medium-sized employer category, in which 2014 winner Max Fordham was runner-up.

Atkins was named large employer of the year – with Hoare Lea as runner-up – while Methods won the small employer category, with QODA Consulting runner-up. (See page 15 for more details).

In his winning presentation Grau explained how the digital revolution was changing the engineering profession through a series of 'stories'.

Each finalist had to give a five-minute presentation to an audience that included CIBSE President John Field and ASHRAE president Tim Wentz, who gave his own talk. The judges included chair Tim Dwyer, and last year's winner of the graduate award, Ryan Rodrigues.

Entrants had to respond to the following question: 'Computers and digital technology are transforming the way engineers work. What impact do you think this is having on innovation, professionalism and traditional engineering skills?'

In his presentation, Grau explained how engineers were adapting to new technology. He showed an engineer juggling three balls, representing a slide rule, a 3D drawing and a drawing board. One by one, the balls were replaced by CAD software, building information modelling (BIM), and a laptop. Grau also explained how increased knowledge gives engineers a technical understanding that transcends national borders.

After being presented with his award Grau said: 'I feel I have achieved something, but the best is yet to come. I now have a responsibility to work harder and harder. It's not the end – it's the beginning.'

Grau joined WSP Parsons Brinckerhoff as a graduate engineer, having obtained an MSc in building services engineering

JUDGING PANEL

Judges for the Graduate Award:
- **John Field,** CIBSE President
- **Jon Hilton,** IMechE president
- **Tim Wentz,** ASHRAE president
- **Ryan Rodrigues,** Graduate of the Year 2015
- **Tim Dwyer,** CIBSE ASHRAE Group chair

Judges for Employer of the Year:
- **Ant Wilson,** Aecom
- **Deborah Pullen,** BRE
- **Susan Hone-Brookes,** Laing O'Rourke
- **Chair,** Ewen Rose

CREDIT: Simon Weir

Grau with ASHRAE president Tim Wentz

> I now have a responsibility to work harder and harder. It's not the end – it's the beginning

Finalists: (from l-r): Richard Garthwaite; Farai Mwashita; Scott Mason; Antoni Sapina Grau; Katie Ewing; Monica Mondelo Madrigal; Samantha Carlsson and Samima Saqib

with sustainable energy. He qualified as a Breeam Associate, Low Carbon Consultant and LCIBSE, and was part of the team that won this year's Teambuild Construction Competition UK.

Grau was one of two Spaniards in the final, which featured eight engineers from all over the world.

The judges awarded second place to **Katie Ewing**, of the University of Bath and Atkins, and third place to **Scott Mason**, Lochinvar's UK senior technical sales engineer for integrated renewable solutions. They won £500 and £300 respectively. The five other finalists were: **Samantha Carlsson**, Cardiff University/Hoare Lea; **Richard Garthwaite**, University of Durham/Royal School of Military Engineering; **Farai Mwashita**, Loughborough University/Hilson Moran; **Samima Saqib**, Heriot-Watt (Dubai); and **Monica Mondelo Madrigal**, Universidad Politécnica Madrid/Foster + Partners.

Grau showed how engineers juggle new technologies

The event also featured a presentation by Doug Ward – director of estates and facilities management at Newcastle upon Tyne Hospitals NHS Foundation Trust – who won the IMechE Construction and Building Services Division (CBSD) Special Achievement Award. Ward outlined the outstanding work done by engineers in hospitals that 'kept people alive', and explained how important it was to have a robust system of electrical power distribution.

ASHRAE President Wentz also gave a talk, during which he told the audience that construction was on the cusp of a golden age, as the industry could build more holistically and sustainably than ever before. He said technology would 'redefine the concept of engineering and enable true integrated design'.

Wentz added that ASHRAE would lead improvements in buildings by recording performance using its energy labelling programme, Building Energy Quotient (BEQ). **CJ**

- CIBSE, ASHRAE and IMechE support the CIBSE Young Engineers' Awards 2016, which are sponsored by Andrews Water Heaters, Ruskin Air Management and Waterloo Air Products. The awards also receive support from the CIBSE Patrons.

Katie Ewing was awarded second place

Scott Mason took third place in the competition

PEOPLE POWER

Health and wellbeing is a major theme at this year's CIBSE Building Performance Conference and Exhibition, so we asked six speakers how buildings can be improved for occupants

> The first step towards improving buildings is to get the basics right – bean bags and table football won't cut the mustard if the heating, cooling, lighting and IT infrastructure fail to deliver – *Sarah Ratcliffe*

The 2016 CIBSE Building Performance Conference and Exhibition will bring together more than 40 expert speakers to showcase the latest thinking on the subject, and help engineers to deliver and maintain high-performing buildings.

The event – at the QEII Centre in Westminster, on 17-18 November – is a chance for professionals to meet, learn and debate critical issues facing the industry, from health and wellbeing to maintenance and operational performance.

Sessions will include: outlook for building performance; digital engineering and building services; achieving performance in use; air quality – impact on health and wellbeing; collaboration for better performance; refurb + retrofit; and innovation in buildings.

Lucinda Lay
Carbon reduction projects manager, University of Oxford

Design sustainably for adaptability, remove redundancy and keep it simple. There are two types of occupant: building users and building managers. Facilitate the needs of the managers and the needs of the users will fall into place.

One of the biggest improvements that can be made is to simplify and centralise the building systems, allowing them to be controlled and optimised easily, with the benefits of low operational costs and a stable environment. Lighting design and temperature controls are some of the most important things to think about when designing or retrofitting a building. Users should have some level of control over their environment and the systems need to be easily maintained.

Andy Ford
Professor of systems engineering in the built environment, London South Bank University

As an occupant, a perfect building is one I delight in visiting every day. Anything that takes away from this is something that needs to change.

Most of the building design processes I have experienced to date are about how to make things work well enough. We need to go a step beyond this. The issue of making buildings work has a tendency to be approached as a complicated, technical problem, dependent on sophisticated control of increasingly complex systems. I challenge this.

As an occupant, I want to go into a building thinking 'this is great', and enjoy the time I spend in it before leaving, feeling uplifted, and knowing the building makes a positive contribution to the built environment.

I don't want to spend any time looking for, and understanding, controls, listening to machinery – be it fans, chillers or automated

ROBERT ADRIAN HILLMAN / SHUTTERSTOCK

shading or natural ventilation, opening and closing systems. I want to walk in at any time of year and feel great.

This means developing skilful, integrated designs of buildings that merge architectural creativity with engineering knowledge of comfort, psychology and building physics to engineer 'delight', eliminating systems – where possible – and seeking passive, responsive solutions that work without intrusion. We need architectural engineering to be reality.

Matt Fulford

Director, Inspired Efficiency

Buildings exist to provide comfort for their occupants, so a logical way to improve buildings is to boost the occupant comfort they deliver. The complexity comes in understanding what elements contribute to comfort.

Evidence highlights such areas as good levels of air quality using natural ventilation; high levels of daylighting with an external view; some control over thermal comfort; and buildings that promote activity. So the simple answer, perhaps, is an openable window, a thermostat and a few flights of stairs for every occupant!

There are two other interesting considerations: does all this come at a cost or benefit to the global environment, and how do we make this work in a capitalist society where money matters? If one looks deeply enough, a virtuous win-win-win cycle exists, because well-designed, high-quality buildings – offering the best possible human comfort levels – also use less energy and deliver value through higher productivity and reduced sickness. So the next question is: why do we often struggle to make these improvements?

Alex MacLaren

Professor in architectural design, Heriot-Watt University

Buildings can be improved for occupants through responsiveness and feedback. I want to be able to interact with my habitat, and I want my habitat to be able to respond to changes in my demands – and, with increasing urgency, the changing demands of the climate and context.

Contemporary society expects intuitive interfaces and ease of access to knowledge and data. Too many buildings subjugate their users by restricting control over their environments. I want to choose to throw open the window and howl into the cold rainy night if I wish. But it also means understanding the implications of my outburst – in seeing the heating demand and humidity of my internal environment immediately rise. I'll understand the consequences of my actions, and I'll still have a choice. This makes me informed and empowered – and a happier person.

In a world where technology now supports – affordably – real-time accurate data feedback in multiple, complex ways, we have no excuse for not engaging with that.

Post-occupancy evaluation should be the preserve not of academic research, but of everyday interaction between user, building and facilities manager; it must be considered a key source of knowledge and inspiration for the design team.

Neil Lewis

Managing director, Waterman Building Services

Choice is one of the most important factors for a feeling of wellbeing. Even in a great office or place of learning, an individual starts to feel trapped and restricted if, day after day, they are forced to sit in the same space, looking at the same view and unable to influence their environment.

Cost, of course, plays a big part in the restrictions within which most people have to live. We cannot expect to overprovide while staying within strict budget constraints, but we probably can do much more with the opportunities presented to us.

Modern IT is now releasing us from all the previous constraints of being wired to a desk, yet we are still designing spaces based on conventions from decades gone by. We need flexible spaces that can quickly change from meeting space to work space, to recreational space, and allow freedom of movement depending on where we choose to work.

It would be wonderful to see an increase in the use of outdoor space for conventional study and learning. Intelligent use of covered – yet open – spaces can be integrated to a far greater extent than is delivered currently, allowing people to step outside their, often claustrophobic, work space or even hospital bed.

Sarah Ratcliffe

Programme director, Better Buildings Partnership

Often, the first response is to think about new trends, innovations and the latest fads – but, for me, the first step towards improving buildings is to get the basics right. Bean bags and table football won't cut the mustard if the heating, cooling, lighting and IT infrastructure fail to deliver. So we need to design for performance, commission well, and monitor and manage to deliver the performance that the occupant expects.

Every occupant is unique, so we need to engage with them to understand their needs and priorities and make sure the building reflects these. This can also save time, cost and waste; there is no point in fitting out a building to a high-spec only to discover the occupant has ripped out everything and replaced it to conform to their own fit-out requirements and branding.

Our understanding of what occupants need is changing all the time, but creating places where they can be happy, healthy and productive is one way to help us think differently. Improving the physical fabric of the building can contribute to this – for example, by incorporating green walls to improve air quality – but the social fabric is also becoming increasingly important. To improve buildings for occupants, we don't just need the technical skills – we need the skills to engage with people too. **CJ**

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BUILDING TIES

To mark their 40-year relationship, CIBSE and ASHRAE hosted a joint seminar on delivering built environments that are sustainable and that reflect the needs of their occupants. **Liza Young** reports from the London event

One of the most important skills an engineer must possess is the ability to build relationships with clients, said ASHRAE president Tim Wentz, at the CIBSE ASHRAE 40th Anniversary Seminar, at University College London (UCL).

'We have to work with clients who are not engineers – not experts in applied science – and convince them that energy efficiency is the right path to be on,' Wentz added.

'The secret to success – whether you are an architect, engineer or contractor – is building relationships.'

He said ASHRAE's Building EQ energy management tool – which rates similar buildings in similar climate zones – could be used to nurture and strengthen links with clients. It has been adapted to form part of a new online course, developed at the University of Nebraska, to teach students how to conduct energy audits, and to develop their management and relationship skills.

The course – which will go out to 250 branches in 130 countries – will take students through each step of the energy audit process, from carrying out preliminary energy assessments and space function analyses, to performing site visits and completing an ASHRAE Level 1 Energy Audit Report and Building EQ label. The ASHRAE Level 1 site visit and post-survey interview are opportunities for developing client relations.

One of the first lectures of the course is on presenting yourself in a way that's not 'you against them'. 'The aim is to convince clients that you're here to help them operate and maintain the building. That is not something you do in one meeting – but over time,' said Wentz. 'This is a skill set that is really needed in our industry – that has not got the attention it deserves. We're really good at teaching physics, but not so good at negotiating.'

Frank Mills, of Frank Mills Consulting, gave a presentation on another ASHRAE initiative – the *Cold Climate Design Guide*. He said the guide was particularly relevant to the UK – a country that experiences extreme cold conditions for short periods.

In 2011, Heathrow Airport was closed for a week because of snow, which cost the economy £280m a day (£145,000 per minute). With this in mind, if £2m was invested into a

CIBSE President John Field, who chaired session two

> The secret to success – whether you are an architect, engineer or contractor – is building long-term relationships

system that used waste heat from the terminal to melt snow from the hard standings around the airport, then the investment would have been recovered in 15 minutes, said Mills.

The UK needs to put its waste heat to better use, he added, citing it as the only developed country in the world that throws away £150bn worth of heat – and 160m tonnes of CO_2 – from its power stations.

Dr Sung Min Hong, CIBSE research associate, addressed the challenges of delivering energy benchmarks to help industry stakeholders improve the energy efficiency of buildings. He said one of the limitations of using the benchmarks in CIBSE Guide F is that it's difficult to take into account individual circumstances that may influence energy demand, distorting the comparison.

Hong said a comparison of buildings' particular circumstances was more useful than contrasting a range of buildings with one static, absolute benchmark. Some methods extended the capability of benchmarking, he added. For example, since display energy certificates (DECs) were introduced in the UK, energy benchmark figures can be adjusted to take into account seasonal and regional weather variations, as well as occupancy patterns.

ASHRAE president Tim Wentz

Hong said a joint CIBSE and UCL benchmarking project – which is analysing data from 40,000 buildings – aims to make benchmarking more useful and robust, while helping stakeholders make better policy and investment decisions. It also aims to review and update the existing benchmarks in CIBSE Guide F, and push the boundaries of knowledge on how non-domestic buildings use energy.

Over the past year, the empirical data has been used to assess different benchmarking methods. Although buildings are currently categorised by activity type, Hong said, this is not necessarily a good indicator.

For example, where Guide F differentiates between primary and secondary schools, *TM 46 Energy Benchmarks* groups together all school buildings. After analysing data from 7,000 schools, Hong found that there was a distinct difference in the way primary and secondary schools use energy. Even though they share an activity type, if buildings have different characteristics, it is very difficult to compare them, he said.

Hong's research also looked at never-before-assessed characteristics, including compactness of building footprint – a proxy for assessing the correlation between heating consumption and fabric condition.

Looking ahead, Hong said research would focus on factors beyond the building envelope, such as regional differences, investment, or size of sustainability teams, as well as indoor environmental quality.

Marcella Ucci, UCL senior lecturer in environmental and healthy buildings, spoke of the industry no longer looking at buildings as an opportunity to avoid risks, but as a chance to add value to people, communities and businesses.

She said a new type of professional is required to embed health, wellbeing and environmental quality into building design.'We are no longer just architects and engineers working together – we are public health professionals, sociologists and planners.'

Ucci said the factors that impact on health and wellbeing can be ranked in order of importance. When carrying out this exercise with her MSc classes, Ucci said the engineering students put structural damage, building collapse and fire at the top of the list, while those studying social sciences considered sanitation and thermal conditions to be most important.

'This is an indication of how the two professions think very differently,' she said. 'As built environment professionals, we are trained to avoid the catastrophic at the building scale, while public health professionals tend to look at the more prevalent conditions of the population.'

UCL's new MSc course health, wellbeing and sustainable buildings will aim to forge a new generation of professionals that drives health and wellbeing in a sustainable manner.

'The question shouldn't be: "What is the optimal design?" It should be: "Under what conditions is this design optimal?"' said Ucci.

Emilia Targońska, Hoare Lea engineer, rounded off the seminar by considering how expertise, together with integrated working and the appropriate application of technology, can produce outstanding built environments. She said: 'There are many qualities of a great building but, only if they all come together, does it become excellent.' **CJ**

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WRESTLING WITH THE FUTURE OF HEAT

Where should the UK source its heat? WSP Parsons Brinckerhoff's **Barny Evans** and CIBSE CHP/District Heating Group chair **Phil Jones** discuss the options

A CIBSE Homes for the Future Group debate at Hoare Lea, in September, highlighted a distinct division of opinion about the future of UK heat: all-electric or gas. However, with so many potential influences on the energy mix of the future, can the argument be so black and white?

The Committee on Climate Change's *Next steps for UK heat policy* report, for example, identifies the need for a new strategy – including the use of hydrogen – and a stronger policy framework to enable building decarbonisation over the next three decades. (For more on this, see page 9.) So we asked two speakers, representing both sides of the 'electric/gas' debate, to go head to head.

Barny Evans (BE): Heat pumps (HPs) should provide the vast majority of space heating and domestic hot water (DHW) in the long term. HPs should be mandatory – or at least policy – for all new developments now, with a long-term plan for retrofitting them, combined with energy efficiency measures for our existing building stock.

Phil Jones (PJ): An entirely all-electric future is unlikely. I agree HPs will play a big part – and accept that an all-electric approach may be most likely in off-gas grid situations. But in high-heat-density areas, such as cities, supplying heat via heat networks is going to be the way forward. District heating (DH) is an 'enabling' technology that allows the connection of much larger, more efficient plant, which can be easily maintained. In the next few years, that could be large, high-temperature HPs, combined with – or even driven by – combined heat and power (CHP).

BE: The need for energy efficiency is a benefit of all-electric solutions. Because they become more efficient at lower flow temperatures, they favour energy efficiency. CHP-led systems become less efficient as thermal demand drops, so they are very resistant to energy

> Some big factors will slow down the move to all-electric. First, consumers love boilers, and radiators to warm their bums on

efficiency measures. A truly competitive market is taking shape in the power sector and, provided we are all-electric, we can benefit. (See our white paper at **bit.ly/2ep4Vvf**).

PJ: Some big factors will slow down the move to all-electric. First, consumers love boilers, and radiators to warm their bums on. Second, changing attitudes will be difficult – heating installers are heavily incentivised to sell boilers. A boiler sold in 2020 could keep going until 2035-40. This won't prevent a decarbonised future, but it will be an uphill struggle. Third, there is a lack of infrastructure. Even if we assume future HPs have a coefficient of performance (COP) of 4, with some reduction in demand, we still need an electricity grid that is twice as big as we have now – and that's excluding electric vehicle consumption. I can't see the gas grid disappearing entirely and the electricity grid doubling – or tripling – in size.

BE: Recent reports have shown that, over a lifetime, the lowest carbon option is heat pumps; the next lowest is gas boilers; and the highest is a CHP system. This is why there is no place for gas CHP in our system; even if you don't accept the all-electric option, a standard gas boiler and mains electricity is lower carbon than a CHP.

PJ: Your hierarchy is based on today's grid factors, but the future is hard to predict. If you can assume the electricity grid decarbonises, why can't we assume the gas grid does too? I agree natural gas will have to fall away as a fuel, but other gases are available – syngas, anaerobic, biomass gasification and landfill, to name a few – before hydrogen comes along.

BE: My understanding is that no-one thinks the decarbonisation of our gas grid is realistic – at least in the short term. The realistic limit at the moment is about 10%. CHP systems or boilers could become low/zero carbon only if we develop new methodology for generating zero carbon natural gas – such as an algae.

PJ: It is highly unlikely the companies that own/operate the gas grid will throw away that asset easily. They will find other things to put into it – perhaps hydrogen. The ingenuity of engineers will bring a decarbonised gas grid.

Let's consider a future in which the gas grid is a near-zero carbon option. That means CHP will still play a part in the mix, running – for example – on hydrogen, and producing local electricity without the high transmission losses of the electricity grid. It opens up real opportunities for fuel cell CHP running on hydrogen directly, without the need for a reformer to convert natural gas to hydrogen. Local CHP is at least 80-85% efficient, as it provides/uses both the heat and power. We will probably never build power stations near cities, where we need heat. So local CHP will always be an option if power stations – even nuclear – throw away heat.

A recent KPMG report argued that hydrogen could be feasible, and a study in Leeds is working to develop a pilot for a local hydrogen grid. So the decarbonisation of the gas grid is starting. Biogass and syngas production/injection may start the process, but lead to a hydrogen-based gas grid.

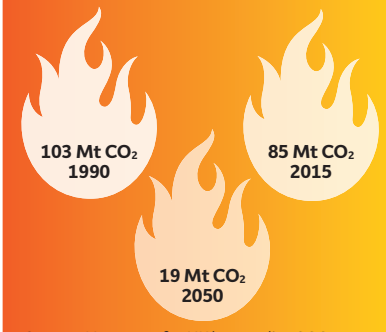
BE: I am a fan of hydrogen in that it offers the opportunity for inter-seasonal energy storage, which should be used through standard hydrogen power stations and then fed as electricity. Replacing mains gas in our network would mean changing every appliance at the same time, including the CHP engines that have been – or are being – installed.

The other issue with hydrogen is that it only helps with CO_2 emissions if it is generated from renewable energy – which means you must have had the renewable electricity/heat to make it in the first place. If you just use gas through steam methane reforming, or electricity through electrolysis, you haven't gained anything – apart from a reduction in local air pollution, which electricity already gives you.

PJ: The previous change – from town gas to natural gas – shows it is possible. But what if the decarbonised gas grid only supplied certain larger, local loads? Simply focusing on a totally HP world closes out all sorts of other options and opportunities. If you are saying DHW will

CO_2 emissions from heating

Meeting the UK's 2050 climate obligations will require the near complete decarbonisation of heat. This is achievable if action is taken now



Source: *Next steps for UK heat policy* CCC report

be all-electric from HPs, then anything more than 3.5 COP is optimistic – unless you go large and put them on heat networks. Also, will consumers want cooking to be all-electric? Social factors will influence energy supply.

BE: We may end up with a zero carbon gas grid or zero carbon hydrogen. If we do, then CHP systems would become low/zero carbon – but so would an all-electric system, which can use both gas and hydrogen in power stations to generate zero carbon electricity. An all-electric system is future-proof in any scenario, whereas any CHP/gas system is dependent on something that may never happen.

PJ: The electricity grid has been decarbonising fast, but much of that is a 'dash for gas', away from coal. How will it decarbonise the rest? It will get harder and harder to reach a 100% zero carbon grid. It is more likely that a range of supply systems and local technology will decarbonise. HPs will be a big part of the heat-generation – and cooling – landscape, but our future will never be all-electric.

BE: A standard Worcester-Bosch gas boiler and mains electricity is lower carbon than a CHP. On this basis, with regard to DH networks, we can leave it to the project engineers to decide if there is a reliable source of heat that would improve the performance of an HP sufficiently to justify the expenses and losses on the network – and loss of choice for the consumer.

PJ: Cities will be a heat network-based solution; you can put any technology on the front end – fuel cells, CHP, solar water, energy from waste – and supply low carbon heat to any type of demand or building. Copenhagen is supplying 98% of its heat via DH.

The off-gas grid areas are probably going to be an all-electric heat pump world; the suburbs will be a mix; and – where the conurbations are heat-dense enough – a heat network is a good approach. Heat networks could wean installers and consumers off individual gas boilers.

Evans and Jones: Testing the strength of their arguments

BE: In the new-build sector, particularly in cities, we face three major issues: CO_2 emissions, overheating and air quality. HPs address all of these.

PJ: Where larger, local CHP displaces individual boilers, it can result in improved emissions overall, through better efficiency and dispersal. On a national scale, local CHP at 80-85% efficiency results in fewer emissions than power stations. The decarbonising electricity grid provides an air quality benefit locally, but not nationally. However, if the gas grid decarbonises, perhaps it's equal all round.

BE: Our cities have a major air-quality issue. This is why we should keep combustion out of urban areas. I propose a compromise:

- Don't change the heating in existing developments, but agree a programme of energy efficiency. Decide whether/how to change them to a decarbonised gas system, all-electric, hydrogen or other when/if these things are available
- New developments should be all-electric. With very little need for space heating, they don't create a massive increase in electrical demand, and we are only building at about 1% of our stock per year
- No CHP engines or other gas systems to be deployed until we have decarbonised the gas grid/converted it to hydrogen.

PJ: I agree we should put energy efficiency first, but that is proving an uphill struggle, with electricity consumption in buildings rising. In existing high-heat-density areas, heat networks allow technology to be changed/connected. And CHP is still going in for cost-saving reasons; this saving can help fund the heat networks that enable future supply.

If a heat network exists – or there's a local heat density that suggests a heat network – a new-build should connect. Unfortunately, cost is king – and that is driving CHP right now. But in 5-10 years' time, my guess is city-wide DH, supplied by a combination of CHP and HPs – it's all in the mix! **CJ**

Barny Evans MCIBSE is associate for energy and sustainable development at WSP Parsons Brinckerhoff, and Phil Jones FCIBSE is an energy consultant and CIBSE CHP/DH Group chair

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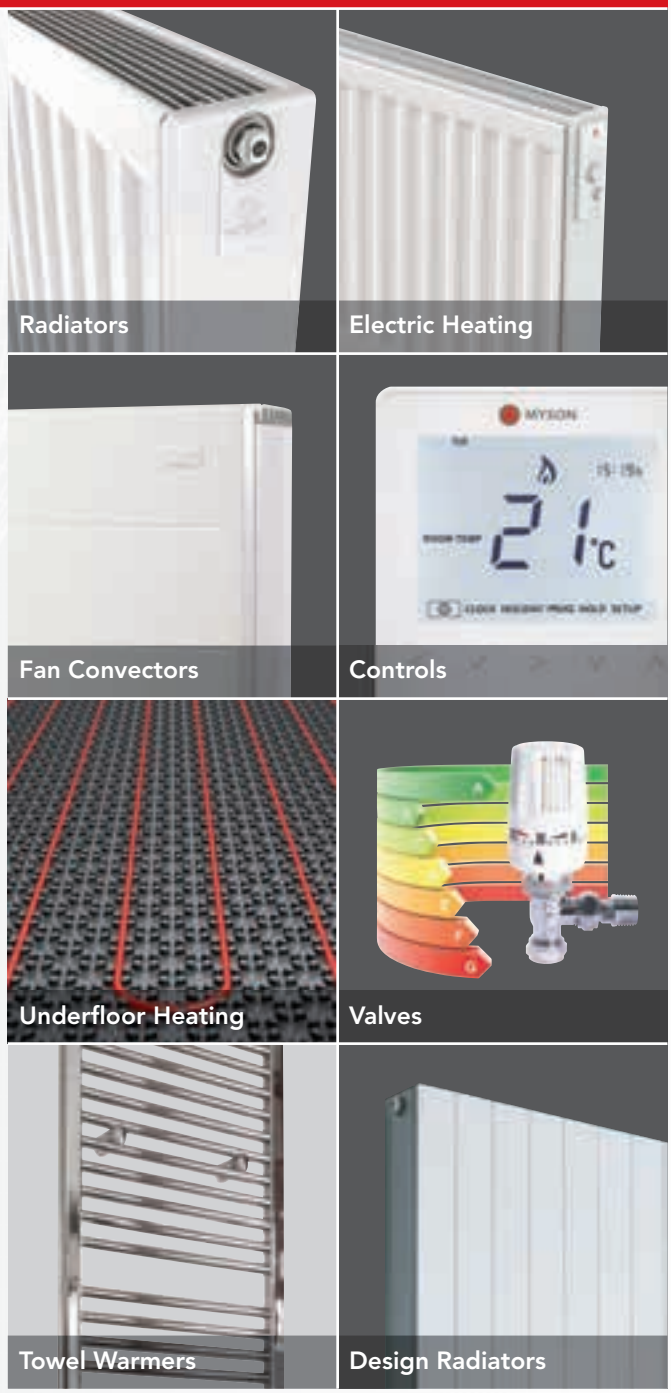

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COMPLETE HEATING SOLUTIONS

FRESH THINKING

A single-sided ventilation strategy that meets environmental criteria – while upholding design quality – has been rolled out in two Nottinghamshire schools. Breathing Buildings' **Shaun Fitzgerald**, Cundall's **Peter Hazzard**, and **John Leonard**, from Nicholas Hare Architects, explain the system

Strict new environmental requirements are making it very challenging for engineers and architects to design economically viable schools without compromising on the quality of materials and architecture.

Baseline designs developed by the Education Funding Agency (EFA) are based on cross-ventilation, where rooms are coupled with full-height atria in the circulation zone. This approach requires noise attenuation and smoke control between the occupied rooms and circulation/atrium spaces, and centralised control of the atrium environment, based on the ventilation needs in each of the occupied rooms. This needs to be coupled with – or substituted for – a system of mechanical ventilation in winter, with considerable capital and running costs, or a network of mixing systems that link with the atrium.

Nicholas Hare Architects, and building services engineer Cundall, have sought to replace this complex strategy with a much simpler, single-sided ventilation system, which could boost natural ventilation on summer days, as well as provide heat recovery. The design team helped develop a new ventilation unit with manufacturer Breathing Buildings, and the first schools to feature the design have now been completed.

The deep-plan classroom design offers an alternative to cross-ventilation, and

reduces engineering complexity and the overall costs of the school.

The schools

The Nottinghamshire Priority Schools Building Programme (PSBP) batch of schools was awarded to Kier in May 2015, supported by its design team of Nicholas Hare Architects (NHA), MEP engineers Cundall, daylight analyst Chris Jackson, and MACH Acoustics. The goal of the Kier team was to deliver six schools, in line with the tight programme and budget provided by the EFA, which met the stringent Facilities Output Specification (FOS). NHA was the architect for the first two schools – Newark Academy and Serlby Park Academy.

FOS stipulates environmental design criteria covering various aspects, such as air quality, thermal comfort, glare-free daylight and comfortable acoustics. Crucially, these performance requirements are to be met within defined energy-consumption targets, which – in turn – require heat recycling in winter.

Several people in the industry have said that increasing engineering performance while tightening budgets presents a severe challenge, because engineering performance is measurable and architectural quality is not. There is a risk that the cost of satisfying the requirements of the FOS may lead to a degradation of architectural quality. The approach taken at the Nottinghamshire schools represents an attempt to meet the sensible environmental criteria of the FOS in a way that is architecturally satisfying, while preserving some funds to contribute to build quality.

Building form

The drive for economy has forced architects to consider deep-plan building forms, with minimal envelope-to-volume building form concepts. These multi-storey, 'big box' approaches reduce the potential for natural ventilation and daylight in teaching spaces – the very criteria that the PSBP wishes to maximise. So the design team reviewed the ventilation strategy of the baseline designs developed by the EFA.

NVHR mixing unit

Even before the PSBP, Nicholas Hare Architects had teamed up with Breathing Buildings to design many schools with a variety of ventilation systems. The desirability of an effective, single-sided ventilation system had long been clear: it could offer flexibility and simplicity in building design and in operation.

However, most of the available decentralised systems were defective in terms of fresh air distribution, draughts or heat recovery, or the energy and space requirements of conventional heat exchangers. Appreciating the advantages of air-mixing systems, Nicholas Hare presented a proposal to Breathing Buildings for a fan-driven mixing unit to supply the fresh air requirements of classrooms with tempered air.

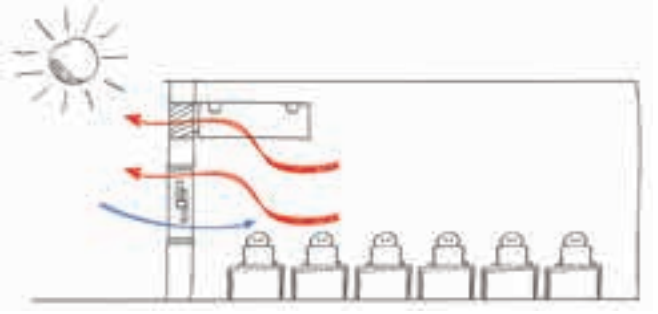
The proposal – based on an old-fashioned car heater – placed a mixing unit at the head of each window, ducting air towards the back of the classroom and allowing it to exit beside the intake, or to be remixed with the incoming air using a simple control. It was developed by Breathing Buildings to be placed into the natural ventilation with heat recycling (NHVR) unit, with two small centrifugal fans in each.

The units achieve the equivalent of heat

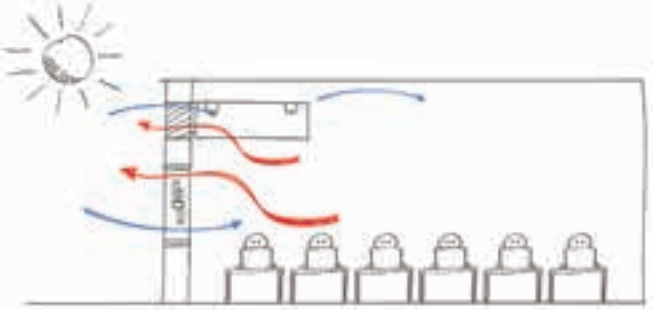
FRESH AIR SUPPLY

When using the fan to supply fresh air, a separate pathway is available for passive exhaust. This pathway can be used for two-way flow when the fresh air fan is not in use and when other openings – such as windows – are closed (as in passive night-time cooling). If a window is open, flow through the NVHR damper will depend on: the relative height of the NVHR to the other opening; the wind pressure; and the difference between room and outside temperatures. The key is how the damper is controlled – multiple temperature sensors in the NVHR ensure draught mitigation, with fan and damper modulation.

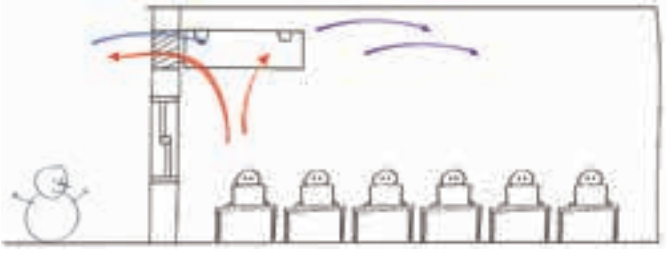
NVHR modes



Natural mode
- Damper opens
- Single-sided ventilation
- Works with other openings in the space



Summer mode
- Damper opens fully
- Air delivered to rear of the space
- Natural exhaust through the unit
- Night cooling



Winter mixing
- Draught mitigation strategy
- Mixes warm room air with fresh external air
- Natural exhaust through the unit

> The desirability of an effective single-sided ventilation system had long been clear: it could offer flexibility and simplicity in building design, as well as in operation

Window design

The window design was optimised to achieve the ideal balance between the performance requirements for daylight, ventilation and temperature control.

Each window opening consists of a number of elements. A large, fixed double-glazed unit supplies daylight (0.70 light transmission), but controls solar gains (with a g-value of less than 0.4). The size and location relative to the classroom space is governed by the FOS requirement for daylight autonomy and useful daylight illuminance.

The size is also economic, being about the largest that standard aluminium window systems will cope with in cost terms. Vertical Venetian blinds offer glare control for fixed windows without interference from the ventilation elements.

Two tall and narrow, inward-opening vents are placed beside the fixed pane. These create the necessary free opening area without the vents intruding significantly into the occupied space. The NVHR unit is plugged into the window frame at high level, above these vents. A single louvre is fixed on the outside, giving a unified external appearance to these three elements. The louvre was carefully selected to have a very high free area and low drag coefficient, as it is required for passive natural ventilation.

The windows behind the louvre can be opened at any time and do not need a blind, which would otherwise block the opening window or flap around in the breeze. Furthermore, there is no risk of anyone falling out, or of a student walking into the edge of an opening window. The windows can be left open out of hours for a night purge if required, as the louvre ensures a measure of physical security.

recovery by more economical means – using low fan power and exploiting the heat gains in the space – and allow boosting of natural ventilation on still, summer days.

Integration into the building

NHA and Cundall worked with Breathing Buildings from the start of the design development for the Nottinghamshire PSBP. It quickly became apparent that the NVHR unit was of interest and the team set out to test how it could be integrated into the design.

Cundall confirmed from the outset that an exposed, thermally massive soffit was essential to furnish the buffer for moderating summertime temperatures, especially on the hottest days. The adaptive thermal comfort criteria used in the FOS are based on operative temperature, which is a function both of the temperature of the exposed surfaces in a space and of the air temperature.

Thermal mass, which is appropriately cooled at night, can help to ensure lower surface temperatures and, consequently, lower operative temperatures.

A comprehensive round of design studies was undertaken to test various options for façade design. The final solution was based on a modular arrangement, consisting of a window opening every 3.7m. This equates to two windows per typical classroom, three windows per typical science lab and four windows for the largest classrooms, such as those for art.

This, by now standard approach not only enables flexibility in space-planning layouts, but also produces a regular and cost-effective elevation design.

Modelling and operation

Cundall undertook dynamic thermal modelling in IES for the entire school at a very early stage, and the results obtained using this integrated design were excellent. Passive ventilation was shown to work throughout the majority of the year; the NVHR units are only called upon to operate and assist in the ventilation of the classrooms during the colder weather, on the hottest summer days, and during the summer nights.

In colder weather, the NVHR unit mixes incoming cold fresh air with warm room air at the façade, with pre-warmed air introduced at the point of entry to the room – so the risks of cold draughts are mitigated. The unit yields fan-assisted ventilation in the latter part of the hottest

summer days, when the effectiveness of the heat absorption from the exposed soffit has waned. In this case, the optimal strategy is to maximise the ventilation rate of the room to minimise the difference between the interior and exterior air temperatures.

The fan-assisted flow to the rear of the room is a more cost-effective way of delivering this feature than a purely natural, cross-flow scheme. In summer, the NVHR offers a further means of ventilating the buildings at night, thereby helping to ensure it is adequately cooled in preparation for the following day.

The integrated design using the NVHR units has offered a simple and aesthetically pleasing solution to what, otherwise, could have looked like a façade peppered with small louvres, or interrupted by ventilation units – more than 100 of which feature in the scheme. The simplicity of this solution also proved to be very cost-effective. **CJ**

● **SHAUN FITZGERALD** FCIBSE is chief executive officer at Breathing Buildings, **PETER HAZZARD** is senior associate at Cundall, and **JOHN LEONARD** is partner at Nicholas Hare Architects

NVHR unit

> The integrated design has offered a simple and aesthetically pleasing solution to what, otherwise, could have looked like a façade interrupted by more than 100 ventilation units

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IMAGES UNLESS OTHERWISE STATED HARRY KH/LAND ROVER BAR

RAISING THE BAR

Land Rover BAR will attempt to achieve Britain's first America's Cup victory next year. If its teamwork is anything like the collaborative approach taken to design its HQ, Sir Ben Ainslie stands a good chance of bringing home the trophy. **Alex Smith** reports

The United Kingdom has excelled at sport in recent years, including stirring success at the Rio Olympics, where Team GB finished second in the medal table, ahead of sporting superpowers such as Germany and China.

Some of Britain's greatest modern-day achievements have come in the Olympic regatta – and with two golds and a silver in Brazil this summer, the UK was again the leading sailing nation at the games. This was despite not having the services of Sir Ben Ainslie, the most successful sailor in Olympic history, who won four consecutive gold medals up to and including 2012.

Despite its recent achievements on the water, one notable trophy has been beyond the reach of British sailing: the America's Cup. Since the first race in 1851, no British team has ever won it. That could change in 2017, when a team formed by Ainslie will be among those challenging the defending champions, Oracle Team USA.

Land Rover BAR (Ben Ainslie Racing) is based in Portsmouth, and has its headquarters in a prominent new building on the waterfront.

Its connection with sailing can be seen in the façade; a large fabric wrap partially covers all four sides of the building. It acts as a solar shade, as well as a billowy metaphor for the boat research and development going on inside.

The headquarters are the focal point for the design, construction and development of the team's boats, as well as for the crew's sports science and fitness facilities. Its set-up has been likened to that of a Formula 1 team; it houses the team's design, commercial, event management, sustainability, marketing and PR teams, who will closely monitor the progress of the America's Cup challenge in Bermuda next year.

On the ground floor, behind the large Union Jack doors, is the workshop, where the boats are assembled, stored and maintened. Above are offices, a gym, meeting rooms and a corporate area. There is a central lightwell rising through the

PROJECT TEAM

- **Architect:** HGP Architects
- **Environmental consultants:** Couch Perry Wilkes
- **Main contractor:** Allied Developments
- **Structural engineers:** Reuby and Stagg

CREDIT MARK LLOYD/ LAND ROVER BAR

building, which helps to bring natural light into the building, and naturally ventilates the workshop. (See panel, 'Inside Land Rover BAR's headquarters').

As well as preparing an assault on one of the oldest trophies in international sport, Land Rover BAR is dedicated to creating a sustainable legacy for sailing (see panel 'Sustainable features'), and sustainability officer Susie Tomson ensures that the environment is central to strategy decisions.

'Sustainability was embedded right from the start. We could have built a cheaper building, but we wanted a long-term option, with design, innovation and sustainability wrapped into one,' she says.

The race to the start line

This presented a challenge for the project team because the HQ had to be designed and built in less than half the time expected for this type of building.

'For the boat to be competitive in the first America's Cup World Series event in 2015, we had to be operational within 18 months,' says Tomson.

Achieving this meant bringing the design team together at the start, and using building information modelling (BIM) to coordinate the design. 'Collaboration was one of the strongest stories on this project,' says Tomson. 'Right from the start, we had to sit down together.'

Phil Ward, associate at Couch Perry Wilkes, said BIM was critical in meeting the tight schedules, and it forced the team to spend more time getting the plans right at the design stage. 'We just used it for design and coordination, rather than scheduling.'

Another problem was meeting the aspiration for a sustainable building before all the money had been raised for the America's Cup challenge.

> Sustainability was embedded from the start. We could have built a cheaper building but wanted a long-term option, with design, innovation and sustainability in one

'We did an assessment of how we could get to zero carbon, and we decided to do it in stages,' says Ward. 'We had already specified good U values and low air permeability. Further reductions were achieved by specifying efficient equipment. Solar PV on the different roofs further reduced carbon emissions.'

Around 20% of the team's electric demands are met by 130MWh/yr roof-top PVs. Renewable energy operator – and one of the team's official suppliers – Low Carbon supplied the array and is working to provide solar power to the team's temporary base in Bermuda. It is also supplying solar power to a local school and supporting the team's official charity, the 1851 Trust, with income from the government feed-in tariff.

There are facilities to allow the future installation of technologies to reduce emissions even further. These include connection points, ventilation louvres, a blanked-off flue to the roof and a gas connection to accept a CHP unit. There are also connection points and space allocated to install seawater cooling equipment to reduce the chiller load at certain times of the year.

Fan coil units that are easy to reposition were specified; on the Tech Deck – the team's education space – they have already been moved by the M&E subcontractor to meet the elvolving requirements.

Internal environments differ across the building. The ground floor houses

CREDIT HARRY KH/ LAND ROVER BAR

CREDIT SHAUN ROSTER

the workshop, where Land Rover BAR is completing its boat for the America's Cup challenge – it will be launched in early 2017. The area is heated by radiant panels to a temperature of 16°C.

The workers and sailors like conditions to be invigorating, says Ward. 'At one point they didn't want any heating in the workshop and, in the gym, they wanted lots of fresh air to assist with their rigorous training regime,' he says.

The worker's hand-on, technical approach meant they could pursue a simple natural ventilation strategy in the workshop, and be trusted to open and close the main doors to adjust internal temperatures, humidity and air quality.

Ward says the team members used trial and error to work out how far they had to open the doors to achieve optimum temperatures.

An atrium runs from the workshop to an ETFE roof, where air is exhausted through glazed louvres.

The fabric wrap – as well as defining the appearance of the building – also helps condition the building. It minimises solar gains in the interior and traps warm air between the fabric and the building envelope, helping to reduce the heating requirements in the building.

'It shelters the building from the elements,' says Ward. 'It provides solar shading, which means we could relax the g-values (solar energy transmittance) of the glazing. We used integrated modelling software to assess the benefit of providing the wrap and a significant reduction in cooling and heating loads was achieved.'

Thermal imaging showed how warm air was being trapped between the fabric and windows, which helped to reduce heating requirements in the winter.

The designers paid special attention to the thermal performance of the envelope. Low U values of $0.15 W \cdot m^{-1} \cdot K^{-1}$ were specified for walls, floors and the roof, and pressure testing showed air permeability was $2.6 m^3/m^2 \cdot h$@50Pa, which compared favourably with the $3 m^3/m^2 \cdot h$@50Pa that had been used in the model.

Quiet please

The designers tried to use thermal mass as much as possible for passive cooling, but the speed of the build did not allow the specification of poured concrete slabs for the steel-frame building. The compromise was to use concrete floors supported by a hollow rib flooring system, which is much quicker to install with exposed slabs.

Noise reduction was also a challenge. The VIP area is on the roof, and special guests did not want to be disturbed by noisy HVAC equipment while they watched the sailing. So the chiller has been positioned in the mezzanine plantroom, while the dry air cooler on the roof has been specified with the lowest possible noise rating.

Post-occupancy evaluation of the building is supported by the University of Portsmouth. Ward says that it was very

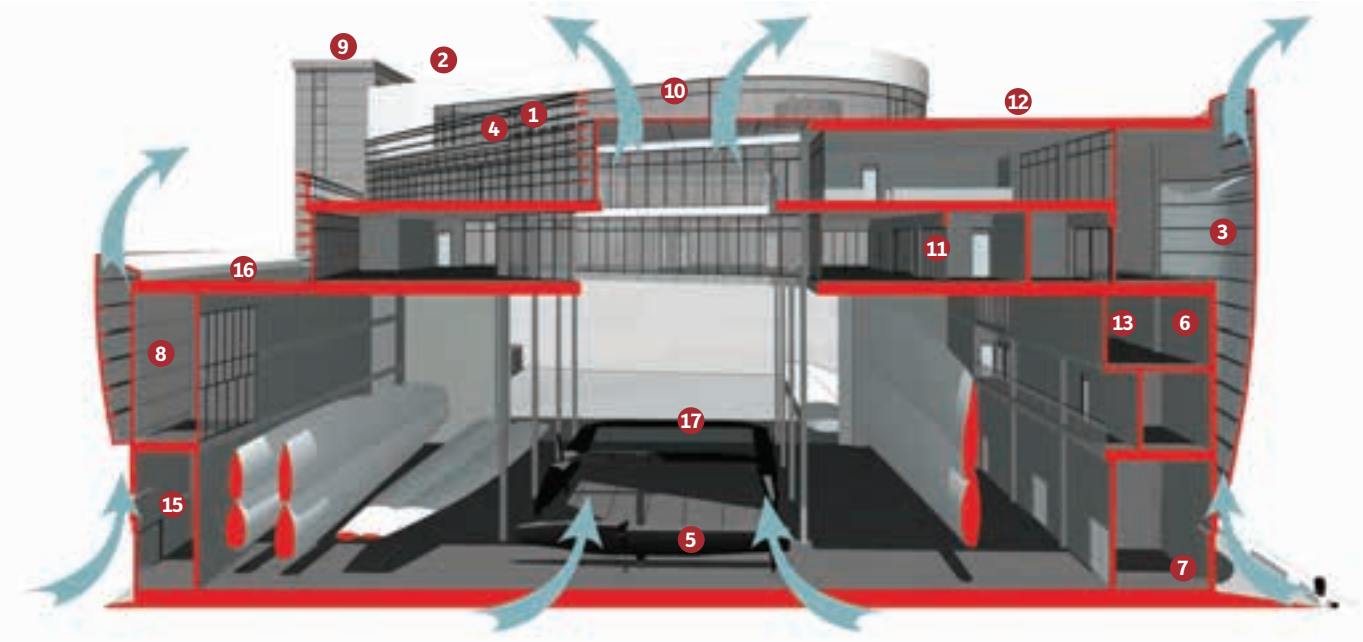
Inside Land Rover BAR's headquarters

Opening the large Union Jack doors reveals the 12m-high workshop and the heart of the boat-assembly, maintenance and research operation. There are also workshops in containers, which will be shipped out to Bermuda, as well as a paint shop and bike store (staff are encouraged to cycle).

On a mezzanine level is a gym, meeting room for the crew, changing area, and showers/toilets. Above that are offices for design and operation staff, and a large open area for meetings. There is a central lightwell rising through the building from the workshop, which helps bring natural light in, as well as allowing the workshop to be naturally ventilated.

One half of a floor is taken up with a Tech Deck, which is designed to ignite enthusiasm for STEM subjects among 11-16-year-olds. This level features a test boat and interactive games, that allow users to experience sailing and try out some of the technologies used by the team.

There is also a canteen and kitchen area and a corporate hospitality VIP area at the top of the building, which offers 360 degree views across the Solent.



Section view of Land Rover BAR headquarters

difficult to make predictions about energy use because the building has so many uses – workshop, restaurant, bar, offices, gym and so on – and it was difficult to know how often areas such as the corporate hospitality would be used.

The success of the building is an auspicious sign for Land Rover BAR as the America's Cup challenge nears its completion. If the cooperation and technical skills demonstrated in the building delivery is replicated by the sailors in Bermuda, a British team might just be returning to Portsmouth with the America's Cup – for the first time in 166 years.

'The builders, M&E teams and designers all pulled in the same direction and– as we worked collaboratively – we were able to move the design forward really quickly,' says Ward. 'This building proves that, with a good team, you can do anything'. **CJ**

SUSTAINABLE FEATURES

The Land Rover BAR HQ was required under planning to achieve the Breeam Excellent standard, and has many environmental features, including:

- A/A+ Green rating for majority of structural materials
- 100% compliant paints and carpets
- 97% of demolition materials recycled
- 70% improvement in air permeability compared to Building Regulations
- 100% demolition crushed and reused foundations
- 1,200-litre tank harvesting rainwater
- 25% water efficiency improvement from Building Regulations
- Reintroduction of native oysters in an artificial reef
- Adheres to ISO 20121:2012 Event sustainability management systems

KEY

1 **Brise soleil** Passive solar shading to southern elevation
2 **Roof** U value 0.15 w/m^2 K
3 **Fabric wrap** Enhanced thermal performance reduction in g value
4 **Glazing** U value 1.4 w·m^{-1}·K^{-1} (including frame)
5 **Floor** U value 0.15 w·m^{-1}·K^{-1}
6 **Wall** U value 0.15 w·m^{-1}·K^{-1}
7 **Air tightness** 2.6 m^3/m^2·h at 50pa
8 **Rainwater harvesting from boat ballast**
9 **LED lighting and daylight control**
10 **Atrium** Ensures natural daylight/ventilation and connectivity to the building
11 **Four pipe variable speed fan coil at high levels** DC motors
12 **Photovoltaic array** 707m^2/114kWp
13 **Plant zone** Air handling and heat recovery; boilers; chiller (10/16°C)
14 **BMS and metering** Gas - incoming, boilers; water; power – each board; lights and power; separate; PV
15 **Future sea water cooling**
16 **Radiant heating**
17 **Natural ventilation**
18 **Future CHP** Flues installed; plantroom space provision; ventilation requirements met

SOUND OF SUCCESS

Creating the right acoustic environment in a performance space is a painstaking task that requires a multidisciplinary approach. **Liza Young** speaks to the team behind a new University of St Andrews music centre

The University of St Andrews is internationally renowned for its research and education – as well as for concerts by its orchestra in residence, the Scottish Chamber Orchestra. To keep in tune with its reputation as a world-class music facility, the university has decided to create a new performance hub that it hopes will attract the best performers from around the globe.

The building, located on the historic Queens Terrace, will offer a range of practice, rehearsal and teaching spaces, a dedicated rehearsal and performance studio, plus a recording suite and library. It is hoped the project will be completed in 2018.

With experience of working on the Stowe Music School, in Buckinghamshire, a team of acousticians and building services engineers from WSP Parsons Brinckerhoff has been selected to design St Andrews' music centre.

The auditorium

Stowe Music School, completed in 2013, is a purpose-built, two-storey facility comprising a 250-seater recital hall, a recording studio, 24 practice rooms, two classrooms and a soundproofed percussion room.

James Healey, acoustics associate director at WSP Parsons Brinckerhoff, says it is important in recital halls that the audience receives the direct sound produced on stage. To deliver this, large, high-level reflectors were placed above the stage at Stowe to angle the sound towards the audience.

'We also wanted to deliver the very early reflections from the sidewalls and ceiling,' he says. 'Acoustic diffusers were installed on the walls, close to the stage, to scatter the sound and avoid undesirable reflections.' In addition, acoustic absorption was used either side and behind the seating area to ensure the audience does not hear any reflected 'late sound'. This can come slightly after direct sound, affecting the audience's perception of the performance.

ISO *3382-1:2009 Acoustics – Measurement of room acoustic parameters* provides some guidance on performance spaces but, generally, the acoustic criteria is based on the team's experiences. 'It's also dependent on the client's aspirations – how they are going to use the space and what will be performed in there,' says Healey. At Stowe, the hall was to be used mostly as a piano-recital space, which needed a controlled environment. This was achieved by providing carefully-modelled fixed acoustic conditions. 'It's important to ensure the sound stays the same, regardless of occupancy,' adds Healey. 'In recital halls with fixed seating, the seats have to have the same absorption qualities as people, so you get a standard uniform sound even if it's unoccupied. At Stowe recital hall, the seats were of equal acoustic absorbance to that of a person so the conditions were balanced regardless of whether the hall was occupied or not.'

In contrast, the recital hall at St Andrews – which must offer a rehearsal space for orchestras and choirs – will require variable acoustic conditions,' says Healey.

Different surface treatments and building materials have a bearing on sound quality. One of the challenges when designing the Stowe recital hall was that the ceiling had to be lowered to free up space in the ceiling void for the services systems. This meant changing the acoustic treatment within the space. 'We made the ceiling heavier and changed the wall

CREDIT: STEPNELL

An orchestra performs in the Stowe recital hall

profiling, to stop the sound escaping through the fabric,' says Healey. 'We wanted to keep the low-frequency (bass) sound within the space because it offers warmth to the listeners by giving them a sense of being enveloped by it. If the materials are light, and there's a lot of absorption or leakage of bass sounds, you get a cold sound that isn't in keeping with the musical production.'

Services strategy

Graeme Bruce, WSP Parsons Brinckerhoff's head of building services in Scotland, says acoustics criteria must be at the forefront of the HVAC services design at St Andrews: 'The air distribution system must be carefully designed so it does not ruin the acoustic performance of the space.'

The ventilation strategy is particularly crucial to the success of the building, adds Bruce. 'In rehearsal spaces, for example, we have to ensure outside noise doesn't encroach into the space, and we don't want noise escaping and becoming a nuisance to neighbours.'

External environmental factors in St Andrews will also be taken into account during design. Humidity control will be crucial for this coastal town, which frequently experiences fog and mist. 'Imagine a November evening,' says Bruce. 'It's pouring with rain outside and 200 people are coming into the auditorium. Because air humidity affects how sound travels, the system we design will maintain a constant condition, regardless of the external environment. Our design must deal with a variety of changing conditions.'

Also high on the list of considerations is the vibration through the building structure. Plant items – such as fans or air handling units (AHUs) – can send vibrations through a steel frame creating unwanted noise.

From a building services perspective, the most crucial element of the St Andrews project will be identifying the noise criteria to which the services strategy will have to be designed.

'At the same time, we have to comply with Section 6 of the Scottish Building Standards, and achieve Breeam Excellent and EPC A ratings. All these are factored into the design process,' says Bruce. 'We have to ensure the acoustics team is aware of our thought processes at every stage, including plant selection and plant location.'

Sound modelling

The acoustics team at WSP Parsons Brinckerhoff uses modelling software to create a 3D representation of the space, within which any sound can be modelled in any location. 'We can take Mozart's recital and predict how it would sound in different points in the hall, and play it back to the client,' says Healey. 'That level of feedback is very important for something like acoustics, where what we're creating is not visible.'

During objective analysis, the client is able not only to visualise the space using the architect's 3D model, but also to hear how it's going to sound. The acousticians work with a combination of models; they use the architect's 3D design for visual cues, and develop their own acoustic model for importing and modelling the sound.

Recording spaces

The architectural detailing and building services design in the recording rooms at Stowe Music School will inform the design at St Andrews. At Stowe, each room has a dedicated AHU that enables a high level of sound insulation between rooms and avoids 'crosstalk' issues – when sound travels through common ductwork between different rooms.

In smaller rooms, such as recording studios, standing waves – or 'flutter echoes', when sound bounces backwards and forwards within a room – can occur if walls are positioned directly opposite one another. 'These unwanted effects have to be removed because you want as clean and pure a sound as possible in a recording studio,' says Healey.

To overcome this at Stowe, the team angled the walls. 'Having a slight angle on opposing surfaces eliminates those echoes. We apply this to all music-related buildings,' says Healey.

Bruce adds: 'One of the benefits of a multidisciplinary approach is that we work in a collaborative manner. This enables us to share information – and make decisions – quickly, which is important because projects usually run quite tight. It also ensures we can deliver – and exceed – the client's brief.' **CJ**

Fixed seats in Stowe hall are acoustically absorptive

Angled walls stop 'flutter echoes' when recording

The clean lines of Stowe Music School's exterior

Papers on lift traffic and waiting times had a strong presence at the event

I WEI HUANG / SHUTTERSTOCK

ON THE UP

Traffic simulation, pulley design and escalator strategies were brought to the fore at the 2016 Symposium on Lift and Escalator Technologies. **Dave Cooper** reports

More than 120 delegates attended the symposium

There is no doubt in my mind that the Symposium on Lift and Escalator Technologies is the best global gathering for the profession – it just gets better every year.

The 2016 event was the sixth staging of the conference, and the fourth time it has been held at Highgate House in Northamptonshire.

More than 120 delegates from 18 countries attended the symposium, which was supported by a small exhibition staged by industry representatives, including components and stainless steel suppliers, control panel manufacturers and the University of Northampton (UoN).

John Sinclair, associate dean from the university's Faculty of Arts, Science and Technology (FAST), opened proceedings, and expressed his delight that CIBSE, UoN and the Lift and Escalator Industry Association (LEIA) continue to work together in a partnership that culminates in an annual international event.

Len Halsey, chair of the CIBSE Lifts Group, chaired the first session on technology and innovation, which Ben Langham opened with a presentation entitled *How current technology trends are empowering us all to drive innovation*. His paper demonstrated that you don't have to have a huge budget to embrace technology.

John Trett came next, with a paper about calibrating induction loops. Drawing on his own experience of having a hearing condition – the result of an infection caught while swimming – he explained the requirements for induction loops and how they often fail to work properly in lifts. I don't think it will be the last we hear of this paper.

The final presenter of the opening session was Dr Jonathan Beebe, who spoke about the integration of lift systems into the Internet of Things – providing sufficient discussion points for the ensuing break.

The second session, chaired by Adam Scott, past chair of the lifts group, focused on traffic simulation. Five papers were presented, covering: a systematic methodology for the design of lift-traffic systems; global dispatcher interfaces; an overview of India; multicar dispatching; and waiting times. Traffic presentations always create lively debate and discussion went on for a long time afterwards.

In the afternoon, I chaired a session about equipment and maintenance. Rory Smith opened this part of the symposium, talking about the role of economic factors in traffic planning. He gave an insight

POGANYEN / SHUTTERSTOCK

For the fourth year, the symposium was held at Highgate House, Northamptonshire

into how buildings are valued, and the impact of our engineering decisions on return of investment.

Dominic Dawson followed, to discuss the report of thorough examination as a management tool for maintenance. The final speaker in this session was Jawk Meijer, who presented a paper about innovations in pulley design, which provoked some interesting discussion among the delegates about rope size and traction problems.

The final session of the day – again chaired by Len Halsey – was a break from the traditional: a 60-minute workshop presented by Nick Mellor, Lawrence Dooley, Stefan Kaczmarczyk and myself. It covered training and looked at qualifications ranging from apprenticeships through to high-end academic qualifications, including PhD and MPhil.

My presentation on how to register with the Engineering Council and the professional bodies followed.

On the second day, Nick Mellor chaired the first of three sessions on codes and standards. Lee Gray opened with a paper about the 1935 code of practice, then Mellor presented a paper by Sam Tanno – who could not attend – looking at the requirements of the new EN81 standards. Finally, Gina Barney presented the requirements of the HTM 08-02 technical memorandum, published by the NHS.

This was followed by a five-presentation session on energy and engineering, chaired by Rory Smith. The first paper looked at the geometry of the lift car and its influence, and was followed by papers on dynamic lift control, lateral vibrations, holistic energy benchmarking, and active cabin damping on ropeless systems.

The final – very entertaining and informative – session was chaired by Ben Langham. The four papers presented included: a discussion about the pilot study for making passengers stand – rather than walk – on escalators; fire systems in a working airport; the London Underground escalator passenger-safety strategy; and the use of lifts to evacuate tall buildings.

Stefan Kaczmarczyk and Richard Peters concluded the symposium by thanking all those who had contributed papers and participated. The quality of the presentations was exceptional, sparking discussions in the Q&A sessions that continued into the breaks.

The seventh Symposium on Lift and Escalator Technologies will again be held in Northamptonshire on 20-21 September 2017, followed by an additional one-day event in Hong Kong in May 2018. A number of papers are already proposed.

If you would like to offer a paper for the 2017 Symposium, visit **www.liftsymposium.org** for more information. Papers from past symposium years may be downloaded without charge from the same website. **CJ**

DAVE COOPER FCIBSE is managing director at LECS

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> Papers included a discussion about the pilot study for making passengers stand, rather than walk, on escalators; fire systems in a working airport; the London Underground escalator passenger safety strategy; and the use of lifts to evacuate tall buildings

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This month: Air conditioning in high-rise towers; comparison of FCUs and chilled ceilings cost model; preventing legionella in district heating systems; CHP contract at leisure centre; and heat pipe dehumidification

CHUYUSS / SHUTTERSTOCK

HIGH STAKES

If cities are to hit their carbon-reduction targets, the next wave of high-rise towers must have more sustainable air conditioning. Arup's **Roger Olsen** says a new hybrid system – combining elements from fan coil units and chilled ceilings – will improve energy efficiency and create more space for occupants

By 2050, 70% of the world's population is expected to live in cities. This rapid urbanisation is placing an ever increasing premium on property, with more developers looking to high-rises to generate return on their land spend.

While profitable, building upwards is a complex and highly regulated business. Two constant priorities are the need to save space and to improve energy efficiency. Some of the most significant steps being made by building services engineers are in the area of air conditioning. The standard, popular option is a fan coil unit (FCU), but these can be thirsty for energy, and noisy.

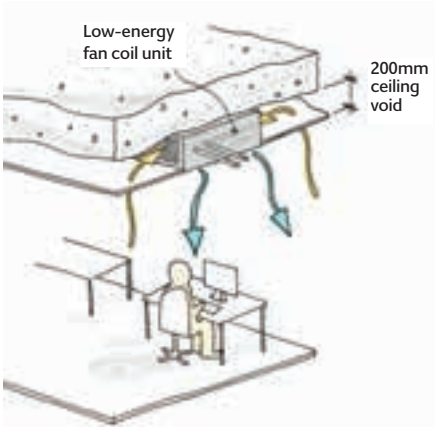
We set out to devise a product to harness the power and flexibility of the FCU, while cutting energy use. It is effectively a hybrid between a low-energy FCU and a chilled beam, operating at chilled-water temperatures as a low-energy fan coil unit, or with 'cooled' water from non-refrigerated sources.

This 'hybrid' design – developed by partner Airedale and supported by fan supplier ebm-papst – is now nearing completion. A 'model' building, based on a nominal 10,000m² office in London, was used to assess 'hybrid'. Alternative air conditioning systems were modelled using guidelines from the British Council of Offices (BCO) Specification, and with a Part L-compliant façade.

FCU v chilled ceilings

There are challenges with existing air and water systems. FCUs are good for cooling capacity and while, in the past, these have tended to be noisy, FCUs are much improved. Performance has been enhanced through the use of EC/DC motors and variable speed fans.

Chilled beams, ceilings and slabs tend not to have sufficient cooling capacity to meet the needs of an office designed to BCO standards, and to meet Part L façade regulations. Active chilled beams, which have ducted air supply,



> There is an advantage to supplying air directly from the unit into the space served; less material is used, with less cost, and less energy is consumed because there is no need to force the air through ductwork

do tend to meet the required cooling capacity. For chilled beams, ceilings and slabs, the cooling water temperatures have to be limited to a safe margin above the room dew-point temperature, to avoid condensation. This often results in a non-openable façade and control of the humidity of incoming outside air.

Vertically challenged

Some clients require exceptionally low storey heights, yet still achieve a BCO specification floor-to-ceiling height – typically 2.75m for new buildings. In the past, a figure of 4m has been used as a storey height for air and water systems. With increasing land values – especially in urban areas – the trend has been towards 'skinny ceilings' with storey heights varying between 3.65m and 3.8m.

The refurbishment of existing buildings often requires design teams to think laterally about how to resolve this challenge, especially within the storey heights from the 1960s and earlier, typically 10 feet (3.05m). A trend is to use exposed services or activated thermal mass, taking advantage of the height released to achieve an alternative appearance. Access to air conditioning systems above the false ceiling usually has to be provided by a fully accessible ceiling – which is expensive – or by individual access panels, which can be unsightly.

The response

The starting point for the hybrid design was to use a cooling coil, which is much larger than the conventional size for an FCU, approaching that used for chilled beams. This means a low face velocity and a very low air-side pressure drop. The large coil size also means a good output can be obtained using cooling water from non-refrigerated, low-energy sources. These include adiabatic coolers, chillers in free-cooling mode and borehole water.

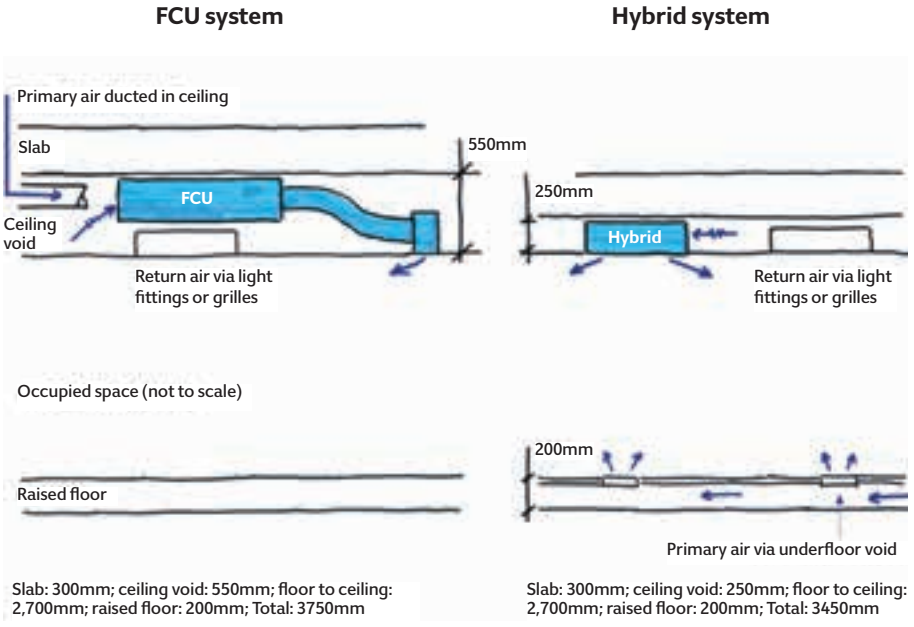
There is an advantage to dispensing with the need for secondary ductwork and supplying air directly from the unit into the space served; not only is less material used, with less cost, but there is less energy consumed, because there is no need to force the air through ductwork.

Our objective was to optimise the airflow pattern. Generally, a high induction diffuser – which uses a radial 'swirl' pattern – is the best approach for supplying air for cooling without causing draughts. The fan discharges air in a 'swirl' pattern, and the perforated bottom face of the 'hybrid' has been designed not to interrupt or divert this. As long as the perforations are of a minimum area and evenly spread out, the swirl pattern is maintained.

The large coil size means that the face velocity is around one-third of that normally used for cooling coils. The internal pressure drop for the fan is around 30% of that required for a conventional FCU. There is no secondary ductwork, so no external pressure drop. The total pressure required from the hybrid fan is about 15% of that required from a conventional FCU. The low airflow and low pressure drop mean that the fan requires very little power. The specific fan power, in $W \cdot L^{-1} \cdot s^{-1}$, is approximately one-third of that available from other FCUs. The fan is variable speed to save energy at times of low load.

We chose the plan dimensions of 600mm x 600mm, as this is a popular size of component for false ceilings. A substantial number of ceilings have a $600mm^2$ grid, and many light fittings are designed to be accommodated within this. The hybrid can easily integrate into different types of ceiling, by the use of spacers or infill panels.

We opted for the 200mm height as this is typically the smallest depth that is achievable for a false ceiling. Other components – such as recessed light fittings, sprinklers and sprinkler heads, and chilled water or low pressure hot water pipework – are likely to cause the ceiling depth to be about 200mm. In residential projects, ceiling depths are often reduced to around 175mm. So it may be possible to rearrange the floor sandwich to achieve a lower storey height. The outside air supply can be changed from ductwork in the ceiling to a floor plenum, at a depth of 200mm. The ceiling void, used for return air, can be reduced from around 500mm to 200mm. With a floor-to-ceiling height of 2,750mm – and a structural zone of 300mm – this saving would reduce the storey height from 3.75m to 3.45m. This



Showing how hybrid system reduces height required in ceiling void

gives the possibility of fitting more storeys in a given height. There is also merit in having an air conditioning system that fits into the 'tight spots' that occur on building design projects.

The two greatest challenges to the project were making the fan behave in the required manner, and fitting all the components – coils, valves, controls, and condensate pump – into the volume of 200mm height x 600mm depth x 600mm width. A number of fan types and arrangements were tried and tested, to obtain optimum noise requirements, specific fan power and the radial swirl air pattern. There were multidisciplinary meetings to optimise coil size and performance, and we tested multiple coil permutations, balancing cooling capacity against the space required for air distribution. The team made extensive use of CFD – combined with highly detailed CAD models – to increase the face area of the filters and heat exchangers to a maximum, while positioning ancillary components in areas where airflow is low. This minimised drag, wasted energy and sound emissions.

The cooling capacity of the systems must be sufficient to remove the heat that arises from internal and solar gains. The model building

had an average heat load of 62W·m^{-2}, rising to 90W·m^{-2} in perimeter zones, with a peak of 120W·m^{-2}. The hybrid is capable of more than 2kW per unit and can easily cope with these cooling loads. The noise levels must be acceptable – typically NR35 for open-plan offices. The indications are that, at one unit per 25m^2 of floor area, the noise will be in the range of NR34 to NR38. Lower noise levels can be achieved by using more units running at a lower speed. The system must also be 'draught free'; this means limiting the air velocity in the occupied zone and, typically, air velocities below 0.25m·s^{-1} are found to be acceptable. Measurement of the airflow pattern from the hybrid shows that it closely resembles the pattern from a high induction swirl diffuser. CFD analysis of the airflow shows that comfortable draught-free conditions are achieved in every part of the occupied space.

The hybrid can deliver heating as well as cooling, and has a condensate collection system and pump. The outline design for a simplified model office showed that three FCUs could be replaced by four hybrid units. As the hybrid does not require secondary ductwork, there are cost benefits and sizeable time savings to be realised in installation, as verified by independent quantity surveyors.

We modelled the building using the Part L compliance tool. We also modelled an FCU system and tested the effect of the improved specific fan power of the hybrid. The hybrid showed a 12% reduction in annual HVAC energy, and a gain of three Breeam points. **CJ**

● **ROGER OLSEN** is an associate director at Arup

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COMPARISON OF FAN COIL UNITS AND CHILLED CEILINGS

In this cost model – covering mechanical and electrical installations – Aecom's specialist MEP cost managers examine the capital cost of fan coil units and chilled ceiling installations to a CAT A office within central London, to a single floor plate covering 1,600m^2 net internal area

Two- and four-pipe fan coil unit (FCU) systems within the London commercial market have, traditionally, been the most popular choice of air conditioning in office developments. They have been regarded as the most commercially viable option from a development appraisal perspective. This holds particularly true for speculative office developments, where the end user and their requirements are often unknown at the start of the project. Agents are more easily able to sell space to prospective tenants because FCU technology is seen as a tried and tested system.

Upon occupation, tenants can easily modify the CAT A space to suit their CAT B design and requirements. FCUs offer flexibility and a safety net for any future needs because they can easily be relocated to accommodate design elements such as meeting rooms and breakout spaces. Ceiling supply and extract grilles can be relocated by extending flexible duct connections to suit design layouts. Similarly, the space can be put back to its original layout once the tenant vacates.

The commercial argument for FCUs is further strengthened by the sheer number of manufacturers and the range of units that are available. Improvements in the industry mean a wide range of design issues – such as shallow ceiling depths or the desire for exposed services – can now be accommodated. Additionally, mechanical and electrical contractors are familiar with the technology, and real economies of scale can be demonstrated across large floor plates, or with repeated floors through the building.

Despite the economic advantages that FCUs appear to demonstrate – and their popularity among developers, agents and tenants – chilled ceilings are increasingly favoured by developers who wish to offer a differentiator from rivals.

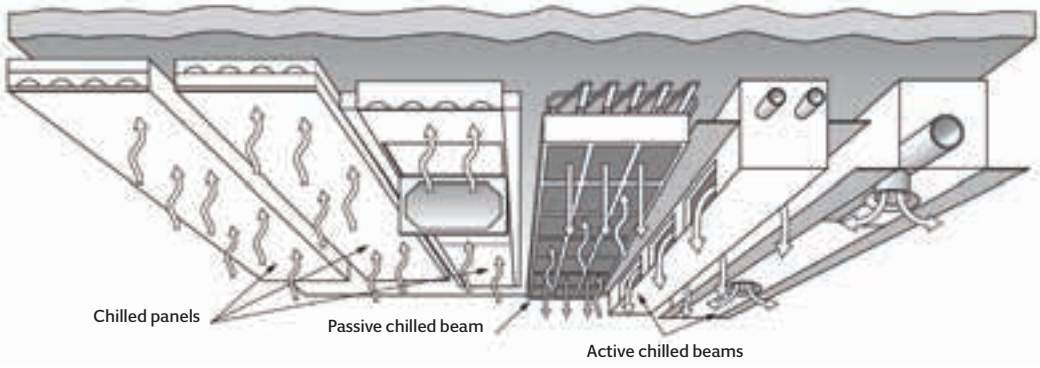
Tenants are also becoming more aware of their space and its surroundings – how it affects their design requirements and their employees, and its impact on the environment.

For and against

The argument for chilled ceilings seems to be gathering momentum within the London commercial market. In the UK construction market, fan coils are highly engineered, with a lot of research and development behind them. But the selection criteria for fan coils have been capital cost first, followed by thermal performance, with acoustic performance a distant third. More often than not, occupant comfort is not even considered.

Many argue that chilled ceilings can go some way to filling the gaps left by FCUs. This is because chilled ceilings can offer benefits that FCUs cannot in areas such as: energy efficiencies; increased life expectancy of the air conditioning system; low ongoing maintenance costs; increased occupant comfort levels; and, potentially, improved floor-to-ceiling heights.

The fight is not over between FCUs and chilled ceilings, with fan coils becoming smaller, quieter and more efficient. In the past few months, developers have examined an industrial look, exposing all the ceiling pipes, ducts and wires. Aesthetically, fan coils appear to lend themselves better to an



Chilled ceilings and FCUs are under increasing competition from chilled beams

FZTOMMY / SHUTTERSTOCK

exposed services solution, but the industrial look – which has become highly desirable – comes at a cost because additional acoustic measures may be required for ductwork and fan coil casings. The jury is still out on whether the cost of the additional time and resource required to make the exposed services a design feature is cost effective.

There has been a great deal of discussion recently, in the trade press and trade associations, about which option offers the best technical, commercial and energy efficiencies for a commercial client. Outside of capital cost considerations, chilled ceilings appear to offer an alternative to fan coils, but there is increasing competition from chilled beams (active or passive), chilled rafts and embedded chilled-mat technologies.

Cost model

The cost-model comparison considers the components associated with the two air conditioning options only – it does not include elements such as lighting, fire detection and fire protection, which are normally included as part of a CAT A cost. The model is based on a speculative central London office, arranged over 15 floors, with two basement levels.

In the cost model, we are considering a typical mid-level floor plate CAT A fit-out, with a net lettable area (NLA) of 1,600m² (about 17,222ft²). The building has been designed to comply with Part L and to achieve a Breeam Excellent rating. The occupancy for both fan coils and chilled ceiling options is one person per 8m² of NLA. The chilled ceiling is a fully capable active system, providing the required cooling output, so no supplementary cooling is needed.

Costs are base dated on first quarter 2016 and the prices used are reflective of a project procured through a competitive two-stage tender process. The cost model does not consider the effects – or perceived effects – of Brexit. It includes subcontractor preliminaries, testing and commissioning, and builders' work in connection only. Costs to complete the services fit out beyond a CAT A standard, professional fees, tenant enhancements and VAT are excluded. **CJ**

Category A works	Based on NIA of 1,600m²	
	Fan coil units	Chilled ceilings
Condensate disposal Copper pipework, discharge to shell-and-core installations	£9,000 (£5.62/m²)	N/A
Fan coil units Combination of four-pipe fan units to perimeter zones and two-pipe to internal zones	£64,000 (£40/m²)	N/A
Chilled-ceiling installations Chilled installation complete	N/A	£264,000 (£165/m²)
Ductwork Primary and secondary ductwork, insulation, fittings, etc	£59,000 (£36.88/m²)	N/A
Ductwork Primary fresh air ductwork, insulation, fittings, etc	N/A	£28,000 (£17.50/m²)
Grilles and diffusers Supply and return	£19,000 (£11.88/m²)	N/A
Grilles and diffusers Return air grilles	N/A	£18,000 (£11.25/m²)
LTHW pipework Insulation, valves, fittings, etc	£51,000 (£31.88/m²)	N/A
LTHW pipework Perimeter trench heating insulation, valves, fittings, etc	N/A	£46,000 (£28.75/m²)
CHW pipework Insulation, valves, fittings, etc	£57,000 (£36.63/m²)	N/A
CHW pipework Connections to chilled ceilings, insulations, valves fittings, etc	N/A	£48,000 (£30/m²)
Power Small power to FCUs	£8,000 (£5/m²)	N/A
Controls BMS to FCUs	£37,000 (£23.13/m²)	N/A
Controls BMS to chilled ceilings	N/A	£40,000 (£25/m²)
Builders' work in connection Including fire stopping at 3% of services installations	£9,000 (£5.65/m²)	£12,000 (£7.50/m²)
Ceiling installations CAT A suspended ceiling	£64,000 (£40.00/m²)	N/A
Total cost	**£377,000 (£235.63/m²)**	**£456,000 (£285/m²)**

ABOUT THE AUTHORS

This cost model was written by Joshua Stallard, trainee surveyor, and Garry Burdett, director, both at Aecom engineering services – whose cost management group specialises in the cost estimating, procurement and cost management of building services installations.

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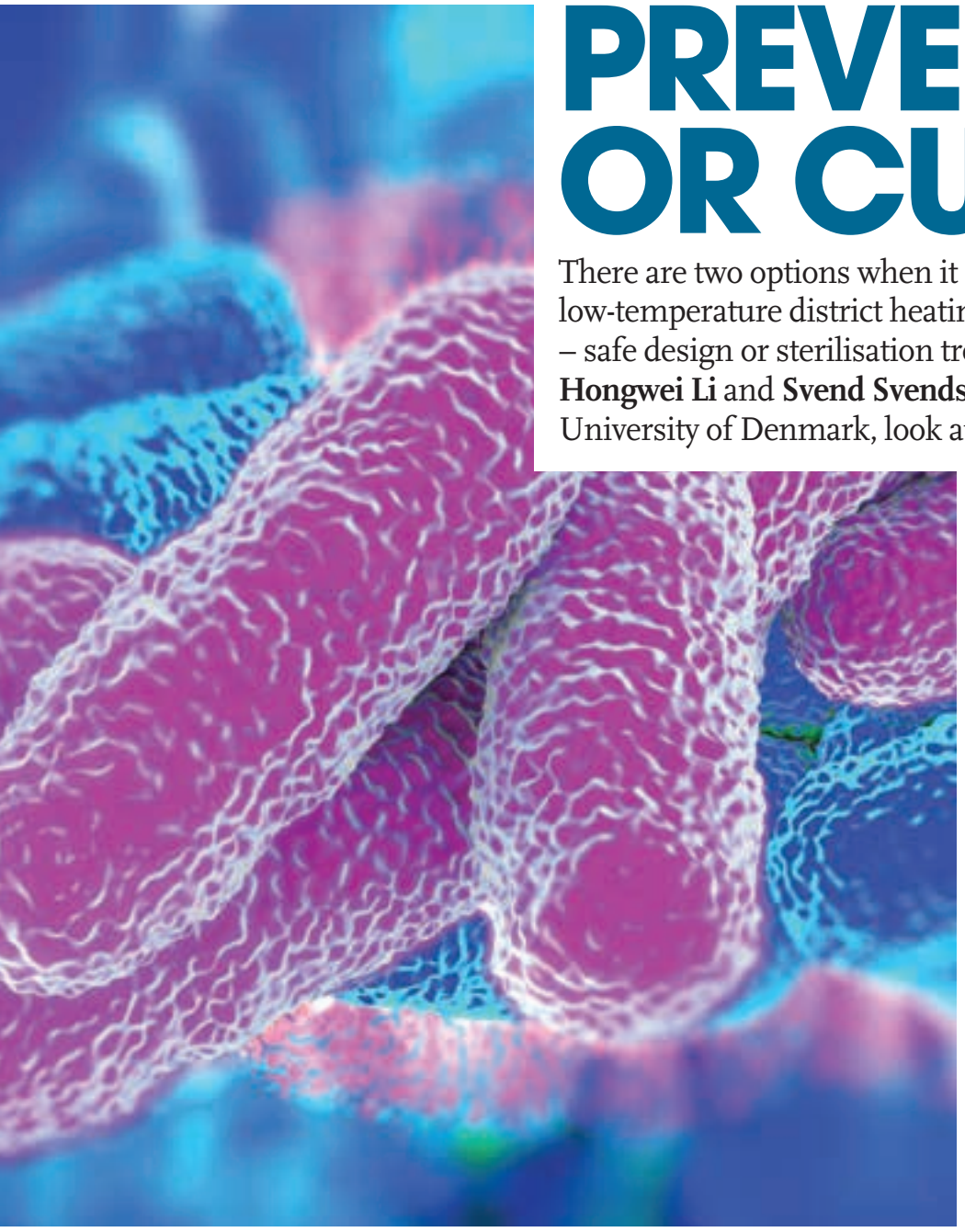


PREVENTION OR CURE

There are two options when it comes to safeguarding low-temperature district heating systems from legionella – safe design or sterilisation treatments. **Xiaochen Yang**, **Hongwei Li** and **Svend Svendsen**, from the Technical University of Denmark, look at the options

Low-temperature district heating (LTDH) with target supply and return temperatures of 55°C and 25°C can help to improve the energy efficiency of the district heating grid and achieve a more sustainable energy system. However, concerns about the reproduction of legionella bacteria in the domestic hot water (DHW) heated by the LTDH provides a challenge.

Legionella bacteria commonly exist in both natural and manufactured aquatic ecosystems. Most countries have a required operation temperature for the DHW system – mostly above 55°C – to prevent the reproduction of legionella. In terms of the district heat- (DH-) supplied hot water system, the rules on operating temperatures may well be stricter, considering the temperature drop throughout the distribution network.

The potential options to ensure legionella-safe conditions can be divided into two categories: alternative designs of the DHW system and sterilisation treatments.

> Sterilisation methods should meet the local requirements for water quality and water regulations, and work stably in the hot water system

Alternative designs for water supply systems

The LTDH-supplied DHW system should be able to deal with the main risk factors of legionella proliferation – insufficiently high temperatures and extended periods of stagnancy. The alternative design method focuses on boosting the local temperature and minimising the volume of domestic hot water.

Decentralised substation system

The main component of the decentralised substation system is the instantaneous heat exchanger unit installed at each home. It is designed to meet both the space-heating and DHW demand.

Unlike the centralised system, the decentralised substation option heats DHW locally, so minimises the total DHW volume. The energy efficiency is also improved by avoiding unnecessary heat loss.

Micro heat pump

The micro heat pump system uses a micro heat pump unit to elevate the DH supply temperature. The heat source can be from either the DH supply or the return, depending on the installation.

The DH supply temperature can be more flexible with the heat pump, and a wider range of low-temperature heat sources can be considered. Also, the DH return temperature can be reduced if configuration b (Figure 2) is applied, which

helps improve the energy efficiency of the DH system. However, this will reduce the coefficient of performance (COP) of the heat pump because of the greater temperature difference.

Electric supplementary heating

This system is also based on temperature elevation and the specific implementation will depend on whether a storage tank is installed. The storage type can help to reduce the peak load in the DH grid. However, there will be more heat loss compared to the direct electric heater because of the storage tank, with the set-point temperature of the consumer's storage tank >60°C to prevent legionella.

Another type of electric supplementary heating is electric heat tracing. The electric heat tracing cable attached to the DHW supply pipe is used to heat DHW to the required temperature after being preheated by LTDH. A storage tank – and potentially domestic hot water recirculation – would not be required for such a system. For large hot water systems, the electric heat tracing option can save almost 30%[1] of distribution heat loss caused by circulation.

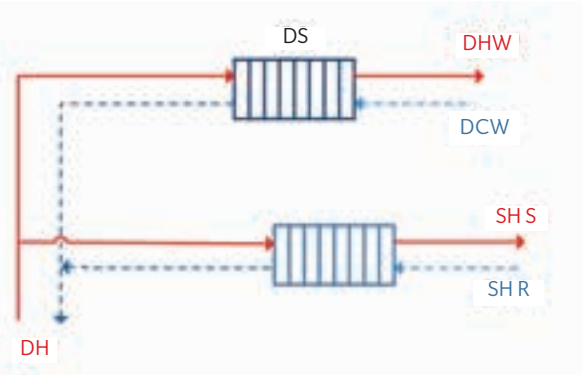
Evaluations of the alternative designs and suitable building types for implemention are listed in Table 1.

Sterilisation methods

These can be divided into three categories: thermal treatments, chemical treatments, and physical treatments. Any sterilisation method should meet the local requirements for water quality and water regulations, and work stably in the hot water system.

Thermal treatment

L. pneumophila in water can be killed by high temperatures, with the time required to do this related to the temperature – for example, 70°C for 10 minutes and 60°C for 25 minutes.[2] Note, however, that even these high temperatures will have limited efficacy on any biofilm.



Key
DS – decentralised substation
DHW – domestic hot water
DCW – domestic cold water
SH S – space heating supply
SH R – space heating return
DH – district heating

Figure 1: Schematic of decentralised substation system

Careful planning and execution is required to make sure the required temperature can reach the end of every branch in the system.

Chemical treatment

Chemical treatments kill legionella by either injecting chemical agents – such as ionisation, chlorine or chlorine dioxide – into the water, or activating the oxidisation as if by sunlight (UV light, photocatalysis).

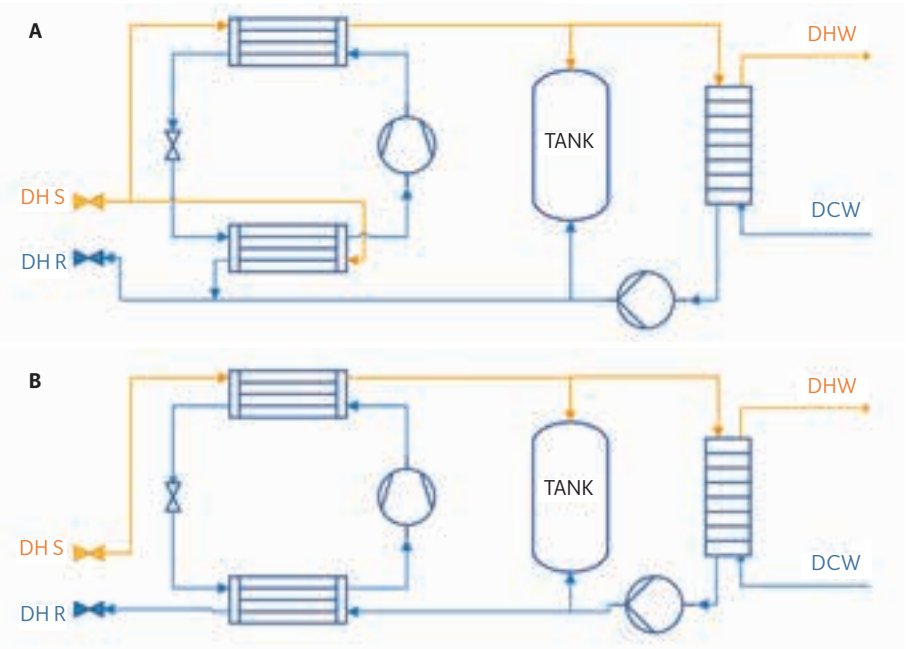


Figure 2: Schematic of micro heat pump system with DH supply flow as heat source (A) or DH return flow as heat source (B)

Table 1:

Approach	Solution	Building type applicable in	Circulation required	Energy source for hot water	Installation & operation difficulty	Investment cost
Volume restriction	Decentralised substation	New	No	DH	Complicated	High
	Micro heat pump	Existing/new	Yes	DH + electricity	Medium	High
Local temperature elevation	Heating element	Existing/new	Yes	DH + electricity	Simple	Medium
	Electric heat tracing	Existing	No	DH + electricity	Simple	Low

Evaluation of the alternative design methods

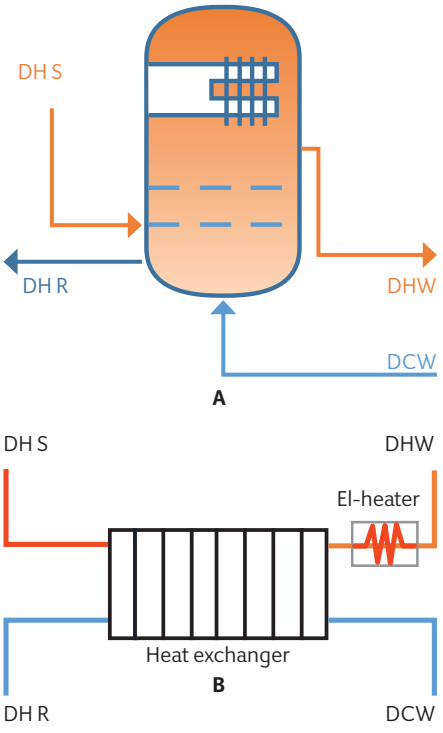


Figure 3: Schematic of electric supplementary heating system (A) storage type and (B) direct type

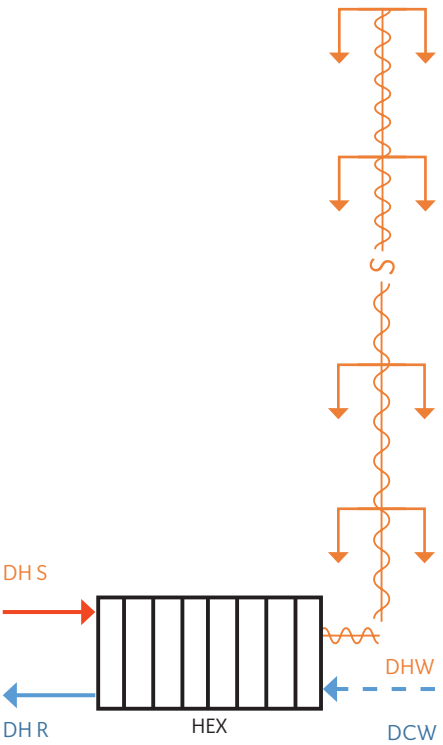


Figure 4: Schematic of electric heat tracing solution

The use of chemical biocides requires meticulous control to maintain effective concentrations without violating water quality requirements.

Physical treatment

This mainly refers to membrane filtration, which prevents the micro-organisms from getting into the protected system. Physical treatment can work effectively; however, to maintain the high efficacy of the filter, it has to be replaced regularly.

The evaluations of different sterilisation methods are listed in Table 2.

Conclusion

This study has suggested several solutions for preventing the potential risk of legionella in the LTDH-heated hot water system. From the alternative system design methods, the decentralised substation option is recommended for new buildings because of the high energy efficiency. For existing buildings, electric supplementary heating is recommended, because it is more flexible with the DH supply temperature and simpler to install. When it comes to sterilisation methods, the chemical treatments are more economical, but should be operated meticulously, following water quality regulations. **CJ**

Further details

The full paper, *A study that considered the available methods of supplying safe domestic hot water using heat from a low temperature district heating system*, is available in *BSERT* at **http://bse.sagepub.com**. CIBSE members always have free access to the online BSERT edition through the CIBSE Knowledge Portal at **www.cibse.org/Knowledge**

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1 Yang X, Li H, Svendsen S, 'Modelling and multi-scenario analysis for electric heat tracing system combined with low temperature district heating for domestic hot water supply', *Building Simulation*, 9 (2016), DOI: 10.1007/s12273-015-0261-4.

2 Stout JE, Best MG, Yu VL, 'Susceptibility of members of the family legionellaceae to thermal stress: Implications for heat eradication methods in water distribution systems. *Applied and Environmental Microbiology*, August 1986, 52(2), 396-9.

XIAOCHEN YANG, **HONGWEI LI** and **SVEND SVENDSEN**, civil engineering department, Technical University of Denmark. **Email xiay@byg.dtu.dk**

Table 2:

	Methods	Efficacy	Operation activity	Additive to water system	Investment cost	Effective level	Feasibility & regulations
Thermal treatment	Heat flushing	Short-term	Temperature & operation time control	No	Low	System	No limits
Chemical treatment	Ionisation	Long-term	Residual control	Yes	Medium	Local	A+B
	Chlorine	Long-term	Residual control	Yes	Low	System	A
	Chlorine dioxide	Short-term	Residual control	Yes	Low	Local	A
	Photocatalysis	Long-term	Residual control	No	Medium	Local	No limits
	Ultraviolet light	Short-term	Non-specific control	No	Medium	Local	No limits
Physical treatment	Filtration	Short-term	Non-specific control	No	High	Local	No limits

Evaluation of the different sterilisation methods

A = the concentration of the agents must comply with local water-quality regulations
B = not applicable in some countries

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RISK AVERSE

A CHP contract can help meet CO_2-related building regulations, with zero capital outlay. **Paul Hamblyn**, of EuroSite Power, explains how system capital expenditure costs can be built into customer utility tariffs

A 100kWe combined heat and power (CHP) system has been installed at Flitwick Leisure Centre – a recently completed new-build project in Bedfordshire. Under the terms of the 15-year agreement, the CHP system was funded by energy service company (ESCo) EuroSite Power. It will also operate and maintain the unit throughout the term of the contract, with the costs built into the utility tariffs charged to the customer.

Flitwick Leisure Centre buys the energy produced by the system from the ESCo, at a guaranteed lower rate than if it bought electricity in the traditional manner or used conventional boilers to produce its heat and hot water. Prices are not guaranteed, but the discount from the electricity and heat tariffs is guaranteed within the contract; if the contract stipulates a 10% discount, Flitwick will always receive a 10% discount, irrespective of the actual tariffs.

By delivering a CHP installation in this way, the ESCo is helping both the end user and the building's developer, Central Bedfordshire Council, to achieve the CO_2 target emissions rate (TER) defined by Part L2A of the Building Regulations 2010 in England and Wales. These require building designers to consider the technical, environmental and economic feasibility of using high-efficiency alternative heating systems – including CHP – to meet the TER.

EuroSite Power's 100kWe CHP system is designed to produce up to 1,373,787kWh of energy (electrical and heat) per year, while reducing CO_2 emissions by 249 tonnes – equivalent to taking about 50 cars off the road each year.

Although the company has extensive experience of providing CHP systems retrofitted to leisure centres in the UK, this was its first installation on a new-build project. As well as ensuring compliance with UK Building Regulations in relation to energy efficiency at the time of installation, the solution guarantees savings for the customer throughout the term of the contract. It also reduces build cost because it is funded by the ESCo.

One of the key benefits to the customer of sourcing CHP through an onsite utility solution is that the provider bears all the risk for the CHP delivering the energy savings required. So EuroSite uses stringent specification processes to ensure the system is fit for purpose and will deliver the performance required to ensure guaranteed savings to clients.

In the Flitwick installation, the CHP is fully integrated with the building's other services and, more importantly, was considered within the original design intent of the building, its Simplified Building Energy Model (SBEM), or similar calculations. To optimise performance, the unit is sized correctly, to the exact requirements of the client, without resorting to money-wasting heat-rejection systems.

Future-proofing

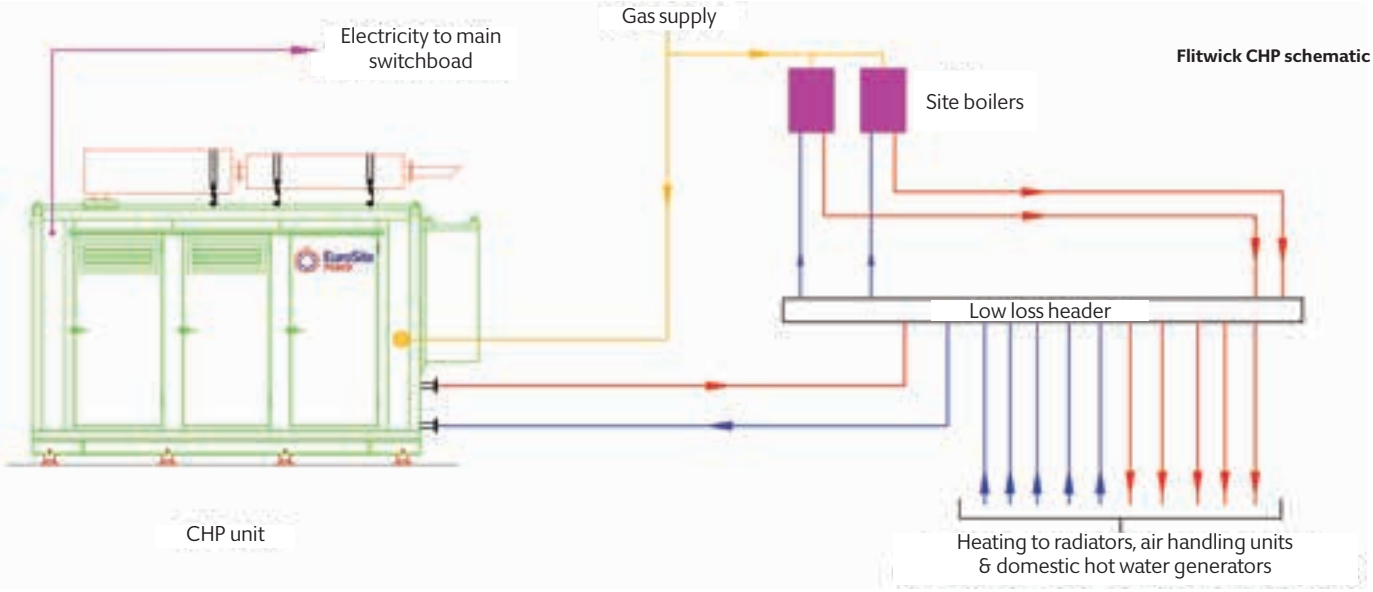
Delivering CHP in this way provides future-proofing for end users, who might be nervous about investing in equipment that could become out of date before it has delivered returns in energy savings. Ultra-low emissions regulations planned for London and the European Union are one example of future-proofing requirements that mean energy managers face the challenge of ensuring compliance of CHP systems with even the strictest future emissions standards.

In April 2014, then Mayor of London, Boris Johnson, published *Sustainable Design and Construction SPG* (*Supplementary Planning Guidance*). Set out as part of the mayor's 20:20 Vision, the target is to reduce London's overall carbon dioxide emissions by 60% by 2025, and to reduce air pollution across the city with a resilient low carbon infrastructure.

In relation to CHP plants, the SPG – at its most stringent – states that, where spark-ignition gas CHP plants are installed in commercial and domestic buildings, they should achieve a NOx rating of <95mg NO_x/Nm^3. These emission standards relate to all developments in London where a CHP plant is proposed. Similar requirements apply to other CHP technologies, and there is a tightening of requirements for conventional boilers. The SPG also states that these standards will be kept under review and updated in line with technological and commercial advances.

The *European Medium Combustion Plant Directive* – set to come into effect by the end of the decade – will impose further strict emissions regulations that will affect CHP

> The CHP is fully integrated with the building's other services and was considered within the original design intent of the building



Flitwick CHP schematic

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systems. Although still under consultation, the emissions levels permitted under the directive are likely to mirror those being imposed in London. With such strict standards pending – and with a potential for these to be reviewed and made even stricter – it is essential that CHP providers ensure technology is future-proof.

Under such schemes, the provider installs and maintains the CHP system, and takes responsibility for all costs, including for operations (encompassing the gas used by the system), maintenance and repair. It then sells the electricity and heating to the customer at a price that is fixed for the life of the contract – usually 15 years – with a typical cost saving of 10%. The provider takes on the technical risk of selecting the correct equipment and meeting any regulatory requirements, such as emissions or air quality standards. All risk is borne by the CHP provider, not the user.

Some companies bear the risk (and costs) of the technology meeting regulations for the next 15 years, whereas others that sell capital equipment – or those funded by some form of grant – may not bear this risk. It can be in the interest of the ESCo contracted on a long-term agreement – as well as the client and the environment – to take steps to mitigate the risks of equipment redundancy by exceeding current regulatory standards when installing plant. Then, as part of the responsibility for ensuring ongoing performance in line with contracted guarantees, equipment will be upgraded as necessary.

This ongoing 'relationship' with the installed equipment makes it a more sophisticated and in-depth process than simply installing equipment that is ripped out and replaced at a later date. In some cases, there may still be efficiency and operational benefits from plant replacements during the period of contractual obligation.

> It can be in the interest of the ESCo to mitigate equipment redundancy by exceeding current regulatory standards when installing plant

Looking further ahead

Some CHP manufacturers are yet to bring cost-effective solutions to market to meet tightening emissions standards, but appropriate future-proof technology is available. With stricter emissions standards already in place in the US, natural gas, engine-driven CHP systems have been developed to operate with the extremely low levels of regulated pollutants allowed by the distributed generation regulations 2007, set by the California Air Resources Board (CARB).

The systems use power-generation technology made possible by recent advances and cost reductions in power electronics (variable speed drives) and magnetic motor/generator materials (hybrid vehicle drive systems). This provides a natural gas-fuelled CHP module, rated at 100kWe continuous electrical output, while simultaneously producing 205kWt of hot water that – when all the recoverable heat is used – delivers an overall efficiency of 90%.

An example of recent technology includes low-emissions natural gas engines, which drive a permanent magnetic generator (PMG). The engine is operated over a wide speed range, depending on the load requirement, while the power electronics convert the variable frequency output from the PMG to high-quality power suitable for use throughout Europe. Variable speed operation maximises fuel efficiency under part-load conditions.

Such technical details may be beyond the expertise of many buildings managers, but where the CHP provider takes responsibility for the system's performance in the long term, the customer is safeguarded against changes in regulatory requirements. **CJ**

● **PAUL HAMBLYN** is managing director of EuroSite Power and a council member of the Energy Services and Technology Association (ESTA)

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PIPE DREAMS

Heat-pipe technology – widely used in hot, humid countries – can also enhance dehumidification in Britain's less extreme climate. Citing an installation in a UK hospital, SPC's **Richard Meskimmon** says payback periods can be less than three years

Heat is absorbed from the incoming warm air stream in the evaporator section, boiling the working fluid

In its simplest form, a heat pipe is a sealed tube – usually made from copper – which is evacuated and charged with a working fluid. For HVAC purposes, this is usually the refrigerant R134A, although a greener, more efficient solution uses water.

With a heat pipe, heat is absorbed from the incoming warm air stream in the evaporator section, boiling the working fluid. Elevated pressure moves vapour rapidly to the cooler, condenser section of the heat pipe, carrying the absorbed heat with it.

As the vapour reaches the condensing area of the heat pipe, heat is released to the cooler air and the vapour condenses – the liquid returning, by gravity, to complete the cycle. The entire heat-transfer process occurs with a very small temperature difference along the pipe, and is the most effective method of transferring heat passively from one place to another. So heat pipes can be used to improve dehumidification significantly, without any additional energy input.

Long used, successfully, for this purpose in hot and humid environments – such as in the Middle East – the technology can also enhance dehumidification in more temperate zones, without unjustifiable capital expenditure.

The UK climate means high humidity is a problem only on a handful of days per year, so conventional air conditioning is often considered a satisfactory solution. But the desire for increased energy efficiency is driving a move towards systems that rely on the control of space humidity.

With chilled beam air conditioning, for example, less air movement is required, so energy is saved, but such systems rely on the close control of humidity for correct operation. Chilled beams are sensible cooling terminal systems, where moisture cannot be allowed to condense because the cooling surface is generally exposed above the occupied space. For them to function

A UK hospital has made a cost saving of £27,000 using heat pipes

VILEVI/SHUTTERSTOCK

> Heat pipes have no moving parts to break or wear out, so are virtually maintenance free – indeed, they will probably outlast the HVAC equipment

properly, therefore, the outside air needs to be efficiently conditioned.

Building occupants benefit too; keeping air quality within the optimum zone of 40-60% relative humidity makes people more productive and results in fewer days lost through illness. However, traditional dehumidification – which can be indirect or direct – poses issues.

With indirect methods, air is cooled below its dew point – usually achieved using a chilled water-cooling coil or direct expansion (DX). A typical sensible heat ratio (SHR) for cooling coils is 80%; if the process requires lower values, the dry bulb temperature of the air must be reduced below its supply temperature – to remove moisture – and then reheated, which imposes a significant energy penalty.

The direct method involves desiccants, and the process requires continual regeneration. It is used for very low humidity control and only becomes economical for air conditioning applications if a source of thermal energy is readily available.

Heat pipes can be used to treat the outside air in a more energy efficient manner. Cooling coil enhancements are made to match the SHR of the process to the load SHR. Wraparound heat pipes allow passive transfer of heat around the cooling coil, and air is precooled upstream and reheated downstream. The SHR of the heat pipe/cooling coil combination is lower than for a conventional cooling coil, so can be considered as an enhanced cooling/dehumidifying coil.

Based on design conditions, the conventional cooling rate is 28kW for each m^3/s of airflow, and the reheat rate is 6kW (Figure 1). The addition of a heat pipe reduces the cooling rate to 22kW and reheat to zero (Figure 2). Up to twice as much condensate can be produced, taking the humidity of the recycled air well below the level that could be achieved by the cooling coil alone.

The heat pipe will only function when the cooling coil is operating, so the number of operating hours will be limited by the UK climate. But the use of heat pipes for dehumidification in the UK can be justified through return on investment (ROI)/payback analysis. We have a recent example where heat pipes were incorporated to improve dehumidification at a hospital with a chilled beam system, and the payback period was less than three years.

In terms of payback and energy savings, calculations must be based on true installation costs and accurate annual weather data. Capital costs associated with the heat pipe are both the cost of the heat pipe itself, and its installation cost within the air handling unit (AHU).

It is important to allow for the lower capital costs associated with reducing the size of cooling plant and ancillaries; the use of heat pipes results in lower chilled water rates, leading to smaller chiller plant, pipework and pumping equipment.

The reduction in installed chiller plant size is equal to the rate at which the heat pipe provides precooling at the maximum design condition. This is a capital cost saving irrespective of the number of operating

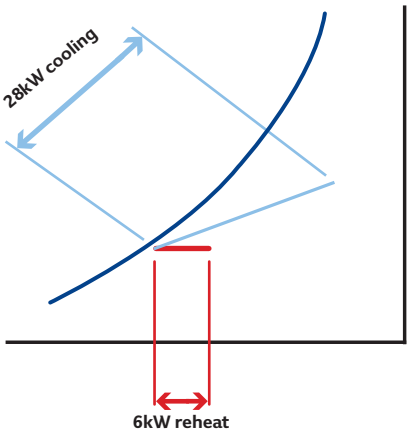


Figure 1: Conventional cooling and dehumidifying process showing cooling and reheat loads

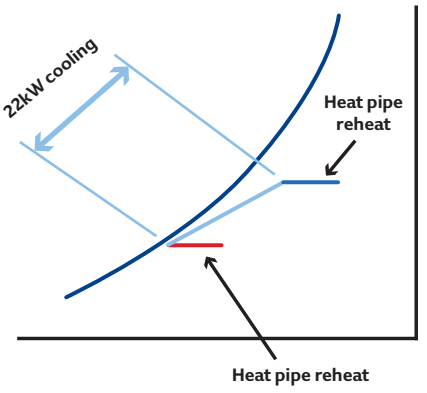


Figure 2: Enhanced cooling and dehumidifying process using heat pipes

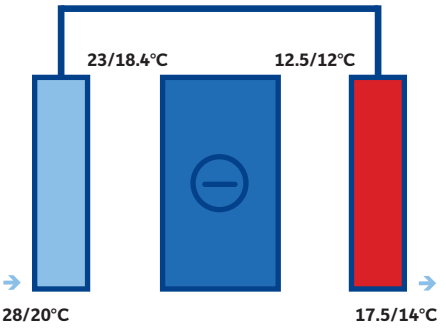


Figure 3: Arrangement of cooling coil and wraparound heat pipe

Wraparound heat pipe and cooling coil

hours. The reheat plant capital cost is unlikely to be affected, as it will be required for winter operation, with or without heat pipes. It's also important to consider that heat pipes have no moving parts to break or wear out, so are virtually maintenance free – indeed, they will probably outlast the HVAC equipment.

Heat pipes have been widely used for dehumidification in hot and humid countries for many years. We believe the technology can be employed just as successfully in the UK's less extreme climate. **CJ**

RICHARD MESKIMMON is technical manager at SPC

Case study: £27K cost saving with heat pipes

A hospital in the UK is undergoing extensive redevelopment of its facilities.

Chilled beams have been installed in critical areas, but the existing chiller plant was of insufficient capacity to provide the necessary dehumidification, with an 8.5°C dew point required in some areas.

The inclusion of heat pipes in the design has enabled the existing chillers to realise the required dehumidification. It has also helped the hospital to achieve an annual energy cost saving of £27,363, with a payback of 2.9 years.

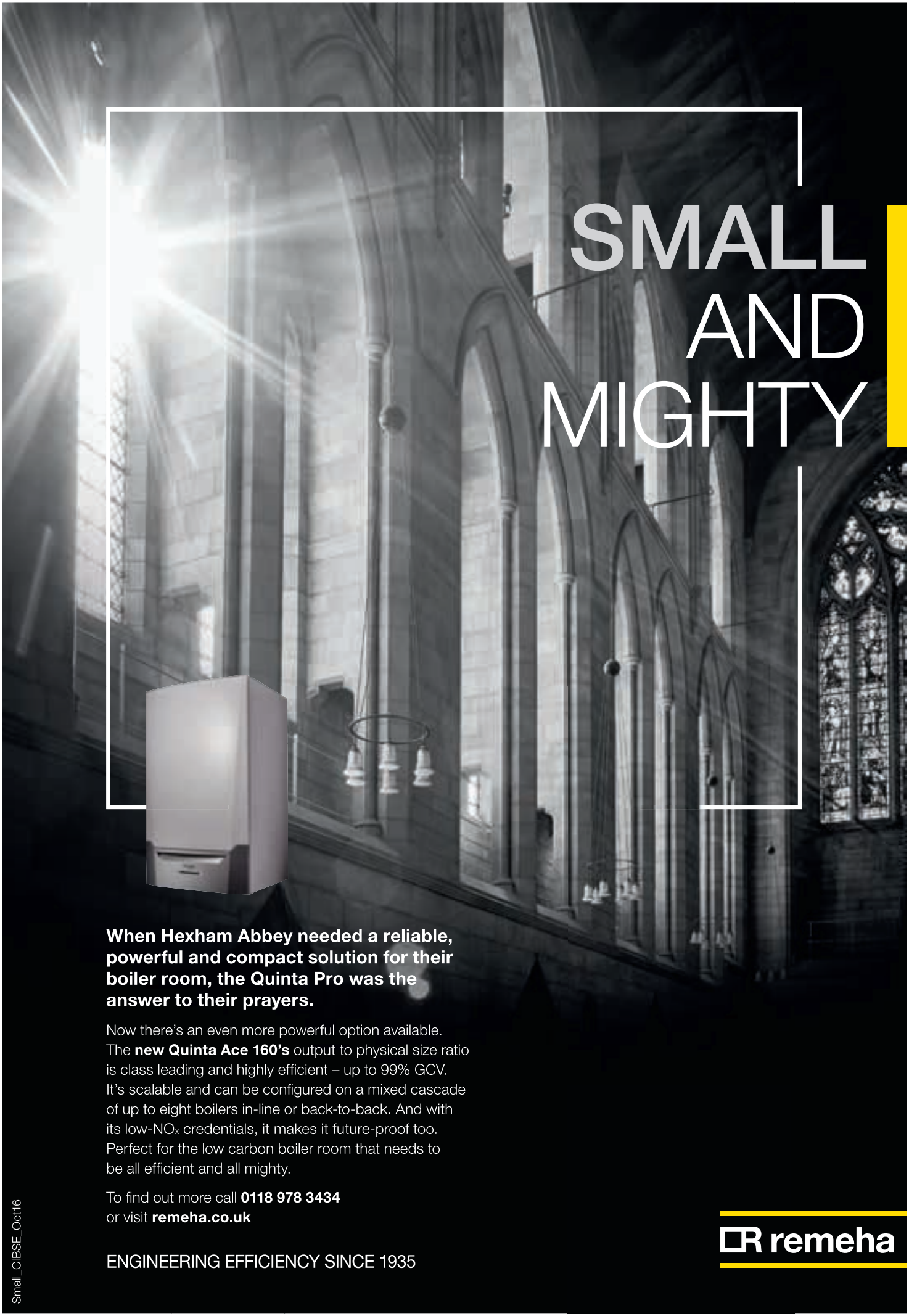
Project details

- 33 outside AHUs
- Total outside air load: 64.41 m³/s
- Total heat pipe precool saving: 355.4kW
- Installed cooling plant capital cost saving: £71,080
- Total heat pipe installed cost: £149,843
- Net capital cost: £78,763
- Annual cooling energy saving: 103,911kWh
- Annual cooling energy cost saving: £13,508
- Annual heating energy saving: 346,371kWh
- Annual heating energy cost saving: £13,855
- Total annual energy cost saving: £27,363
- Payback: 2.9 years

The analysis uses the following assumptions:

- Cost of electricity: 13p/kWh
- Cost of fuel for reheat: 4p/kWh
- Coefficient of Performance (COP) of cooling plant: 3
- Efficiency of boiler plant: 90%
- Cost of cooling plant: £200/kW

In this instance, copper tubes and fins, and stainless steel casings, were used in accordance with Health Technical Memorandum (HTM) guidance. A standard construction of aluminium fins and galvanised steel casings for the heat pipe would roughly halve the cost – hence the payback period.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Offsite manufacture for building services

This module considers the benefits of offsite production for building services applications

The application of offsite production in building services has been enabled through the convergence of improved information handling – particularly using tools associated with building information modelling (BIM) – and enhancements in manufacturing and the supply chain. This CPD will explore the benefits of applying offsite production for building services applications.

Offsite fabrication has been the norm in many industries where 'just in time' supply chains allow the construction of near-identical complete products, making savings through: reduced holding of stock; smaller warehousing requirements; reduced waste; improved recycling of materials; faster response to innovation; and lower cost. But, of course, the building services world has historically had its roots firmly based in delivering a bespoke system, created on site to meet an often imprecisely defined building shell – potentially where prefabrication would have been impractical (and require significant site adjustments) or impossible. However, with improved building definition earlier in the design phase, offsite construction is becoming increasingly common – for example, with ductwork fabrication; pre-assembled and pre-wired pump sets; bathroom pods; pre-assembled and pre-wired fan coil cooling units with controls; integrated boiler/control/piping assemblies; and complete boiler plantrooms.

Figure 1: A fully assembled boiler skid including controls delivered to site

Offsite construction – the part of the construction process that is carried out away from the actual building-site location – is a growing sector, with rapidly changing technology. It now accounts for at least 3-4% of the UK construction sector and can represent up to 80% of the construction cost for some projects.[1]

Investigations undertaken by the Waste and Resources Action Programme (WRAP)[2] – as reported by BESA[1] – indicate that the material waste on a typical 'conventional' construction is 10-times that of an industrialised factory, and that factory CO_2 emissions and embodied energy for the same built process can be more than 55% lower.

Offsite symbiosis

A key benefit of intention to use offsite construction methods is that it converges with the timescale introduced with projects that are delivered using the concepts associated with building information modelling (BIM). It is widely acknowledged that for BIM to deliver benefits throughout the construction process, the design must be brought further forward in the overall process than has been traditionally the case – this is also often a prerequisite for successful offsite prefabrication. As offsite construction will inevitably bridge disciplinary boundaries – for example, mechanical, electrical, lighting, civil, structural and architectural – it, by necessity, promotes multidisciplinary working.

The enhanced planning and collaboration delivers productivity gains on and off the site, and reduces the dependence of site supervision and high-level site skills. This can increase site productivity, as well as enhance the quality of installation – thereby reducing subsequent snags and consequent maintenance issues.

Effective use of offsite construction requires a programme rather than a project-management approach, as strategic resource management across the various work packages is essential to achieve a common aim. It is a more holistic and strategic approach that integrates the supply chain within construction. For a successful implementation, manufacturers and installers need to be consulted at the design stage, because the earlier in the process offsite construction methods are specified, the greater both the time and cost savings, and the environmental benefits. For example, insulation and surface protection can often be added in the factory rather than on site.

Reduced time on site is a major benefit, and savings in the range of 50-75%[1] have typically been reported. The number of people working on site at any one time is also reduced, giving a potential total reduction in site hours of 60-80%.[1] Programme certainty will be improved, because of the removal of some of the site-based uncertainties, with reduced abortive work and defects, prelims and site overheads.

Offsite applications can be categorised in many different ways and, when considering the mechanical electrical prefabricated assemblies, a term that is often adopted is 'non-volumetric preassembly'[3] – such as the domestic hot water pressure booster 'skid' of Figures 1 and 2 – where the factory-assembled system is not considered as enclosing usable space.

A prefab culture

For offsite to succeed, there must be timely supply-chain engagement, and collaboration between consultants, contractors and manufacturers. Some may be unwilling to commit to offsite delivery at early design stage, as they are not sure that this approach will be cost effective. Comparison cost advice on traditional versus offsite is not readily available to inform early decisions, so it is important for clients, designers and contractors to understand that designing for offsite delivery does not preclude traditional construction, while the opposite may not equally apply.

Traditional design processes tend to result in the late development of building services designs, not allowing adequate time for detailed design before fabrication. A late decision to adopt offsite solutions can lead to inappropriate procurement strategies, such as the lack of consideration for how the building services packages are going to be delivered early enough in the design process. A procurement strategy that separates elements of building services into packages may, for example, prevent the delivery of offsite solutions where a number of services that share the same physical zone are split between distinct supply packages.

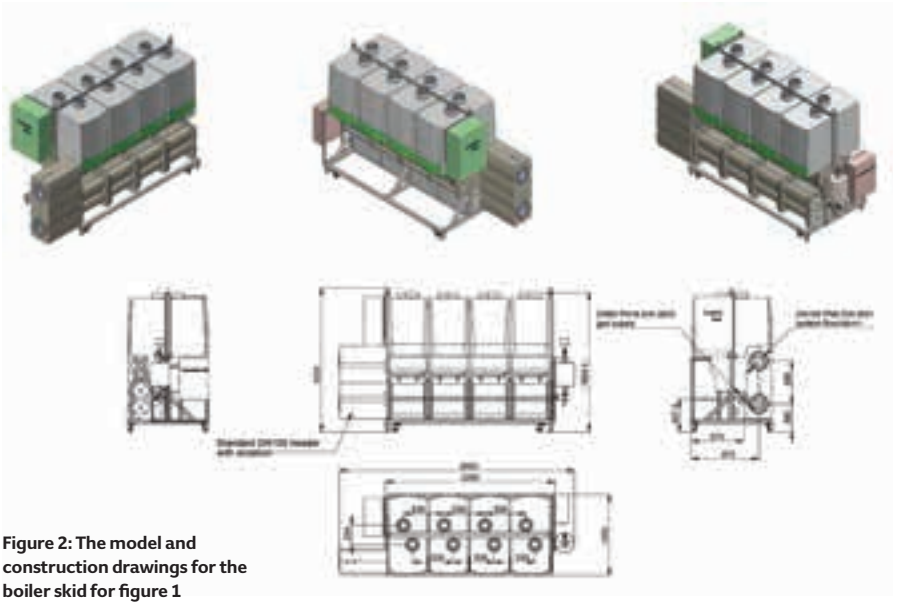

Figure 2: The model and construction drawings for the boiler skid for figure 1

Designs need to be completed and set at an early stage to allow effective use of offsite construction. Late design changes or variations could have undue cost and time consequences that can outweigh the benefits of using an offsite approach.

Refurbishment projects do not preclude this approach. However, modules are likely to be smaller, as they will need manoeuvring through existing structures. At a basic level, even premanufacturing small subassemblies – such as boiler/control/valve sets and support bracketry – can provide significant benefits.

Healthy and sustainable

The reduced time on site is also likely to reduce accidents; in manufacturing, accident rates are 29% less for major injuries and 52% less for fatalities[4], so if construction were to become more like a manufacturing exercise as a result of the widespread take-up of offsite methods, there could be a reasonable expectation of a significant reduction in recordable incidents.

Offsite can provide cleaner work conditions, with lower risk of trips, slips and falls, particularly as working at height is reduced. Manual handling and lifting is reduced too, as materials are mechanically moved to the safe, controlled, weatherproof production space. The factory environment can be properly designed, with purpose-made workstations, appropriately maintained protective equipment and the correct tools to hand, rather than working in often confined site spaces. As there will be a reduced need for onsite commissioning, the risk of electrocution, scalding, and other injuries is reduced, with appropriately controlled sources of heating, power, air and water for testing being provided at the factory workstation.

Offsite production is reported to deliver a significant reduction in waste compared to traditional construction. Fewer components need to be delivered to the site, so there is likely to be a 60%[1] reduction in vehicle movements, as one truck that can contain substantial prefabricated, complete modules is equivalent to around 38 white van deliveries. The impact on the local environment – both on the site and within its environs – is reduced, as there is less packaging, noise, and general emissions. These will have been moved back to the 'factory', where the scale of production will allow for far greater efficiencies in environmental control measures, materials and staff management.

Handling and installation

Large prefabricated sections require heavy-duty cranes and precision handling to be placed in position. The predictability that offsite brings enables better planning of site activities, including the equipment and timing required for installation. With good planning, the use of heavy equipment – as well as other specialised tools – can be adopted with greater efficiency. The availability of the type and capacity of cranes and other lifting devices will vary through the project programme, and be affected by site constraints.

Integrating services modules into the main construction programme can take advantage of tower cranes' increased site coverage and capacity. This will provide the opportunity to allow multistorey riser modules that – when used with temporary (removable) roofing and weather-protection systems – can even be craned in after the main structure is completed. The structural loading of floor

and roof slabs needs careful consideration, as modules are routed into position. Roof plantrooms are usually completed after tower cranes have been removed, and can use mobile or crawler cranes. The space between the building's structural components may determine the maximum size of prefabricated modules that may fit safely without risking damage to the plant or the building. So, for example, incorporating a boiler header assembly in two parts may allow it to be included in modular plantrooms rather than being built in situ. The packaged boiler and domestic hot water (DHW) module of Figures 3 and 4 can be separated on site, so that it can be moved through standard door openings.

In the increasingly collaborative environment being encouraged by BIM, computer models can be developed in such a way that the offsite modules are individually brought into the model in the sequence that the construction process intends. BIM can drive the project plan and visualisations of module deliveries and installation, which might include crane operations and tracing the route that modules will take through the facility to reach their final destination.

Commissioning and operation

While distribution systems will need to be connected on site before they can be commissioned, more complex plantrooms and passenger-moving systems may, largely, be commissioned before delivery. For example, pumps can be run/flow-tested on test rigs, and controls can be proven. It may be feasible to start commissioning on a zone-by-zone basis once sufficient modules have been installed and the building envelope is made weather-tight. Offsite manufacture in a controlled environment enables the supplier to maintain the cleanliness of pipework, reducing the need for flushing during commissioning. With modular wiring, it is advisable to test the whole system once connected, rather than its sub-elements.

Cost savings

The biggest financial benefits can come from the shorter construction programme that should be achievable with offsite construction, giving reductions in financing costs as well as delivering greater control over the cost of equipment. For example, the flow diagram of Figure 5 indicates a process that takes just five weeks – from initiation to delivery and commissioning – of a tailor-made offsite modular boiler skid, incorporating headers, controls, pumps and primary pipework.

Figure 3: The packaged boiler skid

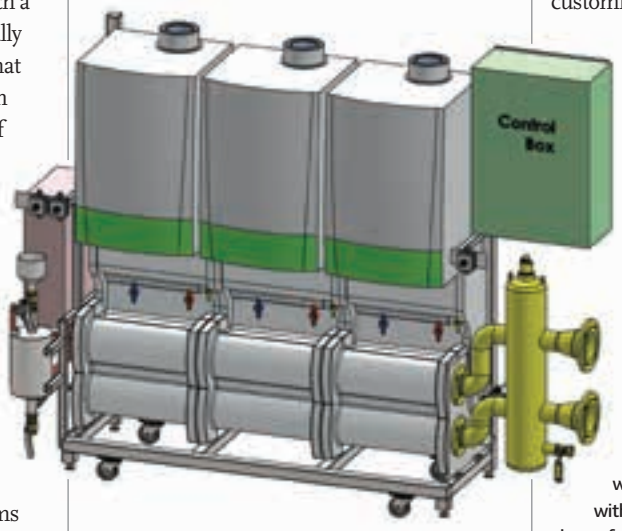

Figure 4: The model of the packaged boiler skid

The storage required on site (and its inherent costs) will be reduced, as modules can be delivered directly to their final position. Significant cash-flow benefits can arise from early completion and, consequently, early occupation. This can also offer considerable financial benefits for clients, as early guaranteed handover and occupation could be crucial in sectors where business is time-critical, such as airport, healthcare, educational or retail buildings, where site availability, or space for storage, may be limited. Offsite is likely to improve cost certainty and reduce risk – both in terms of time and cost – and if the same module can be repeated across a project (or multiple projects), this will benefit capital expenditure (capex) and operating expenditure (opex), as the modules can be more readily integrated into the operation and maintenance procedures.

The financial benefits may not always be obvious – for example, an airport operator, by adopting offsite prefabrication, aimed to take 80% of the mechanical and electrical labour offsite, as security checks were taking up to two hours at peak start times.

Maintaining a close collaborative relationship between consultants and the manufacturers can achieve great improvements in productivity, by optimising offsite solutions through innovations in manufacture and site operations – including product and process standardisation, mass customisation and continual improvement.

'Documentation' – through BIM-enabled links or in traditional digital or paper format – for handover can be rather more precisely developed for modules that can then enable improved facilities management and enhanced life-cycle operation.

Further reading:

Limited guidance has been produced relating to offsite for the building services industry. BESA, however, has an offsite guide[1] that has been used (with permission) as the foundation of this article – and where data and information is quoted without further reference, it will have been drawn from that publication. The buildoffsite website (**www.buildoffsite.com**) has several useful publications, including *Offsite Construction: Sustainability Characteristics* and *Building Offsite – An Introduction*.

References:

1 *An offsite guide for the building and engineering services sector*, BESA (formerly B&ES), 2015

2 The Waste and Resources Action Programme, **www.wrap.org.uk**

3 Gibb, A, *Offsite Fabrication: Prefabrication, Pre-assembly and Modularisation*, Wiley 1999

4 Krug, D et al, *Offsite construction: Sustainability Characteristics*, buildoffsite, 2013

Turn over page to complete module

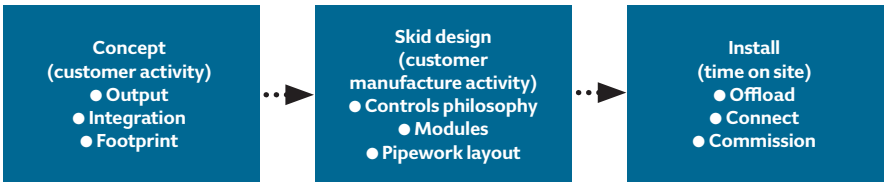

Figure 5: An illustration of a five-week process to deliver a prefabricated boiler assembly to site (Source: Remeha)

Module 102

November 2016

remeha

1. What percentage of the UK construction sector is thought to be accounted for by offsite construction?

- ☐ A At least 1-2%
- ☐ B At least 2-3%
- ☐ C At least 3-4%
- ☐ D At least 4-5%
- ☐ E At least 5-6%

2. When using offsite production, what is the quoted likely reduction in vehicle deliveries to a site?

- ☐ A 15%
- ☐ B 30%
- ☐ C 45%
- ☐ D 60%
- ☐ E 75%

3. In the photograph of the packaged boiler and domestic hot water module, what is specifically noted as enabling 'near-100% boiler efficiency'?

- ☐ A Integrated control system
- ☐ B Variable speed pumps
- ☐ C Optimised primary pipework
- ☐ D Low pressure drop control valves
- ☐ E Flue gas heat recovery

4. Which of these is most significant for the greatest success of offsite production in a project?

- ☐ A Using BIM
- ☐ B Early decisions relating to design and procurement options
- ☐ C Flexible use of tower cranes
- ☐ D Requirement to reduce vehicular movements to site
- ☐ E The ability to install equipment progressively throughout the programme

5. Which of these is unlikely to be a benefit of applying offsite production?

- ☐ A Shorter construction programme
- ☐ B Opportunity to link modular development and delivery into the BIM
- ☐ C Lower local environmental impact during construction
- ☐ D Improved site health and safety
- ☐ E Lower structural loadings, and reduced costs, on all floor slabs

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Drew Clough has joined Rehau as product manager for its underfloor heating and plumbing systems.

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Clough will apply his 15 years of experience in marketing and product management, across a range of industries, to Rehau's products and systems – bringing a valuable new perspective to the business.

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Roof plant screening – with amazing economy

Architectural Profiles, of Reading, has produced a perforated louvre system for roof-top plant installations that reduces material and construction costs by approximately 50% compared to traditional systems.

By effectively allowing 55% airflow, the AP70 louvre system reduces wind load significantly, which reflects beneficially on the weight of the perimeter support structure.

More than 3,000m of perforated louvre was supplied to the Gateway Project at the University of Salford – the first of eight successive educational establishments to install the APL system.

● **Email info@archprof.co.uk**

Concord brings in the style

Newcastle-based IT company Orchard Information Systems required a vibrant and contemporary office design that encourages innovation, so it turned to architectural lighting specialists Concord.

By integrating exciting and efficient lighting into the space, the new office area in the city's Central Square reflects the modern nature of the company.

'The flexibility of the Concord products installed helped the project to feel contemporary while still providing a practical space for working,' said David Warner, of Sine Consulting.

● **Visit www.concord-lighting.com**

Kingspan Pipe Insulation first to receive new Green Guide rating

Kingspan Kooltherm FM pipe insulation has become the first system to be evaluated under the BRE's new Green Guide ratings table and methodology for pipe insulation.

The products received the highest possible summary ratings of between A and A+.

The new approach has been specifically designed to provide a more accurate assessment of the environmental impact of pipe insulation in situ.

Kingspan Industrial Insulation commissioned BRE Global to carry out the environmental profiling and certification.

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

FDS Group partners with Construction United to improve image of construction

As part of its efforts to tackle key industry issues, the FDS Group is now an official partner of Construction United, a leading initiative aimed at improving public perceptions of the industry sector.

Consisting of smoke ventilation contractors Fire Design Solutions and experts in fire engineering FDS Consult, the FDS Group will work with Construction United on the initiative's three main objectives – improving the overall image of the sector, tackling the skills gap and raising awareness of mental health in the workplace.

It will collaborate with a number of Construction United's partners – including building products distributor SIG, Morgan Sindall, and the Construction Industry Council – to look at some of the most pressing issues facing the industry today, and to raise money for its charity partners.

Gerard Sheridan, the chair of FDS Group, said: 'We are very proud to be a part of Construction United.'

● **Visit www.firedesignsolutions.com**

Passive cooling thermal energy storage (TES)

TES is the temporary storage of thermal energy for later use, bridging the gap between energy availability and energy use. Overnight cool energy is stored in the form of 20~27ºC phase change material-filled containers and later used to absorb the internal and solar heat gains during the day, for an energy-free passive cooling system. The environmentally friendly, short payback, maintenance-free cooling solution can be applied to new and existing buildings.

● **Call 01733 245 511 or visit www.pcmproducts.net**

Elco HIUs at the heart of new luxury development

Residents of luxury apartments at The Franklin, in Bournville, Birmingham, are benefiting from heating and instantaneous domestic hot water, thanks to Nexus Futura IS heat interface units (HIUs), from Elco Heating Solutions.

Around 80 highly efficient HIUs have been installed at the development as part of a network heating system, connected to three Elco R603 floor-standing boilers in a centralised plantroom.

The units are capable of providing direct central heating output up to 35kW and are easily accessible for servicing.

● **Visit www.elco.co.uk**

Bigger and better JMv axial fan range from Fläkt Woods

Fläkt Woods, manufacturer of ventilation and air movement technology, has announced the expansion of its JMv axial fan range, which includes a choice of sizes and has been heralded as even more efficient than the original.

An improved design means the axial fans are capable of saving 27% of running costs, which is 3% higher than the initial models that were launched last year.

The extended offering includes five additional sizes, expanding the axial fan range up to 1,000mm in diameter.

● **Visit www.flaktwoods.co.uk**

Ultimate control for LST radiators

Myson offers a comprehensive range of TRVs to complement its range of LST radiators and allow temperature control of each room. Its 'integral' thermostats are designed to maximise the effectiveness of its LST radiators.

The range offers two designs: the Close Coupled kit – which allows the case to be removed for cleaning without removing the TRV head – and the competitively priced Direct Fit kit. Both come with Myson's A-rated TRV and are designed for precision control.

● **Call 0845 402 434 or visit www.myson.co.uk**

Just add water: HygroMatik at Interbad 2016

Held annually in Stuttgart, Germany, Interbad is the international trade show for the spa, pool and sauna industries – and HygroMatik exhibited there for the second time.

Its stand showcased a steam-bath installation featuring the CompactLine C17 Comfort DS and HeaterSlim BS 10 steam-generator systems. Also on display was a key appliance from the HeaterLine series, the new TF 106 temperature sensor, with a temperature limiter that offers maximum safety during a steam bath.

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

Epsilon – the latest innovative LED luminaire from Luceco

Luceco has launched the Epsilon, a direct/indirect recessed luminaire designed to optimise lighting performance and maximise luminaire spacing. It has an architecturally pleasing appearance, is designed in the spirit of the Society of Light and Lighting's LG 7 requirements, and has an efficacy of 120 luminaire lumens per watt. Epsilon offers up to 50,000 hours working life with no maintenance or re-lamping, so benefits the environment in terms of energy efficiency and lamp disposal.

● **Call Zoe Newland-Hodges on 07890 320 152 or email Zoe.nh@luceco.com**

Crick sticks its neck out to pioneer biomedical research

The new Francis Crick Institute has a commanding position near St Pancras, in central London. It is a consortium of six of the UK's most successful scientific and academic organisations, which invested a total of £700m to establish the institute.

Named after Sir Francis – famed for his contribution to the identification of the structure of DNA – the interdisciplinary medical research institute is now open.

Research will be conducted on why disease develops and ways of preventing and treating illnesses such as cancer, heart disease and neurodegenerative diseases.

Integral to this precision development is a wide range of pumps, all of which carry the Grundfos logo. These solutions will help to support the heating, cooling, water supply, pressure boosting and pressurisation requirements of the building.

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

Thermal Energy Storage (TES)

TES is the temporary storage of thermal energy for later use. It can reduce the chiller size by 50% by simply spreading the load over a 24-hour period.

It also reduces running costs by using overnight lower ambient (possible free cooling) and lower electricity costs, while offering smaller plant space and full standby capability using +8~167ºC phase change material (PCM) containers for a conventional HVAC&R applications.

● **Call 01733 245 511 or visit www.pcmproducts.net**

Underfloor air conditioning upsurge in Latvia

AET Flexible Space – in conjunction with its distribution partner in Latvia, Hitex – has received orders to supply its underfloor air conditioning systems to several major refurbishment projects in Riga.

The redevelopments include the Triangula Bastions Business Centre and the Mukusalas Business Centre.

AET Flexible Space has previously achieved success in Latvia at the Nordea Bank headquarters in Riga, which was awarded Most Energy Efficient Building and Most Sustainable Building in Latvia in 2011.

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

JLR embraces solar thermal

Oventrop has collaborated with Arup, Interserve and NG Bailey to design, supply and install seven solar thermal domestic hot water preheating systems for the new Jaguar Land Rover (JLR) i54 facility, a £500m engine manufacturing centre in Wolverhampton.

The factory will be home to the 'Ingenium' engine family – which will power a new generation of JLR products designed, engineered and manufactured in the UK, starting with the two-litre diesel engine in the Jaguar XE – and will employ more than 1,400 people.

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

Heat pump at heart of dementia care home

The new Callywhite Home, in Derbyshire, is built over three floors, accommodates 39 residents, and has been designed for the elderly and those living with dementia. It features an integrated heating and hot water system – including a gas absorption heat pump, condensing boilers and water heaters – from heating and hot water equipment manufacturer Lochinvar.

Solar photovoltaic panels were initially considered, but Lochinvar's Optimus gas absorption heat pump (GAHP) was thought to be a more appropriate choice. To meet dementia care guidelines, it was decided that the space heating should be via an underfloor system delivering constant and gentle, low-temperature heat, while avoiding the use of radiators on safety grounds.

Optimus GAHP has a gas utilisation efficiency (GUE) of 152% at a flow temperature of 50°C when ambient air is 7°C, so is ideal for this type of application.

● **Visit www.lochinvar.ltd.uk**

Prepare to be blown away by Panasonic's new Mini VRF system

Panasonic has unveiled its new, large-capacity Mini VRF horizontal discharge system, which is now available. The powerful system offers a compact installation footprint, great performance and complete flexibility for system design.

It is available in eight or 10HP and is optimised to provide energy efficient performance. The system uses the horizontal discharge and is enabled to operate at 100% capacity at 40°C ambient in cooling mode. It has a maximum rated static pressure of 35Pa, and the Mini VRF fan performance is of such a standard that it can operate in applications with high fan resistance.

● **Visit www.aircon.panasonic.eu**

Polypipe Ventilation launches BIM library

Polypipe Ventilation, manufacturer of energy-saving Domus ducting and Silavent mechanical ventilation appliances, has set up a building information modelling (BIM) library, which is available free of charge.

BIM 'Object' data on Polypipe Ventilation products includes detailed information on product properties, geometry, visualisation data and functional data that enables the 'object' to be positioned and behave in the same way as the product would in-situ.

Using BIM data reduces the risk of discrepancies at an early stage, ensuring cost-effective, safe construction.

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

Powerstar to launch Virtue EV

Later this year, Powerstar will officially launch Virtue EV, the most recent innovation in its Virtue energy storage range.

The Virtue EV rapid/fast-charging systems use battery storage to limit the amount of energy required from the network at any given time.

The system not only provides feasible rapid-charging services, but also offers smart-grid integration, UPS functionality, CO_2 reduction and renewable connectivity.

Visit the website to register your interest and to receive product information and launch event details.

● **Visit www.powerstar.com/virtue-ev**

Ruskin unveils BIM database

Ventilation, air distribution and fire and smoke control manufacturer Ruskin Air Management has launched an extensive – and freely available – library of building information modelling (BIM) objects to support the work of designers, installers and operators of building engineering systems.

The library will be regularly updated with new product information, but already holds a huge amount of free-to-download data on fire and smoke control dampers that engineers can directly incorporate into their BIM models.

Ruskin's 3D objects include key data defining each product's physical characteristics, materials and properties. As a result, the objects can be incorporated directly into BIM models and form part of virtual 3D designs to help construction and installation teams identify any potential 'clashes', so they can iron out problems before work begins. This speeds up the delivery process, cuts costs, and ensures a better quality final product.

Ruskin Air Management is also encouraging library users to send their comments and provide feedback on the BIM library.

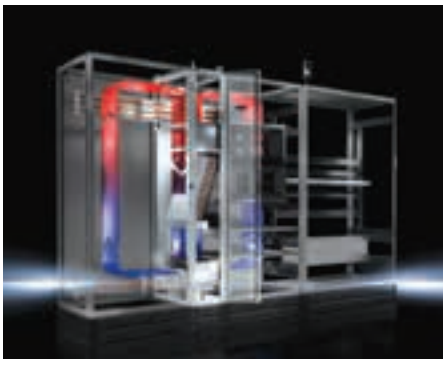
● **Visit www.ruskinuk.co.uk/technical/bim-models and follow @RuskinUK on Twitter**

Brushed nickel trends in UK market place

Innovative and traditional brassware designs company Francis Pegler has launched a range of brushed-nickel taps. The range includes the most popular designs in the portfolio, including the Adorn, Strata, Rune and Chef.

Varying in shape and style, these taps offer elegant fashion through to contemporary chic designs. The complete kitchen range includes 60 styles, all of which come with a minimum five-year guarantee.

● **Call 0800 156 0010, email brouchers@pegleryorkshire.co.uk or visit www.pegleryorkshire.co.uk**



Comfort zone for hot converters

Over the past few years, Rittal's LCP rack industry system has proved effective in cooling power electronics in switchgear.

Rittal has now developed a new generation of these air/water heat exchangers, with numerous improvements aimed at enhancing their performance for control and switchgear manufacturers, as well as users of the machinery and equipment.

A new, improved LCP rack industry system now features recesses to allow the routing of busbar systems and cables.

● **Visit www.rittal.co.uk or follow @rittal_ltd on Twitter**

Martindale Electric expands range of lock-outs

Martindale Electric continues to offer safe isolation with the addition of new professional electrical locking-off devices and kits for miniature circuit breakers and fuse holders.

The lockouts provide reliable solutions to ensure circuits have been de-energised and isolated properly before maintenance and modifications of plant and equipment.

The new LOKKIT6 includes universal fuse carrier lock-off, a TAG4 warning tag and marker pen, plus a PAD10R padlock – and is designed to restrict finger access to live contacts.

● **Call 01923 447 717 or visit www.martindale-electric.co.uk**

Energy-saving options for commercial buildings

A new brochure from Mitsubishi Electric highlights all of the central plant solutions that the company can offer to help reduce energy consumption in the built environment.

'Our occupied spaces have to be made more energy efficient, less carbon intensive and incorporate renewable energy where possible,' says Graham Temple, marketing manager for Mitsubishi Electric.

'The good news is that many of the solutions are affordable, scalable and available now. We have created this brochure to highlight examples where the installation of well-designed, energy-efficient central plant has really made a difference.'

The brochure looks at the e-series modular chiller range and the comprehensive NX chiller line-up.

It details the Ecodan range of air, ground and water source heat pumps, and explains how the company's advanced range of Lossnay mechanical ventilation with heat recovery (MVHR) systems and air handling units (AHUs) can reduce energy consumption for almost any building.

The brochure can be downloaded from **bit.ly/2dxE2TR**

● **Call 01707 282880 or email chillers@meuk.mee.com**

Rinnai makes major investment in London and South East

Rinnai – UK manufacturing supplier of high-efficiency, continuous-flow hot water heating and delivery units – has formed a dedicated sales team covering London and the South East. This follows the opening of a London office.

'The new premises have been set up in response to high demand for Rinnai product and expertise,' says MD Tony Gittings.

The new sales team will work in tandem with the Rinnai UK sales centre and technical support, at the company's headquarters in Runcorn, Cheshire.

● **Visit www.rinnaiuk.com**

PRODUCTS & SERVICES

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

Vent-Axia's Sentinel Kinetic Advance MVHR shortlisted for industry awards

Sussex-based Vent-Axia is celebrating after reaching the final shortlist in the Electrical Industry Awards 2016, which recognise, celebrate and reward companies that are leading the way in the UK electrical sector.

The ventilation manufacturer's Sentinel Kinetic Advance is a finalist in the Innovative Residential/Domestic Product of the Year. The next generation of whole-house mechanical ventilation with heat recovery (MVHR), the Advance offers near-silent, energy-efficient and high-pressure operation, ideal for care homes and student accommodation, as well as new-build residential properties.

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

Back to school for Wieland

Wieland Electric's popular Metalynx2 structured wiring system has been installed for the distribution of all power and lighting in the newly refurbished Halley House Primary School, in Arcola Street, London E8.

The Metalynx2 system was specified by electrical contractors Etech Southern, which designed and installed the electrical infrastructure for the project in accordance with the Education Funding Agency output specification. Etech Southern were able to maximise onsite productivity, as the product is pre-wired and pre-tested at Wieland's factory.

● **Call 01483 531 213 or visit www.wieland.co.uk**

Viessmann introduces new Vitodens 200-W cascade

Viessmann has released a new, flexible Vitodens 200-W boiler cascade system for commercial applications, with outputs ranging from 12kW to 594kW. This requires 30% less space than the previous cascade system and reduces installation times by up to 50%.

The compact dimensions of the new Vitodens 200-W cascade make it ideal for plantrooms that have a small floor area or limited headroom, or that are difficult to access. The height required for its installation is reduced from 2.2m to 1.8m.

● **Visit www.viessmann.co.uk**

DIRECTORY

Your guide to building services suppliers

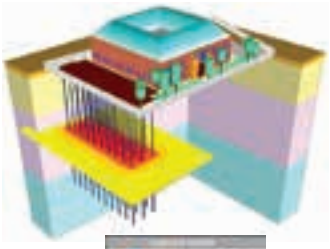
Telephone: 020 7880 7633 **Email:** greg.lee@redactive.co.uk

Air Conditioning

Air Conditioning

Air Handling

Energy Efficiency



Ventilation and Air Conditioning

Senior Project Manager (Mechanical)

EMS Engineering Maintenance Services Ltd is a contracting company based in EC1 and has been established for over 30 years who are committed to providing the best service.

Are you able to quickly develop a rapport with customers and work colleagues, be methodical, possess excellent organisation skills, be self-motivated and;

- Have a minimum of 5 years' experience within the mechanical building services industry at a similar level;
- Be able to manage a team of Project Managers and multiple projects and at any one time;
- Support and report to the senior management team to realise the company objectives;
- Make key departmental decisions quickly and effectively to maintain the smooth operation of the business;
- Manage resources and oversee finances to ensure that the projects covered by the department are delivered on time, on budget and remain profitable?

Salary range 65K-70K plus package.
Following completion of a probationary period, you will be invited to join the company health and pension schemes.

To apply please email your CV to tina@ems-maintenance.co.uk

EMS Engineering Maintenance Services Ltd is an equal opportunities employer.

Mechanical Consultant

£32k-£39k FTE

We have an exciting new opportunity for an experienced, skilled Mechanical Consultant to join our Facilities Management Division at Place Partnership. Our Head Office is based in Worcester with the opportunity for a proportion of flexible working that would suit someone living in either Herefordshire, Warwickshire or Worcestershire regions.

As an integral part of our team of Mechanical & Electrical Consultants, you will be responsible for providing professional expertise, technical advice and support relating to the condition, capacity, suitability and statutory compliance of mechanical installations, plant and equipment managed by Place Partnership. Based in Worcester but covering the North region including Bromsgrove, Shropshire, Telford, Kidderminster, you will be responsible for solving complex problems with manufacturers, contractors, suppliers and customers, and ensuring that installations and maintenance regimes are safe.

You will be degree qualified (or equivalent) in mechanical building services engineering and will have a proven track record in mechanical systems, feasibility, design, and providing technical expertise on maintenance strategy and improvements. You will be a member of CIBSE or the Institute of Mechanical Engineers.

We are a progressive company that is looking to expand and grow. This is a really exciting time to join Place Partnership and a fantastic opportunity for new talent to help shape and develop our business.

If you are enthusiastic and passionate about mechanical engineering, and feel you can add value to our team and are keen to develop your career with Place Partnership, please send your CV with a covering letter to Careers@Placepartnership.co.uk

Informal enquiries to Derek Sandilands, M&E Portfolio Manager on 01905 673190 (no agencies).

Closing date: 11 November 2016

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For further information and to apply, please call us on **+44 (0)203 176 2666** or email **cv@b-a-r.com**

MEP Design & Engineering Manager

London, £90 - £100k + bens

A leading European MEP design and build contractor that specialise in high profile commercial, industrial and pharmaceutical projects are seeking an M&E engineering manager with mechanical bias to oversee the growth and development of the London engineering team. Extensive experience with district heating systems would be advantageous to join this award winning company that have a reputation for high quality project delivery. Ref: 3921

Mechanical Associate

London, to £65,000 + bens

Excellent package and opportunity to work across all sectors whilst mentoring juniors. You will have a strong commercial background. You will represent this respected consultancy in design team and client meetings and have the ability to lead projects internally and externally. With 10 years' experience you should have understanding of Part L, BREEAM, RIBA stages and renewable technology etc. Ref: 3931

Senior Mechanical Engineer

London, £40p/h

A London based CIBSE accredited design consultancy are looking for senior mechanical engineer to assist them on a large mixed use development. This project will last a minimum of six months with a strong possibility to be longer. You will need to be degree qualified and ideally be Chartered. Ref: 3892

Managing Quantity Surveyor

London, £70k - £75k + bonus + bens

A leading M&E Contractor is seeking an experienced Senior Quantity Surveyor who's looking to move into a more senior/commercial management position. Reporting to the Commercial Director for the South of the UK, this role will facilitate an excellent upwards transition to oversee all contractor / sub-contractor portfolios; maintaining the company's contract management function. The Senior Quantity Surveyor will join a highly experienced commercial and contracts management team, being an integral part of a recognised Construction Group who are involved in high value build projects nationally providing services from Design & Construction, Installation, through to Maintenance and Servicing. Our client leads the M&E Fit-Out sector providing an excellent working environment, salaries and benefits, and fantastic training and support at all levels. Ref: 3869

Public Health Engineer

London, £60 - £65k + bens

A leading design consultancy that specialise in unique commercial projects such as large scale museums, galleries, high end office developments. The consultancy is based in Farringdon, currently employ 42 engineers and plan on growing to 50 engineers. As part of the role you will lead projects, work directly with clients, conduct site supervision, tender for projects and lead a team of 3 engineers. This privately owned consultancy is offering a competitive salary, bonus, pension, private medical health and progression to Associate Director level. You will play a key role in the future of this company. Ref: 3812

Senior Mechanical Engineer

London, £38 - £40 p/h

With an environment made up forward thinking engineers designing with a core objective to meet the needs of their clients by developing well-integrated buildings with simple systems that work with natural laws of physics. The requirement is for a Mechanical Engineer to come on board and take a lead role on a number of projects from an expansive portfolio across a host of sectors. Ref: 3923

Thinking of your future

www.b-a-r.com

SILENCE OF THE FANS

A new film *Pursuit of Silence* examines the negative impact noise has on our environment. Quiet Mark's **Poppy Szkiler** says HVAC firms are already joining the silent movement

The Noise Abatement Society raises awareness, educates and campaigns for measured, considered and responsible use of sound. It was founded in 1959 by businessman John Connell, who wrote a letter to *The Telegraph* to complain about 'terrible excessive noise' – and 4,000 readers replied in agreement. In 2012, his granddaughter, and former actress, Poppy Szkiler formed Quiet Mark, and with her husband, Paul, created a 'low noise' certification for appliances and equipment.

HVAC manufacturers that have attained the Quiet Mark standard include Salamander Pumps (HomeBoost pumps for low water pressure), Grohe (Rapid SL Flush quiet toilet system), Xpelair (extract fans), Vent-Axia (extractor fans) and S&P (extractor fans).

Now Quiet Mark is supporting the launch of a new film, *In Pursuit of Silence*, which explores the impact of noise on our lives.

Szkiler explains why building services has an important role to play in reducing the environmental stress caused by unwanted sound.

Why is silence important to our wellbeing?

World Health Organization research on noise effects and morbidity believes it is crucial. It says: 'Environmental noise acts as a stress, at night by disturbing sleep and via annoyance during the day... With chronically strong annoyance, a causal chain may exist between the three steps: health-annoyance-disease.' Its research showed that, in terms of having a negative impact on our health and wellbeing, noise pollution was second only to air pollution as a causal factor.

> The noise from within a building is much more difficult to contain and reduce

What can designers do to mitigate against noise?

The overall soundscape of a building is influenced not only by the technology and machines that are placed within it, but by the materials and surfaces of which it is constructed. Sound waves travel outward from the source – be that a mechanical noise or people speaking – and on reaching an obstacle, such as a wall, floor or ceiling, the direction of the sound is changed. Hard, reflective surfaces amplify noise levels, as the listener hears not only the direct sound, but also the reflected energy.

By thinking ahead about the materials used to construct and line a space in relation to the end use and dimensions, designers can create comfortable acoustic environments.

Is it more problematic to eliminate noise from inside or outside buildings?

Limiting noise emanating from outside a building can be difficult; however, there are now very effective glazing and door solutions that can help restrict the easiest 'entry points' into a building for external noise.

The noise from within a building is much more difficult to contain and reduce. The acoustic properties of the space are determined by the use, number of occupants, the build materials, and products and technology contained within.

It can become a very complex acoustic environment as all the sound sources interact, creating different tones and frequencies throughout the space. Most sounds generated are functional – a product of the operation going on within the building – so can usually only be reduced by replacing products with quieter alternatives.

'Soundscaping' the environment can help, but with so many different sound types to mitigate, it is notoriously difficult to dampen or remove them all.

How do products gain the Quiet Mark standard?

To carry the Quiet Mark award, products need to be assessed for their low noise output or sound-absorbing properties, to determine that they are one of the best options available in their industry. Usually, this means submitting samples to be tested in the Quiet Mark laboratories, where their acoustic qualities are assessed in real-world conditions to understand their output in use. The data is compared to other, similar products, to identify the quietest options on the market.

Could there be more regulations to reduce noise?

The noise legislation that exists in the UK today may be applied in different contexts. However, strengthening Building Regulations would always be welcomed.

How does the film promote silence?

As much a work of devotion as a documentary, *In Pursuit of Silence* is a meditative exploration of our relationship with silence and the impact of noise on our lives.

In our race towards modernity, amid all the technological innovation and the rapid growth of our cities, silence is now quickly passing into legend. The film challenges audiences to slow down and, on some level, make the world new again for them.

● **POPPY SZKILER** is managing director at Quiet Mark

Events & training

NATIONAL EVENTS AND CONFERENCES

CIBSE Building Performance Conference and Exhibition
17-18 November, London
The annual conference returns to the QEII Conference Centre, with a programme that again promises to inform and inspire. Speakers include Max Fordham and Patrick Bellew. Visit the website for programme and to book.
www.cibse.org/conference

Debate: Generalist versus specialist learning
15 November, London
London South Bank University debate, exploring Issues around general cross-disciplinary learning versus focusing on the specialisation of disciplines.

CPD TRAINING

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

Design of heating and chilled water pipe systems
4 November, London

Introduction to the heat networks code of practice
8 November, London

High voltage (11kV) distribution and protection
11 November, London

Lighting and energy efficiency
15 November, London

Mechanical services explained
15-17 November, London

Building services explained
16-18 November, Manchester

Introduction to combined heat and power
18 November, London

Practical approach to LV fault analysis
18 November, London

Design of ductwork systems
22 November, London

Electrical services explained
22-24 November, Manchester

Understanding psychrometric charts
24 November, London

Low and zero carbon energy technologies
24 November, London**Introduction to ground and water source heat pump schemes**
29 November, London

Implementing group and water source heat pump schemes
30 November, London

Lighting Design: principles and applications
30 November, London

Designing water efficient hot and cold supplies
1 December, London

IET wiring regulations: 17th edition (incl 2015 update)
2 December, London

Variable flow water system design
2 December, London

ENERGY ASSESSOR TRAINING

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

Air conditioning inspector
8 November, Birmingham

LCC building operations and DEC
9-11 November, London

LCC design and EPC
16-17 November, Birmingham

Heat networks
16-17 November, London

LCC design and EPC
23-24 November, London

ISO 5001
23-25 November, Manchester

CIBSE GROUPS, REGIONS AND SOCIETIES

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

Joint HCNW, SLL and CIBSE Heritage Group: By gaslight tour
1 November, London
A guided tour, with Rebecca Hatch, on the history of gas lighting.

West Midlands: ISO 50001 implementation and benefits
2 November, Birmingham
Technical seminar on ISO 50001.

FM Group: Power over Ethernet (PoE)
2 November, London
The impact of PoE on structured cabling, covering De Montfort University research.

CIBSE membership and registration briefing session
3 November, London
Applications for the Associate and Member grades and Registration with the Engineering Council at the Incorporated and Chartered Engineer levels.

SoPHE 13th anniversary dinner
3 November, London
Society of Public Health Engineers dinner at Royal Garden Hotel.

Scotland Region 80th anniversary dinner
4 November, Glasgow
An evening to celebrate 80 years of the region.

North East: Technical evening: Henrik Clausen
8 November, Newcastle
With Henrik Clausen, of Fagerhult Lighting.

FM Group: Building legislation and compliance
8 November, London
Event hosted by Clyde & Co, with speakers Rod Hunt and Jo Harris.
www.cibse.org/fm

ANZ: Services in harmony: Acoustic engineering
8 November, Sydney
With guest speakers Kezia Lloyd and Alex Campbell, of WSP Parsons Brinckerhoff.

Merseyside and North Wales: Tour of St George's Hall
10 November, Liverpool

SLL and North West: Computer aided daylight planning using DIALux
10 November, Manchester
Seminar on calculations and measurements of façade systems and skylights using DIALux software.

Energy Performance Group AGM and technical meeting
10 November, London

Merseyside and North Wales: Annual dinner
11 November, Liverpool

HCNE: UPS systems – the changes in uninterruptible power supplies due to semiconductor developments and the impact on mechanical installation design
15 November, London

SoPHE: Anti-microbial copper and Pegler Yorkshire products to assist in preventing HCAIs
16 November, Manchester

HCNW: BIM – vital preparation for successful results
16 November, London
Jason Whittall, of One, highlights the strategic-level clarity, collaboration and planning needed for successful outcomes.

West Midlands: CPD technical seminar: District heating via heat pumps
16 November, Birmingham
With Dr Andy Pearson, from Start Refrigeration.

Hong Kong: Joint symposium: Building a smarter city
22 November, Hong Kong

Society of Façade Engineering: Curved glass – pursuit of the impossible
22 November, London

LuxLive 2016
23 November, London
Annual lighting exhibition, at which the Society of Light and Lighting's Young Lighter of the Year will be announced.

West Midlands: Annual dinner
25 November, Birmingham
Chance to network with region members.

Hong Kong: Energy audit course for building energy efficiency 2016
29 November, Hong Kong
Offering the principles, skills and guidelines needed to carry out effective energy audits.

HCNW and WiBSE: Work, career, inclusivity – unconscious bias
5 December, London

Health, wellbeing and productivity in non-domestic buildings

8 November, London

CIBSE, University College London Institute for Environmental Design and Engineering (UCL IEDE), CIBSE Home Counties South East and the Natural Ventilation Group are jointly hosting a conference that will feature cutting-edge research, scientific evidence and case studies on health, wellbeing and productivity in relation to buildings.

Practical ideas on how to create healthy, comfortable and productive indoor environments will be presented. Case studies of best practice applications will stimulate stakeholders – such as designers, consultants and environmental engineers – to contribute to the design and management of healthier indoor environments, including supporting clients.

Among the topics to be covered are: health, comfort and wellbeing; the effects of indoor air quality on productivity; light and wellbeing in buildings; the relationship between acoustics, health and wellbeing; and the business case for wellbeing.

Speakers include Sani Dimitroulopoulou, from Public Health England, John Mardaljevic, Loughborough University, Alan Fogarty, Cundall, and Marcella Ucci, UCL IEDE.

The event will be held from 12.30pm to 5.40pm at UCL, Gower Street, London.

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

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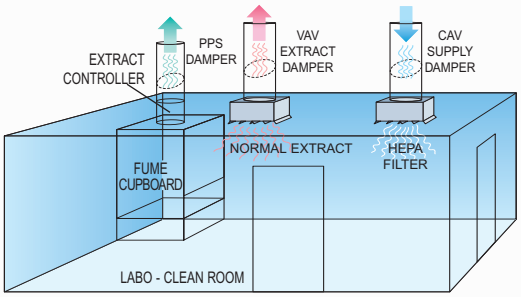

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John Field FCIBSE CEng, President, CIBSE

To register or view the full programme and speaker list visit:

www.cibse.org/conference

17-18 November

2016

QEII Centre

Westminster, London

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Speakers and Chairs Include:

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BIM Academy, Ryder Architecture

Casey Cole
Guru Systems

Mat Colmer
Digital Catapult

Les Copeland
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UCL Institute for Environmental Design and Engineering

Peter Murray
New London Architecture

Robin Nicholson
Cullinan Studio, and Convenor of The Edge

Neil Pennell
Land Securities

Jonathan Purcell
Waterman Building Services

Sarah Ratcliffe
Better Buildings Partnership

Marine Sanchez
Enhabit (formerly Green Tomato Energy)

Dwight Wilson
Imtech Engineering Services London & South

Nick Winser
Energy Systems Catapult

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Themes:

- Achieving Performance In Use
- Air Quality: Impact On Health & Wellbeing
- Collaboration For Better Performance
- Digital Engineering & Building Services
- Innovation In Buildings
- Outlook For Building Performance
- Refurb + Retrofit

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