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Responsible thinking



As ever, there was a lot to take in at Ecobuild, and plenty of feature ideas for forthcoming issues of the *CIBSE Journal*. These included some warts-and-all exposures of issues around commercial building operation and installation of district-heating pipework – as well as a fascinating retrofit housing system from Holland that guarantees building performance for 30 years.

Ecobuild may not be as large as in previous years, but there was more of a sense of urgency than usual. Brexit and its American cousin, Clexit (exit from the climate-change agenda), has made people realise that government policy can no longer be relied upon

to mandate the performance of our buildings. It will have to come from within.

There was plenty of evidence that industry was doing just that. In a defiant session hosted by the World Green Building Council (WorldGBC), developer Lendlease Europe's head of sustainability explained how it had managed to build a net-zero carbon, mixed-use scheme in Sydney.

The WorldGBC has an ambition for every building to be net-zero carbon by 2050. That might sound far fetched, but there was evidence from the conference that the technology and willpower is there to achieve this goal.

Clara Bagenal George, who was awarded the UK-GBC Rising Star Award at Ecobuild, explains how net-zero energy buildings might be achieved on page 20. She says all new developments and heat networks should be made net-zero-ready to take advantage of zero carbon energy sources when they come online.

What is holding us back is the dysfunctional nature of supply chains, and the lack of collective ownership over the design, build and operation of buildings. Debbie Hobbs, head of sustainability at Legal & General, succinctly identified many of the issues during her session on improving non-domestic buildings.

She blamed the lack of control that landlords have over tenant behaviour, and an extended supply chain that lacks the engineering skills to operate buildings in the way that is intended. Hobbs, a mechanical engineer by training, shared some horror stories of commissioned buildings with sensors still unwired.

There was a lot of interest in one of the few environmental standards to be still standing after the government's post-2015 election regulation cull. Minimum Energy Efficiency Standards have focused the minds of landlords worried about being left with unlettable property in a year's time. Hywel Davies' column (page 18) explains the recently published guidance ahead of the standard's implementation in April 2018.

ALEX SMITH, EDITOR asmith@cibsejournal.com

Editorial

Editor: Alex Smith

Tel: 01223 378034

Email: asmith@cibsejournal.com

Deputy editor: Liza Young

Tel: 01223 378048

Email: lyoung@cibsejournal.com

Technical editor: Tim Dwyer

Designer: James Baldwin

CIBSE Journal is written and produced by CPL (Cambridge Publishers Ltd) Tel: +44 (0)1223 378000. www.cpl.co.uk
1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PE.

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Advertisement sales

Sales manager: Jim Folley

Tel: 020 7324 2786

Email: jim.folley@redactive.co.uk

Sales executive: Darren Hale

Tel: 020 7880 6206,

Email: darren.hale@redactive.co.uk

Senior sales executive: Paul Wade

Tel: 020 7880 6212

Email: paul.wade@redactive.co.uk

Advertising production: Jane Easterman

Tel: 020 7880 6248

Editorial advisory panel

George Adams, engineering director,
Spie Matthew Hall

Patrick Conaghan, partner, Hoare Lea
Consulting Engineers

Rowan Crowley, managing director, CIBSE Services

Chris Jones, Fläkt Woods

Philip King, director, Hilson Moran

Nick Mead, engineering consultant

Jonathan Page, building services consultant
engineer, MLM

Geoffrey Palmer, director, Grontmij

Dave Pitman, director, Arup

Christopher Pountney, senior engineer, Aecom

Paul Reeve, director, ECA

Andy Ford, director of research, School of Built
Environment and Architecture, LSBU

Gethyn Williams, regional director, Amerlux

Hannah Williams, mechanical engineer, Atkins

Ant Wilson, director, Aecom

CONTRIBUTORS



Hywel Davies

CIBSE's technical director looks at the Minimum Energy Efficiency Standards



Clara Bagenal George

The UK-GBC's Rising Star gives her thoughts on achieving net-zero energy buildings



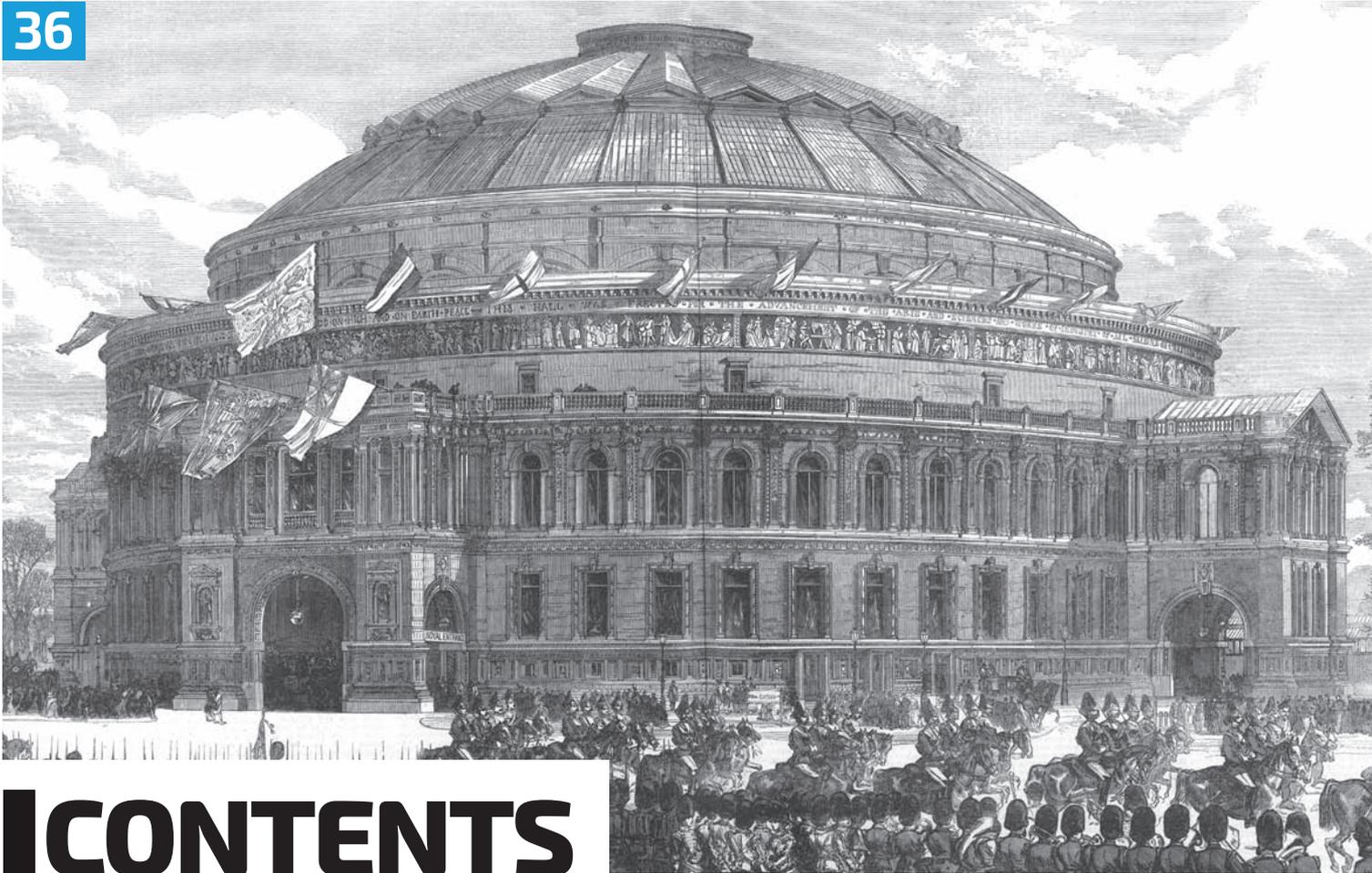
Liza Young

The *Journal's* deputy editor looks at the latest thinking on BIM at the Edge debate and Ecobuild



Tim Dwyer

The technical editor looks at efficient and controllable domestic hot water systems



CONTENTS

News

7 News

Victorian ventilation in Houses of Parliament; T levels plan; property in a digital world

12 CIBSE news

New BIM plug-in; SopHE launches in UAE; overheating TM; HCNW region debate

15 Are we there yet?

Liza Young reports on the BIM Edge debate

Voices

16 Letters

Readers respond to last month's article on the future of UK heat

18 Don't get MEEs wrong

Hywel Davies identifies some outstanding questions with the standard's guidance

20 The road to net zero emissions by 2030

Performance-led policy needed, says Clara Bagenal George

65 Q&A

TÜV SÜD's Angela Reid

Features

24 Value judgements

Building services consultants must add value or risk becoming obsolete, says HPF's Paul Flatt

26 Call to action

Alex Smith and Liza Young report on the Ecobuild conference

30 COVER FEATURE High art, low energy

Arup put sustainability at the heart of Athens' new cultural centre - Greece's first Leed Platinum building

36 The Royal Standard

How the great Victorian engineers ventilated the Royal Albert Hall's huge auditorium

40 Playing by the rules

Unite Students embraced legislation to bridge the performance gap on its estate

42 Cost model

Aecom's Jon Buckle and Hannah Reynolds look at the services costs of out-of-town office developments



Education Special

5 News

Amended school ventilation rules and tackling NO_x emissions

6 Chemistry lesson

The University of Nottingham's new carbon neutral science lab

10 Raising standards

Flow rates, CO₂ and BB101

12 A class apart

Sheffield students' winning design for a new school in Uganda

Technical

SPECIAL FEATURES
Data centres and water heaters

45 In concert

How an innovative algorithm is helping a Swedish data centre to reduce energy use dramatically

48 Data centres presentations

Reports of latest industry knowledge on data centres

49 Keeping future data flowing by returning to the source

Why engineers need to focus on data centre energy sources

51 Exchange of views

The benefits of aluminium and stainless steel heat exchangers

CPD

53 Meeting the growing demand for DHW with efficient systems

Examining the standards that are setting the requirements for hot-water generation

26



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FOR CIBSE

Journal production manager: Nicola Hurley
Tel: 020 8772 3697, nhurley@cibse.org

CIBSE, 222 Balham High Road,
London SW12 9BS

Tel: +44(0)20 8675 5211

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24



Classified

59 Products

A round-up of systems and services for the industry

Jobs

63 Appointments

Jobs at jobs.cibsejournal.com

Events

66 Looking ahead

CIBSE ASHRAE Technical Symposium; BIM Roadshows; CIBSE membership briefing webinars; CPD training; energy assessor training; CIBSE groups, regions and societies

45



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Houses of Parliament refurb to reuse Victorian ventilation

Historical academic research to feed into design brief for £3.5bn restoration

The £3.5bn renewal and restoration of the Houses of Parliament is set to reuse much of the original ventilation system.

A research report on the potential restoration of the historic system is being carried out by University of Kent senior lecture Dr Henrik Schoenefeldt, who is leading a three-year research project funded by the Arts and Humanities Research Council.

Schoenefeldt said that a hybrid ventilation system would be possible, using the current network of voids in the structure. A second scenario would reuse the system as a type of container for a mechanical services system, making it much easier to maintain equipment.

Some form of mechanical system will be needed as the Victorian design relied on heat from hundreds of long-gone fireplaces and gas lights to pull air through the ventilation system.

The voids were built into the architecture for the Houses of Parliament after collaboration between architects Charles Barry and Augustus Pugin and physician David Boswell Reid.

Schoenefeldt said it was important to learn from their designs. He said: 'The research

enables us to re-engage with historic solutions and develop modern sustainable systems.' Schoenefeldt will share his academic research with design teams in the next few months.

The Commons Public Accounts Committee last month backed up the recommendations of the Joint Committee on the Palace of Westminster for MPs and Peers to vacate the building for the refurbishment. However, the House of Commons Treasury Committee wants time to evaluate the investigations so far, before recommending that the project goes ahead.



The £3.5bn refurbishment is expected to take 6-7 years

GHA manifesto demands renewed focus on quality UK housebuilding

The Good Homes Alliance (GHA) launched a manifesto at Ecobuild last month, calling for quality in housebuilding.

A *Charter for Responsible Housebuilding* claims old regulatory and compliance systems are failing occupants, since the Zero Carbon Homes target was axed without a clear replacement plan. The manifesto



states: 'Without changes to regulation and compliance, the wider industry does not feel compelled to act; only the few take this issue to heart and are rightly seen as in the vanguard of a responsible housing movement.'

To help bring a quality focus back to housing, the GHA's document insists UK-wide, near-zero carbon targets for new homes should be re-implemented with a fresh trajectory and timetable. Housebuilders and renewable energy developers must work together to develop cost-effective strategies to meet the new carbon-reduction targets, the GHA added, while the Building Regulations Part L and F should be reviewed.

The GHA added that the compliance system based on SAP and Energy Performance Certificates was not fit for purpose. A new system that addressed energy demand-reduction targets and post-construction verification was required. Inhabitants' health and wellbeing must also be embedded in all aspects of the design.

IN BRIEF

Fellowship hat-trick for Prudence

CIBSE FM Group chair Geoff Prudence has been made a Fellow of the British Institute of Facilities Management (BIFM), the only known holder of fellowships from CIBSE, RICS and BIFM.

A champion of effective building services maintenance strategies, Prudence has been involved in numerous industry activities and improvement initiatives. He was also founding chair of the BIM4FM cross-industry working group.

Prudence is director of facilities and infrastructure at University College London, and has more than 40 years' experience in private and public industry.

Elementa engineer wins Rising Star Award

Clara Bagenal George, of Elementa Consulting, won the Rising Star 2017 award at the recent Ecobuild show. She impressed the judges with her passion for the environment, demonstrated by her local campaign against single-use plastic bags. This helped launch a series of initiatives, including innovative design tools, campaigning with charities, and encouraging young engineers.

The UK Green Building Council and PRP launched the Rising Star Award in 2013, in memory of Mel Starrs, a prominent built-environment practitioner who died in 2012. It is a chance to nominate a peer who has made a difference to the sustainability agenda. For more from George, see page 20.

CIBSE Journal win is just the ticket

CIBSE Journal has been recognised at the Institute of Internal Communication's Central and North Awards, held at the National Railway Museum in York.

Publisher CPL's CIBSE team won an Award of Excellence for team of the year, beating Barclaycard, the Department of Health and Asda.

Editor Alex Smith said: 'We are chuffed that the hard work of our editorial team has been recognised. We are fired up by this, and look forward to winning more accolades with our new-look *Journal*.'

UK to lead 'smart' market growth

Bsria is forecasting a global growth rate of 20% in the 'smart' home/light commercial market in 2017, with the UK to be the fastest-growing region, at 29%. The international market is expected to reach \$15.8bn in value later this year and \$29.8bn by 2021.

The consultancy studied markets in China, France, Germany, the Netherlands, North America and the UK, and predicts rapid growth in sales of smart products and system integration across the board. However, because the market is still in its infancy, there was less demand for service and maintenance, it reported.

Luxury homes are the largest market – accounting for 25% of the total value – with offices and hotels representing a combined total of 23%, Bsria said.

Fan and heat pump testing extended

The scope of Bsria's UK Accreditation Service (UKAS) accredited testing has been extended to include the latest high-temperature fan standard, BS EN12101-3:2015, and the heat pump standard BS EN14825:2016.

Bsria has been testing to the original version of 12101-3 for more than a decade and said its move to the 2015 version showed its 'commitment to supporting fan manufacturers in CE marking their product ranges'.

It added that it would enhance its testing capability further to ensure operation with inverters can also be demonstrated.

Digital will transform property development, claims Arup

The internet of things and 3D cameras will shape future intelligent buildings

Companies that embrace a digital strategy will do 'disproportionately well and have a big impact on our working lives, increase their asset value and create more sustainable buildings', according to a new report from Arup.

Re-imagining Property in a Digital World predicts that every aspect of property development will be 'dramatically changed'.



Physical and digital environments will merge, with 3D-printed desks – enabled for the Internet of Things (IoT) – adapted to their users and housed within 'truly intelligent' buildings.

However, Arup's analysis contains a warning for investors, developers and owners: 'This isn't about gadgets and equipment – it is about strategic thinking that avoids wasting money on the wrong innovations and inefficient capital and operational expenditure,' said global digital services leader Volker Buscher.

By using IoT technology to gather detailed data on properties, the report says operational elements – such as ventilation, lighting, heating and water – can be optimised to deliver energy and financial savings.

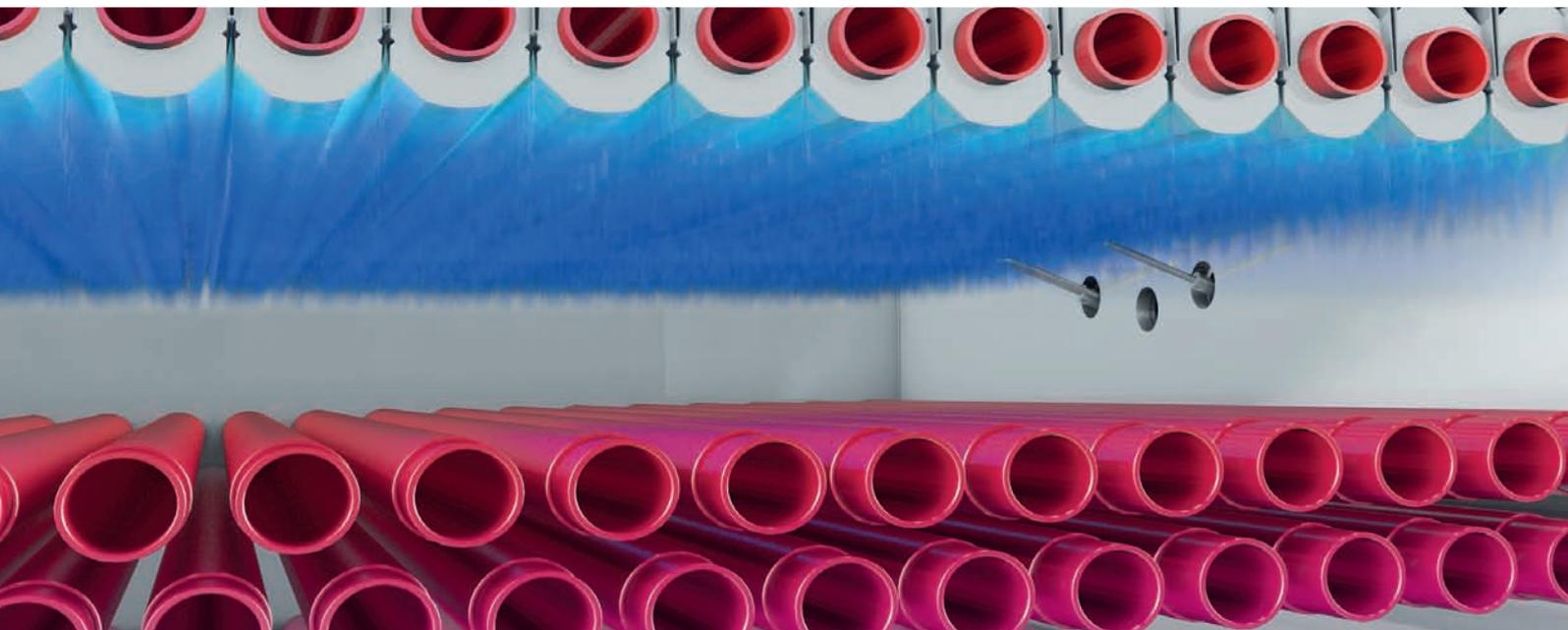
It also discusses how 3D cameras can be used to scan interior environments to develop customisable models. These can be manipulated by design teams and shown to tenants to refine every element of a space before it is built.

AI could overhaul UK power networks

Artificial intelligence (AI) could revolutionise the way power networks are controlled and pave the way for greater use of renewables and energy-demand management, say 'machine learning' specialists. National Grid is in discussions with DeepMind, owned by Google, over plans to embed the latter's AI algorithms into UK power networks, to optimise outputs from power stations and smooth the way for integrating intermittent renewable sources.

DeepMind claims to have cut the energy used to cool the internet giant's data centres by 40%. It uses machine-learning algorithms to analyse millions of pieces of data in producing patterns of electricity consumption linked to household appliances, weather and many other factors. It can then predict peaks and troughs in demand, allowing energy producers to adapt their output accordingly.

In theory, this could allow National Grid to manage the transition from coal-fired power stations to low-carbon sources, and prepare for a surge in demand from electric vehicles. DeepMind is already widely used in the UK healthcare sector for processing medical records.



UK emissions at lowest level since the 1920s

Falling gas prices and rising carbon tax on coal brings about reduction

The UK's carbon emissions fell by 5.8% in 2016, to their lowest level in almost a century, according to figures released by the Department for Business, Energy and Industrial Strategy (BEIS).

UK emissions are down by 36% compared with 1990 levels and are at their lowest level since the 1920s. A 50% fall in the amount of coal burned to produce electricity is the most significant factor in this fall, according to researcher Carbon Brief, which carried out the analysis on behalf of BEIS.

Carbon Brief said the use of coal had fallen by 74% in the past 10 years, helped by lower gas prices and the rising carbon tax on coal. As a result, emissions from gas rose by 12.5%, and from oil by 1.6% because of cheaper oil and more vehicle use.



The use of coal has fallen by 74% in the past 10 years

Meanwhile, the International Energy Agency has reported global carbon emissions from energy remained flat in 2016, as increased use of renewables – and switching from coal to gas – balanced out the rise in fossil-fuel use prompted by economic growth.

Plan suggests ways to boost housing stock

The Housing Forum has produced a 10-point 'advisory plan' to help the government meet its target of building 250,000 new homes annually.

Future-proofing housing supply proposes that planning applications involving fewer than 250 homes should be dealt with by local planning officers, rather than elected officials.

The Forum's suggestions are intended to complement the government's housing white paper and include recommendations to remove party politics from housing delivery.

It urges the government to commission new homes directly, create a single voice for the housing industry and implement the *Farmer Review's* call for modernisation of housebuilding skills and technology.

The Forum stresses the role of local councils, and says they should be given financial mechanisms to commission housing directly, as well as greater freedom to risk-share.

Schools to get up to £4m for HVAC upgrades

The schools that have secured finance for heating and ventilation upgrades under the Condition Improvement Fund (CIF) are set to be announced. CIF helps academies and sixth-form colleges address issues such as asbestos removal, gas safety and heating systems.

The legal requirements for heating classrooms – and the risk of school closure in the event of a system failure – mean mechanical services projects are high on the agenda. More than £435m was given for 1,276 projects across 1,030 academies and sixth-form colleges in 2016 to 2017. This year's successful applicants were to be announced as the *Journal* went to press.

Projects for primary and special schools must have a minimum value of £20,000, rising to £50,000 for secondary, all-through and sixth-form colleges. The maximum threshold in each case is £4m. Submissions for the next funding round should be in by December 2017.

Home energy bills will rise by £100

The average annual UK household energy bill will rise by £100 by 2030, to pay for the government's strategy to meet carbon-reduction targets, according to the Parliamentary Committee on Climate Change.

However, the committee added that the increase would be more than covered by savings from more efficient household appliances, central heating boilers and LED lighting.

Green policies will add around 9% to the average dual-fuel bill – which was £1,160 in 2016 – to pay for renewable subsidies. The committee also calculated that a rise in wholesale energy costs and other factors could push bills up by more than £200, with the switch to energy-efficient appliances only expected to save £150.

But it stated that UK householders should be prepared to pay the extra costs to offset the growing threat from climate change.

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Expo 2020 Dubai, which will celebrate 'human ingenuity', expects to attract more than 25 million visitors. BuroHappold Engineering and Grimshaw are providing multi-disciplinary engineering services for the Sustainability Pavilion, which will promote ecology, sustainable technologies and design. It features an 86,000ft² exhibition space, auditorium, courtyard and reservoir. The roof will generate power using PV panels, while a number of 'energy trees' will also act as solar panels and generate water from the atmosphere.



Hammond praised for T Level plan to boost vocational skills

T Levels designed to give technical subjects equal status to A Levels

Chancellor Philip Hammond's controversial Spring Budget contained a boost for vocational training in engineering and construction that has been welcomed by the sector.

His announcement of a £500m fund for 15 'T Levels' to be developed by 2022 was particularly well received.

Hammond said support for vocational training was crucial in tackling the UK's poor productivity, which, in turn, would support the development of a more prosperous and inclusive society. To grow its economy, the UK needed to compete with the world 'on the basis of superior talent and skills, not just lower costs,' he said.

The strategy will rationalise the number of technical courses available, and students taking higher technical-education courses at levels 4-6 will qualify for maintenance loans.

The Chancellor also announced that the number of hours of training for technical students aged 16 to 19 would be increased by more than 50%, including a 'high-quality', three-month work placement. In addition, he pledged £300m to support 1,000 new PhD places and fellowships in science, technology, engineering and maths (STEM) subjects.

T Levels are designed to give technical subjects equal status to A Levels, so that students pursuing a vocational route are not disadvantaged in the eyes of potential employers or dissuaded from taking a non-academic path by their parents.

Standing-only escalators scrapped

Plans to introduce standing-only on London Underground escalators are to be scrapped, Tube bosses announced last month.

A six-month trial last year, during peak times at Holborn – one of the busiest stations in the capital – was a partial success. By encouraging people to stand – and not walk – on both sides of the escalators at the station, queues at the bottom were reduced.

Analysis showed queuing at the bottom of the escalator was reduced and 30% more people were able to use it, compared with when people stood on the right, a Freedom of Information request via Gizmodo UK revealed. By making people stand on both sides, the test

showed 16,220 people could travel on a long escalator per hour, compared with the usual 12,745. The standing-only escalators were able to carry an average of 151 passengers per minute, compared with 115 on the 'traditional' escalator, according to the study.

However, Underground bosses have no plans to trial the scheme more widely. While congestion was cut on longer escalators, there was no improvement on shorter flights, where more people are willing to walk. The cut-off point was found to be 60ft.

The project was described by many commuters at the time as 'going against everything about being British'.

Movers and makers



Richard Mann has been appointed director of Aecom's building engineering healthcare practice in the

UK and Ireland. He has been with the company for more than 20 years and worked as project principal on several major healthcare schemes.



Jon Lee is to lead Cundall's new acoustic engineering department in the Middle East and North Africa. He is a winner

of the Distinguished Service Award for his services to the Institute of Acoustics, and helps run the Middle East Acoustic Society.



Andrew Somerville has joined Hoare Lea as a director, based in the firm's King's Cross office. He brings

wide-ranging experience in areas as diverse as high-containment laboratories, close-control environments, cold rooms, healthcare and pharmaceutical facilities, R&D, life science, chemistry and controlled-environment laboratories.



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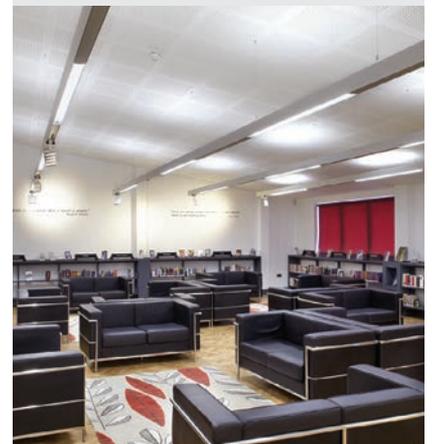
Three versions of **Linear** are available, covering all applications. **Venice** (left), **U-Line** and **H-Line**.



RIDI U-Line Inventive use of LED lighting at Rugby School.



RIDI H-Line put to effective use at Invicta School.



IN BRIEF

President's Prize up for grabs

Entries are now open for the CIBSE Undergraduate Award. Sponsored by Hays Building Services, the award is open to all CIBSE student members in their final year of BSc, BEng and MEng study, and is designed to encourage students to develop their potential.

Entrants need to submit a 2,000-word synopsis of their final-year project, together with a completed application form.

The winner will receive £500 and a trophy, presented at the President's awards dinner in October. Two runners-up will each receive £100.

The closing date for entries is Friday 21 July. For details, visit www.cibse.org/awards

Weather data webinar

If you missed CIBSE's recent webinar on weather data, an on-demand link is now available.

Speakers Anastasia Mylona, CIBSE research manager; Dane Virk, Atkins; and Susie Diamond, Inklings, offered an introduction and overview of the CIBSE Weather Data files.

With increasing demand for buildings to combat climate change, weather data has become an essential component of virtually every new building design.

CIBSE has supplied industry with the standard files to use in building performance analysis since 2002, and now – with Exeter University – these have been updated to a more recent baseline.

Listen to the webinar at: www.cibse.org/weatherdata-webinar, or visit www.cibse.org/weatherdata

See also 'Weather Alert' (June 2016 *CIBSE Journal*).

Clarification

In the news item 'Tropical heat stress puts Chowdhury in first place' (March *CIBSE Journal*), we stated that Chowdhury was a faculty member at Bangladesh University of Engineering and Technology. We would like to clarify that he is a faculty member at the department of architecture, Chittagong University of Engineering and Technology (CUET), Bangladesh.

HCNW region debates better building performance



Speakers Kevin Barrett, Mike Darby and David Stevens

Over-complexity and incomplete design contribute to poor building performance

CIBSE's Home Counties North West (HCNW) Region hosted an event in February, exploring the president's theme: why building performance often fails to satisfy users.

The discussion focused on: collaboration; integration of user requirements into design; the role of FM; how new technology can add value to post-occupancy evaluation (POE); and how this could feed back to designers.

Panel chair Chris Jones discussed the uncertainty that Brexit has brought about for legislation and building compliance. Speakers Kevin Barrett, David Stevens, Mike Darby and

Chris Jones focused on planning, briefing and conception.

Accelerating cost-fixity, differing agendas, failures to identify user requirements, rapid value engineering, contractual divisions, changes and compressed programmes were all identified as contributors to poor integration, with rushed commissioning resulting in the need for specialists to investigate complaints long after occupation.

The panel showed how over-complexity, incomplete design and coordination might also contribute to poor building performance. Taking a user and operational FM perspective, Barrett and Stevens illustrated unnecessarily complex solutions that cost more but failed to grasp very simple user needs.

Jones suggested that Building Regulations approval could become 'provisional' on completion, with final regulatory approval being granted only after a POE, DEC and EPC analysis.

Darby explained how POE analysis was gradually building a database of performance profiles. Significant operating cost reductions were materialising long after commissioning. But Demand Logic's database was also revealing how effective and responsive different kinds of HVAC design solutions were in practice, and in real time.

For more information about the HCNW region, visit www.cibse.org/hcnw

SoPHE launches in UAE

The Society of Public Health Engineers (SoPHE) UAE group was launched in March at the Dubai World Trade Centre Club at Level 33, overlooking central Dubai. As Dubai's first skyscraper, it remains a pioneering symbol of international trade and is home to international corporations including CIBSE UAE.

SoPHE UAE was conceived in October 2016 with Andrew Russell, of Hilson Moran, Simon Lewin, of WSP Parsons Brinckerhoff, and Keith Perry, of Polypipe. Their collaboration aims to raise the standards of public health engineering design as well as the profile of SoPHE in the region.

The event was attended mainly by non-members, indicating great potential for the future of SoPHE in the UAE. The evening started with addresses from CIBSE UAE chair Raef Hammoudeh, of KEO IC, who spoke about CIBSE in the region, and SoPHE chair Steve Vaughan, of Aecom, who

detailed the role of SoPHE as a society.

High on the agenda for the new region is the production of technical bulletins and training, specifically tailored for UAE public health engineering design.

Polypipe highlighted how the firm supports the society through training and education for public health engineers in the region.



The group will tailor public health training for the UAE

New certification website

CIBSE Certification is delighted to announce that its new and refreshed website is live. The updated site includes changes to navigation, with dropdown menus for both mobile and desktop versions.

CIBSE Certification offers both Management System Certification, such as ISO 50001: Energy Management System, and Personnel Certification for Low Carbon Consultants and Energy Assessors.

You can also find a certified energy assessor or consultant near you on the improved Online Register. Visit the website at www.cibsecertification.co.uk

AGM data

The CIBSE AGM will be held on 9 May 2017 at Prince Philip House, 3 Carlton House Terrace, London, SW1Y 5DG. It will be followed by incoming president Peter Wong's address. Members will receive a calling notice this month. Further details at www.cibse.org/agm

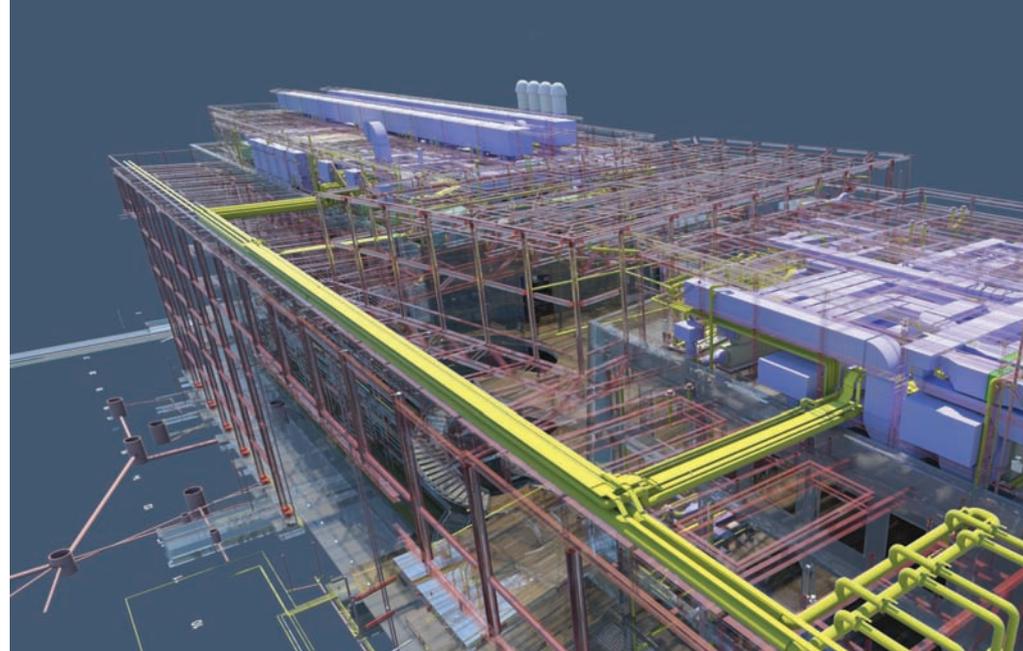
Have you paid your membership subscription?

CIBSE membership renewal payments are now due for 2017; all subscriptions run on an annual basis from 1 January to 31 December.

You can make a payment online by logging into your MyCIBSE account, and clicking through to the 'make a payment' section.

If you are logging into the new MyCIBSE area for the first time since it went live on 28 July 2016, you will need to validate the email CIBSE holds for you by clicking 'Register' on the log-in page.

If you need any help, contact the membership team on +44(0)20 8772 3650 or membership@cibse.org



New BIM plug-in set to strengthen BIM adoption

CIBSE software enables users to upload product data templates

CIBSE's BIMHawk has been adopted by one of the UK's biggest consultant engineers. The website and software plug-in enables the creation of standard parameters for use in BIM objects.

Mike Bartyzel, regional BIM lead/associate director at BuroHappold Engineering, said: 'CIBSE BimHawk gives the opportunity to map and merge our company's shared parameters with product data templates (PDTs), saving valuable time.'

The software enables users to create or upload PDTs corresponding to real-world products with a full set of industry-recognised parameters. The model can be imported directly into BIM platforms.

The plug-in allows clients to acquire structured data in a predictable format.

Contractors, consultants and commissioning engineers will be able to use BIMHawk to compare products on a like-for-like basis, making the process of specifying faster and simpler.

Carl Collins, CIBSE digital engineering consultant, said: 'BIM is supposed to make the whole construction process better, faster and cheaper but, until now, models have suffered from big flaws around compatibility and interoperability between BIM modelling platforms.'

'BIMHawk fixes those problems, and allows us quickly to import accurate and consistent parameters that can be used with confidence of robust data that is standard across the industry.'

Find out more at CIBSE's BIM Roadshows on 16 May, in Leeds, and 21 June, in London.

For more information, visit www.cibse.org/BIMRoadshows and www.bimhawk.co.uk

Yorkshire stars set to shine at regional awards 2017

The CIBSE Yorkshire Awards 2017 are now open for entries.

There are nine categories in total – three of which are new for 2017 – with all criteria having been updated, following feedback from last year.

The awards celebrate the achievements of members across the region, and are set to build on the success of the inaugural event in 2016. The categories are:

- Project of the year
- Collaborative working partnership
- Consultancy of the year
- Facilities and energy management team
- Contractor of the year
- Manufacturers award
- Client of the year
- Apprentice/Young engineer award
- Student awards

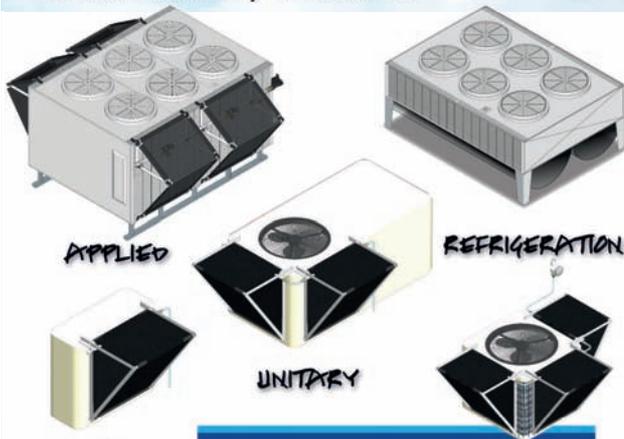
The awards will take place on 10 November, at New Dock Hall, Leeds. The closing date for entries is 12 May, with the shortlist announced on 28 July.

For more information and to enter, visit www.cibseyorkshire.org



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CIBSE tackles hot topic

CIBSE's new methodology for assessing overheating risk in homes was introduced at Ecobuild last month.

Susie Diamond, partner at Inking, said the new methodology – soon to be published as a technical memorandum – is intended to be used with dynamic thermal modelling software.

Drawing from *TM 52 The limits of thermal comfort: avoiding overheating in European buildings* and *CIBSE Guide A Environmental design*, the authors – including CIBSE, Arup, Inking and Aecom – have compiled gain profiles for occupancy, lighting and equipment, as well as offered advice on modelling windows and doors, use of blinds, and considering heat loss from pipework and HIUs. The guide is also prescriptive about which weather files projects should be modelled against.

Diamond said the guide emphasises that if blinds are part of the mitigation strategy, they must be installed at base build.

She said: 'Current methodologies are not conclusive enough and are very easy to "fudge". We need a methodology that is reliable, flexible and easy to understand.'

She added: 'Although overheating is subjective, its impact can be considerable. Impaired sleep affects wellbeing and productivity, which, in turn, could have an impact on the UK economy.'

New members, fellows and associates

FELLOWS

Chow, David Hou Chi
Warrington, United Kingdom

Ng, Chi Lam,
Hung Hom, Hong Kong

Ramjee, Hashil
London, United Kingdom

Rawstron, Stephen Andrew
Cramlington, United Kingdom

Ren, Mel Juan
Manchester, United Kingdom

MEMBER

Chan, Pin On
North Point, Hong Kong

Chan, Kin Pong
N.T., Hong Kong

Chan, Yat Ho
Hung Hom, Hong Kong

Cheng, Chung Wai Alex
Happy Valley, Hong Kong

Deehan, Cara Elizabeth
Omagh, United Kingdom

Ho, Chun Wa Dennis
Kwun Tong, Hong Kong

Ip, Ping Kwan
Tai Po, Hong Kong

Lee, Hong Ping
Tuen Mun, Hong Kong

Lo, Yuan Sheng
Bandar Seri Begawan, Brunei Darussalam

Lui, Sze Kwun
Sha Tin, Hong Kong

Lui, Shiu Ting Elsa
Pok Fu Lam, Hong Kong

Montoya, Jo Kristian
Carmona, Philippines

Ng, Chi Ngai
Tsuen Wan, Hong Kong

Ng, Ka Pui
Hong Kong, Hong Kong

Padden, Ronan
Dublin, Ireland

Pang, Kai Kwong
N.T., Hong Kong

Ross, William
Bessbrook, United Kingdom

Shiu, Wai Tat
North Point, Hong Kong

Sze, Shing Yau
North Point, Hong Kong

Tam, Pang Fung
New Territories, Hong Kong

Trill, James Anthony
Newtownards, United Kingdom

Wong, Pak Wui
Hung Hom, Hong Kong

Yip, Wai Hung David
Tuen Mun, Hong Kong

ASSOCIATE

O'Connell, Brian
Waterford, Ireland

O'Reilly, Gerard
Lucan, Ireland

LICENTIATE

Barnett, Graham Cameron
Perth, United Kingdom

Bone, Trevor
Hampshire, United Kingdom

Fletcher, Adam
Manchester, United Kingdom

Marshall, Robert Ewan
Nottingham, United Kingdom

Rubio Martin, Miguel
London, United Kingdom

Smith, Daniel
West Midlands, United Kingdom

Winney, Michael Peter
Milton Keynes, United Kingdom

Yates, Robert Anthony Leonard,
High Wycombe, United Kingdom

Lloyd, Warren
Fareham, UK

Wilson, Andrew William
Cheshire, UK

Wright, Phillip James
Mount Hawthorn, Australia

ARE WE THERE YET?

Almost a year after the UK government mandated Level 2 BIM for its projects, are the promised efficiencies being achieved? **Liza Young** reports on the BIM Edge debate

The ambition for Level 2 BIM was to progress from 3D spatial models to those that also offer all the information about a building – its components, assemblies, costs, operation and performance – throughout the life-cycle of a built asset.

The Level 2 model was intended to be built progressively, by many parties, into a holistic, up-to-date and digital representation of the building. It would be used to measure social, economic and environmental outcomes, and to evaluate performance against set targets. A more accurate definition of the acronym might even be building information management, focusing on the innovation of data management, rather than simply the use of geometric models.

That was the view of some audience members at the BIM Edge debate, run by Edge and CIBSE Home Counties North East Region at the Institute of Physics in February.

As part of its Construction Strategy, the government has mandated Level 2 BIM for centrally procured projects and looks committed to move to Level 3 by 2020. This has triggered a realisation within the industry that the BIM journey is going to be much tougher than expected, said Les Copeland, director at WSP Parsons Brinckerhoff and chair of the CIBSE BIM Steering Group. 'We were living in nirvana with pink glasses on, not realising it was going to be tough. Everyone shared some pain, and now we all understand the common goal – some of the best relationships have formed out of bad jobs.'

Dwight Wilson, digital engineering manager at Imtech Engineering Services, said a positive to come from BIM is that clients have started asking questions about their asset data. At the end of last year, all the

larger jobs came with some sort of asset-information requirements (AIR) – detailed pieces of information about the asset. 'People are realising that we have to do this, it's no longer an option, so they're asking how we can collaborate and work better,' he added.

Debate chair, Dr Anne Kemp – director at Atkins and chair of the UK BIM Alliance – said the process is encouraging collaboration and refocusing teams on the end product, rather than just on compliance reports. Implicit in this journey is a responsibility on client advisory teams to understand and advocate BIM, because not all clients are aware of what to do with asset information. 'The client is after direction. Part of our job is to coach the client, inform them, and work together,' said Copeland.

Not all the stakeholders understand the real value of data, however. 'There's a party going on here called BIM, but facilities managers do not have a ticket to the show at the moment, and we are shouting into the dark as to what we think they need,' added Copeland.

Kemp said collaboration can be difficult if people have a commercial vested interest because, for some, efficiency gains mean less money. Another barrier is the 'blame culture' in the UK, said Copeland. 'Contracts are drafted to stand up in court and address what happens when it goes wrong, rather than how to prevent it from going wrong. Until we have collaborative contracts, we won't see any changes.'

BIM terminology is also stymieing buy-in from end users. Edge member Helen Taylor, practice director at Scott Brownrigg, said the language was off-putting for colleagues, while manufacturers' naming conventions needed to be agreed and fixed, to avoid discrepancies.

CIBSE's newly launched BIMHawk – a website and software plug-in that enables the creation of standard parameters for use in BIM objects – aims to combat this. It allows clients to acquire structured data in a predictable format that is used from start to finish by the design and delivery teams, thereby dispensing with the need to create new models from scratch.

Presenting a client view, Karen Alford, from the Environment Agency, said a common language must be developed to make BIM work. 'The definition of digital is two-way communication, whether between software or between organisations. We all have to work together to solve software or communication problems,' she said. Investing money into 'trial projects' to explore these opportunities might be the best way forward, Alford added.

Getting the whole industry to adopt BIM could be problematic, however, because the government's influence as a client is limited, especially with small and medium-sized enterprises (SMEs) that cannot afford the investment. But Copeland believes this will change. 'The sooner we get Level 2 to become the day job and business as usual, the faster this gap will disappear.' **CJ**

Clients must be steered towards collaborative BIM



Reflections on a *Journal* article about the future of UK heat; the price of renewables is questioned; and the usefulness of PPMs

A hot topic

I read the article by David Davies and Alex Pepper on the future of heat ('Power of good', *CIBSE Journal*, February 2017) with interest. There is clearly some excellent research behind it. I was, however, concerned that combined heat and power (CHP) and heat networks were too often conflated.

District heating is a viable, bankable solution for low-carbon heating of the future, and gas CHP is a means to achieving its rollout – but it is not a long-term solution because of its use of a fossil fuel.

The 'be clean' in the London Plan is actually defined as 'be clean: supply energy efficiently' and is not explicitly anything to do with CHP. That said, it has been heavily interpreted to mean district heating and, as gas CHP is a mature technology with a bankable risk profile, the implication is gas CHP. CHP also enables additional revenues, in the form of electricity sales for every unit of heat sold on a network, making the very large capital cost of heat networks a viable investment opportunity – something that might not be possible with a heat-only solution, such as heat pumps or waste-heat collection.

As the article points out, a conversion of the gas grid to hydrogen is not viable in the short term for technical and commercial reasons. Heat networks can provide this short-term solution by allowing a gradual switch away from gas towards a technology-agnostic energy vector. Heat networks also allow the use of waste or secondary heat sources.

Electricity is also a technology-agnostic energy vector, in that there are many potential sources for its generation, and it has the benefit of relatively low transmission and distribution losses. The issue with electricity generation is that it often includes heavy losses

at the point of generation. If these could be captured in the form of heat, and piped into our cities – as across much of Europe, Scandinavia and Russia – we could greatly increase the efficiency of our energy systems.

The losses on heat networks are generally associated with long wet systems internal to a building, rather than the external 'heat network' element. For example, I recently worked on a London development of 3,000 homes, where the losses were estimated at 3-4% from the heat network and energy centre, and 14% from the 26km of internal building services pipework. So unless our solution of the future does away with wet systems – which means individual dwelling heat pumps or direct resistive heating – then we will continue to need wet building services.

Heat pumps would work much better on a tube vent shaft, connected to a river via a heat network, or connected to a ground source system, for example. But to capture this waste or secondary heat source, a wet system in buildings is required. I would suggest that the missing link is that government policy needs to continue to facilitate, and actively encourage, the development of heat networks in high-density areas. This will mean that proposed changes to SAP in the Building Regulations will need to consider this policy requirement.

The future of low-carbon heating is not about gas CHP; it is about a technology-agnostic vector for the collection, transportation and use of low-carbon heat. Gas CHP solutions can be changed out once the capital of the network has been recouped, and alternatives – such as heat pumps and energy from waste – can be used. Once gas CHP is no longer a viable way of reducing carbon, it should be discouraged and other ways of achieving the strategic aim of a low-carbon heat vector should be written into policy – this can be done today.

Thomas Briault MCIBSE, associate director, Arup

CHP does have a future

The article 'Power of good' appears to assume that the electricity grid can decarbonise, but that the gas grid will not. As I said in the debate article 'Wrestling with the future of heat' (*CIBSE Journal*, November 2016), it is highly unlikely that the operators of the gas grid will simply throw that asset away, having invested billions. There is already plenty of work going on to decarbonise the gas grid – see the Sustainable Gas Institute. If the gas grid is lower carbon, then CHP is lower carbon, and that isn't factored into the article. With all the problems to overcome in both, it is unfair to assume the electricity grid can decarbonise resulting in the demise of CHP, yet the gas grid cannot decarbonise. CHP is often highly economic and does have a long-term part to play in a low-carbon economy.

Phil Jones FCIBSE, CIBSE CHP-DH Group chair

If the price is right

The UK's 2016 Contract for Difference [private law contract between a low carbon electricity generator and the Low Carbon Contracts Company] bids had best strike prices of £80/MWh for onshore wind and £50/MWh



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for solar – although, as far as I am aware, the solar bidder withdrew post-bid. This would indicate that the prices quoted in the article ‘Price of solar and wind is a match for fossil fuels’ (*CIBSE Journal*, February 2017) are the wrong way round. It is also questionable to say that new fossil-fuel plants could not compete with these prices. We would have to ask the Chinese and Indians about the cost of new coal-powered plant; however, a new gas plant – even with the carbon tax – would be cheaper than that quoted for onshore wind. All that would require is a contract that allowed it to operate continually.

George Horne MCIBSE

Editor replies

Thank you for pointing this out. The figures quoted in the article represent the change in average global figures over the last 10 years.

CIBSE LinkedIn Group asks if scheduled PPMs waste resources

Wayne Smith

In my early career, as a BMS support engineer, I would turn up on sites and go through the planned preventative maintenance (PPM) tasks on the schedule. To survive the tedium, I would look for ways to make improvements, giving more value to the client and gaining job satisfaction. With IoT [the Internet of Things], smart building technologies and building analytics emerging into maturity, is now a good time to implement smarter maintenance practices?

David Cadwallader

I’ve always thought that PPM should be used in conjunction with energy and cost analysis. In the past, I’ve seen PPM that said a boiler had eight years’ life left, yet we demonstrated that a replacement would pay back after two years.

Paul Martin

BMS PPM is pretty much out of the window in times of hardship. Most customers I have come across haven’t bothered until a breakdown, or when they noticed significantly higher energy bills. It has been reduced to once- or twice-a-year health checks. Hours run, plant faults and many other features are all possible with the right BMS package, but getting them connected to a conditional-based, web-connected solution is a challenge with the worry over hackers. Traditional routine maintenance is the safest solution, carried out by trained personnel.

Tony Johnstone

Can it be done more intelligently and allow us to offer a much better service than is, regrettably, normal? Definitely. AI [artificial intelligence] and ‘expert systems’ can open up opportunities on the back of BMS data.

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

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Don't get MEES wrong – but guidance is not top-rated

In February, the government published official guidance on the Minimum Energy Efficiency Standard for non-domestic properties. Hywel Davies gives an outline of the guidance and identifies some outstanding questions

The Minimum Energy Efficiency Standard (MEES) comes into effect on 1 April 2018, for new domestic and non-domestic lettings. After that date, landlords will not be permitted to rent out a property with an Energy Performance Certificate (EPC) rating of F or G, unless they have made all possible cost-effective energy-efficiency improvements. 'Cost-effective' broadly means an improvement that offers payback within seven years.

From 1 April 2023, all non-domestic, let properties must have an EPC rating of E or above – for domestic rented property, this deadline is April 2020.

The Energy Efficiency (Private Rented Property) (England and Wales) Regulations 2015, which implement provisions in the Energy Act 2011, have been described by lawyers as 'complex and difficult to understand'.¹

The original regulations were made on 26 March 2015,² but an amendment in June 2016³ postponed the dates on which the Exemptions Register for the regulations opens to domestic and non-domestic landlords. The register now comes into operation on 1 April 2017 for non-domestic premises, and on 1 October 2017 for domestic properties.

The regulations run to 30 pages and cover both the rights of tenants in domestic properties to request energy-efficiency improvements, and the rules on letting F- and G-rated buildings. There are also provisions for enforcement, penalties, appeals and exemptions.

The recently published guidance is the first plain-language description of the steps landlords will have to take to meet the MEES requirements. It only addresses non-domestic properties, but guidance on domestic lettings is promised.

It is important to realise this is only guidance; it cannot clarify the regulations where they are vague and, ultimately, the courts will decide their meaning. So although the guidance addresses the exemptions issue, it can only offer advice on how to read the regulations.

While welcome – and helpful in many instances – there are some areas where it cannot provide clarity and where problems are likely to emerge.

The most obvious relates to exemptions, and the first



“The exemption will last for five years, but does not pass to a new owner or landlord”

concern is the definition of 'relevant energy-efficiency improvements' (Reg 24). This allows relevant improvements to be identified by a Green Deal report, an EPC report – prepared by a registered energy assessor – or 'a report prepared by a surveyor'.

So a landlord with an F- or G-rated building may not be obliged to take the recommendations in the original report prepared with the EPC by an accredited energy assessor, but may be able to engage 'a surveyor' to draw up a new list of recommendations. This is perverse, but the wording is just not clear.

Where a landlord considers that some, or any, of these improvements are not cost-effective, they either need a written report from a 'relevant person' to confirm this, or three quotes from 'relevant installers' to show that the measures will not pay back in less than seven years. But the guidance and regulations are unclear here too.

This has the makings of a major loophole. The exemption will have to be registered, but that will not be difficult. It will last for five years, but does not pass to a new owner or landlord.

A further question relates to listed buildings and those within conservation areas. The guidance not only offers advice on the application of the MEES regulations, but also expresses a view on the interpretation of Regulation 5(1)a of the Energy Performance of Buildings Regulations (EPB). Between the EPB and MEES regulations, this is quite opaque, and the guidance is unable to offer transparency.

Other areas of the regulations and guidance will doubtless raise questions, but MEES is clearly here to stay – and from 1 April 2018 it will be in force.

CIBSE members can expect to receive an increasing number of enquiries about this, and may want to make themselves aware of the regulations and guidance so they are able to respond to them.

References:

- 1 For more on this, see, for example, an article by Peter Williams of Shoosmiths, available at bit.ly/CJApr17MEES1
- 2 For the original regulations see bit.ly/CJApr17MEES2
- 3 For the amended Regulations (which only change the dates as described in the article) see bit.ly/CJApr17MEES3

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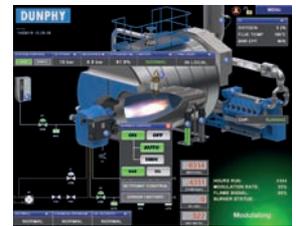
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The road to net zero emissions by 2030

We urgently need performance-led policy, based on metrics that drive net zero energy developments, says Elementa Consulting's Clara Bagenal George, who last month won the 2017 UK-GBC Rising Star Award

To safeguard against catastrophic climate change we need all new buildings to be net zero energy (NZE) by 2030. We need a radical shift in what is seen as a successful building, focusing on human-centred design. We need performance-based policy that uses metrics to drive NZE. As engineers, let's work together and make the UK a centre of excellence for NZE. As a first priority, let's fix London's broken carbon policy.

In June 2016, the World Green Building Council launched its global 'advancing net zero programme', targeting all new buildings to be NZE by 2030, and every building by 2050.¹ This will involve a radical shift in how we approach the design of new buildings, and how we deliver large-scale retrofit programmes.

Current building regulations lack integrity, and their application within the planning process forces design teams to submit evidence that is dishonest and without rigour. The meaning of zero carbon in the UK has been diluted by successive attempts to create a definition that was palatable to powerful lobbies. Since the government scrapped the Code For Sustainable Homes, there is no longer a recognised standard that



"All new developments and district heating schemes need to be 'zero emissions ready'"

encourages buildings to exceed current regulations.

London is often regarded as atypical, allowed to set its own carbon targets, while this freedom was removed elsewhere. Today, all new London homes are described as zero carbon, yet they only need to achieve a 35% reduction in regulated carbon emissions – emissions associated with heating, ventilation and lighting – compared with current building regulations. The remaining regulated carbon emissions can be 'offset' through cash-in-lieu contributions to the relevant London borough.

While the intent is positive, London's policies perpetuate 'business as usual' thinking, and lock design teams into specifying systems that they know are working in the wrong direction – away from net zero.

In his keynote address at the CIBSE awards in February 2017, Dr Pawel Wargocki highlighted that our primary reason for constructing buildings is not to

reduce carbon emissions, but to create inspiring, nurturing places for people. NZE design tackles this conflict head on – it offers us both.

I believe we need to shift our thinking towards human-

Table 1

NZE driver	Metric	Description
Reduce the total heating and cooling demand	Thermal energy demand intensity	Measured in kWh(thermal)/m ² per year. Gives an indication of the total amount of thermal energy needed to heat and cool a building.
Reduce the peak heating and cooling demand	Peak thermal load	Measured in kW (thermal), this will encourage 'peak shaving' measures that reduce demand on the grid.
Include best-in-class efficient mechanical and electrical systems	Total site energy use intensity (TEUI)	Measured in kWh(energy)/m ² per year. TEUI gives a measure of full building energy use, including plug and process loads.
Consider embodied energy/carbon	Embodied carbon	Accounting for the carbon emissions associated with the materials used in constructing the building.
Think about energy storage	Energy storage	Measured in percentage reduction of peak demand, both in heating season and cooling. It is the capacity of the development to store energy: Heat/coolth - to encourage energy sharing - that is, rejecting the heat into a domestic hot water store, rather than rejecting it to the atmosphere. Electricity - battery storage to increase resilience and reduce peak demand on the grid.

centred design, creating culturally rich, socially just and inspiring places that enhance our wellbeing. Our definition of success needs to shift from a building that performs slightly 'less bad', to one that regenerates its environment. A key measure of success has to be buildings that are fossil fuel free, powered by renewables and whose embodied energy impacts are offset.

Real-life working examples exist, many using the Living Building Challenge² as their framework. The past two winners of International Project of the Year at the CIBSE Building Performance Awards are among them – the David and Lucile Packard Foundation headquarters in California, and DPR Construction's NZE office in San Francisco.

To drive NZE design, policy needs to be based on broader performance metrics, as shown in Table 1. Currently, the only metric that is used is CO₂/m² using out-of-date emissions factors. On its own, this doesn't always direct us to effective design choices.

For buildings to reach zero emissions, we also need investment in renewables to supply 100% of their energy. It is not essential that all buildings achieve this today, but it is fundamental that energy demand is reduced in line with NZE metrics (see Table 1). When the grid becomes further decarbonised, the energy that is consumed will eventually be emissions free. Investment in renewables and grid storage is therefore a prerequisite for success.

All new developments and district heating schemes need to be 'zero emissions ready', with a plan showing how to achieve combustion-free NZE buildings (regulated and unregulated) without costly retrofitting of building fabrics and services.

The C40 cities' report (Urban Efficiency II)³ highlighted that 'policy mixes' and the use of complementary strategies and incentives across various programmes are crucial to achieving required targets. To drive an actual reduction in carbon emissions, widespread post-occupancy evaluation, increased research and education into NZE performance, and incentives to drive change are also required.

The NZE framework is honest because: it includes all energy (regulated and unregulated); works with integrity, being based on actual measured performance; and is

FIRST PRIORITY: FIXING LONDON'S BROKEN CARBON POLICY

London has set a citywide CO₂ emissions reduction target of 60% by 2025, relative to 1990 levels. We are currently not on track, exacerbated by the fact that the current London Plan is now a barrier to net zero energy development. Under current policy, new buildings need to achieve 35% carbon emission reductions compared with a Building Regulations baseline.

Outdated carbon factors are used when carbon emissions are calculated against these planning requirements. This has the effect that fossil fuel-powered hot water generation – that is, combined heat and power (CHP) – is preferred, which appears to have lower carbon emissions than electricity-driven hot water generation through air source heat pumps (ASHP) (see Figure 1). Additionally, developments are obliged to connect to fossil-fuelled district heating schemes, thanks to the position of district heating in the London Plan 'energy hierarchy', even if the alternative is 100% renewable.

The London Plan is being updated this year and Elementa Consulting invites you to join a cross-sector initiative to develop concrete recommendations for a new energy and carbon policy for London. Contact clara.bg@elementaconsulting.com for more information, and if you would like to be involved.

rigorous, as 'zero means zero'. It is fully aligned with the ethical principles of the Royal Academy of Engineering, and with the CIBSE code of conduct, which seeks to 'promote the principles of sustainability and to prevent the avoidable, adverse impact on the environment and society'.

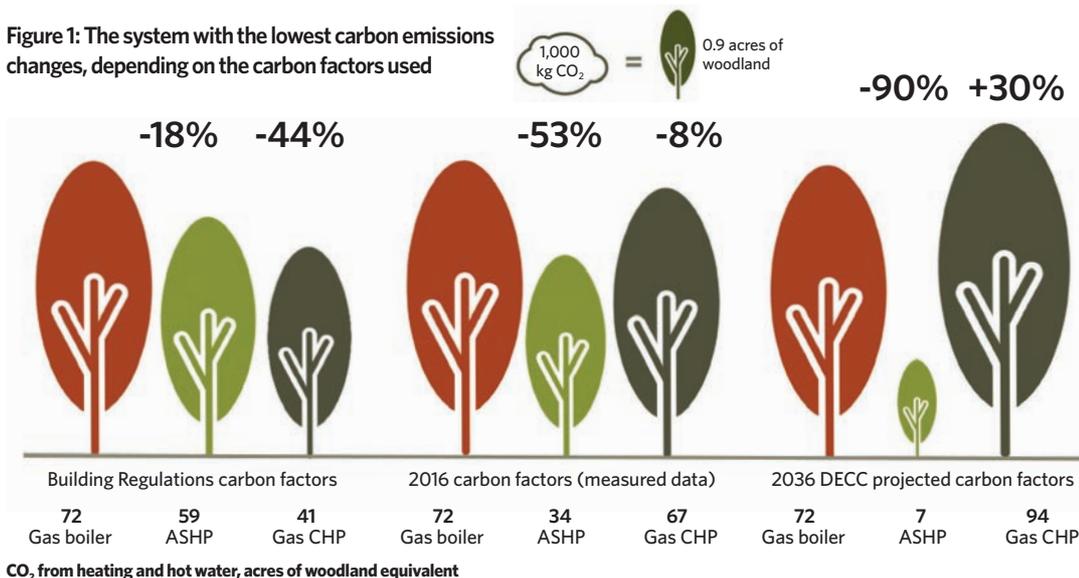
We have an opportunity to make the UK a centre of excellence for NZE design and construction, and building services engineers must be at the forefront of this seismic shift in thinking.

■ The Rising Star Award, launched in 2013, promotes people who have made a difference to the sustainability agenda

References:

- 1 WorldGBC launches groundbreaking project to ensure all buildings are 'net zero' by 2050. (5 March, 2017). bit.ly/CJApr17netzero1
- 2 International Living Future Institute, *Living Building Challenge: A visionary path to a regenerative future* living-future.org/lbc/
- 3 Urban Efficiency II: Seven innovative city programs for existing building energy efficiency, a report by C40 Cities bit.ly/CJApr17netzero2
- 4 Integral Group and Pinna Sustainability and British Columbia Office of Housing and Construction Standards (2016), *Stretch Code Implementation Working Group: Energy step code implementation recommendations* bit.ly/CJApr17netzero3
- 5 The London Assembly Environment committee, *Cutting carbon in London – 2015 Update* bit.ly/CJApr17netzero4

Figure 1: The system with the lowest carbon emissions changes, depending on the carbon factors used



CLARA BAGENAL GEORGE is an environmental design engineer at Elementa Consulting.

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VALUE JUDGEMENTS

Building services consultants risk obsolescence unless they use their engineering expertise to extract value for clients, warns Hurley Palmer Flatt's CEO, **Paul Flatt**. He tells **Alex Smith** that employee training programmes are key to creating the calibre of engineer necessary for his firm to succeed in an increasingly competitive market

Many in construction have flagged up concerns over a possible skills shortage after Britain leaves the European Union (EU). The narrative suggests that companies over-reliant on European engineers will be left with yawning gaps in their personnel once Brexit kicks in and workers return home.

Paul Flatt, CEO of multidisciplinary building services consultant Hurley Palmer Flatt (HPF), does not share these concerns, and has little sympathy for those who may struggle to recruit. 'At the end of the day you have to invest,' he says. 'Look at the tech-media world – 10 years ago these firms didn't exist and you don't hear them complaining about a skills gap [because they have trained up their own workforce].'

HPF's investment in people takes the form of its graduate trainee programme – which was shortlisted for a CIBSE Building Performance Award last month (see panel, 'Growth through graduates') – and its Gifted & Talented framework, which aims to accelerate the progression of promising engineers. Last year, 12 graduates were recruited, but Flatt says they could have taken 70, based on how good the applicants were. 'We're not struggling to find people in the UK,' he adds.

To join HPF, you don't just have to be an excellent engineer; you also need to be able to communicate and have commercial awareness, insists Flatt. 'It's no good saying you've done the best engineering; that's just compliance. Engineers have to add value – and that, fundamentally, is what will keep them alive.'

Flatt is speaking to me in the boardroom of HPF's new offices close to London's South Bank. The company moved to 240 Blackfriars last year, after combining its West End and City sites. Flatt regards the slick, modern office – and, indeed, the well-groomed staff – as a calling card for prospective clients.

His emphasis on recruiting commercially aware graduates is a response to the competitive marketplace, where property firms are snapping at the heels of engineers, with their offerings on sustainability services



and facilities management (FM). Flatt worries that engineers could be left behind unless they approach their work with a commercial mindset – a trait HPF's graduate training programme aims to instil into them.

When it comes to communication, Flatt believes the quality of graduates has risen significantly over the past 10 years. 'It surprises me how confident they are – saying what they believe. An older generation would think about an issue but not bring it up, but this generation will. It means they learn more quickly,' says Flatt, who puts it down, in part, to schools encouraging children to mix with people of all ages and backgrounds.

When I last met Flatt, in 2014, HPF had just acquired commissioning engineer Andrew Reid. We meet in similar circumstances now, as the consultant recently bought civil and structural engineer Bradbrook Consulting, the acquisition driven by a desire to extract more commercial value for clients. Flatt says more building services engineering is being done in collaboration with structural engineers, particularly in refurbishments. By integrating the two – there are opportunities to save on costs. 'Working together means we can reuse more space effectively and save money for clients,' says Flatt, who believes engineering design has been hindered by a lack of collaboration with other professions. 'Up until now, everything has been siloed. If you look across, you can make very good savings.'

Having access to structural engineers takes out a complex link of communication, adds Flatt, who believes procurement is simplified by being multidisciplinary. 'At the moment, there might be three identical contracts for three engineers – better to have one contract, one firm,' he says.

A holistic approach to engineering is behind HPF's advanced building optimisation (ABO) tool, which aims to ensure designs maximise energy savings and space efficiency. It considers renewables, material specification and the cost of potential solutions, and looks at the life-cycle of a building. 'We help translate the gap between the engineer and the architect,' says Flatt. Clients use ABO to test the architect's initial designs, so opportunities

to cut costs and energy are identified at an early stage. 'We provide commercial value,' says Flatt, who insists it is vital that engineers demonstrate this. 'If they don't, there's a risk there will be no engineering consultants in 30 years' time, because the developer will speak directly with the manufacturer. It's similar to the role of a hospital consultant; they might not be involved in the operation, but they give the high-level advice. They are seen as the senior people who can make a difference.'

The growing complexity of buildings is giving engineering consultants the opportunity to demonstrate their ability to save clients money, claims Flatt. He cites the integration of the building management system (BMS) with IT networks at UBS's new headquarters at 5 Broadgate as an example of the sophisticated work that only building services engineers with added experience in IT could do. HPF has an IT, security and technology division, and a strong track record in mission-critical sectors such as banking and data centres.

Engineers are also in a good position to ensure developers are protected from uncertainty over future energy supplies, says Flatt, who believes local energy centres will offer more security and options for increasingly off-grid supply. 'There is a limited

“Engineers have to add value – and that, fundamentally, is what will keep them alive”

GRADUATES FOR GROWTH

The HPF graduate training programme aims to progress engineers to senior positions within four years, with chartered status following shortly afterwards.

Those on the Graduate and Training Engineering Solutions (GATES) scheme have placements in all of the HPF divisions. A technical scheme mentor and a member of HR meets with each graduate every quarter to assess their competence and discuss an overview of their progress.

Training courses and workshops are arranged to ensure a wide range of skills is developed, including 'soft' skills such as project management. HPF also sponsors a PhD, two part-time degrees for junior engineers, and a Master's degree.

GATES was shortlisted in the Building Performance Training Programme category at the 2017 CIBSE Building Performance Awards.

capacity in existing gas and electricity grids – they're under pressure in terms of demand. As a result, more energy production will be local to source, and I don't just mean CHP,' he adds. (See page 48 for more on energy centres.)

One advantage of centralising energy production is that you remove plant in individual buildings, and generate more development value for the client. 'It's back to making sure engineers are commercial,' Flatt says. 'We have to be price-driven – not in terms of our fee, but in terms of operational and capital costs.'

Although he is keen to emphasise the commercial angle, it's clear that engineering expertise is the bedrock of the business, while the graduate programme aims to create the means to grow – whatever Brexit brings. **CJ**

COMPANY FACTS

- John F Hurley and Partners formed in 1968
- Paul Flatt appointed MD in 2001. Company renamed Hurley Palmer Flatt
- Number of employees: 380
- Graduate trainees: 25, and 10-15 expected this year
- Turnover £20,080,864 and operating profit £644,064 for year to 31 March 2016
- Building services engineering consulting represented 84% of income in same period
- Business hubs in Dubai, India, Australia, Singapore and the US



CALL TO ACTION

Speakers at this year's Ecobuild exhorted delegates to make a difference and work towards cutting carbon and improving wellbeing in homes, offices and the wider built environment. **Alex Smith** and **Liza Young** report

A sense of urgency was apparent in the auditoriums of the Ecobuild conference and exhibition this year. Speakers demanded that delegates do more to reduce the environmental impact of buildings, and called on them to make the most of the growing public clamour for healthier buildings and better air quality.

As well as describing new standards designed to improve building performance – and the technology innovations that would help industry cut carbon and make buildings healthier – speakers weren't afraid to speak out against what wasn't working in the design, construction and operation of buildings.

As a major contributor to greenhouse gas emissions, the built environment poses a threat to the UK meeting its carbon reduction targets for 2020 and 2050, said Patrick Brown, assistant director of the British Property Federation, in a session on Minimum Energy Efficiency Standards (MEES).

He said properties built in the 19th and 20th centuries have left a legacy of stock that is not being replaced fast enough.

MEES – a provision under the Energy Act – require all tenanted commercial buildings to be rated E or above by 2018 for new lettings, and by 2023 for all lettings. 'The best way to bring the landlord on board is to interrupt their income stream,' said Brown.

Peter Williams, a professional support lawyer at Shoosmiths, said potential barriers to undertaking energy efficiency works include the inability to obtain planning – or the tenant's – consent, or the possibility that works may devalue or damage the property.

Currie and Brown director Adam McTavish said measures that would meeting MEES' seven-year payback test were lighting and control upgrades, variable speed pumps and, sometimes, boilers. He said improvements under MEES cost between £1/m² and £9/m².

In the same session, on improving energy efficiency in non-domestic buildings, Debbie Hobbs, head of sustainability at Legal & General, voiced her frustration at not being able to control energy efficiency in her portfolio. She blamed the complex supply

chains, which don't always have the skillsets to maintain buildings properly. 'In the UK, we have lost the engineering skills to operate our buildings,' said Hobbs, who remarked that people who operated buildings had to be involved in the handover.

Guaranteeing energy performance of new homes was high on the Ecobuild agenda. Property and construction professionals introduced a pilot scheme to develop an innovative insurance product that will underpin an energy-performance warranty. Lynne Sullivan, Good Home Alliance chair, said the insurance-backed warranty will create a commercial incentive to design, build and operate houses that perform as intended. Peter Mayer, BLP research and development manager, said a customer – be they a developer, social landlord or the private rented sector – could potentially claim through the ILife insurance policy if a new house uses more energy than expected. If a deficiency in the building's façade or services is proven, the claim would be accepted and the issue rectified. Mayer said, for the insurance to work, they would have to balance the income from premiums against the cost of claims. 'The premiums of many would pay for the claims of the few. But premiums would need to be low enough to be affordable,' he said.



"The best way to bring the landlord on board is to interrupt their income stream"





Determining the validity of a claim would be a tough job that would require a year's worth of energy data, added Mayer. He said energy use would have to be investigated to determine whether the façade, the services or the user was at fault.

One innovative housing project discussed was the Dutch retrofit system Energiesprong, which offers a 30-year performance guarantee. Ron van Erck, head of international market development, announced that up to six UK housing associations had signed up to 100 retrofits using the technology. These include between 10 and 12 in London. Emily Brahan, head of sustainability at Nottingham Energy, discussed the challenges of procuring an Energiesprong project of nine homes in the city, including persuading occupiers that the makeover would save them money.

Building information modelling (BIM) was in the spotlight on the last day of Ecobuild. Paul Oakley, director at BRE, said BIM had three different meanings: the model; the process of modelling; and building information management. 'The latter is the requirement stipulated in BIM Level 2 – the thing that's produced, how it's produced and the who, what and when of production.'

Dan Rossiter, senior BIM communicator at BRE, documented how he took the process one step further than most – by applying it to his own home in South Wales.

'The idea was to show I could produce BIM Level 2 deliverables, but also to use the graphical models and non-graphical data to help manage my home in a more efficient way, as well as to inform retrofit works,' said Rossiter, who documented his journey on his 'There's no BIM like home' blog, available at BIMbloghouse

'If I want external insulation or triple glazing, I can use the cost analysis and test it with my model, to see what gives the best cost-and-return ratio. If I needed to replace a window, I could check its size, finish and basic performance information to make sure it was replaced with a suitable alternative. Gas and electric safety test data documents could be embedded into the circuit/piping models respectively, and each item of equipment can include its product information.'



Jeff Shaw hosts a session on light and wellbeing



Riba president-elect
Ben Derbyshire

Phil Palmer, virtual construction manager at BAM, explained how BIM was employed during operation at Wharfedale Hospital, Leeds. He said retrospective BIM was used to develop an operational 3D facilities management (FM) model, containing the 4,000 assets that require servicing and maintenance in the 76-bed, 9,600m² hospital.

Using the hospital asset model, technicians carry out regular equipment checks by scanning equipment's quick response (QR) codes to receive the latest information on that unit, including the date of the last inspection, issues identified and when the next check is due.

Palmer said that the FM team is now able to carry out 60 room surveys in two hours – which is 33% quicker than when using the manual system – and gives the team a five-year maintenance plan.

Dr Maria Spyrou, energy efficiency programme manager at M&S, explained how demand side response (DSR) is helping support the grid at peak demand times. It is also a way of saving money through cost-avoidance schemes, and a way of making money through balancing services schemes. Spyrou said M&S entered a distribution use of system (DUoS) scheme – which allows load shedding at peak periods – five years ago. The retailer has also upgraded 16 onsite diesel generators, 12 of which have been approved for triad avoidance – by which businesses can reduce load and increase generation when national demand is at its highest. It is now looking at frequency response, which requires an asset to be switched on within 30 seconds.

The fact that carbon energy accounting methodologies use static emissions factors is a drawback to DSR, said Barny Evans, of WSP. 'Between 4am and 5am – the best time to charge the battery or put the washing machine on – we are not using fewer kilowatt-hours, but better kilowatt-hours. At the moment, carbon calculation methodologies do not allow for that. Energy storage will show as carbon increase, when it's actually a carbon benefit,' he said.

One strong theme at this year's Ecobuild was health and wellbeing. Dr Gavin Dunn, director of Building Performance at BRE, explained how its agreement with the International Well Building Institute meant a Well certificate would be accepted as evidence for Breeam points.

SLL president and associate director at Arup Jeff Shaw hosted a packed auditorium at a seminar on light, circadian rhythms and wellbeing. Dr Debra J Skeen, of the University of Surrey, referred to a study of 166 seven- to 16-year-olds, which revealed that lighting rooms in tune with circadian rhythms increased alertness by 70% over a year. She said older people benefited most from good lighting, and cited a German study that showed falls per month in a home reduced from 14-18 to between two and four after new

lighting was installed in the corridors.

With the change in politics in America and the UK, there was a feeling that industry should not wait for governments to initiate change. This was evident in a discussion hosted by the World Green Building Council, which – despite the USA's potential exit from the climate-change agenda – was confident that its target of making all buildings net-zero carbon by 2050 was possible.

Anita Mitchell, head of sustainability at Lendlease European gave grounds for confidence with a case study on the Barangaroo development in Sydney, which she claimed was the first net-zero, mixed-use development in Australia. Lendlease has a large presence in the UK has been recommended as the partner of a £2bn regeneration scheme in Haringey – it will be interesting to see if it achieves net-zero carbon buildings here. [C](#)

PREPARING FOR CHANGE

The resilience of cities was another major theme at the three-day event.

At the City Hall stage, in a session on building resilient communities, architect Julie Fitcher said the urban form can either maximise or minimise the effect of the climate. So planners need to consider how buildings interrelate, and the effect they can have on wind speed, air temperature, pollution and chill factor.

Professor Derek Clements-Croome, of the University of Reading, called for an urban well standard – similar to the Well Building Standard – with health, happiness and flourish indicators. 'Biophilic design should be emotional to improve the quality of life; technology alone is not enough.'

Joris Voeten, urban green space senior engineer at Polypipe and Permavoid, Holland, said city planners should look to get inspiration from tropical forests, which function as ecosystems.

In an ecosystem, he said, everything is designed around water, which is released only when the forest cannot hold onto it any longer. In a city, this can be recreated with capillary drainage and irrigation architecture, which stores rainwater and reuses it to irrigate plants and flush toilets.



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Arup's design of Athens' new cultural centre put sustainability on the agenda from the start, and the commitment and vision of the client and design team resulted in it becoming Greece's first LEED Platinum building, says **David McAllister**

PROJECT TEAM

Architect: Renzo Piano Building Workshop with Betaplan
Building services: Arup with LDK
Structural engineering: Expedition with Omete
Landscape design: Debra Nevins Associates with Helli Pangalou
Venue consultancy: Theatre Projects
Project manager, quantity surveyor: Faithful & Gould

Greece has had more than its share of economic turmoil in recent years, with austerity measures prompting popular protests in the summer of 2011. At the same time in Athens, plans for the Stavros Niarchos Foundation Cultural Center were being unveiled, representing an investment in the country's future and offering a beacon of hope and optimism in otherwise uncertain times.

Designed by architect Renzo Piano Building Workshop (RPBW) – and privately funded by the Stavros Niarchos Foundation – the €566m (£500m) cultural centre is three projects in one: a 28,000m² opera house, a 22,000m² library, and 170,000m² park. The design team was international, but made extensive use of local labour and supply chains, and more than 2,000 people were employed on the project.

The centre offers world-class facilities and is home to the Greek National Opera and the National Library of Greece. In addition, the

library includes a public lending facility, a library for youth and children, a business centre, exhibition space, and facilities for the storage and preservation of rare books and manuscripts. The park, with views of the sea and the Acropolis, is a great space for a stroll, but it also hosts outdoor performances, while the centre has a flexible second performance space and a dance school. The MEP design had to suit all of these various needs.

Planned approach to sustainability

Sustainability was extremely important to the client, and defined the approach to the design brief. Environmental sustainability noticeably influenced the building's form, architecture and engineering, exemplified by the vast 100m x 100m photovoltaic (PV) canopy that stands tall above the building.

Arup guided and collaborated with the client and design team to agree objectives and targets. It then produced a strategy that captured the project's ambitions for carbon emissions, energy consumption, water use, materials, climate-change adaptability, and sustainability in operation. These principles were revisited regularly during the design phase. It was agreed to target Leed Excellent; in the end, the centre attained Leed Platinum, the first building in Greece to do so.

Passive design

Performance venues can be energy-hungry, so energy consumption was a key consideration. Arup's approach had three stages: passive design to reduce demand; energy-efficient engineering systems; and the use of renewables once demand had been reduced.

The relationship between the park and the buildings is unusual. A normal approach might be to situate the opera house, library and car park within the park; instead, RPBW located the buildings at one end of the site, nearest the sea. The park was landscaped with a vast, gentle, man-made slope, which starts at street level and has its highest point on top of the buildings. Visitors can walk up the tree-lined slope to the green roof of the buildings. The highest point is set by the flytower, which extends 32m above the opera-house stage and is used to withdraw and store scenery.

As a result, the building is semi-buried, so its fabric is naturally well insulated. A U value of 0.25W/m²K was targeted for the green roof, and the final performance was better. Targets for the building fabric's thermal performance also exceeded 'Kenak' requirements – Greece's equivalent of Part L in England and Wales. >>

» The library incorporates skylights – set into the green roof – with horizontal external shades featuring blades profiled to cut off direct sun but maximise diffuse daylight penetration. In the opera house, the auditorium, stages and much of the back-of-house facilities do not require daylight, so these are in the middle of the building, allowing rehearsal rooms, changing rooms and offices to be located on the perimeter.

Where feasible, the spaces close to the façade – which is subject to the uncontrollable variations of infiltration and a transient population – are those that can accept a wider range of temperatures. Spaces requiring close control, such as the manuscript storage facility, are deep within the building; a range of intermediate spaces and tolerances sit between the extremes. Conceptually, the building is layered like an onion.



Most of the external façades look onto service roads cut into the landscape, and incorporate punched windows with high-performing glass for minimal solar gain and good daylight. This is an important consideration for performers who spend most of their time in darkened rehearsal rooms and on stages, as well as a means to reduce lighting energy. However, solar gain is still limited because the façades are mostly opaque. Further shade is provided by the retaining walls opposite the façade, which support the man-made park slope and a monolithic, free-standing ‘cliff’ wall facing the sea.

The impressively tall, glazed façades of the public foyers are protected from the heat of the Greek sun by motorised, retractable, external fabric blinds. The glazing’s solar and thermal performance – and the weave of the blind fabric – were chosen so that, when the blinds are deployed in strong sunlight, the light transmission is still sufficient to



44

Number of main air handling units in the centre, along with several smaller systems



achieve a light, airy environment. The blinds operate under a KNX control protocol, which monitors and responds to the sun’s position and intensity, and prioritises limiting solar gain and maximising daylight. After dark, the blinds retract fully to expose the curved back wall of the auditorium and the vast wall of books in the library foyer.

Energy-efficient engineering

Lighting has a dual impact on a building’s energy consumption, because of electricity use and cooling energy to address heat gains, so special attention was paid to the cultural centre’s architectural lighting. Each space had agreed lighting power limits, while all of the architectural light fittings in the building and the park used low-energy LED technology – including some bespoke fittings developed for Renzo Piano by manufacturer iGuzzini.

The heating, ventilation and air conditioning (HVAC) strategy was tailored to each of the building’s myriad functions. An opera house is much more than just the auditorium, stage, foyers and bars; there are dressing rooms, musicians’ and dancers’ rehearsal spaces, scenery and costume workshops, administration spaces, industrial scenery assembly rooms, VIP lounges, recording studios, catering facilities and much more. Even the library has a large datacentre and archive storage, plus restoration workshops, reading rooms, and storage for rare and fragile manuscripts and photographs.

To function efficiently, each type of space has its own HVAC system controlling temperature, humidity level, acoustic limits, air cleanliness, hours of use and tolerances. There are 44 main air handling units, and several smaller systems, all chosen to meet the demands of the spaces they serve resource-efficiently. CO₂ monitoring means the ventilation systems only provide as much outside air as is needed by occupants.

Noise limits

The main auditorium has exacting acoustic requirements: background noise had to achieve preferred noise criterion (PNC) 15. This required careful design of the HVAC system, with quiet fans and vibration isolation, and three layers of acoustic attenuation: plantroom; at the point of entering the auditorium; and at each balcony branch. Low-frequency fan noise was reduced by passing the air through a large, acoustically lined plenum. Regenerated noise from airflow has to be avoided, so very low duct velocities are maintained and the number of in-duct components has been minimised. As a result, the external static pressure drop and corresponding fan energy is low, even though the total auditorium airflow is 15m³ per s.

Theatre lighting and equipment is notorious for high electrical demands and large heat gains, which place an energy burden on the auditorium’s air conditioning. Certainly, the functional demands of the main auditorium’s theatre lighting could not be achieved with today’s



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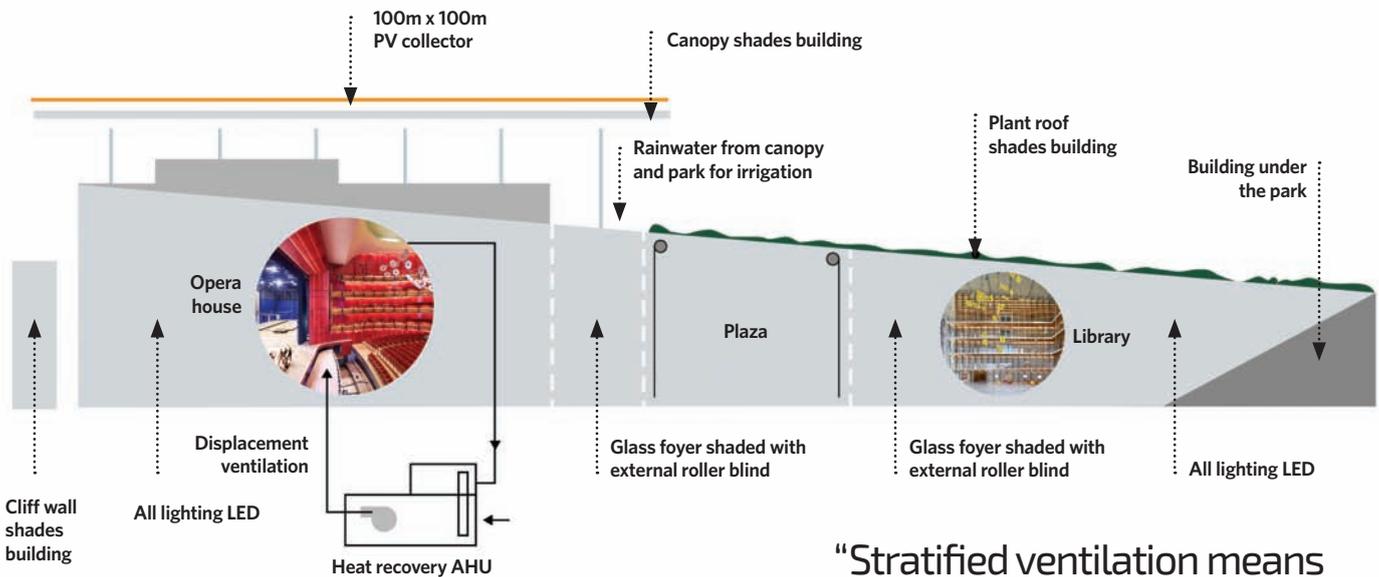
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Schematic section through opera house and library

» LED technology so Arup and venue consultant Theatre Projects worked closely to minimise the energy demands of the lighting and equipment – and its impact on the HVAC design – considering diversity in use over a three-hour period and a 15-minute period, to refine the plant sizing.

The space is cooled by displacement ventilation, with pleasantly cool air supplied via floor grilles, drawing the heat from the audience and extracting at ceiling level. Stratified ventilation means the audience feels comfortable, even though the top of the auditorium could reach 28°C or more because of the theatre-lighting heat gains. A ventilation design that mixed the air would use much more energy.

The datacentre in the library has a high heat load of 1,000W/m² and contains sensitive IT equipment. When considering the annual Athens weather data, Arup was surprised to discover that free cooling was viable for a reasonable proportion of the year by mixing outside air – when it is cool enough – and recirculated air. Chilled water is used only when the outside temperature is too high for free cooling. This method requires high-efficiency filtration, but the extra fan energy to pull air through the filters was less than the chiller energy saved.

Nevertheless, the building has a significant cooling demand; the peak water-cooled chiller capacity is approximately 5MW, plus redundancy. While much of that heat is rejected to atmosphere via cooling towers, some is recovered. A 1MW ‘heat recovery chiller’ operates with an elevated condenser water temperature to preheat the domestic hot water and LTHW circuits; the impact of the reduced coefficient of performance (COP) is compensated for by the savings in natural gas.

Energy source

The final step was to consider the energy source – in particular, renewables. Ground source heat pumps were rejected because of mismatched loads and payback. The favoured solution was a 100m x 100m canopy perched on top of the building and covered in PV panels. Such a bold and dominant installation was only possible because it was addressed at the very start of the project. It became a fundamental component of the architecture and a defining feature of the project.

The design team wanted to maximise the yield by using as much of the surface area as possible. Most PV installations feature rows of panels separated by gaps that serve as maintenance access corridors, because standard panels cannot take much weight and walking on them risks damage. But the centre’s panels were laminated, to strengthen them sufficiently to be ‘trafficable’. The extra layer of glass reduced the efficiency a little, to 17.6%, but it allowed the entire 10,000m² surface

“Stratified ventilation means the audience feels comfortable, even though the auditorium could reach 28°C or more because of lighting heat gains”

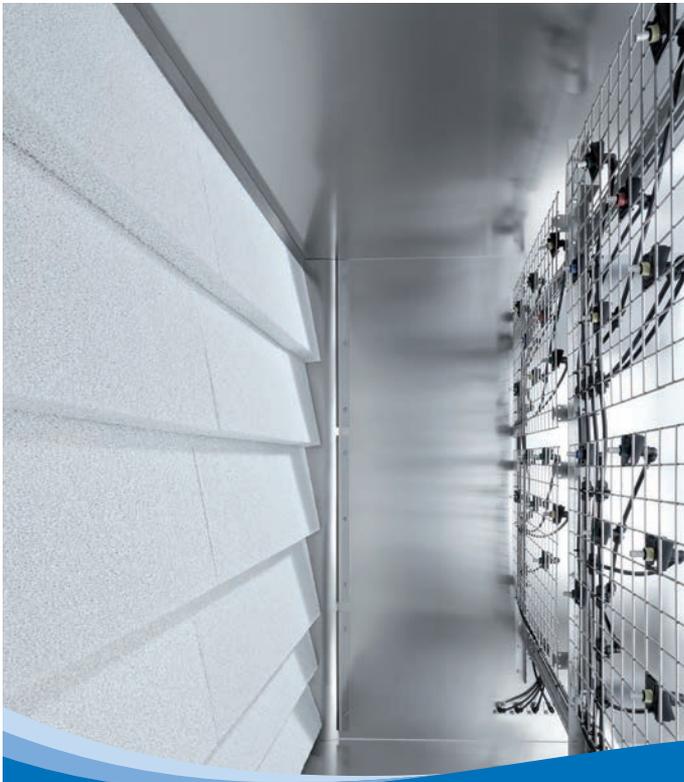
area of the canopy to be covered, with no separations. The annual yield of the PV installation is around 2GWh per year, and the peak capacity is 1.6MW. The electrical energy generated is so large that a transformer is housed within the ferro-cement canopy, while a sculpted cable spiralling from its underside expresses how the canopy collects the sun’s energy and delivers electricity to the building.

Strategic approach

The client’s ambition to build a sustainable project was realised, thanks to: the design team’s approach of considering sustainability from conception; taking a collaborative approach with support from all parties; collectively agreeing objectives; defining a strategy and sticking to it; and considering sustainability in all aspects, large and small. **CI**

■ **DAVID MCALLISTER** is lead MEP engineer and project manager, formerly of Arup





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THE ROYAL STANDARD



Ventilating the Royal Albert Hall's huge auditorium was one of the great challenges of 19th century services engineering. **Henrik Schoenefeldt** and **Maria Köhler**, of the University of Kent, describe how the great Victorian engineers achieved the feat

The idea to build a 'Central Hall of Arts and Sciences', was first proposed by Queen Victoria's beloved consort, Prince Albert, after the Great Exhibition of 1851 – but he was never to see his vision become a reality.

Albert's untimely death in 1861 saw the ambitious project shelved until 1865 when the Prince of Wales – later King Edward VII – appointed a committee to revive the scheme.

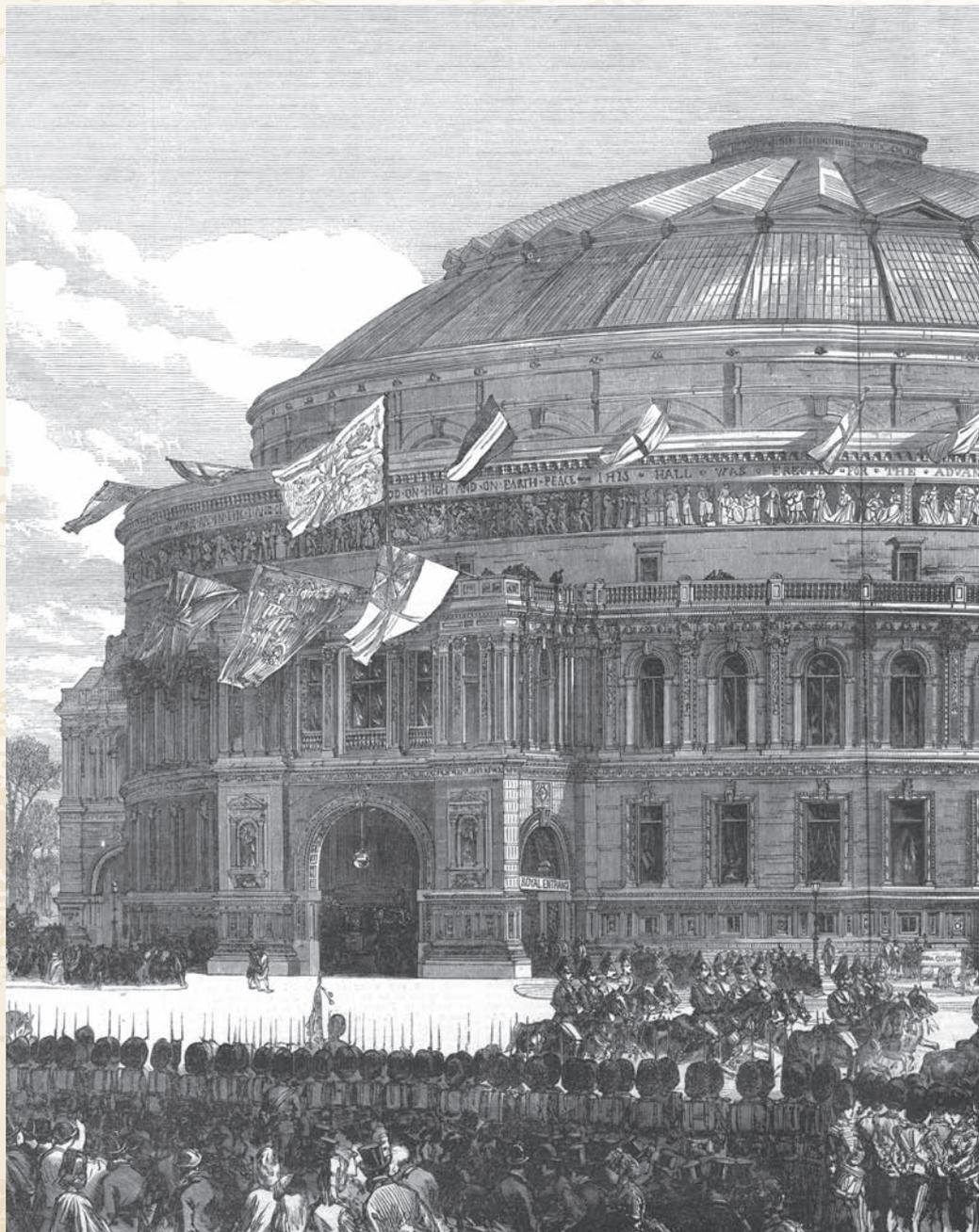
The building received its now familiar name – Royal Albert Hall – in 1867, when a still grieving Victoria renamed it in honour of her late husband, at a ceremony to mark the laying of the foundation stone.

The Prince of Wales's committee comprised the prince himself and a group of architects and engineers. These included Lt Colonel Henry Scott of the Royal Engineers, the man who later became responsible for the design and the execution of the building.

A concert hall, based on the form of the Roman Colosseum, was first developed by Francis Fowke, a captain in the Royal Engineers, but he died with his plans incomplete, leaving Scott to finish and adapt the original design.

Ventilation and climate control were a challenge in his creation – a vast space measuring 185ft by 219ft and 135ft high (56.4m by 66.8m by 41.1m high) that could accommodate audiences of up to 8,000. Like many theatres of the time, maintaining adequate ventilation and preventing overheating were most challenging.

Civil engineer Wilson Weatherly Phipson¹ was appointed in 1869 to design the warming and ventilation system under Scott's direction. Phipson's scheme was a hybrid, following principles developed by Belgian engineer Englebert-Theophile Van Hecke. The system combined a fan-driven air supply with a



thermally driven extract system. The hot air was exhausted through a circular shaft above the central oculus in the ceiling. This shaft ended in a lantern above the roof and was equipped with manually adjustable louvres that allowed attendants to regulate the outgoing flow. Air was extracted using the natural stack effect assisted by the waste heat of more than 9,000 gas burners fixed around the oculus. Scott wrote that the buoyancy 'exerts an enormous force,' in particular when the space was heated during the winter months, or the gaslights were in use.

Fresh air, introduced with the aid of two large fans driven by a 5hp (3.7kW) steam engine, underwent a process of heating and humidification before it entered the hall. Phipson stressed that the Van Hecke system allowed for the creation of uniform climatic conditions².

These principles were not new, but the challenge was applying them to a very large and tall space. The original plans show that an extensive network of air chambers was created inside the basement for the distribution and conditioning of supply air. It was composed of three concentric air chambers. A large, oval plenum chamber was situated

below the central arena, followed by an inner and outer ring of linear chambers. These followed the curve of the main walls.

Ventilation was introduced at a relatively late stage in the design development. Despite the potential risk of technical solutions being constrained and compromised by existing plans, the late arrival of the building services engineer in architectural projects was not uncommon. It was the case in many Victorian public buildings renowned for their complex environmental systems, such as the Natural History Museum, Royal Courts of Justice and the Houses of Parliament.

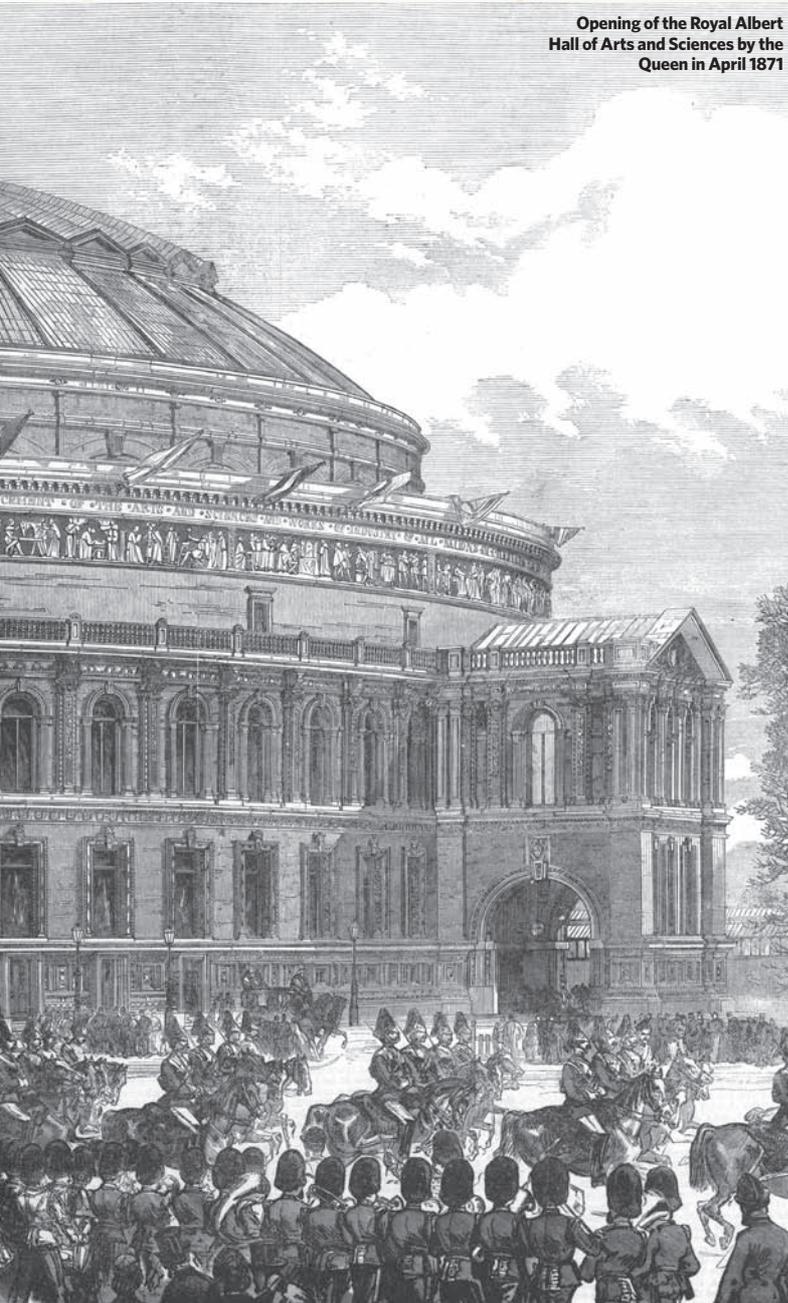
The air was forced into the basement chambers through two shafts at the south end of the hall, using two large, steam-powered fans 6ft (1.8m) in diameter. The supply was divided into two – one inlet supplying the chambers on the eastern side, and the other on the western side of the oval plan.

The air first entered the outer ring of chambers, which in the original drawings is referred to as the 'main heating chamber'. It supplied warm air for the boxes, corridors and function rooms, but was also linked to the central plenum of the arena. It was connected to this through four cross-channels, two on the north and south end, respectively, and to the inner ring via four shorter cross-channels.

The inner ring was used to supply air to the amphitheatre seats surrounding the central arena. The cross-channels had valves to adjust the quantity of air conveyed to the plenums below the arena or amphitheatre stalls, respectively. The shorter cross-channels permitted attendants working the system to continue the supply to the amphitheatre seats over periods when that to the arena was closed. Phipson wrote that the valves also allowed the supply in certain sections to be closed off or to concentrate it in one area.

The main heating chamber was also linked to an array of vertical shafts to convey tempered air upwards to the spaces surrounding the main hall, such as the boxes, corridors and various function rooms. Each of

Opening of the Royal Albert Hall of Arts and Sciences by the Queen in April 1871



RESEARCH AIDS BUILDING CONSERVATION

This article is based on research conducted in the context of the module *AR828 - Rediscovery - Understanding Historic Buildings and past Environmental Technologies*, which forms part of the University of Kent's MSc in Architecture and Sustainable Environment.

The module was developed by Dr Schoenefeldt with the aim of formally embedding the study of historic environmental principles and technologies within the teaching of building science. The aim is that this should better inform building conservation practice.

The material used in such research included drawings, letters, records of historic measurements, scientific reports and past engineering literature. Research topics ranged from 18th-century principles of daylight design and early solar thermal technology to the ventilation of French hospitals and the history of mixed-mode ventilation.





The 135ft high hall could accommodate audiences of up to 8,000

Phipson's specifications	
Winter temperature	Hall & rooms: 55°F to 58°F (12.8°C to 14.4°C). Corridors, stairs, porches: 52°F to 55°F (11.1°C to 12.8°C).
Summer temperature	During hottest days interior to be kept below the exterior air temperature.
Humidity	Wet bulb thermometer not to exceed dry bulb thermometer by 10°F (5.6K).
Ventilation rate	3,600,000ft ³ per hour (28.3m ³ per second).

Phipson specified control regimes and pre-conditioning the hall before performances

» the larger rooms above the entrance porches were served by two fresh-air shafts. These had separate valves to adjust the supply to every room or box individually.

The outer and inner ring of heating chambers were filled with hot water coils and 'moistening tanks' to raise the temperature and humidity of the supply air. The system followed the principle of a warm air central heating system – a technology that had already been well-established since 1830. The temperature in the hall was boosted by warming the supply air, but it also incorporated arrangements for cooling, humidification and air filtration.

It followed a method of air conditioning developed during the 1830s and 40s. The air was heated using hot-water condensing boilers. Water running through cast-iron pipes was heated by steam supplied via a central boiler house, containing three boilers producing 25 hp (18.6kW). The heating was divided into 16 sections, each of which could be operated separately, according to demand in different parts of the hall.

Phipson paid close attention to the operational dimension of the system. In the original 1869 contract, he gave detailed specifications for the system, which included references to monitoring and control procedures and a 12-month post-occupancy

evaluation period, to allow the system to be tested and fine-tuned.

The hall was equipped with an array of scientific instruments to monitor the condition of the air, which included hygrometers, thermometers and anemometers. A self-acting valve with anemometers was installed near the input fans to monitor and control the amount of fresh air passing into the basement passages. Phipson specified separate control regimes for summer and winter and gave instructions to pre-condition the hall in preparation for concerts.

Records relating to the performance of the system show that Phipson's concern about operational procedures was justified. In his paper, Scott stressed that the performance of the system was heavily reliant on the diligence of the staff responsible for the operating and monitoring procedures³. One of the operational challenges was synchronising the fan-driven supply with the buoyancy-driven extract. Scott reported instances where the pull of the shaft had caused inward draughts every time the doors leading into the hall were opened. To prevent air pressure in the chamber becoming lower than outdoors, the louvres of the shaft had to be adjusted to regain a balance.

"The system followed the principle of a warm air central heating system – well established since 1830"

Overheating posed the most significant challenge, both in winter and summer, as the large audiences – up to 8,000 people – represented a substantial heat load. Phipson reported that the body heat of these crowds, combined with the gaslights, caused the temperature to rise by around 4.5K during performances. Before a concert, the hall was warmed to a moderate temperature, but by the time 8,000 people were seated it had already increased by just over 2K. Anticipating the effect of thermal stratification at different levels of the hall, Phipson asked attendants to supply cooler air at the upper levels. While some cooling was provided by spraying the incoming air with cold water, and by circulating cold water through the hot-water coils, the ventilation was central to preventing overheating. Phipson specified a supply of 3,600,000ft³ per hour (28.3m³ per second), but the amount introduced was adjusted depending on the size of audience and indoor temperature.

While higher ventilation rates were able to reduce the rise in air temperatures or renew the atmosphere, it also exposed the audience and performers to increased draughts rising through the floor. In his specification, Phipson acknowledges the importance of positioning inlets at a distance from people to protect the audience from the cooling effect of air currents. Because of the high density of people seated within the arena and stalls, however, this was not achievable. They were sited immediately above the main air inlets for the hall, exposing the audience to uncomfortable draughts from below, if the ventilation rate was high. The fresh air for the main auditorium was supplied through gaps between the boards covering the arena floor and via apertures in the risers of the raked seats inside the stalls.

For staff, daily balancing the requirements of ventilation and thermal comfort of Prince Albert's grand vision was a constant challenge. **CJ**

■ **DR HENRIK SCHOENEFELDT** is senior lecturer in sustainable architecture at the University of Kent and an Arts and Humanities Research Council (AHRC) leadership fellow, and **MARIA KÖHLER** is an MSc student at the University of Kent

References:

- 1 Sturrock, N, The Forgotten Engineer who moved in high circles, *CIBSE Journal*, September 2015.
- 2 Notice on Dr. Van Hecke's system of warming and ventilation, Wilson Weatherly Phipson. Paper read at Society of the Medical Officers of Health in Whitehall, 16 November 1861
- 3 The construction of the Albert Hall. Lt Col Henry Scott read at RIBA on 22 January 1872.

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PLAYING BY THE RULES

Sustain's **Amy Dartington** and **Stuart Gray** explain how Unite Students embraced ESOS and MEES to bridge the performance gap

With more than 150 buildings in 28 cities, Unite Students is one of the UK's leading providers of student accommodation. The business places great importance on carbon management and this – coupled with legal requirements – resulted in the firm embarking on an ambitious programme to achieve an 80% carbon reduction on its buildings by 2050, against its 2014 baseline.

In spring 2015, Unite Students began working with Bristol-based energy and carbon management company Sustain on its compliance with the Energy Savings Opportunity Scheme (ESOS). Sustain has since continued to offer portfolio-wide analysis for Unite in relation to the Private Rented Sector Energy Efficiency Regulations – known in the industry as the minimum energy efficiency standard (MEES).

Between 1 January and 31 December 2014, Unite's energy spend was £14.7m. For the sites at risk of non-compliance, Sustain identified a potential annual saving of £380,000, allowing them to achieve compliance with MEES.

From compliance to target

Sustain carried out new Energy Performance Certificate (EPC) assessments across Unite Students' estate. It added the data to the ESOS assessment and created an asset-management database that could be built on with further data relevant to energy management.

ESOS and MEES helped to drive Unite Students' carbon and energy ambitions, as required by the regulations – an audit across 90% of energy use (ESOS) and EPCs for all buildings (MEES). They also helped it achieve sign-off on exacting carbon-reduction goals; Unite Students has committed to a target with the Science Based Targets Initiative (SBTI), which helps companies determine by how much they must cut their emissions to prevent the worst impacts of climate change.

The work carried out for ESOS gave the board external validation of the opportunities and the costs to deliver the target, as well as

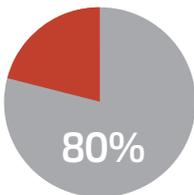
the confidence to sign off on carbon-reduction targets in line with the Climate Change Act and current science. Further confidence in the programmatic approach has been generated by the work in response to MEES. This devised the optimum solution for balancing carbon reduction, Simplified Building Energy Model (SBEM) improvement and cost saving, while driving the ambition to get better data on which to base investment decisions.

Once the case is made at a strategic level, building-level business cases are required by ESOS and MEES to ask: What are we spending? Where are the opportunities? How are our buildings performing and how can we improve this cost-effectively? What level of performance do we want? Answers to these can form a robust energy-efficiency programme.

Results

Sustain and Unite Students set out to bridge the performance gap between SBEM-predicted energy consumption and actual, metered consumption. Sustain built a bespoke end-use profile for Unite Students' buildings, with the same metrics as SBEM, and using a methodology that allowed it to calculate building-specific profiles. It then applied the

CO₂ reduction target



● 80% carbon reduction
Unite Students' ambitious target for its UK estate by 2050





Stratford One, Stratford, East London



Blenheim Court, Bristol



Waverley House, Bristol

Energy Conservation Measures (ECMs) to the profile, using known data points and data points sourced from SBEM. The result was a hybrid model that meets compliance and informs investment planning.

Unite Students needs to balance competing demands for the ECMs. Perversely, demand for SBEM improvement can be at odds with that for carbon reduction. In response, Sustain built a simple ranking methodology that normalises competing benefits to a cost per benefit – carbon saving, SBEM score or return on investment (ROI). Each of the metrics is assigned a weighting out of 100, and can be amended to reflect the priorities at any given time. Using the weightings, an ECM is given a score – also out of 100 – relative to the rest of the ECMs for that building. Unite can then use a single metric to evaluate the returns an ECM will achieve relative to all proposed ECMs, tailored to its priorities.

The ESOS and MEES exercises followed the first four of five stages:

Review: Collate and evaluate Unite's energy performance

Target: Prioritise the worst-performing areas

Identify: Propose solutions to improve performance and comply

Verify: Evaluate and propose programmes to achieve targets

Practice: Solution pipeline flowing through to installation.

We delivered a workshop to present the results, train Unite Students' staff to use the analysis tool, and discuss the process for implementation, helping Unite develop a new energy-management process that is currently being rolled out. After presenting a list of recommendations provided by ESOS, targets were set to develop business cases and the most efficient way to arrive at installations that satisfy MEES, internal targets, affordability, feasibility and practicality.

Recommendations

Unite has a relatively uniform portfolio of sites; replicable specifications for fit-out allow it to group buildings by building services. Although the sites perform well, the focus for Unite was reducing consumption from the building services, while maintaining a comfortable and flexible environment suitable for the needs and occupation of each student.

We looked at Unite's space-heating services – researching control strategies and trialling different heaters – as well as the domestic hot water demand, where potential savings could be made with heat pumps.

First, we advised Unite to get a firm understanding of its end-use profile. The vast majority of Unite's sites have a single half-hourly electric meter, recording space heating (electric heaters), domestic hot water (showers, washing), lighting, small power, and ventilation. Our advice was to target measures to reduce high end-use consumers.

The issue for hot water and space heating was the carbon intensity of grid electricity. Unite was presented with two options: look to increase the efficiency of its services – through heat pumps, for example – or change to a less carbon-intensive fuel such as gas or biomass.

In high-rise accommodation, we advised Unite to look at the current services infrastructure, asking: how much room is in the risers and is there an existing distribution system for domestic hot water? The feasibility of retrofitting a central wet heating system will be the deciding factor in investment appraisals. We advised Unite to review all floorplans with proposed space heating changes to determine where wet distribution systems could be retrofitted with minimal difficulty.

The residential-style use of its buildings means there is a high demand for domestic hot water. Where buildings currently have a central electric water heater, it is practical to consider replacement with a heat pump; this way, Unite can trial the technology without the added complication of the distribution system.

Sustain has highlighted the practicalities of installing the measures to the setup of Unite's buildings, and using practicality as a factor for evaluating investments. A 'complexity factor' is now a recorded data point within Unite's asset register when surveying its buildings.

Unite Students, with Sustain, used ESOS and MEES to push for a systematic, long-term asset plan. With the firm's internal targets, the regulations encouraged a new energy-management process, creating a repeatable methodology for designing a programme for action. **C**

AMY DARTINGTON and **STUART GRAY** are senior associates at energy and carbon management company Sustain



Stratford One common area

Cost model

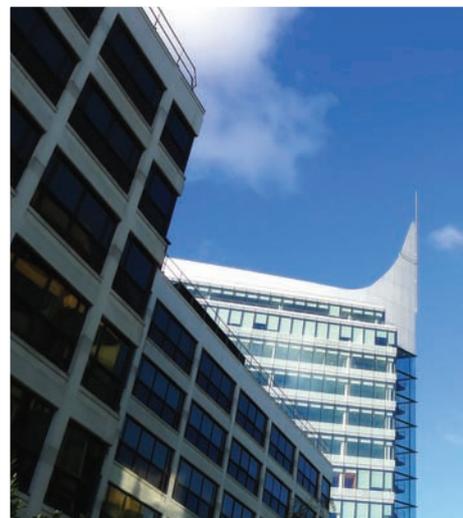
Out-of-town offices in the South East

As central London rents soar, developers are moving out of town to build new office developments that are still within striking distance of the capital. Aecom's **Jon Buckle** and **Hannah Reynolds** look at the services costs of this type of build

This cost model examines the capital cost of the shell-and-core and Category A fit out of an out-of-town commercial office in the South East of England. The office features air-cooled chiller plant, boiler plant and air plant, on floor four-pipe fan coil units, LED lighting, fire alarm and sprinkler coverage, and BMS controls.

Upgrades to major roads, and the introduction of Crossrail and other rail improvements, will improve the commute for many. By moving to out-of-town premises, businesses will enjoy reduced rental charges, but retain the ability to reach the city centre.

Rents are lower than in central London for several reasons. Land prices in the South East are generally more affordable than in the capital, while labour can also be cheaper, contributing to a reduced construction cost.



Services design

Functionality is a key design factor for out-of-town offices, with a drive to maximise the net internal area. Generally, there is no requirement for a basement. Compared with central London, planning consents are less stringent when it comes to plant location, so having a basement to hide away plant from neighbouring properties – and to avoid exceeding designated building height restrictions – is less of an issue.

Out-of-town office sites are often sizeable compared with those in the capital. Developers frequently construct multiple offices in one location, with a common external plant building. Having a larger site also presents more opportunities to gain Breeam credits.

They are usually supported by a single services core, which maximises the number of tenant (Cat A) areas. Reception spaces in out-of-town offices tend to be more functional and, subsequently, more economical. From a developer's perspective, the need for an impressive reception area to differentiate an office from its neighbours is less of a priority outside London. Economical use of the ground-floor space is a consideration. However, having a smaller reception allows the flexibility to offer amenities such as cafes, restaurants and small shops. This can be important, as offices may be isolated, making the opportunity to buy food and drink within the premises a considerable benefit.

Typically, out-of-town offices have large floor plates served by fan coil units (FCUs), offering the flexibility for multi-tenancy letting across the floors. An alternative to FCUs could be a variable refrigerant flow (VRF) system. Letting agents – who have knowledge of market trends – often influence the choice, and there are more examples of Grade A out-of-town office spaces using VRF systems. In owner-occupied projects, chilled beams – which are cheaper to maintain – may also be a suitable replacement for FCUs, the key benefit being a reduced whole-life cost.





While exposed services are not a priority for the out-of-town office rental market, it is common for an element to be incorporated into the design for aesthetic purposes.

Cost-model assumptions

The cost model is based on an out-of-town office arranged over 10 floors – including ground – with no basement but an undercroft. It has a gross internal area (GIA) of 23,000m² with an approximate Cat A net lettable area (NIA) of 19,000m², resulting in a net-to-gross efficiency of 83%. It has been designed to achieve Breeam Excellent. The occupational density is assumed as one person per 10m².

Costs are base dated at Q1 2017 and the prices are reflective of projects procured through a competitive two-stage tender process. The cost model includes subcontractor preliminaries, testing and commissioning, and builders' work in connection with services only. Costs to complete the services fit out beyond Category A standard, professional fees, tenant enhancements and VAT are excluded.

Alternative design solutions

The scope of MEP services within the cost model are typical for out-of-town offices. However, a number of alternative design solutions are frequently considered. Lighting is a key example of this. The cost model is based on LED fittings, but it is not unusual for T5 fluorescent fittings to be specified – although this is likely to become less common.

Toilet pods are a design aspect growing in popularity; they include all sanitary



Shell and core cost of an out-of-town office in the South East

Shell and core (GIA)	Cost model		
	Total £	£/m ² of GIA	% total MEP cost
Sanitary installations Sanitary appliances, including WCs, wash hand basins, cleaners' sinks, urinals, showers, and the provision of disabled toilets and accessible showers. The showers are assumed to be on the ground floor.	161,000	7.00	2%
Disposal installations Soil, waste and vent installation to all sanitary appliance points, including anti-siphonage and ventilation pipes. Installation of a rainwater disposal system. An allowance has been made to provide capped-off drainage connections to kitchenettes and retail units on the ground floor. Condensate drainage for fan coil units, including insulation.	327,000	14.00	4%
Water installations Installation of mains cold water services, including storage tanks, pumps, water softening, salt saturators and so on, and connections to sanitary appliances. Installation of hot water services, including distribution, pump sets and connections to sanitary ware. Installation of non-potable water services, including distribution, pump sets and connections to sanitary appliances. Provision of capped-off cold and hot water services to office-floor kitchenettes and retail units. An allowance has also been made for miscellaneous water points.	413,000	18.00	5%
Heat source Low-emission condensing boiler plant, with associated pump sets, primary distribution pipework and insulation.	102,000	4.00	1%
Space heating and air treatment Air cooled chillers (roof-mounted), inclusive of water-treatment and acoustic requirements. Installation of chilled water distribution system, including pumps, pipework, valves and insulation. Low temperature hot water distribution system, including pumps, pipework, valves and insulation. Metering to CHW and LTHW systems. Air handling units and associated supply and extract ductwork distribution. Dedicated reception air conditioning system and any necessary supplementary heating and cooling.	2,350,000	102.00	26%
Ventilation systems Toilet and shower supply and extract system, ventilation systems to plantrooms, lift motor rooms and refuse areas. Provision of Colt firefighting lobby ventilation system.	336,000	15.00	4%
Electrical installations HV installations, including switchgear, transformers and so on. Installation of LV distribution system, including switchgear, primary containment, cabling and rising busbar. Provision of power to mechanical plant, installation of small power and lighting, including emergency lighting and controls to landlord areas. Provision of enhanced lighting to lift lobbies, reception areas and toilet areas. Installation of external lighting. Provision of life-safety generator system only, including fuel, flues and acoustic treatment. Earthing and bonding.	2,169,000	94.00	24%
Fuel installation Installation of gas service to condensing boiler.	47,000	2.00	1%
Fire and lightning protection Installation of sprinkler system, including tanks, pumps and risers. Installation of gaseous suppression systems to switchrooms and generator room. Installation of dry risers to office floors and installation of lightning protection.	445,000	19.00	5%
Lift and conveyor systems/installations Installation of four passenger lifts (21 person, 2.5m/s, DDA compliant) with enhanced finishes, serving ground to level 9. One goods/firefighting lift serving all floors. Destination control system to all passenger lifts.	1,421,000	62.00	16%
Communications, security and control systems Installation of fire-alarm systems, including interface panels, head end equipment and terminal devices. Provision of landlord security system, including CCTV and access control to landlord areas. Provision of security turnstiles to reception area. Provision of a disabled alarm system, refuge alarms and induction loops to reception/lobbies. Installation of central building management system (BMS), including central control panels and BMS to plant and equipment.	1,091,000	47.00	12%
Builders' work in connection with services	301,000	13.00	3%
Shell and core total cost (totals have been rounded up for the purpose of the cost model)	9,163,000	400.00	100%

» appliances, lighting, small power and the like, but are pre-fabricated off site. The pods are delivered to site, craned into place and connected to the capped services. Generally the pods are unisex, with a toilet, wash hand basin and hand-drying facility within them.

As well as offering faster installation, the pod construction method requires less labour onsite. Another benefit is that the landlord areas can be reduced and the overall net lettable space increased, as there is no need for separate male and female toilets. **CJ**

JON BUCKLE, senior project surveyor and **HANNAH REYNOLDS** trainee surveyor, Aecom with thanks to **JON FLIN**, director at Aecom

ABOUT THE AUTHORS

This cost model was written by Hannah Reynolds, trainee surveyor, and Jon Buckle, senior project surveyor, both at Aecom engineering services, whose cost-management group specialises in the cost estimating, procurement and cost management of building services installations.



Category A fit out of an out-of-town office in the South East

Cat A (NIA)	Cost model		
	Total £	£/m ² of NIA	% total MEP cost
Disposal installations Condensate drainage, including insulation.	71,000	4.00	1%
Electrical installations Installation of distribution boards to each floor, LED lighting and emergency lighting, including controls (based on a modular wiring system). Provision of power to mechanical services, floor outlet boxes. Earthing and bonding.	2,861,000	151.00	55%
Space heating and air treatment Installation of four-pipe fan coil system, including CHW and LTHW pipework distribution and insulation. Installation of ductwork distribution, plenums, grilles, diffusers and insulation. Installation of condensate drainage to serve FCUs.	1,296,000	68.00	25%
Fire and lightning protection Sprinkler protection to all office floors.	385,000	20.00	7%
Communications, security and control systems Fire-detection and voice-evacuation systems. BMS controls to fan coil units.	554,000	29.00	11%
Builders work in connection with services.	56,000	3.00	1%
Cat A total cost	5,223,000	280.00	100%



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IN CONCERT

A new data centre in Stockholm is reducing energy use dramatically by employing an algorithm that integrates separate control systems to reduce infrastructure energy load. **Andy Pearson** reports

On an industrial park west of Stockholm, Sweden, is situated one of the world's most efficient computer data centres. DigiPlex's Upplands Väsby facility has delivered a power usage effectiveness (PUE) of just 1.06 – a notable performance. PUE is the measure of how efficiently a data centre uses energy; it is the ratio of energy used to energy delivered to the computing equipment. The average data centre PUE is 1.7.

The performance of the Stockholm facility is all the more impressive, given that 0.03 of the PUE is attributable to losses in the uninterruptible power supply system. 'The data centre is using just 3% of the power consumed by the servers in keeping them cool,' says Geoff Fox, DigiPlex's chief innovation and engineering officer.

The new complex is part of a growing trend to locate data centres in the Nordic region, to take advantage of its climate and readily available, clean, hydro-electric power. Like many other data centres located here, the 6,000m² Upplands Väsby facility is cooled by more than 60 indirect evaporative cooling (IEC) units. These highly efficient units deliver 'free' cooling using process fans alone for most of the year. However, unlike other data centres in the region, the performance of the IEC units at DigiPlex's site has been optimised using an innovative control algorithm developed by the company.

Called Concert Control, the algorithm enables normally separate control systems to work in concert with each other, to reduce the combined infrastructure energy load. This is in contrast to more conventional plant-control systems in which mechanical and electrical plant often operate autonomously, which wastes energy.

The company calculates that its solution will return an additional 10% in energy savings, on top of the savings delivered by cooling the data centre using indirect evaporative coolers – which could be as much as £50,000 per year.

Fox and his team developed the algorithm from first principles, using established building management system (BMS) controls techniques. To understand how it works, it is first helpful to have a basic understanding of the Upplands Väsby data centre's cooling system.

Inside the facility a series of halls house hundreds of heat-generating, data-processing units called servers. These are mounted in vertical racks, set out in lines to form a series of aisles. A 'chimney' is attached to the rear of each rack, to duct the hot air generated by the servers to a sealed, structural false ceiling. The use of chimney racks, and the sealed-ceiling configuration to remove hot air, allows the data hall to become a reservoir of cool air.

The IEC units supply cooled air to the data hall at a high level and at a very low velocity. Fans integral to each server then pull air from this chilled reservoir through the servers. The air – now warmed by up to 12K – is discharged from the rear of the server into the exhaust chimney, and then to the IEC units via the ceiling plenum.

Although the IEC units are a highly efficient way to deliver cooling, the

»



Upplands Väsby data centre PUE

1.06

Data centre average 1.7



0.03 of Upplands Väsby's PUE is attributable to losses from the uninterruptible power supply



The data centre uses just 3% of the power consumed by the servers in keeping them cool

» system has no mechanism to interface cooling supply with cooling demand directly. Nor can it link the dynamic inputs – such as outdoor and indoor air conditions, and IEC unit process fan speed – to the cooling performance of the unit. The control algorithm was developed to resolve these shortfalls and to optimise the system's performance.

The beauty of Concert Control is its simplicity; the algorithm references the server electrical load directly, and uses the specific volume, specific heat capacity of the air, and the temperature rise (K) across the servers to calculate the mass flow rate of air that needs to be delivered by the IEC units.

The algorithm has a unique way of establishing the server cooling demand. There is no control over the power consumed by customers' servers but, by metering, the company knows exactly how much power the servers are consuming at a particular point in time – and so how much heat the cooling system has to remove.

“The algorithm references the fan curves to decide the most economic number of IEC units to run”

The higher the processing load on the server, the more power it will consume and the greater its need for cooling.

‘This control technique uses real-time energy consumption of the servers – taken from the power-management system – as a reference point; it then varies the speed of the process fans in the IEC units to match the supply air volume to the cooling load by referencing the fan curve characteristics,’ explains Fox. The advantage of precisely matching the supply air volume to server power consumption is that it enables a very low pressure differential to be maintained between the cold aisle and the rack chimneys. This almost eliminates air leakage between the two to prevent recirculation.

Knowing the volume of cooled air required to cool the servers, the algorithm then calculates the optimal way to supply this air. DigiPlex co-invested in an environmental chamber and data-hall mock-up at Munters' works. This enabled prototype units to be tested for a full range of environmental conditions and process loads, to gain an

Table 1: The optimal number of IEC units for various loads

ITH load kW	No of running units	Minimum process fan volume	pPUE	System COP
200	2	20,700 m ³ /h	1.02	60.6
300	3	20,700 m ³ /h	1.02	50.8
400	4	20,700 m ³ /h	1.02	60.6
500	5	20,700 m ³ /h	1.02	44.6
600	6	20,700 m ³ /h	1.02	45.6
700	6	20,700 m ³ /h	1.04	27.5
800	6	20,700 m ³ /h	1.05	19.6

The table indicates how many IEC units run at different load scenarios. It also illustrates the impact of the limited fan turn-down at both the 300kW and 500kW loads. The system coefficient of performance (COP) is the ratio of kilowatts of power in to kilowatts of cooling out. In both instances, the system COP is less than is the case where the load has actually increased by an additional 100kW. A lower fan turn-down speed would have enabled an additional IEC unit to run, increasing the cooling efficiency. DigiPlex is currently working with Munters to achieve lower minimum speeds for the IEC fans, to further optimise the system.

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in-depth understanding of the unit's performance. The algorithm references the fan curves to decide, automatically, the most economic number of IEC units to run and the fan speed at which they will operate to optimise their efficiency. The fan affinity laws determine that fan power is proportional to the cube of rotational fan speed, so – at lower fan speeds – the power drawn by the motor drops dramatically. The detailed modelling provided the algorithm with data to tell it when it is most energy efficient to ramp up or down the IEC units' fans, and when it is more energy efficient to turn individual units on and off.

The algorithm also factors in the limitations of the IEC units, which have a minimum process fan speed. 'Contrary to most operational standpoints, the modelling demonstrated that, typically, it is more energy efficient to run all of the IEC units together at a low speed than to run fewer units at a higher fan speed,' Fox says. (See Table 1.)

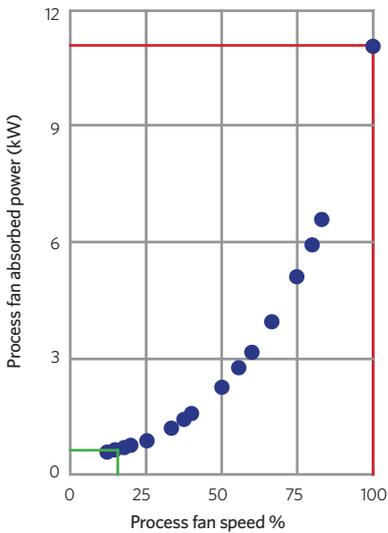
Because the power drawn by the motor drops dramatically at lower fan speeds, a key benefit of this characteristic is that Concert Control is efficient at low-load conditions, with no loss of performance when, for example, a data centre first opens.

This control has proved effective in delivering energy-efficiency improvements. The system was tested at the Stockholm data centre on a data hall incorporating six IEC units and an 800kW simulated server load, to stress the plant and systems. It was during these tests that the PUE of 1.06 was recorded, at an external ambient dry-bulb temperature of 15K above the yearly average temperature. Power draw from the IEC unit's scavenger fans is reduced by running the heat exchanger wet whenever the external temperature is above 5°C. Water usage is not an issue because the system uses rainwater harvested from the roof for the evaporative/adiabatic cooling process.

'The principle behind matching the air volume supplied by the cooling plant to the server electrical loads holds good for all conventional data centre cooling applications, wherever they are located,' says Fox. His company is currently in the process of deploying this control method with a chiller-based system and a computer room air conditioning (CRAC) unit, free cooling CRAC units and adiabatic coolers in one of its legacy data centres, where it has historic energy consumption data. It expects to achieve savings of up to 10% on mechanical cooling power consumption, as a result of this and other system upgrades.

The company has also started to look at the cost benefit of chilled water temperature adjustment, compared with chilled water volume control, with a view to developing a second-generation control strategy for centralised plant. ■

Relationship between fan speed and power



Cooling capacity (kW)	Process fan speed (%)	Process fan absorbed power (kW)
160	100	11.03
133.33	83.33	6.56
128	80.00	5.91
120	75.00	5.09
106.6	66.63	3.93
96	60.00	3.13
89	55.60	2.74
80	50.00	2.23
64	40.00	1.56
60	37.50	1.41
53.33	33.33	1.18
40	25.00	0.85
32	20.00	0.73
30	18.75	0.70
26.67	16.67	0.66
24	15.00	0.63
20	12.50	0.58

At lower fan speeds the power drawn by the fan motor drops dramatically. The worked example for a nominal 160kW of IT heat load, shows that if the cooling is provided by one indirect evaporative cooling (IEC) unit, with its process fan running at full speed (100%), then power consumed by the fan motor will be 11.03kW. But, if cooling is provided by six IEC units, with their fans running at 16.6% capacity, then the total power consumed by all six fan motors is only 3.96kW – a 74% reduction in fan power consumed



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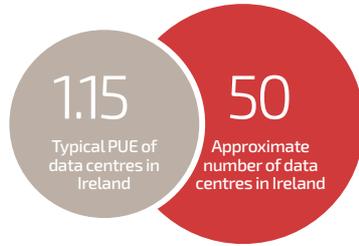


Highlights of CIBSE ASHRAE webinar on data centres

Ireland's digital success

At the recent CIBSE ASHRAE Group event – held at the International Energy Research Centre (IERC), in Cork, Ireland – data and energy adviser David McAuley explained why Ireland has become a hub for the world's data centres. Firms were attracted there for five major reasons: a tech-savvy workforce; competitive tax rates; resilient power and fibre-optic infrastructures; and long-established links with the US and the EU. There are around 50 data centres in Ireland, he added.

The global appetite for data would continue to grow through activities such as virtual reality (VR), gaming, and smart cities, said McAuley, who believes there will also be more demand for local data centres, because network latency inhibited activities such as real-time VR.



McAuley warned that the Irish power network had to keep pace with demand, and said there would be more pressure to go green. Carbon disclosure by Greenpeace and others has exposed data-centre firms that use fossil fuel rather than renewables. More collaboration is also needed between designers and operators, to ensure data centres are designed for end users and waste minimised.

Raising standards in the datacoms industry

The work of ASHRAE Technical Committee 9.9, covering the IT and data sectors, was explained in a presentation by committee chair Robin Steinbrecher. He said its most important work was establishing thermal guidelines for the industry, which create common specifications on temperature and humidity limits for equipment manufacturers. He described metrics for performance and power consumption established by the committee, and outlined some key publications.

Work being done by the committee was highlighted, including its contributions to the new ASHRAE Standard 90.4 *Energy standard for data centres*, and to a data-centre infrastructure management white paper.

Standard 90.4 was published last autumn, and establishes minimum energy-efficiency requirements for the design, construction and operation of data centres.

Watch now at www.cibseashrae.org

The life-cycle of data centres

At this month's CIBSE ASHRAE Technical Symposium in Loughborough, Sophia Flucker – of UK-based Operational Intelligence – will present a paper on minimising the environmental impact of data centres.

Flucker will be looking beyond energy efficiency and using a life-cycle approach to explain that there are two other significant areas of impact – the embodied impact of materials and the grid power source.

By focusing purely on energy efficiency, operators may cause a burden shift by taking action to reduce energy consumption, while increasing the embodied impact. Although there is limited data available, research has identified which factors have a significant effect on a facility's environmental impact.

Flucker recommends that this should be used not only in the design process, but also throughout the data centre life-cycle.

■ The Technical Symposium *Delivering Resilient High-performance Buildings* is at Loughborough University on 5 and 6 April. Visit www.cibse.org

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Keeping future data flowing by returning to the source

The maximum energy efficiency of data centres is reaching its limit, argues Robert Thorogood, who says engineers will have to focus on energy centres to secure the next big sustainability wins in the sector

The data centre sector has changed markedly in the past few years. There has been a focus on low-energy facilities and locations, so countries with access to cheaper and renewable energy – including Scandinavian countries, Ireland and Holland – are favoured. This is linked to the widening of environmental operating ranges by ASHRAE (white paper, 2011) and the European Telecommunications Standards Institute (2009), and the EU Code of Conduct on Data Centres Energy Efficiency (2008).

Previously, it had been necessary to control temperatures and humidity levels to very tight levels – for example, 21°C +/- 1°, and a humidity range of +/-10% on a stepping of 50%. So when external temperatures were above, say, 22°C, the chillers had to work hard to ensure internal temperatures were maintained. With today's operating ranges of between 5°C and 40°C – with a humidity band of 20% to 80% RH – there is the opportunity to have partial or no mechanical compression, or to use alternatives such as adiabatic cooling.

Adiabatic cooling in data centres is more prevalent and has led to huge reductions in power usage effectiveness (PUE) – the ratio of the power entering a data centre and that used to run the computer infrastructure – even in climates not as cool as Scandinavia's.

A move towards retail colocation (colo) models – as a result of the high cost of wholesale colocation space – has also had an impact on PUE. When data-centre racks are using all, or most, of their power delivery, the overall performance of the data centre improves, as seen when modelling PUE against load level and ambient temperatures. There has also been a gravitation towards cloud-based solutions on a large, low-cost scale, particularly with the 'big 5' technology companies – Google, Facebook, Microsoft, Apple and Amazon. These are often referred to as hyper-scale solutions and have huge amounts of computing power available.

As with colo spaces, the more a data centre is used to the maximum, the better its overall performance and PUE. Technology companies tend to have standard deployments of servers in racks, with 8kW or 10kW per rack not uncommon. However, these are deployed as each



“As an industry, we no longer talk of reducing PUEs from more than 2.0 to, say, 1.5”

data hall is brought on line, so – after a few months – the data hall is full and the PUE tends towards its lowest level. This has also meant getting huge amounts of air through the racks and segregating the cold inlet side from the hotter, exhaust side – hence the deployment of hot aisles, or chimneys, and cold aisles. Segregation is key; even within the rack there has to be separation between the inlet air and exhaust air, to ensure there is no recirculation.

The impact of these changes has driven the MEP designer to consider solutions that would never have been contemplated 10 years ago. Certainly, indirect-air or direct-air cooling were thought niche then. Today, these types of solutions – along with adiabatic and variable-speed compressor cooling – are all within the MEP designer's toolbox.

As an industry, we no longer talk of reducing PUEs from more than 2.0 to, say, 1.5. Instead, the norm is to contract on a maximum PUE of 1.2 and hope to operate

in and around 1 to 1.15, depending upon the weather, location and loadings. Far more important is IT load, which is something the MEP designer can't influence much – but they can consider how the energy supplied to the data centre is sourced. Already the major tech companies and colocation providers are grappling with how they source energy in a responsible manner, ideally from renewable sources. So the industry's focus for the future will be on how energy can be produced.

Energy centres have been around for years, but most – particularly those that have a large process load, such as hospitals, laboratories and data centres – have been located within a building. With targets for greater use of renewable energy sources and reducing energy use, designers are being encouraged to develop energy centres as stand-alone facilities, with the sole function of producing energy at a local or district level. These centres are then connected – using district networks – to collections of buildings.

An example is the energy centre for the Aberdeen Exhibition and Conference Centre, due to open in 2019. It uses multiple technologies in a single energy centre to support all the facilities on the site. Expect to see similar examples in the data centre sector soon.

■ ROBERT THOROGOOD
is director at Hurley Palmer Flatt



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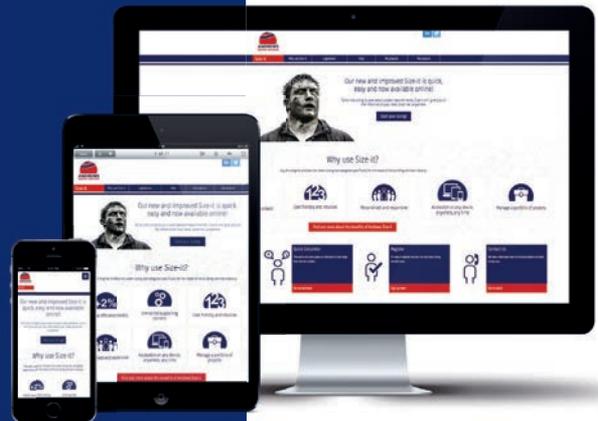


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EXCHANGE OF VIEWS

Aluminium heat exchangers are lightweight and have high thermal conductivity, but stainless steel equivalents have higher corrosion resistance. Ideal Commercial Boilers' Darren Finley weighs up the benefits of each material

W

hile conventional boilers were designed to prevent the condensation of hot gases inside the boiler, modern condensing boilers work in the opposite way. This has led to an increase in boiler performance and efficiency, but has created the challenge of managing the acidic condensate produced during low-temperature operation. This drips from the flue and, if allowed to stagnate, will lead to corrosion – particularly in aluminium heat exchangers, which are less resistant to corrosion than those built from stainless steel.

Ideal Commercial Boilers manufactures boilers containing steel and aluminium heat exchangers. We believe the best way to avoid corrosion in aluminium heat exchangers is to design out the risk in the first place. Our heat exchangers allow condensate to flow over the surfaces without pooling, and drain away via the condensate trap. Critical design features that ensure this occurs include the heat-transfer pin profile on the heat exchanger and the inclined surfaces in the sump.

The pins, positioned in the flue ways, are 6.5mm diameter cylindrical forms of varying length that maximise the surface area exposed to hot combustion gases. The profile of these pins, and the spacing between them, ensures good drainage of condensate through the heat exchanger to the sump.

Aluminium has the benefit of being lightweight, having a high conductivity ($237 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ compared with $14.9 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ for stainless steel). So the use of aluminium means the exchange surface can be reduced significantly to achieve the same output to a heating circuit when compared to stainless steel. This allows for lightweight and compact boiler designs.

Corrosion from aluminium heat exchangers – and often from aluminium flues, mistaken for heat exchanger corrosion – can occur when acidic condensate is not draining freely from the heat exchanger or is pooling in the flue tube.

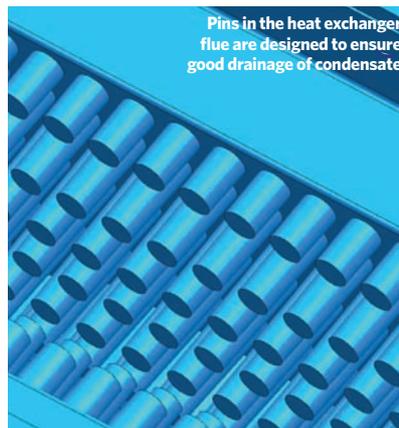
On the heat exchanger itself, a chemical reaction contributes to the aluminium being highly resistant to the corrosive effects of condensate during operation. On contact with water or oxygen, a non-porous, protective layer of aluminium oxide is formed naturally; this is alumina, or the passivation layer. It is only a few nanometres thick and the heat output of the appliance is determined after this layer has been created, so no measureable difference in heat transfer is present. The light coating does not create a difference in the surface texture of the pins.

Aluminium designs are more tolerant to variable system quality – for example, flow rate settings, air and dirt – because they allow for bigger waterways. The larger waterways are facilitated by the 4mm thickness of the waterway wall in the aluminium heat exchanger. If the stainless steel tube was enlarged, then the wall thickness would have to increase – with a cost and weight penalty on the appliance. The stainless steel tube thickness is commonly kept to a minimum (often 1.2mm to 2.0mm) to reduce both cost and weight.

The larger waterways – at least double that of typical stainless steel heat exchangers in some cases – means aluminium designs are better



An aluminium heat exchanger



Pins in the heat exchanger flue are designed to ensure good drainage of condensate

suited to boiler replacement on older systems, where there is likely to be more contamination in the system fluid.

This is because the aluminium heat exchanger allows for a wider range of temperature differentials of, typically, 11K to 25K. So, aluminium operates well in older systems – which may be designed to operate at, for example, 82°C flow and 71°C return – where a differential of 20K, typically required for correct operation of modern boilers, may not be available without system modifications. Heat exchangers with higher water content are able to deal with lower water flow rates

through the heat exchanger and, consequently, higher temperature differentials without any localised spot boiling of the system fluid.

Stainless steel demands a higher level of commissioning, requiring precise system balancing and pump set up to prevent noisy operation. Noise is possible, particularly if the system pump is not correctly commissioned. This can result where the flow rate through the heat exchanger is lower than that required to prevent localised boiling on the heat exchanger wall.

Stainless steel heat exchangers tending to have narrower waterways means they depend on water velocity to clear air and debris. As well as noise, this will reduce the heat output of the boiler, cutting efficiency.

The lifetime of both types of heat exchanger is designed to be a minimum of 10 years if commissioning and servicing is performed correctly. Water treatment and flushing requirements are similar for both, although care should be taken when flushing old systems when small waterways are present in the heat exchanger design. Aggressive fluxes, that might otherwise cause corrosion, are less common in modern installations, and would be removed with correct flushing. **CJ**

DARREN FINLEY is chief commercial officer at Ideal Commercial Boilers

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Meeting the growing demand for domestic hot water with efficient, controllable systems

This module examines the evolving standards that are setting the requirements for hot-water generation and considers how continuous-flow, condensing, gas-fired hot-water heaters can be an efficient solution

The supply of domestic hot water for taps, showers and other appliances is a constant and growing requirement – regardless of season – across much of the world. This is happening as building space heating loads have reduced, sometimes practically to zero, as more robust fabric designs have been required to meet standards. However, there is always a heat demand to satisfy the supply of potable hot water. This CPD will examine the evolving standards that set the requirements for hot-water generation and consider how continuous-flow, condensing, gas-fired hot water heaters are able to offer an efficient solution.

Setting the standards for the efficient supply of hot water

The Energy Related Products Directive (ErP) has provided a common reference – based on extensive cross-Europe research – by which to set standards for water heaters and, when used in conjunction with local regulations, is promoting increasingly effective systems.

The ErP is made up of two parts – Ecodesign and Energy Labelling. Ecodesign covers water heaters with a rated output equal to or below 400kW, while Energy Labelling is required for water heaters up to 70kW. The actual requirements for water heating energy efficiency are set according to the heater's output power and use profile, with the efficiency requirements rising with the size of the heater.

The Ecodesign requirements (as defined by EU regulation No 814/2013¹) set minimum efficiencies and operational parameters that go beyond simple thermal efficiencies. They include allowances for 'smart' control – that effectively modulate the energy consumed and the water output to meet the demand – and for the use of energy employed for the overall control of the appliance.

The required performance is related to a 'load profile' of hot-water use, ranging from the smallest 3XS (a heater for the supply of hot water at 35°C to meet the typical needs of a single outlet), through L (serving a bath, sink and shower at

55°C), to the largest 4XL (indicatively representative of the supply at 55°C to meet the typical use of 16 showers and outlets serving a residential home). As well as energy efficiency, other relevant factors – such as the storage volume for storage water heaters and the heat loss from hot water storage tanks – are included. From September 2018, Ecodesign will also set a maximum nitrogen oxide (NO_x) emission level of 56mg·kWh⁻¹ for gas water heaters.

The actual minimum overall thermal performances as currently required by Ecodesign are quite modest, particularly for small water heaters – for example, 3XS 22%, L 30% and 4XL 32%. These are set to go up in September 2017, most notably for the larger capacities – so 4XL will rise to 64% – but this should still be well within the capabilities of modern water heater systems.

To differentiate between the performance of various manufacturers' systems, the energy labelling scheme for water heaters – as required by EU regulation 812/2013² – came into force in 2015. The minimum level on the label is set by the relevant Ecodesign requirement. The scale goes from G to A, >>

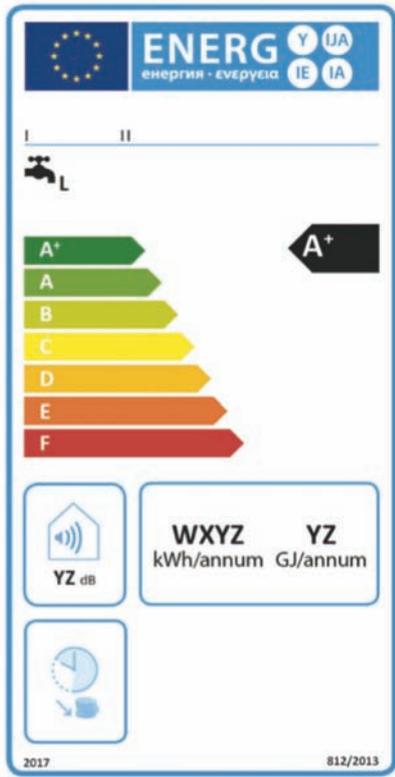


Figure 1: The label that will supersede (in September 2017) the current label that is used for hot water heaters. The new label shifts the scale from the current G→A to F→A+

» but as of 26 September 2017 will be modified to show a scale of F to A+ (see Figure 1), to link in with the more demanding Ecodesign requirement. The calculation to determine the ranking of a particular water heater includes factors that attempt to assess the overall environmental impact of operation.

The responsibility for ensuring that a product has an appropriate label rests with the manufacturer, who must provide a standard table of information required by the Eco directives, known as a ‘fiche’.

High-efficiency, condensing, gas-fired water heaters are currently in band A, whereas older, non-condensing water heaters – and heaters using other fuels – are likely to be in bands B to G. For example, many direct electric hot-water heaters are likely to be rated as C because electricity, typically, has a high carbon factor compared to natural gas, so has an increased operational environmental impact.

To meet the specific requirements of UK regulations, the system must meet the Ecodesign requirements, but there are also specific calculations and factors that feed into the National Calculation Methodology.³ For example, in England, the *Non-Domestic Building Services Compliance Guide*⁴ gives additional factors that can add up to 5.5% ‘efficiency credits’ to the simple gross water-

heater efficiency – as illustrated in the box-out. This is used to show compliance with the Building Regulations, as might be determined with the freely available Simplified Building Energy Model (SBEM) software.

The application of continuous-flow hot-water heaters

Centralised plantrooms for heating and hot water systems have been the traditional solution for the majority of commercial buildings for many years. These, typically, would employ storage of hot water – with the inherent standing losses and space requirements – to meet variations and peaks in demand. They would be sized at the design stage so that there is always a certainty of supply of hot water available when demanded by the user. This approach often leads to excessive safety margins, which add to the expense of purchase, installation and running costs.

An alternative to the traditional storage-based systems is the application of continuous-flow, hot-water heaters that only consume energy when there is a demand for hot water. Modern continuous-flow, condensing, gas-fired hot water heaters can be connected using a manifold arrangement (as illustrated in Figure 2) to provide a hot-water system capable of coping with virtually any size of site or application. The modularity also allows for additional plant to be added at a later stage if the building hot-water load is increased, and offers some redundancy in the case of module failure and maintenance.

The close control integrated into such systems is able to deliver a continuous flow of hot water at a constant temperature, without the need for storage. With almost all continuous systems, the user can set the required temperature of hot water to suit the needs and demands of the site.

As the systems have the same requirements as a wall-hung boiler, they are also readily applied to decentralised hot-water systems that are in close proximity to the draw-off points, so reducing distribution losses, enabling close temperature control and simplifying the maintenance of the hot-water piping network. The

HEAT-EFFICIENCY CREDITS

Example of applying heat-efficiency credits to direct-fired, continuous-flow water heater, in accordance with AD Part L of England and Wales Building Regulations.

A new building is to have a correctly selected and installed direct-fired, continuous-flow water heater that has fully automatic combustion controls. At a flow rate of 0.22 L·s⁻¹, increasing the temperature of incoming mains water from 10°C to 60°C, the heater consumes 48.3kW of natural gas.

Assuming a water density of 1kg·L⁻¹, the power input to the water
 = mass flow rate x water specific heat capacity x water temperature increase
 = 0.22kg·s⁻¹ x 4.186kJ·kg⁻¹·K⁻¹ x (60°C - 10°C) = 45.88 kW

So the gross thermal efficiency = $\frac{\text{Output power to water}}{\text{Input power from gas}} = \frac{45.88\text{kW}}{48.3\text{kW}} = 95\%$

Heat efficiency credits (as shown in green in Table 1) are available for three aspects of this installation that in combination add (1 + 0.5 + 2 =) 3.5% to the calculated gross efficiency for the hot-water heater. The resulting 95 + 3.5 = 98.5% is used when assessing the building emission rate (BER) – the annual CO₂ emissions of the proposed building in kg·m⁻², compared with the notional target emission rate (TER) in the national calculation methodology (NCM).

System type	Measure	Heating efficiency credits (% points)
All	Decentralisation	2 - but not applicable to systems in new buildings
Direct-fired	Integral combustion circuit shut-off device	1
	Fully automatic ignition controls	0.5
All	Correct size of unit confirmed using manufacturer's technical helpline and sizing software	2

Table 1: Heating efficiency credits for additional measures applicable to domestic hot-water systems (Source: Table 31 *Non-Domestic Building Services Compliance Guide 2013*)

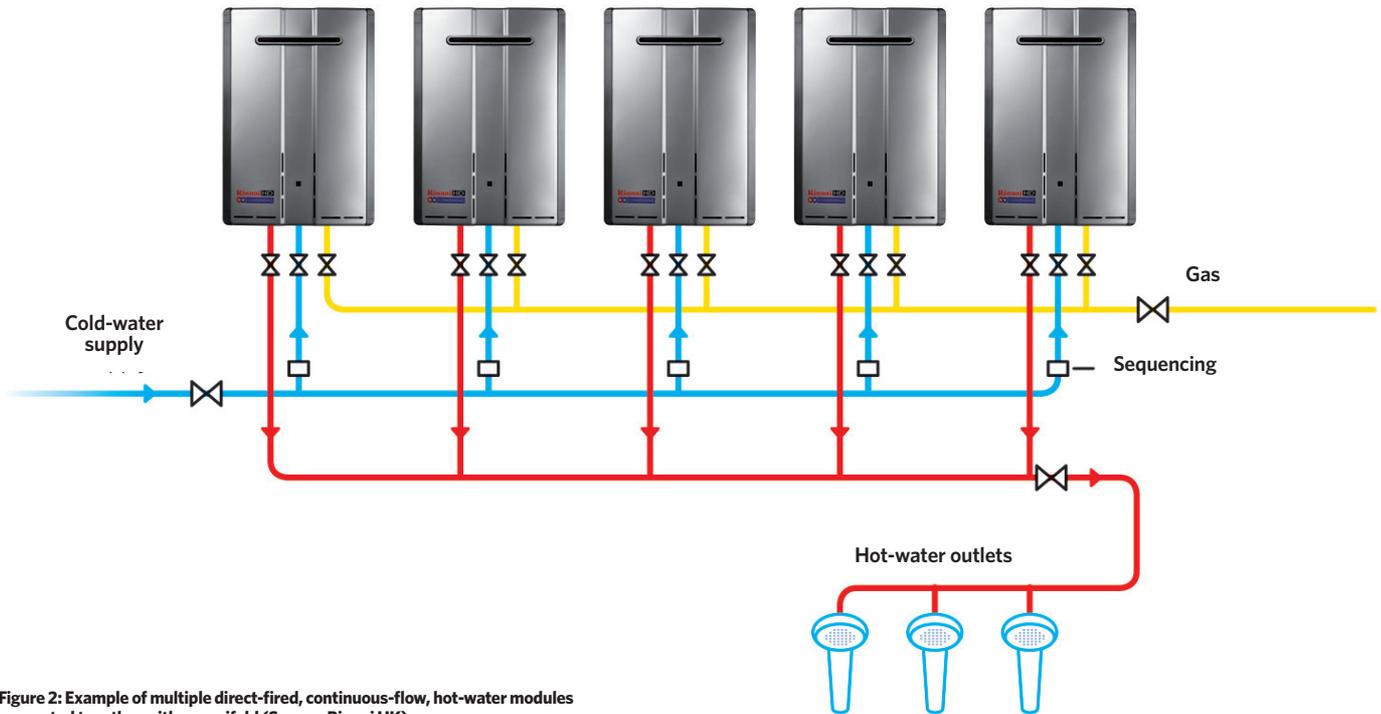


Figure 2: Example of multiple direct-fired, continuous-flow, hot-water modules connected together with a manifold (Source: Rinnai UK)

temperature of the water distribution is accurate to $\pm 1K$ and, as there is no storage of water, there is no need to heat up a volume of storage water to reduce Legionella risk. Smart controls can be added to commercial condensing, continuous-flow systems to optimise their performance. Continuous-flow, condensing, gas-fired hot-water heaters can be employed as stand-alone technology or used in conjunction with the other technologies – such as solar thermal or pre-heated water from variable refrigerant flow (VRF) or other heat recovery systems – to provide an efficient source of hot water.

Condensing, direct-fired hot-water systems (such as that shown in Figure 3) are always able to maintain condensing operation because – unlike many traditional systems – there is always an opportunity to condense the water from the flue gases to capture the otherwise lost latent heat. This is because of the availability of low-temperature incoming mains water that is well below the flue-gas condensing temperature (which is typically $57^{\circ}C$). The amount of condensation, and heat recovery, will increase as the flue gases are made cooler.

Recent independent modelling⁶ of continuous-flow hot-water systems indicate lower initial capital costs, as well as more favourable life-cycle costs over 20 years, when compared with indirect stored and stored hot-water systems. The detail of the net present value (NPV) analysis employed, together with a more detailed description of the modelling assumptions and inputs, were discussed in the October 2016 *CIBSE Journal* CPD article. As examined in more detail in that article, a shower block in a holiday camp – with six showers and four basin taps – was modelled to establish the comparative performance of a continuous hot-water system with that of a direct-fired storage option, and with a more traditional condensing gas boiler and storage cylinder.

The continuous-flow system was based on four heavy-duty water heaters, each with a nominal output of 48kW – equating to around 14 litres per minute of

hot water at 50K temperature rise (from $10^{\circ}C$ to $60^{\circ}C$) – and a gross thermal efficiency of 95%. The indirect-fired storage option was based on a pair of 40kW condensing, natural-gas boilers, with a gross efficiency of 89%, heating a pair of 400-litre cylinders. The direct-fired storage option consisted of a pair of 230-litre cylinders with integral burners, each with around 37kW output and gross thermal efficiency assumed as 96%. In this example, the model indicated that the continuous-flow system has a 20-year NPV of 6% to 7% lower than the two storage systems.

A further analysis was undertaken for the increasingly common application of a fast-food restaurant.

Echoing common trends, the boiler used for the indirect-fired storage system was assumed to serve only the hot-water cylinder, as fast-food restaurants typically use heat-pump systems for space conditioning. Using similar standard operational and efficiency assumptions as that of the previous example, the resulting NPVs again indicated that the continuous-flow system is around 6% to 7% lower on fuel consumption than the two storage systems, based on that 20-year analysis period.

The combination of increasingly strict regulations and the evolution of systems to ensure flexible and efficient operation – plus the motivation of the energy label – offers a positive outlook for the reduction in environmental impact of meeting the increasing demand for potable hot water.

© Tim Dwyer, 2017.

Turn to page 56 for references.

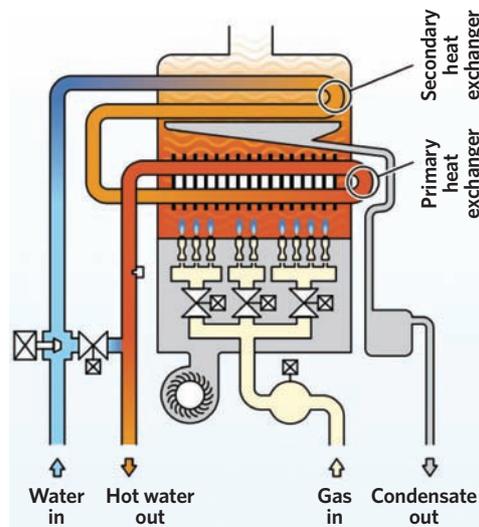


Figure 3: Example of a continuous-flow, condensing, gas-fired hot-water heater (Source: Rinnai UK)



» Module 110

April 2017

1. From September 2018, what will be the Ecodesign maximum NO_x-emission level for gas-water heaters?

- A 16mg·kWh⁻¹
- B 35mg·kWh⁻¹
- C 55mg·kWh⁻¹
- D 56mg·kWh⁻¹
- E 64mg·kWh⁻¹

2. In what energy-label band are high-efficiency, condensing gas-fired water heaters most likely to be?

- A A
- B B
- C C
- D D
- E E

3. What heating-efficiency credits (as applied in the NCM) are available when fully automatic ignition controls are used?

- A +0.5%
- B +1.0%
- C +1.5%
- D +2.0%
- E +2.5%

4. What accuracy is quoted for the control of output water temperature for modern continuous-flow, condensing, gas-fired hot-water heaters?

- A +/- 0.5K
- B +/-1.0K
- C +/-1.5K
- D +/-2.0K
- E +/-2.5K

5. In the modelling example of the fast-food restaurant application, what was quoted as the approximate 20-year NPV saving for the continuous, hot-water system, compared with storage types?

- A 2% to 3%
- B 3% to 4%
- C 4% to 5%
- D 5% to 6%
- E 6% to 7%

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References:

- 1 Commission Regulation (EU) No 814/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council, covering Ecodesign requirements for water heaters and hot-water storage tanks.
- 2 Commission Delegated Regulation (EU) No 812/2013 of 18 February 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council dealing with the energy labelling of water heaters, hot-water storage tanks and packages of water-heater and solar-device text with EEA relevance.
- 3 www.uk-ncm.org.uk - accessed 10 March 2017.
- 4 bit.ly/CPD110ref4 - accessed 10 March 2017.
- 5 *Life-cycle study of continuous-flow water heating* - report for Rinnai by AECOM, 2016 (available by request from Rinnai - www.rinnaiuk.com).



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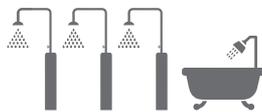
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Weather Data Sets

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

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



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

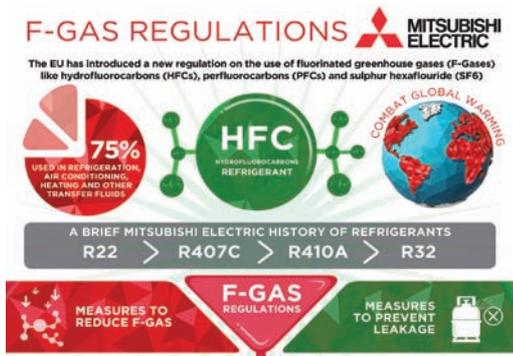
- Test Reference Year (TRY) Hourly Data
- Design Summer Year (DSY) Hourly Data

Find the package that is right for your next project:

www.cibse.org/weatherdatasets

*All packages are available in EDSL Tas, EPW & Excel

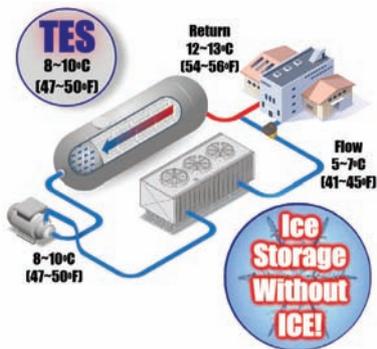
✓ Infographic seeks to help with F-Gas understanding



The infographic can be downloaded at a dedicated website, which also includes a video explaining the effect of certain refrigerants on global warming, and why new products are being introduced.

'We hope this helps increase understanding and are talking directly with customers to ensure that we, as an industry, have all the information needed,' says Temple.

■ Visit www.livingenvironmentalsystems.mitsubishielectric.co.uk



^ Thermal energy storage (TES)

Phase change materials (PCMs) store and release thermal energy during the process of melting and freezing and the latest range of PCM solutions between -100°C and +885°C, offer new application opportunities.

The excess capacity of existing +7°C water chillers can be stored in +10°C PCM containers overnight, using lower ambient and lower electricity costs. This efficiently lowers cost as stored energy tops up the day peak loads, saving considerable running costs.

■ Email info@pcmproducts.net or visit www.pcmproducts.net



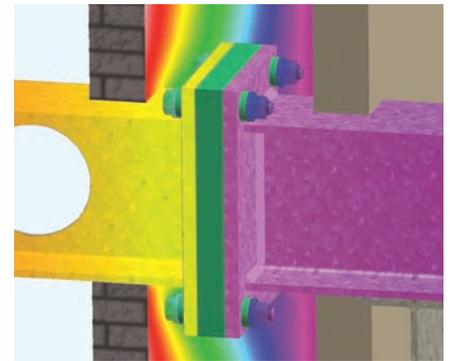
◀ Space-saving, safe-surface temperature radiators installed in nursing home

Super-slim, low surface temperature (LST) natural convection radiators have been installed at the Elmhurst care home, in Cumbria. With a wall-to-front-face depth of only 75mm, Autron's Slenderline is one of the slimmest LST radiators on the market. In addition, units equipped with Autron's 3H2W emitters are fully compliant with NHS guidance notes: safe hot water and surface temperatures. These radiators' cases have been tested not to exceed 43°C during operation.

■ Call 01952 290 498, email sales@autron.co.uk

Mitsubishi Electric has issued a new infographic on the requirements and repercussions of the F-Gas Regulations to help explain why the legislation has been introduced, and what people need to do about it.

'We've designed this as a quick, simple way of taking in the main points, which will be highly relevant to anyone involved in air conditioning, whether an installer, consultant, designer or building owner,' explains Graham Temple, marketing manager for the company's range of split air conditioning systems.



^ New 'thermal breaks' CPD-certified training module introduced by Ace Fabreeka UK

ACE Fabreeka UK, developer of Fabreeka TIM material, has introduced a new continuing professional development (CPD) certified training course titled 'Introduction to Thermal Breaks'.

The aim of this introductory module is to give trainees the basic knowledge required to identify opportunities for the application of thermal breaks and structural thermal breaks. The learning content is hosted free of charge online, which means that it can be accessed 'on the go', including from a mobile phone.

■ Call 01942 407 652, email barry@ace-fabreeka.co.uk or visit www.ace-fabreeka.co.uk

✓ New close control adiabatic humidifier

The new Condair DL in-duct adiabatic humidifier offers the accurate humidity control normally only available from steam humidifiers, but with the low energy performance and evaporative cooling benefit of a cold water system. It also incorporates many anti-microbial features that make it one of the most hygienic humidifiers available.

The Condair DL is a hybrid humidifier that combines spray and evaporative technologies to maximise moisture absorption and provide humidity control at +2%RH.

■ Visit www.condair.co.uk



^ 7. Dunham-Bush helps create comfortable learning environment at Stowe School's new £6m science centre

Stowe School is a co-educational independent boarding school in Stowe, Buckinghamshire. Dunham-Bush BM fan convectors have been installed within the ceiling voids in the school's new science centre to ensure a comfortable working environment for students.

The new, two-storey contemporary building has been built on the existing footprint of the original building, and blends new with old in a sympathetic manner.

■ Email phil.bell@dunham-bush.co.uk

✓ **AET FlexTouch controller now with CO₂ mode control**

AET Flexible Space, supplier of underfloor air conditioning systems, offers the FlexTouch controller to allow enhanced indoor environment regulation for users and facilities managers.

Available in black or white, the controllers are a popular option for meeting rooms and cellular offices where accessing the floor-recessed Fantile controller may be restricted.

The FlexTouch 3 enhanced model has sensors for CO₂, humidity, VOCs and particulate count.

■ Call +44 (0)1342 310 400 or email lucy@flexiblespace.com



✓ **Grundfos Pumps is at the heart of the operation**

Hospitals must remain operational 24/7. This means having a reliable, effective and efficient pump system that will give the assurance needed to maintain and deliver heating, cooling, water supply and water-boosting requirements.

With this in mind a hospital trust, responsible for three hospital sites, asked Grundfos Pumps to undertake an energy audit to discover how their efficiency and energy use could be improved.

All three sites were surveyed, an energy report was produced for each and presented to the client. With projected savings of more than 200,000kWh per year, the decision was made to go ahead with the recommended upgrades.

Grundfos replaced more than 90 obsolete pumps with various members of the NB, MAGNA and TP pump families that support the hospitals HVAC systems. With a total investment of £80k across all the sites, this outlay will deliver a return on investment of a healthy three years.

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



Lochinvar puts NO_x emissions to the sword

Boiler and water heater manufacturer Lochinvar has launched a range of low NO_x, fully condensing, gas-fired water heaters aimed at small commercial and large residential projects.

EcoSword is available in nine models with storage capacities ranging from 163 to 388 litres and with rapid hot water recovery rates from 210 to 540 litres per hour, based on a temperature rise of 50°C. As a result, this technology represents a cost-effective option for end users looking to use condensing technology in smaller hot water demand applications.

The 'cold zone' heat exchanger design ensures that the unit operates in condensing mode as much as possible and, along with its fully modulating pre-mix burner, allows it to achieve seasonal efficiencies of up to 98.2% (Building Regulations) and water heater efficiency of up to 94% (ErP).

All models are WRAS certified and 'A' rated under the ErP Energy Labelling legislation.

■ Visit www.lochinvar.ltd.uk



◀ **Big Foot Systems wins innovation award at climate control Middle East awards**

Big Foot Systems is delighted to announce that it won an award in the Climate Control Middle East Awards 2016.

It was crowned winner of the Dominic de Sousa Award for innovation for its range of non-penetrative support frames. Now in its sixth year, the Climate Control Middle East Awards recognise and honour HVACR and allied organisations that show a strong commitment to socio-economic development and sustainable development goals in the region.

■ Call 01323 844 355 or email enquiry@bigfootsupport.com

✓ **'Is it something in the air?'**

'Outstanding!' is how managing director of air movement solutions company Gilberts Blackpool describes his company's employment history.

The latest attainment of 25 years' service prompted the firm to check its records. It found that currently almost 25% of Gilberts' employees have been with the Lancashire manufacturer at least 20 years.

'Is it something in the air? We are only a mile or so from Blackpool seafront,' said managing director Jonathan Haslam.

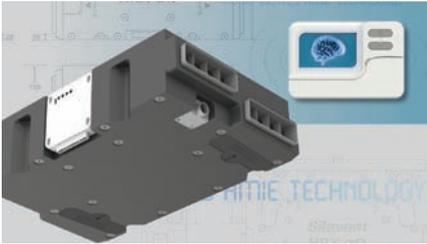
■ Call 01253 766 911 or email info@gilbertsblackpool.com



▲ **Celestial LED lighting from Luceco**

Celeste is an attractive new circular LED luminaire from Luceco featuring a 'corona' backlight effect with a direct/indirect light distribution. The Celeste is ideal for many commercial and residential lighting applications boasting a market-leading efficacy range of 11m/w 107. The luminaire can be surface, or wall-mounted, or suspended using a three-point 1.5-metre suspension kit, an attractive 'heavenly' pendant. Available in 12, 21 and 30W options.

■ Email Zoe.nh@luceco.com or call 07890 320 152



Polypipe system announced as finalist in H&V News Awards

Polypipe Ventilation's Silavent HRX-aQ mechanical ventilation with heat recovery (MVHR) appliance is a finalist in the H&V News Awards, in the Domestic Ventilation Product of the Year category.

The HRX-aQ has been designed to take into account factors, such as property design, fabric, location and orientation, matching ventilation rates to the internal environment and occupants' requirements for maximum comfort.

This is achieved through advanced air management for indoor environments (AMIE) technology.

Visit www.polypipe.com/ventilation



Nuaire's carbon filter works harder

Iaq-box is an exciting advancement in carbon filtration. Designed to complement its MVHR range, Nuaire's Iaq-box removes 99.5% of NO₂ from the air, making it the most effective system available, as verified by the BRE.

Available in single and double width, the Iaq-box gives greater flexibility. The double system offers greater surface area to remove more NO₂ and give the lowest possible air resistance for a quieter-running MVHR system.

Visit www.nuaire.co.uk



Swegon's answer to simultaneous heating and cooling

Swegon's Omicron Rev S4 is your one-box solution - a heat pump chiller and heat recovery device all in one.

It is the perfect solution for buildings that require simultaneous cooling and heating during warm and cold climates - with modern construction techniques and increased thermal insulation, this is becoming more and more a factor.

The Omicron Rev S4 has two heat exchangers allowing for independent and simultaneous supply to cooling and heating water circuits. With a low ambient operation to -18°C there is also less requirement for a boiler. Designed to be highly efficient at full load, especially in cooling mode, the Omicron's outstanding part-load performances are achieved, thanks to the partialisation steps and the smart logic developed for it.

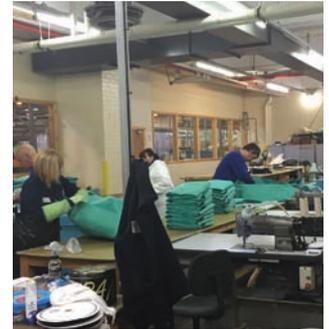
Visit www.swegon.co.uk

TBA protective technologies buys clothing manufacturer

TBA Protective Technologies (TBA-PT), manufacturer of high performance and heat-resistant textiles, has acquired protective clothing manufacturer CAC Industrial Products as part of its strategy to expand its in-house fabrication capabilities.

For more than 145 years, TBA-PT has been making advances in the design, manufacture and fabrication of high performance textiles and products for a variety of demanding applications.

Call 01706 647 422, email info@tba-pt.com or visit www.tba-pt.com



Fan coil remote display module

A series of fan coil designs announced by Advanced Air include innovative ideas such as the remote display module RDM. This is surface mounted on the control box cover, so there is easy access without having to remove any screws or bolts.

Commissioning is much easier and the fan coil can be commissioned without the BMS being completed. It provides a cross-check between what the BMS is displaying and what is actually happening within the fan coil unit.

The remote display module's PCB features an LED seven segment display with four characters. It has buttons for auto/manual mode selection, calibration and up/down buttons to change the fan speed when in manual mode. The seven-segment display can show the precise voltage at the fan motor and, from this, the air volume can be accurately calculated or found from a simple graph voltage/air volume.

Visit www.advancedair.co.uk



Toshiba's new heat recovery VRF system opens frontier for energy efficiency

Toshiba's latest three-pipe heat recovery VRF air conditioning system, SHRM-e, sets a new industry benchmark for energy efficiency performance and continuous heating, achieving a world first of 8 European seasonal energy efficiency ratio (ESEER).

SHRM-e delivers improvements across the board in terms of occupant comfort, ease of installation and breadth of building application, all made possible by developments in key technologies: a compressor and intelligent control system, supported by a battery of incremental improvements.

Visit www.toshiba-aircon.co.uk



Wieland Powers the way for new Marlborough school >

Wieland has supplied its Metalynx2 modular wiring system, along with components for lighting and power distribution, throughout the new Marlborough Primary School in London W3.

The project, being overseen by contractor Mace, is part of a redevelopment by the Royal Borough of Kensington and Chelsea of a new two-form entry primary school in the heart of Chelsea.

All electrical work has been overseen by PhoenixME, which specified the use of Wieland's Metalynx2.

■ Call 01483 531 213 or visit www.wieland.co.uk



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To inhibit the build-up of limescale, KalGuard from Sentinel Commercial is a scientifically and independently-proven limescale control device that uses unique driven electrolytic technology. KalGuard is arguably the best limescale control device on the market, in terms of overall cost-effectiveness, performance, ease of installation and maintenance.

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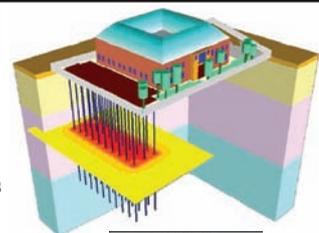
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Senior Electrical Design Engineer - Croydon

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A world renowned multi-disciplinary consultancy is now looking for a Chartered senior engineer in their Croydon office. Working on a number of prestigious UK and Middle East projects, you will be capable of running a team of electrical engineers with strong project delivery. This consultancy offer one of the best benefits packages currently on the market.

Senior 2D CAD Technician - North London

£35k to £40k plus benefits

A forward thinking building services consultancy requires a senior CAD candidate due to an increase in workload. Carrying a minimum of 7 years of AutoCAD experience within building services, you will also have a desire to learn Revit. Sought after candidates will possess a stable work history and strong project knowledge within the residential sector.

Principal Electrical Engineer - Manchester

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A world renowned, multi-disciplinary consultancy based in Manchester is currently looking for a Principal Electrical Design Engineer on a permanent basis. Terrific opportunity to join a consultancy that can provide exposure to some of the most recognisable projects in the industry whilst developing your project management skills.

Senior Mechanical - Leeds

£45k to £50k plus flexible benefits

A well-known Leeds city centre based consultancy is recruiting for a permanent Senior Mechanical Design Engineer to work on their varied project portfolio. Wider responsibilities of the role include training, developing and undertaking appraisals of junior staff through to contributing to the growth of the company, as well as business development.

Electrical Design Engineer - Southampton

Up to £40k plus excellent benefits

One of Hampshire's most dynamic MEP Consultancies is looking for an Electrical Design Engineer to join their expanding team. Offering high quality design for a number of high profile clientele this is your chance to push your career forward. You must be an experienced engineer who is wanting to progress within an esteemed professional environment.

Principal Mechanical Design Engineer - Berkshire

Up to £55k plus benefits

An award winning client with a stellar reputation for quality is looking for a project lead who is capable of working across a wealth of market sectors. This is a client facing role for a technically astute engineer who wants to work on nationally recognised projects for a Times Top 100 Company.

Senior Electrical Engineer - Cambridge

Up to £50k plus excellent benefits

An architecturally led practice with masses of personality is looking for a Senior Electrical Engineer who can offer the same. This is a team lead role for a technically capable engineer who wants to join an award winning company who truly value their staff. You must be confident working across a number of market sectors and have experience in a client facing role.

Intermediate Mechanical - Leeds

£35k to £40k plus benefits

An internationally recognised consultancy is currently looking to recruit an Intermediate Mechanical Design Engineer for their recently established central Leeds office. With projects ranging from luxury hotels through to large commercial office developments, the work is both challenging and varied which is sure to test your current skillset.

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Principal Electrical Engineer
London, £45k - £55k + bens

Have you been thinking about finding a new challenge that presents the opportunity for personal development and progression? I have a strategic role that requires a forward thinking person who is passionate about innovative design in modern buildings and is keen to run their own teams and division. You will be an experienced engineer within Building Services who has a steady career history working for design consultancies. This position is a chance to work with one of the UK's leading engineering firms that have a highly regarded reputation for excellent project delivery and first class employee benefits. Ref: 4084

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

An opportunity has arisen with an award winning consultancy that is at the forefront of building high performance buildings with a focus on sustainable design. They seek a Senior Electrical Engineer to join the well-established team in London. You will have the opportunity to work on some of the most iconic buildings in London that are pushing the boundaries of design within the built environment. Ref: 4172

Senior Mechanical Design Engineer

City of London, £60k - £65k + bens
This global consultancy who employ in excess of 500 staff, are a top 5 consultancy in the industry and have won multiple awards. This exciting opportunity to lead Mechanical Mission Critical projects in the UK ranging from £50m - £500m in value. My client is looking for someone who can work independently, be an expert in Mechanical Mission Critical engineering and someone who can grow and lead a team. Ref: 4076

Senior Mechanical Design Engineer

City of London, £55k - £60k + bens/£30 - £33p/h
An independently owned design consultancy specialising in CAT A and CAT B commercial fit out projects for banks, blue chip companies, and retail clients. This consultancy have a reputation of technical excellence, and are committed to the development of their staff. This role is open to engineers seeking either permanent or contract positions and is a long term opportunity. Ref: 4230

MEP Revit Technician
North London, To £45k + bens

Excellent package offered for an aspiring MEP Revit Lead with 5 years Building Services experience. Working on projects with contract values ranging from £20 - £200 million. This medium size consultancy compete with multinational organisations; you must be driven and dedicated here as the growing company seek to further cement an excellent reputation for delivering quality service. Ref: 4201

Senior Mechanical Engineer
London, £33p/h

A well-established design consultancy need a Mechanical Engineer capable of a dual role for a four-month contract. You will report to the lead senior mechanical engineer providing site inspection for a mixed use high end residential and commercial office scheme in London. Suitable engineers need to be flexible on location split between the office and site and provide design, review and comment on contractor's working drawings. Immediate start. Ref: 4217

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Recruitment drive

After being crowned CIBSE Employer of the Year 2016, TÜV SÜD Wallace Whittle's Angela Reid explains how the medium-sized firm develops its staff

TÜV SÜD Wallace Whittle aims to attract and retain engineers by applying a 'grow our own' philosophy that allows young employees to work on a variety of projects and gain a range of technical skills. The firm mentors staff through on-the-job and knowledge-transfer training. It also sponsors juniors to undertake further education and offers summer placements to students and schoolchildren. To enhance networking and learning, the company promotes inter-office working, allowing staff to take opportunities at different sites.

Q How do you attract talent?

A Recruiting in the building services industry is challenging at all levels. To attract young talent, we have a structured training programme that offers engineers a route to chartered status. We work across all sectors and offer staff the chance to develop skills by working on a variety of building types, and being able to transfer easily between offices within the UK and overseas. Feedback has shown that this is important to young engineers particularly, and it attracts staff.

Q Are schools and colleges more aware of building services as a career?

A Unfortunately, on speaking to our younger members of staff, it seems building services is not given as a career option in schools. Most found their way to building services through family members already involved in the industry, or through mechanical or electrical engineering studies at college. We try to raise awareness by visiting local schools and colleges and giving presentations to encourage students to consider a career within this industry.

Q How does the development programme work?

A At the outset, each staff member, with their mentor, assesses their skills and aspirations. They are then assigned training modules based on their needs. These are tracked, with tests at the end to demonstrate learning. Simultaneously, areas of on-the-job learning are identified and engineers are allocated live project activities. Once an activity has been completed three times, it is signed off to show that a level of competency has been achieved. These actions, plus non-technical skills, are logged to contribute towards their Engineering Practice Report.

Q Do you recruit apprentices and graduates?

A We recruit school-leavers and support them through college and/or university, and offer on-the-job learning. This 'growing our own' approach has been very

successful, and helped us deal with some recruitment challenges.

One of our school-leavers has been with us for nine years, starting in the Aberdeen office and now based in Glasgow. During his time with us, he has gained an undergraduate degree and a Master's qualification, and is now a CIBSE Low Carbon Energy Assessor. His interview for Chartered status is later this month.

Q Are you attracting engineers from diverse backgrounds?

A The engineers we attract are diverse in terms of age, experience, background and education. This benefits our business by providing a larger pool of ideas and experiences that we can draw on to meet strategy and client needs. In many ways, however, we are still dominated by a 'white, male culture', and see this throughout the industry. In particular, we see a lack of female candidates across all disciplines – an area we hope to develop.

Q How do you encourage new mothers back to work?

A This is best achieved by offering flexibility in the working week, allowing mums to find a balance between work and childcare. We have mums – and some dads – who either vary their working hours, work from home part of the week, or work part-time. Feedback from our female staff suggests this supports them in returning to work after maternity leave. We also use back-to-work days, to allow new mums to get back into the office culture and rebuild the confidence that is sometimes lost after a number of months away.

Q Will Brexit affect your ability to fill vacancies?

A We don't know yet. Free movement of labour between the UK and other EU member states has allowed us to employ skilled staff from a number of European countries. Brexit could make the UK less attractive to Europeans and we don't know how movement may be restricted under the government's plans for new immigration laws. We believe the construction industry was largely in favour of remaining in the EU and we benefit from the experience and knowledge of our European neighbours, to whom we often look for insights and best-practice examples.

■ **ANGELA REID** is director of sustainability at TÜV SÜD Wallace Whittle

INTERNATIONAL AND NATIONAL EVENTS/ CONFERENCES

CIBSE ASHRAE Technical Symposium

5-6 April, Loughborough
Themed 'Delivering resilient high performance buildings', the 2017 symposium will include presentations of more than 50 peer-reviewed papers over the two days. The aim of the symposium is to provide evidence of the successful adoption of resilience in the design and operation of buildings.

www.cibse.org/symposium

BIM Roadshows

16 May, Leeds
21 June, London

Presenters will use a project case-study to demonstrate the real-world application of digital technologies and work-flows.

CPD TRAINING

For details, visit www.cibse.org/training or call 020 8772 3640

Building drainage explained

19 April, London

Practical controls for HVAC systems

20 April, London

Lighting and efficiency energy

25 April, London

Low and zero carbon energy technologies

25 April, London

Mechanical services explained

25-27 April, Leeds

Building services explained

26-28 April, Manchester

Energy monitoring and targeting

27 April, London

Earthing and bonding systems

27 April, London

IET wiring regulations

28 April, London

Energy efficient building regulations: Part L

28 April, London

Ground water source heat pump schemes 1

9 May, London

Ground water source heat pump schemes 2

10 May, London

ENERGY ASSESSOR TRAINING

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

LCC building operations and DEC

19-21 April, London

LCC building design and EPC

25-26 April, Manchester

LCC building design and EPC

9-10 May, Newcastle

CIBSE GROUPS, SOCIETIES AND REGIONS

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

REHVA annual meeting

4 April, London

East Midlands: AGM and tour of Schneider Electric HVAC training facility

4 April, Ashby-de-la-Zouch

The Schneider training academy has numerous operational examples of both mechanical and electrical systems/installations, supplied to the plant room via a plate heat exchanger.

West Midlands: CPD technical seminar on generators

5 April, Birmingham

With speaker Will Mason, from JCB Broadcrown.

ILEVE: Fume cupboards explained

5 April, Southampton

Paid-for workshop aimed at LEV Engineers, health and safety officers and those wanting to improve knowledge of fume cupboards.

FM Group: Alternative maintenance techniques and AGM

6 April, London

AGM followed by event hosted by Optimum Group

services in partnership with The Wellcome Trust, looking at their alternative maintenance techniques.

Southern Region: AGM

6 April, Chichester

Taking place at South Downs Planetarium and Science Centre.

HCNW, SLL and IET joint event: Human-centric lighting

19 April, High Wycombe

Helen Loomes, of Trilux, explores whether new understanding of the biology of light and circadian rhythms can improve work and quality of life.

West Midlands: AGM and wellbeing at work technical seminar

19 April, Birmingham

Presentation by Paul Chatwin, of Cundall.

HCNW: AGM and hydraulic design of district heating networks

20 April, London

With speakers Georgina Penfold, of Spraga, on planning and negotiating networks with stakeholders; and Glyn Adicott, of Hydraulic Analysis, demonstrating software and methodology for pipework design.

Merseyside and North Wales: AGM and new products show

20 April, Liverpool

Taking place at Anfield Liverpool FC.

Yorkshire: AGM and district heating modelling

26 April, Leeds

With speaker Glyn Adicott, of Hydraulic Analysis.

SLL Masterclass

27 April, Glasgow

Continuing the lighting knowledge series, focusing on human responses to light.

Ireland: AGM

27 April, Dublin

AGM, with a networking opportunity after.

West Midlands technical seminar: cascading and discrimination

3 May, Birmingham

With speaker Alessandro De Danieli, from Schneider.

HIGHLIGHTS



Kevin Kelly, Dublin Institute of Technology, Technical Symposium, 5-6 April



Paul Chatwin, Cundall, West Midlands AGM, 19 April

CIBSE membership briefing webinars

London, St Albans, Cardiff

The CIBSE membership team is holding a number of webinars and briefing sessions to help support members as they move up the membership grades.

The sessions will mainly focus on applications for the Associate and Member grades and registration with the Engineering Council at the Incorporated Engineer and Chartered Engineer levels. During the session, information is provided on a wide range of subjects related to membership applications. Upcoming dates:

- Home Counties, 8 May 6-7.30pm, London
 - Home Counties North West, 10 May, 6-7.30, St Albans
 - South Wales, 15 May, 6-7.30pm, Cardiff
 - CIBSE HQ, 8 June, 6-7.30pm, Balham, London
 - Home Counties, 26 September, 6-7.30pm, London
- Find out more and book at www.cibse.org/briefings

As well as the briefing sessions, a range of webinars are also available:

- Qualification requirements webinar
26 April, 5-6pm
- How to start your engineering practice report webinar
4 April, 1-2pm
- LCIBSE EngTech Membership and registration webinar
6 June, 1-2pm

Find out more and book at www.cibse.org/webinars





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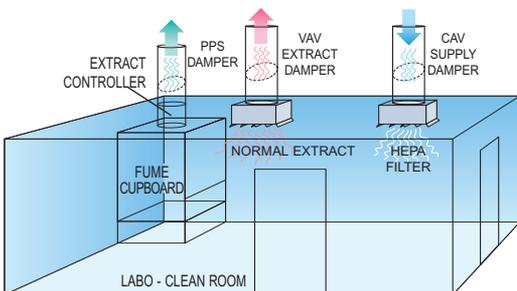


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