

CIBSE

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The official magazine of the Chartered Institution of Building Services Engineers

August 2012



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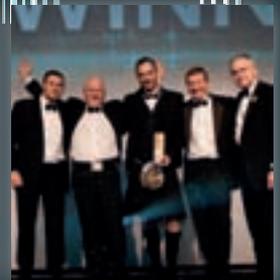
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Editorial

Editor: Alex Smith
Tel: 01223 273520
Email: asmith@cibsejournal.com
Deputy editor: Carina Bailey
Tel: 01223 273521
Email: cbailey@cibsejournal.com
Technical editor: Tim Dwyer
Design: CPL (Cambridge Publishers Ltd)

Advertisement sales

Sales manager: Jim Folley
Tel: 020 7324 2786, jim.folley@redactive.co.uk
Sales consultant: Mark Palmer, Tel: 020 7324 2785, mark.palmer@redactive.co.uk
Sales executive: Darren Hale
Tel: 020 7880 6206, darren.hale@redactive.co.uk
Recruitment sales: Paul Wade
Tel: 020 7324 2762
paul.wade@redactive.co.uk
Advertising production: Jane Easterman
Tel: 020 7880 6248
jane.easterman@redactive.co.uk

For CIBSE

Publishing co-ordinator: Nicola Hurley
Tel: 020 8772 3697, nhurley@cibse.org

Editorial advisory panel

George Adams, engineering director, Spie Matthew Hall
Laurence Aston, director, Buro Happold
Annabel Clasby, mechanical building services engineer, Atkins
Patrick Conaghan, partner, Hoare Lea Consulting Engineers
Rowan Crowley, director, inside track
James Fisher, e3 consultant, FlaktWoods
David Hughes, consultant
Philip King, director, Hilson Moran
Chani Leahong, senior associate, Fulcrum Consulting
Nick Mead, group technical director, Imtech Technical Services
Christopher Pountney, graduate engineer, AECOM
James Rene, engineer/acoustician, Max Fordham
Alan Tulla, independent lighting consultant
Ged Tyrrell, managing director, Tyrrell Systems
Ant Wilson, director, AECOM
Terry Wyatt, consultant to Hoare Lea

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CIBSE, 222 Ballham High Road, London SW12 9BS
Tel: +44 (0) 20 8675 5211. www.cibse.org
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Engineers deserve Olympic applause

By the time you pick up this magazine you may already be celebrating the first gold medals of the Olympic Games. Mark Cavendish could have sprinted to victory in the men's cycling road race and Lizzie Armistead may have won the women's crown.

For the engineers and builders responsible for delivering the Olympic venues the race has already been won. The industry has confounded sceptics who doubted that the UK construction industry was capable of delivering something of this scale to time and budget.

The *Journal* has covered many of the Olympic venues and infrastructure in great depth – not least July's feature on the Aquatics Centre – but to mark the opening of the Games we have profiled some of the building services professionals who have helped to create the greenest Olympic venues ever built (page 12).

There is a recurrent theme from our Olympians – that collaboration and early involvement is key for a successful outcome. This is a familiar refrain for anybody using Building Information Modelling (BIM) and it is evident in our article on Bristol Royal Infirmary hospital (page 32), where Hoare Lea is using BIM to bridge the gap between design and operation.

Some of the more observant among you may have noticed the editor has undergone a Doctor Who-like regeneration this month. I have taken over the hot seat from Bob Cervi and I would like to thank him for all his hard work.

Bob hands over a title that carries enormous respect in the industry. It's 'the magazine you can trust', one head of sustainability told me.

I intend to carry on Bob's good work and cover the most innovative buildings with the technical rigour readers have grown used to.

We will also be looking to bring you more analysis of the big issues affecting energy and sustainable building, from fracking to Part L, and we will be speaking to the most influential and inspirational figures in engineering and construction.

I would also like to say how pleased I am to be working with Carina Bailey, who has been promoted to deputy editor. I have already benefited from Carina's enthusiasm and experience, and I look forward to working with her on future issues. Hopefully, we will both get to meet some of you at the fast approaching CIBSE Conference and Exhibition on 10-11 October, if not before.

Alex Smith, Editor

asmith@cibsejournal.com



In Brief

FRACKING GETS OK

Extracting gas trapped in rocks using hydraulic fracturing – or ‘fracking’ – is safe, according to a report by the Royal Society and the Royal Academy of Engineering.

Despite fears that fracking can contaminate water and cause earthquakes, the report says the technique is safe – if firms follow best practice and rules are enforced.

The report was commissioned by the government’s chief scientist, Sir John Beddington, after shale gas extraction was halted by reports of earth tremors in the north west of England.

SPONSORS BACK YOUNG ENGINEERS

Lochinvar and Ruskin Air Management have been announced as the first two sponsors of the new CIBSE Young Engineers’ Awards. Taking place on October 11 at the Institution of Mechanical Engineers in London, the awards scheme combines the CIBSE ASHRAE Graduate of the Year and CIBSE Employer of the Year awards.

To attend or to enter visit:
www.cibse.org/awards

Low VAT on energy measures ‘illegal’



Shutterstock/Alena Brozova

VAT on insulation is currently charged at 5%

● EC push to increase VAT on low energy products in UK could threaten Green Deal

The UK government may be forced to increase the rate of VAT charged on energy saving measures, following intervention from the European Commission.

Currently, the UK charges just 5% VAT on heating controls, heat pumps, solar thermal, PV and insulation. However, the EC has ruled this is illegal and has ordered the UK to charge the full 20% rate on these measures within two months, or face a challenge in the European Court of Justice.

The Builders Merchants Federation (BMF) says this could not have come at a worse time with the government’s flagship Green Deal scheme about to

launch. Policy manager Brett Amphlett warned that it could undermine the ‘golden rule’ where the cost of improvements must be met by repayments from energy savings.

‘This is really disappointing,’ said David Frise, head of sustainability at the Building & Engineering Services Association. ‘VAT is a tax on consumption; so it just seems bizarre to increase the rate of tax on measures designed to reduce consumption of energy.’

‘I can understand that the European Commission would want to bring everyone into line, but this is the wrong line,’ added Frise. ‘Wouldn’t it be better to allow all member states to do the same thing and encourage people to invest in energy saving measures?’

Amphlett added that the BMF had been urging the government to extend the 5% VAT rate to all Green Deal projects.

‘Sadly it seems that bishops and bakers have the clout to force the government to concede on its VAT plans for alterations to churches and historic buildings, and on sales of hot pasties and static caravans. Yet the building trade faces the prospect of the Chancellor removing a lower rate that already exists for some energy-saving measures just before the introduction of a flagship policy to improve the energy-efficiency of our homes and workplaces. How crazy is that?’

The government is already under pressure from opposition MPs about the high level of interest being charged on Green Deal finance. Labour says a £10,000 Green Deal loan will cost £22,000 to pay back over 25 years because of the 7.5% interest rate. This would require the energy saving measures to deliver savings of £900 a year.

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Olympics are 'superb advert' for UK construction



The Olympic Park in Stratford, east London

The construction of the Olympic Park has been described as 'a superb advertisement for UK plc', which will help British firms win business at home and abroad. Now the government is being urged to adopt the procurement practices used in Olympic projects to improve the delivery of all public sector construction.

Sir John Armit, chairman of the Olympic Delivery Authority (ODA), has produced a report that highlights the positive experiences of companies involved in the Games. He listed new and better ways of working, innovation and

optimism about the future as key outcomes for suppliers.

The Secretary of State for Culture, Olympics, Media and Sport, Jeremy Hunt, commissioned the report. He said the Olympic Park was a 'world-class advert for British construction', adding: 'I am delighted that we will now be able to help even more companies go for gold.' But Armit said it was important to ensure that 'working on London 2012 is the start, not the end, of this success story'.

His report includes feedback from 250 businesses that worked on the Olympic Park. More

than two thirds said working on the Games had enhanced their reputation; more than a third said they had already won new business as a result; and nearly half said their company's financial situation had been enhanced by working on London 2012.

Armit also said that about three quarters anticipated future work at home and abroad, while more than two thirds of large businesses said it had increased their ability to take on big projects. However, he identified that small- and medium-sized businesses need more help to work overseas.

The report urged the government to adopt the ODA's principles of procurement and programme management, and advised it to ensure that marketing restrictions applying to London 2012 suppliers 'are relaxed as soon as possible after the Games' to help them maximise the promotional opportunities.

It added that the 'CompeteFor' network – a free service enabling businesses to compete for contract opportunities – should be retained for all public sector projects and that the ODA's Learning Legacy website should be continued after the Games end.

To read the full report visit:
www.goc2012.culture.gov.uk
 /2012/07/05/armitt-report

Olympic legacy is explained

The engineering experts behind the London 2012 Olympic and Paralympic Games have revealed how its legacy will live on for at least 30 years after the event finale in August.

Simon Wright, Holly Knight, Dr Dorte Rich Jørgensen and Andrew Comer described how residents and businesses in east London will benefit from the infrastructure, technology and energy facilities for a generation after the Games end, at a Science Media Centre briefing staged last month.

A cornerstone of the Olympic Village is the energy centre, which already has the 'backbone' infrastructure in place to support power supplied by hydrogen fuel cells, gas from waste and synthetic cells.

'Taken as a whole, what's been achieved in east London is quite startling,' enthused Comer, a civil engineer with Buro Happold.

Meet the building services engineers who delivered the Olympics on page 12

Meter guidance could kickstart renewable heat

Better understanding of heat metering could throw a lifeline to the Renewable Heat Incentive (RHI), according to the Building & Engineering Services Association (B&ES).

A lack of industry standards has hampered deployment of heat meters, which has had a serious impact on RHI applications, the association said.

According to reports, at the end of last month there had been a total of just 77 successful applications nationwide.

B&ES president Bob Shelley said: 'This contrasts with the government's objective of growing the market for RHI-compliant projects by 700% by the year 2020 – with an estimated 110,000 commercial installations being supported in that period.'

He was speaking at the launch of the B&ES *Guide to Good Practice: Heat Metering for the RHI*, which is available as an electronic document to improve installation standards.

'We are confident that the introduction of the guide will help stimulate renewed interest in the commercial returns the RHI can deliver to the sector,' said Shelley.

The guide is available via www.b-es.org

Energy firms seek virtual answer

A research consortium, co-funded by the government, is spearheading efforts to create 'virtual power plants' that could give much needed support to the National Grid.

Based around clusters of combined heat and power (CHP) systems, these plants would be designed to improve flexibility and give better load-balancing potential to reduce stress on the electricity network, particularly at times of peak demand. The project, which is due to report back in May 2013,

aims to improve resilience, enable and incentivise low carbon and lower cost electricity production, and reduce the need for utility engineering projects.

ENER-G, Advanced Digital Institute, Flexitricity, Smarter Grid Solutions and UK Power Networks, have secured £100,000 of match funding from the Technology Strategy Board, the government's innovation agency, towards exploring the development of virtual power.

The project will investigate the

feasibility of using networks of small CHP generators to support local networks. This virtual power plant system requires complex software and a central control system to ensure that it reacts immediately to local supply and demand requirements.

The project will also address how to maximise the potential for distributed heat and cooling through CHP, examining district heating, heat stores and technologies such as absorption chillers.

CRC fines imposed despite review

Despite calls to cancel or reform the Carbon Reduction Commitment (CRC), four companies have been fined a total of £99,000 for failing to deliver the required reports.

Utility firm Saur was fined £41,000, Henkel £38,000, while Tomkins and B1 Group each suffered £10,000 penalties at the hands of the Environment Agency for submitting carbon footprint reports after the deadline.

Firms face fines of £500 for each working day a CRC report remains outstanding, plus a £5,000 penalty if the report is delayed more than 40 working days past the deadline. The scheme targets organisations with energy bills higher than £500,000 and compels them to measure and pay for each tonne of CO₂ they emit.

The scheme is currently the subject of a government consultation in the face of criticism about complexity and high administration costs. The government believes administrative costs for businesses could be cut by £250m by 2030.

UK tops energy efficiency ranking

The UK has been placed top in a new energy efficiency ranking of major economies, published in the US.

It is followed by Germany, Japan and Italy, according to the first-ever International Energy Efficiency Scorecard produced by the American Council for an Energy-Efficient Economy www.aceee.org

The rankings are based on metrics that make up energy use, as well as the sectors primarily responsible for energy consumption – buildings, industry and transportation.

However, another report published by the Department for Business has drawn criticism of UK climate change policies from the business community. It reveals that UK policy adds more to energy intensive industries' electricity costs than in any other country.

'These figures should come as a wake-up call to the government. It must help those companies most at risk from higher energy costs, and make provisions for them in its forthcoming Energy Bill,' said Katja Hall, chief policy director at the CBI.

Legionella source may never be found

The source of the recent outbreak of Legionnaires' disease in Edinburgh may never be identified, according to a leading expert.

Bill McCoy, chair of the ASHRAE committee that produced the proposed Standard 188, covering the prevention of legionellosis associated with building water systems, said investigators would find it hard to pinpoint the source in such a large outbreak.

More than 100 people have contracted the disease and three had died (when the *Journal* went to press). Sixteen cooling towers across four sites in the South West of the city have been treated, but McCoy said it would prove difficult to pin the blame on one building.

During a visit to CIBSE last month he said: 'In most cases, the source is never proved.'

Standard 188, which has just been published by ASHRAE, sets out an approach for managing hazard levels in buildings.

McCoy said: 'Legal and insurance experts are insisting, more and more, that building operators adopt a defensive stance. This means ensuring they have a system in place that identifies all the critical control points for preventing outbreaks – then, at least, they can say it

didn't come from here.'

The CIBSE meeting heard that a large number of outbreaks were not attributable to cooling towers, yet they are often the focus of investigations. McCoy said risks were equally high in potable water services.

Meanwhile, Basildon Hospital has been told it is not doing enough to eradicate the risk of legionella, despite spending millions on the problem since a fatal outbreak 10 years ago.

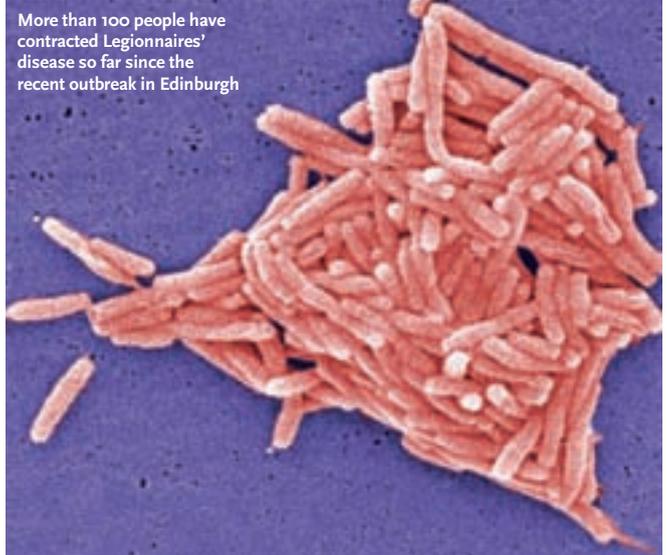
The management says it spends a sixth of the entire maintenance

budget – about £500,000 a year – on legionella control, but regulators say it has still not met its targets to minimise risk.

Hospital chairman Ian Luder said: 'If there was a golden bullet, we would take it. But we have sought advice from all the national experts and they all agree the bug cannot be completely eradicated.'

'We have spent £2 million since 2002 and £500,000 a year on water management systems.' The hospital has had another 13 cases since the fatality in 2002.

More than 100 people have contracted Legionnaires' disease so far since the recent outbreak in Edinburgh



Industry mourns loss of Mel Starrs



Tributes have poured in for Mel Starrs, who died suddenly at her home this month, aged 38.

Starrs was a strong advocate for sustainability and was a prolific blogger and social media user on

issues in the built environment.

An associate director at architect PRP, Starrs also had extensive experience working as a building services engineer at Halcrow, Babbie, Whitby Bird and Max Fordham.

Starrs had been working with CIBSE immediate past president Andy Ford on a new CIBSE Diversity programme.

Ford said: 'I am shocked and sad to hear of Mel Starrs' death.'

'I was personally very much looking forward to working with her to launch the CIBSE Diversity programme and a CIBSE Women's

group and our task will be all the harder without her.

'Although I had only really known her through her online efforts at driving for a better sustainable built environment, these were huge and I admired them enormously.'

'My thoughts are with her family and friends – a special person indeed and a sad loss.'

Tributes poured in across the construction industry. Fairsnape's Martin Brown summed up the thoughts of many: 'The built environment has lost an important sustainability champion, maven and friend. We have lost an anchor.'

Local housing rules 'unrealistic'

Housebuilders and groups representing local government have condemned the high number and variable quality of local planning standards. They have called for a rationalisation process, including the elimination of some initiatives such as the Code for Sustainable Homes and the 'Merton Rule'.

The Local Housing Delivery Group (LHDG), chaired by Sir John Harman, was set up following a request from Housing Minister Grant Shapps, to help address the housing crisis. Its first interim report calls for a 'simplification' of the process, as complying with the many standards can 'have an adverse effect on the viability of some developments'.

The report, *A Review of Local Standards for the Delivery of New Homes*, is a response to the establishment of the new National

Planning Policy Framework, which gives councils increased influence over the housebuilding process.

The Home Builders Federation and the Local Government Association have agreed to abide by the report's recommendations, which include an urgent government-backed review and consolidation of existing housing standards 'to ensure they meet the aspirations of local communities without undermining viability'.

The LHDG believes that many local plans are not realistic or viable, and Harman said local authorities needed to strike a balance between sustainability and economic viability, and should adopt a collaborative approach to devising local plans.

He said: 'The trouble about the system for local standards is there isn't one. To create this system will be a challenge, but now is the time.'

Industry failing to attract female students

Many engineering firms are struggling to attract female applicants despite 17% of job vacancies in England now being directly attributed to skills shortages.

A report, by consultant UKRC & WISE, and sponsored by BAE Systems, suggests that too few girls opt for science, technology, engineering and maths (STEM) subjects at school, and so are unable to access science and technical careers. The report says this is a cultural – rather than an ability – issue, adding that despite major attempts to promote STEM subjects, only 76 more girls studied physics in 2011 than in 2001.

CIBSE is making diversity a priority, according to Angela Ringguth, the Institution's education consultant. She told a recent CIBSE Patrons meeting that 15% of graduate members are female, but this proportion falls to less than 6% at chartered membership level.

Ringguth said: 'We think young women members are falling away after they come into the industry – possibly because our profession is not particularly family friendly.'

CIBSE has now set up a diversity panel, chaired by immediate past president Andy Ford, to consider how to improve recruitment and retention of female engineers.

US engineers must reach out

New ASHRAE president Tom Watson has called on engineers to take a more proactive role in the development of their communities. Watson's Community Sustainability Project programme sets out to encourage US engineers to share

knowledge with local projects. The aim is to improve the built environment for groups that would otherwise struggle technically and financially. Watson made the appeal at his presidential address at an ASHRAE Conference in San Antonio.

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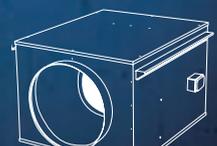
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Visualise and win

Members are reminded that this month is the final chance to enter the Building Simulation Group 2012 Award, the winner of which will receive a £1,000 prize.

The award is open to any Masters degree level – or equivalent – student whose research includes a major element about the development or application of building simulation tools.

The 2012 award will focus on projects in the area of 'Validity of Building Performance Simulation'. The closing date for initial entries, including a one-page summary, is 31 August. Full details are available at www.cibse.org/bsg

President's blog

Don't forget to check out what CIBSE president David Fisk has been up to this month – read his regular blog at www.cibsepresident.blogspot.co.uk

Big questions on the small screen

The Business Channel.tv, in association with CIBSE, recently screened a programme exploring the business case for putting any workspace onto a lower-carbon trajectory, and showing how new, innovative technology can make a difference.

The programme asked: 'How do you retrofit your older building stock to cut carbon and save energy in a way that is financially and operationally efficient? How do you take into account government schemes such as the Carbon Reduction Commitment, the Green Deal and the Renewable Heat Incentive?'

Originally shown on 27 June, it features commentary from Camfil Farr, The Carbon Trust, Flaktwoods UK, Gratte Brothers, JCC Lighting Products, Mitsubishi Electric and the UK Green Building Council, and is now available to watch at www.thebusinesschannel.tv

Technical Symposium 2013: call for papers



The 2013 Technical Symposium will take place in Liverpool on 11 and 12 April next year, and CIBSE is now inviting papers.

The symposium, which will be the third such event, will encourage researchers and industry practitioners to share experiences and develop networks, and will encompass both experienced professionals and those at the developmental stage of their careers. It is intended to bring to the fore the latest practice and research, and provide a glimpse of future developments from across the world.

This invitation is for papers concerning research and development into systems that may include:

- Benchmarking systems that can intelligently inform building engineering system design and operation;
- Building systems monitoring and feedback methods to enable improved operation and feedback into the design and construction process;
- Integrating renewable energy systems into the built environment;
- Metering, intelligent monitoring and control techniques to predict and manage energy use;
- Mechanisms to promote intelligent building information transfer from design to operation;

- Innovations in building services systems to improve effectiveness of the built environment;
- Practically maintaining the integrity of historic buildings without profligate energy use;
- Environmental assessment and certification for continual monitoring and improvement;
- Maintaining energy performance for the Olympic and Commonwealth Games estates;
- Influencing clients to properly understand total life cycle energy use of their buildings; and
- Developing a professional workforce to deliver innovative and effective low energy buildings.

Papers are welcomed based on recent or current research and application, as well as the actual or potential impact of that research on the built environment. All papers will be peer-reviewed and published electronically through CIBSE. Selected papers may be developed for publication in *Building Services Research, Engineering and Technology (BSERT)*.

To submit your paper for consideration, please provide an abstract – maximum 300 words – by 17 September. For more information, visit www.cibse.org/symposium2013. For details of symposium sponsorship opportunities, email nhughes@cibse.org

Journals add value to membership

Building Services Research, Engineering and Technology (BSERT) and *Lighting Research and Technology (LR&T)* are CIBSE journals that publish the latest research in the fields of lighting and building services.

Published by SAGE, *BSERT* is free and accessible to all CIBSE members, while Society of Light and Lighting members can also access *LR&T*.

LR&T is an internationally-recognised journal of lighting research, regarded globally as one of the leading titles in the field.

BSERT publishes groundbreaking building services research papers, including the research demonstrating that domestic party walls lose far more heat than previously thought, leading to a major change in the assessment of heat loss in

homes. It also published the first comprehensive study showing the variability between the various software packages used to calculate carbon emissions ratings for non-domestic buildings.

Both journals are available via the 'CIBSE Knowledge' section of the CIBSE website (click on 'Technical Journals'). As they are hosted on SAGE's website, a separate log-in is required.

Benefiting from extra investment and donations

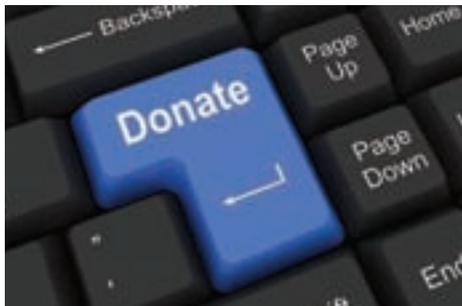
In its report to the CIBSE AGM, the Benevolent Fund was pleased to report that donations and investment income both increased in the year ending 31 December 2011 when compared to 2010.

The grants made by the Benevolent Fund decreased from their high level in 2010, so the Fund is now in a healthier position than it was a year ago. Unfortunately, this improvement was offset by a decrease in the value of investments, so it still has to adopt a cautious approach.

The Fund reported that it was hoping to increase the standard grant made to most of its clients, but this had not yet been confirmed.

The Fund thanked the donations from the regions – in particular, the West Midlands region, which gave more than £2,500 in 2011. It also thanked the almoners – there are almoners for all the UK regions (except East Midlands), who look after almost 50 clients. In November, Andy Ford, then CIBSE president, presented long service awards to retired almoners Tony Karup and Tony Sanderson.

Internationally, there are almoners in the Republic



of Ireland and in Australia. However, the Fund noted that, at present, they do not have any clients in CIBSE's overseas regions. They consider that they should be helping CIBSE's overseas members but have so far not been very successful in doing so.

It also reported that the management committee, which normally convenes four times a year, trialled a virtual meeting for its most recent meet.

Finally, it was noted that it will be the 80th anniversary of the founding of the CIBSE Benevolent Fund in 2013. Members are considering how best to mark this milestone.

Simulation is now the real thing

The Building Simulation and Optimization (BSO) Conference is being held at Henry Ford College, Loughborough University, on 10 and 11 September.

More than 50 papers from 14 countries have been accepted by the scientific committee, and will be presented in parallel sessions over the two-day conference, with keynote presentations from leaders in the field.

Prizes sponsored by design practices and software vendors will be presented at the conference dinner, which is being held at Leicester's National Space Centre.

Building performance simulation has reached maturity, in that it is widely used in practice for evaluating the performance of building prototypes and for compliance testing. Future applications will focus increasingly on the use of simulation in optimising design and operation of buildings.

The conference explores approaches for the optimisation of building design and operation, including methods for evaluating the sensitivity of the solutions to uncertainty in design parameters, as well as the development of

new models and approaches appropriate for future design needs – including those relating to climate change, daylight modelling, and ventilation modelling.

The conference also includes several papers that demonstrate the use of simulation and modelling in the performance analysis of contemporary buildings.

The conference is being organised by IBPSA-England in association with CIBSE. For more information, and to register, visit www.bs012.org

Last call for entries – Employer of the Year Award

If you put the development of young engineers at the heart of your business, and you can show innovation and commitment in developing the skills and expertise of your more junior employees, then make sure you enter the CIBSE Employer of the Year Awards.

If your organisation pro-actively champions young people in the BSE industry, through your commitment to young people in the workplace or

by supporting those employees through education, then tell us your story.

This is your final chance to share your dedication with the rest of the industry, to highlight the long-term benefits of being part of your organisation, and to further cement your reputation as a champion of young engineers. Visit www.cibse.org/youngengineersawards for more information and to enter. The closing date is 31 August.

Conference focuses on CHP and DH

The CHP Group is holding a one-day conference in September, looking at questions arising from the increased interest in combined heat and power (CHP) and district heating (DH).

There is a huge interest in CHP and DH as a result of the current economic climate. Organisations are looking to cut costs and ensure security of supply, and this is making them turn to CHP/DH. New business models are bringing money to CHP/DH projects, and they are being seen as a way to cut costs in the medium-to-long term.

What are the opportunities to use CHP/DH to cut running costs? Will it ensure security of supply? How does current and forthcoming legislation encourage the use of CHP/DH? Will the Green Deal and RHI have an effect? The conference, taking place on 27 September, will set out to answer these questions, along with providing real case studies of where CHP/DH is underway. For more information visit www.cibsetraining.co.uk/conferences

New Mid-Career College course programme

Next year's Mid-Career College course programme has now been confirmed, and you will receive your personal course booklet with next month's *CIBSE Journal*.

If you are keen to plan your year's CPD before then, the course schedule is now available on the CIBSE website. The programme covers a wide range of topics including mechanical, electrical and public health, fire, lighting and facilities management. There are also a number of courses on energy efficiency and sustainability.

Discounts are available for members and for those who book early. Visit www.cibsetraining.co.uk/mcc for a full list of events.

GAMES CHANGERS

The XXX Olympiad has finally arrived. During the next two weeks more than 10,000 athletes from 204 nations will strive to win gold medals in 300 events. For building services engineers the race to deliver the venues on time and budget has already been won. We speak to five engineers who have been key to UK construction's Olympic success



Emmanuelle Danisi,
associate, Arup

What was your Olympic role?

I was project manager and co-ordinated Arup's engineering team on the Aquatics Centre. Our scope encompassed building services, lighting and security, as well as structural engineering, fire, acoustics and sustainability.

What was the best innovation?

The most exciting innovation seems like a very small thing – the pool hall ceiling bubbles, which accommodate the lighting, speakers and security cameras. There is a lot happening in a small space, and everything has to be able to survive in a tough, pool hall environment, and perform to exacting broadcasting requirements. This design meant that all the equipment was recessed into the ceiling void, maintaining the amazing visual purity of Zaha Hadid's curved design for the timber ceiling. We made it happen through months of discussion with the client, the architect and contractor, a lot of calculations, and extensive modelling in 3D. We had to work on every detail, down to the drawings for the bracket installation. We are really pleased with the end result.

What have you learnt?

That the success of the project relies heavily on the dedication of the team

involved, their constant attention to detail and, critically, on continuity within the whole design team from concept to completion.

Who deserves a gold medal?

It's too difficult to pick out a single individual because, over the past six years, so many people have been heroes on one part of the project or another, putting in enormous extra effort at the right moment to get things completed on time – both in the design and the construction phases.

Who is your Olympic hero?

Nadia Comăneci, I remember watching her on TV as a child; she was amazing and inspiring.

What event are you most looking forward to?

Diving. It's really impressive and the concrete diving towers look absolutely amazing!

Have you got any tickets?

Unfortunately no, but I was present at the opening of the Aquatics Centre last year and was lucky enough to go to one of the diving test events. It was really nice and a bit surreal to see the building in use and full of families. It made me feel really happy to see the enthusiasm of people for the venue as they entered the pool hall.

“ We made it happen through months of discussion with the client, the architect and contractor



AQUATICS CENTRE: CREDIT WHERE IT'S DUE

July's feature on the Aquatic Centre should have included two engineers as co-authors. Apologies to Emmanuelle Danisi, building services project engineer and Jeffrey Yuen, mechanical design engineer, both at Arup

David Palmer associate director, Water Group, Buro Happold

What was your Olympic role?

Since 2006 I have been part of the Buro Happold Water Group that has been responsible for flood risk management across the park, and for defining the parkwide water strategy and water space masterplan for the Games and legacy periods.

What was the best innovation?

The greatest contribution the team has made has come from the imaginative and practical flood risk mitigation measures that have resulted in more than 4,000 properties benefiting from a reduced risk of flooding in legacy and beyond. The project as a whole has benefited hugely from the close relationship the team developed with the Environment Agency and British Waterways, helping to deliver more than 60 separate planning applications without appeal. The innovative water strategy that was defined by the group has resulted in a saving of more than 40% in potable water use and the nearby blackwater Old Ford Water Recycling Plant, which can provide non-potable water for irrigation after the Games.

Who deserves a gold medal?

I would award a gold medal to the Buro Happold Water Team. Their work is largely unseen but is already providing some major, sustainable benefits to the local communities in legacy.

Who is your Olympic hero?

It is hard to look beyond Steve Redgrave but I always loved the mix of brilliance and irreverence that decathlon gold medallist Daley Thompson brought to the arena when he performed.

What event are you most looking forward to?

I love the grace of the rowing events and the chaos that can come out of the BMX racing.

Have you got any tickets?

I've been lucky enough to get tickets for fencing, basketball, hockey, beach volleyball and the Paralympic athletics.



“Flood risk mitigation measures have resulted in over 4,000 properties benefiting from a reduced risk of flooding

“Working together as a team and integrating sustainable thinking in the design process from the beginning does pay off



Gustavo Brunelli, associate at BDSP Partnership

What was your Olympic role?

I led BDSP's environmental consultants team on the Velodrome design, and assisted with the co-ordination of the building services design.

What was the best innovation?

The intention was to create the most sustainable Velodrome, while meeting the several (and sometimes conflicting) requirements of the venue. The main driver was the integration of simple and robust strategies that would get us well beyond the Olympic Delivery Authority targets. The lightweight – yet heavily insulated – roof epitomises this integrated thinking, where a light structural solution meets thermal requirements, as well as allowing strategic daylight penetration and supporting the sport lighting system. The ventilation shows how integrated design allowed the maximum use of what would otherwise be an odd, unused space: 20 air handling units are fitted into the structural bowl, which doubles up as plant room and plenum for the arena's natural and mechanical ventilation.

What have you learnt?

That working together as a team and integrating sustainable thinking in the design process from the beginning does pay off.

Who deserves a gold medal?

Chris Bannister from Hopkins for being a constant presence and thorough co-ordinator, never overlooking a single detail and getting the team to move forwards together.

Who is your Olympic hero?

I obviously started following cycling more closely after being involved in the Velodrome design in 2007, so I will have to pick Chris Hoy as my Olympic hero because of his outstanding performance in Beijing.

Have you got any tickets?

Unfortunately I did not manage to get any tickets for the Velodrome for the Olympics, but I will be there during the Paralympics to check out the action!



Dr Dorte Rich Jørgensen,
Atkins sustainability manager,
London 2012 Infrastructure team

What was your Olympic role?

I joined the Atkins London 2012 project team in 2007 as the sustainability manager for the infrastructure team. I worked with design teams to ensure the client's 12 sustainability objectives were embedded in the design. Examples include ensuring materials had low embodied energy – for example, replacing PVC pipes with high density

polyethylene equivalents – and energy efficient lighting design and controls.

What was the best innovation?

The project has created a paradigm shift in the construction industry. It has shown that with strategic drivers embedding sustainability, diversity and equality onto a project from the outset, people's behaviour and practices can be changed. It's been a game changer.

What have you learnt?

I am inspired by how this innovation could be embedded in projects around the world to drive behavioural change and help reduce climate change.

Who deserves a gold medal?

I would award everyone on the project for creating the greenest Games ever while designing for legacy too. I would award the client for staying committed to that outcome – a world class result. At Atkins we have achieved the highest CEEQUAL score to date (98.3%) and we have beaten the tough targets such as achieving 98% reuse of site demolition materials.

“ The ethos of collaborating together as one team has been brilliant

Who is your Olympic hero?

The Danish National Women's handball team of my generation who rose from unknowns to national heroines, winning medals at the Olympics and World championships. As a former premier league handball player, I was part of an English Universities Basketball Championship winning team, playing alongside an Olympic team player, and I find results like that inspiring.

What sport are you looking forward to?

Beach Volleyball because it is a temporary venue at Horse Guards Parade, which will have an incredible summer party atmosphere. It will be a once-in-a-lifetime experience.

Have you got any tickets?

Football, volleyball, basketball, handball and beach volleyball. I am very excited!

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Mike Simpson, technical and design director at Phillips Lighting

What was your Olympic role?

Initially I was providing the technical responses to the invitations to tender. Once we had won a significant number of the bids I focused on delivering lighting to the three main permanent venues – the stadium, velodrome and Aquatics Centre. We have specific design responsibility for the stadium and velodrome and worked with Arup to

“The design of the building can affect the effectiveness of the lighting, particularly for broadcasting

install and commission its design for the Aquatics Centre.

What was the best innovation?

Our biggest innovation was broadcast lighting that was developed specifically for 2012 to produce flicker-free slow motion TV pictures. Installed in the Velodrome and diving area it will enable broadcasters to film at 500 frames per second.

What did you learn from the project?

It is so important to engage with design teams at the earliest possible stage. The building design can affect effectiveness of the lighting, particularly for broadcast. Viewing angles and mounting height are critical for cameras and judges, and if buildings won't allow for these then lighting will be compromised.

Who deserves a gold medal?

Team Stadia. We were engaged at the early design stage before the roof structure was finalized. Instead of saying 'here are the towers put your lights on them' we worked through all the lighting requirements to end up with the current design. There was a good 3D analysis of floodlight positions to ensure no obstructions, and they provided us with GPS to mark out aiming positions, which took 60% off commissioning time.

Who is your Olympic hero?

If we are talking sport it has to be Seb Coe who has driven the Games from conception to completion. I have an anti-hero – the media, which has tried to pour cold water on what will be an inspiring event. I have hardly heard about the achievement of UK construction in delivering venues on time and on budget.

Do you have any tickets?

I have a ticket for athletics and one for the open ceremony final rehearsal where my daughter will be wrestling with 2,500 costumes and associated volunteers.

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Your letters

This month:

The performance gap – 18 years on; insulation versus district heating; and the importance of the admittance method

Performance gulf

In 1994, I came into facilities management (FM) from aircraft maintenance. Soon after, I joined a quality improvement team dedicated to producing a ‘cradle to grave’ project process. The need arose because many new facilities were uncomfortable for various reasons, including where ‘heating systems were fighting cooling systems’. When, 18 years later, I read those same words in the article ‘Work in Progress’ in the March 2012 *CIBSE Journal* (page 44, first column), I felt a profound sense of déjà vu.

Why is it that in this sector, there is such a gap between predicted energy performance and actual performance? When an aircraft flies the Atlantic, the fuel needed for the weather conditions and payload has to be calculated very accurately. When Werner Von Braun did his sums for the Apollo programme, slide rules were commonplace and mainframe computers were about 64 kB, yet he got those right.

Some of it is poor client specification; for example putting more people into a facility than the designer had been told. While some of it is poor design and some of it poor commissioning. Last minute ‘value engineering’ does not help. But does it go further than that? Is there something wrong in the way the sums are done?

Do we have people that don’t always know what they are doing? Do we give facilities managers systems that are too complex to run,

or don’t we train them well enough or give them enough system design information? Is too much of the ‘design’ left to the contractor?

When we worked on ‘cradle to grave’, someone said what we produced was probably better than anything CIBSE had. Certainly, it did result in much better projects. With building design, construction and handover taking up to three years, say, it is still only 5% of the 60-year life typically expected. Yet, mistakes made cast a shadow over the remaining 95%. As always, it is easier to pose questions than answer them, but what do others think?

Rob Farman

Admittance method provides accurate load estimates

It was with some delight that I read the article by Tom de Saulles entitled ‘Learning Tool’ in the March *Journal*. It is some years since I was involved in the development of the admittance method at BRE, but I always believed that the method, if applied properly, could – and should – provide accurate estimates of the heating/cooling loads of building.

This belief was based on the fact that the method had been developed over many years by the application of the basic laws of physics to the transfer of energy within and around buildings, and the development of the appropriate equations to simulate these transfers.

Why is there a gap between predicted energy performance and actual performance in building engineering? When an aircraft flies the Atlantic, fuel needed has to be calculated accurately

It is therefore somewhat reassuring to hear that the ‘laws of physics’ still apply and that the admittance method is still a valuable tool. I look forward to reading a copy of the paper by White *et al* in the near future.

John Harrington-Lynn

Focus on insulation not district heating

I am writing in response to the ‘Power debate’ article in *CIBSE Journal*’s May 2012 edition, and the ‘Right solution’ opinion piece from the April 2012 edition.

This debate is obviously polarised. One side of the debate, as set out by Jones and Hamnett, believes district heating and combined heat and power (CHP) can save carbon emissions and is the best investment in our future. The other side – comprising housing associations using the technology, a few professional engineers such as myself and, indeed, the Department of Energy and Climate Change chief scientific adviser David Mackay – look at the available figures and are not convinced.

As I understand it, the theoretical benefits of the technology are marginal and could be lost in practice. The discussion would be clearer if we had data on the actual running of CHP and district heating systems – how much fuel was consumed, how much electricity was sold and how much useful heat was sold to the consumer at what cost. In my experience, the industry is reluctant to provide this.

I’ve asked the CHPA and been witness to DECC asking the industry – I don’t know if they have the data yet. I presume the energy services companies (ESCOs) have this data, because their business model is based on it.

A householder can pay 4p/kWh for gas burnt in an efficient boiler (and there are already concerns about

The thumbnail image shows a page from the CIBSE Journal. The main heading is 'LEARNING TOOL' in large, bold, orange letters. Below the heading, there is a sub-heading 'A new tool that combines the CIBSE admittance method with a user-friendly interface aims to make building physics more accessible to non-specialist and students on the construction sector. Tom De Saulles explains'. The page contains several columns of text, including a section titled 'The admittance method' and another titled 'The software provider'. There is also a photograph of a woman sitting at a desk with a computer monitor, looking at the screen. The overall layout is clean and professional, typical of a technical journal.



MANUFACTURER'S VIEWPOINT

Watering down the energy requirements for buildings will only store up problems for future occupiers. The government must not lose its nerve by loosening green regulation, writes **Martin Fahey**, of Mitsubishi Electric

There has been much said about Part L of the Building Regulations and whether the requirements for consequential improvements (CI) are a good or bad thing.

Some elements of the media took great delight in condemning how this will impact on the homeowner, who not only faces the bill to replace a broken boiler, but may have to face the cost of immediately insulating their home as well. Further alarmist noises were made around the prospect of a 'conservatory tax'.

However, if we are to get anywhere near government targets for emissions reductions, we have to make our existing building stock more efficient.

Overall, buildings in the UK now account for 35%* of all greenhouse gas emissions, which is more than either industry or transport.

Despite some ongoing and recent challenges, we do appear to be going in the right direction with new low carbon buildings.

However, it is estimated that around 75% of our existing buildings will still be in use in 2050.

The Department of Energy and Climate Change documents detail that around 80% of our heat demands are currently served by gas, and the Carbon Trust highlights that 90% of heating systems are not controlled effectively. So it is easy to see that the current status quo is not a sustainable proposition.

One of the primary difficulties with more stringent requirements, of course, is the finances, especially in these economic times. However, there is a strong economic argument for improving energy efficiency in terms of the significant reductions in running costs that can be achieved.

Businesses can also look to offset the capital costs of any renewable equipment they add into the work against their annual tax bill, as long as the equipment is listed on the government's Enhanced Capital Allowance (ECA) scheme.

Perhaps part of the problem is that with the current gloomy outlook, too few are prepared to take a long-term view and invest in their bricks and mortar.

At the same time, we hear daily reports that businesses are sitting on piles of cash, and are reluctant to spend it.

As an industry, we need to encourage that spend, not just for reasons of self-interest, but also to highlight how much energy – and money – can be saved.

Join in the debate by visiting our Green Gateway LinkedIn group, where you will also be able to view the latest thoughts of group members from across the UK building industry.

We also have a Twitter account @green_gateway, which offers followers a chance to receive up-to-the-minute news and views from those both within and outside the industry, including key opinion leaders.

Martin Fahey is sustainable solutions manager at Mitsubishi Electric and co-ordinator of the company's Green Gateway programme. Further information is available at www.greengateway.mitsubishielectric.co.uk

**The Carbon Plan: Delivering our low carbon future*



forcing low income tenants further into fuel poverty). From our enquiries, we've found that, provided the developer pays for the heat network, the cheapest an ESCO will sell heat to householders is 5p to 10p/kWh. On top of this, there are maintenance costs and standing charges for the network that can be more than that of a gas boiler.

The ESCOs are probably only paying 2p to 3p/kWh for their gas and presumably sell the excess electricity to subsidise the costs further. This pricing would allow the ESCO to burn several times the amount of gas a householder would in their domestic boiler to provide the

same amount of heat. There is no evidence in the financial model that any fuel or carbon savings will be achieved.

Finally, to argue that heat networks should be used in the future to provide heat from a variety of

sources is at best hopeful without knowing what the national energy strategy is going to be.

What are the consequences of putting a heat pump, solar panels, heat stores, waste incinerators, or biomass boilers at the end of the district heating system? Is it feasible? Is it a good idea?

Without the facts that this will save any money, fuel or CO₂, now or in the future, we shouldn't be moving forward with this policy as it distracts from solving the problem. The best option for now is to reduce the heating load we need to meet by investing in insulating our existing building stock.

Bill Watts, senior partner, Max Fordham

Obsolete solar hot water heating systems

As a retired CIBSE member I admire the innovation and green credentials shown by the younger and practising members.

I understand, however, that some are still specifying obsolete solar hot water heating systems that require anti-freeze and metal pipework.

On my retirement six years ago I had a solar hot water system installed in my house, which took less than half a day to complete, and is still significantly cheaper than the old fashioned systems, does not require a separate heating coil or heat exchanger, uses

food grade quality flexible tubing and is independent of mains electricity. It has worked perfectly with no maintenance requirement other than a six monthly replacement of water

conditioning crystals in the cold water feed and expansion cistern.

I hope that any CIBSE members specifying these older systems will consider this letter.

Mike Dewhurst

CIBSE Journal welcomes article proposals from any reader, wherever you are – whether it be letters, longer opinion pieces, news stories, people or events listings, humorous items, or any ideas for possible articles.

Please send all letters and any other items for possible publication to: asmith@cibsejournal.com, or write to Alex Smith, Editor, CIBSE Journal, Cambridge Publishers Ltd, 275 Newmarket Road, Cambridge, CB5 8JE, UK. We reserve the right to edit all letters. Please indicate how you wish your letter to be attributed, and whether you wish to have your contact details included.

To argue that heat networks should be used in the future to provide heat from a variety of sources is at best hopeful without knowing what the national energy strategy is going to look like

PRACTICAL AND PROPORTIONATE



HSE has launched a consultation on the future of Approved Codes of Practice. Hywel Davies looks at proposals affecting design, installation and maintenance of building services systems

In March I set out the findings of Professor Ragnar Löfstedt's review of health and safety legislation, *Reclaiming health and safety for all*. One of the key recommendations was for the Health and Safety Executive (HSE) to review its Approved Codes of Practice (ACOPs) by June 2012.

The HSE has now carried out an initial review of 32 of its 52 ACOPs, to consider whether the guidance is practical and proportionate, and whether it helps employers understand and meet legal obligations. Twenty ACOPs have not been included as they are associated with ongoing sectoral reviews or amendments.

This initial review considered: whether an ACOP was the most appropriate way to provide guidance on the issue in question; whether methods of compliance can be sufficiently described to provide reasonable certainty of compliance; what revisions are needed for accuracy; and whether advice is presented in a suitable format for the intended audience.

On 25 June the HSE launched a public consultation on its proposals to review 32 of the current ACOPs.

The consultation seeks views on HSE's proposal to revise, consolidate or withdraw 15 ACOPs by the end of 2013. It proposes to make either minor revisions or no changes to a further 15 ACOPs by 2014. Finally, it proposes withdrawing the ACOP for the Management of Health and Safety at Work Regulations 1999, replacing it with a set of new guidance materials by the end of 2013. It also seeks views on a proposal to set a 32-page limit on ACOP length, other than in exceptional circumstances.

ACOPs to be reviewed by the end of 2013 are in nine groups covering dangerous substances and explosive atmospheres, legionella, asbestos, gas safety, hazardous substances, workplaces, management of health and

safety, agriculture and pipelines. The following summarises the proposals.

ACOPs to be revised, consolidated or withdrawn

Dangerous Substances and Explosive Atmospheres Regulations 2002

L134 – Design of plant, equipment and workplaces

L135 – Storage of dangerous substances

L136 – Control and mitigation measures

L137 – Safe maintenance, repair and cleaning procedures

L138 – Dangerous Substances and Explosive Atmospheres Regulations 2002.

Offering advice on complying with the Dangerous Substances and Explosive Atmospheres Regulations 2002, the HSE proposes to consolidate these into a single revised ACOP (L138).

Legionella

L18 – Legionnaires' disease

HSE proposes to revise Part 1 of this ACOP, removing Part 2 and making it separately available as revised technical guidance. Due by end of 2013.

Asbestos

L127 – The management of asbestos in non-domestic premises

L143 – Work with materials containing asbestos

HSE proposes consolidating these into one revised ACOP, retaining and revising L143 and simplifying and incorporating L127 on 'duty to manage'.

Gas safety

L56 – Safety in the installation and use of gas systems and appliances

COP20 – Standards of training in safe gas installation

HSE proposes consolidating these ACOPs, revising L56 and clarifying what dutyholders can do to comply with legal requirements. Changes will clarify and, if possible simplify, definitions of



The consultation package seeks views on HSE's proposal to revise, consolidate or withdraw 15 Approved Codes of Practice

'gas fitting' (para 12) and 'work' (para 22-25), and update meters and flues in voids. The part on landlords' duties will be removed. COP20 is largely outdated and is proposed for withdrawal. Relevant material will be incorporated within L56.

Hazardous substances

L5 – The Control of Substances Hazardous to Health Regulations 2002

HSE propose revising this ACOP and improving other COSHH guidance for low risk sectors.

Workplaces and management of health and safety

L24 – Workplace health, safety and welfare

L21 – Management of health and safety at work

HSE proposes to revise L24 to reflect recent regulatory changes, and review other HSE publications providing guidance on related workplace health, safety and welfare issues, and to withdraw L21.

Pipelines

L81 – Design, construction and installation of gas service pipes

HSE proposes withdrawing ACOP and replacing with guidance.

ACOP L144 – Managing health and safety in construction is not being reviewed as part of this package.

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



CONSULTATION DETAILS

The consultation can be downloaded from www.hse.gov.uk

It closes on 14 September 2012. To contribute to CIBSE's response, email technical@cibse.org

£10 A WEEK TO SAVE THE WORLD

By misrepresenting the tuition fee issue, the British media is harming the country's ability to build up the engineering workforce it desperately needs, says **Dr David Tann**

Increasing the amount universities are able to charge in tuition fees was controversial and almost completely misunderstood. The negative publicity has been hugely damaging because it will undoubtedly lead to many youngsters – particularly those from less affluent backgrounds – opting not to take up valuable opportunities in further education.

In the case of building services engineering, the stakes are particularly high because of our role in helping the nation meet its energy needs.

Students all have access to loans and the repayments are not triggered until they start earning more than £21,000 a year. Their repayments can also be subsidised by employers in the future – and often are. However, it has suited some people with political agendas to present this as a debt just like any other.

The average repayment for a part-time student – the majority in our industry – is estimated to be the equivalent of £10 a week. This is a tiny price to pay for a highly rewarding career that offers a rare opportunity to enhance the built environment and tackle major issues like climate change.

Affordability

The earning potential of building services graduates is higher than many other professions – average salaries are around £34,000 after graduation. While this makes them eligible to make repayments earlier, our graduate engineers are better placed to afford them.

The negative publicity about finance is harming our industry. Employers and educators need to work more closely together to redress the PR balance and represent the opportunities offered by a career in building services, while also emphasising affordability.

We must not get this wrong. We are desperately short of skilled building engineers. Recent figures from the Institution of Mechanical Engineers (IMechE) suggest that we will need to more than double engineering

£10 a week is a tiny price to pay for a highly rewarding career that offers a rare opportunity to enhance the built environment



graduates in the next five years to keep pace with the UK's building and infrastructure growth targets.

In London alone, it is estimated that another 18,000 building services operatives are needed and that 60% of them should be graduates.

However, this is not just about numbers. The technical challenges faced by our industry are increasingly complex – successful graduates will be those with a full understanding of how building systems work.

There is a growing realisation across the sector that the archaic structure of our supply chain, which forces different professions to work in silos, hampers efforts to deliver properly integrated and, therefore, effective renewable and low carbon building solutions.

Young engineers are busily reinventing this. Collaboration and integration are second nature to them and are key to delivering low and zero carbon technologies that perform to their full potential. The industry is also facing a new skills challenge, with a particular focus on retrofitting existing buildings. This rapidly evolving backdrop presents new challenges to educators and also to employers.

Ironically, despite the increase in tuition fees, universities will be worse off. The change in fee structure is part of the government's strategy for relieving

itself of the burden of funding higher and further education. From now on the vast majority of the cost will be borne by students and employers – this will not deliver more money to universities.

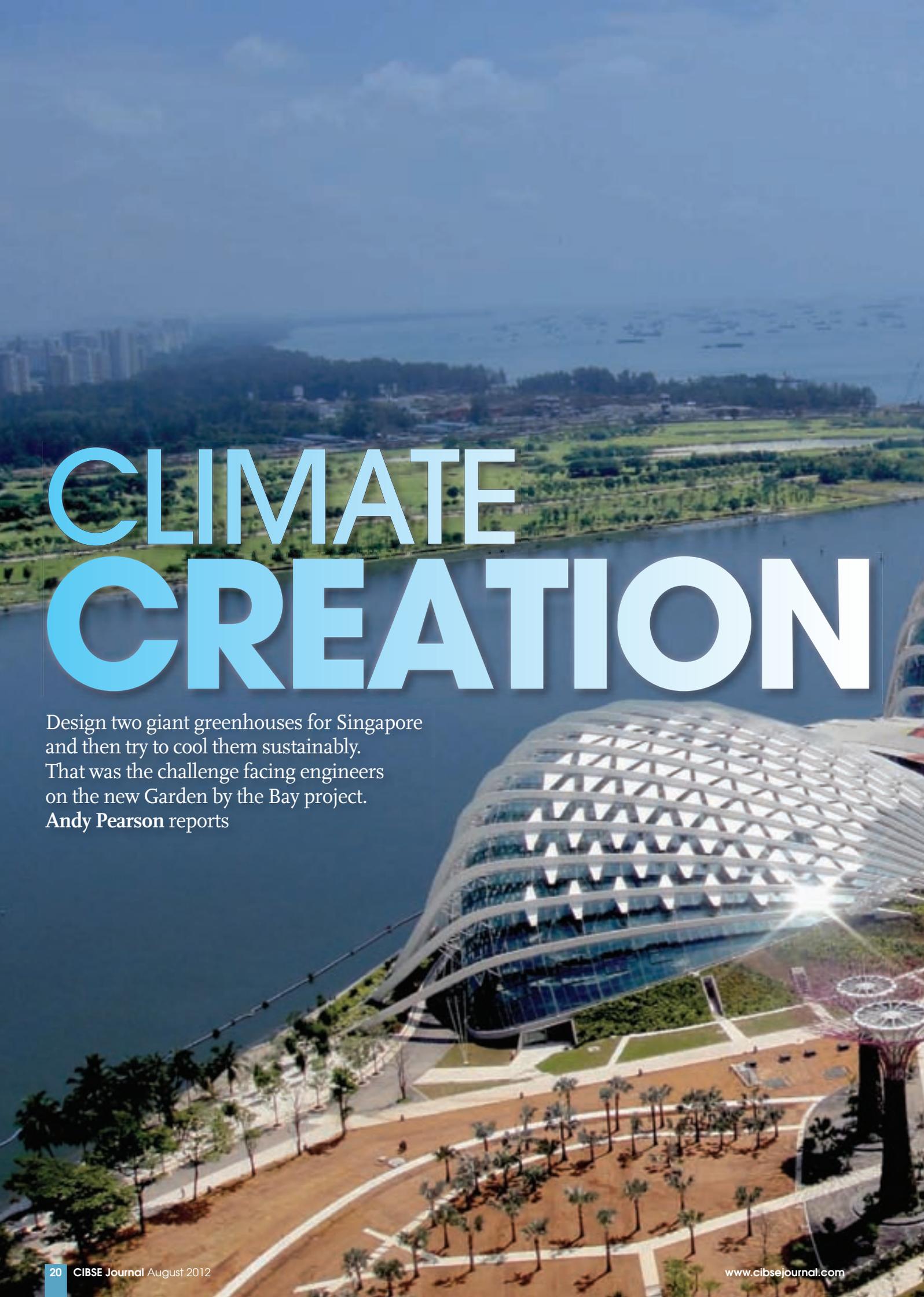
CIBSE's pivotal role

To produce this new breed of collaborative, multi-skilled engineers, we have to find new ways of supporting ourselves and, by extension, the industry. Our collaborations with industry will be even more important. We already co-operate through Knowledge Transfer Partnerships (KTPs); joint research; sponsored part-time study and so on – and we will have to do much more.

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• **DR DAVID TANN** is head of the Department of Urban Engineering at London South Bank University www.lsbu.ac.uk



CLIMATE CREATION

Design two giant greenhouses for Singapore and then try to cool them sustainably. That was the challenge facing engineers on the new Garden by the Bay project. **Andy Pearson** reports

Land has been reclaimed on Singapore's southern coastline to create three gardens that form the Bay project

All images courtesy of Adler Ten

If there were a prize for the least sustainable building project, then an air conditioned, giant greenhouse dome in Singapore would be a contender, you would think. But think again. Two such huge 'biomes' that have been constructed as part of the city state's Gardens by the Bay development, may have strong claims to being very eco-friendly.

The Gardens by the Bay comprise three public gardens being created on reclaimed land at the mouth of the river in the south of Singapore. The 52 hectare Bay South scheme includes landscaped gardens, a function room, concert arena, shops – and the two giant 20,000 sq m, scallop-shaped biomes that each has its own particular micro-climate. The biomes have been christened the 'Flower Dome' and 'Cloud Forest'.

The design team for the £400m Bay South project faced an unusual and exacting sustainability challenge in such a hot and humid climate: to air condition the biomes so that their projected carbon emissions

would be no worse than those of a modern Singapore office in November.

The Bay South domes, which opened to the public on 29 June, are air conditioned by circulating about 10,000 litres of liquid desiccant, burning 17 lorry loads of forestry waste a day, and cooling thousands of square metres of pathways and pavements.

Gardens in the tropics are noted more for their luscious foliage than for their vibrant flowers, so the Flower Dome has been designed to recreate the conditions of a Mediterranean spring climate. The Cloud Forest dome recreates the conditions of... well, what else but a cloud forest?

Conditions within the Flower Dome have to be maintained at 25C and 60% relative humidity (RH) during the day, and dropped to 16C and 80% RH at night. The Cloud Forest dome will be kept at a temperature of 25C, 80% or higher RH, during the day, and dropped to 17C, 80% RH at night. The project team's task was to recreate these cool environments beneath the domes' glass ➤

The real challenge of this building is trying to balance the light levels and heat with the comfort of the visitors

Below and main picture on facing page: the 'supertrees' are made of steel filigree surrounding a concrete core. Smaller images opposite: the roofing structure of the biomes



skins to enable the alien blooms to flourish at a latitude just 1.4 deg north of the equator, where the temperature is a constant 24C to 30C for 95% of the year.

The challenge of cooling the domes is made all the more difficult by the need to simulate seasonal fluctuations in air temperature. This is achieved by dropping the temperature at night in the Flower Dome by an additional 4C and in the Cloud Forest dome by an additional 1C. This temperature reduction takes place every night of every third month to simulate an end-of-winter condition to encourage the plants to bloom. 'The system has to be capable of going down to these very low temperatures at night because we cannot fight the solar gain during the day,' says Atelier Ten's Patrick Bellew, a member of the design team.

Balancing act

The first task facing the design team in developing a solution was to establish the relationship between the horticultural lighting requirements, solar gain and cooling load. The brief from the client, the National Parks Board of Singapore, was to achieve a level of 45,000 lux for the same number of hours as the domes at Cornwall's Eden Project, where similar plant species had flourished. 'The real challenge of this building is trying to balance the light levels and heat with the comfort of the visitors,' says Bellew.

Achieving optimum daylight levels while minimising the heat gains for the glazed

structures required extensive daylight modelling. The domes were positioned adjacent to the river estuary to avoid being shaded by the tall buildings planned for the surrounding area.

However, in addition to buildings, daylight analysis of the initial designs highlighted a problem of shadows cast in the mornings and afternoons by the proposed structural solution. Conversely the structure was also found to provide insufficient shading from the intense midday sun. 'Being close to the equator means direct solar radiation is intense when the sky is clear. However, Singapore can also be quite cloudy for long periods and the luminance levels under these conditions can be lower than in a Mediterranean summer,' says Bellew.

As a result of the modelling, the initial structural solution of a fin-shaped truss gave way to a self-supporting structural gridshell with additional lateral stability provided externally by a series of giant steel arches. The advantage of this solution is that the elements of the grid shell are relatively slender to enable sufficient daylight to reach the plants. 'It gave us the best overall transparency to daylight so when there is no sunlight we still get very high light levels,' Bellew says.

Glazing selection was also critical to the scheme's success. It needed to have a high degree of transparency to meet the target daylight requirements for times of high cloud cover but it also needed to be able to filter out the infrared frequencies to minimise heat gains from the intense tropical sun on cloud-free days.

'When the sun does come out it is 1,100 W/sq m, so it is pretty toasty,' says Bellew. The team modelled a variety of options including ETFE pillows and single glazing, but these were unable to filter out sufficient infrared. In addition, the single glazing would also have been prone to condensation when not in direct sunlight.

Double-glazing with a low-e coating applied to the inner face of the units' outer pane was found to provide the best solution. It allows 65% of daylight frequencies to pass through with only 35% of solar heat transferred. 'We wanted sufficient light but no heat' explains Bellew.

In addition, a series of 7m x 10m retractable, cable-tensioned, triangular blinds have been incorporated into the supporting structure outside the domes for use on sunny days. The blinds also provide added resilience in case of system failure.



Hot challenge

Once the domes had been designed, the next task was to find a way of dealing with the heat loads. The design team's goal was to make the domes' servicing invisible to avoid the flower displays being surrounded by the clutter of louvres, chillers and air handling units.

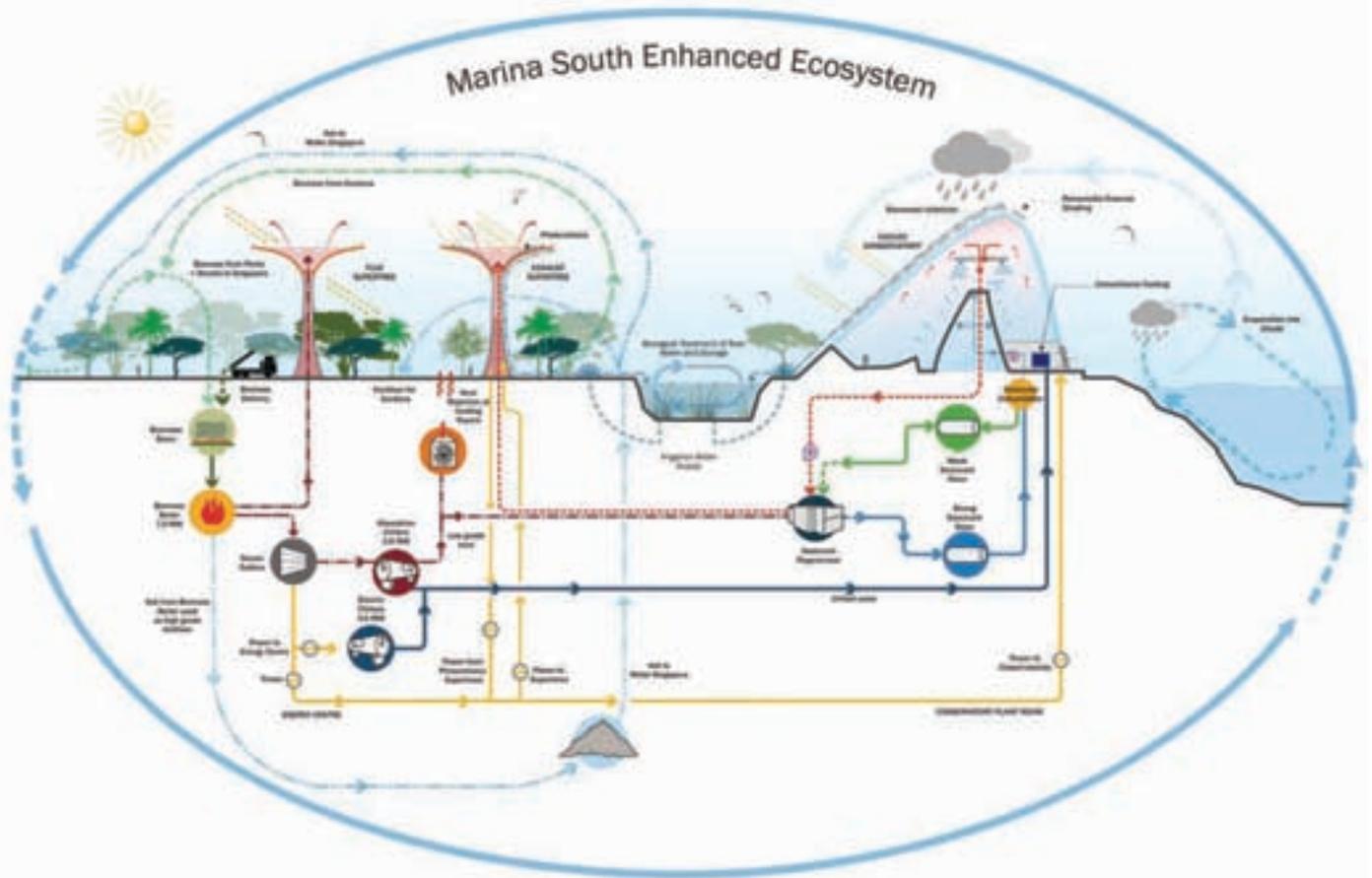
For the Flower Dome, Atelier Ten opted for a displacement ventilation system combined with a network of chilled water pipework embedded in the concrete screeds of the paths and circulation areas. The displacement ventilation system is the primary source of cooling. Conditioned air is supplied at low level within the occupied zone. This solution limits the volume of air needed to cool the large glazed space and to keep the visitors comfortable. Even so, 110cu m/s of conditioned air is supplied through ducts which measure up to 5m x 5 m, which

have cleverly been incorporated into the landscaping. The chilled air is supplied at a temperature of 18°C, 80% RH, (or dryer) through grilles concealed in the edges of flower beds and through diffuser bins concealed within the planting

The displacement air helps to pressurise the dome to prevent infiltration. As the air heats up it rises to the top of the dome where a proportion is allowed to disperse through openable vents. The remainder of the air is extracted, mixed with up to 20% fresh air and recirculated, or used to regenerate the desiccant that forms part of the cooling system.

In addition to the air system, the dome is cooled by chilled water pipework cast into the hard landscaping and pathways at a temperature just above the dew point of the air within the space. While the vegetation removes solar radiation by converting the

“ We've stretched every sinew to make the most of the resources at our disposal from the local climate and environment



This image shows the workings of the ecosystem of the South Bay site

► heat into chemical energy, this simple solution works by absorbing the solar radiation as soon as it strikes the ground, and before it has had the chance to re-radiate as heat into the air.

‘The chilled floors are about preventing heat gain,’ says Bellew. As a result displacement ventilation is kept to a minimum while the chilled surfaces of the paths help to keep the dome’s 2,000 visitors an hour comfortable.

Cool blast

The environmental solution in the Cloud Forest dome is similar to that of the Flower Dome, with a displacement ventilation system and chilled pathways but, in addition, this dome has jet diffusers and evaporative misters to increase humidity and air movement. The climate will simulate a mountain cloud forest – a fact emphasised by the large man-made mountain contained within the space. This 40m high construction is home to the world’s highest indoor waterfall and a series of exhibition spaces cast into its slopes and aerial walkways to take visitors through the tree tops.

This dome was originally intended to be cooled using displacement ventilation alone. However, computational fluid dynamics

analysis showed that warm air would have collected near the top of the mountain, making it too hot for the plants and too uncomfortable for visitors. As a result displacement diffusers at the mountain’s base and peak have been enhanced with the addition of jet diffusers concealed in the mountain’s slopes to deliver 110 cu m/s of conditioned air. The jet diffusers blast cooled air into the dome, mixing the air and preventing it from stratifying over the height of the mountain.

Above the mountain, stratification is allowed and this is where the extract air intake has been located. The removed air can either be cooled and recirculated or used to regenerate the desiccant.

Evaporative misters, mounted on the underside of suspended walkways, will add a fine spray of water droplets to the dome’s air. This will increase humidity within the space; the droplets will also absorb heat as they evaporate, reducing the cooling load.

The 8,000 kW of cooling needed to air condition both domes is supplied from plant hidden from view in the adjacent five-storey plant room, which is located beneath a hill south of the domes.

In keeping with the garden theme the primary source of energy for the cooling system is waste wood. The client, the National ►

PROJECT TEAM

Client: National Parks Board of Singapore

Landscape architect: Grant Associates

Sustainability and building services: Atelier Ten

Local M&E engineer: CPG Corporation

Structural engineer: Atelier One

Architect: Wilkinson Eyre

Boiler and turbine contractor: EcoWise

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Seventeen 'supertrees' are arranged in three clusters on the site

► Parks Board, is responsible for about three million trees, which generate about 5,000 tonnes of hardwood waste a month. Instead of being dumped in landfill, the forestry residue is chipped and mixed with dry wood from waste shipping containers from the nearby port. It is then burnt in a 30 m long, 16 m high 7.2 MW biomass boiler, situated in the site's energy centre, to create superheated steam. This is used to drive a turbine generating 1.2 MW of electricity to power the four centrifugal chillers that cool the domes' supply air, and to meet part of the site's power requirements.

'The domes are effectively carbon neutral for cooling, if you ignore the carbon transporting the materials to site,' says Bellew. The resulting ash is split into two steams: fine ash, which is high in nitrates, is mixed with the park's vegetation waste to make fertiliser; while the larger ash particles are taken off-site for use in concrete manufacture.

Chilled solution

The chillers are able to draw electricity from the grid when the generator is not working. As a secondary backup, the domes are also connected to the Singapore district cooling network. In addition to driving the electric chillers, the high temperature hot water downstream of the steam turbine also drives two absorption chillers.

'Because the biomass boiler and steam turbine are not easy to modulate, the absorption chillers serve as a heat dump to help stabilise the system, in addition to providing the base cooling load,' says Bellew.

The combined outputs of the chillers meet the domes' sensible cooling requirements.

The chillers are connected to a variable

temperature chilled water circuit, which supplies the air cooling coils and floor cooling loads. The system's elevated evaporator temperatures ensure significant energy savings are achieved by increasing the chillers' efficiency. Cooling towers situated on the upper level of the energy centre reject surplus heat from the circuit.

In addition to the absorption chillers, heat from the biomass boiler is also used to regenerate a liquid desiccant circuit. The desiccant removes moisture from the fresh air supply to the domes, which means it requires less energy to cool it. The fresh air passes through the desiccant and is mixed with the return air before passing over the cooling coils to lower its temperature before it is supplied to the domes. Water removed in regenerating the desiccant is exhausted to atmosphere through a flue concealed in the trunk of one of the scheme's giant, man-made 'supertrees'.

Green giants

The supertrees, which are up to 50 m high, are a feature of the landscape. There are 17 of them located in three clusters on the site. Their trunks are actually formed from steel filigree surrounding a hollow concrete core; the metal lattice acts as a supporting frame for vegetation to climb up. The trees are topped by steel branches, which, in seven of the trees, support photovoltaic panels to generate additional power for the site. In addition to concealing the exhaust from the desiccant regeneration, the trunk of another tree conceals the main boiler flue. Two supertrees even contain lifts to carry visitors up to an aerial walkway, while another houses a treetop café.

Amazingly, given that this is a scheme to air condition two giant greenhouses, it is aiming for Platinum accreditation under the Singapore Building and Construction Authority's Green Mark scheme, the country's equivalent to LEED and BREEAM.

Can constructing two domes on the equator, and then modifying the climate within, ever be described as a sustainable proposition? 'Perhaps not,' says Patrick Bellew, 'but given that the scheme was going to be built in any case, Atelier Ten has succeeded in developing a solution with a positive outcome.'

He concludes: 'We've stretched every sinew to make the most of the resources at our disposal from the local climate and environment, and endeavoured to identify virtuous cycles where the project can be beneficial to the local environment.' **CJ**

How the liquid desiccant works

More than 10,000 litres of liquid desiccant are used to dehumidify the air for the giant biomes at Bay South. Liquid desiccant, rather than solid desiccant, was used on this project because it allowed the supply and exhaust air ducts to be located in different parts of the biome.

A highly concentrated solution of lithium chloride dissolved in water is sprayed into the stream of fresh air. 'Desiccant helps strip the moisture down to 30% relative humidity,' says Atelier's Patrick Bellew.

As the air passes through the liquid curtain, the desiccant removes moisture without altering the air's enthalpy. As it dries the air, the concentrated desiccant solution absorbs moisture, diluting it and increasing its volume so that more of the solution leaves the airstream than is sprayed into it.

The weak solution is regenerated by boiling off

the excess moisture using waste heat before it is returned to the system.

The drying process slightly increases the temperature of the airstream, which then has to be cooled to the supply condition by passing it over a conventional cooling coil. According to Bellew, this is a much more energy efficient solution than the conventional one of removing moisture from the air by passing it over a cooling coil – which has to cool it more than is necessary to remove the moisture – and then reheating the air to supply condition.

Because desiccants store energy in the form of latent heat of vaporisation of water, rather than the specific heat of water, the concentrated desiccant solution in the system's giant buffer tank stores about 10 times more energy than in the equivalent volume of chilled water. The stored desiccant will help balance supply and demand loads.



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HEATING

HERITAGE

An award winning air-source installation at a Georgian mansion shows how energy costs can be minimised for some of the most challenging properties, writes **Jackie Lambon**

Newton Hall, built in 1722, was the home of the Widdringtons – an influential landowning family associated with Northumberland as far back as the 12th century. The house was most recently owned by William Widdrington, who died in 2009. The Grade II listed property was subsequently bought by Paul Hindhaugh, managing director of Hindhaugh Homes, who wanted to restore it into a family home.

The new owners knew they would be high energy users in this very large property, because its historical importance meant they were limited in what they could do to



“The only way they could heat the property cost effectively was to look at getting an even heat distribution from underfloor heating and marrying it with renewable technology

prevent heat loss. With the grand house boasting high ornate ceilings and decorative plasterwork on the inside, and protected decoration and detail on the outside walls, they could not install any insulation apart from in the loft. The property also had to keep the single-glazed sash windows.

They decided that the only way to heat the property cost-effectively was to look at getting an even heat distribution from underfloor heating, and marrying it with renewable technology.

The main driving point for Hindhaugh in choosing renewable technologies was to minimise heating and hot water costs. When the original calculations, based on oil, were carried out (oil was the previous heating fuel method), it was estimated that the house would cost nearly £2,000 per month to maintain at a constant temperature of 21C (based on oils costs of

about 65p a litre).

Hindhaugh called in HT Energy, which had installed a ground-source heat pump in Hindhaugh's last building project. Initially a ground-source system was looked at, but it was calculated that the property would need as many as 10 boreholes. As well as the high capital costs involved, this number of boreholes posed siting problems because of the property's large-scale formal gardens.

It was decided that an air-source system could be installed, and located by the side of an old timber studio that was about to be pulled down and rebuilt. The decision proved to be a good one: the Newton Hall project won the Domestic Air Source Installation of the Year gong in the National Heat Pump Awards 2012.

The heating system at Newton Hall comprises four F2015-11kW units, which are controlled by an SMO 10, running in a

Solar thermal panels are controlled by the heat pump system



► cascade system. The first air-source unit is dedicated to hot water. A VPB500 500-litre hot water tank is linked to a NIBE solar thermal system, with a 500-litre buffer tank for the central heating.

The underfloor heating system throughout the property is run off this buffer tank, which provides back-up in the event that all the zones shut down. Linking in to the air-source system are three solar panels with a pump station and heat exchanger, where the potable water passes through and then returns to the VPB cylinder.

The solar thermal panels are designed to work with the heat pump, which means that it is not necessary to have a separate solar controller – the built-in heat pump controller is able to control the solar panels.

Hindhaugh Homes will now only install renewable heating systems within their properties, not only for environmental reasons but because they also gain an extra selling point – although their developments may be large, luxurious barn conversions, they won't cost the earth to heat. **CJ**

● **JACKIE LAMBON** is marketing manager for NIBE Energy Systems

6 The new owners knew that they were going to be high energy users in this very large property, as they were limited in what they could do to prevent heat loss

Low carbon plan: Firms back heat pump strategy



A family poses with their new air-source heat pump, installed in social housing

A number of energy companies and heat pump manufacturers have jointly backed a strategy that they claim shows how industry and government can achieve a 'radical decarbonising' of residential heating in the UK by 2030.

They have commissioned a report by Ecuity Consulting, which argues that a long-term regulatory strategy must be in place, alongside necessary investment, to encourage heat pump uptake. According to the report, elements of this regulatory plan could include:

- Looking into innovative solutions to link the Green Deal with the Renewable Heat Incentive (RHI) to enable consumers to obtain up-front capital;
- Reviewing the case for raising the noise threshold for air source heat pumps under

Permitted Development Rights from 42 dB to 45 dB to limit installation complexity; and

- Reviewing specified default efficiency values for air source heat pumps, and recognition of hybrid heat pump solutions under the Standard Assessment Procedure (SAP), to reflect the performance of new products.

The report contains the results of detailed modelling of RHI possibilities for different tariff and duration options. It proposes setting a tariff duration of less than 10 years under RHI Phase 2 for the domestic sector, to combine cost effectiveness with adequate consumer incentive.

The report calls for the use of Building Regulations, in retrofit as well as in new build, to push the decarbonising of residential heating systems to new limits towards the end of the decade, without the fiscal burden that accompanies incentive schemes. It claims this would allow a range of low carbon heating technologies to compete fairly, and would move the UK's heating stock beyond today's default option of high efficiency gas boilers. It says a similar change in Building Regulations, successfully transformed the residential heat market by outlawing lower efficiency systems.

The backers of the report are British Gas, EDF Energy, e.on, Daikin, Kingspan, Mitsubishi Electric, NIBE, and Vaillant.

The report *6.8 million Heat Pumps by 2030: from Vision to Reality* can be downloaded at www.quity.com under the Knowledge section.



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The use of Building Information Modelling for the design of new hospital facilities in Bristol shows how this approach could benefit the NHS more widely. **Ben Roberts** explains

MODEL PATIENT

A new £50m ward block is currently under construction at the Bristol Royal Infirmary (BRI). The team has designed the project using a fully collaborative Building Information Modelling (BIM) approach, and this is now being continued through the construction phase, with the aim of integrating the designers' models with the building operators' processes.

BIM was a requirement from the contractor from early stage D in 2009. The architect, structural engineer and MEP consultant were all new to BIM and adopted new software to learn on the job. The University Hospitals Bristol NHS Trust supported the decision and is looking at how it can benefit after handover.

The contractor, Laing O'Rourke, made protocols available from the start, setting a standard for how the project was to be delivered. The project protocol focused not only on model set-up good-practice, but also on requirements for exporting the model to software for off-site manufacture.

Design team members have used their BIM models from stage D for production of drawings and schedules, creating visualisations for lighting design





PROJECT TEAM

Main client: University Hospitals Bristol

Architect: CODA Architects

Structural Engineer: AECOM

Mechanical/electrical/plumbing consultant: Hoare Lea

Procure 21 Contractor: Laing O'Rourke

M&E sub-contractor: Crown House technologies

BIM: Challenges and lessons learnt

During the design process, the team faced some limitations and difficulties with the BIM approach, and many lessons have been learnt to improve the implementation of future projects.

The team were able to identify a number of previously unforeseen coordination issues using automated clash detection. However, we first had to align the three models and wade through thousands of clashes. The team very quickly learnt that it is essential to get protocols right from the start, in order to make such processes effective. In this case, clash detection at an earlier stage with more basic models would have saved much time during detailed design.

At the start of the project, much of the software was immature (particularly MEP software), and links between software platforms were very cumbersome to begin with, so many of the 'ideal' BIM methods were put aside. The capabilities of the software have now improved, and it is also

much quicker to transfer models to other packages such as thermal analysis or visualisation software. Hopefully this will further improve and extend to links with all analysis packages, as this will be a key opportunity for supply chains to provide the NHS with a more streamlined workflow.

All the teams used the same software platform for reasons of interoperability. If you are using different platforms, it is well worth trialling file exchanges and identifying problems at the start of the project.

BIM supports NHS aspirations because it requires full collaboration between the supply chain and client. By adopting BIM from the early stages, the design team naturally collaborated to resolve issues. Using the 3D model made problems obvious and often presented clear options for resolutions. Sharing responsibility for these problems meant that the team could decide upon the best solution in each case and assign an action accordingly.

Model ownership and responsibility are often raised as concerns with this approach, but for this project, the responsibility did not differ greatly from a traditional approach. Each team member was responsible for their own model and it was agreed what would go in each model. Any information formally issued is the responsibility of the issuer. Models can be passed on as 'work in progress' for development by others (such as for fabrication), but anything issued from this model will then be 'owned' by the new issuer.

The interface between MEP designer and installer needs to become more collaborative, with the installer providing their requirements before the design model is created, and with the designer monitoring the implications of changes after detailed design. This way, ownership of the model is passed over at a recognised stage, but information is shared between the two parties in order to smooth out the handover process.

Hoare Lea



or planning submittals, embedding automated calculations into virtual equipment, circuiting and automated panel schedules, and links to prefabrication software. The combined models were used for co-ordination and clash detection, sequencing, client presentations and for discussing design intentions.

The team are now looking at the feasibility of the Trust using the model to monitor and maintain the building. It may be linked into software tools for asset management or with the building management system (BMS) to assist with controlling and monitoring systems. The Trust will be responsible for keeping the model up to date, and for providing future teams with access to the record models.

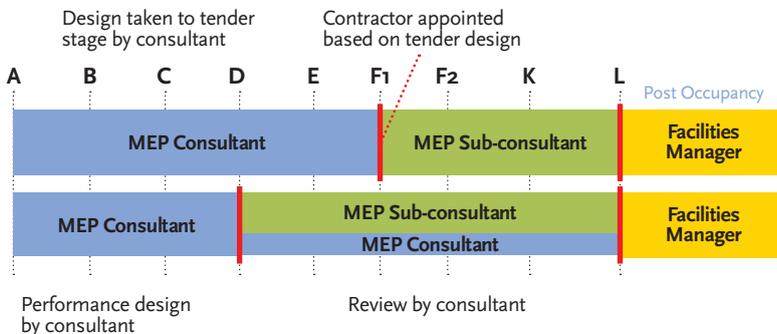
A BIM approach suits healthcare projects for a number of reasons. The requirements of the end-users in hospitals are very specific, meaning there is much communication between the occupants and designers. As non-technical users, it is much easier to convey design intention using a virtual representation of the rooms.

Hospitals typically host a wide range of MEP systems, and service distribution routes are often congested. Coordinating these accurately before starting on site is of significant benefit to buildings with complicated servicing strategies. Healthcare buildings often use prefabrication for this reason and, if standard modules are ascertained during the design stages, they will not have to be reinvented after detailed design.

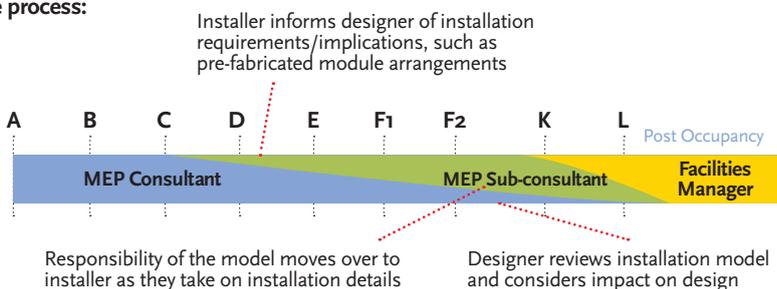
In addition to co-ordination, the diverse range of services means that hospitals generally consume a lot of energy during use. Although the technology is in its infancy, operators can link the BIM model to their BMS in order to monitor performance against the design intent.

Improved collaboration and communication between designer and installer

Traditional process:



Collaborative process:



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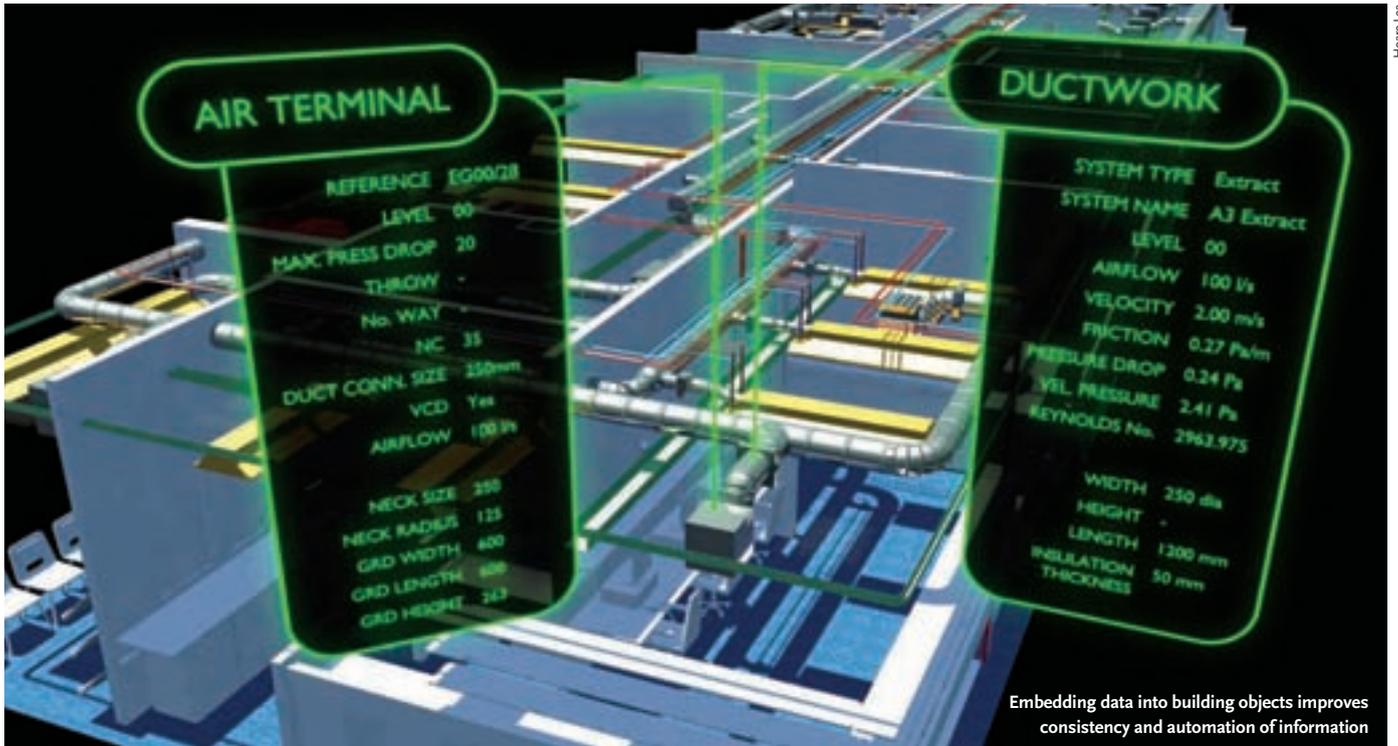
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Hoare Lea



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► This is the aspiration for the ward block. By bridging the gap between design and operation, there is an opportunity for users and designers to improve their understanding of how buildings can be operated more efficiently, offering potentially large energy savings.

The NHS is keen to drive the reduction of waste in construction and building management. It has its own targets as well as BREEAM and other government targets (See 'Advice for NHS Trusts as construction clients', Waste and Resources Action Programme, March 2010).

The ward block took advantage of prefabrication wherever possible, and fabrication details were taken from the designers' BIM models. Structural and architectural modules were taken directly from the designers' models; whereas prefabricated MEP modules were taken from the installation model.

Hoare Lea is now working with Crown House to streamline the transfer of models from consultant to installer, as this is seen as an opportunity to save time and cost during production stages.

The project was delivered using Procure 21, which promotes collaborative working and continuous improvement through early stage contractor appointment. Having contractor and installer involvement through the early design stages of a BIM project enables the team to consider fabrication requirements as the design model is being created; thus reducing the

need for reworking after detailed design that occurs on a traditional project. Early contractor involvement is very important for successful BIM implementation whatever the sector.

The use of PFI or LIFT procurement means that construction teams are often also responsible for energy management during occupancy. As with early contractor involvement, having input from building operators from the outset enables greater understanding of building use and BIM's potential for FM and building management. This will be important for all PFI procured projects and will enable the facility manager to understand maintenance requirements and the design intent of installed systems. These procurement routes are more suitable for collaborative BIM projects than the traditional design-and-tender process.

This was Hoare Lea's first fully collaborative BIM project and we found it a positive experience. We are delivering further BIM projects in healthcare and other sectors, and developing our knowledge and capabilities to the next level.

Despite a steep learning curve, benefits outweighed problems and we delivered the project successfully. As MEP consultants, we have been able to take advantage of many efficiency improvements in order to offset the effects of the learning curve, even on our first project.

Ben Roberts is senior mechanical engineer at Hoare Lea

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POWER SHORTAGE

The boom in renewables will be short-lived if systems fail to generate green energy. Proper monitoring is essential to identify failing systems and ensure renewables don't become a byword for profligacy, argues **Tony Day**

The deployment of renewable energy systems in buildings is on the increase. Government incentive schemes, planning requirements and building regulations are driving the uptake in technologies such as solar photovoltaics (PV), heat pumps and biomass boilers.

The installations have the potential to achieve significant energy savings, but only if they are metered properly to ensure they are performing properly. While metering of these systems is mentioned in building regulations, there is no requirement for proving that the systems actually save energy or carbon. Systems installed for planning purposes may never actually be put into use, which is a significant waste of investment.

To be eligible for the Feed-in Tariffs (FiT) scheme and Renewable Heat Incentive (RHI) there must be a report on energy generated, but this doesn't mean system owners have to check whether the systems are delivering real value for money.

Renewables must be monitored or

government risks wasting taxpayers' money on installations that do not work. Monitoring and targeting (M&T) systems will help ensure systems perform according to original expectations and will identify system failure and deterioration of performance.

M&T systems can be adapted for renewable energy systems and can provide a holistic picture of building energy and carbon performance. This integration of reporting will ensure that renewables are not merely an expensive bolt-on solution for carbon reduction.

As renewables become included in Energy Performance Certificates (EPCs), it is important that measurement and verification (M&V) regimes transparently demonstrate real performance for both contractor and client. In many cases, this requires careful consideration of how M&T systems need to be designed and set up, and an awareness of what could go wrong.

Renewable energy technologies are installed with the aim of saving carbon

Robust monitoring and targeting is vital as renewable energy technologies are still unfamiliar territory to maintenance teams, and they may not be experienced in the tell-tale signs of underperforming systems

emissions and reducing imported energy dependency. Where subsidies such as FiTs and RHI are eligible, renewables also come with a promise of real cost savings for building owners. However, they are expensive to purchase and install, and the savings they are expected to deliver are often very sensitive to the actual energy delivery.

Many renewables (particularly PV) come with simple monitoring systems and displays. But do these ever show comparative performance against expectation? What does that mean, and do system owners spend time looking at whether value for money is actually being achieved? This becomes an issue if there are numerous renewable energy assets across a dispersed estate.

Renewable energy systems normally have some form of backup – PV systems are grid connected, and renewable heat systems will normally have fossil fuel backup – so if the renewable system fails, there will not be a loss of service. However, there needs to be a trigger or alarm in place to ensure that the renewables are continuing to do their part. If renewables are not set up with an adequate M&T system (and many are not even set up with simple alarms),

it is possible that system failure will go unnoticed for months, as the backup system quietly kicks in.

Robust M&T is vital, as renewable energy technologies are still unfamiliar territory to maintenance teams, and they may not be experienced in the telltale signs of underperforming systems.

What can go wrong?

Different technologies have different potential problems to watch out for, and a few are discussed here.

PV systems suffer disproportionately from shading. A study at London South Bank University¹ showed that an 11% loss of direct annual sunlight led to a 28% reduction in electricity generation. Even seemingly trivial shading such as a handrail around a roof, or a tree branch, can change the resistance characteristics of a whole array, seriously reducing output.

The causes of shading may have been overlooked during design and installation, or may be introduced at some point after installation – for example, a mobile phone mast might be erected on an adjacent building. There is little protection of renewable energy systems in the planning

Calculating PV performance

Modified Cumulative Sum Difference (CUSUM) techniques can be a powerful monitoring and reporting tool for renewable energy systems. For PV systems, we expect a linear (or near-linear) relationship between electricity output and solar irradiation (measured in kWh/m²). Figure 1 shows just such a relationship over six months for a PV array. The excellent relationship suggests the system is performing reasonably well. CUSUM analysis uses the equation of this line to predict output of the system for prevailing irradiation conditions, and compares this with the actual output.

The differences between actual and predicted outputs each month are cumulatively summed to give a running total of over- or under-performance. Figure 2 shows the 12-month CUSUM for this array, the first six months of which are the period covered in Figure 1.

It is apparent from this graph that after February the performance of the system deteriorated rapidly, and that between

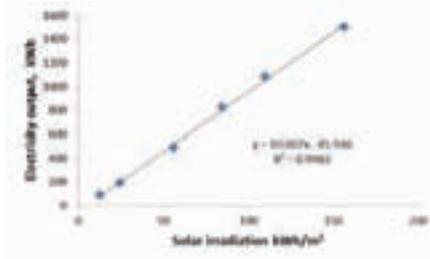


Figure 1: Regression line for PV electricity output against solar irradiation over six months

December and January approximately 1,100 kWh of potential electricity generation was lost. This equates to more than 0.5 tonnes of unavoids CO₂ emissions, and around £360 of lost FiTs payments. Contrast this with a CUSUM for a well-performing PV array over the same period (see Figure 3) where little deviation from predicted output is observed. This method of monitoring can be fully automated to provide current savings or waste and incorporate alarms to highlight changes in performance.

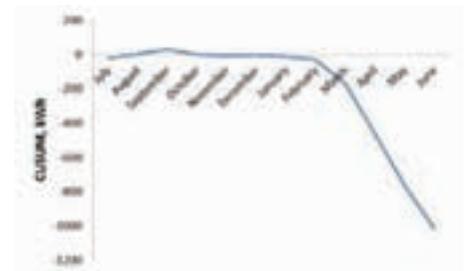


Figure 2: 12-month CUSUM for the PV array in Figure 1

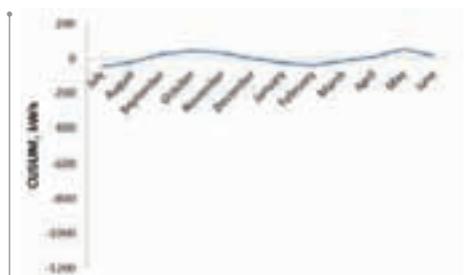


Figure 3: 12-month CUSUM of a good-performing PV array

system against future shading factors.

PV systems may also need cleaning. Where they are installed at shallow angles (less than 20°), they may not benefit from self-cleaning. Algae or moss growth can be common. And because they are located on roofs, it may not be easy to keep a visual check on the need for cleaning. They can also suffer from bird damage or fouling, or damage from objects blown in strong winds. All of these are unpredictable and possible almost anywhere.

PV systems also suffer from inverter failure. Multiple inverter systems might experience partial component failures that could go unnoticed for a long time.

Solar thermal systems also suffer from shading, but this is less of a problem than with PV. More significantly, solar thermal systems need to be viewed as any other hydronic thermal system in terms of their maintenance and operating requirements. Solar collectors regularly experience temperatures in excess of 100°C , and the primary circuits must be adequately pressurised. Any loss of working fluid and pressure can result in vaporisation and flow failure. Primary flow is often initiated by a differential temperature being sensed



Badly sited installations don't help

Courtesy of NHERC Foundation

between the collectors and the thermal store. If the controls fail or drift out of calibration, the system won't work properly.

Some systems use heat dissipation circuits that operate in times of low or no demand. These introduce another set of control elements (sensors, valves and

actuators) that can cause problems.

Heat pumps (ground or air) are considered renewable due to the high ratio of ambient energy transfer to fossil fuel input. However, there is only a true carbon advantage of using heat pumps over gas-fired condensing boilers if the average coefficient of performance

This calculation uses solar irradiation data, which may not always be available for a particular site. Sunshine hours may be a good alternative, provided a good relationship can be established for that site. Another, and perhaps better, alternative is to use the original predicted monthly energy yields. At the feasibility/design stage it is likely that the consultant will have used some modelling to predict the yields in order to forecast carbon savings and financial benefits. These predicted (or target) values can be used in place of the regression analysis equation to produce the CUSUM graph. Figure 4 shows this for the system presented in Figures 1 and 2. Notice similar trends with Figure 2, showing when the system began to deteriorate significantly. Using this method can still provide a tool for early corrective action.

Again, contrast this with Figure 5, which shows the CUSUM against consultant predictions for the well-performing system shown in Figure 3. This shows that the system consistently out-performs predictions, and the actual rate of return can be recalculated

and compared with the original investment decision. Reporting such successes can be every bit as important as spotting and fixing failing systems.

Other technologies

The same principles shown here can be adopted for the other technologies discussed in this article. However, the variables used to measure performance may change, as may the calculations for reporting savings. For example, the performance of a heat pump will depend on the heat demand (and therefore degree-days), and its comparison to a hypothetical alternative plant (for example, a gas-fired boiler). Solar thermal systems present other issues, as there may be a mismatch between supply (solar irradiation) and demand (hot water/occupancy levels), which need to be accounted for. Measurement and verification systems, therefore, need to be set up with care, and a good understanding of the monitored technology and its intended use is essential.

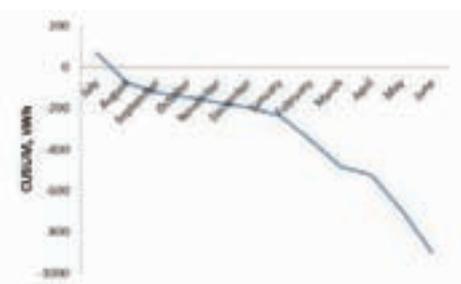


Figure 4: CUSUM chart based on actual minus predicted monthly electricity yields from consultant feasibility study

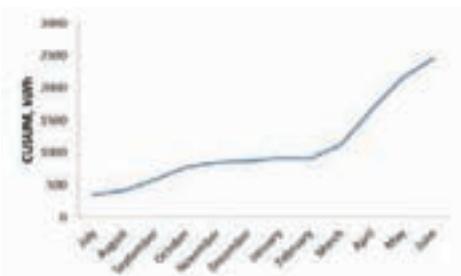
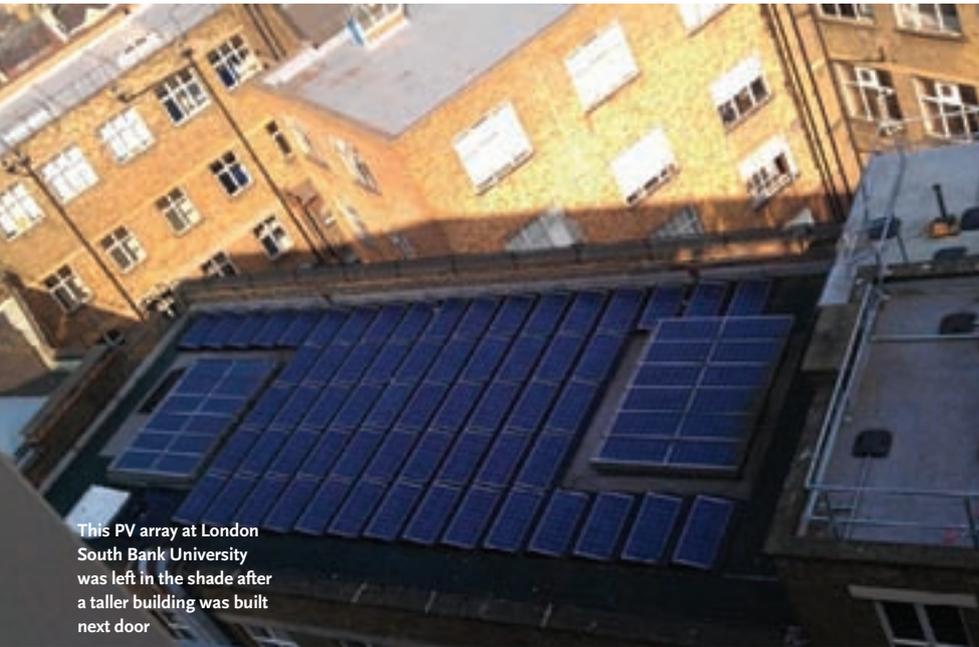


Figure 5: CUSUM chart for a well performing system measured against consultant predictions



This PV array at London South Bank University was left in the shade after a taller building was built next door

Photo courtesy of Energy Performance Ltd

sited on rooftops or, more commonly now, adjacent to buildings. The most common problems are wind shading from surrounding buildings, lower-than-expected local wind speeds, or control gear failure. Local wind regimes are probably the most difficult renewable energy resource to predict, and because the output of a wind turbine is proportional to the cube of the wind speed (up to the rated output), this is probably the dominant factor in turbine performance.

What to monitor

Each technology discussed above will have different monitoring and reporting requirements, although each can ultimately be reported in terms of energy, money and carbon saved over a specified period of time. If continuous monitoring is employed, there is an excellent opportunity to undertake condition monitoring, to check against expected savings, to report successes, and to ensure early rectification of faults.

Considering the high cost of renewable installations and the sensitivity of returns to real performance, not to do this would appear rather cavalier (see box on *Calculating PV performance* on previous pages).

The FiTs scheme in the UK has seen more than a gigawatt of PV installed in the UK. The RHI is promising to help renewable heat technologies become established by offering additional subsidised payments. Any widespread failure will discredit renewables and constitute a vast wasted investment. Proper monitoring, measurement and verification is important for all energy systems, not least for renewables.

By incorporating renewables into effective M&T systems, they can be properly viewed in conjunction with other carbon and energy reduction strategies – not as a separate side-show.

If managed properly, these decentralised and dispersed systems can benefit the UK with widespread carbon reductions and less reliance on the imports of fossil fuels. And on a local level they offer a much better return of investment than the bank on the High Street. **CJ**

References

1. N. Moore and A.R. Day, *Shading impact of a new building on an existing photovoltaic array in London*, Sustainable Urban Development in Buildings and Environment, Chongqing, September 2011

● **PROFESSOR TONY DAY** is energy service director at TEAM (EAA Ltd)

➤ (COP) is maintained above 2.2 (depending on the electricity grid carbon factor used). The COP depends heavily on the temperature difference between the heat source (ground or outdoor air) and load (that is, the building heating circuit flow temperature). Other factors include the heat pump refrigerant charge, compressor motor efficiency, cycling rates, system flow rates and heat exchanger cleanliness.

With air source heat pumps, the external evaporator must be kept free of frost and ice. This is achieved by various means, all of which impose a parasitic heat requirement, and subsequent reduction in COP. In ground source systems, the ground temperature is rarely monitored, but this is a key factor in the system performance. If the ground temperatures do not recover between heating seasons, gradual degradation of performance may occur.

Biomass boilers present an interesting case. In the case of wood fuel, heat output is easier to monitor continuously than the fuel input, which can only be measured by deliveries. Where dual fuel systems are employed (such as a gas fired boiler), it is necessary to measure the heat delivered by each boiler (which is required by the RHI). Controls can drift – or have unintended complex interactions – that can result in the low-carbon source being under-utilised.

In order to maintain their optimum efficiency, biomass boilers are also likely to need more maintenance than gas-fired boilers, and with the price of biomass fuels likely to rise, it is important to ensure systems operate at maximum performance.

Small-scale wind turbines are often

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Condensing, continuous flow hot water heaters

This module considers the role of condensing continuous flow hot water heating in helping to reduce carbon emissions, as part of a low carbon future

The recently published annual progress report¹ by the UK government's Committee on Climate Change (CCC) indicated that significant improvement was needed in the take up of energy saving measures to meet the UK's CO₂ emission reduction targets, particularly as there are practical limits on applying fabric improvements to existing buildings. This CPD will provide a brief update on the provisions that are driving this improvement and consider how one technology – condensing continuous flow hot water heating – can help to achieve a relatively small but significant reduction in CO₂ emissions.

The European Union (EU) is rolling out legislation² to ensure that end users are more properly informed about the potential environmental impact of many appliances, including hot water heaters. According to the background research undertaken by the EU, it is thought that the continued strong sales of low-efficiency water heaters is due to end-users considering the purchase costs of products rather than their life cycle costs, since the information available to purchasers on the energy efficiency of water heaters is limited. This lack of knowledge, combined with potentially weak standards, can lead to the developers of an installation providing equipment that requires lower capital outlay but at higher

life-cycle energy (and environmental) costs – a particular risk with tenanted properties. This situation is seen as especially challenging when water heaters are linked in as part of a solar-led system, resulting in end users missing opportunities for cost-effective improvements in energy efficiency.

There have been a number of legislative processes and white papers published by the UK government since the landmark 2004 Energy Act that, in various – and possibly disparate – ways, attempt to direct future energy use in buildings to reduce CO₂ impact. Just last December, the government³ confirmed that heating and powering buildings still produced 35% of the UK's 'greenhouse gas' emissions. An aspiration of that report was that by 2050 'emissions from heating and powering our buildings will be virtually zero'. The expectation is that the energy supply will be 'decarbonised' by reducing the UK's dependence on traditional fossil fuels. In the meantime, improvements in the effectiveness of the building envelope and the efficiency of its environmental systems are in the forefront of carbon reduction measures.

Data collected in 2005⁴ indicated that water heating (both gas and oil fired) emits 6% of all fuel-related CO₂ in the

EU (as shown in Figure 1). This EU study considered opportunities to reduce the carbon resulting from water heating, and suggested that even applying a reasonably conservative 'realistic' outlook for improving the efficiencies of hot water production, 71Mt CO₂ equivalent per annum across Europe might be saved compared with 'business as usual'. The report proposed that such a scenario would require:

Financial incentives – The recent CCC report indicated that the 2010 boiler scrappage scheme was responsible for an increase in replacement rates for boilers. Under certain restricted circumstances, the Green Deal may provide opportunities for funding replacement hot water heaters;

Certification – Such as building energy performance certificates (EPCs) or display energy certificates (DECs);

Labelling – Such as that resulting from the proposed rollout of labels to meet the EU energy efficiency labelling directive⁵ (as illustrated in Figure 2). The proposed energy labels are for stand-alone water heaters and hot water storage tanks, as well as for combined packages of water heaters and solar thermal systems; and

Minimum targets – Set through such devices such as the UK Building Regulations. For example, the current

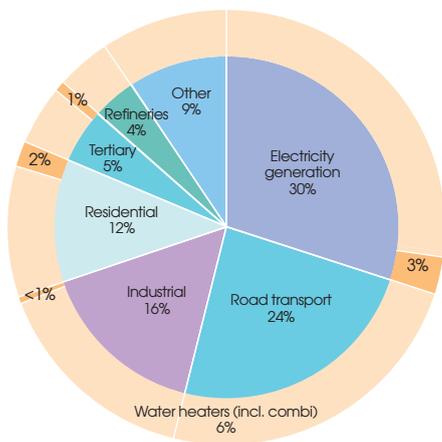


Figure 1: EU-15 energy-related greenhouse gas (GHG) emissions (more than 80% of total GHG emissions) by sector, according to EEA 2007

consultation document⁶ for the 2013 revision to AD Part L has a proposed recommended minimum gross efficiency for direct gas fired hot water systems of 90% for new construction over 30kW, compared with the previously recommended minimum of 73%. A comparable mandate in 2005 that practically demanded all new domestic boilers be condensing – despite scepticism at the time about their practicality⁷ – led to more than nine million installations⁸.

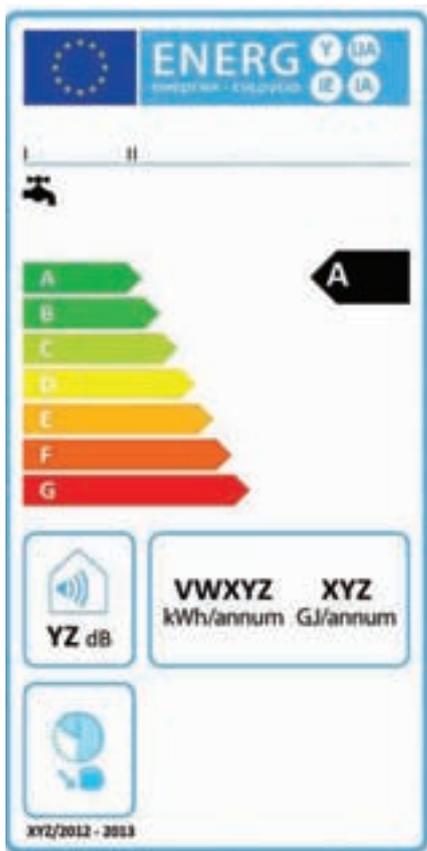


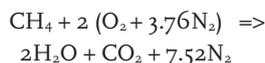
Figure 2: Proposed conventional water heater EU energy label. Practically, to achieve an 'A' rating, anything but small domestic hot water heaters will have to be condensing water heaters

The latent potential gain in efficiency

There is a mature UK market in high efficiency dedicated direct gas-fired water heaters, having been applied in the UK for more than 40 years. The gas market in the UK and Europe is principally natural gas (that is, approximately 90% methane (CH₄) – a hydrocarbon); natural gas has a high latent heat content (water vapour) in the products of combustion. The actual composition of natural gas will vary, depending on its source.

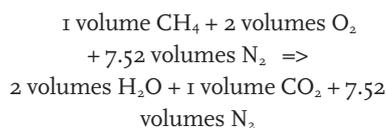
The combustion of hydrocarbons in a water heater is a reaction of oxygen (O₂) in the air (air principally being comprised of 79% nitrogen and 21% oxygen), with the carbon (C) and hydrogen (H) compounds in the fuel creating CO₂ and superheated water vapour (H₂O), plus the nitrogen mainly passing straight through. A simplified combustion equation for the most effective combustion of methane (given in 'moles') is

methane + air =>
water + carbon dioxide + nitrogen



with the flue gas (on the right hand sides of the expressions above) containing neither fuel nor oxygen, both having been completely utilised in the chemical reaction. This perfect ratio is called the stoichiometric ratio, and provides a theoretical best mixture for combustion of the methane gas to produce heat without wasting fuel or causing excessive harmful gases.

The relationship established by 'Avogadro's principle' means that each mole of gas will take up the same volume, and so whilst the water is in a vapour form (and the flue gas being known as 'wet'):



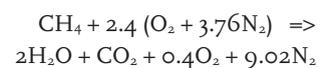
So the stoichiometric air-to-fuel volume ratio for methane combustion is 9.52 (air) : 1 (methane).

The percentages in this stoichiometric mixture's 10.52 volumes of flue gas are 9.5% CO₂, 71.5% N₂, and 19% H₂O that will be in vapour form and will include significant amounts of latent heat. (The instrumentation used to control the air/gas mixture is likely to monitor the

'dry' flue gas that has a total of 8.52 volumes and a resulting 11.74% CO₂ by volume, under stoichiometric conditions.)

All combustion systems use slightly more air than theoretically needed to ensure complete combustion of the fuel (known as 'excess air') – this is represented by a lambda value, λ, of greater than 1, where λ = (actual air ratio)/(stoichiometric ratio). If systems were operated with a lambda of 1, it is unlikely that all the gas would react – due to imperfect mixing, as well as variations due to pressures and air moisture content – so wasting fuel. Incomplete combustion will also create poisonous carbon monoxide (CO) and particulate matter (soot) in the flue gas.

A simplified example process with 20% excess air would be:



$$\text{and } \lambda = (\text{actual air ratio})/(\text{stoichiometric ratio}) = 10.02/9.52 = 1.05$$

However, the increased air supply will reduce the temperature of the flue gases (so reducing efficiencies) and potentially increase the amounts of environmentally significant oxides of nitrogen (NO_x). By carefully monitoring the flue gas composition, the excess air levels can be controlled at the lowest possible level, so that the oxygen concentrations in the high temperature zone of the combustion process can be minimized to reduce the NO_x formation and maintain efficiencies.

Recovering latent heat to improve hot water heating efficiencies

The application of dedicated water heaters has become common in small commercial and industrial applications. The development over the last 15 years of non-storage, high output 'instantaneous' continuous flow heaters allows the provision of large quantities of potable (domestic) hot water without the need to store hot water. If well designed, controlled and operated, such a (non-condensing) heater can provide gross efficiencies of more than 80%. Such systems can also provide operational and space advantages by not requiring storage; storing hot water will add to heat losses, and the additional pipework and controls add to the complexity of systems, both in design and maintenance, resulting in lower gross system efficiencies than for non-storage, continuous flow systems. However, they

need to be sized to cope instantaneously with peak demand, whereas storage systems can spread the fuel demand over a longer period.

A *condensing* continuous flow hot water heater additionally attempts to recover the heat in the flue gases through the flue by deliberately inducing condensation (recovering the latent heat in the flue gas). This is achieved by adding a 'secondary', or extended, heat exchanger in the flue that exchanges heat with the incoming water, as shown in the example in Figure 3. The dew point of the flue gas from the combustion of natural gas is around 57°C; hence, condensing systems operate most efficiently with incoming water temperatures below 57°C. Condensation will potentially release approximately 3.5MJ per m³ natural gas and increase overall gross efficiencies to more than 90%. Since the resulting condensate is slightly acidic (typical pH 3.6 – similar to orange juice), the materials for the heat exchanger are frequently manufactured from stainless steel. All the materials and construction that is exposed to the condensate must be able to properly resist the acidic atmosphere.

The additional performance of a condensing water heater is due not only to the recovery of latent heat, but also to the lowering of the flue gas exit temperatures. As the flue gas exit temperature falls, there will also be greater amounts of condensation – hence, again, increasing the overall efficiency. The resulting flue gases are typically 50-60°C and, depending on the external conditions, can result in considerable plumbing from the flue as

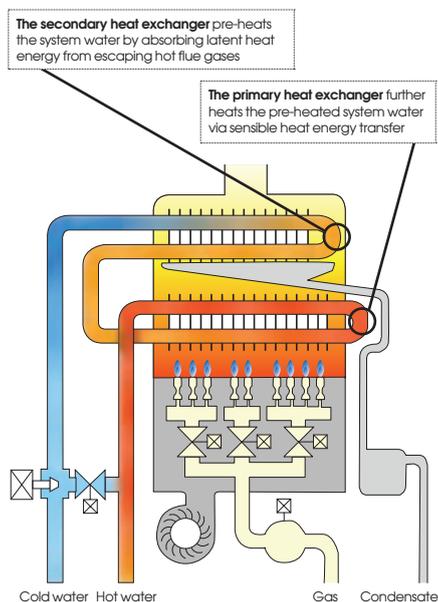


Figure 3: An example of a condensing water heater

the remaining water vapour in the flue gas condenses into small entrained liquid droplets.

The low flue gas temperature is likely to mean that a fan is needed to remove products of combustion – this would be an integral part of the condensing water heater. By applying fast response digital control to the fan – using sensors in the flue gas to monitor the excess air – it can be automatically regulated to provide close to stoichiometric combustion, while ensuring that the flue gases are safely removed through the positively pressurised flue.

Since the flue will be subjected to low temperatures, it may be made from plastic, stainless steel, ceramic or glass – the key quality being its resistance to the slightly acidic flue gases. A fan-assisted flue will also provide greater flexibility for the positioning of the system (i.e., it does not need to be sited adjacent to an external surface), as well as having a small diameter, allowing simpler routing through the building; significant lengths of PVC or ABS pipework (more regularly associated with drainage applications) can be used. A drain is required to remove the condensate and, again due to the low condensate temperatures, this can be run in plastic (though in a position that is not at risk of freezing). It is important that the condensate drains freely from the heat exchanger, as any residual liquid will reduce the heat transfer and potentially increase the acidity adjacent to the heat transfer surfaces.

When a condensing continuous flow water heater system is constantly fed with water from the mains supply – typically under 10°C and well below the required 57°C – it will work in condensing mode throughout the whole year. However, there are many applications where the feed water may have a higher temperature – for example, in larger systems where there is a requirement to provide circulation in the hot water system, or in systems that are providing instantaneous top-up to water pre-heated via a renewable heat source (such as solar thermal or heat pumps). These systems will still condense if the feed water is below 57°C; however, it is important that the selected heater is designed to accept such pre-heated water.

Conclusion

The challenge of continuing to reduce carbon emissions from buildings will become greater as the 'easy wins' provided



Figure 4: A commercial continuous flow condensing hot water heater

by improving the building fabric become more complex to implement. The decarbonisation of the energy supply is still some 40 years (at least) in the future and, hence, the benefits of using lower carbon systems are increasingly important. More than 9%⁸ of energy consumed in non-domestic UK buildings is by gas water heating and, compared to traditional oil, gas and electric powered storage systems, the application of condensing continuous flow water heaters (as shown in Figure 4) can reduce the energy required to supply hot-water, and so reduce operational CO₂ emissions.

© Tim Dwyer, 2012

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Module 43

August 2012

Rinnai

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What approximate percentage of the UK's 'greenhouse gas' emissions are accounted for by buildings, according to the recent Department of Energy and Climate Change (DECC) report?

- 15%
- 25%
- 35%
- 45%
- 55%

Approximately how many condensing boiler installations are there in the UK?

- Up to 1 million
- Between 1 and 4 million
- Between 4 and 6 million
- Between 7 and 9 million
- More than 9 million

What is the percentage of water vapour in the flue gas volume when methane fires a water heater with a lambda of 1.05?

- 15%
- 16%
- 17%
- 18%
- 19%

What is the maximum temperature normally required to condense water out of the flue in a natural gas water heater?

- 10°C
- 50°C
- 57°C
- 60°C
- 100°C

Which of these is least likely to be included in a continuous flow condensing water heater system?

- A combustion fan automatically controlled to provide efficient combustion
- A hot water storage tank
- A gas supply
- A cold water supply and/or a return feed from a recirculating domestic hot water service
- A drain

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AET's new solar collectors for commercial buildings

AET has launched a high-quality flat plate solar thermal collector designed to harvest free energy from the sun for use in commercial space or water heating applications. The flat plate absorbers are finished in a high-quality selective coating, which has been developed to increase the amount of heat energy harvested by the absorber. The coating is applied using the environmentally friendly physical vapour deposition (PVD) technique. Copper absorber pipes and manifolds are ultrasonically welded to the back of the absorbers to maximise heat transfer.

● For more information visit www.flexiblespace.com

Lochinvar brings comfort back to Sir Walter Scott's home

As part of a multi-million pound restoration programme, Lochinvar high efficiency condensing boilers and water heaters have been installed at Abbotsford, the home of famed Scottish writer and poet, Sir Walter Scott. Abbotsford, near Melrose in the Scottish Borders, was designed and developed by Scott, one of the foremost literary figures of the 19th century. He wrote some of his most famous works at the house, which is currently undergoing much needed repair in advance of its reopening to the public in 2013.

● For more information visit www.lochinvar.ltd.uk

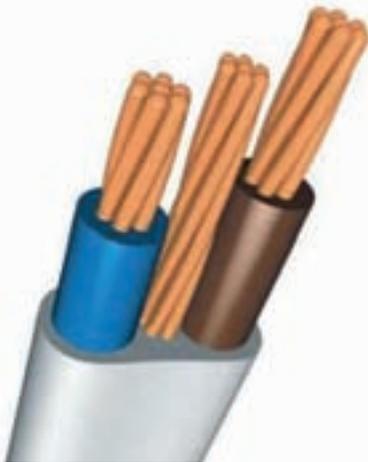


Chris Davis,
business
development
director at
Dimplex
Renewables

Dimplex renewables quadruples sales

Leading name in heating, Dimplex, is bucking the economic trend as its Dimplex Renewables division goes from strength to strength. The UK's continuing move to a low carbon economy has seen Dimplex Renewables quadruple sales year-on-year, with increasing demand for renewable technology from the domestic, social housing and commercial sectors. Dimplex Renewables offers one of the UK's widest ranges of products, across air and ground source heat pumps, solar thermal water heating, SmartRad low-temperature fan convectors, solar PV and the EC-Eau range of highly efficient, renewables-compatible, hot water cylinders.

● For more information visit www.dimplex.co.uk/ or call 0845 601511



Celebrating two decades of CableCalc level P with a free version of new twin and earth calculations

To celebrate 20 years of CableCalc, Castline Systems has released a new, free version of its popular CableCalc program, which will calculate single-phase radial and ring circuits wired in twin and earth cable. It even includes free technical support by email. CableCalc level P is a fully working, unlimited use version and provides far more than just simple volt drop calculations. CableCalc level P can be downloaded from www.castlinesystems.com free of charge.

● For more information, call 01293 871751 or visit www.castlinesystems.com

GE Lighting illuminates Tower Bridge for the first time

After a major refurbishment involving GE Lighting, the stunning architectural details of London's iconic Tower Bridge will be clearly visible at night for the first time in its 118-year history. The new lighting scheme was specifically developed to enhance the aesthetics of the bridge and ensure an energy efficient lighting scheme was in place. The creation of architect Sir Horace Jones and civil engineer Sir John Wolfe-Barry, Tower Bridge is arguably one of London's most famous and widely recognised landmarks.

● For more information visit www.gelighting.com/eu



Multipurpose BACnet temperature controller from Titan

The BACnet enabled CCM-204 multipurpose temperature controller is designed to offer complete control flexibility for ventilation and air conditioning systems. With a vast array of inputs and outputs, the advanced application-specific controller can offer control strategies ranging from single-stage heating or cooling to three-stage heating, venting and cooling. Designed and manufactured in the UK, the CCM-204 multipurpose controllers can be used stand-alone, as part of a master/slave group or as part of a building management system.

● For more information, call 0161 406 6480 or visit www.titanproducts.com





Fläkt Woods launches roadshow

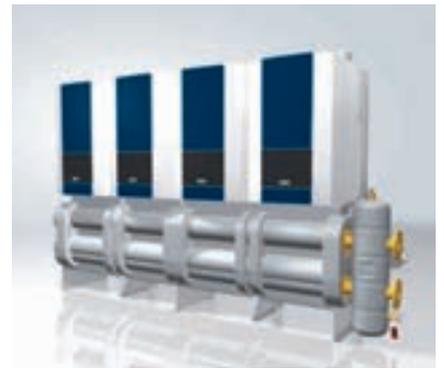
Fläkt Woods – a leading manufacturer of ventilation and air climate solutions – has launched a new Mobile Fire Roadshow, which is designed to highlight the effectiveness of its latest range of smoke and fire dampers in commercial and residential applications. Visiting London, Cardiff and Manchester throughout September 2012, an integral fire chamber will give building services engineers the opportunity to experience a live demonstration and see Fläkt Woods' products in action.

● For more information visit www.flaktwoods.co.uk

New heating systems from Stokvis at Energy Event 2012

Stokvis Energy Systems will feature an evacuated tube solar collector which, when coupled to a solar store and linked to a plate heat exchanger, saves money by utilising free solar energy. Independent laboratory tests prove that the system produces more than 750kWh/m² per year in direct heating mode, and a 850kWh/m² per year in pre-heat mode. The new R40 wall-mounted boiler from Stokvis Energy Systems incorporates the latest gas heating technology, providing maximum efficiencies and minimum environmental impact.

● For more information visit www.stokvisboilers.com or call 020 8733 3050



Zen air curtain at Bishopsgate refurb

A Zen air curtain from JS Air Curtains is integrating seamlessly into the entrance hall at 1 Bishopsgate, following the building's recent refurbishment. The air curtain is helping to keep the large reception warm while minimising heat loss from the entrance. The office refurbishment was the first in the UK to achieve a Gold SKA rating, and helped the Grade 2 listed building in the City of London achieve in excess of 30% savings in energy and CO₂.

● For more information visit www.jsaircurtains.com or call 01903 858656



iVector commercial outputs without compromising style

Myson has recently launched iVector, the first in a new generation of intelligent fan convactor products. Outputs range from 2 kW to 10 kW in compact sizes between 800 mm and 1,600 mm, all with a standard height of 600 mm. Sound levels as low as 24 dBA make iVector silent when operating at normal fan speeds. iVector is an excellent choice for traditional boilers and renewable systems with low water temperatures. The solid one-piece casing has a decorative design as standard on all models, bringing a domestic look to the commercial arena.

● For more information visit www.myson.co.uk or email ivector@myson.co.uk

Lumiance launches LumiPanel

Lumiance has introduced the LumiPanel, a stylish family of ultra-slim LED panels – available in both round and square formats – which are suitable for surface-mounting, recessing or suspending. Elegant yet extremely easy to install, the LumiPanel is ideal for installation in a multitude of applications, including: hospitality, retail and corporate offices, where a quick, simple and effective upgrade to LED illumination is desired. The ultra-slim profile (just 15 mm) makes it suitable for use in areas where a restricted ceiling void has previously prevented good overhead lighting.

● For more information visit www.havells-sylvania.com



Calmag receives WRAS approval on its range of Electromag water conditioners

Leading water conditioning company, Calmag, based in Keighley, West Yorkshire, has had its Electromag range of commercial scale inhibitors approved by WRAS – the Water Regulations Advisory Scheme. WRAS has been set up to promote knowledge of the UK Water Supply Regulation Bylaws and to encourage their consistent interpretation and enforcement, for the prevention of waste, undue consumption, misuse, erroneous measurement or contamination of water.

● For more information visit www.calmagltd.com or call 01535 210320





First for Polypipe Domus system

The first installation of the recently launched Domus Radial Duct System from Polypipe Ventilation, manufacturer of energy-saving domestic and light commercial ventilation systems, has been completed by IBD Distribution. The Domus Radial Duct System is an innovative whole-house air distribution system, where each room is individually connected directly to a manifold (air distribution box) by a 75 mm flexible semi-rigid duct. To provide maximum support for the new system, a full specification and design service is also available.

● For more information visit www.polypipe.com/ventilation or call 08443 715 523

Polypipe launches Domus Thermal

Polypipe Ventilation, manufacturer of market leading energy-saving domestic and light commercial ventilation systems, has launched Domus Thermal, a uniquely engineered, patent-pending duct insulation system for round and rectangular duct systems. Domus Thermal has been designed to comply with 2010 Building Regulations and to prevent both heat loss and the formation of condensation. Domus Thermal has been developed by Polypipe specifically to meet the recommendations of the government's 2010 *Domestic Ventilation Compliance Guide*.

● For more information visit www.polypipe.com/ventilation or call 08443 715 523



Evinox ModuSat now reads electrical pulse meters

The Evinox Modusat heat interface unit for communal heating systems now offers the facility to read electrical pulse meters in addition to reading heat and cold water meters. This enables Evinox to provide an enhanced billing solution, which includes metering and billing of electricity usage, as well as energy for heating and hot water and cold water usage. In addition to this, our ModuSat Room Controller allows residents to read all three meters – they can view consumption figures, credit details and tariff rates on the controller.

● For more information visit www.evinox.co.uk or call 01372 722277

Vent-Axia launches energy efficient Sentinel Totus² D-ERV

Vent-Axia has launched the next generation of its popular Sentinel Totus Demand Energy Recovery Ventilation (D-ERV) system. Part of the company's innovative Lo Carbon initiative, the new improved Sentinel Totus², integrates the proven demand ventilation control concept, with high efficiency EC/DC motor technology and a state-of-the-art counterflow heat recovery cell to achieve up to 94% energy recovery. Additional benefits include reduced sound levels achieved through the use of high density acoustic insulation and improved air paths within the unit.

● For more information visit www.vent-axia.com or call 0844 8560590



Polypipe unveils new concept in rainwater harvesting systems

Polypipe, one of the UK's leading manufacturers of plastic sustainable drainage and water management products, is responding to the growing need for sustainable rainwater reuse systems through the launch of its Rainstream RXL. Rainstream RXL high volume water storage tanks are available with an optional anti-bacterial lining, and have been expertly engineered using the same technology as Polypipe's popular Ridgistorm-XL large diameter pipes. The Rainstream RXL tank's modular design allows any storage capacity to be created and features integral pre-storage.

● For more information visit www.polypipe.com/wms/products/rainstream



Prestige job for 'Space Airconditioning'

Space Airconditioning, UK Daikin Distributors since 1980, was recently nominated to supply replacement air conditioning equipment at the Windsor headquarters of the Duke of Edinburgh's Award. The building suffered from an ageing and dysfunctional air conditioning system, which lacked centralised control for the multiple, HCFC R22-based split system air conditioning units, and had an ineffective ventilation arrangement. In addition, a number of the existing air conditioning units were out of order. As a result, comfort levels got a definite 'thumbs down' from staff and visitors alike.

● For more information visit www.spaceair.co.uk





Siemens enhances Entro access control

Enhanced support for smartcard technology is the key benefit of the latest version of the popular SiPass Entro access control system, by Security Products from Siemens. SiPass Entro 6.55 features upgraded hardware, which efficiently handles the additional data associated with smartcards, as well as new software and firmware to provide full compatibility with most commonly used Wiegand card data formats. In organisations where smartcards are being used for other purposes, it will, in almost all cases, be possible to use the same cards for access control.

● For more information visit www.siemens.com/buildingtechnologies or call 01291 437920

Panasonic revitalises the Mercure Hotel Norwich

One of the world air conditioning leaders, Panasonic, has teamed up with distributors Fridge Spares Wholesales (FSW), for the rejuvenation of the centrally situated Mercure Hotel Norwich. As part of a recent refurbishment, the Mercure Hotel has been retrofitted with 45 Panasonic EthernA ECONAVI air conditioning units. Reading contractor Aria chose the Panasonic EthernA wall mounts through nationwide distributor, FSW, primarily because the innovatively eco-friendly units proved to be an all round cost-effective and energy-saving solution.

● For more information visit www.panasonic.eu or call 01344 853390



Seventh environmental plan seeks to cut emissions further

Mitsubishi Electric has released details of its seventh global environmental plan, which aims to mitigate the environmental impact of both its manufacturing facilities and the use by consumers of its advanced range of products. The three-year action plan is aligned to the company's Environmental Vision 2021, the long-term environmental management vision of the Mitsubishi Electric Group. Martin Fahey, sustainable solutions manager for the company's Living Environmental Systems Division, UK, says: 'We realise that not only do we need to develop products that can help customers lower fuel bills and reduce carbon emissions, we also need to examine our own operations to see where we can make a difference.'

● For more information visit www.greengateway.mitsubishielectric.co.uk



Martin Fahey... Mitsubishi is keen to make an environmental difference



Infinity – lighting along the right lines

New from Riegens Lighting is Infinity, a flexible modular lighting solution that offers endless combinations, minimises energy consumption and provides a continuous light without any dark shadows. The system fits together quickly and easily using T, L and X modules to produce continuous light in illuminated lines with even light distribution. The system can be wall mounted and can run up a wall across a ceiling and down the adjacent wall, with no gap.

● For more information visit www.riegens-lighting.com or call 01376 333400

Green gateway website gets revamp

Mitsubishi Electric has launched a revamp of its Green Gateway website to engage everyone involved in the built environment in the debate on how we decarbonise our building stock.

'The new website will offer a more interactive experience for visitors and includes easy access to the Green Gateway social media links,' explains Martin Fahey, sustainable solutions manager for the company. 'The site is designed to provoke debate within the industry and we will be looking to expand on the subjects it covers over the coming months.'

● For more information visit www.greengateway.mitsubishielectric.co.uk



Remeha boilers provide ultra efficient heating in bivalent system

Remeha Quinta Pro gas condensing boilers are helping provide ultra efficient heating at St Michael's Care Home and Convent, Essex. The heating system, designed by NCC Mechanical Services, combines two air source heat pumps with two Remeha Quinta Pro 115 kW boilers, linked to a 500 litre buffer tank, to deliver variable temperature heating through underfloor heating, radiators and fan convectors. For maximum efficiency, the heating system operates at 45/35°C, with additional controls. Two more Remeha Quinta Pro 45kW boilers provide constant temperature hot water (82/71°C) to the low pressure hot water frost coils of four large heat recovery units for tempered air delivery.

● For more information visit www.remeha.co.uk or call 0118 978 3434



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Evander Glazing and Locks completes chemist programme

With the help of Evander Glazing and Locks, a prominent national chemist retailer was able to understand the risk to their business in a timely manner and implement a programme of upgrade work. The client was instructed to carry out a Glass Identification Survey on stores that opened in 1996. With their strong brand heritage, health and safety was of paramount importance, and Evander were appointed to complete a glazing survey on 1,996 stores, completed in six weeks from start to finish.

● For more information visit www.evander.com

JS Humidifiers has a gas at BAT

JS Humidifiers has supplied two gas-fired humidifiers capable of delivering up to 480 kg of steam per hour, to British American Tobacco's research and development facility in Southampton. Seeking an energy efficient alternative to their existing 10-year-old live steam humidification system, the Condaire GS gas-fired humidifier proved the perfect replacement, as it provides high capacity steam generation with low operating costs, offering 65% cheaper steam than electric humidifiers. Two Condaire GS humidifiers were installed, each capable of delivering up to 240 kg of steam per hour.

● For more information visit www.jshumidifiers.com or call 01903 850200



Modupak multi-boiler package

The new R40 wall-mounted boiler from Stokvis Energy Systems incorporates the latest gas heating technology, providing maximum efficiencies and minimum environmental impact. With five models, ranging from 65 kW to 145kW, all small commercial requirements can be accommodated, along with larger commercial properties when modules are combined to form the 'Modupak'.

The Modupak is a frame-mounted combination of up to eight boiler modules in a back-to-back configuration, or up to six boiler modules as an in-line formation.

● For more information visit www.stokvisboilers.com or call 020 8733 3050



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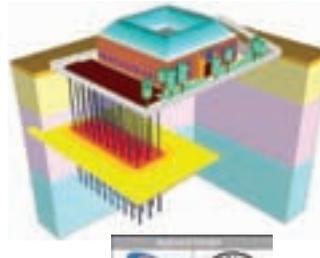
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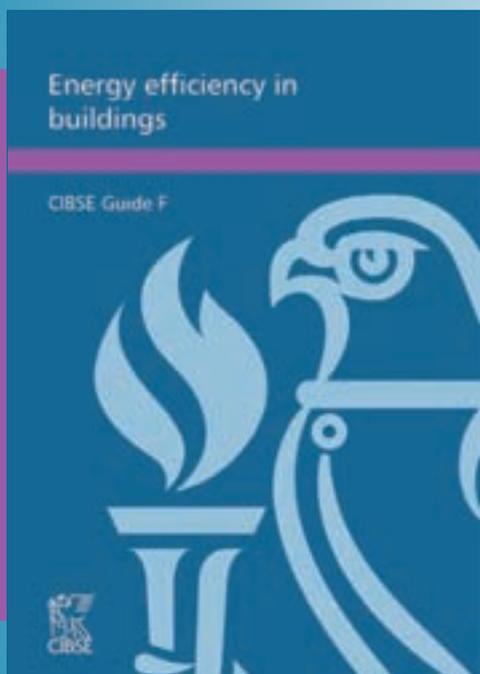


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Since the last edition of CIBSE Guide F, published in 2004, the UK Government has set a legally binding target to reduce national greenhouse gas emissions. The Government's latest Carbon Plan sets out specific targets for improving the energy efficiency in new and existing buildings. There have also been significant regulatory changes over the last eight years, including two revisions to Part L of the Building Regulations and the transposition of the Energy Performance of Buildings Directive into UK legislation. The next two revisions of Part L will push for further improvements in energy efficiency to progress towards the Government's aspiration for all new buildings to be zero carbon by 2019.

This 2012 edition of CIBSE Guide F includes a new section on 'developing an energy strategy'. This reflects the changes to planning policy, which now include targets for reducing carbon dioxide emissions from new developments and the need to submit a detailed energy strategy report as part of the planning application.

Energy management has moved up the corporate agenda, aided by the work of the Carbon Trust and the implementation of the CRC Energy Efficiency Scheme. Part B of this Guide (covering the operation of the building) has been updated to include more information about carbon management, and the need for improved metering and monitoring.

In addition, the section on energy efficient refurbishment has been expanded in recognition of the pressing need to upgrade the existing building stock and the opportunities to improve performance.

This edition incorporates the new and revised guidance that has been published since 2004. This includes key CIBSE documents and publications by the Carbon Trust and BSRIA. These key references have informed many of the updates and are referenced throughout the Guide.





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Our client is looking for senior electrical design engineers who have experience working on AWE or Sellafeld projects. Ideal candidates will hold current SC or DV security clearance. Long term opportunities.

Int Mechanical Design Eng | Bristol & Cambridge | to £32K | ref: 2615

A blue-chip multi-disciplined consultancy is looking for an ambitious mechanical design engineer who wants to progress their career. You will be given support to take the lead on your own projects and gain Chartered status.

Senior Electrical Design Engineer | Southampton | to £45K | ref: 2486

An international M&E consultancy involved with data centre and high technology projects are currently looking for a senior electrical design engineer. Ideal candidates will be Chartered, or working towards, and have significant experience within the mission critical sector.

Senior Acoustic Engineers | London & Berkshire | £NEG! | ref: 2600

We are looking for senior acoustic engineers for a number of clients who want to build their in house capabilities. Ideal candidates will have experience working in a multi-discipline environment and be able to lead projects as well as small teams. Excellent opportunities!

Intermediate Electrical Design Engineer | London | £NEG! | ref: 2643

A large multi-disciplined consultancy based in central London is looking for an electrical design engineer to support the team on major UK and international projects. Ideal candidates will have some post graduate experience and be willing to work towards Chartered status. Contract or temp to perm opportunity!

Mechanical Design Engineer | London | to £35K | ref: 2503

A medium sized M&E consultant based in central London is looking for a motivated self-starter to join the team. Ideal candidates will be degree qualified and have experience on a mixture of projects, including healthcare and education. Excellent opportunity to rapidly progress to senior level and lead projects.

t: 02392 603030

e: cv@blueprintrecruit.com

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RECRUITING



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North West, North East, N. Wales & W. Mids, East Mids, S. Wales & Bristol, S. West Coast, E. Anglia, Central London, Home Counties (S. London), Herts Bucks Beds & Essex (N. London).

Ideal candidates: Will have experience in the ventilation and air distribution industry along with a proven track record in customer liaison and sales negotiation. An existing portfolio of reliable contacts is essential for the steady development of orders.

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www.mideng.net

To express an initial interest, with details of your experience, please email: recruitment@mideng.net



Intermediate - Senior Mechanical Engineer
Hampshire, £30k - £45k

We are currently recruiting for a mechanical engineer in Hampshire. Our clients business is built on the back of fantastic project delivery. They have been established for over 20 years and following recent projects wins now have a requirement to expand their team. Project workload involves a range of exciting and challenging projects including MoD, education, and multi million pound high spec residential schemes. The ideal candidate will be degree qualified and ideally chartered or working towards CEng status. BAR808/JA

Senior/Intermediate Mechanical Design Engineer
Midlands, £35k + Car Allowance

We have a fantastic career opportunity in the Midlands for a motivated and aspirational Mechanical Building Services Engineer to join an up and coming consultancy. Successful applicants will have previously worked on a variety of projects with focus on project delivery, initial and detailed design of building services, and have experience in client liaison, attending design and client meetings along with conducting site surveys and writing specifications. Applicants will be degree qualified in mechanical engineering or building services. BAR895/PA

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

Thinking of your future www.b-a-r.com



We are seeking experienced personnel for both immediate plus future posts in the Middle East & beyond.

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- **Building Fabric & Service Technical Authors**

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Wage bonuses for posts within Saudi Arabia.

Please contact Kevin Day
kevinday@cmlgroup.ae

Events & training

NATIONAL EVENTS AND CONFERENCES

The Energy Event 11-12 September, Birmingham

Headline speakers include Alistair Campbell, Prof Brian Cox, Daisy McAndrew and Philip Lowe, director general for energy at the European Commission. www.theenergyevent.com/PR

Renewables Roadshow 13 September, Coventry

The first of six exhibitions across the UK aiming to make energy-efficient technologies more accessible to specifiers, contractors and installers. www.renewables-roadshow.co.uk

Second Symposium on Lift and Escalator Technologies 27 September, Northampton

This symposium will provide a detailed, academic study of engineering and related management issues, for people employed in lift-making and allied industries. www.liftsymposium.org

Combined Heat and Power/District Heating Delivers!

What are the opportunities to use CHP/DH to cut running costs? Will it ensure security of supply? How does current and forthcoming legislation encourage the use of CHP/DH? Will the Green Deal and Renewable Heat Incentive have an effect? www.cibsetraining.co.uk

Building Services – the CIBSE Conference and Exhibition

10-11 October, London
Bringing together the entire building services supply chain to debate the challenges, identify the most successful

business strategies, and forge and renew relationships. www.buildingservicesevent.com

The FM Event 10-11 October, London

A new event focusing on facilitated networking, increasing knowledge-sharing and making new business connections – the three top priorities identified by the senior FM community. www.thefmevent.com

CIBSE Young Engineers Awards 2012

11 October, London
The Young Engineers Award and the Employer of the Year award take place together for the first time. ASHRAE president Tom Watson will also be presenting. www.cibse.org

Mind the Performance Gap – Regulated vs Unregulated

16 October, London
Can we bridge the performance gap between regulated and unregulated? www.cibsetraining.co.uk

Old Buildings and Energy Efficiency: SPAB's Research and Reports Day

30 October, Birmingham
A one-day event bringing together key new findings and research on energy efficiency and the performance of old and traditionally constructed buildings. www.spab.org.uk/spab-events-awards/events

Retro Expo – Fit for the Future

30 October, Birmingham
New three-day exhibition and conference on sustainable retrofitting. www.retro-expo.co.uk

Building Engineers: Professionals with a Common Goal 8-10 November, Buckinghamshire

The Association of Building Engineers' 50th Annual Conference and Exhibition. www.abe.org.uk/conference

Fire Risk Solutions for Timber Structures 3-4 December, London

An international conference looking at the findings of timber frame fire testing. www.frits2012.com

National Insulation Association Annual Conference and Exhibition 4 December, Birmingham

An in-depth look at the issues in the sector. www.nationalinsulationassociation.org.uk

CIBSE GROUPS AND REGIONS

For more information visit www.cibse.org/events

Building Simulation and Optimisation 10-11 September, Leicester

The first IBPSA (International Building Performance Simulation Association) England conference in association with CIBSE. www.bso12.org

Water Efficiency in Domestic and Commercial Bathrooms 19 September, Manchester

A Society of Public Health Engineers evening seminar. m.atherton@dssr.co.uk

Rehabilitation of Existing Pipework and Ductwork Systems

20 September, High Wycombe
With increasing emphasis on rehabilitating existing buildings in the current economic climate, duct cleaning and water treatment are important considerations when re-using existing systems. This seminar will cover both aspects. www.cibse.org/events

Mind the performance gap – regulated vs unregulated

16 October, CIBSE HQ, London

For a number of years we have been measuring building energy performance in different ways, often comparing oranges with apples. There is a clear gap between the way we measure and compare predicted and actual energy performance.

Designers look at regulated loads, whereas facilities managers look at the whole energy bill, including unregulated loads. Energy certificates have taken a similar line, with Energy Performance Certificates (EPCs) only considering unregulated loads based on perfect operation.

Can we bridge the performance gap between regulated and unregulated? Where does poor



management and waste fit in? How can we provide the construction industry with a more coherent way of representing building energy performance?

This conference seeks to address some of these questions to ensure that actual performance can be related to design.

For more information visit www.cibsetraining.co.uk/conferences

CHP Group Conference – CHP/DH Delivers! Especially in a Credit Crunch

27 September, London
This conference sets out to answer key questions and provides real case studies where CHP/DH is under way. www.cibsetraining.co.uk/conferences

East Midlands Region Autumn Ball

29 September, Castle Donington
Drinks reception followed by a four-course dinner, then dancing to live music. densel.davy@nitworld.com

LED – An Office Solution? 15 November, High Wycombe

A Home Counties North West region event. www.cibse.org/events

Sanitary Pipework Design and Material Options

21 November, Manchester
An evening event. m.atherton@dssr.co.uk

CPD TRAINING

For more information visit www.cibsetraining.co.uk or call the events team on 020 8772 3660

Air Conditioning Inspection for Buildings 4 September, London

Energy Survey 11 September, London

Energy Performance Certificate Training (two days) 24 September, Birmingham

LEED 201 24 September, London

LEED 251 25 September, London

The new Mid Career College programme is now ready to view at www.cibsetraining.co.uk/mcc
Discounts are available for members and early bookings.

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Building Services



The CIBSE Conference & Exhibition
10-11 October 2012, London Olympia, UK

Designing – Engineering – Integrating – Managing – Collaborating

KEY CONFERENCE SPEAKERS:



Paul Morrell OBE
Chief Construction Adviser
HM Government



Akhtar Hussain
Director, Building Engineering
AECOM



Sarah Cary
Sustainability Executive
British Land



Robin Nicholson CBE
Senior Partner
Edward Cullinan Architects

- **Exciting and informative case studies** from **Atelier Ten** and **Buro Happold** which will outline how they have made the most of business opportunities abroad
- **Meet face to face with potential suppliers** to source and discover new technologies at the **Building Services - The CIBSE Exhibition**
- **Network with the entire building services supply chain** to discuss the challenges facing the industry



Official Publication:



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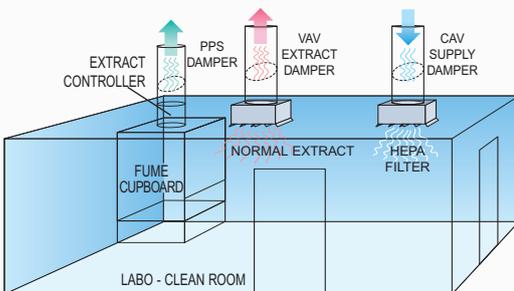


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