

# CIBSE JOURNAL



The official magazine of the Chartered Institution of Building Services Engineers

November 2015

**THE BIG SQUEEZE**  
Consultants reveal  
pressure of workloads  
- exclusive survey

**STRESS TEST**  
CIBSE subjects BIM  
Toolkit to school  
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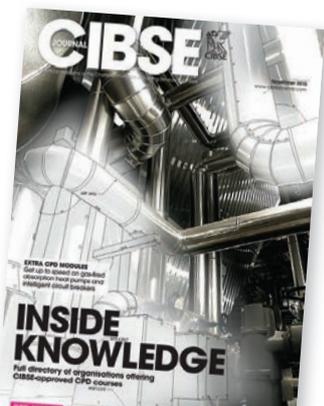
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# Managing success

Anybody who has chosen building services as a career will be very heartened by our first comprehensive survey of the industry. Engineering firms taking part reported big rises in turnover and profit from 2013 to 2014 and a large increase in the number of M&E engineers employed.

There is also good news for those entering the industry from college, with nearly every respondent reporting rises in the number of apprentices and graduates employed. But amid the good news, there are warnings of an overheating market from industry leaders interviewed in our market analysis. For the continuing health of our sector, the issue of skills shortages, flat fees and rising costs need to be addressed.

Twenty-seven companies responded to our detailed questionnaire and we would like to thank all those who took time to complete the survey, especially when considering the amount of work engineers have on at the moment.

Firms responding to the survey ranged from blue-chip global big-hitters such as Atkins, WSP and Ramboll, to the more 'boutique' end of the spectrum. It was also good to see a strong representation of companies outside London, and a submission from one of the world's

most famous architects Foster + Partners – giving an indication of how influential building services engineering is in the design of leading-edge urban buildings.

Prime examples of the valuable contribution engineering is making to the built environment can be seen in the shortlist of the 2016 Building Performance Awards, announced this month (page 18). Even some of our most sober judges were moved to describe some project entries

as industry game changers. The University of Bath's Bill Gething summed up the feeling of the judges by describing having to make 'delightfully difficult decisions'.

Of course, not all building projects go according to plan, particularly when it comes to performance. BIM is regarded as the silver bullet to fix industry shortcomings and the NBS BIM Toolkit is regarded as key in helping companies design, build and operate buildings in a more efficient way. To understand the potential of the Toolkit, which is still in beta, the CIBSE BIM Group used it on a hypothetical junior school. From its observations on page 30, there are still modifications required before its potential can be fully realised.

**Alex Smith, editor**

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## GOING UP IN THE WORLD

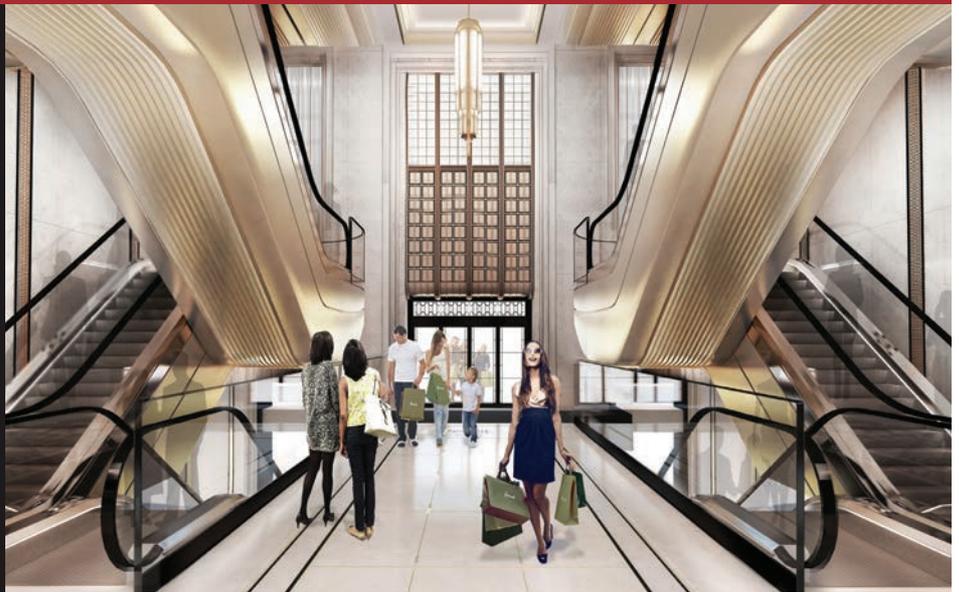
The design for Harrods' new grand entrance hall, featuring a network of escalators, has been inspired by the rich history of this iconic London store.

Make Architects embarked on the design by peeling away layers of successive refurbishments to reveal the original 1939 hall, with its sinuous lines and fine metalwork.

E+M Tecnica is the building services consultant on the project, Nulty+ the lighting designer, and WSP the vertical transportation and structural engineers.

Behind false walls, the design team discovered original panelling, lighting and windows, which have been retained to set the scale and proportion for the new hall.

The new ribbed and fluted nickel-bronze escalators and chandeliers – and the intricate woven metalwork – have been made locally. Crowning off the hall is a new glazed dome that floods the space with natural light.



## Environment Agency offers more time for ESOS compliance

### ● CIBSE says move will help deal with ESOS 'tidal wave'

The Environment Agency has offered some leeway for firms rushing to comply with the Energy Savings Opportunity Scheme (ESOS).

The Environment Agency (EA), which is managing the scheme, said it would not act against firms that show they have a plan to comply with the policy by the original audit deadline of 5 December – but will do if they are not fully ESOS-compliant by 29 January 2016. It confirmed that penalties would only be applied for non-compliance three months after the new deadline.

Andrew Geens, head of CIBSE Certification, said: 'This discretionary approach to enforcement will be welcomed by many of our ESOS Lead Assessors who faced working around the clock to meet the deadline.' He said that although only 500 firms had completed the registration process, ESOS Lead Assessors have been facing a 'tidal wave' of ESOS

work over the last three months.

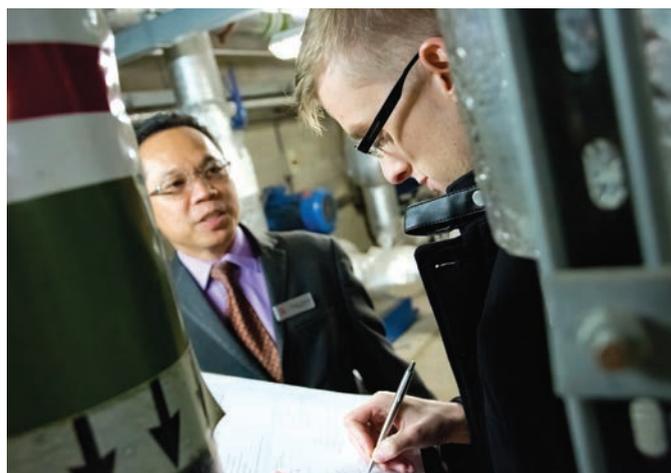
Geens said that although concerns have been expressed about the number of assessors available, he felt there were already sufficient registered assessors. They will be able to pick up work from late compliers as they finish projects for early compliers.

If firms are using ISO 50001 as the route to compliance, they will be given until 30 June to comply. This is to benefit organisations that have audited in time for 5 December but are found to

have non-conformities during the audit. Geens said that if a firm already had a non-certified energy management system in place that has been in operation for at least six months, the 30 June deadline would be achievable.

He said: 'It is not intended to allow a company to decide now to use this route to compliance because, from a standing start, this period is not long enough.'

If you wish to find a CIBSE ESOS Lead Assessor, visit <http://bit.ly/1M6PthL>



### California fires up 'battery-powered' buildings

More than 20 office buildings in California expect to cut their reliance on grid-supplied electricity by 25% thanks to battery systems that store energy for use at times of peak demand.

Property management giant The Irvine Company plans to install Tesla battery systems 'the size of five parking spaces' across its portfolio. The buildings will automatically switch to the stored power reserves whenever they receive a signal from the local grid that demand is too high.

Renewable energy firm SunEdison will install the Tesla batteries as part of a wider strategy to provide 10MW of additional power capacity to the grid system in Southern California.

The batteries – which can last between four and six hours without grid support – will be charged during off-peak hours, when demand is low, and the stored energy will be used when needed, or during power cuts. In total, 24 office buildings will install the Tesla systems.

The Irvine Company's vice-president of energy management, Rich Bluth, said energy storage was a 'game-changer' that would 'allow building owners to participate in grid support and reduce costs'.

**DesignBuilder wins ASHRAE BIM award**

Team DesignBuilder won the Lowdown Showdown's 'best innovative workflow' award at the ASHRAE Energy Modelling Conference. Entrants had to design a 53,600ft<sup>2</sup>, three-storey office building, the location, form, fabric and HVAC systems of which were left open to stimulate creativity and innovation.

Using software tool DesignBuilder Optimisation, the team identified the optimum net zero solution and quantified the cost benefit of higher- and lower-performing solutions.

The winning team included: Carnegie Mellon University, Arup, SUMAC, Atelier Ten, Carnegie Mellon University and Revitaliza Consultores.



**Most firms will miss BIM deadline**

● Many contractors still 'have a long way to go' to be ready for 2016 Level 2 date

A survey has found that most building services firms will miss the government's 2016 deadline for the implementation of Level 2 building information modelling (BIM).

According to research carried out by the Electrical Contractors' Association (ECA), in partnership with CIBSE, 57% of firms are 'not fully ready' and 27% are 'not ready at all'.

Only 16% said they were on track for the mandatory use of BIM on all public sector contracts from next year.

However, nearly two-thirds of respondents believe that BIM Level 2 will be 'good for the sector', while 57% said it would be the 'future for building services'.

'This survey confirms that, while there is a growing awareness of Level 2 BIM in the MEP sector, there is still a real need for more information,' said CIBSE technical director Hywel Davies. 'There is also a requirement for specific tools and guidance for the sector, which CIBSE is working closely with industry partners to develop.'

ECA director of business services Paul Reeve agreed that BIM awareness was 'generally high across building services', but said that many contractors, and others associated with the sector, 'still have a long way to go



to be ready for the government's 2016 BIM deadline'.

'While some companies have already engaged successfully with BIM, many more have yet to engage with the aspects that allow effective information sharing with others in their supply chain,' he added.

Reeve said the ECA would be 'flagging up' its findings to government and the industry, but would also work with its 'BIM readiness' partners to tackle the important gaps identified by the survey.

See 'The right tool for the job?' on page 30, where CIBSE BIM Group assesses the NBS BIM Toolkit.

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# UK accused of sending 'perverse' signal on energy

## ● UK government policy criticised ahead of December's UN climate summit in Paris

The UN's chief environment scientist has criticised the UK for 'abandoning its leadership' on climate change at the worst possible time.

Professor Jacquie McGlade said cuts in renewable subsidies, along with tax breaks for fossil-fuel producers, sent 'worrying' and 'perverse' signals to other countries ahead of December's UN Climate Change Conference in Paris later this year.

In an unprecedented attack on a member state, she claimed that



AXL/SHUTTERSTOCK

150 other nations were about to make pledges to adopt cleaner energy sources just when the UK appeared to be going in the opposite direction.

In an interview with the BBC, McGlade said she was seeing

a 'worldwide move towards investment in renewable energy'.

A UK government response said its clean energy budget was overspent by £1.5bn, and that its policies needed to be 'reset' to take the burden off taxpayers.

'We are absolutely committed to getting a global deal in Paris, which will create a level playing field for businesses, driving innovation and growing the low carbon economy,' said a statement issued by the Department of Energy & Climate Change.

'Ensuring that subsidies are used where they are needed most, so they can compete with other technologies, provides the best value for money for hardworking bill payers,' it added.

## Chancellor unveils building plan

Chancellor George Osborne claims his new 'four-point plan to get Britain building' will change the way infrastructure projects are planned, determined and funded.

The first step is to remove planning rules on brownfield sites to free up land for development. The next will be to pool the 89 local authority pension funds into six British Wealth Funds, each with assets of more than £25bn. The Treasury claims this will 'save millions of pounds every year in costs and fees' with the funds used to develop the expertise to invest in infrastructure.

The government will bring forward sales of land, buildings and other assets to raise up to £5bn to fund projects. Finally, a National Infrastructure Commission – headed by Lord Andrew Adonis – is to be set up to offer 'unbiased analysis of the UK's infrastructure needs'.

## ...but Rudd insists renewables should stand on own feet

Energy Secretary Amber Rudd reinforced the government's commitment to cut subsidies for renewable energy and urged the sector to 'stand on its own two feet' at the recent Conservative Party Conference in Manchester.

She said the party would remain 'tough on subsidies', before adding that there was 'no magic money tree'.

'I support cutting subsidies – not because I am an anti-green Conservative, but because I am a proud green Conservative on the side of the consumer,' Rudd said.

'We must be tough on subsidies. Only then can we deliver the change we need.'

Rudd declared her support for 'fracking' for shale gas, claiming it had dramatically cut CO<sub>2</sub> emissions in the US and that it was 'cheaper, without subsidy, than the alternatives'. 'The kind of transformation we need... will only happen if low carbon energy becomes cheaper than the alternative,' she added.

The Energy Secretary also confirmed plans to insulate one million homes over the next five years, but did not announce a replacement for the Green Deal domestic subsidy scheme.

## Earthship in bid to raise £20,000

The off-grid 'Earthship' low carbon training facility, in Brighton, has turned to crowdfunding to raise £20,000 for refurbishment.

The 'Earthship', which is built from recycled materials, needs new battery banks to store energy from its solar panels, a new vegetable oil-powered back-up generator, and an ultraviolet water-filtration system.

## BURNTWOOD SCHOOL WINS RIBA STIRLING PRIZE

Burntwood School, in Wandsworth, London, has won the coveted 2015 RIBA Stirling Prize.

Buro Happold Engineering, with architects AHMM and contractor Lend Lease, turned the site's tired 1950s buildings into a robust, future-facing school with six striking structures in a campus-style layout.

Buro Happold engineered the integral lightweight framework that enabled heavy, faceted, precast-concrete façade panels to be used for the new buildings. Oliver Blythe, Buro Happold lead engineer, said: 'We employed a "passive-first" design approach, which reduces both the reliance on mechanical heating and cooling systems and, subsequently, energy use.'

This approach to design takes into account the thermal mass of the concrete, the heat generated by 2,200 pupils and staff, and the prevailing weather system.



CREDIT: ROB PARISH

## Movers and makers

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### Les Copeland



Copeland joins WSP Parsons Brinckerhoff as a senior technical director for building services across the UK, based in London. Previously at Brookfield

Multiplex and Kier, Copeland has worked in the construction industry for 24 years, successfully delivering a number of projects, including high-rise residential and commercial towers.

'After 12 years working at senior management level, I welcome the new opportunities that WSP Parsons Brinckerhoff offers and I look forward to supporting our activities in the current marketplace,' he said. 'It's an exciting time to jump back into engineering consultancy as the digital revolution, led by BIM, will change our industry forever. WSP Parsons Brinckerhoff is at the forefront of the industry in this field and I'm happy to be part of this great team.'

### Colin Fox



Fox has joined Grontmij UK's Manchester office as an executive engineer. His career started in 1985, as an electrical engineer at

Oscar Faber & Partners – now Aecom – where he spent nearly 25 years. He also enjoyed shorter periods at BDP and Trafford MBC. Colin has design and project management experience, working on public and private sector projects, including: data centres for global banking institutions; Blue Chip company media studios/offices; a major rail station remodelling; factory line refurbishment for global automotive giants; plus main infrastructure and learning development projects for universities.

### David Dean



Formerly an associate director at Aecom's Liverpool office, Dean has joined Grontmij UK's Manchester office as an executive engineer. He

started his 30-year career as a mechanical design engineer with Oscar Faber & Partners, which evolved through Faber Maunsell into Aecom.

He has experience of designing and managing various projects across the public and private sectors, ranging from multi-level underground shopping developments situated on Red Square, Moscow, to major hospital developments in Leeds, Liverpool, Bolton and Bermuda.

# Call to divert university funds to tackle vocational skills crisis

## ● Only 10% of 25-40-year-olds in the UK have a post-secondary vocational qualification

Trainers and construction firms have launched a campaign to have £532m diverted from universities' funding to bolster technical courses in further education (FE) colleges.

A report by the Policy Exchange, funded by Wates and the Construction Industry Training Board (CITB), suggests the money could make a major dent in the sector's skills

shortages. *Higher, Further, Faster, More* pointed out that funding for higher education institutions had risen by 26% since 2009 – partly because of the introduction of tuition fees – and that universities had access to £12.3bn of 'unrestricted reserves'.

In the same period, the budget for FE colleges has fallen by 24%, undermining skills training, according to the report's authors, who identified £532m of the Higher Education Funding Council for England grant that could be diverted to improve the quality of the technical qualifications offered by FE

colleges, national colleges and institutes of technology.

Jonathan Simons, head of education at Policy Exchange, said: 'As well as degrees, we need many more people with high-class technical and professional skills – and that means a flourishing FE system.'

Steve Radley, director of policy at the CITB, said there needed to be a 'radical' rethink of how funding is allocated. 'Just 10% of 25-40-year-olds in the UK have a post-secondary vocational qualification. Industry needs a reformed FE sector to provide the skills needed for growth.'

## Energy Envoys can help save planet

An environmental volunteering scheme has been launched for 300,000 young people, as part of the Duke of Edinburgh's Award (DofE).

The Energy Envoys scheme – created by the National Energy Foundation and supported by the UK's professional engineering institutions – aims to help schools and communities use energy more wisely, save money and reduce their carbon emissions.

Young people across the UK who are working towards their bronze, silver or gold DofE can now



volunteer as an Energy Envoy to complete the volunteering section of their award.

In its first year, the National Energy Foundation expects to support up to 1,000 Energy Envoys, delivering between 13,000 and 78,000 hours of volunteering through the country.

With a rolling registration of more than 300,000 participants, and operating through more than 12,700 centres across the UK, the DofE provides huge potential for developing a nationwide network of Energy Envoys.

## First 3D model of capital at your fingertips

The first fully interactive 3D digital model of London was unveiled at the property show MIPIM UK, at London Olympia.

VUCITY – a gesture-controlled, 5m x 3m interactive map of the city – is a joint venture between digital communications agency Wagstaffs and 3D modellers Vertex Modelling.

It visualises nearly 100km<sup>2</sup> of London in 3D, and offers planners, architects and councils a level of future-proofing in property and land development. Users can overlay and review existing, consented and proposed developments. They can also



overlay sunlight paths, plus protected viewing corridors via the government's London View Management Framework.

VUCITY includes real-time transport overlays and TFL

cameras, while data overlays include demographics, traffic and pedestrian modelling. For details, visit [www.vucity.co.uk](http://www.vucity.co.uk)

See 'Walking among giants' in the February 2015 *CIBSE Journal*.

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# Rodrigues scoops 20th CIBSE Graduate of the Year Award

● The event was attended by previous winners of the Graduate Award

Ryan Rodrigues, of Hurley Palmer Flatt and London South Bank University, has won the 20th CIBSE ASHRAE Graduate of the Year Award – and with it a trip to the ASHRAE Winter Meeting in Orlando, Florida, next January.

Rodrigues beat nine other graduate hopefuls, who were each challenged to give a four-minute presentation on 'How collaboration and teamwork can enhance my work as an engineer'.

The CIBSE Young Engineers Awards are sponsored by Andrews Water Heaters, Ruskin Air Management and Schneider Electric, and supported by CIBSE Patrons.

The graduate runners-up – Arup's Alexandra Lindsay-Bethune and Atkins' Charity Nicholls – also received bursary awards from the Rumford Club.

CIBSE President Nick Mead said: 'This year's new graduate engineers will be going into a very different world from 20 years ago, and must address some of



Charity Nicholls, Ryan Rodrigues and Alexandra Lindsay-Bethune

the most difficult challenges of recent times, such as sustainability and climate change. Therefore, it is more important than ever that we support them at an early stage to give them the best possible start to their lives as engineers.'

The awards, held at the Institution of Mechanical Engineers in London, were followed by the annual ASHRAE presidential lecture given by the society's president David Underwood.

See page 22 for the full report and page 16 for the Employer of the Year Award winners.

## MEES may cause property values to fall

Landlords face a reduction in the capital value of their asset unless the Energy Performance Certificate (EPC) for a building can be improved.

That's according to software company CO<sub>2</sub> Estates, which has been involved in research looking at the effect of EPCs on medium- to long-term property values as a result of minimum energy efficiency standards (MEES).

'The risk implied by MEES is real, and the possible effect of regulations could be as much as a 10% reduction in a building's capital value,' said Andrew Cooper, engineering and asset manager director at CO<sub>2</sub> Estates. 'We have seen a number of transactions where the EPC has been used to negotiate on prices.'

As of 1 April 2018, a non-domestic property cannot be let

unless it has an E-rating or higher on the EPC. If it doesn't, energy efficiency improvements must be made before the property can be let. CO<sub>2</sub> Estates claims that the regulations could suppress rental levels at rent review and lease renewal.

Read CO<sub>2</sub> Estates' research paper at <http://bit.ly/1GnArkE>, and see Hywel Davies' article on MEES on page 26.

## In brief

### WATES GROUP ACQUIRES SES

Construction and property services company Wates Group has reached an agreement to acquire Shepherd Engineering Services (SES).

The acquisition will unlock substantial expertise in technical and specialised construction operations, including off-site pre-fabrication, enhancing Wates' existing construction and property services offering.

Shepherd Facilities Management (SFM) has also been acquired, with a significant number of contracts and strategic frameworks from Shepherd Construction concluding the deal.

### SWECO BUYS OUT GRONTMIJ

Grontmij has become part of Sweco, which will hold 97.36% of all shares after settlement of the post-closing acceptance period. Sweco will now commence a statutory buy-out procedure.

For the immediate term, the contracting arm will remain Grontmij, and will rebrand to Sweco during 2016.

### DOUBLE ACQUISITION FOR ADEXSI

The Adexsi group has completed two acquisitions, making it one of Europe's largest smoke exhaust, fire safety and natural ventilation companies – and increasing its annual turnover to almost €150m.

The France-based group has bought SIH and Eternit Flachdach to add to its portfolio of specialist companies.

## The perfect combination..... P-Sensor and the CMR Velogrid



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P-Sensor

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## Resilient Cities group in action

A task group has been set up to focus on green infrastructure as a building service, and will form part of the CIBSE Resilient Cities special interest group.

Its first meeting, which took place in September, was attended by a mix of industry and research representatives, who swapped information and exchanged ideas.

The group is looking to organise breakfast technical tours of green walls and roofs. It also wants to develop independent design and maintenance guidance for building services engineers and facilities managers.

For more information, visit [www.cibse.org/Networks/Groups/Resilient-Cities](http://www.cibse.org/Networks/Groups/Resilient-Cities)

## Referees needed

The CIBSE Technical Symposium team will shortly commission around 70 authors to submit papers or posters, all of which will need to be peer reviewed.

Any Members or Fellows who are willing to review papers should contact the team, and include a few words about their areas of technical expertise.

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

If you are interested, email [symposium@cibse.org](mailto:symposium@cibse.org)

The CIBSE Technical Symposium will take place on 14 and 15 April 2016, at Heriot-Watt University in Edinburgh. For more information, and to book your place, visit [www.cibse.org/symposium](http://www.cibse.org/symposium)

# Check out new UK-SPEC to document your competence

## ● Important changes set to come into effect

The Engineering Council has just released the third edition of its UK-SPEC. This includes a number of wording changes, as well as the introduction of Competence E5.

CIBSE's assessment criteria for Licentiate, Associate, Member and Fellow is based upon UK-SPEC requirements, so documentation has been updated in line with these changes. The updated Competence Criteria are at [www.cibse.org/findyourgrade](http://www.cibse.org/findyourgrade)

All of those applying for CIBSE corporate grades and Engineering Council registration must ensure that they use the UK-SPEC third edition when completing their application, as follows:

- International applicants applying on or after 1 December 2015
  - UK applicants applying for or after the 1 February 2016 closing date
- Applicants should familiarise themselves with the



most up to date Competence Criteria documentation to ensure their Work Experience/Engineering Practice Report covers all competencies.

Additionally, all corporate grade competencies have increased by one to include Competence E5: Exercise responsibilities in an ethical manner. The range as given by the Engineering Council asks candidates to:

- Give an example of where you have applied ethical principles as described in the *Statement of Ethical Principles*

published by the Engineering Council and the Royal Academy of Engineering

- Give an example of where you have applied/upheld ethical principles as defined by your organisation or company, which may be in its company or brand values

For more information on the UK-SPEC update, visit [www.cibse.org/uk-spec](http://www.cibse.org/uk-spec)

You can find out more about the application and interview process by attending a Membership Briefing Session. For upcoming dates and locations visit [www.cibse.org/briefings](http://www.cibse.org/briefings)

# Hong Kong signals new chapter for Young Engineers Network

More than 20 CIBSE young engineers from around the world will meet in Hong Kong later this month, for the Young Engineers Network (YEN) annual conference – the first time this has taken place outside the UK.

The CIBSE YEN is an international network of regional groups, which provides support and professional development. It is led by the young engineers, and groups meet regularly to share best practice, coordinate activities and plan future developments.

Until now these meetings have been held in the UK, with participation by young engineers from the Gulf, Hong Kong and Australia, who have travelled to join the meetings.

The Hong Kong location is seen as the next stage in the development of YEN as a truly international network of young engineers.

The five-day conference will include technical visits, seminars and briefings on the building services challenges in Hong Kong. There will also be the opportunity for

attendees to take part in the Annual Hong Kong Building Services Technical Symposium.

Attendees will be reporting from the trip on CIBSE Twitter and LinkedIn.



RONNIE CHUA / SHUTTERSTOCK

# Employers of the Year impress judges with strong commitment to training



Overall and small category winner SDS has a diverse staff training programme

through which mentors of different disciplines are matched for non-technical informal mentoring.

In the firm's entry, project engineer, Joshua Howell, said: 'Ethos has continuously encouraged me to develop my technical ability and push me to my technical limits. I feel that the company's open, can-do approach is developing me to become the best engineer that I can be.'

Finally, SDS (Services Design Solution) won in the small category, and was also the overall winner.

The judges said the firm's sense of commitment went far beyond its small size. SDS's entry clearly showed how it met all the criteria, demonstrating the company's clear commitment to developing staff through a diverse programme of appraisals, training courses, seminars, educational visits, placements and policies.

Steven Griffiths, trainee engineer, added: 'I am made to feel part of a team, in a supportive learning environment at all levels, from director through to my peers.'

'I have gained experience on a variety of project types, giving me the chance to engage in creative and innovative uses of engineering technology.'

See our Q&A with SDS director Shaun Hoppins on page 97.

● **Developing young people is ingrained in culture**

The winners of the Employer of the Year awards were announced to a full house at the Institution of Mechanical Engineers (IMechE) in October. The accolades, which form part of the wider CIBSE Young Engineers Awards, were presented to companies that showed exceptional commitment to supporting and mentoring newly qualified engineers or students.

Hoare Lea won in the large category group, taking the

award in recognition of its commitment to developing young people – something they say is ingrained in their culture. The judges said they were a very strong all-rounder and exceeded every criteria. Judges noted, in particular, an impressive rise in graduate recruitment, and strong equal opportunities policy and practices. Their graduate exchange scheme and annual merit scheme are also impressive.

In his testimony, which formed part of the firm's entry, Matthew Taylor, Hoare Lea electrical engineer, said: 'The investment

Hoare Lea gives to develop its employees is apparent as soon as you join the firm. You see the nurturing support given to fresh graduates, and then how this continues to provide opportunities for more senior staff to become some of the leading engineers in the industry.'

Ethos Engineering claimed the award in the medium category, and was commended on its innovative and clear commitment to 'on the job' training. The company sponsors staff to further their academic or professional education, and offers an impressive scheme



Ethos Engineering won the award for medium-size firms



Hoare Lea exceeded every criteria to be named large Employer of the Year

# PROJECTING EXCELLENCE

Four new project categories in the 2016 Building Performance Awards have attracted a wide range of exemplar case studies, making the judges' job even tougher this year. **Alex Smith** had a ringside seat at the shortlisting session to find out which entries made the final round



Join the best of the industry's talent on awards night to see who will scoop the accolades. The glittering event – on 24 February 2016, at London's Grosvenor House Hotel – will celebrate achievements across the built environment supply chain. Don't miss your chance to be there. To book a table, visit [www.cibse.org/bpa](http://www.cibse.org/bpa)

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Arboreal Architecture, Clapham Retrofit

**N**early 50 organisations have been shortlisted for the 2016 Building Performance Awards following the addition of four new project categories. The companies were nominated across 13 categories at an all-day judging session in London last month.

The 16 industry experts were impressed with the variety of entries, and the amount of evidence produced to support their award submissions.

The new project categories were launched for the 2016 Awards in response to the popularity of the building categories in previous years. There are now individual Project of the Year Awards in sectors covering: Commercial/Industrial/Retail; Leisure; Public Use; and Residential buildings. In total, 17 organisations were shortlisted in these categories.

The judges said the new categories attracted a high calibre of entrants. They were particularly impressed by the Project of the Year Residential category. 'This was a really fantastic set of entries, but they were all very different,' said Bill Gething, professor of architecture at University of the West of England. 'There are entries here that are really changing the agenda. Choosing a winner is a delightfully difficult decision,' he said.

The judges agreed that the housing sector was becoming increasingly important for engineers, as house builders struggled to address the technical challenges of overheating and energy reduction.

Aecom technical director Foroutan Parand congratulated CIBSE for focusing on the domestic sector. 'We are being asked to do more and more in this area as people realise that physics applies as much to domestic buildings as commercial buildings,' said chair of the judges, Hywel Davies.



Sheffield University/Wroclaw University of Technology, Poland – LILAC Leeds

The Project of the Year International attracted a high calibre of entries, and was whittled down to a shortlist of five by the judges. The judges found it difficult to separate the leading entries, which had excellent performance data. 'The buildings are exceptional,' said Tamsin Tweddell, partner and sustainability leader at Max Fordham. 'They're game-changers.'

The Energy Saving Project of the Year had a substantial number of entries highlighting the search for innovation in the sector. 'This was a varied category, with products for both domestic and commercial use,' said Davies. 'Several entries demonstrated good evidence for their ability to deliver cost-effective energy savings.'

In the Collaborative Partnership Award, Munish Datta, head of facilities management and Plan A, Marks & Spencer, remarked that the entries showed how important it was to collaborate at the right time. 'In the best entries the stakeholders were involved at a



Studio Partington's Derwenthorpe Phase 1

really important design stage – they didn't get involved too late in the project.'

In the Energy Management Initiative Award, judges were impressed by how companies were able to find energy savings in their estates, after the low-hanging fruit had been picked. 'I know how hard it is to achieve year-on-year savings,' said Mitch Layng, associate director: portfolio energy management at M&G Real Estate. 'I like the idea of a new process that affects operations,' he said.

In the Commercial/Industrial/Retail category, there were some closely matched entries. Davies was pleased to note that the entries understood the difference between DECs and EPCs. Something that was 'almost worthy of a prize itself,' he said.

Entrants for the Project of the Year Public Use came from the opposite end of the funding spectrum, but the judges said the quality of entries was excellent. 'There were really good submissions in this sector,' said managing director of Building Services Design, David White, while Jamie Agombar, head of sustainability, National Union of Students, felt that the entries weren't overselling themselves in this category. 'There was no gloss,' he said, though Gething noted there was 'good data'.

Agombar thought the excellence of the best projects would inspire designers and clients of future public buildings.

In the Building Services Consultancy of the Year category (up to 100 Employees), the judges were impressed by the enthusiasm of some of the entries. Trox key account manager Michelle Perry praised one entry in particular.



Max Fordham, Girton College Cambridge

'You can feel the passion the company has in its people and its genuine desire to motivate the client and build better buildings.'

The Consultant of the Year category contained the 'heavy artillery' and the judges remarked on the professionalism of the entries. 'I read the first one, and I thought the second couldn't be as good, but it was and so were the third and fourth,' said Perry. The judges spent longer talking about the merits of these entries than any other category. 'They're all pretty even but they bring different things to the table,' said Sarah Ratcliffe, programme director at Better Building Partnership.

The judges noted that a number of entries had missing or difficult to understand data. Davies hoped that future entrants would follow entry requirements and provide the data which would maximise chances of victory.

The full shortlist is overleaf on page 20, and the awards will be presented on February 24 at Grosvenor House Hotel in London. To attend the event please visit [www.cibse.org/bpa](http://www.cibse.org/bpa) CJ



AWARDS JUDGES

- 

**Hywel Davies**,  
CIBSE technical director and chair of judges
- 

**George Adams**,  
past president, CIBSE
- 

**Jamie Agombar**,  
head of sustainability, National Union of Students
- 

**Munish Datta**,  
head of facilities management and Plan A, M&S
- 

**Alan Fogarty**,  
partner, Cundall
- 

**Bill Gething**, professor of architecture, University of the West of England
- 

**Susan Hone-Brookes**,  
environmental leader, Laing O'Rourke
- 

**Mitch Layng**, associate director: portfolio energy management, M&G Real Estate
- 

**Richard Jackson**,  
director, sustainability, UCL
- 

**Foroutan Parand**,  
technical director, Aecom
- 

**Michelle Perry**,  
key account manager, Trox
- 

**Geoff Prudence**,  
chair CIBSE FM Group
- 

**Sarah Ratcliffe**,  
programme director, Better Building Partnership
- 

**Jeff Shaw**,  
president elect, Society of Light and Lighting
- 

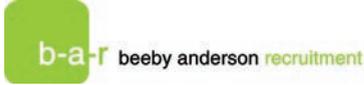
**Tamsin Tweddell**,  
partner & sustainability leader, Max Fordham
- 

**David White**,  
managing director, Building Services Design

**CIBSE BUILDING PERFORMANCE AWARDS 2016 SHORTLISTS**

**BUILDING SERVICES CONSULTANCY OF THE YEAR (UP TO 100 EMPLOYEES)**

Sponsored by Beeby Anderson Recruitment



- Beverley Clifton Morris (BCM)
- Steven A. Hunt & Associates
- SVM Consulting Engineers

**BUILDING SERVICES CONSULTANCY OF THE YEAR (MORE THAN 100 EMPLOYEES)**

Sponsored by Andrews Water Heaters



- Aecom
- Arup
- Atelier Ten
- Hoare Lea

**BUILDING PERFORMANCE TRAINING PROGRAMME AWARD**

Sponsored by Vaillant



- Refrigeration and Climate Control Centre of Excellence (RCCC) – Air Conditioning and Mechanical Contractors’ Association (AMCA)
- BIM Level 2 Fundamentals – BRE Academy
- Soft Landings Training – BSRIA
- Building Disclosure and Benchmarking Course – University of Nebraska (UNL) – Lincoln
- Building Services Explained for VolkerFitzpatrick Site Teams – VolkerFitzpatrick

**COLLABORATIVE WORKING PARTNERSHIP AWARD**

Sponsored by RS Components



- Bolton Market, Bolton – Beverley Clifton Morris (BCM)/Willmott Dixon
- John Lewis, York – IES/John Lewis
- Barclays CPMO – Realsys (part of ISG)/Barclays

**FACILITIES MANAGEMENT TEAM AWARD**

Sponsored by Gratte Brothers



- Aston Go Green, Birmingham – Aston University

- Broadgate Estates London Portfolio – Broadgate Estates
- International Commerce Centre (ICC), Hong Kong – Kai Shing Management Services (KS)
- Sirius, Canberra, Australia – Mirvac Group

**ENERGY MANAGEMENT INITIATIVE AWARD**

Sponsored by Imtech



- Energy Management and Optimisation Project – ALDI Stores
- British Land Portfolio Energy Reduction Programme – British Land
- Bupa Energy Saver Fund – Bupa UK
- John Lewis, York – Lateral Technologies and Solutions
- Project Graphite – Sainsbury’s Supermarkets

**ENERGY SAVING PRODUCT OF THE YEAR**

Sponsored by Spirotech



- Emerald – R290 Refrigeration & Heating Plant – A1 Engineering Solutions
- Totem by Asjagen Microcogenerator – Adveco
- EW-HT heat pump – Climaveneta SpA
- EndoTherm – Endo Enterprises (UK)
- Hydromx® – PBA Energy Solutions

**LIGHTING FOR BUILDING PERFORMANCE AWARD**

- The National Theatre – NT Future, London – Atelier Ten
- WWF, Living Planet Centre, Woking – Atelier Ten
- New Emergency department and 24-bed ward, Antrim Hospital, Northern Ireland – Beattie Flanigan Consulting Engineers

**PROJECT OF THE YEAR – INTERNATIONAL**

- Shopping and Entertainment Centre PROSPECT, Kiev, Ukraine – CD International Building Services Engineers
- American University of Sharjah (AUS), Campus Service Centre, Sharjah, United Arab Emirates – Cundall
- David and Lucile Packard Foundation Headquarters, California, USA – Elementa Consulting/Integral Group
- Holiday Inn Express Singapore Orchard Road, Singapore – Intercontinental Hotels Group
- Sirius, Canberra, Australia – Mirvac Group

**PROJECT OF THE YEAR – COMMERCIAL/ INDUSTRIAL/RETAIL**

- One Embankment Place, London – ChapmanBDSP
- Foundry, London – Cullinan Studio
- 101 Park Drive, Abingdon – Elementa Consulting
- 50 Shakespeare Street Refurbishment, Nottingham – Nottingham Trent University

**PROJECT OF THE YEAR – LEISURE**

- Splashpoint, Worthing – Aecom
- Butlin’s Skegness Firehouse restaurant, Skegness – CD International Building Services Engineers
- Chichester Festival Theatre, Oaklands Park – Skelly & Couch
- Everyman Theatre, Liverpool – Waterman Building Services

**PROJECT OF THE YEAR – PUBLIC USE**

- Wilkinson Primary School, Derwenthorpe Phase 1 – Architype
- Mayville Community Centre (renamed Mildmay Centre), London – Bere: architects
- Manchester Town Hall Complex Transformation Project (MTHCTP), Manchester – Building Design Partnership (BDP)
- Andrew Wiles Building (Mathematical Institute, University of Oxford), Oxford – Hoare Lea
- Britten Pears Archive, Suffolk – Max Fordham

**PROJECT OF THE YEAR – RESIDENTIAL**

- Clapham Retrofit, London – Arboreal Architecture
- Girton College, Cambridge – Max Fordham
- LILAC, Leeds – SSoA, Sheffield University/ Faculty of Architecture, Wroclaw University of Technology, Poland
- Derwenthorpe Phase 1, York – Studio Partington

**BUILDING PERFORMANCE CHAMPION**

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# THE FUTURE'S BRIGHT

On the night the Graduate of the Year Award celebrated its 20th anniversary, the next generation of young engineers showcased their talents to win the prestigious title. **Liza Young** reports

“Winning this award will open lots of doors for me, and the trip to Orlando will help me gain important contacts in the industry”



## JUDGING PANEL

- **Tim Dwyer** CIBSE ASHRAE Group chair
- **Nick Mead** CIBSE President
- **David Underwood** ASHRAE President
- **Richard Folkson** IMechE President
- **Emilia Targonska** Graduate of the Year 2014
- **Kevin Mitchell** Graduate of the Year 1996

**N**ine young engineers stood up and made their voices heard when they competed for the CIBSE ASHRAE Graduate of the Year 2015 title.

The graduates were challenged to demonstrate their presenting and communication skills at the London headquarters of the Institution of Mechanical Engineers (IMechE) last month, in a bid to win a trip to the ASHRAE Winter Conference in Orlando, Florida.

Ryan Rodrigues, electrical engineer at Hurley Palmer Flatt, scooped the top prize after impressing the judges with his comical, yet practical, take on how collaboration and teamwork enhances his work as an engineer.

Arup's Alexandra Lindsay-Bethune, who graduated from the University of Edinburgh in 2013 with a first class Master's degree in electrical engineering and renewable energy, came a close second, receiving £500 from the Rumford Club.

Third place – and £250 – was awarded to Charity Nicholls, of Atkins, who graduated with a MEng degree in architectural engineering from Heriot-Watt University in 2013.

Rodrigues, who completed an MSc in building services engineering and graduated with distinction from London South Bank University, said he was overwhelmed to win the award.

He said: 'Winning this award will open lots of doors for me, and the trip to Orlando will help me gain important contacts in the industry.'

In his presentation, he stated that his role as an engineer – or any engineer for that matter – was to solve problems. 'It is what I'm paid to do, it is what I like to do and it





From left... finalists Peng Jiang, Ruth Howlett, Ryan Rodrigues, Charity Nicholls, William Webb, Andrew James, Alexandra Lindsay-Bethune, Demetrios Constantinou and Jorge Abarca Montero



is why I came into the industry in the first place,' he said.

'For me, the goal of the engineer is to solve problems day in, day out.'

He added: 'When I come across a problem for the first time, I scratch my head for a few seconds and, using my knowledge and skillset, I come up with a solution.'

He said this solution has three key criteria: quality, cost and time.

'But, as an engineer, I am not alone. I have access to a wide range of team members – individuals with their own knowledge boxes – from mechanical engineers to civil engineers, structural engineers, project managers, cost consultants and, yes, even architects are on that list!'

Rodrigues, who is also a STEM Ambassador and Big Bang Fair judge, said these key team members allow him to access a wider knowledge pool, which can be tapped into through a variety of media and technologies, including face-to-face interaction or web conferencing.

'The end result is that my knowledge field increases,' said Rodrigues. 'And other key criteria – confidence, communication and efficiency in completing a task – also increase.'

He said that the next time he encounters a problem, the solution would be far better than before because it would be technically superior, and save the client time and cost.

'If those things happen, we'd definitely get a pat on the back, and maybe get a nice bonus – if we're lucky,' Rodrigues added.

When the work is finished, Rodrigues said that gained knowledge still remains. 'So when problem two and problem three arrive, I'm in a better position to solve them.'



Ryan Rodrigues... worthy winner



Alexandra Lindsay-Bethune... second



Charity Nicholls... third place

He added: 'And the better you are at solving problems, the better you are as an engineer.' **CJ**

● Tenth finalist Abdul Wahab Malik, of NED University/Meinhardt, Pakistan, was unable to get a travel permit for the event in London. The ASHRAE UAE Chapter will present him with his finalist's certificate.

# Feedback

This month, LinkedIn users consider whether developments in battery technology will enable buildings to become the power stations of the future; plus questions on ISO 50001

**Mike Barker**

The battery is coming, and with it a different future. Energy sources, like the internal combustion engine, are on their last legs – witness the level of deception that VW adopted to cover the inadequacies of diesel. Then factor in that the world’s largest and most profitable company (Apple) is increasing its electric vehicle research team to 1,800 staff. And when a four-door Tesla sedan does a Top Gear-ish 0-100kmph in 2.9 seconds – and covers 400km on a tankful – what’s not to like?

If buildings are to become the power stations and petrol stations of the future, how will we engineer them? In an ideal world, the magic grid would have infinite capacity and be run by a charity willing to take your building’s self-generated energy at a moment’s notice (Feed-In Tariffs) – or, at the very least, in equal exchange for electricity whenever you needed (net metering).

**Chris Kershaw**

Tesla have realised a domestic energy store ‘Powerwall’ so it can’t be far off for commercial.

**Mike Barker**

Investment bank UBS said in 2014 that ‘the payback time for unsubsidised investment in electric vehicles, plus rooftop solar, plus battery storage will be as low as six to eight years by 2020’.

This year, UBS also found that the three-year cost of owning a Tesla S is the same as that of a Audi A7 3.0 TFSI. Price parity is more important than concerns about climate change; however, if the tax on emissions had to increase, then EVs would win outright. What is important now is just how your buildings will supply energy for that Apple, Leaf or Tesla in the garage.



The four-door electric Tesla sedan

DARREN BRODIE / SHUTTERSTOCK

**Robert Lancaster**

While I agree that buildings can and will become power stations, I don’t think, on a sustainable front, it will be via lithium ion batteries, but something low-cost and relatively small, like Carnegie Mellon’s aqueous. As for transport, something similar would be ideal, or new biofuels for the IC engine.

**Tony Johnstone**

I am suspicious about biofuels – they still seem to mean competition with food crops at a time when population growth (and movement) are promising upheaval. Where are we with hydrogen? Wasn’t that supposed to mop up surplus generation? Anyway, buildings are going to be all electric before too long – economic onsite generation would seem to have a tied market.

**Graham Smith FCIBSE**

Biofuels can be grown from algae so do not have to compete with food crops. They can also be substituted into our existing infrastructure far easier than most alternatives with liquid and gas biofuels. A Tesla has an appeal, but I need a car that can do longer distances without a long recharge. Hydrogen fuel cells seem to be progressing

‘If buildings are to become the power stations and petrol stations of the future, how will we engineer them?’

slowly. Energy storage needs to be considered far more, and batteries need to be recyclable. We need to ensure our decisions incorporate the right options.

**James Schenck**

In my view, batteries should be both thermal and electric; the end use of the energy matters.

**Andrew Geens answers questions about CIBSE’s ISO 50001 Certification accreditation**

**Mike Barker**

Why would a building owner bother with LEED and BREEAM when they can get certified to ISO 50001 Energy Management Standard and ISO 14001 Environmental Management Systems Standard instead?

**Andrew Geens**

ISO 50001 and ISO 14001 would work well for a lot of companies but, equally, there may be situations where BREEAM or LEED are a requirement.

**Claire Das Bhaumik FCIBSE**

What would it cost to implement ISO 50001 for a large business? I’ve heard figures of up to £100,000!

**Andrew Geens**

It is simpler and cheaper for small companies compared to a large manufacturing plant with several fuels and significant energy users. In the latter case, it will be more expensive to introduce but, on the other hand, the scale of the resulting reduction in energy costs will also be greater.

*CIBSE Journal* welcomes readers’ letters, opinions, news stories, events listings, and proposals for articles. Please send all material for possible publication to: [editor@cibsejournal.com](mailto:editor@cibsejournal.com), or write to Alex Smith, editor, *CIBSE Journal*, CPL, 275 Newmarket Road, Cambridge, CB5 8JE, UK. We reserve the right to edit all letters.

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# THE NET CLOSES IN ON WASTEFUL LANDLORDS

Regulations that will restrict the letting of F- and G-rated properties in England and Wales were passed just before the General Election in May. **Hywel Davies** explores what the restrictions are and considers what landlords might do in response

Readers may recall that the government consulted in August 2014 on regulations to limit the letting of buildings with poor energy efficiency ratings. These were originally described as ‘Minimum Energy Performance Standards’, or MEPS. The government considered the responses received and, as a result, amended its proposals, including dropping the ‘MEPS’ label. This is probably helpful because, outside of Europe, MEPS usually describes minimum energy efficiency standards for appliances and equipment, which we cover by the term ‘eco-design requirements’.

Now we have The Energy Efficiency (Private Rented Property) (England and Wales) Regulations 2015, which cover domestic and non-domestic properties. For the latter category, the regulations apply to non-domestic private rented (PR) sector properties in England and Wales, which are defined in the Energy Act 2011 as property let on a tenancy that is not a dwelling. However, the regulations exclude property let on a tenancy granted for six months or less (as long as granting of the tenancy does not mean the tenant will have occupied the property for more than 12 months), and property let for more than 99 years.

All non-domestic property is in the scope of the regulations, except where specifically excluded from the existing requirements to have an Energy Performance Certificate (EPC) as set out in the Energy Performance of Buildings (EPB) Regulations 2007 or the Building Regulations 2010.

The minimum energy efficiency standard (MEES) is set at an EPC rating of E for both domestic and non-domestic sectors. A domestic or non-domestic PR property that has a valid EPC with an F or G rating is defined by the regulations as ‘sub-standard’.

An EPC is valid if it has been entered on the register within the past 10 years

and has not been superseded by a subsequent EPC. This means that a building without an EPC cannot be sub-standard, and that older EPCs with possibly better ratings cannot be used to escape the provisions of the regulations.

A sub-standard property may not be let unless the landlord has made all relevant energy efficiency improvements, or there are no relevant improvements to be made. This provision only applies for five years, however, and the clock starts ticking when the landlord registers the property on the Privated Rented Sector (PRS) Exemptions Register, which ‘the Secretary of State must establish and maintain’.

The regulations also contain safeguards to ensure that they only require permissible, appropriate and cost-effective improvements. Where landlords can show the following, then they are exempt from making improvements, subject to entering details on the register of exemptions:

- The measures are not cost effective, either within a seven-year payback or under the Green Deal’s Golden Rule
- Despite reasonable efforts, the landlord cannot obtain the necessary consents to install the required energy efficiency improvements, including from tenants, lenders and superior landlords
- A relevant, suitably qualified person provides a written opinion that improvements are inappropriate because they will damage the fabric or the structure of the building
- The measures will reduce a property’s value by 5% or more.

There are also provisions for giving temporary exemptions, lasting up to six months, for events, such as the receivership of a landlord, subject to entry on the Exemptions Register.

From 1 April 2018, the regulations will apply to the granting of any new tenancy, either domestic or non-domestic. From 1 April 2020, they will apply to existing domestic tenancies and, from 1 April 2023, to all

There is the prospect of local authorities being responsible for enforcing the new regulations on themselves





non-domestic tenancies. Local authorities will be responsible for enforcement for domestic properties, and local weights and measures officials for non-domestic. The penalties for not complying could be substantial, with a penalty of 20% of rateable value – up to a maximum of £150,000 – where non-compliance has lasted more than three months.

This does open the prospect of a loophole, as landlords who do not have an EPC can offer property for rent without a 'valid EPC', so the property cannot be defined as sub-standard under these regulations. While this is unlawful and exposes the landlord to penalties under the EPB Regulations, these are capped at a far lower level than under the energy efficiency regulations.

Given the evidence of the past eight years of EPB regulatory avoidance, this prospect cannot

be discounted. There is also the prospect of local authorities being responsible for enforcing the regulations against themselves.

However, those who do have a valid EPC, or who obtain one for the first time in connection with a transaction, will need good advice on energy efficiency improvement measures, their likely cost and the expected benefits. Calculations will be needed to determine whether the improvements are cost effective within the terms of the regulations.

This is likely to require the expertise of CIBSE members, who have the knowledge and skill to calculate and model the impact of potential improvement measures on buildings. They can also provide sound advice on those measures that are 'inappropriate' under the regulations, and the most cost-effective measures to bring a building up to 'standard'.

Although these regulations do not come into force fully for another two and a half years, wise landlords are already assessing the impact on their portfolios, and planning how they will manage the obligations that will come into effect from 1 April 2018. They are likely to seek good advice well before then, and *Journal* readers should be well placed to offer it.

- See news story 'Property values may fall due to MEES' on page 14.

#### References:

- 1 The Implication for Valuers of the Energy Efficiency (Private Rented Property) (England and Wales) Regulations 2015 <http://bit.ly/1GnArKE>

● **HYWEL DAVIES** is technical director at CIBSE [www.cibse.org](http://www.cibse.org)

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# CLIMATE OF CHANGE: ARE OUR CITIES OVERHEATING?



High demand for new developments is taxing the minds of consultants and contractors, says **Geoffrey Palmer**



New developments in Salford, Manchester

TOM HELENIK / SHUTTERSTOCK

As consulting engineers, we all ponder overheating, the urban heat-island effect, cost-effective CO<sub>2</sub> reduction and the overall sustainability of our projects. We use BIM, passive design, complex analysis, soft landings and a myriad of other tools to better understand our built environment, and the part it plays in wider society.

Overheating and recent climate change of a different sort, however, is also taxing the minds of consultants and contractors. I am referring to the London speculative development market. Never before have we seen so many instant flat sales, off-plan to overseas and wealthy investors. This demand has resulted in a massive increase in this area of the market, one with which designers and builders are struggling to keep pace. Recruitment of good individuals – rather than just the traditional concern of work winning – is taxing many in our industry. Not a bad thing, I hear you say, but is this sustainable? How do we keep diversity in our business to cushion any future slowdowns? How do we generate robust designs that a rapidly growing contractor workforce can implement when skilled labour becomes a

rare commodity. Repetition, off-site fabrication, multiskilled operatives and more extensive use of modern systems and techniques must have a part to play.

Let's start with repetition. This allows installation teams to develop their ability through a project, maximise the use of apprentices and help build growing capacity as more work faces become available on a project. A good level of repetition also opens additional avenues for modularisation and off-site fabrication. When we do get high repetition and a great desire to hand over completed sections of large projects – where connections to prefabricated elements are necessary – there may be benefits from multiskilled teams, again with apprentices growing into the role.

Large projects have always warranted off-site discussions, with many electing to use toilet pods, some incorporating riser modules, and a few on-floor services and large-scale plantrooms. Now it is capacity, as well as installation speed and quality, that is a key driver in these discussions. Off-site fabrication is often talked of, but we need to change this term to *design for off-site fabrication*. This ethos cannot be bolted on but must run through the whole design process

Never before have we seen so many instant flat sales, off-plan to overseas and wealthy investors

from day one. Otherwise opportunities for off-site fabrication will be to zero.

So what are the modern systems I have alluded to? Modern may not be the best term, as many of these technologies have been available for some time. From pre-insulated ductwork to self-balancing controls; from plug-and-play lighting and modular wiring systems to proprietary jointing. These exist to make site work and testing easier. Such systems are often discounted on cost grounds, but – in this new climate – engineers need to consider them more fully and help ensure their pricing and cost-benefit analysis are robust. This is at a time when rapid market growth can make effective cost estimation more difficult.

Another area for consideration is the real-life diversity in some of our most expensive residential towers and whether our designs have been optimised for the potential part-load and part-occupied scenarios. We have seasonal efficiency data for key building plant, but our regulations generally assume full in-use buildings. While total energy use may be below that calculated for building control, without careful consideration of controls strategy and part-load performance, relative efficiencies can quickly drop off. As engineers, we often look at this type of analysis, but how often does the 'what if' scenario have a real impact on plant selection?

In my business, I have looked at regional diversification to provide some additional robustness and new sector penetration alongside the speculative London market. We now have a good presence in Manchester and are undertaking some large industrial projects, although recruitment of good people here remains challenging.

I may be worried unduly about these additional technical challenges and having lots of eggs in one basket, but I can't be the only one. Can I?

● **GEOFFREY PALMER** FCIBSE is a director at Grontmij, part of Sweco



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# THE RIGHT TOOL FOR THE JOB?

The NBS BIM Toolkit is designed to help organisations reach Level 2 BIM, but how does it perform under test conditions? The CIBSE BIM Group used the beta version on a hypothetical junior school project and found issues that urgently need to be addressed. **Tim Dwyer** reports



**T**he requirement for Level 2 BIM on all centrally procured public sector projects is looming – from 2016 it will be mandated for all such buildings and infrastructure.

To help industry move to this level the government commissioned RIBA Enterprises to develop a tool to provide step-by-step help to define, manage and validate responsibility for information development and delivery at each stage of the asset life-cycle.

The toolkit, which had more than £800,000 funding from Innovate UK, is intended to be the chosen way of delivering projects to meet Level 2 BIM requirements, but how well does it work for the wider building industry?

To assist RIBA Enterprises in the development of the BIM Toolkit the CIBSE BIM Group tested out the nascent online toolkit (phase 2 beta) in the early part of the summer. Their findings and RIBA Enterprises' responses are summarised below.

## Testing the BIM Toolkit

Two teams of senior industry practitioners drawn from the CIBSE BIM steering group – representing designers, contractors, building operators, maintainers and clients – created a 'project' using the BIM Toolkit as a 'client tool'. One group was set up as client/design team, testing from stage 0 to 4, and the other as a contractor/sub-contractor team considering

stages 4 to 6. The aim was to use the tool in a realistic scenario using a hypothetical project for a small junior school.

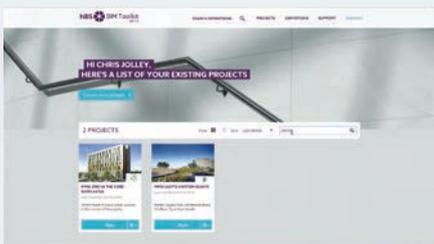
Both teams had a shared concern about the ambiguity in the Toolkit of the terms 'task' and 'deliverable'. These appeared to be interchangeable, with 'task' applied to design stage outputs and 'deliverable' to physical entities for incorporation in the project works.

In normal industry parlance a task is an activity while a deliverable is a 'thing' that is provided – and not all tasks result in a deliverable. In response, RIBA Enterprises has acknowledged the distinction and intends to add further explanation to the Toolkit.

Similarly, the CIBSE teams noted that the tasks in the Toolkit are not linked to a timeline; in the real world a task is required at a certain point and a project cannot move forward with tasks incomplete. RIBA Enterprises said the Toolkit is not intended as a substitute for detailed project-programming tools.

The CIBSE BIM steering group felt that, irrespective of the above, the fact the Toolkit did not provide a check of 'deliverables issued' was a missed opportunity for a client to measure stage progress/completion and to flag-up incomplete works before allowing other things to move forward. This was less of an issue of programming than of precedence-scheduling and ensuring delivery.

The group believed that integrating



Level of detail and level of information templates, and list of projects



further information processes, such as those defined in the *BSRIA BG6 Design Framework for Building Services*, would provide a more rigorous, and usable, pathway through the 'project' with the Toolkit. RIBA Enterprises said that publishers with related content would hopefully create this in the Digital Plan of Works (DPoW) format and distribute it to their members/customers for use. It is its intention – or hope – that private clients will do this as well as publishers.

The steering group said the Toolkit will not allow a deliverable unless it is defined by Uniclass 2015. 'Documentary' deliverables were notably absent from the beta version. For example, the Toolkit ignored the need for some statutory documents required by the Building Regulations, such as: logbooks; commissioning certificates; air tightness test reports, and the like. RIBA Enterprises said that classification of more documents was in



A 3D model in NBS BIM Toolkit

progress and that the CIBSE BIM group's support would be well received.

RIBA Enterprises acknowledged that the ability to add custom deliverables and custom properties would be valuable to cover the possibility that something unusual is needed as a deliverable in a project.

The CIBSE BIM steering group was bemused by the Toolkit's 'product data templates', which, unlike the official Product Data Templates (PDTs) – currently being developed by the cross-industry collaborative user group through an open source, consensus, peer-reviewed process – did not follow the same skeletal structure and confused both general and project-specific information. To avoid further confusion, it recommended the Toolkit should adopt a different name for its product schedules, since they follow neither the format nor the process used by genuine PDTs. It suggested the term 'Property Sets' – as used in the DPoW brief issued by the BIM Task Group.

RIBA Enterprises said it hoped the BIM Toolkit's level of information (LOI) would be used as a base by others intending to extend them, and that the Toolkit's PDTs only provided a consistent language and core of minimum requirements to support the

exchange of digital construction information.

This response misses the steering group's point, which is that the official PDTs are created only to be one part of the property sets in the Toolkit (or other version such as COBie). PDTs were intended only to capture general product data in a digital form for direct-inputting to a BIM. (Currently such data must be input manually). By misbranding PDTs, the Toolkit confuses the distinction between general and project-specific data and the difficulties of sourcing general data in digital form that the PDTs were invented to resolve.

It was noted by the steering group that the Toolkit allowed LOIs and levels of detail (LODs) that were not required to harmonise with work stages. For example, the DPoW allowed LOI 5 and LOD5 deliverables to be required at (say) work stage 2.

While the BIM steering group understood that the need for such arrangements arose

The group considered that the beta version has some way to go before it will be able to deliver the promised efficiencies and opportunities for the whole industry



where, say, a client always uses the same product and thus can specify it as a brief requirement. But it was still concerned that in the hands of ignorant compilers of a DPoW, ‘advanced’ LOIs and LODs may be specified that demanded detail that was neither appropriate nor indeed possible to provide, and which would add cost and complication. The steering group recommended the Toolkit should flag a warning where advanced LOIs and LODs are specified, to allow inappropriate or reckless use of this facility to be challenged.

RIBA Enterprises acknowledged CIBSE’s observation that there were gaps in Uniclass coverage – for example, in the particular exercise undertaken by the review team there is no classification for school or commercial kitchens, only residential or recreational; no school toilet, only residential or women’s public, and so on – and they advise that further work on Uniclass is in progress.

The steering group considered that a ‘lay’ client would be unable to complete the project in the Toolkit without professional help – a point acknowledged by RIBA Enterprises.

The group observed that the Toolkit offered overly detailed scope descriptions at initial brief stage when outcomes and required performance would better define requirements and enable practitioners to help the client form the ‘final brief’. The Toolkit ignored this well-proven step to the genesis of good project briefs. The CIBSE team had a further concern that assembling the scope in list form would result in omissions that would be costly and disruptive to address later. RIBA Enterprises noted these points.

**Summary**

The steering group considered that the Toolkit process was extensive, but felt the end product was not as useful or detailed as existing, more user-friendly, project tools in defining

roles, outputs and deliverables. They were particularly critical of the absence of wide-ranging schedules of tasks/deliverables.

They were concerned that unless the Toolkit is accessible and useful enough to be embraced by all those involved in a project, it will come to be seen as further bureaucracy and will not enable the efficiency, clarity and ultimately collaboration that are at the heart of the BIM mission. And since the Toolkit was designed as a ‘client-tool’, they saw that omission of delivery, operational and maintenance data as a critical and fundamental flaw in the beta version.

The group was complimentary of the RIBA-Enterprises team for producing so much good material in so short a time. The group recognised that RIBA-Enterprises had insufficient time to properly incorporate the various suggestions from other stakeholders or to move far from the formulations of its existing NBS products in developing the Toolkit.

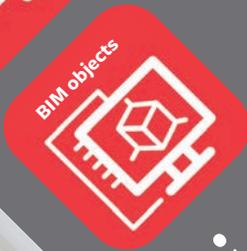
That said, the group considered that the beta version has some way to go before it will be able to deliver the efficiencies and opportunities for the whole industry, and especially the MEP sector, that the Government’s BIM mission promised.

The Toolkit comprises open fields that one independent commentator reckoned to involve 200,000 decisions to complete, yet, once done, still lacks the granularity to be as useful as established process systems, such as BG6. Further, it missed and, indeed, obfuscated the opportunity to embrace other valuable inputs, such as the industry-produced PDTs, which enables digital data to be more easily inputted.

The group remains keen to provide further input to the development of the Toolkit to help future iterations more fully accommodate the needs of the whole building community. CJ



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# SURVIVING THE BOOM TIMES

Business may be booming in the building services sector, but the pressures of frozen fees, skills shortages and rising construction costs mean industry's top consultants cannot afford to be complacent. **Roxane McMeeken** reports on the findings from *CIBSE Journal's* first consultant survey and speaks to industry leaders facing an overheating market

In many ways, building services engineers 'have never had it so good'. However, just as when the then Prime Minister, Harold Macmillan, made this famous declaration in 1957 – about the UK's booming, post-war economy – this is not the whole story.

As the construction industry emerges from recession, *CIBSE Journal* makes its first 'state of the nation' assessment of the building services engineering sector, supported by revealing evidence from our

inaugural survey of the sector's companies, conducted exclusively for us by Hewes & Associates.

We asked respondents about trends in turnover, profit and employment, and found that there is much to celebrate, with revenues rising and engineers taking an ever-more pivotal role in projects. Challenges continue to stalk the sector, however, not least in that fees are lagging behind the positive trends being seen elsewhere.

## Onwards and upwards

Perhaps the most heartening finding of our survey – in which 27 companies took part – was that total operating profit for the firms for 2014 was up compared with 2013, by a huge 45%. In cash terms, this a rise in collective profit from £38m to £55m. This figure excludes Atkins because the comparatively much larger size of the company results in skewed figures – a 17.5% increase to £161m.

Sales have also grown well, with the firms combined (excluding Atkins) enjoying a revenue rise of 11% over the period, to £856m. Some of the more impressive increases were at Hoare Lea, where turnover rose from £52m in 2013 to £60m in 2014, at WYG, where sales grew from £73m to £84m, and at Cundall, where revenue climbed from £21.5m to £27m.

'The market is a different place to what it was two years ago,' says Matt Hann, business growth director at WSP Parsons Brinckerhoff, where building services turnover has grown from £20.5m in 2013 to £22m in 2014. 'The

## About the survey

The inaugural *CIBSE Journal* industry survey shines a light on the health of the building services sector by analysing financial performance and recruitment levels. Based on the number of chartered CIBSE members they employed, we sent questionnaires to more than 60 companies. We asked them for their latest sales and profit figures, and employment details, including the number of mechanical and electrical engineers they had. In total, 27 firms responded and we have ranked their data in five

tables according to sales, number of employees, engineers, chartered engineers and graduates. The survey is a snapshot of the industry rather than a comprehensive overview. Some of the participants returned information solely relating to their building services divisions, so we have grouped them separately to firms that provided information on their organisation as a whole. Please email [editor@cibsejournal.com](mailto:editor@cibsejournal.com) if you have any comments on the survey or would like to participate next year.

There is much to celebrate, but challenges continue to stalk the sector, not least in the fact that fees are lagging behind the positive trends being seen elsewhere

building services sector is buoyant and a great place to work, and that makes our staff members feel motivated.'

This reflects the wider growth story of the construction industry; the Construction Products Association (CPA) said that activity rose in every quarter of 2014, with the strongest growth in private housing and commercial properties. For 2015, it forecasts growth of 4.9%.

Another piece of good news, Hann says, is that projects are happening around the UK rather than only in London, which often performs as a separate and significantly busier segment of the national market. 'It has taken a while for things to start moving further north, but now we are working on fantastic projects up and down the country,' he says. Recent appointments include an £80m teaching and learning facility in Glasgow and healthcare projects via frameworks in Scotland and England. WSP Parsons Brinckerhoff is also working on an impressive, six-tower, 'vertical village' development in Manchester, which recently won planning permission.

Equally tellingly, Grontmij opened its first building services office in Manchester in January and it expects to employ seven or eight engineers there by year-end. Geoffrey Palmer, director at the company, says: 'This was a response to the government's talk of creating a "northern powerhouse", which we think is really happening.'

Others, however, are still finding that most of their revenue is from the South East. Ray Upjohn, chief executive of Chapman BSP, for

#### Financial performance by 2014 sales

		Sales			Operating profit	
Company Name	2013 £m	2014 £m	Year end	2013 £m	2014 £m	
1 Atkins	1,705.2	1,750.1	31/03/2014	99.2	106.4	
2 Capita Property & Infrastructure	297	328.8	31/12/2014	16	26.9	
3 WYG	72.9	83.9	31/03/2015	3.4992	4.8662	
4 Ramboll UK	63.926	67.713	31/12/2014	n/a	n/a	
5 BDP	59	65.2	31/12/2014	1.1	2.1	
6 Hoare Lea	51.8	59.9	30/04/2014	7.2	7.1	
7 Grontmij	54.525	50.467	31/12/2014	0.768	1.127	
8 Cundall	21.3	26.8	30/06/2014	n/a	n/a	
9 Hurley Palmer Flatt	17.969	22.711	31/03/2015	0.612	0.704	
10 Hilson Moran	16.139	16.971	31/12/2014	0.317	0.368	
11 ChapmanBDSP	11.907	14.829	30/09/2014	0.661	1.2	
12 Troup Bywaters + Anders	12.3	13.7	31/12/2014	2.3	2.6	
13 Hulley & Kirkwood	9.875	10.583	30/06/2014	0.827	0.954	
14 Clancy Consulting	8.5	8.9	30/04/2014	0.595	0.6675	
15 Red Engineering Design	5	6.9	31/10/2014	0.127	0.571	
16 DSSR	6.999	6.832	31/03/2014	0.413	0.497	
17 Atelier Ten	4.93	5.524	31/12/2014	0.245	0.343	
18 Desco	4.2	5	31/03/2015	0.612	1.166	
19 Elementa	2.858	4.832	31/12/2014	0.0481	0.556	
20 Rolton Group	4.128	4.247	30/09/2014	0.117	0.103	
21 Services Design Solution	2.5	2.7	31/05/2015	n/a	n/a	
22 Henderson Green	2.1	2.1	31/03/2014	n/a	n/a	
23 Skelly & Couch	1.6	1.967	31/03/2014	0.392	0.498	
<b>Building services only</b>						
1 Foster + Partners	8.57	10.28	30/04/2014	1.7	2.15	
2 WSP/Parsons Brinckerhoff	20.5	22	31/12/2014	na	na	
3 Waterman Building Services	5.7	8.5	30/06/2014	0.088	0.234	
4 Pick Everard	4.55	4.95	30/04/2015	0.25	0.15	

▶ example, says: ‘Our work in the UK is mainly in London.’ The firm is seeing more mixed-use schemes in the capital than anything else, typically with an equal mix of retail, residential and offices, such as the redevelopment of Battersea Power Station.

Happily for companies with a London-biased workload, the international market offers the chance to diversify. ‘International work is still reasonably strong,’ says Upjohn. It makes up 20% of Chapman BSP’s turnover – which grew from £12m in 2013 to £15m in 2014 – and the firm’s overseas business is split roughly equally between the Middle East and Africa.

Hurley Palmer Flatt balances a London-focused UK business with even more overseas work, and its non-UK book of business makes up 40% of turnover, which was £23m for 2014. It will be higher now, after the firm acquired Andrew Reid & Partners last autumn, which is another sign of growing confidence in the

market and a move that chief executive, Paul Flatt, says ‘doubles’ the business. At home, the workload now comes from three main sectors, he adds: ‘Commercial corporate – such as banks, insurers and legal firms, the development sector – driven by the shortage of offices, especially in London; residential schemes, backed by overseas investors; and the technology, media and telecoms (TMT) sector. It’s no secret why these organisations are growing: they need more data storage and their businesses, research and technology are expanding all the time.’

Many building services engineers claim that, in addition to rising workloads, the role they are performing on projects is being enlarged. Upjohn says: ‘We are being brought in much earlier, mainly because of the work clients need to do on energy efficiency at the planning stage these days. Planners are now more interested in how much daylight a building will have and the layout of the

plantroom. We also find that we are being consulted a lot more about the façade, on issues such as how it can maximise shading while also allowing in as much daylight as possible.’ This is logical and satisfying, he says. ‘It means you can make buildings a lot more efficient – by moving plant off the roof to make space for penthouses, for example, or by influencing the orientation of the building to reduce solar impact.’

### Frozen fees

Despite building services engineers being busier and distinctly more upbeat, our survey revealed that there has been little improvement in fees. Of the respondents, 60% said fee levels had not changed, with a further 12% saying they had actually decreased. Bob Spittle, chairman of environmental engineering at BDP, says: ‘Fees are still very, very competitive, and I do not expect them to improve any time soon

## Total employees

Company Name	Total employees		Full-time		Part-time		Other		Chartered staff		Non-chartered staff	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1 Atkins	8,972	8,415	8,279	7,749	693	666	0	0	1,203	1,333	7,769	7,082
2 Capita Property & Infrastructure	3,484	4,432	na	na	na	na	na	na	1,450	1,462	2,034	2,970
3 WYG	1,230	1,419	857	991	92	98	27	27	105	115	535	550
4 Ramboll UK	1,057	1,132	942	1,033	115	99	0	0	462	491	595	641
5 BDP	788	924	692	813	82	89	14	22	652	790	136	134
6 Hoare Lea	637	697	609	670	28	27	0	0	273	304	364	393
7 Grontmij	679	644	606	579	47	48	26	17	209	166	470	478
8 Cundall	403	553	390	540	13	13	0	0	108	123	295	430
9 Hurley Palmer Flatt	193	216	181	200	12	16	0	0	28	40	165	176
10 Hilson Moran	193	203	178	189	15	14	0	0	116	128	53	46
11 Troup Bywaters + Anders	177	177	173	169	4	8	0	0	28	28	149	149
12 Hulley & Kirkwood	142	150	135	141	7	9	0	0	29	31	86	92
13 Clancy Consulting	145	145	120	120	20	20	5	5	75	75	45	45
14 ChapmanBDSP	90	134	86	130	4	4	0	0	10	26	80	116
15 DSSR	94	102	91	99	3	3	0	0	49	46	31	38
16 Atelier Ten	72	88	64	83	1	2	7	3	25	33	47	55
17 Desco	56	68	52	62	4	6	0	0	14	14	43	54
18 Red Engineering Design	41	54	40	52	1	2	0	0	6	7	35	47
19 Rolton Group	46	54	40	49	6	5	0	0	9	10	37	44
20 Elementa	35	50	30	50	0	0	5	0	6	11	24	39
21 Services Design Solution	40	45	33	37	4	3	3	4	4	5	35	40
22 Henderson Green	28	31	27	30	1	1	0	0	8	2	20	29
23 Skelly & Couch	25	29	23	26	2	3			6	6	16	18
<b>Building services only</b>												
1 WSP/Parsons Brinckerhoff	240	270	250	265	3	2	3	3	43	52	207	218
2 Waterman Building Services	91	127	91	127	n/a	n/a	n/a	n/a	35	50	56	77
3 Foster + Partners	77	88	76	88	0	0	1	0	20	18	57	70
4 Pick Everard	74	78	66	67	3	4	5	7	18	21	56	57

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because clients have come to expect the current levels.'

Ian Durbin, managing partner at Hoare Lea, was only slightly more optimistic: 'Fees are flattish. They are not as cut-throat as they were, and they are showing early signs of just starting to get a bit better. But each time you try to increase them by a small degree, it becomes clear that some firms out there are still doing the work for less.'

Fees are particularly gridlocked in the public sector because of the requirement to procure at the lowest price possible. 'This is quite damaging,' says Peter Mark, divisional director at Mott MacDonald. 'Think about if you were getting quotes for someone to do your bathroom. You would not choose the lowest price because you would question the quality you would get – it's the golden rule.'

Frozen fees are a real problem because the cost of everything else is going up. As a result, 'the whole industry is being squeezed',

says Durbin. The key rising cost is staff. As *CIBSE Journal* has reported previously, rising workloads are driving companies to recruit, resulting in more candidates switching jobs and salaries rising. Our survey found that the number of people employed by the respondents collectively (excluding Atkins) increased by 17.5% from 2013 to 2014. Mark says: 'Salaries are well and truly outstripping inflation. Recruitment agents are overheating the market. They will get a candidate a 10, 15 or even 20% pay rise and then, six months later, will phone them up again. There is a relationship between salaries and fees – you can't lose money on every project.'

The fact that the sector is not recruiting enough people is compounding this issue. Spittle says: 'As we have emerged from this recession, it's become clear that – more than in any other recession in my career – we have seen people leave the sector and not return.' Mark adds: 'We are hitting a skills shortage.'

### Total engineers

Company Name	Total engineers		Civil		Structural		Mechanical		Electrical		Other	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1 Ramboll UK	750	748	252	264	292	274	89	81	77	76	40	53
2 Capita Property & Infrastructure	577	640	201	226	129	131	146	143	101	140	0	0
3 Hoare Lea	508	560	0	0	0	0	321	355	164	183	23	22
4 Grontmij	462	547		120		24		60		34		309
5 Cundall	294	424	35	48	70	93	80	114	73	108	36	61
6 WYG	229	253	84	88	86	98	52	58	7	9	0	0
7 Hilson Moran	169	174	0	0	0	0	53	51	39	39	77	84
8 Hurley Palmer Flatt	138	165	0	2	5	4	51	60	59	65	23	34
9 BDP	115	152	2	2	27	36	65	87	(relate to both M&E)		21	27
10 Troup Bywaters + Anders	127	127	0	0	0	0	72	67	49	54	6	6
11 Hulley & Kirkwood	115	123							75	80	40	43
12 Clancy Consulting	120	120	20	20	70	70	17	17	13	13	0	0
13 ChapmanBDSP	69	96	0	0	0	0	24	38	28	37	17	21
14 DSSR	72	72					40	42	31	28	1	2
15 Atelier Ten	46	58					24	28	18	22	4	8
16 Desco	47	46	0	0	0	0	26	25	21	21	4	7
17 Red Engineering Design	31	43					20	26	11	17	0	0
18 Elementa	29	42	0	0	18	25	11	27	0	0	0	0
19 Rolton Group	27	32	3	4	8	9	8	8	4	5	4	6
20 Services Design Solution	19	27	1	1	0	0	9	12	6	11	3	3
21 Skelly & Couch	22	24					22	24	(relate to both M&E)			
22 Henderson Green	20	22					10	11	10	11	0	0
<b>Building services only</b>												
1 Atkins	1,737	1,919	790	846	200	218	487	556	259	293	1	6
2 WSP/Parsons Brinckerhoff	183	208					100	110	70	82	13	16
3 Pick Everard	164	166	57	57	31	29	42	44	24	25	10	11
4 Waterman Building Services	67	91					67	91	(relate to both M&E)			
5 Foster + Partners	78	88	0	0	21	19	16	22	6	12	35	35

➤ A further squeeze is coming from increased construction prices, says Palmer. According to the RICS Building Cost Information Service, tender prices rose by 4.5% in the first quarter of this year, compared with the first quarter of 2014. ‘Increased construction costs have caught some people unawares,’ says Palmer, ‘and now tenders are coming back more expensive than originally budgeted for, and it’s difficult then to go back and ask for more money. This is causing a lot of heartache.’

Meanwhile, building services engineering firms are under pressure to invest in research and development that could make them more efficient and more able to cope with meagre fees. ‘More prefabrication would decrease costs and improve efficiency,’ says Spittle, ‘but it does change the way you work because you often design in a different sequence, as you need to make decisions earlier than if you were in a standard RIBA design sequence.’ This requires investment in training, as well as the development of new work processes.

All those new recruits need training, too, and huge investments are needed to train staff in building information modelling (BIM). Not only will BIM Level 2 be required on centrally procured public sector projects next year, but some level of BIM is now required by ‘most clients’ in the private sector, says Durbin.

The technology has the potential to lower costs for building services engineers: ‘There are signs that it’s making us more productive,’ Durbin adds. However, training costs, procuring software and developing work processes are all significant outlays. Moreover, ➤

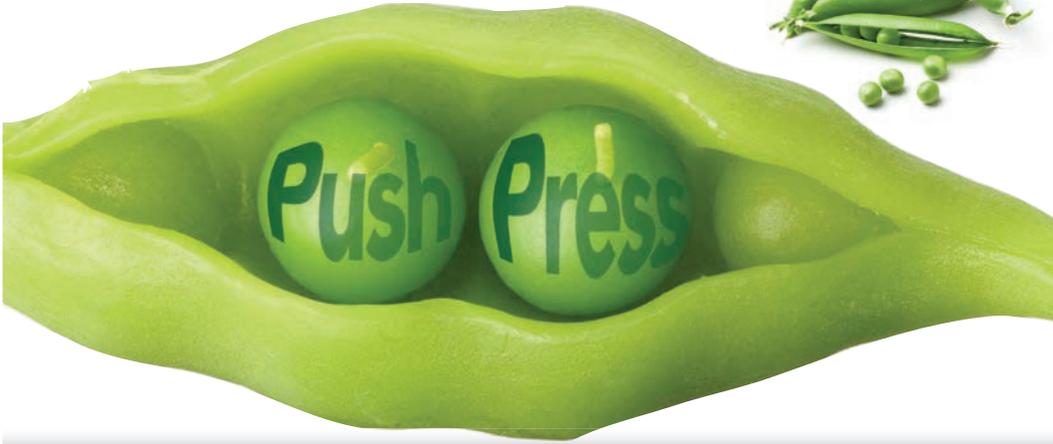
### Graduates employed

Company Name	Graduates employed		New apprentices		Overseas staff	
	2013	2014	2013	2014	2013	2014
1 Atkins	550	637	75	77	8474	8735
2 Ramboll UK	122	144	4	2	9	11
3 BDP	71	63	3	4	130	150
4 Hoare Lea	55	63	5	15	9	9
5 Grontmij	68	61	2	3	n/a	n/a
6 WYG	45	56	2	3	377	346
7 Cundall	18	35	0	0	56	75
8 Hulley & Kirkwood	10	20	1	1	0	0
9 Hilson Moran	7	11	0	0	15	12
10 ChapmanBDSP	2	11	3	5	7	8
11 Hurley Palmer Flatt	6	10	0	0	17	16
12 Rolton Group	6	10	0	0	0	0
13 Atelier Ten	5	9	0	0	52	56
14 DSSR	6	8	2	4	0	0
15 Red Engineering Design	4	7	0	0	120	102
16 Desco	3	5	3	2	20	20
17 Services Design Solution	1	5	0	0	0	0
18 Clancy Consulting	5	5	7	7	40	40
19 Troup Bywaters + Anders	1	2	6	3	0	0
20 Elementa	1	2	0	0	2	5
21 Henderson Green	1	1	2	2	0	0
22 Skelly & Couch	3	1	0	2	0	0
23 Capita Property & Infrastructure	na	na	17	18	42	42
<b>Building services only</b>						
1 WSP/Parsons Brinckerhoff	8	18	4	8	0	0
2 Foster + Partners	7	12	0	0	2	9
3 Waterman Building Services	4	7	0	1	10	15
4 Pick Everard	5	5	3	2	0	0



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For straight MEP, fees are unchanged, but grown-up clients are prepared to pay for ‘value added’ services – they understand what they need to pay for a proper job

Durbin says: ‘BIM needs constant work. You don’t just train people once – you have to keep training them so they stay up to date. And all this investment has to come out of our profits.’

One more squeeze on the sector is what Durbin calls ‘ever-decreasing programme lengths’. ‘Increasingly clients are saying that they don’t want to wait for, say, a year, for a building to be designed. They are looking at ultra-efficient automotive or aeroplane manufacturing and wondering why buildings have to take so much time,’ he says.

‘This is down to a lack of understanding of what the design process really involves, but it’s a phenomenon with even very experienced clients, and it’s adding a lot of pressure.’

Despite these strains, the overall positive

mood of building services engineers may well be justified; the CPA is forecasting further growth for the construction sector next year, of a healthy 4.2%.

However, to return to Macmillan, the former Prime Minister learned that growth alone does not amount to a healthy economy when his economic boom was marred by spiralling inflation. In the same way, building services should hope for more next year than simply a further increased workload.

If fees do not improve, then something else will have to give if companies are to remain profitable. The good news is that some of the sector’s leaders are already thinking about possible solutions (see panel, ‘Easing the squeeze’ below). **CJ**

## Easing the squeeze

Can anything be done to loosen the grip of those factors putting a squeeze on the building services engineering sector? The industry leaders that we interviewed had some bright ideas that offer real hope for the years ahead.

New approaches to design might help. Ian Durbin believes this will be needed to meet the demand from clients for shorter programmes. ‘It might mean we have to change the way we deliver design by working more closely with the other disciplines. This is something I am thinking about at the moment and I haven’t got any definitive answers yet – but probably the industry needs to think about this collectively.’

Peter Mark suggests that more standardisation in design could allow building services engineers to be more efficient: ‘BIM is recalling the old question posed in the *Latham Report* [published in 1994, on making the industry more efficient] of whether everything needs to be uniquely specified.’

As for the skills shortage, Ray Upjohn, who started out as an apprentice, believes apprenticeships have huge potential for the sector. ‘It’s a long-term plan, but apprentices are very valuable,’ he says. ‘You train them up within your environment from the start of their career and the ones that apply themselves can go far.’

With university fees costing upwards of £9,000 a term, the apprenticeship route has become an attractive alternative for high-calibre young people who don’t want to start their career saddled with debt.

However, Mark says: ‘The gaps will be filled largely by people coming from overseas – which is very welcome because some of these engineers, such as those from Poland, are better trained than their British counterparts.’

Perhaps there is also some room for manoeuvre on fees. Paul Flatt says: ‘For straight MEP, it’s true that fees are unchanged; however, grown-up clients are prepared to pay more

for “value added” services – they understand what they need to pay for a proper job.’ Such services include acoustic and electromagnetic compatibility studies, BIM, fire engineering and utilities management.

Despite fears that clients will not budge on fees, the firms we interviewed all report being able to be more choosy about the jobs they accept, which offers hope that market conditions might change. One senior engineer told *CIBSE Journal* privately: ‘Nowadays, if you don’t take a job, there will be another one.’

Palmer adds: ‘We explain to clients that there is a right fee for doing the job well and with the appropriate level of seniority. Sometimes you lose jobs that way, but we are certainly still getting our fair share of interesting projects.’

To really make headway with fees, Spittle says, building services engineers must shout about their work. ‘We need to get better recognition for the contribution we make to the industry.’



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# THE HOME OF GRAPHENE

The first big breakthrough in graphene took place in Manchester, and now the city has a £61m facility aimed at developing the material for everyday use. CH2M Hill's **Ian MacAskill** describes the challenge of designing services for the extraordinarily complex National Graphene Institute

In 2004, two professors at the University of Manchester Andre Geim and Kostya Novoselov isolated graphene, and such is the fascination with the possibilities and properties of graphene, they were awarded the Nobel Prize for Physics in 2010.

Graphene is the world's thinnest material and even though it's only one-atom thick, it is 200 times stronger than steel and its superior strength, conductivity, stiffness and transparency mean its revolutionary

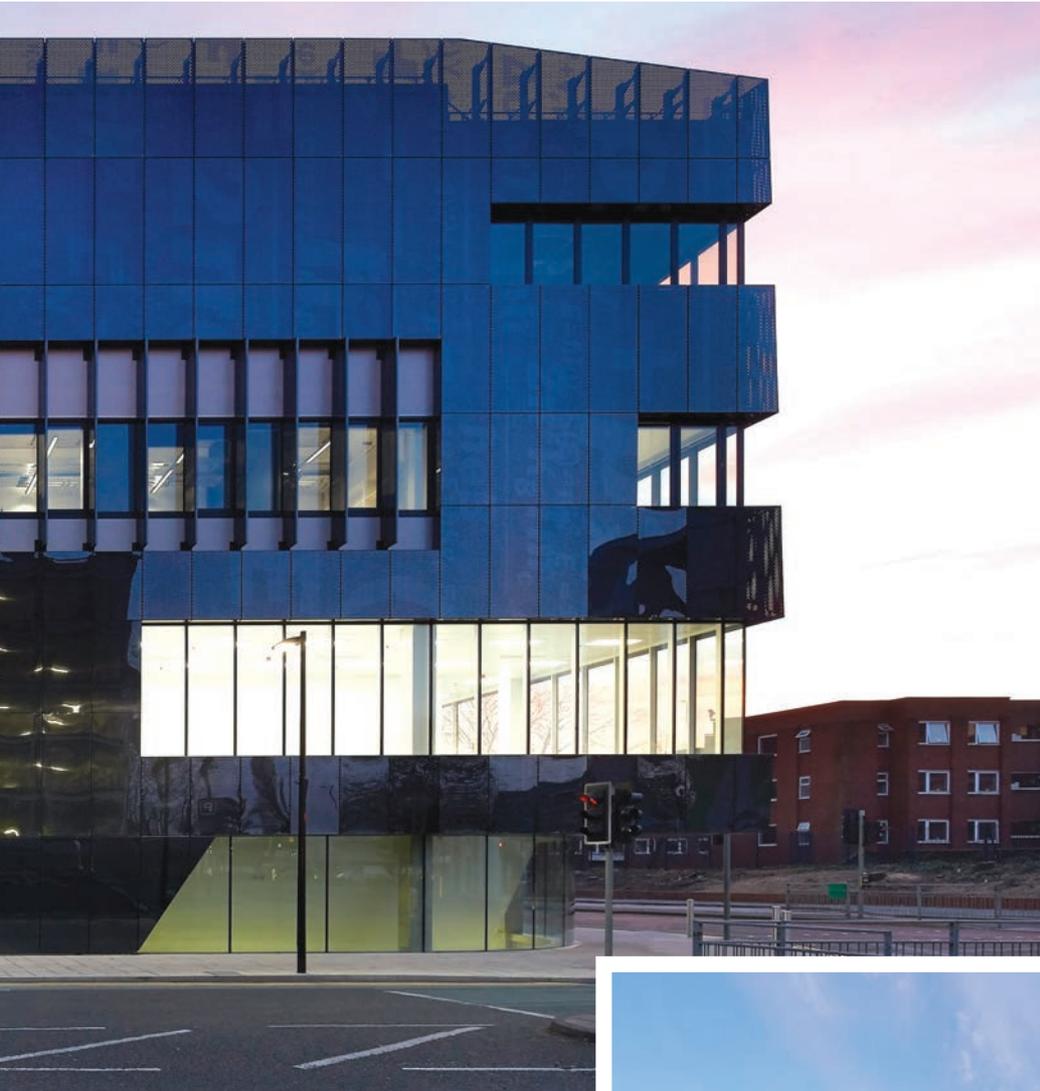
properties have applications in electronics, energy and medicine.

To capitalise on the work done by Geim and Novoselov, the University of Manchester has built a £61m state-of-the-art laboratory dedicated to the research and commercial development of graphene.

The National Graphene Institute (NGI), designed by Jestico + Whiles is a five-storey glazed building containing 7,600m<sup>2</sup> of research space.

Its aim is to bring academics and commercial partners under one roof to explore potential applications for graphene. The facilities will allow the development of prototypes that could potentially enter into full production. Commercial partners include BAE and Rolls Royce.

Funded by the UK government and the



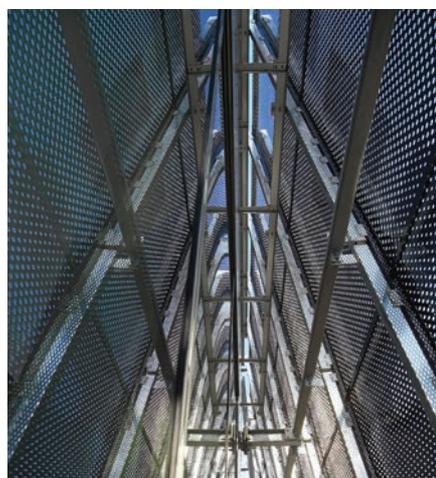
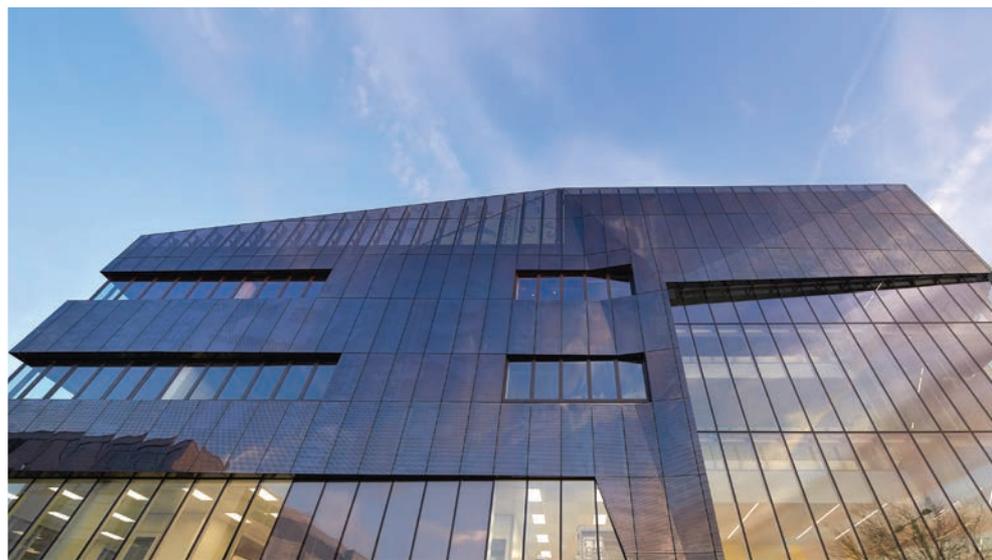
**PROJECT TEAM**

- **Client:** University Of Manchester
- **Technical architect and M&E consultant:** CH2M HILL
- **Building architect:** Jestico + Whiles
- **Main contractor:** BAM Construct
- **Structural engineer:** Ramboll
- **Project manager & QS:** EC Harris
- **CDM coordinator:** Keelagher Okey Klein
- **Approved building inspector:** HCD

European Regional Development Fund, the NGI is one of the most advanced research laboratories targeting graphene and other two-dimensional materials (one-atom thick). The building is designed for use by 200 researchers and includes laser, optical, metrology and chemical laboratories. It has offices, seminar rooms and two cleanrooms (spaces with very low levels of contaminants), including one that takes up the whole lower ground floor.

Carrying out research at an atomic level requires highly controlled environments. As well as being clear of contaminants, temperatures must be stable and rooms free from vibration, magnetic and noise interference. The facility also has huge energy requirements – the heat gains from the vacuum pumps, fans and magnets, servicing the specialist equipment is 3-400W/m<sup>2</sup>.

The cost of the services accounts for 50% of the construction cost, which gives you an indication of the scale of the challenge faced by the MEP designer.



### Laboratory design

The scale and sophistication of the building services and the required power and cooling capacities for research are similar to those found in industrial research and manufacturing facilities. Capabilities to achieve power distribution for research equipment alone in excess of 200W/m<sup>2</sup> result in the potential for large cooling loads. The system is designed so that any space can have environmental cooling for occupants

Extensive design effort was made to isolate the main mechanical, process services and electrical plant from the sensitive laboratory space

- Circulation
- Central utility block
- Cleanroom - bay
- Cleanroom - gowning
- Cleanroom - bay
- Office
- WC/storage/support

Figure 1: Lower ground floor



or process cooling for equipment, where it is currently built out as a lab or not.

The client brief required the cleanroom and labs to accommodate interdisciplinary research, which meant designing flexible spaces that can meet future research needs.

The lab spaces are in a modularised structural grid, which allows the floor area to be reconfigured into specialised zones or open-plan research space. Process service distribution is through a fixed spine in each floor plate. Standard lab zones have two recirculation air-handling units capable of meeting the high room gains. Control can be done per lab module in parallel or master slave, or by grouped control if labs are opened up. Centralised make-up air is provided to compensate for the three segregated process extraction systems that remove solvents, gases and general fumes.

The exhaust from fume cabinets, wet decks



and other ancillary exhausts are considerable, and the systems are designed to remove and treat up to 24m<sup>3</sup>/s of exhaust.

As such, the make-up air plants are extensive, with a cleanroom plant including pressurisation capacity of 27m<sup>3</sup>/s and a laboratory make-up air and supply system capable of supplying 11m<sup>3</sup>/s and recirculating up to 7m<sup>3</sup>/s. Heat recovery run-around coils were installed between the process exhaust streams and makeup air handling units. The centralised plants control relative humidity within the labs and cleanroom to 45%+/-5%.

### Cleanrooms

The centrepieces of the facility are the 1,500m<sup>2</sup> cleanrooms at basement and first floor level. These are configured as a bay and chase layout on a raised floor construction.

In this arrangement, the clean bay area contains the process tools and equipment, and clean air is supplied downward from the ceiling mounted FFU (fan filter unit). The air passes into the room through the raised floor and then recirculates up through the adjacent clean bay chase (see Figure 1).

The cleanrooms consist of three main areas: the 1 metre deep raised floor, the 3 metre high cleanroom and finally the plenum space which is 4 metres at its highest point. The plenum height is required to contain the numerous service and ducts. Air inside the plenum is pushed down into the cleanroom. (See the section views in Figure 2.)



## Avoiding magnetic interference

The equipment necessary for research into atom particles, such as electron beam machinery, is very sensitive to magnetic interference. Some of the equipment is so sensitive to magnetic fields that the turning of a metal handle can skew results.

To prevent/minimise interference of sensitive electromagnetic equipment, their metals have to be designed out within a 5m

radius. This means that re-bars in some areas are made from stainless steel rather than ferrous steel.

If rooms are small, faraday shields have to be built into adjoining spaces to ensure the magnetic field is not disturbed.

The control gear required for LEDs has to be moved out of plenum spaces because of their high magnetic fields.



Facilities are interconnected by dedicated clean stairs and clean lifts. The lift is fitted out to cleanroom material standards – the lift shaft is epoxy coated, the car has fan filter units in the roof and the shaft is at a negative pressure with respect to doors, landing and adjacent areas.

Bays are linked by a work-in-process corridor allowing easy inter-disciplinary movement between shared facilities.

The basement area cleanrooms are currently fitted out with a combination of ISO 5/6 (Class 1,00/1000), which means air must contain no more than 100 particles (0.5 microns or larger) per cubic foot of air for ISO 5 and 1000 particles for ISO 6.

By comparison, air in a typical office contains between 500,000 to 1,000,000 particles (0.5 microns or larger) per cubic foot of air, so the least contaminated NGI spaces are 10,000 times cleaner. The 400m<sup>2</sup> first-floor cleanroom provides an ISO 6 (Class 1000) space which can be adapted to improve cleanliness if required.

The clean air management system has programmable variable speed control, allowing individual spaces to be tailored to the research demands and night time set-back of air flows while still maintaining cleanliness levels. This ensures energy use and room cooling is minimised throughout its lifecycle.

Additionally, the cleanrooms have to comply with stringent vibration criteria of VC-D at the basement level and VC-B on the first-floor area. Rigorous vibration control is



essential for research at an atomic level.

Extensive design effort was made to isolate the main mechanical, process services and electrical plant from the sensitive laboratory spaces in a structurally independent central utility block (CUB).

Not one, but two frames were acoustically and structurally isolated from the main building via a 50mm isolation joint. The smaller frame contains plant equipment while the second houses the principal laboratory, cleanroom and office accommodation.

#### Specialist and electrical services

Contained within the main clean space is a suite of microscopy rooms, each with individual air temperature controls capable of maintaining +/- 0.1K over periods of 12 minutes. Increased acoustic attenuation is provided to mitigate potential noise contamination of the scientific measurements which are completed in this suite.

Facilities such as NGI cannot exist without special services that integrate with scientific equipment. Providing for these services,

► emergency power, early smoke detection and security systems means there are more than 75 different HVAC, electrical and process flow systems and streams covering 3,000m<sup>2</sup> of laboratories, cleanrooms and support space.

The electrical services follow some of the traditional laboratory and cleanroom approaches by dedicating and separating power by research lab or cell.

This also requires specialist earthing systems for each laboratory. A total diversified power load of over 3MW is required to serve the research demands as well as the cooling and HVAC plant power requirements.

All systems are backed up by a standby generator.

### The benefits of BIM

The complexity of the services required for cleanrooms, labs and support spaces within a restricted building footprint made BIM invaluable on the project, and a fully federated model was prepared to ensure the usable research space was maximised.

Clash detection meetings and reviews between consultants and subcontractors occurred every two weeks when the team identified and resolved the main clash points.

An example of the benefits of this ongoing dialogue was a problem relating to the footing of a 12-tonne roof mounted extraction unit that was overlapping the movement joint and had the potential to cause vibrations throughout the building. Had BIM not highlighted this, the contractor estimated it would have cost in excess of £30,000 to rectify the issue.

Research facilities such as NGI are high-energy users, and it is a big challenge to minimise unregulated and regulated carbon. This starts with passive elements such as the form and façade, which reduce heat gains in research spaces using lots of power.

The demands of low/zero carbon technology and Part L compliance has meant that sustainable engineered solutions are a cornerstone of the project. High efficiency plants, equipment and motors, low energy filters and variable volume flow systems were specified and there is extensive



Figure 2: North-south section view

### Built-in resilience

Resilience was a key requirement in terms of future proofing the building and ensuring research is never lost. All major plant has redundancy built in with spare air-handling units, chiller, transformer, pumps and fans. More specialised systems include leak detection, gas detection and monitoring, aspirated smoke detection (necessary due to high air change rates), and extensive telecom/data systems including more than 100km of Cat 6a cabling.

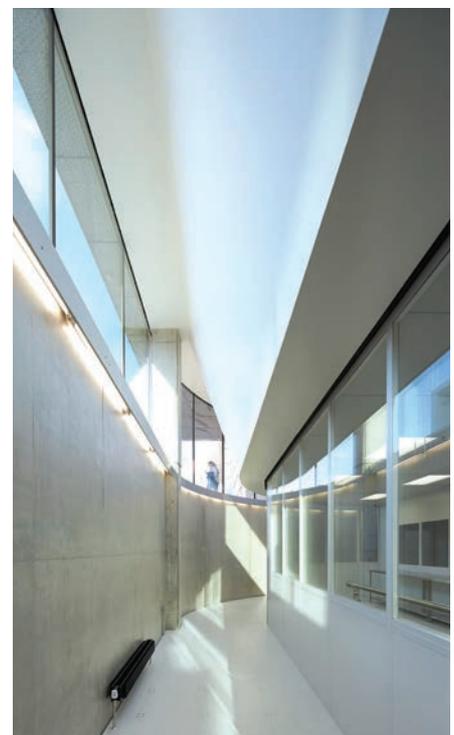
The facility was designed to be able to adapt to new 2D material research as well as research on graphene. The building is highly modularised to allow spaces to change and reflect new areas of research. The process and HVAC services are universally distributed from the CUB to meet the primary demands of each space.

The spaces are built at a scale that allows secondary systems, such as recirculation cooling, to be added or modified in each

laboratory. Plant areas share access to the 3,000kg goods lift, which was sized and planned for delivery of scientific equipment, and there is plant maintenance access at 3.0 x 4.0m with a 2.7m door opening height.

The through-and-through lift opens on each floor to the individual plant spaces as well as the access corridors serving the labs and cleanrooms. Although the NGI was an exceptionally tight build, which used 100% of the site curtilage, main distribution headers and cable trays have been installed with some flexibility to allow for higher capacity.

Gas and process pipe racks were spaced and coordinated to allow capacity for additional future services. Consideration was also given to the potential future addition of a helium bulk storage tank and basement helium recovery plant to meet the cryogenic research demands of graphene.





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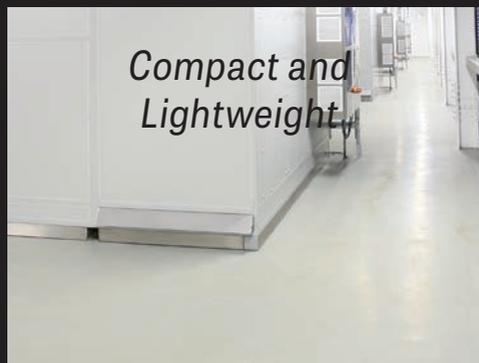
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► monitoring and automatic controls.

Although the plant was designed with a standalone capability, the long-term intention is to integrate the primary energy supply onto the University of Manchester's steam distribution infrastructure fuelled by waste heat from proposed CHP developments. With a view to this, the high-efficiency air-cooled central chiller plant has been designed with a lead absorption chiller utilising this waste heat to provide up to 900kW of base load cooling requirements for the facility.

Much of this cooling can be used at night and weekends as the facility requires continual operation of the cleanroom and process cooling water plant for research equipment. There is also a 17kW array of photovoltaic cells, which helped the building to achieve a BREEAM rating of very good, along with the wild meadow garden terrace

and selection of sustainable building materials and methods.

The university believes graphene's potential will best be developed by creating a second dedicated building, and CH2M is designing the MEP services for the £60m Graphene Engineering Innovation Centre (GEIC), which is designed to progress the research of NGI from technology readiness (TR) level 2 to TR levels 3-6 in the GEIC.

Due to open in 2017, the 8,400m<sup>2</sup> facility will be used to develop industry-led applications into prototype and early production. It will also help to consolidate Manchester's global position in graphene research, and help the university live up to its claim of being the home of graphene. **CJ**

● **IAN MACASKILL** ACIBSE is UK design manager at CH2M Hill



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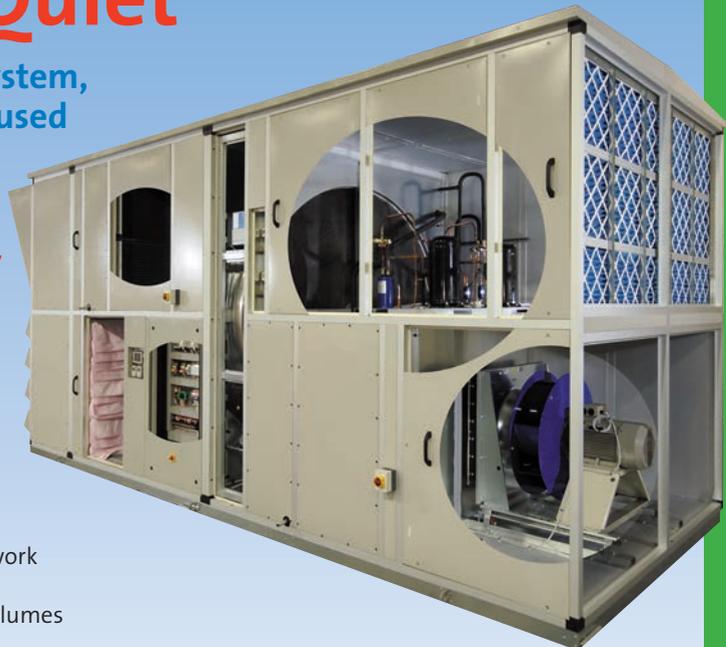
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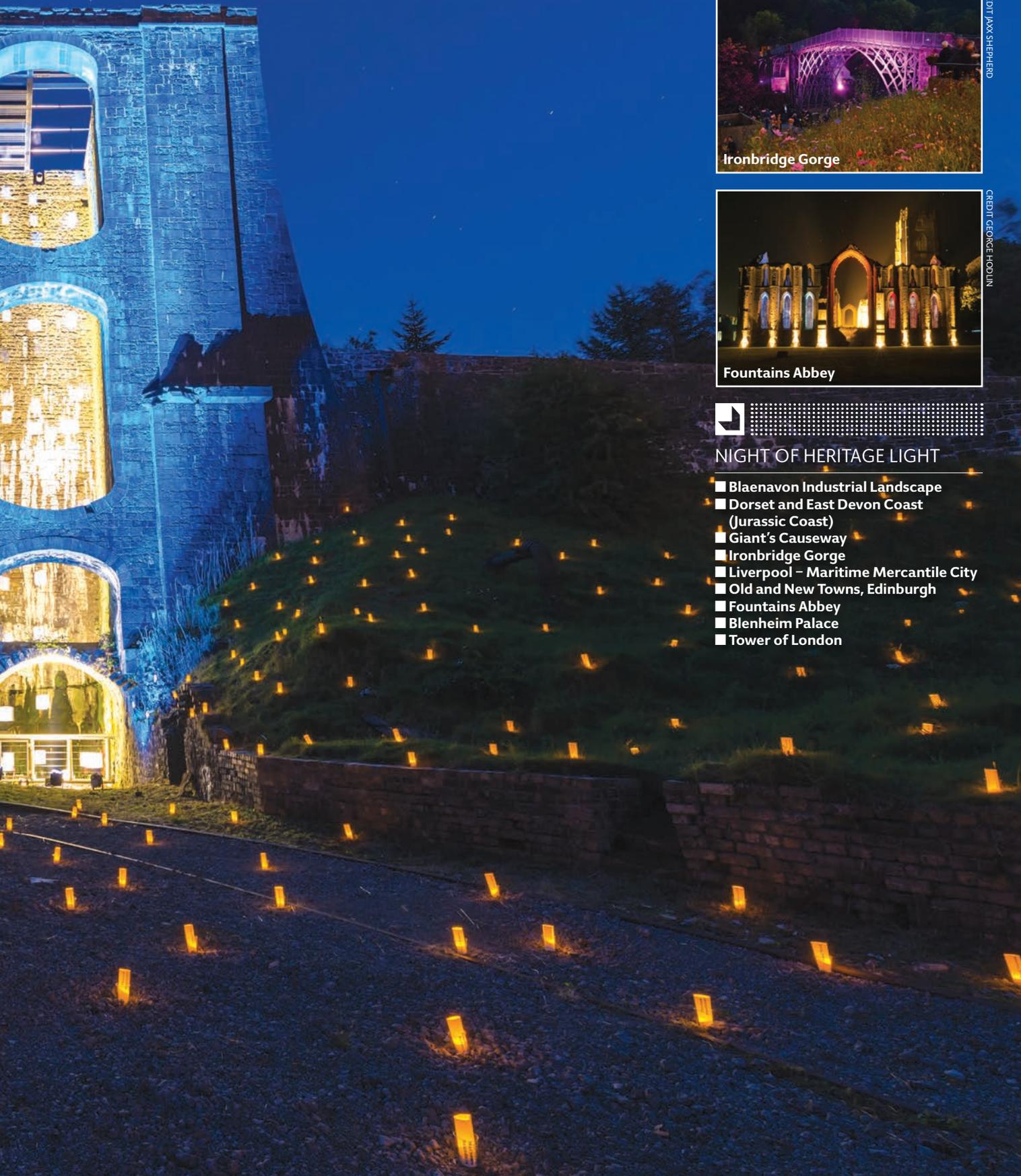
Blaenavon Industrial Landscape was one of nine great UK destinations transformed by lighters in the Night of Heritage Light. **Liza Young** reports

**S**ome of the world's leading lighting designers have turned nine of the UK's most iconic landmarks into a series of spectacular illuminations.

Blaenavon Industrial Landscape in Wales and the Giant's Causeway in Northern Ireland were two of the nine Unesco World Heritage Sites illuminated by the Society of Light and Lighting and CIBSE at the Night of Heritage Light (NoHL).

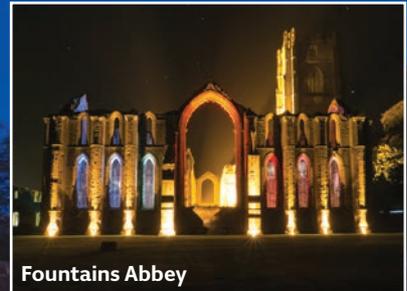
The event was designed to promote lighting as both an art form and a science by creating a 'light map' across the country. ➤

Blaenavon Industrial Landscape



CREDIT: JAXX SHEPHERD

Ironbridge Gorge



CREDIT: GEORGE HODLIN

Fountains Abbey



NIGHT OF HERITAGE LIGHT

- Blaenavon Industrial Landscape
- Dorset and East Devon Coast (Jurassic Coast)
- Giant's Causeway
- Ironbridge Gorge
- Liverpool – Maritime Mercantile City
- Old and New Towns, Edinburgh
- Fountains Abbey
- Blenheim Palace
- Tower of London



Giant's Causeway

CREDIT: CARETH OCAZHIAN



Blenheim Palace

CREDIT: STEVE ALLUM



Dorset and East Devon Coast

CREDIT: MIKE MASSARO



Tower of London

CREDIT: RACHEL FERREMAN

▶ Celebrating the International Year of Light, the spectacle showcased the talent of SLL members. Lighting designers taking part included Arup, BDP Lighting, Cundall Light4, Hoare Lea, Troup Bywaters & Anders, Light and Design and G3 Lighting Design.

Starting at the Tower of London, the NoHL moved northwards, as natural light faded at the end of the day. Each installation took place as the sun descended below the western horizon, and was captured in these images by the Royal Photographic Society.

The sites were either lit for the first time or the lighting designers supplemented existing lighting.

The Giant's Causeway was the last landmark to be lit and provided a particular challenge as it had no mains power. Consultant Jim Patton MSLL said: 'We used

a mix of battery-powered LED fittings and more powerful generator-powered LED floods at remote locations. They were at some distance from the viewing position in an attempt to give an indication of scale.'

Liz Peck, SLL president, said: 'By combining light with some of the UK's most beautiful sights, we can capture the public's attention in a way that showcases the best that the lighting industry has to offer.'

'Lighting is an art as well as a science, and we're hoping that this event will inspire people to look more closely at the part light plays in their everyday lives, from the street to their place of work.'

'It's about inspiring the next generation of minds to make the great breakthroughs in lighting by thinking big and realising the industry's potential,' said Peck. **CJ**

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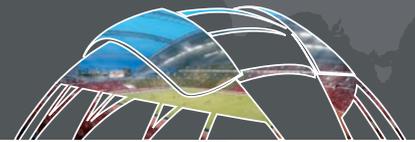
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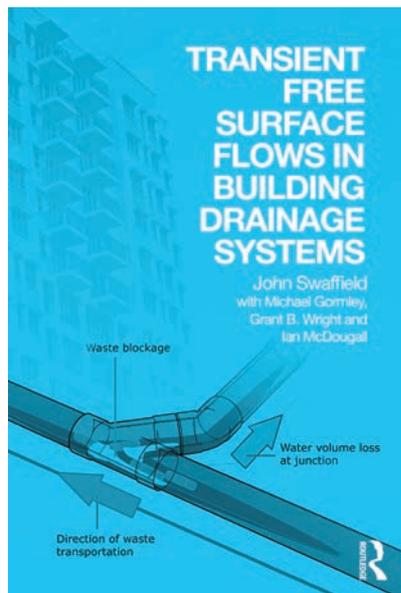
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# THE FINAL WORD

Past CIBSE president **John Swaffield** died before he was able to finish his second work on modelling fluid flows in building drainage systems. **Michael Gormley**, who helped complete the book, explains why the author's final contribution to the industry is an essential text



*Transient free surface flows in building drainage systems*, by John Swaffield, with Michael Gormley, Grant Wright and Ian McDougall

**J**ohn Swaffield's final book is a unique blend of engineering physics and practical application of free surface flow modelling. It looks at the challenge of climate change, and the opposing threats of increased rainfall intensity and too little water from reduced flow appliances and water-conservation initiatives.

Designing systems that cope with these changing loads will put outdated design procedures under strain. Current design methods are too rigid and abstract to deal fully with the vast range of possible scenarios.

*Transient Free Surface Flows in Building Drainage Systems* contains all the physics relating to free surface modelling, solid transport prediction, wave attenuation, rainwater modelling and whole-system design. It allows the reader to engage with the topic from an engineered design point of view. Practical case studies demonstrate the effectiveness of this method and show how designs can be modified to improve system performance, even under extreme conditions.

Climate change, urbanisation and the increasing complexity of sanitary engineering systems are among the greatest challenges facing public health engineers today. Current design methodologies, based on discharge and fixture units, have served the industry well, but perhaps at the expense of losing contact with the underlying building physics associated with their application.

For instance, reduced water-consuming appliances may not be accurately represented by methodologies based on data for older, much higher water-consuming appliances. An example is when a building code calls for a large pipe and the WCs attached to the system are low-flush volume. Here, there is a higher possibility of waste material being deposited in the large pipe where it can accumulate and cause a partial or full blockage. This is counterintuitive to most people; however, a sound understanding of the fluid mechanics associated with solid transport informs the engineer of the likely consequences.

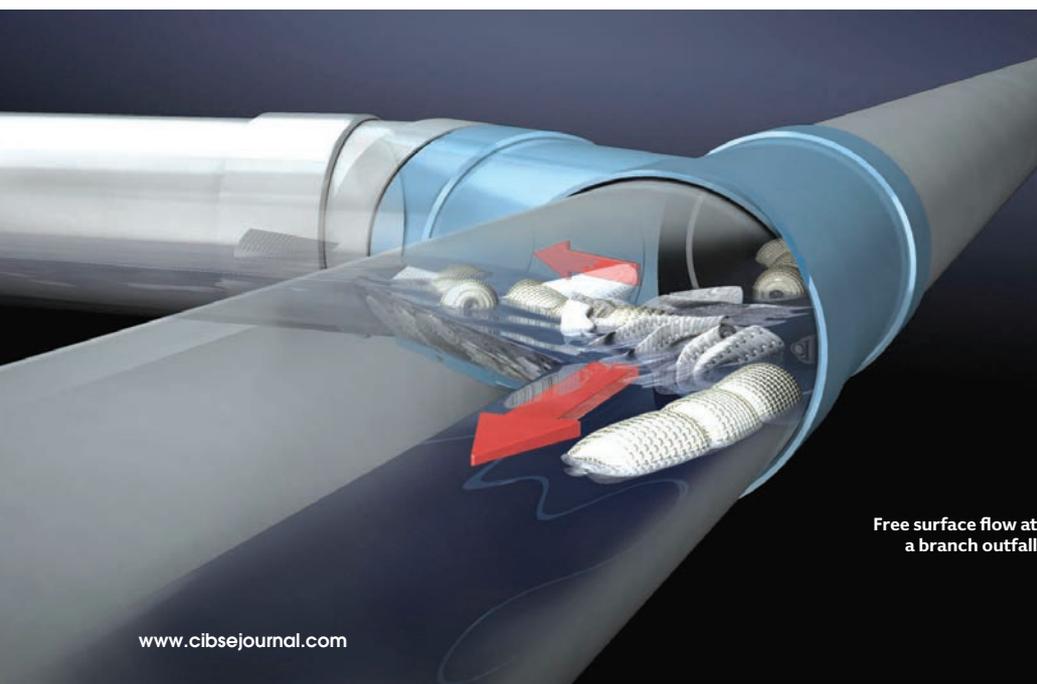
The book provides a unique perspective on more than 40 years' research and gives the reader enough information to understand, predict, design, analyse and criticise building drainage-system codes, regulations and designs – essential skills for a modern public health engineer.

At the centre of the approaches described in the book are the Saint-Venant equations of continuity and momentum. The defining unsteady flow equations of continuity and momentum were developed in the mid-19th century by Saint-Venant (1870) as a pair of quasi-linear hyperbolic partial differential equations that may be solved by a variety of numerical techniques. These equations are incorporated in a method of characteristics (MOC) solution technique.

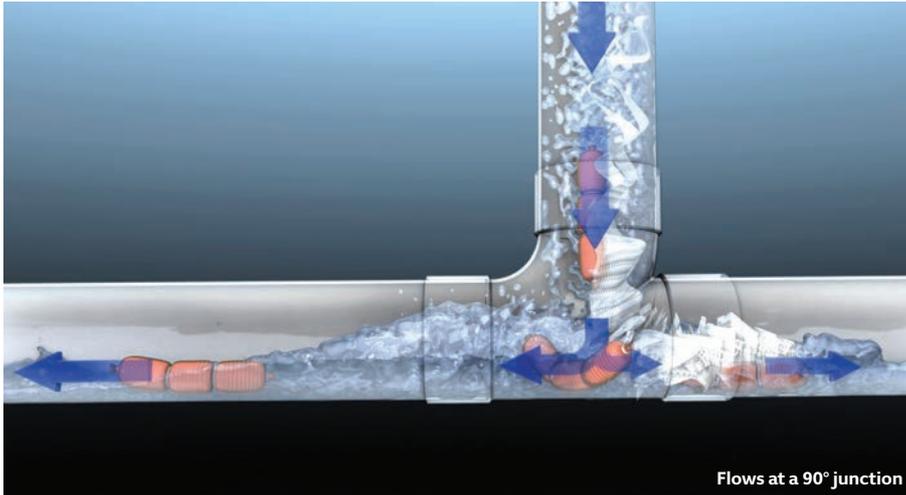
The MOC is the main method adopted, but the book also describes alternative approaches to the solution of the governing equations, thereby giving the reader a full insight into the possible modelling methodologies available.

The methods described have been applied to the building drainage simulation models – Drainet, Airmet, Roofnet, Siphonet – which together form a comprehensive suite of simulation tools that can be used to assess and compare design solutions easily.

Dr Roy Hunter, who worked for the National Bureau of Standards (NBS) at the Department of Commerce, in Washington USA, produced the basis for the fixture unit and discharge unit methods in use today. These are based on steady-state hydraulics, and use probabilistic methods to assess demand on water supply and loading on a



Free surface flow at a branch outfall



modelling to describe system flows under siphonic conditions.

**About John Swaffield**

Swaffield retired as head of the School of the Built Environment at Heriot-Watt University in 2008, and was CIBSE President in from 2008-09. He then planned to publish two books covering the vast amount of research he had led in more than 40 years in industry and academia. The first of these, *Transient airflows in building drainage systems*, was published in 2010. In this celebrated book, he dealt with the mechanisms of air pressure transient generation, suppression and modelling in buildings, effectively collecting his work on this subject in a thoughtful, provocative way.

Swaffield then began work on *Transient free surface flows in building drainage systems*. Written as companion to the first, it was set to complete his treatise on modelling and mechanisms of all flows in building drainage systems. Sadly, Swaffield died before it could be finished. In late 2011, I and two of my colleagues at Heriot-Watt University – Grant Wright, a lecturer in civil engineering, and Ian McDougall, a computing officer – undertook the task of completing it, which presented a number of challenges.

First, there was the difficulty in piecing together the material Swaffield had left. We also wanted to maintain his voice; we were keen to make sure that his personality pervaded the text. The final challenge was trying to remain faithful to Swaffield’s opinions. We were acutely aware that we weren’t just finishing a book, but producing work that was to be his legacy in the important field of public health engineering. **CJ**

● **MICHAEL GORMLEY** MCIBSE is senior lecturer in architectural engineering in the School of the Built Environment at Heriot-Watt University

➤ drainage system. The danger with steady-state and probabilistic approaches is that the engineer does not have to consider the underlying fluid mechanics of the problem, and the solution can be inflexible and devoid of innovation. *Transient free surface flows in building drainage systems* gives alternative methodologies, particularly where innovative solutions are called for and desirable.

The book also covers the numerical techniques necessary for the application of flow modelling to rainwater drainage systems, both conventional and siphonic. It starts with a brief overview of the operation of rainwater drainage systems, before going on to outline possible approaches to the simulation of conditions within such systems. Throughout, the underlying principles are illustrated through application of some of the many numerical models that have been developed over the past 20 years at Heriot Watt University, Edinburgh (FM4GUTT, Siphonet, Roofnet).

Siphonic rainwater modelling poses many computational challenges because it includes transition from free surface modelling when the system runs conventionally, and full-bore

Urbanisation, climate change and the increasing complexity of sanitary engineering systems are among the challenges facing public health engineers



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# HALL OF FAME

Neil Sturrock, from CIBSE Heritage Group, explains why Liverpool's St George's Hall was the first air-conditioned building

**D**escribed by Queen Victoria as a building 'worthy of ancient Athens', the neo-classical St George's Hall, Liverpool, is the epitome of Grecian grandeur.

But the façade isn't its only claim to fame. The building, which hosted Charles Dickens' world premiere reading of *A Christmas Carol* in 1866, is also home to the world's first modern air conditioning system, designed by Dr David Boswell Reid.

First operated in December 1851, Reid's 'systematic ventilation' led the design of the building, which he claimed was the only one where he had been given a sufficiently free hand to install the system he envisaged.

Although the term 'air conditioning' was first used about 75 years later, this article will show that his system at the Liverpool concert hall had all the necessary elements to describe it that way.

## The layout

The building has an unusual – and probably unique – combination of justice and entertainment combined in a single edifice, where five major spaces are spliced together, rather than joined end-to-end.

This combination of functions came about when two separate architectural competitions in 1839 – to design major public buildings in Liverpool – had been won by the same architect, Harvey Lonsdale Elmes of London.

Although Elmes was only 25 years old and relatively inexperienced, he had designed a number of buildings in Prince's Gate and

Birdcage Walk in London, and had already won a competition in Liverpool to design a new school for Liverpool College (which later became the Liverpool Collegiate School).

The competitions were for a concert hall (to be funded by public subscription) and the Assize Court Building, to be paid for by a Treasury loan under the Liverpool Improvement Act.

When Elmes was asked how the two might be arranged to create a public forum, he offered to combine the buildings and produce a structure that was bigger than any other throughout the land. This immediately sold the idea to the council.

## The influence of Reid

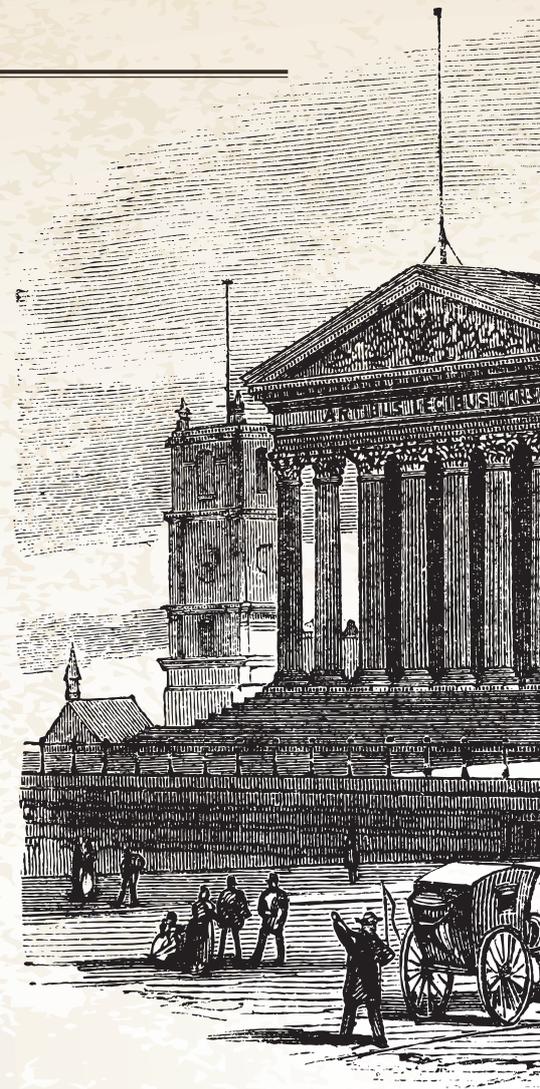
Soon after Elmes' official appointment, he requested that the council consider employing Reid as 'ventilator'.

Elmes was aware of Reid's work at the Palace of Westminster and had almost certainly attended one or more of the lectures Reid gave on ventilation, primarily in London's Exeter Hall.

Reid was formally appointed in July 1841 to fulfil the same role in St George's Hall, making it clear that he would be unable to spend a great deal of time in Liverpool.

The degree of control afforded to Reid is evident in a letter – dated 9 August 1841 – from Elmes to the structural engineer, Robert Rawlinson, less than a month after Reid was appointed.

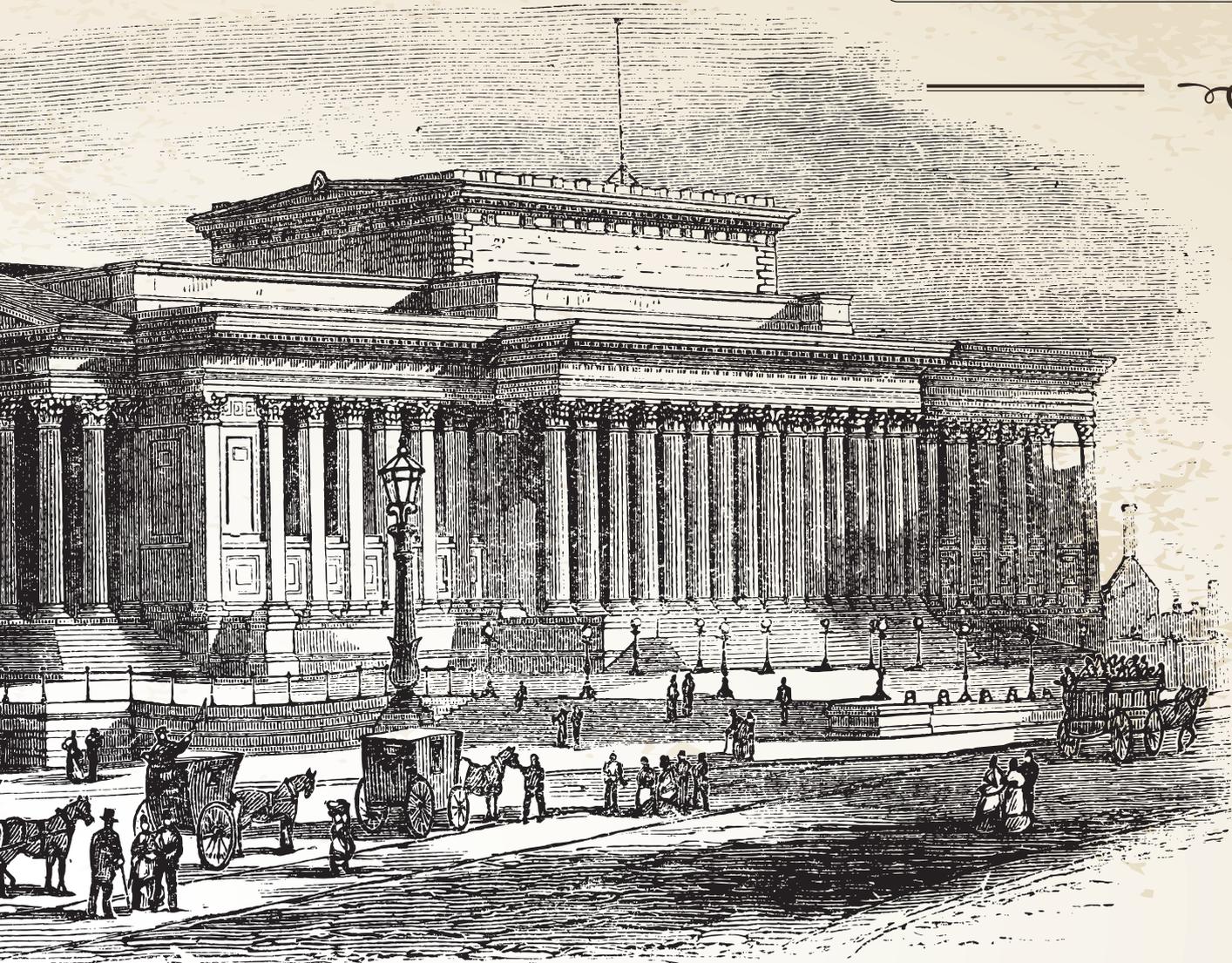
When referring to the 'positions of the benches both longitudinally and transversely', Elmes instructs Rawlinson to take into account 'the area of 400ft superficial (section) for the vitiated air to pass'. He goes on



to say: 'You will oblige me, therefore, by referring to the ventilation plans which are correct.' In a further letter to Rawlinson, dated 27 September 1841, Elmes refers to his 'definitive' plan, saying that: 'Dr Reid wished some alteration made in the course of the smoke flue, which incurs the necessity of placing the bench considerably higher up the ground.'



Figure 1: Steam injectors below main heating coil



It is apparent that both architect and structural engineer were being dictated to by the requirements of the 'ventilator' before work had even started on site.

### Reid's system

An air-conditioned building requires control of: temperature (up or down); relative humidity (up or down); air throughput rate;

and air filtering or cleaning. Reid's system combined all these elements, although the amount of cooling available depended on the temperature of the town's water in the mains system, as there was no means of refrigeration.

The temperature of the supply air was controlled by passing it over one or more of the five large heater batteries comprising 4-inch (100mm) cast iron pipes containing hot water in winter and cold water (from the town mains system) in summer.

Another 27 coils were fed from steam boilers, but Reid anticipated that these would only be used in extremely cold weather or for pre-occupancy warm-up. The elaborate arrangement of connecting ducts allowed the final supply temperature to each of the major spaces to be varied by mixing warm air with cold, fresh air.

The two main fresh air supply shafts each contained a cold-water fountain providing a fine mist. These reduced the moisture content in summer and provided a degree of adiabatic cooling, but their main purpose was to clean the air. It then passed through

a vast thermal labyrinth of brick columns and arches, where impurities would be deposited.

Reid was aware that moisture needed to be added to the warmed air in winter for the occupants' wellbeing. This was achieved through nozzles that injected steam directly into the airstream. This came from a small boiler, which had been included in his design for this sole purpose (Figure 1).

The air was extracted by feeding the vitiated air into four exhaust shafts (see panel, 'Proposed extract tower', on page 62), although air from the main hall roof space could pass directly outside. The original main hall roof had upstands with glass louvres for this purpose.

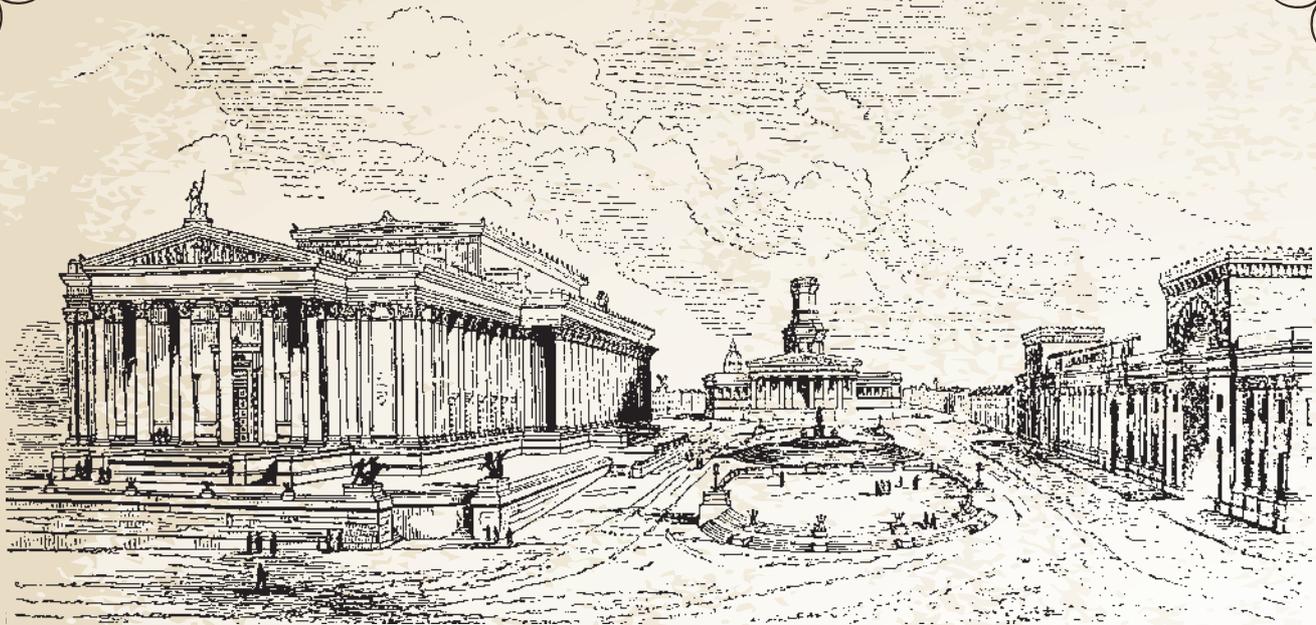
The four exhaust shafts had braziers of coal constantly burning at the bottom; these were replaced by gas jets after a few years to reduce labour.

Special attention was given to the roof space of the Crown Court: being at the south end of the building, in sunny weather the vitiated

CREDIT: LIVERPOOL CITY COUNCIL



The Great Hall



► air could discharge directly outside, with the extract rate being boosted by solar gain to the attic.

The air supply rate could be increased using large paddle fans driven by a steam engine, but Reid's instruction manual<sup>1</sup> makes it clear that this should only be necessary in the summer when the stack effect would be insufficient, or in winter for pre-occupancy warm-up.

There were four fans, each 10ft (3m) in diameter with eight 5ft (1.5m) by 2ft 6in (0.75m) blades. These could be made to operate individually or in any combination, and the 'mechanical' supply rate could be varied from approximately 1,000 to 50,000 cfm (0.5 to 25m<sup>3</sup>/s).

### Typical arrangement

The small concert room system is almost identical to that applied more than 160 years later in the 2014 Stirling Prize-winning Everyman Theatre.

Fresh air for the concert room is taken from slightly above street level (in the 19th century Lime Street would have been heavily contaminated with horse manure), cleaned and passed through the thermal labyrinth before reaching the central distribution chambers.

This air is then either passed through – or around – the Great North Water Apparatus (one of two major hot water coils) containing 72 30ft (10m)-long pipes, each 4-inch (100mm) in diameter.

The air then passes along



Figure 2: Concert Room ceiling showing roof-light and air outlets

the main supply duct and splits left and right (west and east) before rising up two vertical shafts, arriving under the seating.

Air was delivered into the concert room primarily through a continuous grille in the riser under each row of seats, and additional supply came from the front of the stage and the front of the seating. Extra fresh air – delivered from special fresh air towers behind the lower roof parapet – can be supplied directly into the concert room from either side of the stage.

The vitiated air passed into the roof space through numerous apertures in the ceiling, each with an adjustable flap behind it. In addition, and especially when the gas jets were lit on the chandelier, the glass quadrants ►

“The four exhaust shafts had braziers of coal constantly burning at the bottom; these were replaced by gas jets after a few years to reduce labour”



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► in the roof light over the chandelier could be opened to allow excess heat to escape (see Figure 2 on page 60).

Reid had persuaded the building committee that his system could be much smaller if the main hall was not used for functions while the courts were in session.

However, he made allowances to ensure that the concert room and the adjacent (north) court could be used simultaneously, and the direction the vitiated air from the concert room took depended on this.

Under normal circumstances the air from the concert room went to the north-east exhaust shaft but, if this court was also being used, the air from the concert room went to the north-west exhaust shaft. This ensured that sufficient drawing power could be applied to both at the same time.

### The first air-conditioned building?

It could be argued that this was not Reid's first attempt at air-conditioning a large space, and that the honour should go to the Temporary House of Commons in 1836.

However, St George's Hall was the first building where such a system was integrated fully into its design and construction – both the architect and structural engineer relied on Reid to let them know his requirements before even the bench levels could be set.

Reid's system was first used when the courts came into session on 8 December 1851, while the Houses of Parliament – using a similar system – were not used until February 1852. **CJ**

● A complete history of the design and construction of St George's Hall can be found on the Heritage Group website. Read more on the pioneering work of David Boswell Reid in 'The pioneer who rid Parliament of hot air', January 2015 *CIBSE Journal*.

### References:

- 1 *Diagrams of the Ventilation of St George's Hall and the New Assize Courts*, D B Reid, 1855 (Liverpool Record Office).
- 2 HEVAC heritage <http://bit.ly/1Mevuvy>
- 3 *Illustrations of the Theory and Practice of Ventilation*, D B Reid, Longmans, London, 1844.



Small concert room  
LIVERPOOL CITY COUNCIL



LEONID ANDRONOV / SHUTTERSTOCK

## PROPOSED EXTRACT TOWER

By the time Elmes was being asked to consider the arrangement of the two competition buildings, the council decided to construct another building housing daily courts, including magistrates' courts and a bridewell (central lock-up); this was also indicated on his plans.

Reid saw this as an opportunity to incorporate a communal extract tower for all three buildings, similar to the stand-alone tower he designed for the Temporary House of Commons.

The extract tower was to be 30ft (9m) in diameter at the bottom, and about 200ft (65m) high with a furnace burning permanently at its base. It was to be connected to the larger building(s) by underground

tunnels so all vitiated air and chimney smoke would pass through it.

Elmes' drawing (on page 60), which appears in Reid's 1844 book<sup>3</sup>, shows how it might appear. All of the 110 fireplace chimneys in the main building were to have flues that turned downwards. However, in April 1845, it was decided that the smaller building would not be built at that time (the Liverpool main bridewell and magistrates' courts were eventually built around 1859 on a site nearer to the town hall).

The north end of the 'forum' was to be closed off by the daily courts and bridewell. The building on the right was the now-demolished classical front to Lime Street Station, which had been designed by borough architect John Foster Junior, in 1835.

In 1845 the Council decided that there

were insufficient funds for the daily courts building but, by then, St George's Hall was up to principal floor level and all the lower elements of the Reid extract system had been completed, so the way vitiated air and chimney effluent were to be extracted had to be completely reconsidered.

The tunnel connecting the lowest level of St George's Hall to the proposed exhaust tower was then bricked up and forgotten about. (After working closely with the hall manager, this underground system is scheduled to be reopened for inspection later this year). Four new exhaust ducts were then incorporated into the building and these terminate at the four corners of the highest roof behind the parapet.



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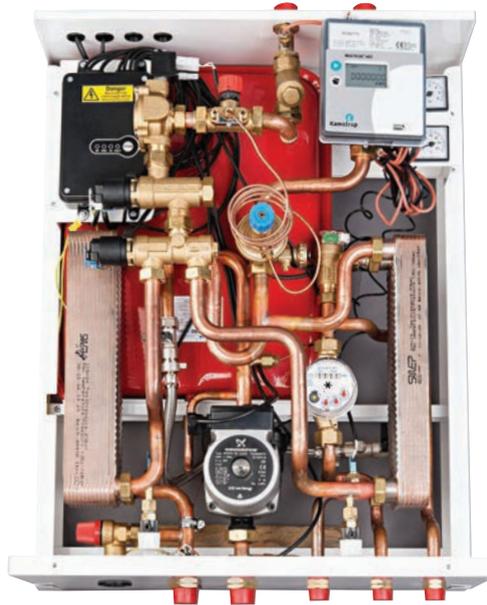
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This month: Optimising flue design for energy efficiency; what the ErP Directive means for boiler specification; CIBSE's fuel cell micro-CHP demonstration project and research on heating and cooling

# EXHAUSTIVE RESEARCH

Accurate flue design is essential for many commercial boilers to work at maximum efficiency. **Jim Kinnibrugh** explains how performance can be compromised

**W**e are rightly addicted to energy efficiency but this drug has side effects that have a bearing on the design of both negative and positive pressure flues.

In a positive pressure (PP) flue, exhaust gases are driven by a combination of pressure from fans inside boilers, expansion due to combustion and the buoyancy imparted to them by the residual heat of combustion. A negative pressure (NP) flue is a heat engine that propels the exhaust upwards using the buoyancy of the residual energy of combustion.

The heat energy in an NP flue has expanded the exhaust with a consequent lowering of its density. This minutely reduces the pressure inside the flue (hence the negative pressure designation) and causes what we perceive as suction at the bottom of the flue where it connects to the boiler. This is commonly known as the draught and the whole is known as the stack effect or natural draught and is measured as pressure differential in Pascals (See Figure 1).

At this point alarm bells should be ringing. The flue is working all the time the boiler is firing so is it taking too much energy? Does it have enough? Has it been designed to work using the least amount of energy for its function? If a chimney is an integral part of a building, does that compromise efficiency?

Boiler manufacturers have worked hard to improve combustion and heat transfer efficiencies with the result that the volume and temperature of exhaust gases have declined. This in turn has reduced the energy available to drive the stack effect.

As a general rule, the greater the height, the greater the draught and the greater the cross-section, the greater the capacity to handle mass-flow. So a tall chimney with a large flue can dispose of the exhaust from a big boiler.

As buoyancy only works upwards, it is important to minimise horizontal runs, which require energy to overcome resistance to flow but achieve no lift. Equally, as the heat energy does the lifting, allowing heat to escape through the flue wall will attenuate the power of the flue to lift the exhaust and so

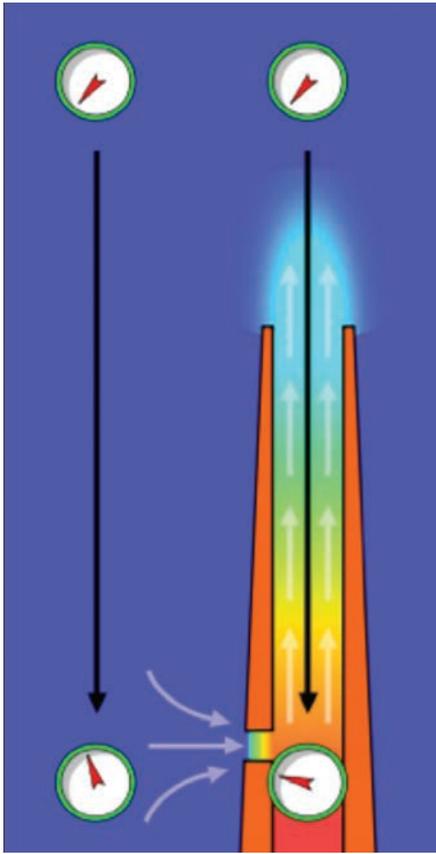


Figure 1: The stack effect – a negative pressure flue

it is essential to insulate the flue adequately. A leaky NP flue will allow ambient air in and this will both collapse the small partial vacuum and lower the heat, which imparts the buoyancy.

Leaks between the inner and outer flues in a concentric air-flue will contaminate the incoming combustion air and attenuate combustion efficiency as the inner, exhaust element of the flue is running at positive pressure and the outer at negative pressure. A combustion gas analyser will reveal this when its exhaust gas probe is applied to the incoming air test port.

So far so simple. Precision in design and adherence to some fundamental rules has become essential. A flue must be straight, vertical, smooth, insulated and the correct height and diameter to lift and disperse the mass-flow from the boiler. These design objectives are achieved by the use of a calculating method which has been refined over more than half a century and was the basis for BS EN 13384:2008. Software employing all the calculations in this standard has proved capable of giving the correct sizing for efficient flues.

Combining this with a designation according to BS EN 1443:2003 will provide the correct characteristics for the given application.

Biomass boilers and gas-fired condensing boilers are good examples of plants that need accurate flue design to support their efficient functioning. Exhaust gas temperatures from condensing boilers of 55°C and below are achieved through precise control over the combustion, the flow of the hot combustion gases and the transfer of heat into the water. There is an internal draught through the combustion chamber or chambers and on through the heat exchanger, and this must not be influenced by the draught in the chimney flue.

High winds cause the draught in the flue to increase through the Bernoulli effect. Fluid passing across an opening drags molecules from the opening, causing molecules farther inside to be drawn up to replace them. Thus, wind lowers pressure at the top of a flue and increases the draught, necessitating the use of draft regulation to prevent the phenomenon from drawing hot combustion gases through the boiler's heat exchanger faster than the heat can be transferred into the water. Thwarting the boiler designer's intention in this way causes heat energy to go up the flue instead of meeting the load and wastes fuel.

The use of old flues designed for earlier types of boiler, which created larger volumes of hotter exhaust gases, can cause efficiency loss. An example was found on a north London council estate three years ago. A 26m-high, 55cm-diameter flue, which provided the correct maximum draught for the coal-fired boilers installed in the early 1950s, had been used unconverted through changes from coal to oil to gas to high efficiency (HE) gas.

An irregular, rapid crackling noise which disturbed residents in all eight storeys of flats at the end of the block where the chimney was located was investigated. It was caused by the huge draught necessary to serve 65% efficient coal-fired boilers pulling the flame of the pressure-jet burners in three 0.5MW HE gas boilers off their burner nozzles. This left a gap between the burner nozzle and the rear of the flame occupied by an explosively inflammable mixture of air and gas in the presence of a source of ignition, the flame. Naturally this mixture was repeatedly exploding into flame, being pulled off the nozzle and reigniting. The continual series of explosions was what was irritating the residents.

The draught exceeded that required to serve the gas boilers, and the draught regulators on the primary flues from each of the boilers had been removed to stop the clattering noise they were making as they opened and closed to relieve the excess draught in the flue. With



So far, so simple. Precision in design and adherence to some fundamental rules has become essential



nothing to divert draught from the boiler combustion process it was all going through the boilers.

What neither the residents, their tenants' management office nor the maintenance contractor was aware of, was the fuel this wasted. When this was explained, the flue conversion work was agreed with alacrity. The answer was to reduce the carrying capacity of the flue (equals increasing resistance to flow) by taking its diameter down by 10cm and fitting draught stabilisers with silicone rubber seals to deaden the noise they would make when closing (see image below). The sizing was calculated to allow for poorer flue performance in hot weather, which reduces the temperature differential upon which the stack effect depends. The thermosetting resin liner was installed in two days and is immune to any of the condensates that had progressively damaged the very fine refractory lining installed in the early 50s.

**University failure**

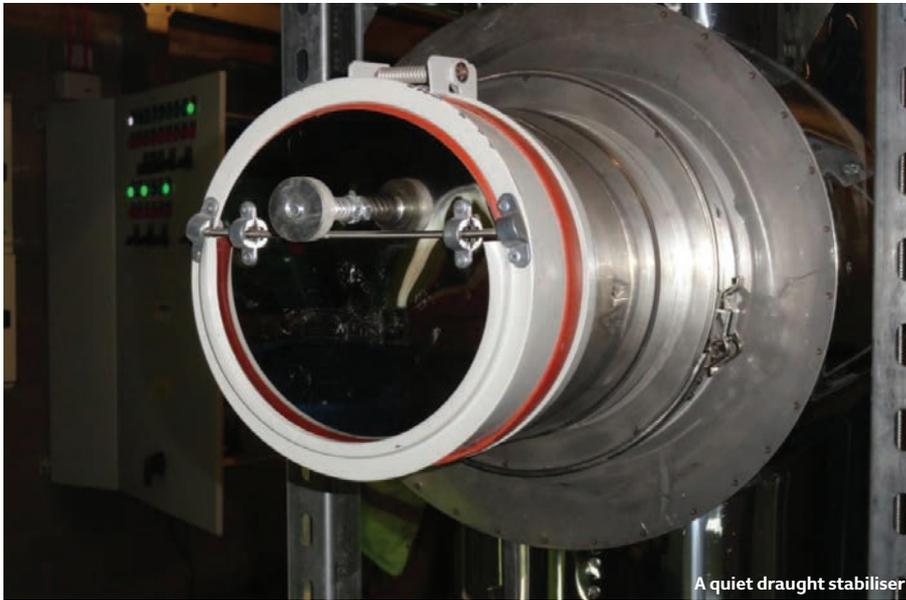
No liner could save a southern university from an incorrect new flue that had a 19.6m horizontal route including 6 x 45° bends and a 90° bend leading to an 11.5m main riser with its own pair of 45° bends.

That amount of resistance to flow was bound to make the boiler overheat, clinker the ash from its biomass fuel and damage the refractory combustion chamber lining.

This led to day-long outages while the clinker was chiselled out by hand and frequent and expensive replacements. The reason – appearances.

The routing of flues in new work needs to be agreed early and determined by engineering principles.

If the appearance and position of the chimney is an aesthetic issue then this must be negotiated with the architect on the basis of explanation of the energy efficiency implications of the choices.



A quiet draught stabiliser

**Summary**

This tells us that improvements in boiler performance must be served by the correctly calculated design of correctly designated flues and that the primary, horizontal flue is there to connect the boiler to the main riser by the shortest route not to hide the chimney from view.

Draught regulators should always be fitted to protect boiler performance from high winds and finally – in the case of the 1950s estate – proves that the updating of old flues is possible and can save the cost of a new chimney. **CJ**

● **JIM KINNIBRUGH** is a consultant specialising in commercial and industrial chimneys and flue systems. He is the author of chapter 10 of *AM15 Biomass Heating* and acting chair of the Chimneys and Flues Group

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# SMOOTH TRANSITION

Condensing boilers have been mandatory in the domestic market for more than a decade, but it is only recently that the commercial sector has followed suit after the introduction of the ErP Directive. Bosch's **Pete Mills** explains what the new requirements mean for consultants

In the commercial heating and hot water sector, non-condensing boiler technology has historically represented a sizable portion of the market, with the sector dominated by cast-iron, floor-standing, atmospheric boilers for outputs less than 400kW. While the Energy-related Products (ErP) labelling initiative does not apply to boilers of more than 70kW in output, the directive does impact on the type of commercial boilers that need to be installed – particularly in replacement scenarios.

Under the ErP Directive, a new commercial boiler with an output of between 70kW and 400kW has to be of a condensing type. When you consider that the market for boilers of this size currently stands at around 3,000 units sold per year, the industry has a lot of work to do to make sure the transition from the more traditional cast-iron boilers to condensing models is a smooth one.

Early estimates suggest that around 70% of the 3,000 commercial boilers sold each year will be of the wall-hung variety, with systems comprising multiple smaller output boilers in a cascade arrangement becoming a more common choice. This will, of course, bring significant efficiency gains – not only because these boilers, by their nature, operate more efficiently, but also because a cascade has the ability to modulate to a small percentage of its total output. This results in year-round efficiency according to seasonal demand, and each of the boilers shares any wear and tear, to prolong life-span.

## ErP Directive – out with the old, in with the new

One challenge that will have to be overcome by the heating and hot water industry is the manner in which older systems need to be dealt with. It tends to be the case that older



Systems comprising multiple boilers will become more common thanks to the ErP Directive

The need to follow condensing boiler best practice will grow in importance as the shift away from cast iron gathers pace



commercial heating and hot water systems are those that will be centred on a cast-iron atmospheric boiler. The new requirements effectively mean that boilers must be able to condense, which is relatively straightforward for the industry to grasp, but things start to be more complex when it comes to replacement installations.

The removal of the option for a cast-iron boiler to be replaced like for like means specifiers, contractors and consultants will have to consider how the existing system will need to be adapted to accommodate the incoming condensing boiler. Best practice is more important than ever, with some flues or flue routes simply not suitable, having originally been fitted to vent an atmospheric gas boiler. With few exceptions, the flue system for a condensing boiler will need to be completely sealed, which means many of the flue routes installed with much older boilers could need re-siting.

On the system side of things, one of the main objectives needs to be the protection of the new boiler from the potentially harmful deposits that may be in circulation within an older system. New condensing boilers will have smaller heat exchangers, with less water content and smaller waterways. While flushing, treating and refilling of the system will take place as a matter of course, old pipework is susceptible to regular build-up of particulate, which has the potential to hinder or harm boiler performance. Where it is not practical to replace the existing pipework, a plate heat exchanger should be considered

to keep the primary boiler water separate from the secondary heating circuit and avoid cross contamination.

One of the other by-products of a condensing boiler is condensate, which needs to be managed and disposed of safely. Of equal importance, however, is the need for the condensate to be routed correctly to protect it from freezing. This is a particular consideration for commercial installations where boiler houses may be positioned below ground level, with no gravity run for the condensate dispersal. If the condensate discharge pipe freezes, the boiler will, generally, shut down, so some thought needs to be given – at the installation stage – to how this can be avoided, either by using a pump or draining it appropriately.

The need to follow condensing boiler best practice will grow in importance as the shift away from cast iron gathers pace. Ultimately, the ErP Directive is designed to drive improvements in the efficiency and performance of heating and hot water products. The directive presents an opportunity to review efficiency, implement controls and – with the Carbon Trust having estimated that a 35% CO<sub>2</sub> reduction could be achieved by 2020 in non-domestic buildings – the ErP Directive could yet prove key to hitting this target.

### Standardising the future

The ErP Directive presents a different way for consultants to deal with the sector's manufacturers. It represents a shift towards a standardisation that is likely to spread across not only the heating industry, but all buildings, from the design stage to the build. Consultants who may have been accustomed to manufacturers' data sheets at the quotation stage will now need to get used to standardised documents, which will be the same across all manufacturers, to help with and encourage comparison.

The requirement for manufacturers to provide easily accessible data on efficiency, output and cost – in a standardised and comparable way – is further evidenced by the ErP Directive and the growing presence of building information modelling (BIM) files. The directive's impact on commercial boiler replacements, therefore, extends well beyond the installation, as manufacturers increasingly need to provide standardised, transparent data to consultants and designers. CJ

**PETE MILLS** is the commercial technical operations manager at Bosch Commercial and Industrial Heating



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# SMALL AND MIGHTY



CIBSE's headquarters building in Balham

Fuel cell micro-CHPs have the potential to make a huge contribution towards the UK's energy reduction targets, but how do they work in practice? To find out, CIBSE installed a system at its Balham HQ. **Alem Tesfai** reports

In recent years, the search for more reliable and sustainable energy sources has intensified. Though still on the brink of market entry, fuel cell micro-combined heat and power (CHP) systems for residential and small commercial applications have been proposed as one of the most promising innovations contributing to the transition towards a sustainable energy infrastructure.

With high electrical efficiency – more than 50% – and a low heat-to-power ratio, the system can run at high electrical and thermal efficiency throughout the year.

CIBSE has recently installed a solid oxide fuel cell (SOFC) micro-CHP system at its London headquarters – a converted, and recently renovated, Victorian townhouse – for testing and demonstration.

It aims to use this research project to build in-house expertise, and develop a body of knowledge in the form of publications, and other training material.

This case study, which I conducted with research manager Anastasia Mylona and Professor John T S Irvine, will look into the performance, availability and latest development of fuel cell micro-CHP systems, and the challenges and opportunities of introducing them into the UK market.

Initial results show the maximum heat recovered is about 1,000W at the return temperature of 15°C, and 300W at 45°C, which corresponds to an average combined efficiency of about 85%.

## Micro-CHP systems

CHP, also known as cogeneration, is the simultaneous production of heat and electricity from the same primary energy source, such as oil, coal, natural or liquefied gas, or solar.

Until now, CHP plants have been large-scale units used for industrial processes and district heating, but progress has been made to apply micro-CHP as a substitute for high-efficiency boilers at domestic scale (with an electrical power below 5kW<sub>e</sub>).

A variety of micro-CHP systems are currently available, including: steam turbines, reciprocating internal combustion engines, combustion turbines, micro turbines, Stirling engines and fuel cells.

The latter has been proposed as the most efficient way to convert the hydrogen – or hydrogen-rich hydrocarbons – to heat and power at the point of use for decentralised stationary power systems, and transport.

Unlike conventional fossil fuel power stations, which have many intermediate energy conversion stages, the conversion of the chemical energy in fuel cell systems takes place in a single step. Avoiding these intermediate steps reduces the irreversible energy losses and enables fuel cells to achieve efficiencies in the region of 40–60%.

These products could be used to meet the electrical and thermal demands of a building for space heating and domestic hot water and, potentially, for absorption cooling. Figure 1 shows a fuel cell micro-CHP system arrangement.

## Selecting suppliers

During the selection process, the performance and reliability of several fuel cell micro-CHP products were compared, as well as availability and the supplier's previous experience.

A lack of independent data to compare fuel cell micro-CHP systems meant the

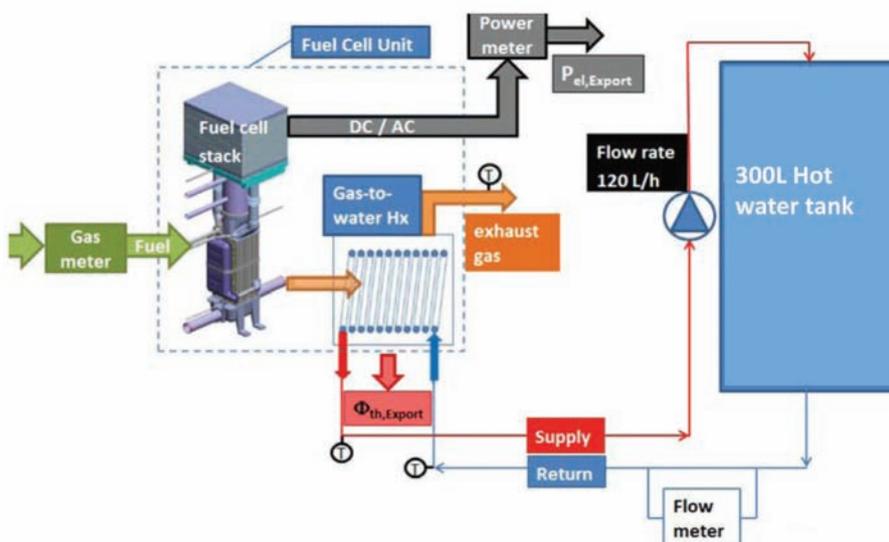


Figure 1: Schematic of fuel cell micro-CHP system arrangement adopted

selection process was mainly based on the manufacturer’s ability to supply and maintain the system, as well as upfront cost and a good technical support system.

Presently, the selected system BlueGEN supplied by SOLIDpower is the only fuel cell micro-CHP product that has Microgeneration Certification Scheme (MCS) accreditation, so is eligible for the Feed-In Tariff that provides long-term financial support.

The micro-CHP system generates 1.5kW of electricity and about 200 litres of hot water a day, reducing both heat and energy bills.

The high electrical demand at CIBSE HQ – 25kWh – means all the electricity generated by the unit is consumed and none exported to the grid. Also, the 200l/day of hot water generated by the system is used to cover most of the 250l/day domestic hot-water demand at CIBSE HQ.

**Installation issues to avoid**

Often, gas systems have a solenoid valve connected after the main gas meter, which switches off the building’s gas supply in the event of a power cut. Any gas supply interruption would cause a forced shut down, potentially damaging the SOFC stack.

An external shutoff valve is unnecessary because the SOFC micro-CHP comes with its own safety features, and should be connected before the solenoid valve to ensure continuous gas flow. It is important to consult your system provider and installers about the safe gas connection to the system.

Water pressure within the building can also vary depending on the location, type and height of the property. The standard level of mains water pressure is 10 metres-head (or 1 bar).

It is therefore important to measure water pressure at the site before installation. If the

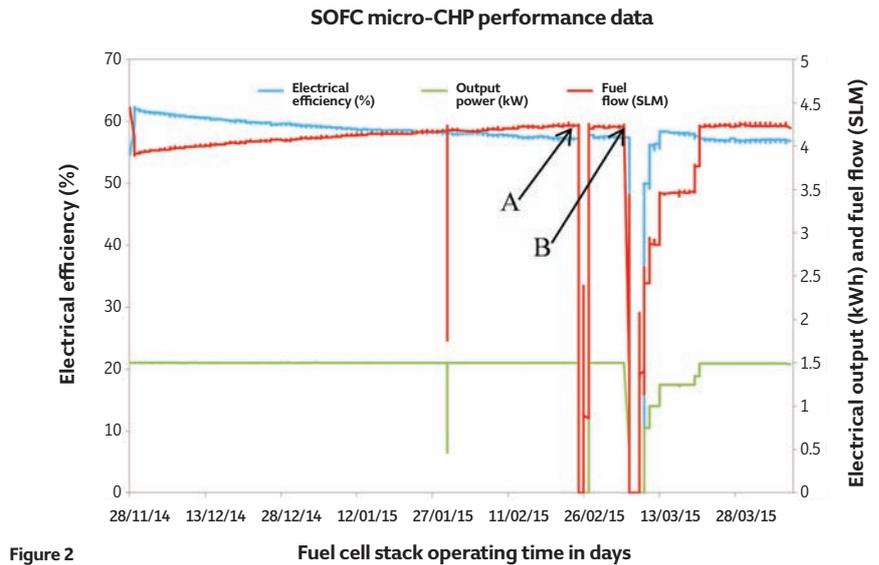


Figure 2 Fuel cell stack operating time in days

pressure is insufficient to push the water to the furthest point of use in the building, a pressure-booster may have to be installed, which could add around £1,200 to installation costs.

The system should be optimised so that most of the hot-water demand is covered by the heat recovered from the unit, which can also be used for pre-heating.

The tank size and whether to include a backup heating system – such as an immersion heater, solar or a combi-boiler– will depend on the hot-water demand.

Hot-water temperature must comply with current regulation, and it is also worth checking the pipe size connections of the existing pipe system and make sure the new installation is compatible. To install the unit, the building will have to be connected to gas, an electricity supply, mains water and the internet (see panel ‘Key connections’).

While recovery of the heat produced by the

unit is optional for operation, it is necessary – under MCS requirements – to make use of the heat for hot water to claim the Feed-In-Tariff available for CHP systems.

**Electricity generation performance**

The newly installed unit started generating electricity on 29 November 2014. To avoid damage and reduce stress on the unit, the power output was kept at 1.5kW.

The base load electricity demand of the CIBSE building is 5kW, meaning all the power generated by the unit is consumed onsite.

The electrical efficiency data in Figure 2 shows that with a fuel input of about 2.5kW the system was generating 1.5kW electricity, giving about 62% electrical efficiency. With the additional heat recovery into domestic hot water, the overall efficiency is about 85%.

After five months’ operation, the electrical efficiency gradually dropped, stabilising at about

**KEY CONNECTIONS**

- A mains gas supply  
All gas work and pipe fitting carried out should be completed in accordance with the relevant Gas Safe gas installation requirements
- The electricity grid  
All unused electricity is exported to the grid. All electrical work carried out to connect the system to the existing electrical connections of the building should be carried out in accordance with BS 7671, and an approved kWh meter should be installed for the purposes of recording electrical output
- Mains water
- The internet, for unit control and monitoring.

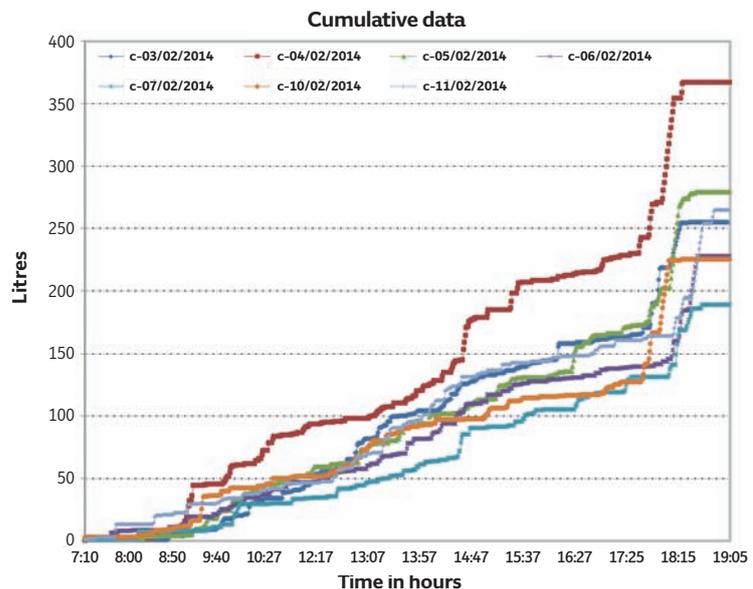


Figure 3: Seven days cumulative data showing hot water requirement throughout the day

Based on the initial performance, SOFC micro-CHPs could provide both significant energy and cost savings

Figure 4: A consistent 3K difference between flow and return temperature shows high heat recovery

Figure 5: The flow and return temperature showing high heat recovery (3.5K) when the return temperature is about 15°C, and 1.5K when the return temperature is at 45°C

57%, indicating slight stack degradation.

As shown in Figure 2, at points A and B a power cut caused the safety solenoid valve to shut off the gas supply to the unit, causing a forced shutdown.

As a result, at point A the unit was switched off for about 18 hours during which the temperature fell by about 200°C. After the stack was reheated and electrical production re-initiated, the system recovered well and continued generating electricity at 58% efficiency.

But, two weeks later another power cut interrupted the gas supply to the unit at 1am on a Saturday. During the three-day period that the gas was off, the stack temperature dropped by about 500°C.

Because of the big uncontrolled temperature drop, it was feared that the unit might fail to recover its pre-shutdown performance level, but it was nursed back slowly to its operating temperature, generating 1.5kW electrical output. Even after this second thermal cycling

the unit maintained similar performance, reaching about 58% efficiency. Since then, the stack has been operating at almost 57% efficiency, with no major performance drop.

However, it is unknown whether the thermal cycling will affect the long-term efficiency and durability of the unit.

**Heat recovery**

Thermal performance of the fuel cell was tested at 1.5kW, where electrical power generation for this unit is most efficient.

CIBSE headquarters has three kitchens and seven toilets. As shown in Figure 3, the hot-water requirement varies throughout the day, averaging at about 250l/day, with most of the hot water used at about 5.30pm by the cleaners.

At that point – as shown in Figure 4 – the temperature can drop to about 16°C.

During the week, the hot water tank temperature moves between 35°C and 45°C (Figure 3). The data shows a steady 3K temperature difference, indicating good heat recovery. At the weekend, hot water tank temperatures reach about 60°C. From this point, the thermal output of the unit can only maintain temperature by compensating the heat losses of the hot water tank and the heat recovery loop. Starting from a return temperature of 15°C at around 6pm, the unit requires about 14.5 hours to raise the temperature of the hot-water tank from 15°C to 45°C (Figure 5).

From this point, the heat recovery loop temperature difference drops to about 1.5K. The fuel cell unit generates temperature differences of 3.5K at the beginning of the loading process, falling to 1.5K at the end of the loading process.

Figure 6 shows the comparison of the heat output flow temperature and the return flow temperature against the heat recovered in W. The result shows the maximum heat recovered is about 1,000W at the return temperature of 15°C, and 300W at 45°C, which corresponds to a combined average efficiency of the entire CHP system of about 85%.

These results indicate the lower the temperature of the storage tank, the higher the heat recovery. To maximise heat recovery, return temperature should not exceed 45°C.

**Conclusion**

The SOFC based micro-CHP initially started generating electricity at 62% efficiency, and after the first 3,506 hours of operation its efficiency dropped to 57%.

Despite two forced shutdowns, it recovered well, indicating its robustness. But whether the forced shutdown will have a long-term effect on the durability of the unit is yet unknown.

The power production efficiency loss due to

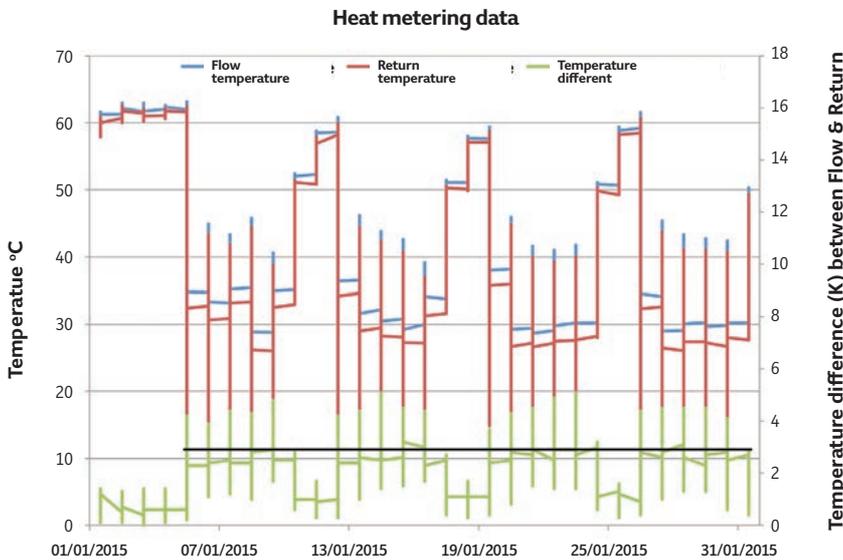


Figure 4

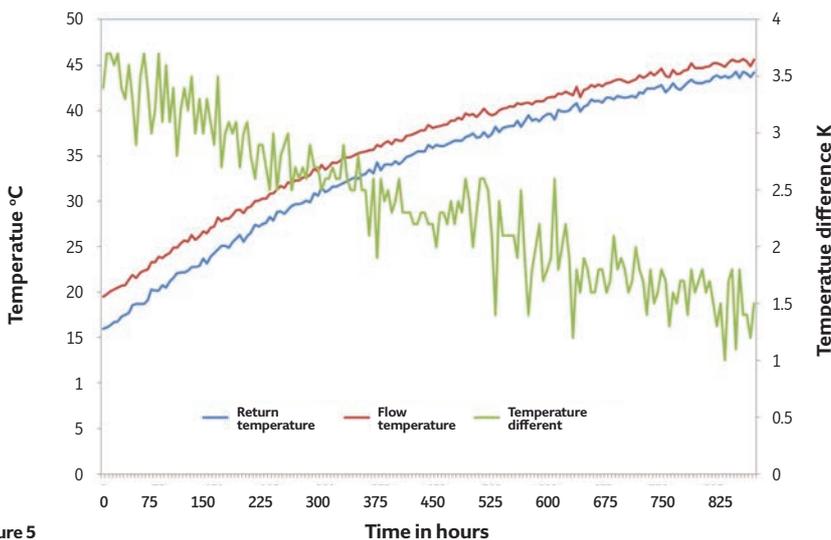


Figure 5



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said early  
bath, I wasn’t  
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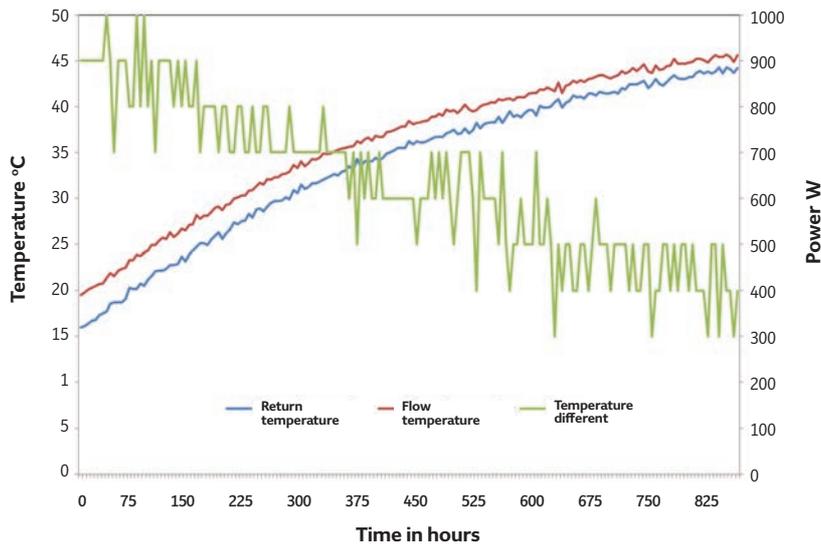


Figure 6

stack performance degradation is maintained at 1.5kW by increasing fuel flow from 2.5kW to 2.8kW. The thermal output of the unit depends on the flow return temperature of the heat recovery loop. The maximum heat recovered is about 1,000W at the return temperature of 15°C, and 300W at 45°C, which corresponds to an average combined efficiency of about 85%.

The results clearly indicate that to maximise the heat recovery from the SOFC micro-CHP the return temperature should not exceed 45°C.

The micro-CHP was successfully integrated to the existing heat supply technology, and heat

recovered from the unit covered most of the domestic hot water requirement. Based on the initial performance, SOFC micro-CHPs could provide significant energy and cost savings when used appropriately in an office. Based on current Feed-In Tariffs and energy prices the average return period of investment for a system like this is about 10 years. **CJ**

● Alem Tesfai is a fuel cell systems research associate at CIBSE

**References:**

- 1 Delta-EE, personal communication, 2013

Figure 6: The flow and return temperature showing 1,000W of heat recovered when the return temperature is about 15°C, and 300W heat recovered when the return temperature is at 45°C.

**SELECTING INSTALLERS**

The project plan and system layout were discussed and defined with all various installation companies that were invited to provide a quotation.

These ranged from £4,000 to £7,200, excluding VAT. The installers were selected based on price, MCS certification and the technical know-how, as well as previous experience in the installation of SOFC micro-CHP.

Experience has shown three key issues that need to be considered before embarking on the installation of the SOFC micro-CHP system:

- 1 What is the base load power requirement of the building (the minimum level of electricity demand)?
- 2 What is the domestic hot water requirement of the building?
- 3 Can the system be safely and efficiently integrated with the buildings current system or will it be a replacement to the current system?

System providers can help develop a business case, which will consider the heat and power demand of the proposed building. It is critical to explore different options for plant layout with as many system installers as possible to minimise installation time and cost.

**Market overview**

One of the main obstacles to micro-CHP commercialisation is its upfront cost.

To succeed in the market, a fuel cell-based micro-CHP system must compete in performance and cost against rival technologies, such as Stirling engine-based micro-CHP, grid supplied electricity or combi-boilers.

Commercial secrecy and low production volumes have meant that price information for fuel cell micro-CHP is not widely disseminated. However, based on our research in the UK and other markets, currently a 1kW fuel cell micro-CHP costs about €16,000 (£12,000).

Achieving mass production and a technically advanced durable product is expected to reduce the price to about €6,000 (£4,500) by 2020.

In Europe and other parts of the world with similar climates, fuel cell micro-CHP systems are marketed as a heat and power system with combined efficiency of more than 80%.

By achieving 55-60% electrical efficiency, fuel cell based micro-CHP are still more efficient than centralised power generators. Currently, fuel cell stack life for both PEM and SOFC micro-CHP

systems is reported to be around 80,000 hours, which is close to the system's lifetime.

This would remove any fuel cell stack replacements during its lifetime, further lowering the overall cost. This indicates system durability is consistently increasing, showing the fuel cell-based micro-CHP may be technologically ready, at least for the market entry level.

But we have witnessed companies who supply such systems go into administration, with CFCL being the most recent. The importance of continuity for confidence building in the market place and in the wider public is critical.

Moving to a more sustainable energy systems such as fuel cells can only come from strong governmental leadership, giving confidence that would trickle down to the stakeholders and the market. More than 80,000 smart power units incorporating fuel cell technology have been installed in Japan, driven by the government's objective to introduce 5.3 million units by 2030. This is also realistic in the UK, where smart power units are suitable for 90% of households and small businesses – equal to 22 million premises.

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# HEATING AND COOLING MAGNIFIED

The Sirach network encourages research and debate to promote sustainable innovation in refrigeration, air conditioning and heat pumps. Members **Metkel Yebiyo** and **Graeme Maidment** introduce the group

6 The energy used in heating contributes 31% of the UK's total CO<sub>2</sub> emissions while cooling accounts for 10%

The refrigeration, air conditioning and heat pump (RACHP) industry underpins everything we do. It touches many fields that we encounter in our everyday lives. Without heat and refrigeration, for example, the food supply would still be seasonal and limited to locally produced items; data centres would fail to work; comfortable living conditions would be difficult to deliver; zero carbon heating would not be an option; and certain medical advancements would be impossible.

As we transition towards a low carbon economy, there are sizeable environmental and economic benefits from developing and using efficient, innovative, low carbon heating and cooling technologies that reduce energy use and carbon emissions.

Many heating and cooling technologies other than boilers and vapour compression systems are available. Figure 1 includes technologies that may be familiar – including absorption and adsorption – as well as some obscure technologies, such as electrocaloric and thermoacoustic heat pumps.

In a series of articles, the Sustainable Innovation in Refrigeration, Air conditioning and Heat pumps (Sirach) network will review individual heating and cooling technologies on a bi-monthly basis.

We will describe the technology, the principles of operation, its main applications,

and the challenges and opportunities in penetrating the market – and what is needed for this to happen.

## What we use

Because heating and cooling are used so extensively, nearly half (46%) of the energy consumed in the UK is used to provide heat. The energy used in heating contributes 31% of the UK's total CO<sub>2</sub> emissions, and two-thirds of UK heating demand comes from domestic and commercial buildings.

Cooling systems use 19% of the UK's electricity demand and account for 10% of CO<sub>2</sub> emissions.

Fossil fuel-powered boilers dominate the heating market in the UK and, although they are very efficient in energy terms (about 95% for a condensing boiler), they use high-quality fuel combusted at high temperatures to heat water to a low temperature.

The conversion of high-quality fuel to low-quality heat in this way is not a good use of our finite resources.

At the same time, modern cooling is almost entirely based on a compression and expansion refrigeration cycle. Vapour compression refrigeration is a mature, reliable and relatively low-cost technology.

Over the years, the design of components and equipment of refrigeration systems – such as heat exchangers, compressors, fans, pumps, refrigerants and expansion valves – were considerably improved because of extended research and development efforts.

Anticipated improvements, however, are incremental because modern vapour compression cooling is already near its fundamental limit of energy efficiency.



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**The Sirach network**

► Sirach is an organisation for promoting new technology in refrigeration, air conditioning and heat pumps, bringing together researchers and industry innovators. It aims to increase the flow of information between those with problems and those with the ideas to solve them.

Members of the network collaborate to address a key strategy for ‘UK plc’ – technical innovation for long-term profitability and a clean environment. The challenge is to increase innovation to the same level as in Japan and Germany, to enable us to compete globally in the 21st century.

Traditionally, innovation has been by select companies, research organisations and universities. However, there is now a great opportunity for all to benefit.

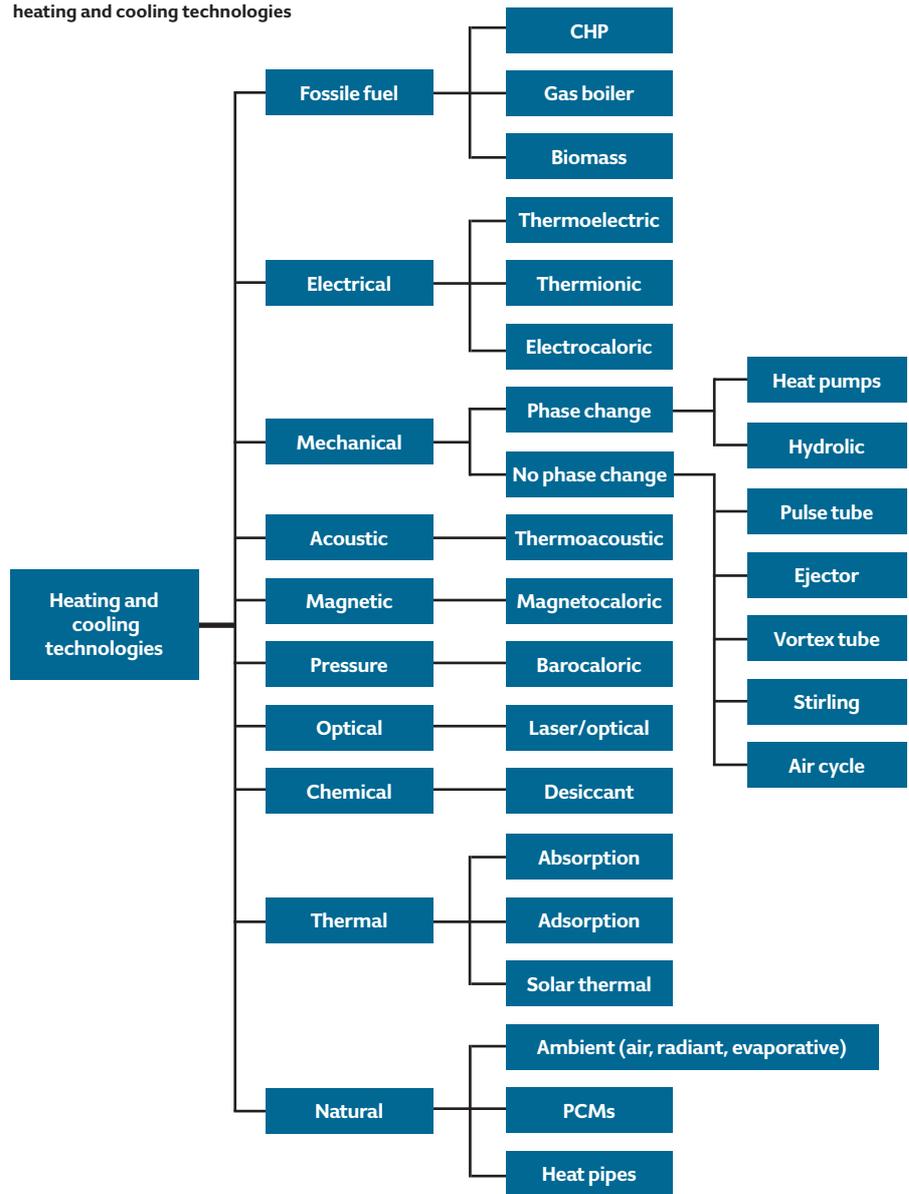
Sirach organises regular meetings, newsletters and research reports; come along to the regular meetings, held throughout the country at leading universities and businesses that engage in research. Our next meeting will take place on 20 January 2016, at Daikin UK’s new national training and technology centre in Woking, Surrey. The focus will be on domestic and commercial heating and cooling – next-generation technologies.

The Daikin centre features a whole floor dedicated to air conditioning technologies, eight heating training bays, and numerous demonstration rooms. It is designed to support the expansion of the air conditioning industry and further encourage the growth of the UK renewables market.

Sirach’s meeting will include technical presentations, a facilitated networking session and a tour of the facility. Booking is available via [www.sirach.org.uk](http://www.sirach.org.uk)

In the January 2016 issue of *CIBSE Journal*, Sirach will review magnetocaloric heat pumping. **CJ**

Figure 1: Different types of heating and cooling technologies



● Readers wishing either to suggest innovative cooling and heating technology, find out more information or be included on the Sirach mailing list should register at [www.sirach.org.uk](http://www.sirach.org.uk) or email [info@sirach.org.uk](mailto:info@sirach.org.uk)

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

## Metering and monitoring systems for power reliability and availability

This module examines the internal and external factors that can affect electrical supplies, and how metering and monitoring system can support compliance with relevant standards

Power quality is defined as the characteristics of the electrical supply that affect reliability, stability and continuity of service to a system. Reliable power is essential in modern lives, and there is hardly a single industry or market sector that does not require high levels of power quality and reliability.

Historically, prior to the advent of solid-state electronics, alternating current (AC) power quality was defined primarily by voltage, frequency and power factor. If these aspects were maintained within industry tolerances, then it would have been reasonable to expect the consumers – domestic, commercial, institutional and industrial – to be suitably supplied with electrical power.

Since the advent of solid-state electronic equipment, however, there has been an increasing need to consider other more complex factors – such as harmonics, transients and momentary disruptions – all of which can result in:

- Unexpected business downtime
  - Power quality disturbances account for 30-40% of business downtime
  - Poor power quality costs 4% of annual turnover (industry sector)
  - Estimated financial loss of €150bn

(£110) per year in Europe<sup>1</sup>

- Equipment malfunction and damage
  - Overheating of motors, capacitors, cables and transformers
  - Accelerated wear and tear on critical components
  - Improper function
  - Premature ageing
  - Nuisance tripping of circuit breakers

Some 70% of the power quality disturbances originate within the consumer's premises, while 30% are on the network side.<sup>2</sup>

Some important changes and developments that have occurred in recent years also increase the need for assessment and maintenance of power quality:

- There is a greater dependence on continuous availability of electric power
- E-commerce is changing the way all spheres of human activity are interacting with the world
- Intelligent technology demands power that is free from interruption or disruptions
- Use of renewable energy has resulted in an increase in power quality issues
- The level of quality perceived by the supplier (or regulator) may be different from what the customer requires or desires.

### Power quality phenomena and causes

Power quality issues should be considered in terms of the time and duration over which effects occur. Long-term power quality issues – such as power system harmonics, unbalanced phases, under and over voltages, frequency variations, voltage fluctuations (flicker) and poor power-factor – can lead to equipment failure, malfunctions, overheating and damage. Short timescale power quality issues – including short-duration voltage variations, interruptions and dropouts, sags and swells and system transients – may well result in visible and immediate impact, including reduced efficiency, potential malfunction and damage, all resulting in unscheduled downtime.

### Standards and regulations

It is not only the effect that other systems might have on a particular installation, but also the effect that that installation has on others.

### The Distribution Code<sup>3</sup>

This code covers technical aspects relating to the connection and use of the electricity

► distribution licensees' distribution networks. It is a cross-industry code, developed by industry, including suppliers, and the UK government.

The district network operator (DNO), as well as generators, suppliers and customers connected to, or seeking connection to, the DNO's distribution system must comply with the code. The DNO and all users have a duty under this Distribution Code to provide such information and resources as are necessary to facilitate compliance with, and implementation of, the Distribution Code. The Distribution Code contains guidelines for all aspects of the supply industry; of particular significance to the power quality is the **Distribution Planning and Connection Code (DPC)** that contains:

**DPC4.2.2 Frequency and voltage** – Requires that the voltage and frequency of the system complies with the Electrical Safety, Quality and Continuity Regulations.<sup>4</sup>

**DPC4.2.3 Voltage disturbances and harmonic distortion** – DPC 4 recognises that in fault conditions, the voltage may fall significantly at the moment of fault. These transient effects are heavily affected by system design and, in particular, the earthing system design.

Reference is made to BS EN 50160:2010 *Voltage Characteristics of Electricity Supplied by Public Distribution Systems* (discussed below).

DPC 4 also requires that the harmonic content of any connected load must comply with the limits set out within Annex 1, Item 1 Engineering Recommendation G5/4-1, *Planning levels for harmonic voltage distortion and the connection of non-linear equipment to transmission and distribution systems in the United Kingdom*.

**BS EN 50160:2010 Voltage characteristics of electricity supplied by public electricity networks<sup>5</sup>**

This standard describes and specifies the characteristics of the supply voltage that can be expected from the DNO, and covers frequency, magnitude, waveform and symmetry of the line voltages, defining acceptable levels, measurement periods and intervals of power quality phenomena, including:

- Power frequency
- Flicker
- Supply voltage dips
- Short and long interruptions
- Temporary over-voltage
- Supply voltage magnitude
- Supply voltage unbalance
- Harmonic voltage
- Inter-harmonic voltage
- Mains signalling voltage

**Engineering recommendation G5/4-1<sup>6</sup>**  
This standard was issued by the Energy Networks Association (ENA) and defines the permitted levels for harmonic voltage distortion and the connection of 'non-linear' equipment.

G5/4-1 aims to ensure that the levels of harmonic current in the public electricity supply system do not give rise to problems for connected users.

G5/4-1 provides the standard basis of assessment for use by network operating companies (NOCs) and their customers, which then forms part of the connection agreement signed by the NOC and customer.

Maximum permissible harmonic currents are defined within G5/4-1 and tabulated in Table 7 of the document.

To measure and assess harmonic content of systems properly, all measurement devices – including fixed meters – need to be IEC 61000-4-30 Class A-compliant.

### Developing a strategy

The design of systems and means to mitigate export of power problems to the public supply network (and across a local network) is beyond the scope of this article.

However, even with the best designed system there is still a risk that an installation might either affect other systems, or that it might be affected by other systems.

A monitoring system may be found to be the most cost-effective and robust way to manage this risk, but there should be an overall strategy to monitor and manage power quality.

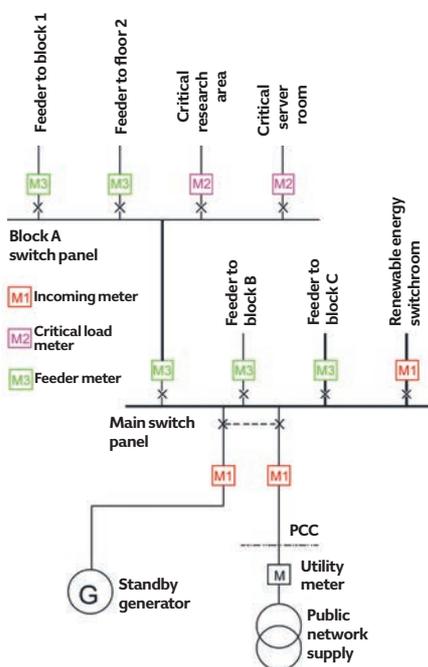


Figure 1: Typical simple distribution system

Figure 2: Typical meter application



### Power meters (incoming)

High accuracy (0.2 class); very high sample rate (>512 per cycle); energy usage monitoring; load monitoring; reliable data; basic power quality monitoring (V, I, kW, kVA, PF and total harmonic distortion); advanced power quality recording (sags, swells, outages, transients); utility bill verification (check accuracy of utility bills); alarm configuration (to capture events and time index them); additional inputs (gas, water and so on.); EN50160 reporting and IEC61000-4-30 Class A-compliant for harmonic measurement to G5/4



### Power meters (critical loads)

High accuracy (0.2 class); high sample rate (>256 per cycle); load monitoring; reliable data; basic power quality monitoring (V, I, kW, kVA, PF and total harmonic distortion); advanced power quality recording (sags, swells, outages, transients); alarm configuration (to capture events and time index them); additional inputs (gas, water and so on)



### Power meters (feeder)

Good accuracy (0.5 class); energy usage monitoring; load monitoring; reliable data; basic power quality monitoring (V, I, kW, kVA, PF and total harmonic distortion); additional inputs (gas, water and so on)

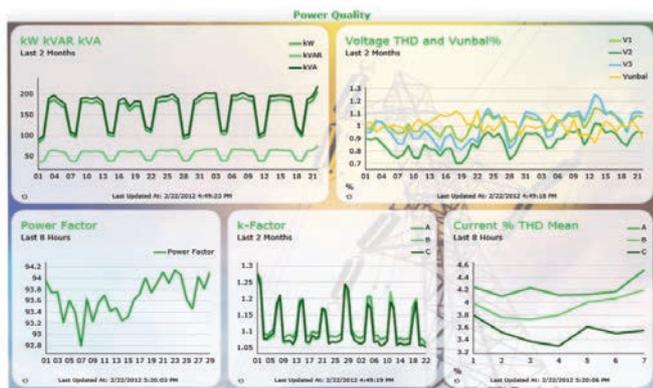


Figure 3: Graphical views

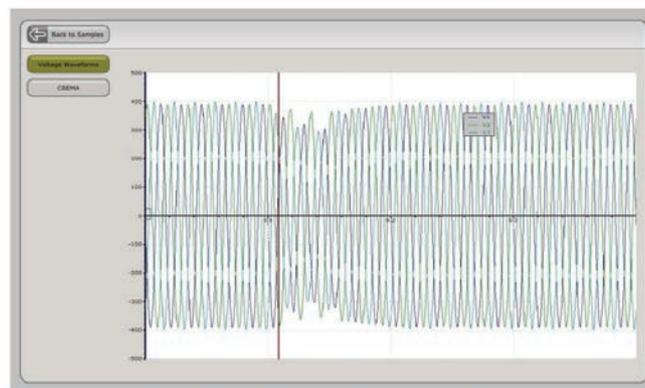


Figure 4: Short-duration voltage variance

1) Determining goals for the monitoring system

a) Energy metering

Systems that record energy usage (kWh), voltage, current and power demands are widely applied in buildings. Measurements can be made at a site, building or even equipment level, and can be collected at regular time intervals (such as half-hourly). These results can inform operational analysis and have benefits for energy management, load reduction, peak levelling and billing.

CIBSE TM39<sup>7</sup> offers a useful methodology for this type of monitoring. Instantaneous and customised logging of parameters can also provide insight into performance and network health. Such monitoring is commonly managed by a building management system (BMS), or dedicated energy management system.

However, these systems often provide neither the measurements, nor the resolution, needed to monitor and report on power quality.

b) Power quality metering

These systems use more specialist meters and often include a dedicated recording network. They are typically aimed at maximising the efficiency, safety and reliability of the electrical infrastructure, and measuring power quality, as well as being capable of:

- Maximising the efficiency and reliability of the electrical infrastructure
- Measuring the quality and quantity of power in the system
- Offering sufficient time-domain resolution
- Maximising system uptime
- Improving maintenance response
- Ensuring power quality compliance
- Network protection and control

2) Selecting and appropriately locating the correct types of meter to capture data and transient events

The hardware, firmware and software sophistication of a meter are generally related to its cost. It is, therefore, important to select the correct meter for application at a given

point in the system. Complex meters provide greater accuracy and more information, but might not be needed at all points in a network (see Figure 1).

A key location to measure power quality is at the main switch panel. This will effectively provide data and information on the point of common coupling (PCC), as defined in G5/4-1, and hence enable assessment against this and other standards. Meters with a high degree of information and good resolution should be installed on incoming supplies, including all sources such as generators, renewable energy and dual supply points.

Outgoing supplies should also have meters fitted. It is sensible to provide high functionality meters for critical loads or main feeders that serve non-critical loads. Although small supplies may necessitate less complex meters, it is best to confirm what type of loads are envisaged, as that individual supply to plant or outbuilding might end up being a source of a problem. Typical applications of meters are shown in Figure 2.

3) Applying the most appropriate software to visualise results and provide analysis

Meters that store data and capture events are available; more basic meters will provide real time readouts that must be collected and stored elsewhere. Monitoring software should be able to communicate with all types of meter used, and then be able to collate and present data so that the user can carry out analysis. Ideally, software should be able to: acquire data from multiple sources; have long term storage and data history; allow logical application of 'virtual metering'; and allow data to be shared or exported to other packages.

The software is often able to present data in a visual form that enables easy but accurate assimilation of information and viewing of results.

4) Make informed decisions based on results

Once power quality data is recorded and

collected, the findings should be used to determine the health of the system and, if necessary, influence the design or investigation of options for mitigation measures or improvements.

Thereafter, monitoring and vigilance is necessary to maintain compliance and correct operation.

The 'internet of things', 'smart cities' and spreading use of embedded intelligence in all aspects of life means that power quality cannot be ignored and will become increasingly important in years to come. Awareness and a strategy to monitor and manage effects are essential.

© Adam Rawlinson, 2015.

Further reading

BSRIA Power Quality Application Guide AG2/2000. Copper Development Association - *Electrical Design - A Good Practice Guide*, 1997. Section 3.

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- 1 Manson J and Targosz R - *European Power Quality Report*, Leonardo Energy, November 2008, section 5, page 8.
- 2 Bhattacharyya S and Sjeff Cobben S *Consequences of Poor Power Quality - An Overview*, Technical University of Eindhoven, from *Power Quality*, edited by Eberhard A, Intertech Web 2011. [www.intechopen.com](http://www.intechopen.com). Part 1, chapter 1, section 2.
- 3 Distribution Code of Licensed Distribution Operators of Great Britain, DPC 4. [www.dcode.org.uk/the-distribution-code/](http://www.dcode.org.uk/the-distribution-code/)
- 4 *Electricity Supply Quality and Continuity Regulations 2002*, HM Stationery Office. SI 2665
- 5 BS EN 50160:2010 + A1:2015, British Standards Institution.
- 6 Engineering Recommendation G5/4-1 *Planning Levels for harmonic Voltage Distortion and the Connection of Non-Linear Equipment to Transmission Systems and Distribution Networks in the United Kingdom*, Energy Networks Association, 2005.
- 7 CIBSE Technical Memorandum TM39 *Building Energy Metering*.

Turn over page to complete module ➤

# Module 84

November 2015



**1. What is the estimated financial loss across the EU due to unexpected business downtime relating to power quality issues?**

- A £150bn
- B £100m
- C €150bn
- D €75bn
- E Impossible to estimate

**2. Which of the following generally appear as short-timescale power quality issues?**

- A Frequency variation, transients, power factor
- B Interruptions, transients, sags and swells
- C Transients, power factor, under-voltages
- D Harmonics, short duration voltage disturbances
- E Unbalanced phases, frequency variation, power factor

**3. Which of the following is NOT covered by BS EN 20160:2010?**

- A Flicker
- B Harmonic voltage
- C Phase current unbalance
- D Supply voltage dips
- E Power frequency

**4. In the article, which publication is referred to for values of maximum permissible harmonic currents?**

- A DPC4
- B CIBSE TM39
- C BS EN 50160
- D G5/4-1
- E IEC 61000

**5. Which of the following is NOT necessarily needed for a meter connected to a feeder?**

- A 0.5 class accuracy
- B Advanced power quality analysis
- C Reliable data
- D Additional inputs
- E Energy usage monitoring

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## Kelpies are the mane event

Although only a recent addition to the Scottish tourist scene, the 2 x 30 metre high, 300 tonnes horse head sculptures in Falkirk, known as The Kelpies, have certainly made their presence felt.

The name is a derivation from mythological beasts who it was said possess the strength and endurance of 10 horses. These

structures are now a major tourist attraction with a brand new visitor centre to support them. The original plans for the centre had to be reviewed when it became clear that the draw of this attraction was such, that a larger facility would be required.

Grundfos Pumps worked in association with the consultant Atkins and contractor Marmac Services to develop a bespoke solution that would meet the needs of the envisaged one million annual visitors. This meant supplying the complete M&E solution of circulators, booster and pressurisation sets plus ancillary items.

● Call 01525 850 000, email [grundfosuk@grundfos.com](mailto:grundfosuk@grundfos.com) or visit [www.grundfos.co.uk](http://www.grundfos.co.uk)

## Hexagon theatre benefits from new PEL system without closing its doors

PEL Services has completed a major upgrade to the public address (PA) and voice alarm (VA) system at Reading's Hexagon Theatre.

At the same time, PEL refurbished the security systems in place to provide the premises with greater protection. All work was carried out without compromising the theatre's schedule.

PEL combined its sound, fire and security systems expertise to install the next generation of upgrades.

● Call 0333 123 2100, email [info@pel.co.uk](mailto:info@pel.co.uk) or visit [www.pel.co.uk/sound/public-address-systems](http://www.pel.co.uk/sound/public-address-systems)



## Nexus units from ELCO at heart of urban regeneration project

350 Nexus Futura Bitherm heat interface units from ELCO UK have been installed at the Stoke Quay development in Ipswich, Suffolk.

The installation also included three R3603 floor standing condensing boilers as well as a Gemini indirect cylinder.

The Nexus units were specifically designed for the Stoke Quay apartments, with top exit pipework to accommodate design conditions.

Comprising seven models, the Nexus range encompasses indirect, direct, storage and cooling units.

● Visit [www.elco.co.uk](http://www.elco.co.uk)

## The diversity of the Xterminator

As it grows more in popularity every year, Marflow Hydraulics' Xterminator valve set is being used increasingly with a variety of different terminal devices.

Over the past few years, the Xterminator valve set has been mostly credited as a great solution to work with fan coil units. However, customers are increasingly using the product with a larger range of terminal devices, just as it was originally designed for and demonstrating its true flexibility.

● Visit [www.marflowhydraulics.co.uk/didyouknow](http://www.marflowhydraulics.co.uk/didyouknow)



## Aquatech Pressmain to exhibit at Building Energy & Efficiency Exhibition

Aquatech Pressmain and Autron will be exhibiting new products at the Building Energy & Efficiency Exhibition at Manchester Central on November 10-11, 2015.

Aquatech Pressmain will be showing its new unique Minipack pressurisation unit, which is designed to maintain a minimum set pressure in a sealed heating or chilled water system.

Designer of low surface temperature radiators, Autron, will be exhibiting its specialist radiators and a new trench heating product.

● Visit [www.aquatechpressmain.co.uk](http://www.aquatechpressmain.co.uk) and [www.autron.co.uk](http://www.autron.co.uk)



## ErP-compliant condensing pressure jet boiler launched by Ideal Commercial Boilers

The Evojet condensing range of pressure jet boilers, available in outputs ranging from 150kW to 1450kW, offers ErP compliant efficiencies of up to 109.3% part load, and is available in a total of ten outputs. These appliances are designed to operate in condensing mode as standard, no economiser is required. This not only maximises efficiency, but also ensures Evojet can offer the smallest dimensions possible for appliances of this type.

● Call 01482 492 251, email [commercial@idealboilers.com](mailto:commercial@idealboilers.com), or follow @idealboilers on Twitter



### Continuous close control with HygroMatik resistive humidification

HygroMatik has introduced its resistive steam humidification unit, HeaterLine.

HeaterLine is a heater element steam humidifier designed to work with any water type. The product comes as a 90kg unit, with greater capacities and varying voltages available upon request.

The unit is available in nine sizes with steam outputs of 6 to 225 kg/h. Steam output of over 45 kg/h is gained by using multiple units in parallel.

● Call 02380 443 127  
or visit [www.hygromatik.com](http://www.hygromatik.com)

**Installation made easy with Evomax**  
Ideal Commercial Boilers has launched two new flue accessories for its best-selling Evomax wall-hung condensing boiler range.

The Ideal Commercial Boilers Plume Kit is specially designed for Evomax boilers being installed in awkward locations.

Compatible with Evomax models up to 120kW, the kit includes standard appliance connector, horizontal flue kit, special rain collar, external plume kit 1m and terminal.

● For more information, call 01482 492 251, email [commercial@idealboilers.com](mailto:commercial@idealboilers.com) or follow @idealboilers on Twitter



### Ideal Commercial Boilers extends forces with Compheat

Ideal Commercial Boilers has extended its sales force in the north of England after signing a contract with Compheat, an established and well-renowned sales agency for the HEVAC sector.

Andy Forrest, Paul Jones and Mark Clayton, commercial business development managers for Ideal Commercial Boilers, will now be working alongside Compheat managing director Gary Kettlewell, and Paul Hill and Chris Dooley, to provide a consultative service.

● Call 01482 492 251, email [commercial@idealboilers.com](mailto:commercial@idealboilers.com) or follow @idealboilers on Twitter

### Improve indoor air quality with HygroMatik steam injection humidification

To answer the growing need for short distance humidification with condensate-free saturated steam, HygroMatik has introduced its unique 4-in-1 DDS steam injection humidifier.

The unit is designed for applications where clean, low-pressure steam is needed – such as hospitals, museums, laboratories, universities and airports.

It is available in two versions, the DDS 20 and DDS 40 – with a maximum humidification capacity of 270kg/h and 770kg/h per unit, respectively.

● Call 02380 443 127  
or visit [www.hygromatik.com](http://www.hygromatik.com)



### Gilberts works with Croydon new school development

An £11m+ commitment by Croydon London Borough Council to achieving better outcomes for its children with special needs has been spearheaded with the opening of a new school that blends education with the local environment.

The Priory SEN takes inspiration from its location in woodland; thus the BREEAM 'very good' rated three-storey, 3000m<sup>2</sup> building features natural ventilation.

Gilberts' glazed-in louvres are among the most energy efficient available today.

● Call 01253 766 911  
or email [sales@gilbertsblackpool.com](mailto:sales@gilbertsblackpool.com)

### Systemair – new EC water terminals

Systemair has launched a range of water terminals following their acquisition of a production facility in France.

Available in two- and four-pipe options, with cooling loads from 0.5kW to 28.0kW, the range covers duct-mounted fan coil units, ceiling cassettes, floor standing & wall mounted units as well as a comprehensive range of controls and accessories.

An online selection tool is available for selections and data sheets.

● For more information contact [info@systemair.co.uk](mailto:info@systemair.co.uk) or visit [www.systemair.co.uk](http://www.systemair.co.uk)



## Manifolds from Marflow Hydraulics

The technical team at Marflow Hydraulics has modified its portfolio of manifold solutions and has just relaunched them as the Diversiflow range.

A centrally located, multi-terminal manifold unit provides significant benefits when compared with the conventional approach of installing individual valve sets at each terminal unit.

The Diversiflow manifold system houses all of the valves required for a group of terminal units in a single, insulated box – providing easy and convenient access.

● Visit [www.marflowhydraulics.co.uk/diversiflow](http://www.marflowhydraulics.co.uk/diversiflow)



## Martindale fused G-clamps set new safety standards

Now available from Martindale Electric is the new range of insulated Drummond G-clamps, designed to provide safe and easy connection to bus bars.

The new range of moulded G-clamps, which eliminate the need to drill the bus bar, provides installers with a safe and reliable connection, via a standard 4mm socket.

Ideal for connecting power monitoring and measuring equipment, the clamps are clearly colour coded.

● Call 01923 441 717, email [sales@martindale-electric.co.uk](mailto:sales@martindale-electric.co.uk) or visit [www.martindale-electric.co.uk](http://www.martindale-electric.co.uk)



## Mikrofill supplies West Mercia police

The ageing heating plant at Malinsgate police station in Telford, Shropshire was recently replaced with 6 No Ethos 130kW condensing boilers, with a burner modulation of 10 > 1.

The stainless steel boilers were installed with a Mikrovent low loss header/air and dirt separator, a pre-commissioned Mikrofill 1000/2 pressurisation package and a modular frame kit.

All services were maintained throughout the six-week project thanks to the phased design programme.

● Call 03452 606 020 or visit [www.mikrofill.com](http://www.mikrofill.com)

## National Library of Wales chooses Remeha boilers

Remeha boilers have been installed at the National Library of Wales in Aberystwyth, to provide more reliable, resilient heating that will maximise its energy and carbon savings.

Contractors Aber Heating installed three Remeha Gas 310-500 Eco Pro boilers into the main boiler room serving the offices, and three Remeha Gas 610-1000 Eco Pro boilers into the book-stack boiler room serving the critical cells where the collections are stored.

'The quality of Remeha's boilers and service has earned them a good reputation with us over the years,' said Aber Heating's Mark Sandford.

● Call 0118 978 3434, email [boilers@remeha.co.uk](mailto:boilers@remeha.co.uk) or visit [www.remeha.co.uk](http://www.remeha.co.uk)



## Specflue launches next generation of HIU's

The next generation of Heat Interface Units (HIU) has been launched.

Manufactured by Thermal Integration, and distributed by Specflue, the DATA has been designed for better performance and ease of use, in properties where the domestic hot water and central heating is supplied through a district heating system using a central boiler. Delivering the same benefits of traditional HIUs, they are unique in their capability to communicate digitally with each other, the occupant and the building's computerised management systems.

The DATA has the ability to harness advancing technologies, such as CHP, biomass, heat pumps, waste incineration and solar. These are mostly uneconomical to employ in individual properties, but can now be combined, using the DATA, to generate heat to numerous properties.

The DATA is one of the smallest, but most advanced HIUs on the market, and is capable of producing up to 75kW domestic hot water and 20kW indirect central heating.

● Call 0333 999 7974 or visit [www.thermalintegration.com](http://www.thermalintegration.com)



## Enterprise remote monitoring and facilities management software

The user-friendly ActiveFM interface allows you to manipulate large volumes of complex data into an interactive format.

Web based, your data is accessible whenever and wherever you need it. With the ability to set up email alerts, you don't even need to log in to know when your system needs your attention.

ActiveFM ensures that assets are protected and that your system is operating efficiently.

● Call 0141 810 2828, email [sales@resourcedm.com](mailto:sales@resourcedm.com) or visit [www.resourcedm.com](http://www.resourcedm.com)



## Bloomsbury boutique hotel benefits from Remeha heating

The Goodenough Club, the London hotel part of the educational charity Goodenough College, has upgraded its heating with Remeha Gas 210 Eco Pro boilers.

Contractors EMS recommended installing two Remeha Gas 210 4-section Eco Pro boilers due to the reliability and efficiency of the Remeha boiler range and the professional and proactive after sales service.

Careful planning and strategic phasing of the project, supported by the easy installation offered by the Remeha boilers, helped minimise disruption at the club and maintain its 4-star service. This is the second Remeha installation for the charity, following a boiler replacement at Goodenough College.

● Call 0118 978 3434, email [boilers@remeha.co.uk](mailto:boilers@remeha.co.uk) or visit [www.remeha.co.uk](http://www.remeha.co.uk)



## The iVECTOR is a cost-effective heating solution from MYSON

Fan convectors don't have to be expensive: MYSON's iVECTOR offers the latest in energy efficient heating technology, with high heat outputs at low water temperatures, a stylish design, intelligent and flexible controls, silent operation and enhanced availability.

It delivers a variety of commercial outputs without compromise on any of its features, yet MYSON is confident that the iVECTOR is priced competitively against other commercial fan convectors.

● Call 0845 402 3434, email [sales@myson.co.uk](mailto:sales@myson.co.uk) or visit [www.myson.co.uk](http://www.myson.co.uk)



## Skanska signifies Cygnus wireless alarm

The Monument Building, in the City of London, is using Bull Products' latest Cygnus wireless alarm system during construction works.

Being built by construction group Skanska, the building will offer 88,000ft<sup>2</sup> of office accommodation with 4,000ft<sup>2</sup> of retail space.

The Cygnus alarm system can link as many as 480 alarm and detector units in different zones on a construction site. Individual units can be fire-alarm call points, first-aid alerts, combined call points and first-aid alerts, smoke detectors or heat detectors.

● Call 0844 669 1111, email [info@bullproducts.co.uk](mailto:info@bullproducts.co.uk) or visit [www.bullproducts.co.uk](http://www.bullproducts.co.uk)



## Swegon launches new Titanium range of ERUs

Swegon UK has introduced a new collection of energy recovery units (ERUs). Available in four variants – Flat, Global, Mural and Total – the Titanium range offers flow rates from 0.25m<sup>3</sup>/s to 4.25m<sup>3</sup>/s and efficiencies up to 96 per cent.

All models feature an intelligent built-in control system, which allows individual units to be monitored and adjusted remotely through a dedicated app.

The system enables engineers to quickly configure air-flow modulation and optimise energy usage.

● Visit [www.swegon.co.uk](http://www.swegon.co.uk)



## Vent-Axia shares benefits of reshoring with Sussex businesses

Vent-Axia has shared its experiences of reshoring its manufacturing from China at the latest Sussex Chamber of Commerce manufacturing forum.

At the event, other Sussex manufacturers heard from marketing manager Jenny Smith (right) how reshoring had created jobs and boosted the firm's competitive advantage.

As well as hearing about Vent-Axia's reshoring initiative, delegates at the event were able to tour the facilities and see for themselves how moving manufacturing back to Crawley has benefited the company.

● Visit [www.vent-axia.com](http://www.vent-axia.com)



## Kingspan Koolduct revitalises university library

The University of Hull has opened a new chapter for its main library with a multi-million pound redevelopment, which is supported by Kingspan's KoolDuct system.

The Kingspan KoolDuct system features a premium performance insulation core, allowing it to achieve very low thermal conductivities.

It can also be used to produce ductwork with minimal air-leakage, leading to considerable energy savings over time through reduced fan energy usage.

● Call 01544 387 384, email [literature@kingspaninsulation.co.uk](mailto:literature@kingspaninsulation.co.uk) or visit [www.kingspaninsulation.co.uk](http://www.kingspaninsulation.co.uk)

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**AET clients upgrade controls systems at installations**  
AET Flexible Space underfloor air conditioning systems have been installed at more than 100 sites across the UK.

A number of the installations have required minimal upgrades or modifications to the original equipment specification, however developments in controls and communications components have led to improvements in functionality.

Clients such as Jaguar Land Rover, TAG Farnborough and Bloomberg have all upgraded their existing systems with AET.

● Call 01342 310 400, email [lucy@flexiblespace.com](mailto:lucy@flexiblespace.com) or visit [www.flexiblespace.com](http://www.flexiblespace.com)



## Perfect planning from Purmo

The Plan Compact from Purmo is a stylish, high-performance flat panel radiator.

Its sleek appearance and attractive glossy finish make it stand out against more traditional panel radiators.

The Plan Compact combines these good looks with a leading performance. It comes in a range of stocked sizes as well as made-to-order colours and sizes, offering versatility and flexibility, making it perfect for your next project.

● Call 0845 070 1090, email [uk@purmo.co.uk](mailto:uk@purmo.co.uk) or visit [www.purmo.com/en](http://www.purmo.com/en)

## Renewable technology at core of the Omnie section

The Omnie collection by Timóleon brings together integrated heat pump solutions, which include high-performance air to water heat pumps as well as a compatible selection of underfloor heating systems and fully compatible control options.

The recently published Omnie brochure – subtitled *Making a Home Whole* – includes detailed information on the LWD air source heat pumps which are produced by the hugely respected German manufacturer, Alpha-InnoTec.

● Call 01392 363 605, email [Chris.Weaver@timoleon.co.uk](mailto:Chris.Weaver@timoleon.co.uk) or visit [www.omnie.co.uk](http://www.omnie.co.uk)



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**Electrical Associate**

**£55-£60k + benefits, London**

If you want to step up and take a lead role within design engineering this position will enable you to lead project teams, develop engineers, and implement engineering and environmental strategies whilst working on the world's most iconic projects. If you have 10-15 years' experience working in electrical design this is where you can implement those skills at a senior management level and be part of a very successful engineering consultancy. BAR3098/CB

**MEP Revit Technician**

**£40k - £45k - Tax Free, Doha**

A skilled technician practised in calibrating M&E designs to produce detailed models is required to work on the consultancies highest profile regional project. You will be reporting to the Head of MEP Qatar and be responsible for delivering key Revit MEP and AutoCAD drawings for the project. Minimum 4 years working Revit experience required. BAR2988/PA

**Principal Electrical Engineer**

**£48 - £55k + benefits, Manchester**

Lead the biggest projects in the North, one on the site of an iconic British TV series. You will have exposure to multiple sectors including Hotels, Concert Halls and other prestigious buildings on this ten year project worth billions. BEng, experience on large projects and client facing. BAR3099/AA

**Senior Mechanical Engineer - Data Centre**

**£340 per day, London**

My client understands the technology with which they surround themselves is becoming more complex, more inventive, and more intelligent. As a result they seek a Senior Mechanical Engineer who has demonstrable experience within the Data Centre field to join a front runner within the Mission Critical sector with over 85 years of bespoke engineering experience. BAR3085/GD

**Intermediate/Senior Public Health Engineer**

**£40k - £50k + benefits and bonus, London**

A leading multi-disciplinary engineering consultancy with an exceptional reputation for delivering high level commercial, and residential projects are searching for a career driven engineer that is keen to develop their design skills, be promoted, and work in a client facing position. You will be working towards leading projects throughout their full life cycle, designing solutions, and working as part of a dedicated team. BAR2893/MO

**Senior Electrical Design Engineer**

**£40 p/h, London**

We are currently working with a building services consultancy that works a little differently to other companies. It is a business that is owned and managed by engineers and this gives employees the advantage of allowing them the freedom to work in the way they want. The projects are within the hospitality, commercial, and retail sectors. BAR3090/KB

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**Associate (Mechanical bias) Birmingham**

£55,000-£60,000 Plus Benefits

A fresh thinking building services consultancy is now looking for an associate to join their office in Birmingham, to implement strong expansion plans. This is a dynamic role for someone with 10 years plus in building services design. You will be expected to manage a small team of engineers and build long lasting relationships with current and new clients, whilst retaining a "hands-on" design element. This role would suit a top senior engineer looking to move into an Associate position who possesses strong commercial awareness of the area.

**Intermediate Mechanical Design Engineer Glasgow**

£28,000-£32,000 Plus Benefits

This successful multi-disciplinary consultancy requires a technically strong intermediate engineer in their Glasgow office. Ideally you will have skills in developing innovative design for a range of mechanical services that include HVAC, gas, and plant layouts. The candidate will also need to be able to run their own projects with minimal supervision. This client can offer a fast track to senior level for engineers who perform well within this role; they will also consistently develop your engineering skills.

**Associate Electrical Engineer Waterloo**

£65,000 Plus Benefits Package

An award winning building services consultancy based near Waterloo Station is currently looking for an Associate level Electrical Engineer to work on commercial projects in Central London. This is a fantastic role which offers a clear route to Directorship with the expansion of their team. Candidates should be comfortable in client facing and team leading roles, and have a real passion for their work.

**Design Manager (Electrical) South-East London**

£67,000 Plus Benefits Package

A renowned commercial and high end developer based in South East London is looking for an electrically bias Design Manager. Working closely with the project team you will develop innovative electrical solutions on fast track projects, whilst managing external building services consultancies. This is a fantastic role for someone wanting to work client side.

**BIM Manager (MEP) London/Oxfordshire**

£40,000-£60,000 Plus Benefits

The building services industry can only get better with a strong BIM lead. If you agree with this statement then we want to hear from you! We have an opportunity for an experienced BIM manager with solid Revit MEP/BIM Modelling skills to join a leading consultancy in London. You will be in charge of winning business using the latest BIM technologies, as well as leading a team of technicians through a range of dynamic and challenging projects.

**Contract Electrical Design Engineer Waterloo**

£40 Per Hour

We are currently recruiting on behalf of an award winning multi-disciplinary engineering consultancy. The ideal candidate will be knowledgeable in crossrail station design. They are currently seeking an ambitious and self-motivated contract Electrical Design Engineer to work on a full time basis within their talented workforce in London. Immediate starter preferred.

Find more jobs online at [conradconsulting.co.uk](http://conradconsulting.co.uk)

For a confidential chat, contact George 8am to 8pm on 0203 1595 387 or [george@conradconsulting.co.uk](mailto:george@conradconsulting.co.uk)



**Project Director**  
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VINCI Facilities are seeking an exceptionally talented Project Director to lead its high profile Private Finance Initiative contract delivering all major aspects of hard facilities management to a busy teaching hospital of 1,250 beds.

Applicants should have a minimum of 5 years' experience of managing similar NHS or complex facilities with full responsibility for all elements of the contract from financial and commercial to statutory, H&SE and risk.

A sound knowledge of the PFI payment mechanism and contract would be a major advantage together with a proven track record of working in partnership with public and private organisations at Board and senior manager levels.

Educated to degree level in an appropriate Engineering or building discipline and member of a recognised Institution giving Chartered status or at minimum working towards.

Candidates must be able to demonstrate strong leadership and team-building skills and be able to drive change and quality through continuous improvements. Experience with ISO9000 or alternative would be an advantage.

**Application with CV to:**  
**recruitment@vinci.plc.uk**

Informal discussion can be held upon request

Closing date for applications 30th November 2015  
Interviews will be held in December 2015

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To support our growing customer base and market coverage requirements, we have a need for:

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- 1 - covering Scotland.

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To apply for any of the above vacancies please address your CV along with your salary expectation to:  
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# SMALL WITH BIG AMBITIONS

The CIBSE Employer of the Year Award is presented to firms that show exceptional commitment to developing young engineers. **Shaun Hoppins**, director of this year's winner, SDS, explains what it means to be recognised



**SDS** (Services Design Solution) was the overall winner of this year's CIBSE Employer of the Year award, presented in front of a full house at the IMECHE in October. The Plymouth-based company also took home the top accolade in the small employer category.

SDS's support and mentoring of newly qualified engineers or students went far beyond its small size, said the judges. Its diverse programme of appraisals, training courses, seminars, educational visits, placements and policies showed a clear commitment to developing staff.

## How does it feel to win both the small business category and the overall award?

As a small business, it was extremely rewarding to win Employer of the Year for our category – and to win the overall category against such prestigious practices was astounding. It is a credit to everyone's hard work in implementing and advancing the training and development initiatives, and the hard work that the apprentices and graduates are putting in.

## Is recruiting engineers difficult? How do you attract talent?

Recruiting the right calibre of engineers to reflect the values of the business has been a challenge.

The demands on building services engineers has been escalating, with the introduction of ever-more onerous benchmarks necessitating investment in the development of existing staff, plus the introduction of new people into the business.

We have found our positive reputation in the marketplace has

We currently have more graduates than apprentices. Recruiting bright A level students is problematic because most go straight to university

had an encouraging impact on the recruitment of qualified engineers, and our graduate training scheme helps in attracting young talent.

## Do you have a dedicated programme to train and support young engineers?

During the past 24 months we have implemented a Professional Qualifications Training Scheme as a road map for newly qualified engineers to achieve professional accreditation.

Our structured training plan targets the technical and personal development of young engineers to meet the Engineering Council's Competencies. It is developed during the staff appraisals, and reviewed and updated by the trainee's line manager and personal mentor.

Training is delivered through a mix of internal courses, external training, lunchtime seminars, e-learning, online CPDs, evening seminars, knowledge sharing and 'on the job' mentoring.

## Do you recruit more university graduates or apprentices? How does your approach to their training differ?

We have a mix of 'apprentice' engineers and graduates. We currently have more graduates – enticing bright A level students has been problematic, because most go straight to university.

For our apprentices, the journey towards professional accreditation is more convoluted. We sponsor them through HNC/foundation degree and degree courses on a part-time basis over several years, after which they need to complete their journey to chartership. However, they have the advantage of a strong foundation

of experience to support their career. The graduates immediately begin our Professional Qualifications Training Scheme, which plots their passage to professional registration, with a strong focus on developing their understanding of practical solutions to support their technical understanding.

## SDS has grown significantly since 2004. What are your aspirations for growth in the next 10 years?

We are committed to excellence in the service we offer. Through this, we aim to achieve further organic growth by expanding into new territories and specialisms. To enable us to deliver against this aspiration, we will continue to invest in our staff. This in turn will enable them to offer our clients the highest level of technical expertise.

## How can schools and colleges promote building services?

Schools, colleges and even some universities appear to have a complete lack of awareness of the role of building services engineers. This results in a lack of interest in it as a career option.

We have worked with schools at primary and secondary level to try to promote our specialism. This includes working with a local primary school on a scheme called 'Widening Horizons', to raise levels of aspiration and interest in engineering.

We also support a local secondary school in their Career Academies mentoring programme, and provide other local schools with opportunities for work experience and placements.

**SHAUN HOPPINS** is a director at SDS, CIBSE Employer of the Year

# Events & training

## NATIONAL EVENTS AND CONFERENCES

**The National Engineering & Construction Recruitment Exhibition**  
**27-28 November, Birmingham NEC**  
 Meet recruiters, find careers advice, join CV clinics and seminars. Incorporates Women in Engineering forum.  
[www.engineerjobs.co.uk](http://www.engineerjobs.co.uk)

**CPD TRAINING**  
 For more information, visit [www.cibse.org/mcc](http://www.cibse.org/mcc) or call **020 8772 3640**

**Energy surveys**  
**5 November, London**

**Design of ductwork systems**  
**6 November, London**

**Designing water efficient hot & cold supplies**  
**12 November, London**

**Introduction to heat networks and code of practice**  
**11 November, London**

**Lighting & energy efficiency**  
**13 November, London**

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

**Mechanical services explained**  
**17-19 November, London**

**Energy building regulations: Part L**  
**19 November, Exeter**

**Energy systems ISO50001 (ESOS compliant)**  
**19 November, Birmingham**

**Fire detection & alarm systems for buildings BS 5839 Part 1 2002**  
**20 November, London**

**Understanding and application of psychrometric charts**  
**20 November, London**

**Electrical services explained**  
**24-26 November, Manchester**

**Building services explained for FMs**  
**25-27 November, Manchester**

**Low and zero carbon energy technologies**  
**26 November, London**

**Energy monitoring and targeting**  
**1 December, London**

## ENERGY ASSESSOR TRAINING

For more information visit [www.cibse.org/events](http://www.cibse.org/events) or call **020 8772 3616**

**ESOS training**  
**10 November, London**

**LCC/EPC training**  
**11-12 November, Birmingham**

**Air conditioning inspection training**  
**17 November, Manchester**

**Heat networks training**  
**18-19 November, Birmingham**

**ESOS training**  
**20 November, Leeds**

**Heat networks training**  
**30 November - 1 December, London**

**LCC/DEC training**  
**1-3 December**

**ESOS training**  
**7 December, London**

## CIBSE GROUPS, REGIONS AND SOCIETIES

For more information, visit [www.cibse.org/events](http://www.cibse.org/events)

**Yorkshire Region: Chairman's annual awards dinner 2015**  
**6 November, Leeds**

**Merseyside & North Wales Region: Annual dinner**  
**6 November, Liverpool**

**Scotland Region: Annual dinner 2015**  
**6 November, Glasgow**

**East Midlands Region: Military infrastructure**  
**10 November, Kegworth**

**North East Region: Northumbria University 50th anniversary**  
**10 November, Newcastle upon Tyne**  
 Presentation by Stephen Hodgson of Northumbria University.

**Ireland Region: Introduction to solar**  
**11 November, Cork**  
 An evening CPD seminar.

**Southern Region: Energy monitoring targeting POE**  
**12 November, Brighton**  
 An evening seminar.

**HCNW Region: Big data... and building engineering services**  
**12 November, London**  
 With Professor William Webster, director, Centre for Research into Information, Surveillance and Privacy, University of Stirling.

**CIBSE membership briefings**  
**12 November, London**  
**25 November, Birmingham**  
**3 December, Manchester**  
 Find out about the CIBSE application and interview process.  
[www.cibse.org/briefings](http://www.cibse.org/briefings)

**East Anglia Region: Annual dinner**  
**13 November, Cambridge**

**Society of Façade Engineering**  
**17 November**  
 Visit to Pilkington Glass Factory, with tour of float glass plant and glass coater.

**West Midlands Region: Case study - Comply stay alive - Fire alarms**  
**18 November, Birmingham**  
 This case study investigates a fire at a care home in Scotland, highlighting what went wrong and how lives could have been saved.

**SoPHE: Waterless urinals - Myths and realities**  
**18 November, Manchester**  
 Presentation by Simon Pearce, from Gentworks.

**Yorkshire Region: Guide M with Geoff Prudence**  
**18 November, Leeds**  
 Geoff Prudence will explain the benefits of the guide for cost saving, risk minimisation, lower whole-life costing and the generation of real-world data.

## SLL Young Lighter of the Year and LuxLive 18 November, ExCel, London

The winner of the 2015 Society of Light and Lighting (SLL) Young Lighter of the Year award will be unveiled at LuxLive in November. The awards provide a unique platform for young lighters to illustrate their knowledge and research on a lighting subject, hone their presentation skills, and raise their profile within the industry. Four shortlisted finalists will each give a 15-minute presentation to an audience before the winner is announced. All of the finalists receive a cash prize, plus a year's free SLL membership.

The four finalists and their topics are:

- Christina Herbert - A symbol of urban identity
- Inessa Demidova - Practical implementation of circadian lighting in office environments
- Youmna Abdallah - Light poverty in precarious environments within developing countries
- Zeynep Keskin - Daylight and seating preference in open-plan spaces.

For more information, visit [www.sll.org.uk](http://www.sll.org.uk) and [www.luxlive.co.uk](http://www.luxlive.co.uk)



**WIBSE personal effectiveness: Dealing with stress**  
**19 November, London**

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

**Southern Region: HWS from CO<sub>2</sub> heat pumps**  
**19 November, Southampton**  
 An evening seminar.

**Hong Kong Chapter: 13th Asia Pacific conference on the built environment**  
**19-20 November, Hong Kong**  
 A conference focused on the 'next gen' technology to make green building sustainable.

**HCNW Region: The Francis Crick Institute**  
**24 November, London**  
 Steve Berry, of Arup, will discuss the services challenges and solutions at the Francis Crick Institute.

**East Midlands Region: F-gas regulations**  
**24 November, Northampton**  
 This seminar covers the 2015 updates to the F-gas regulations.

**Assessing new metrics for daylight prediction**  
**25 November, London**  
 Presentation with Cosmin Ticleanu, of BRE.

**HCNW Region: Natural ventilation at MK**  
**26 November, Milton Keynes**  
 With Owen Connick, of Breathing Buildings.

**Yorkshire Region: Student research conference**  
**26 November, Leeds**  
 Leeds Beckett University students will present a research paper.

**SLL Masterclass: Inside out: Light and architecture**  
**26 November, Leicester**  
 Lighting interior and external architecture.

**East Midlands Region: Annual dinner-dance**  
**28 November, Nottingham**

**SoPHE Scotland seminar**  
**2 December, Edinburgh**  
 Creating the ideal washroom environment, by Geberit.

Recognising the people, products and projects that demonstrate engineering excellence in the built environment

# CONGRATULATIONS TO THE 2016 SHORTLISTED ENTRANTS

WINNERS ANNOUNCED ON WEDNESDAY 24 FEBRUARY 2016 GROSVENOR HOUSE HOTEL, LONDON

Join CIBSE and the shortlisted teams for an evening celebrating excellence and achievements in building performance.

**BOOK NOW**  
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Awards host  
 Louise Minchin



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CMR Controls manufactures low air pressure and air volume measurement sensors and control systems for standard air conditioning, clean rooms, sterile laboratories, containment facilities, and fume cupboard extract systems.

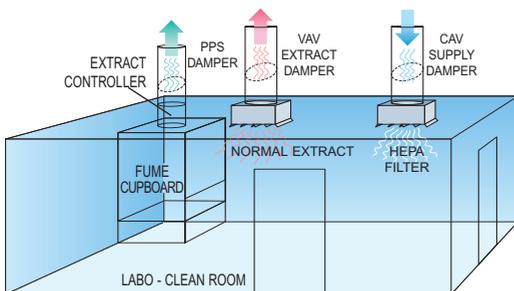


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A complete turn-key system to control room pressure to +/-1Pa. Fume cupboard face velocity to 0.5m/s at high speed and provide constant air changes into the labo - clean room.



### DPC CONTROLLER

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### CAV AND VAV DAMPERS

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



Metal Damper

### PPS EXTRACT DAMPER

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



PPS Damper

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