

# CIBSE



JOURNAL

The official magazine of the Chartered Institution of Building Services Engineers

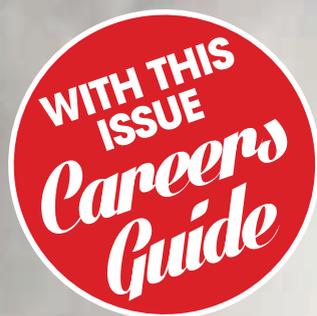
January 2014

## PERIOD DRAMA

How a leaky Victorian home won Passivhaus status

## TALES FROM THE RIVERBED

Developer harvests heat from the River Thames



# TIME TO GET THE HOUSE IN ORDER

Consultants in race against the clock to save Palace of Westminster

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*CIBSE Journal* is written and produced by CPL (Cambridge Publishers Ltd) Tel: +44 (0)12 2347 7411. www.cpl.co.uk 275 Newmarket Road, Cambridge CB5 8JE.

**Editorial copy deadline:** First day of the month preceding the publication month

**Printed by:** Warners Midlands PLC

The opinions expressed in editorial material do not necessarily represent the views of the Chartered Institution of Building Services Engineers (CIBSE). Unless specifically stated, goods or services mentioned in editorial or advertisements are not formally endorsed by CIBSE, which does not guarantee or endorse or accept any liability for any goods and/or services featured in this publication.

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©CIBSE Services Ltd. ISSN 1759-846X

#### Subscription enquiries

If you are not a CIBSE member but would like to receive *CIBSE Journal*, subscribe now! Costs are £80 (UK) and £100 (international). For subscription enquiries, and any change of address information, please contact Neil Walsh at nwalsh@cibse.org or telephone +44 (0)20 8772 3696. Individual copies are also available at a cost of £7 per copy plus postage.

The 2013 US annual subscription price is £100. Airfreight and mailing in the US by Air Business, C/O Worldnet Shipping NY Inc, C/O Air Business Ltd / 155-11 146th Street, Jamaica, New York, NY 11434. Periodical postage pending at Jamaica NY 11431. US Postmaster: Send address changes to *CIBSE Journal*, C/O Air Business Ltd / 155-11 146th Street, Jamaica, New York, NY 11434.

**Cover image:** Songquan Deng / Vectormart / Shutterstock.com



ABC audited circulation:  
18,558 January to  
December 2012



# Cutting the fat

I hope you've all had a good winter break and been able to recharge your batteries over the festive period. With a brighter economic climate in construction, led by an upturn in the commercial and private housing sectors, it looks as if 2014 could be a busy year. (See our salary survey on page 10 of the Careers Guide for more evidence of an upturn, as well as – finally – rising levels of pay).

One project that will be keeping consultants and contractors occupied for many years is the Palace of Westminster, which is to undergo a £1.9bn restoration to bring its structure, fabric and services up to date. For decades the bare minimum has been done to keep MPs and Peers comfortable in their chambers. Some of the services are more than 100 years old, and are in desperate need of repair. Aecom got an early Christmas present last month as part of the team that was awarded a £2m contract to undertake a feasibility study into how works are to be carried out. Read our feature on page 22 to see the huge challenges the restoration poses.

You can get a sense of the scale of the task facing the project teams entrusted with restoring Charles Barry's Gothic masterpiece, when you see how much engineering and resource went into the retrofitting of just one Victorian terrace home near Shepherd's Bush in London.

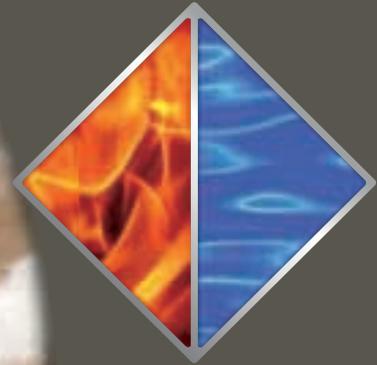
Green Tomato Energy won the Refurbishment Project Award at the 2013 Building Performance Awards for its upgrading of 20 Lena Gardens into a Passivhaus certified home. The project provides some very useful lessons for anybody involved in the upgrading of Britain's ageing housing stock.

As well as making housing more energy efficient, there will have to be a greater use of renewables if the UK is to hit its zero carbon housing targets. One development, in Kingston upon Thames, is using the solar energy absorbed by the River Thames to provide heat and hot water to more than 100 apartments. Building services engineer, Chris White, has designed an open water heat pump system at Kingston Heights that can generate 2.3MW of heat, and is using a closed water loop to capture heat generated by air conditioning from a hotel onsite (see page 34).

Finally, fatbergs...Christmas will have generated thousands of them in our sewer system, as fat from turkeys, parsnips and roast potatoes is poured down the sink. Find out how professionals deal with this in our feature on page 44.

**Alex Smith, editor**  
asmith@cibsejournal.com





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## MOTT TAKES ON MONGOLIAN WINTER

Mott MacDonald has been appointed building services and cost consultant on the development of a five-star Hilton hotel in Ulan Bator, Mongolia. The climate will provide a tough challenge with winter temperatures plunging to  $-40^{\circ}\text{C}$ , so the design includes two separate heating systems. Mott will provide mechanical, electrical and public health

engineering and cost-consultancy services for the 280-room hotel, which is due for completion by mid-2015. The building covers  $26,000\text{m}^2$  over 12 levels. Facilities include a pool, spa, sauna and ballroom below ground, and retail, bars, restaurants and meeting rooms above ground. The UK firm will also help with procurement, cost management and quantity surveying.

# Government boost for renewable energy scheme

## Higher tariff payments announced after disappointing uptake of energy scheme

The government has acted to shore up the Renewable Heat Incentive (RHI) by announcing higher tariff payments that will come into effect in April.

The large-scale biomass payment will rise to 2p/kWh; ground source heat pumps will now receive an average of 7.2p/kWh; and solar thermal increases to 10p/kWh.

Air to water heat pumps (AWHPs) are included in the RHI for the first time, after intensive industry lobbying, and installations will receive a tariff of 2.5p/kWh. Biomass CHP is also included at 4.1p/kWh along with some biogas combustion systems.

Energy and Climate Change Minister Greg Barker said the RHI was 'designed to bridge the gap between the cost of fossil fuel heat sources and renewable heat alternatives'. He added that it was 'vital that we get the level of support right, so that the market can invest with confidence'.

However, his department admitted that uptake of the scheme since its launch in 2011 had been disappointing. Currently just 2% of the UK's heat is generated by renewables.

'We have seen strong uptake in certain renewable heat technologies and a 7% rise in renewable heat in

2012. However we have not, so far, seen the levels of uptake that were anticipated when the scheme was launched,' said the DECC in a statement.

'While applications of biomass installations smaller than  $1\text{MWth}$  have exceeded our expectations, uptake for the other technologies offered support has been lower than was originally anticipated. Based on current applications, we estimate the total heat generated in 2013/14 will be about  $1.2\text{TWh}$ . This is just over a third of what was originally expected.'

The industry has welcomed the changes. Niall Horgan, Kingspan Environmental's European sales director, said the renewable energy market was 'starting to come of age', but was a long way from reaching its potential. 'That is why subsidies like the RHI are so important – to help support the technology while it

establishes a foothold.'

Daikin UK MD Peter Verkempynck, said the inclusion of AWHPs was 'excellent news that would help stimulate growth in the renewable heating sector'.

The increased tariff for ground source heat pumps was welcomed by GI Energy chairman Mike Fellowes, who said it was a 'fantastic boost' for low carbon heating systems that could 'transform the market'.

'This new scheme will provide a simpler tariff and remove the distinction between large-scale ground source heat pump installations and smaller systems.'

**'It is vital we get the level of support right, so that the market can invest with confidence'**

## Biomass still dominating RHI

The latest quarterly statement covering the performance of the non-domestic Renewable Heat Incentive (RHI) shows that biomass is still by far the main beneficiary of the scheme.

Since the previous statement, spending on small-scale biomass increased by 32%; medium scale biomass by 13%; and fell slightly for large scale biomass. Overall expenditure increased by 19%.

Both small and medium biomass exceeded their spending 'triggers', which could, in theory, prompt a reduction in tariffs, but because all other technologies remain well within their budgets, tariff levels will remain unchanged for now.

RHI payments to small biomass projects were forecast at  $\pounds 32.3\text{m}$ , which is  $\pounds 4.3\text{m}$  above its individual technology trigger. Medium commercial biomass forecast spend is  $\pounds 26.4\text{m}$ ,  $\pounds 100,000$  over its individual technology trigger. The total forecast expenditure was  $\pounds 70.3\text{m}$ , which is just below the trigger of  $\pounds 71.6\text{m}$ .

Just  $\pounds 100,000$  was spent on solar collectors, although that represents a 67% rise. Small heat pumps were up by 25% to 500,000 and payments for large heat pump projects stayed put at  $\pounds 500,000$ .

## Aecom wins prestigious parliament job

The trio of firms that will play a key role in the Palace of Westminster restoration programme has been named.

The team, comprising consultants Aecom and Deloitte Real Estate, and architect HOK, will conduct a £2m feasibility study of the options for refurbishing the Grade I listed Victorian building.

They will then consider the three options available for carrying out the works: firstly, to continue running repairs while the building is in use; secondly, to embark on a rolling programme of more substantial repairs; or thirdly, to relocate parliament's day-to-day operations and blitz the repairs.

Work on the study is expected to begin early in 2014 (full feature on page 22).

## DECC to simplify Green Deal

Plans to simplify the Green Deal have been welcomed by industry.

The Department of Energy and Climate Change said the Green Deal Advice Report would be improved, with more measures that can be supported by the policy added to the list.

In the meantime, the number of households signing up for Green Deal work has passed the 1,000 mark, with 219 projects completed. The total number of assessments carried out reached more than 100,000 in November.

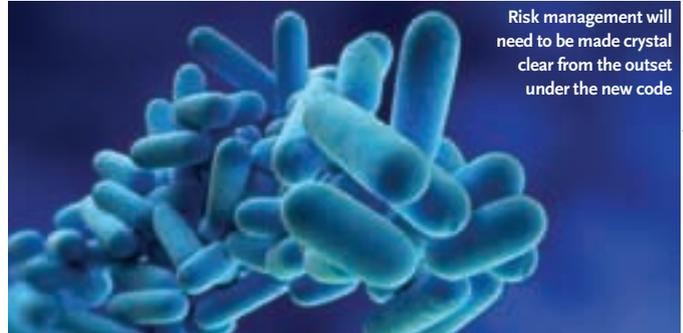
# HSE steps up legionella control with new ACOP

## ● Guidance becomes statutory requirement under new code

Major changes to legionella control procedures have been published by the Health and Safety Executive (HSE), placing more onerous demands on manufacturers, importers, suppliers and installers.

Many measures that were previously just guidance have become statutory requirements under the new Approved Code of Practice (ACOP) L8 (fourth edition). Guidance documents dealing with the management of Legionnaires' disease risks and the control of legionella bacteria in water systems are also now available.

'This is the most significant change to the rules dealing with the control of legionella for some time and will have a significant impact on the way in which these risks are managed,' said Jamie Tranter, general manager at Legionella Control International.



Risk management will need to be made crystal clear from the outset under the new code

SEBASTIAN KAULITZKI / SHUTTERSTOCK

L8 now makes clear reference to Control of Substances Hazardous to Health Regulations 2002; Health and Safety at Work etc Act 1974; Management of Health and Safety at Work Regulations 1999; and gives guidance on how to comply with health and safety law. The scope and application of the new documents have also been expanded and include references to spa pools.

Risk assessment procedures are no longer simply guidance, but are specifically included to make this process more robust. The need

to review risk assessments after no more than two years has been removed, but the new L8 states that they should be 'reviewed regularly, or if there is a belief that the risk assessment is no longer valid'. The ACOP gives a number of specific circumstances where risk assessments should be reviewed.

Speaking of the impact on risk management, Tranter added: 'Roles, responsibilities, lines of communication and contractual arrangements need to be crystal clear at the outset.'

## BDP appoints new chief executive

John McManus has been appointed chief executive of the international design practice, BDP. He succeeds Peter Drummond, who has been in the post since October 2004, but decided not to seek re-election.

McManus, who is Glasgow based, becomes the first architect to lead the



multi-disciplinary practice. He has been with the company since 1985. During Drummond's tenure, BDP expanded to become an international business with projects in 37 countries. He now becomes chairman of the company's southern region, taking overall responsibility for the London and Bristol studios.



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# Housing Standards Review is 'backward step'

## ● Code for Sustainable Homes has important part to play, says CIBSE Patrons group

The government's determination to slash red tape in the housebuilding sector risks undermining its own sustainability goals, according to a range of experts.

Speakers at a seminar hosted by the CIBSE Patrons at the Royal Institute of British Architects attacked the threat to cull the Code for Sustainable Homes (CSH).

Ashley Bateson, chair of the CIBSE Homes for the Future group, said the Department for Communities and Local Government (DCLG) had prejudged its Housing Standards Review process by using 'emotive language', suggesting that regulation was a burden.

He said the CSH had an important part to play in closing the performance gap in housing.

The BRE's Chris Cousins said the government was proposing to replace local decision-making with a

'lowest common-denominator national standard', and had 'significantly diluted' the 2016 zero carbon homes standard. If the focus had been on how to build 'fantastic homes for the future', the outcome would have been different, he claimed. DCLG's proposals to impose a 'needs test' on local planning authorities risked creating a 'lawyers' charter', he added.

The energy efficiency standards in the latest revision of Part L of the Building Regulations would set a lower standard than CSH Level 4, so are a 'backward step', the Patrons heard.

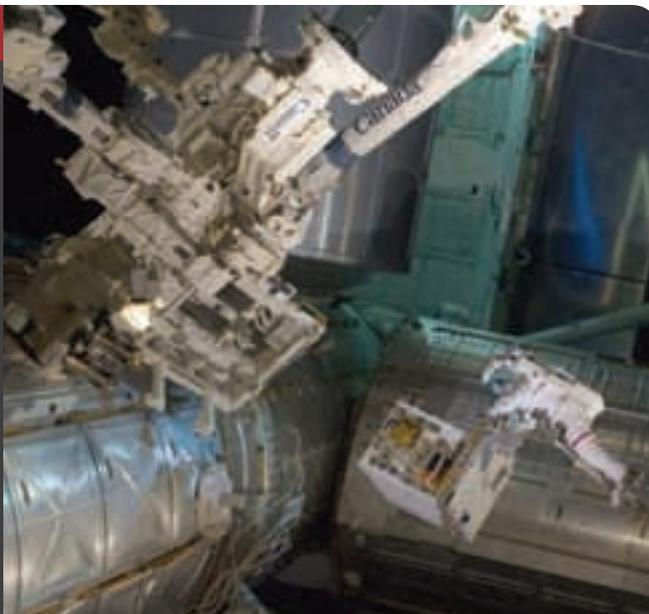
However, architect Julia Park, of Levitt Bernstein, said she would not be sorry to see the CSH abolished to clear up the 'confusing and uncoordinated multiple assessment schemes'. She added: 'Many architects have given up trying to make designs comply with CSH because it often leads to unintended consequences.'

**Turn to page 20 for opinion on the Housing Standards Review**

## COOLING CRISIS

The International Space Station has been hit by a serious problem in one of its two cooling systems. However, Nasa said the situation was not life-threatening. Two external cooling loops circulate ammonia outside the station to control the temperature of equipment, but one had shut itself down after detecting 'abnormal temperatures'. Three crew spacewalks are planned to fix the problem, one on Christmas day.

A spokesperson told the BBC that they suspected a malfunction had affected a flow control valve inside a pump. Some electrical systems were moved over to the second loop as a precaution, but the space agency stressed that the crew and the station itself was not in danger.



FILICKR / NASA GODDARD PHOTO AND VIDEO

## US government to double green electricity

President Obama has ordered the US federal government to more than double the amount of electricity it gets from renewables by the end of 2020.

This is the next stage in the President's Climate Action Plan, set up in 2009. Currently, just 7% of the electricity consumed by federal agencies is from renewable energy sources.

The administration claims to have cut greenhouse gas emissions by more than 15% from 2008, and energy use by more than 9% per square foot in federal buildings, as a result of Obama's action plan so far.

## One in seven renewable heat installations faulty

One in seven renewable heat systems are poorly installed, an Aecom report has found.

The study, which looked into consumers' experiences using the Renewable Heat Premium Payment, discovered that 14% of installations were faulty.

It suggested that there was a need for 'substantial effort to improve installer training' to reduce the number of problems caused by installation.

According to the study, people who had the technology installed for a whole year were more likely to report problems.

Some customers said installers themselves did not fully understand the system they were installing.

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## In brief

### RENEWABLE POWER FOR 380 STORES

The John Lewis Partnership has signed an energy supply deal, which will see more than 380 Waitrose and John Lewis sites powered entirely by renewable electricity.

SmartestEnergy, which buys electricity from sources across the UK – including an anaerobic digestion plant and food waste from local farms – will provide the power. Its chief executive Robert Groves said it was ‘good news for the growing number of independent renewable generators in the UK, as continued expansion in demand for green energy ensures they have a route to market’.

A John Lewis spokesman said the agreement ‘provides us with full transparency over where our energy is coming from’.

### BB WORKPLACE BOUGHT

Cofely has completed the acquisition of Balfour Beatty’s UK facilities management business.

Balfour Beatty WorkPlace will be combined with Cofely’s existing UK business, with the new entity operating under the Cofely brand.

The acquisition creates an enlarged Cofely business with more than 15,000 employees and a turnover of nearly £1bn. The business will provide energy and technical services, facilities management and outsourcing.

### ASHRAE CALLS FOR INDOOR AIR QUALITY BALANCE

The drive for energy efficiency must not be allowed to compromise indoor air quality, ASHRAE has warned.

Engineers are battling to maintain the right balance between environmental demands and health and comfort considerations, the society will say during a seminar at this month’s ASHRAE Winter Conference in New York.

Seminar chair Andrew Persily, of the National Institute of Standards and Technology, said: ‘As we move toward low-energy homes, we need to remember to provide low-energy homes that support and – ideally – improve the health and comfort of the occupants.’ For more information visit [www.ashrae.org/newyork](http://www.ashrae.org/newyork)

# Think big for district heating schemes in London, say experts

## ● Planners blamed for calling for networks on wrong sites

Many district heating (DH) schemes in London are underperforming because planners are calling for them on inappropriate sites.

Consultants at the CIBSE event: *How can we make Community Heating deliver low carbon homes?* revealed that planners were demanding heat networks on sites that had too few housing units for DH to operate effectively.

The London Plan states that CHP and district heating is mandatory on schemes of more than 500 dwellings but, according to speakers at the CIBSE Homes for the Future debate, planners were funnelling developers, such as RSL’s, to install DH on schemes of only 50 units.

Phil Jones, independent energy consultant and chairman of the CIBSE Energy Performance Group, said: ‘I think there’s huge opportunity for district heating in the UK, but in the right place. I’m worried we have been putting in



KN / SHUTTERSTOCK

Watch Phil Jones’ interview at [cibsejournal.com](http://cibsejournal.com)

systems that are too small, with the wrong energy loads.’

On these schemes, efficiencies were low, said Jones, and the capital cost relatively high. ‘You’ve got to do it big,’ he said. ‘Scale matters.’

Speakers representing housing associations said smaller DH schemes were not performing as well as expected.

Affinity Sutton development manager Jake Lock said post-occupancy reviews showed higher-than-expected bills and heat losses for small housing schemes.

BRE technical director Robin Wiltshire agreed that DH could

work in London, but only if there was critical mass. ‘Any building can be connected to a district heating scheme, but you must have a strategic view,’ he said.

Jones said DH was viable with 500 homes and with schemes connected to large ‘anchor loads’ such as universities and hospitals.

CIBSE and the Combined Heat & Power Association (CHPA) are developing technical standards for district heating. CIBSE has published an updated guide *AM12 Combined Heat and Power for Buildings*. Visit [www.cibseknowledgeportal.co.uk](http://www.cibseknowledgeportal.co.uk)

## Tube heat to warm homes



SAMOIT / SHUTTERSTOCK

A plan to capture waste heat from London Underground tunnels and an electrical substation could help warm homes and cut energy bills.

The partnership between Islington Council, the Mayor of London, UK Power Networks and Transport for London will expand Islington’s Bunhill Heat and Power heat network, which already supplies more than 700 homes. Capturing waste heat from a Northern Line ventilation shaft and a sub-station will connect a further 500 homes to the network.

The project is part of the larger European Union co-funded Celsius project, aimed at demonstrating how the efficiency and performance of district heating systems in cities can be improved by capturing and using sources of waste heat.

The Mayor of London has also produced a study into the capital’s untapped heat resources to expand the role of district heating across the city. He has set targets to reduce CO<sub>2</sub> emissions by 60% and produce 25% of London’s energy from local sources by 2025.

# Backing for carbon reduction budget

## ● No justification for change, says advisory committee

Government advisers have urged the UK to continue its push towards 50% carbon reductions, despite fears raised by business leaders that this could put us at an economic disadvantage.

The Committee on Climate Change said there had been no changes to global science and policy that would justify relaxing the aims of the UK's fourth carbon budget that sets targets for 2023-2027.

Members concluded, after a review, that the country risked more from climate-related damage and rising energy bills if carbon saving actions were delayed any longer. Reducing emissions could save more than £100bn, it said, while pointing out that the low carbon sector generated a trade surplus of £5.2bn last year.

The UK Green Building Council

said the government should 'stick to the targets' because this would give business the confidence it needs to invest in low carbon solutions.

'Nowhere is this more evident than the construction and property sector, which offers by far the most cost-effective carbon-cutting potential of any sector of the economy, yet has been plagued by government constantly moving the goalposts on key policies,' said chief executive Paul King.



0907 / SHUTTERSTOCK

## Nine out of 10 rate *Journal* highly

Almost nine out of 10 *CIBSE Journal* readers rated the magazine either good or excellent in the reader research survey 2013.

Readers found the *Journal* hard to put down, with a quarter of respondents dedicating more than an hour to browsing the pages.

More than half those questioned said the level of technical coverage in the journal was good, with building case studies, CPD, and HVAC-related technical articles considered most useful.

And, although most respondents said they would welcome the *CIBSE Journal* app, almost 90% said that they would read both the print and digital versions.

Readers wanted to see more costs data, mechanical engineering and electrical projects, while a technical section was suggested for the journal website.

The *Journal's* online presence was rated excellent or good by three-quarters of survey respondents (75%).

This was in line with 60% of those surveyed, who said they would be most inclined to visit a website to access industry news.

Overall, readers said they were pleased with the journal's coverage, but suggested more future activity forecasts, articles covering the Asia region, post-monitoring analysis, and more frequent salary updates.

● Downloads of the new *CIBSE Journal* app has reached 600 after only three months. Views of the optimised version for Android and web browsers leapt by more than 50% in November to 16,600. Download the app at [www.cibsejournal.com/app](http://www.cibsejournal.com/app) and access the Android/browser version via [www.cibsejournal.com](http://www.cibsejournal.com)

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## Simulation prize winner named

The CIBSE Building Simulation Group Prize 2013 was presented to Rongweixin Chen for his MSc paper, *A conceptual case study of an innovative natural ventilation strategy for summer cooling*, recently completed at the University of Cambridge.

The subject of this year's award was 'Simulation of ventilation in buildings' and entrants were judged on originality, research approach, technical content, application and presentation.

Visit [cibse.org/bsg](http://cibse.org/bsg) for more.

## Committed to diversity



Past president and CIBSE diversity panel chair, Andy Ford FCIBSE, has been

appointed vice chair of the Construction Industry Council (CIC) diversity panel.

The panel is a collaborative forum and platform for members of all construction disciplines to promote diversity policy and activities within the industry. Visit [www.cibse.org/diversity](http://www.cibse.org/diversity) and [www.cic.org.uk/networks-and-committees/diversity-panel.php](http://www.cic.org.uk/networks-and-committees/diversity-panel.php) for more.

## Proposals sought

CIBSE is seeking proposals to update or develop its guidance on building logbooks and building energy metering. Proposals are invited on the following:

- Update to CIBSE TM39 (2009), *Building Energy Metering*
  - Update to TM31 (2006), *Building Log Books Toolkit*
  - A new commissioning code for sub-meters and automatic meter reading.
- For more information email [npeake@cibse.org](mailto:npeake@cibse.org)

# CIBSE ANZ meets to discuss new five-year strategic plan



NEALE COUSLAND / SHUTTERSTOCK

## ● ANZ committee discussed staging a region-wide seminar to raise profile

The Regional ANZ committee met to discuss and review its strategic plan on the weekend of 30 November.

CIBSE ANZ's first strategic plan was made in 2008 and initially covered a two-year period, but this second review will look further into the future, covering five years.

Everything was up for discussion and nothing was sacred. This was the start of the review process and a lot of good work was carried out over the weekend, but there is still more to be done before the review is complete.

The committee spent time developing ideas of what it thought was important to its region

and members, and then collated the ideas in three main strategies: recognition and relevance; education; and membership growth.

Some points covered all three strategies, such as the staging of a successful region-wide seminar series that would raise the profile of CIBSE while increasing its recognition and relevance, providing education, and encouraging membership growth.

The ANZ region has chapters in six Australian states, including Australian Capital Territory, New South Wales, Western Australia, Queensland, South Australia and Victoria, as well as three cities in New Zealand – Auckland, Christchurch and Wellington.

If you are located in Australia or New Zealand and want to find out more about activities and events in the region, visit [www.cibse.org/anz](http://www.cibse.org/anz) or email [secretary@cibse.org.au](mailto:secretary@cibse.org.au)

**'Everything was up for discussion and nothing was sacred'**

## WiBSE holds first role-model event

Ant Wilson of AECOM spoke with enthusiasm about his career, which began with his university education and first appointment at Oscar Faber in 1979.

Speaking at the WiBSE organised role model event at the Aecom offices in November, he took the audience through his early years working with powerful

computers, developing the earliest forms of BIM and solar and thermal simulation software. He was part of the team that developed FACET software, later sold to IES.

Wilson and his team played a part in writing many technical guidance documents, BCO guides to specification, and Part L.

He also spoke of the support he has given to graduates, who went on to shine at the CIBSE Graduate of the Year awards.

Wilson, who showed the steady drop in heating degree-days in the UK, closed the session with a drive for more sustainable design.

For more information visit [cibse.org/wibse](http://cibse.org/wibse)

# Façade engineers celebrate world first

## ● Abu Dhabi towers recognised for engineering complexity and ingenuity

The design of Abu Dhabi's Al Bahr Towers, submitted by Aedas Architects, was recognised at the first international façade engineering awards in November. Held at the Hilton Hotel in Canary Wharf, the awards celebrated the 10th anniversary of the Society of Façade Engineering. Judging was chaired by Chris Macey, managing director of the Wintech Group, which sponsored the event along with a group of façade engineering experts from Hong Kong, Italy and the UK.

The winning entry, completed last year, was recognised for its overall contribution to the development of façade engineering as a professional discipline.

The judges particularly liked the ingenuity and engineering complexity of the façade design, commenting that there was no other project on the planet that embraces the principals of active shading in such a comprehensive and elegant way.

The building uses a series of automated opening arrays of active shading *brise soleil* blades that track the sun over the course of the day.  
[www.cibse.org/sfe](http://www.cibse.org/sfe)



## February closing date for UK member applications



The next closing date for applications for the Associate (ACIBSE) and Member (MCIBSE) grades is 3 February, 2014.

If you aim to submit your application by the February

closing date, please make sure your application is complete and includes:

- Application form
- Work experience listing
- Engineering practice report
- Organisation chart
- Development action plan

For sample reports, visit [www.cibse.org/applicanthelp](http://www.cibse.org/applicanthelp)

For full details of the requirements and application process for ACIBSE and MCIBSE membership, go to [www.cibse.org/membership](http://www.cibse.org/membership) or email the membership department at [membership@cibse.org](mailto:membership@cibse.org)

## SDAR Journal marks launch with award

The Irish Lighter and Young Lighter Awards were presented at the official launch of *SDAR Journal's* third edition at the Dublin Institute of Technology (DIT).

James Duff and Peter Whitty, of Arup, won the Irish Lighter 2013 award for their paper, *LEDs are the Panacea – and other fairy tales*, and Sean Fox, of DIT, was crowned Young Irish Lighter 2013 for his paper, *Does MRSE Relate to Illumination Adequacy*.  
Society of Light and Lighting



Professor Brian Norton and Dr Kevin Kelly (left and right)

president and *SDAR Journal* editor, Dr Kevin Kelly, and DIT president professor Brian Norton also gave a talk.

To submit abstracts for the *SDAR Journal* 2014, visit [arrow.dit.ie/sdar](http://arrow.dit.ie/sdar) For more information on lighting awards, visit [www.sll.org](http://www.sll.org)

# @ Feedback



ANDREW ROLAND / SHUTTERSTOCK

In the first of this month's LinkedIn topics, Reinhold Wieland asks what is the most efficient way to heat a church, with its large volume of air, high ceilings, and infrequent meetings...

**Maurice Ramsay**

We have completed churches using underfloor heating – both for solid floors, that have a slow response time – and tray-based underfloor heating over suspended floors, that have a quicker response time. We have also completed the refurbishment of a large, uninsulated church using 450mm-deep naturally convecting trench heaters placed under the seats, along with low-profile radiators concealed beneath seats alongside aisles.

**Martin Stichbury**

We have just replaced our ageing boilers with new biomass boilers. We did not change the existing radiator system and just looked at the central plant. If we had to start from scratch, I would retain some gas-fired ability to run alongside the biomass.

**Kat Christopoulos**

An air source heat pump would be a good alternative to gas boilers to serve underfloor heating, depending

Security at the core will be more effective than additional layers

on your current hot water provision. Heat pumps are not ideal for hot water provision as they do not reach the required temperatures to kill legionella, but they can be a pre-heat option, topped up by an electric immersion or boiler.

**John Keenlyside**

I've designed heating for a few churches and the best solution was a two-speed, gas fired AHU with huge output from cheap plant giving fast heat-up, then dropping to low speed at occupancy, to run practically silently. But you need mains gas. Alternatively boiler and radiators.

**Ian Childs**

In refurbishment, the ideal in detailing any system for thermal comfort is to either model the building or to visit and check the site before firming up anything.

A few years ago we checked an old weatherboard church (1920s) up in the mountains and found draughting up through the floorboards and ceiling boards. They puttied the gaps and the heating (pre-installed radiant IR) was found to be ample plus energy costs went down and more people started coming back to church.

**Russell Debnam**

The nice thing about radiant heating is that it does not blow away in draughty churches.

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



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Velocity Averaging Sensor



**P-Sensor**

CMR are the inventors and manufacturers of both the P-Sensor and the Velogrid. The Velogrids are made to measure to fit any ductsize up to 3m x 3m and the P-Sensor has a keyboard to easily enter : duct height - width - density - magnification factor and the scaling in m/s - m3/s - m3/h - l/s. It can even work out the Air Change rate. And the BMS gets three linear volume signal outputs of 0..10V 4..20mA and an addressable Modbus rtu bus.

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## PUTTING THE VALUE BACK INTO ENGINEERING

*The term 'value engineering' has been horribly misused, but Ruskin's David Fitzpatrick argues the time is right for a new definition*

We asked if the threat of hackers and criminals breaking into buildings was on our readers' minds

### Simon Owen

It is certainly something that manufacturers need to be considering more, as having security at the core of products will always be more effective than the additional layers that engineers can specify and build in. There must be a solid base from the start.

### Reinhold Wieland

Real-time energy management and live connections to all sorts of building services is now reality. Providing a secure network is important and we strongly recommend setting up VPN access on a VLAN network with good password protection. Most companies now have stringent

IT requirements and getting around them can be a challenge.

### Chris Topham

We are finding that more and more BMS and building control systems are using the existing corporate IP network, rather than having a discrete network. Using a converged IP network is absolutely the right thing to do. It reduces costs for the client and contractors; as long as the contractors have the right networking security skills. Typically, contractors will be working with FM stakeholders, and might not be talking to the IT team. For real life 'live' examples of the issues search 'niagara' on the Shodan HQ site.

Mike Barker asks whether insulation is the answer, or should we revisit more traditional methods?

### John Hefford

The purpose of insulation is to lower energy bills by reducing heat loss through the building fabric. In theory, the occupant would change the programmer/thermostat settings to reduce the hours that the boiler is on. In practice, the occupant will not touch the programmer, but will have a warmer house. Eventually, the house will get too warm, and the occupant will ventilate by opening the windows!

### Paul Norton

Most problems start when aspects of the climate are not considered in the building envelope design. More passive means are the starting point before any other add-on energy-saving measure.

### Tony Johnstone

If we do not improve our living conditions – that is, comfort – what's the point of engineering? Reduction of waste is the aim – not reduction of standards.

### Simon Owen

While various products minimise waste, the least disruptive and cheapest way to make a difference is through user education.

*CIBSE Journal* welcomes readers' input, whether it be letters, opinions, news stories, events listings, humorous items, or ideas and proposals for articles. **Please send all material for possible publication to: editor@cibsejournal.com**, or write to Alex Smith, editor, *CIBSE Journal*, CPL, 275 Newmarket Road, Cambridge, CB5 8JE, UK. We reserve the right to edit all letters.

I love that term 'value engineering'. It sounds great, but it often hides a multitude of sins.

Value engineering is often nothing to do with value. It has become a euphemism for 'taking things out' to get the cost down. Often the things that are left out create a legacy of poor performance.

The economy is recovering, but the situation remains fragile. We all want a deeprooted recovery built on quality, not consultants and contractors tying themselves in knots trying to meet unrealistic budgets. Recovery in our sector means high performing buildings that don't disappoint.

CarbonBuzz benchmarking shows that buildings – even many built to the latest specifications – are using between 1.5 and 2.5 times the energy predicted. What was left out to turn these buildings into such a disappointment?

### Expectations

This is also not just about energy. It is about making buildings fit for purpose. If they are failing to meet client expectations in running cost terms, you can be sure they are falling down elsewhere too.

The economic recovery is being built on confidence – and we need some of the positive thinking championed by the governor of the Bank of England, Mark Carney. He has been talking up the UK's prospects for months because he recognises that optimism is an

important factor in a recovery.

The building services engineering sector has much to be optimistic about. We have taken some heavy blows during the recession, but emerged stronger and leaner. We have developed an array of excellent products and cutting-edge technologies able to deliver high performing buildings. In other words, we are the value engineers and the value we bring to clients needs to be properly rewarded.

So, new economy – new definition of value. Rather than leaving things out, we need to

Often the things that are left out create a legacy of poor performance

argue hard for the long-term value we bring to clients in improved building performance and lower running costs. Otherwise, a new cycle of low

cost and low value will start all over again – and nobody gains from that, least of all building owners.

\*David Fitzpatrick is sales director of Ruskin Air Management.

*Ruskin Air Management is a market leader in air distribution and fire and smoke control. It combines the Actionair, Air Diffusion and Naco brands, and boasts more than 500 years of combined sales experience. The companies work together to provide complete HVAC solutions for the built environment.*





# WHERE NEXT FOR PART L?

Now that Part L 2013 is complete, what further changes to Building Regulations can we expect on the way to ‘zero carbon homes’ and non-domestic buildings? **Hywel Davies** summarises the latest update and looks at what could be in store

With the recent publication of the Part L 2013 Approved Documents for new buildings (ADL1A and 2A), we now have a complete picture of building regulations governing conservation of fuel and power.

The documents include updated Compliance Guides, amendments to the Part L Approved Documents for works to existing buildings, and the release of the latest versions of SAP and SBEM. All of these documents can be accessed from links provided with this article on the app or web version.

We now know the major changes for 2013. Homes must achieve a 6% improvement in carbon emissions relative to 2010, and will require a calculation of the fabric energy efficiency, both at the design stage and on completion. Non domestic buildings will, on aggregate, need to achieve a 9% improvement, but the exact figures vary by building type.

New non-domestic buildings: uplift by building type	
Distribution warehouse	4%
Deep plan office with AC	12%
Retail warehouse	8%
Shallow plan office	13%
Hotel	12%
School	9%
Small warehouse	3%
Aggregate across build mix	9%

To support these changes there will be a wider range of notional non-domestic buildings – including smaller warehouses, top-lit and side-lit buildings – and the assessment of DCLG and its advisers is that these

requirements are achievable, with good fabric and building services design and construction or installation in most building types. One significant addition to the Approved Document is a summary of key characteristics of notional buildings in Table 5, with full details to be included in the National Calculation Methodology Modelling Guide.

There are also some changes to the standards for building services, which include the introduction of the Lighting Energy Numerical Indicator, or ‘LENI’ as an alternative compliance option for lighting, for those who do not wish to use the existing approach.

Standards for chillers, fan coil units and lighting have also seen some alteration or ‘strengthening’. These amendments are contained within the non-domestic compliance guide.

The 2013 edition consolidates requirements made in the 2012 amendments, which implemented aspects of the Energy Performance of Buildings Directive (EPBD), and which require ‘the feasibility of high-efficiency alternative systems to be taken into account before construction commences’.

A further change to the Approved Documents is their publication in single column format, which is far easier to read on screen on a desktop, laptop or tablet. And finally, Part L only applies to England, and not Wales, which is producing its own update – perhaps to be known as ‘Part Ll’?

So we are now fairly clear on the outcomes of the Part L 2013 review. But most readers will know that 2013 is a waypoint, not the final destination. We are on the march towards ‘zero carbon buildings’, or ‘nearly zero energy buildings’. In making presentations

Part L only applies to England, and not Wales, which is producing their own updates – perhaps to be known as ‘Part Ll’?

to industry about the 2013 changes, Whitehall officials have been careful to emphasise that government remains committed to zero carbon homes.

The 2013 Budget reaffirmed the commitment to ‘zero carbon’ new homes from 2016. We are also committed to ‘zero carbon’ new non-domestic buildings from 2019, and are told that the approach will be ‘as for new homes, but greater diversity of buildings and [the policy is] not as advanced’.

The EPBD requires ‘nearly zero energy’ buildings from 2020. A look at the 2012 Building Regulations shows the requirement is already included, but does not come into force until the end of 2020. Which is just as well, as nobody would know how to comply today.

So what might happen next? It is likely that some additional amendments will be needed to Part L. The 2013 review has taken just over 30 months to deliver the changes recently published. Even if we started work on Part L 2016 on 2 January, and worked at the same rate, it would be the middle of 2016 before results emerged. And that is without allowing for the slight hiatus that an election in 2015 may cause.

Meanwhile, policy on Allowable Solutions is emerging, with further consultation to come on how the scheme will work. And we have the ongoing Housing Standards Review, through which government aims to limit requirements for energy performance to the Building Regulations, and remove them from the planning regime. However, the Environmental Audit Committee has questioned this approach, so here is further uncertainty.

It is impossible to predict the likely outcomes, but it is certain that we are set for years of discussion, consultation, debate and articles on Part L on the road to ‘zero carbon’, or ‘nearly zero energy’ buildings.

A happy new year to all readers!

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

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# RAPID RESPONSE



In this brave new world, how you prepare for the aftermath of a cyber attack is just as important as protecting a building against security breaches in the first place, says **David Fisk**

SONGQUAN DENG / VECTORMART / SHUTTERSTOCK



The Institute of Engineering and Technology has offered a timely wake-up call to building services designers in its report on the cyber threat to intelligent buildings ('In the firing line', December 2013 *CIBSE Journal*). At Imperial College London, we have had a cyber-terrorism module on our systems engineering course for the last two years. Our masters students find it a shock. Even though they are seasoned designers, they are not used to the idea that a design needs to reflect threats from an aggressor 'out there'.

If intrusion had ever been an issue before, somebody in the architect's team would have checked for burglar-proof glazing systems. At most, there would have been an access system to power up so that unwanted visitors could not get past the reception desk.

But a cyber threat is different in kind because the attack is delivered remotely, not by someone who can be strong-armed to the ground by security.

The advantage of anonymity can be enough to justify to the attacker the time taken to acquire the necessary skills. And unfortunately, malicious software (malware) is becoming increasingly easy to obtain.

Of course, no-one would attack a building management system (BMS), would they? Unfortunately it's precisely this thinking that leads BMSs to have the weakest protection – which, in turn, is why they are a target. This is the new logic of war game design. The question is, what should the building services engineer do about it?

A successful attack invariably requires some human intervention at the beginning. The designer or facilities management contractor can hardly take responsibility for a rogue maintenance employee with a USB stick, a password left on a screen Post-it note or someone left to prowl the boundary looking for stray Wi-Fi. But once the network has been

compromised, no further human input is needed. The malware can now be left to do its work, operating at speeds that can outpace software protection.

To combat this, the designer could choose to hardwire everything in a stand-alone system, much like the old days. After all, no-one can hack a digital watch. However, that would represent both a significant loss of functionality and a lot of copper wiring. It might be better to live with the threat.

The first step in this brave new world would be to talk to the company's IT security officer. They probably do not even know the BMS is connected to their network! In my experience, they can provide useful tweaks to the tender for a new BMS. They also have far more up-to-date knowledge of the form of threats, itself a rapidly changing field.

The next and most important step is to remember that there is no such thing as a burglar-proof house: if they want to get in, they will. It is much the same with cyber threats to system security. Even with all the cyber protection available, it is always best to plan for the worst – that is, that it will not work against a new attack.

So the real issue may be something quite different, and the most sensible approach may be much closer to building services engineers' core competence. If an attack is successful, and HVAC software is infected, how much of the physical building service systems can be started for the 10-14 days that it takes to clear out the malware? In some modern systems – which go into lockdown as a fail-safe measure – the answer is, very little. Facing a growing real-world threat, that cannot be the right answer.

**The most important step is to remember that there is no such thing as a burglar-proof house**

Do you think the cyber security of buildings management systems is an issue in our industry? Join in the debate at CIBSE's LinkedIn group at [www.linkedin.com](http://www.linkedin.com)

● **DAVID FISK** FEng HonFCIBSE is immediate past president of CIBSE



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# DEMISE OF THE CODE WILL STIFLE INNOVATION



The proposal to wind down the Code for Sustainable Homes is stifling new ideas, and will remove incentives for moving towards zero carbon building, says Max Fordham's **Hero Bennett**



There's no question that a review and rationalisation of the varied housing standards in England is a good thing. The problem is the scope of the government's Housing Standards Review, with resulting consultation that is too narrow and will result in disruption for the industry.

Ideas will be stifled by the proposal to wind down the Code for Sustainable Homes, which had an important impact on bringing a holistic approach to housing design. The 'simplification of enforceable standards' sounds a good idea, but it will remove incentives for enhancing ecology, and using sustainable materials.

Beneficial aspects of the Code are in danger of being lost, particularly credits in the energy category that were not directly related to fabric efficiency or overall energy consumption.

If the intention is to reduce the regulatory burden on housebuilders, then there should be a detailed examination of the way Building Regulations are defined. Max Fordham suggests two separate approaches should be allowed, the first through a set of prescriptive requirements that

are easy to navigate, understand and measure. This would provide a system that supports small housebuilders. Each requirement should be accompanied by an alternative set of defined 'outcome' goals. This would allow projects with higher design or innovation aspirations – such as *Grand Designs* presenter Kevin McCloud's *The Triangle*, above – to meet the 'spirit' of the prescriptive requirements, but also to leave room for the creativity essential for the UK to stay at the forefront of innovation in sustainability.

There are some puzzling aspects to the review, including the 'one in, two out' rule. It is simply not appropriate to Building Regulations. The regulatory obstacles to development are the conflicting standards, not their number. What's more, this rule – by preventing the formal codification of a universal set of Building Regulations – is counterproductive.

In relation to energy, the assertion that the carbon and energy targets should be dealt with through Building Regs makes sense at first glance. However, reverting to a 'building regulation only' stance for energy

consumption will make the jump to zero carbon in 2016 problematic. There will be no incentive for housebuilders to invest in innovation to meet this aspiration in the interim, and councils that have invested in greater standards already, would be forced to rescind. In addition, the zero carbon standard proposed includes 'allowable solutions' that the Code does not. It is likely to encourage creative accounting of carbon use by some developers.

The improvement of Part L, in terms of insulation and airtightness, has had a number of unintended consequences. These include an increase in the incidences of summer-time overheating in new dwellings. Our engineers believe this is due to poor regulation of design.

Buildings often have too many south and east facing windows, with no solar shading and insufficient natural ventilation. Part L requires a basic calculation to show there is no 'high risk' of high internal temperatures, based on existing weather files, to mitigate overheating. Unfortunately, this method is fallible. A safer approach might require designers to show they have met an appropriate percentage of façade shading and natural ventilation (the prescribed method) or to demonstrate evidence that the design did not exceed the prevailing thermal comfort guidance for more than 1% of occupied hours.

There is also a need for well-sized, ventilated, internal drying spaces. Airtightness of homes is improving faster than occupants' understanding of the implications of this change in building performance, specifically over ventilation and condensation.

The Department of Communities and Local Government has not yet said when the review results will be released. At Max Fordham, we hope it uses this opportunity to move us forward, and not push us backwards.

The 'simplification of enforceable standards' sounds a good idea, but it will remove incentives for enhancing ecology, and using sustainable materials

● **HERO BENNETT** is partner and sustainability consultant at Max Fordham

# Air Design - the new name in air handling and heat recovery

A new name has emerged in air handling and heat recovery. Air Design is an innovative manufacturer of air handling units (AHU) and heat recovery units (HRU) based in Netherton in the West Midlands. Part of the £90 million Elta Group, Air Design primarily fulfils the requirements of the Building Services market. With ranges encompassing the latest technologies in component parts - plug fans with variable speed drives, fans with EC motor control drives, high efficiency thermal wheels, plate-to-plate heat recovery, plug-and-play control options - Air Design also has the capabilities to meet the requirements of specialist and bespoke applications.

The new specialist supplier is located in production and office premises in excess of 3000 square metres, close to Elta Group headquarters in Kingswinford.

## In-house expertise

With an emphasis on product quality, value and consistency, the Air Design range of AHUs is designed and manufactured with in-house systems developed to achieve and maintain the level of quality vital in manufactured products. All departments comply with the exacting quality procedures of ISO9001 to ensure that standards are maintained throughout.

To design and create the correct approach to customers' needs is deep within the business culture, from initial sketch to final product. The expertise in air handling, through an accumulated knowledge of HVAC engineers and the extensive facilities of the larger parent Elta Group, allow the provision of support, guidance and an expertly engineered product.

Air Design has invested substantially in the latest selection software that offers full design verification against specification and provides comprehensive drawings for integration into customers building designs. Further investment in CAD driven production equipment facilitates the accurate assembly of AHUs from these



drawings

with competitive lead times to ensure the finished units satisfy the standards expected by customers.

## Energy Efficiency and Compliance

With Government targets for reduction in carbon emissions and energy consumption from our buildings, tiered minimum efficiency requirements within legislation impact upon ventilation systems, these include the Energy related Products (ErP) Lot 6 and Lot 11. The continued roll out of the ErP Directive and on-going UK Building Regulation updates will further influence AHU design and development.

Working in tandem with its strategic partners, Air Design is committed to delivering energy efficient air handling solutions. This commitment is resulting in the company's investment in more efficient and technologically advanced products. Only by making such investments will the company ensure its clients are fully compliant and derive maximum benefit in terms of reduced running costs whilst helping to conserve the world's finite resources.

## Key appointments

Proud to be a British manufacturer, Air Design's investment extends to its team of people, providing local manufacturing jobs, internal training and development.

Additionally, new expertise from the marketplace has been integrated into the business with the appointment of two key personnel. Account Manager Mark Guider has joined with more than 20 years' experience in the HVAC industry, having

worked

for several of the major equipment manufacturers and suppliers.

Guy Hammer joins Air Design as Specification and Projects Sales Manager. Guy has considerable experience and expertise working within the HVAC sector of the industry dealing with consultants, specifying authorities, design and build contractors and distribution outlets. He has enjoyed particular success working within the education sector. His new role will be working with consultants and specifying bodies across the country in order to win greater specification of the company's extensive and growing product range.

## Building from a strong foundation

Air Design's combination of in-house technical expertise, advanced manufacturing facilities and experienced workforce dedicated to meeting the highest production standards, are just some of the reasons behind the business's already growing reputation in AHU sales and service.

**More information can be found at the newly launched website [www.air-design.com](http://www.air-design.com) or for a copy of the company brochure contact the sales office on 01384 720460.**

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# NO TIME TO LOSE

A state of the art project in its day, the Palace of Westminster has started to crack and crumble. With some systems dating back more than 100 years, the building services are in serious need of restoration. **Liza Young** took a tour to find out more

**T**he Palace of Westminster is facing a future of leaks – and not just from MPs and civil servants. With its 22km of pipework, 700km of cabling and 11km of hot and cold water systems, ever-spiralling energy bills are becoming a fact of life for the ageing building. Time is running out.

Estimates for the restoration of architect Charles Barry's 1836 Gothic masterpiece – built after fire destroyed most of the old Palace – are put at £1.9bn, but work is unlikely to start before 2020.

The Palace has already undergone a number of major restorations in its history – the first to repair damage inflicted during the Second World War and another in the 1980s, but little has been done since then.

'A huge backlog of problems has built up, and you could ask, why wasn't it brought up before? We've wondered ourselves about that,' says Dr Richard Ware, director of the Palace of Westminster Restoration and Renewal Programme. 'There is an argument to say this should have been done 30 years ago.'

'The systems that were put in place when the Commons chamber reopened in 1950, you might have thought would have been looked at again in the 80s, but they weren't.'

Many features of the purpose-built



## FACTS AND FIGURES:

- Grade I listed building
- Part of UNESCO Westminster World Heritage Site
- Eight acres
- More than 1,100 rooms
- 6,969 fire detection devices, including 2,584 smoke detectors
- 128 M&E plant rooms, 80% in the basement
- 98 distribution risers
- 40 air handling units
- 11km steam system
- 11km hot and cold water systems
- 70km building management system cabling
- 100 electric distribution boards





SHUTTERSTOCK / COPYRIGHT: HOUSES OF PARLIAMENT 2013



The Palace's 160-year-old cast-iron roofs are leaking and causing damage

home for parliament have never been restored since its construction. The heating, ventilation, water, drainage and electrical systems are now well past their life expectancy.

The building, parts of which date back to 1099, houses 20 different types of services, including steam, condensate, hot and cold water systems, mains cold water, gas, compressed air and drainage. To reduce the risk of failure of pipes and cables, the 11km steam system must now operate at a reduced pressure. To make matters worse, some of the pipework in daily use is between 60 and 100 years old.

Because of the sheer scale of M&E work required and the disruption it would cause to the operation of both Houses, the current medium-term risk reduction programme focuses only on known areas of failure. This means it addresses 15% of the primary system plant rooms and just one of the 98 riser shafts (vertical ducts).

Ware says that in 2009, a big investment was made in managing the imminent risks in a bid to buy time. 'But that's only the tip of the iceberg,' he says. 'It keeps it safe – we hope – and in good order for a few more years.'

It is the sheer scale of the 32,375m<sup>2</sup> estate that complicates the regeneration process, says Mel Barlex, programme technical director and parliamentary director of estates.

A survey carried out six years ago, he says, showed only 26% of the M&E systems were in a good and serviceable condition, and just 7% were considered to be in good condition. At the time, the cost of refurbishment was estimated at more than £6,000/m<sup>2</sup> for the Palace of Westminster alone.

“To make matters worse, some of the pipework in daily use is between 60 and 100 years old

Barlex says: 'Most of the services in the basement are not easily accessible or clearly labelled. And it's because we constantly adapt and fit without removing that we've got problems. Pipes and cables just get added to and added to over time because of the proximity of the other processes in there.'

### Finding roots

The biggest riser shaft – J Riser – located below Central Lobby, holds the heat exchanger and air handling units. B Riser serves the Commons chamber and contains 2,500 cables.

'When we got here, none of them were labelled,' says Parsons Brinckerhoff project manager, John Harper. And so began a painstaking process that aimed to trace the route of every single cable. Even today, many still remain unlabelled.

Harper says that some time ago, workers discovered what they believed to be a BT box in one of the plant rooms. It transpired that it housed the entire system for Hansard – the verbatim report of proceedings of both the House of Commons and the House of Lords. It was later rewired over a summer recess.

Clearly, the intricate infrastructure and complicated IT network poses a significant hurdle for the restoration and renewal team.

'Infrastructure for us is going to be the biggest challenge,' said parliamentary estates

► senior project leader (M&E) Andrew Peck.

He says that to keep the building working while it is fully occupied, temporary infrastructure must be installed before the old systems can be removed and the new put in.

'There are 128 plant rooms, with interconnecting pipework and infrastructure,' says Peck. 'The work we're doing with M&E is prioritising those highest-risk items and working through them. Three years ago, that was the steam network and the condensate, and we've done a lot of work to address those problems now – particularly controls – but there's still lots of pipework that is 60 to 100 years of age.'

Ware says: 'When you think about the lifecycle of a building, this building is in a very advanced age, and in need of some major, major work.'

He adds: 'It is a large site – it covers eight acres – and, of course, the style of the building is highly decorative and that has implications for maintaining it. If it was all just concrete and glass, or very plain, we would have lower bills for maintenance. As it is, we've got a great deal of wonderful decorative detail, which is part of what we need to conserve and renew for future generations.'

Adam Watrobski, parliamentary estates principal architect, says the work needed will be a careful balance between conservation and restoration. The original 1950s air handling unit will be refitted rather than demolished, and a prefabricated one put in.

'At the end of the day, the building has to work – it's a working building not a museum – but we try to keep vestiges of things as a sort of standing archaeology,' said Watrobski.

'We are overseen by the Government Historic Estates Unit, which is part of English Heritage, so we need to be able to justify to others outside what we're actually doing.'

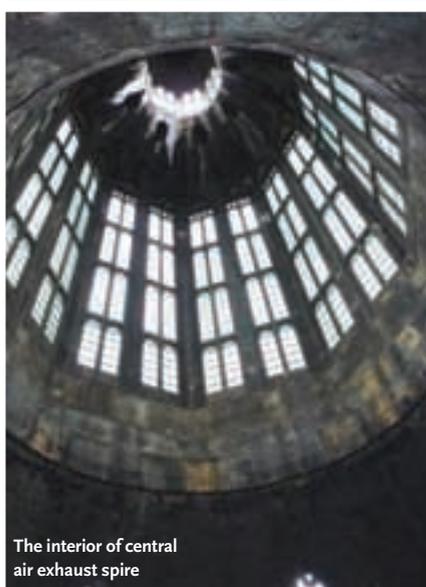
Has this sparked tension between the requirement for preservation and the increasing need for energy efficiency?

Watrobski says: 'Not from my point of view, because it is a working building and we need to look at the significances very carefully. The bits you need to keep, you need to keep. For example, the House of Lords' interior is probably the most important Victorian secular interior in the world (certainly in the country) – and we don't propose doing anything with that. Whereas with areas of lesser significance we will.'

Barlex adds: 'In terms of carbon reduction, we're doing what we can. We have set ourselves aggressive targets, but this is a Victorian building, so we can only do so much with it – but we are doing a huge amount to



Cloister Court, which was built using Anson limestone, is decaying



The interior of central air exhaust spire

‘ The cost of refurbishment was estimated at more than £6,000/m<sup>2</sup> for the Palace of Westminster alone

try to improve it. Often with all buildings, if you can't fix the fabric, you've got to fix the way you manage and use the building.'

In January, a new initiative will be rolled out reminding staff of the part they have to play as well.

'Services have been added to over time, so there's an opportunity to look afresh and see if there are better ways of sizing and routing pipes. Generally, it's better housekeeping that we're doing, but it's efficiencies as well,' says Barlex.

These include controls, building management systems, and more efficient plants to aid carbon footprint reduction.

'From the fabric side, we need to get the place patched up,' says Watrobski.

'We have done two experiments on the use of sheep's wool insulation in cast-iron roof spaces and we've had some considerable success with that.' Wool has certain specific characteristics, which enable it to absorb moisture and then give it out later making it ideal in situations where high interstitial condensation is likely. 'We're looking at it very seriously indeed,' he says.

The Palace's 2020 carbon target is set at 34% on its 2008 baseline. 'And we don't know yet what targets may be set by the public sector beyond 2020,' says Barlex. 'But it's going to be tight, given the nature of the building... but we're working very well to achieve it.'



M&E systems (above), and typical supply point to corridor and original supply duct (below left and right)

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### Next steps

In 2012, a pre-feasibility study, was carried out, which indicated that 'doing nothing is not an option'.

'It is recognised in both Houses that we can't just leave this. We've got to tackle it,' says Ware. 'They also firmly ruled out any idea that we would abandon this building and build a new parliament somewhere else.'

The decision was made to undertake a much more detailed examination of the costs and risks involved in tackling the renovation. Last year, the restoration team conducted a major procurement exercise to buy-in the expertise needed to carry out the next study.

A team comprising consultants Deloitte, Aecom and architect HOK has won the contract to conduct the feasibility study, which will examine three approaches:

- Go on working around the Parliament in the Palace, trying to make the best possible use of quieter periods, night-time working, recess working, and trying to carry out all the work that needs to be done with minimal disruptions to both Houses
- Carry out a phased major refurbishment, or
- Empty the Palace and really blitz what needs to be done to try and get through it in the shortest possible time

Whichever option is chosen, the programme will attempt to buy more time – approximately 10 years – while a longer-term approach is identified, says Ware.



If it is decided MPs should leave the Palace while work is carried out, it would mean having to source temporary accommodation that will have to be kitted out. 'We don't expect to make a fundamental decision until after the 2015 election, and this study will make way for that,' he says.

The scale of the project is such that the team anticipates both Houses will vote on the proposal. But, with the estimated start date still a decade into the future, is time running out to preserve the home of parliament? **CJ**



### WATCH NOW

Watch more on the restoration at [Cibsejournal.com/app](http://Cibsejournal.com/app) or on the web/Android via [www.cibsejournal.com](http://www.cibsejournal.com)



## Ventilation v design

Neil Sturrock, chairman of the CIBSE Heritage Group, said: 'The original systems never worked because the 'ventilator' David Boswell Reid was constantly hampered by the architect Charles Barry and they were both, in theory, controlled by a frequently changing committee.'

'If Reid had been allowed to have a much higher exhaust tower, I have no doubt that there could have been a unified system, which dealt with the whole building, and which would have worked. As it was, Barry insisted that the architecture was not dictated by the requirements of a ventilation system and so the central spire (the extract tower) is much lower than the two air inlet towers (the Clock Tower and the Victoria Tower).

'Add to this the obstacles in the way of unauthorised alterations that Barry made and the fact that the House of Lords was persuaded by the Marquess of Clanricarde to dispense with Reid's services in 1846 and entrust their ventilation to Barry and you have a recipe for disaster, which is exactly what happened!'

Sturrock says a physical barrier was installed in the basement between the two Houses and each man tried to design a separate system.

After a government arbitration found in Reid's favour in 1852, he was awarded more than £3,000 in compensation, and asked to try to make the system work. He then carried out more than 30 alterations, including lowering the ceiling in the House of Commons.





# RETURN OF THE VICTORIANS

When the founder of Green Tomato Energy bought a leaky, dilapidated Victorian terrace house in London, it was the perfect test project for his company's new low energy refurbishment service. The result is one of the UK's first retrofit to Passivhaus standards. **Andy Pearson** reports

6 The building's roof was demolished, chimney breasts removed, and plaster stripped from the walls to enable a thorough investigation of the building fabric early in the project

**D**omestic energy-efficient retrofit projects do not come more ambitious than the Victorian mid-terrace house in Lena Gardens. Its refurbishment had to tackle the issue of its heat-pervious solid brick walls and leaky sash windows. The task was made all the more demanding because the West London property is located in a conservation area, which prevented alteration of the building's exterior. Despite these challenges the scheme's designers – Refurbishment Project winners in the 2013 Building Performance Awards, Green Tomato Energy – managed successfully to transform this unpromising dwelling into the UK's first private domestic Passivhaus-certified retrofit.

Passivhaus buildings are super-insulated with controlled ventilation to provide high levels of occupant comfort while using very little energy for heating and cooling. The key to their design and construction is meticulous attention to detail, according to principles developed by the Passivhaus Institut in Germany.

Green Tomato Energy's feat is even more impressive because the project was undertaken between January and October 2010, which meant it was completed before the launch of EnerPHit, the Passivhaus refurbishment standard, which takes into account the bigger challenges associated with retrofit. Equally remarkable, Lena Gardens was the first Passivhaus scheme the practice had designed. It was undertaken at the same time as Princedale Road, another Passivhaus retrofit in West London.

The four-storey house belongs to Tom Pakenham, co-founder of Green Tomato Energy. 'Because we were doing everything for the first time, we probably wouldn't have



attempted a Passivhaus solution if it had been a client's project, because the risks would have been too great,' says Akta Raja, Pakenham's co-founding partner at Green Tomato Energy.

In 2009, the firm was looking at setting up a business to deliver low energy improvements to homes. As Pakenham had just started renovating his home, the team seized the opportunity to test their plans.

'It was intended to be a research project, not



## WATCH NOW

See how Lena Gardens met the Passivhaus EnerPHit standard on the Journal app at [Cibsejournal.com/app](http://Cibsejournal.com/app) or on the web/Android via [www.cibsejournal.com](http://www.cibsejournal.com)



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just from a technical perspective but also from the client's perspective – because it enabled us to work out how to deliver a strong client experience,' Raja explains.

The Passivhaus design was developed with input from building physics engineer Edward Borgstein, who helped come up with the most effective low energy interventions. The team was fortunate in that Lena Gardens was in need of significant renovation,

including replacement of the windows, which enabled the low energy element of the works to be cost-effectively incorporated into the scheme. Passivhaus Planning Package (PHPP), the software design tool produced by the Passivhaus Institut, was used to model performance of the proposed interventions.

'The house was in need of a full refurbishment even before we decided to try for Passivhaus standard,' says Raja.

On site, the building's roof was demolished, the chimney breasts removed, and plaster was stripped from the walls to enable a thorough investigation of the building fabric early in the project. As a result, remedial works were carried out to the walls and additional structural beams installed to provide additional support. 'Nasty surprises came from things like the walls not being straight,' says Raja.

The walls were then insulated internally, ➤



The roof was insulated using 180mm of phenolic insulation (above left), and featured three small solar thermal arrays, including the one above. Floor joists have been rehung to avoid penetrating insulation (below left).

➤ using phenolic foam in a two-layer system. A layer of Oriented Strand Board (OSB), was incorporated into the walls, and the joints taped to form a continuous, airtight layer. The building's second and third floors were replaced because their timbers were rotten and similar OSB layers were installed under the floors and over the ceilings.

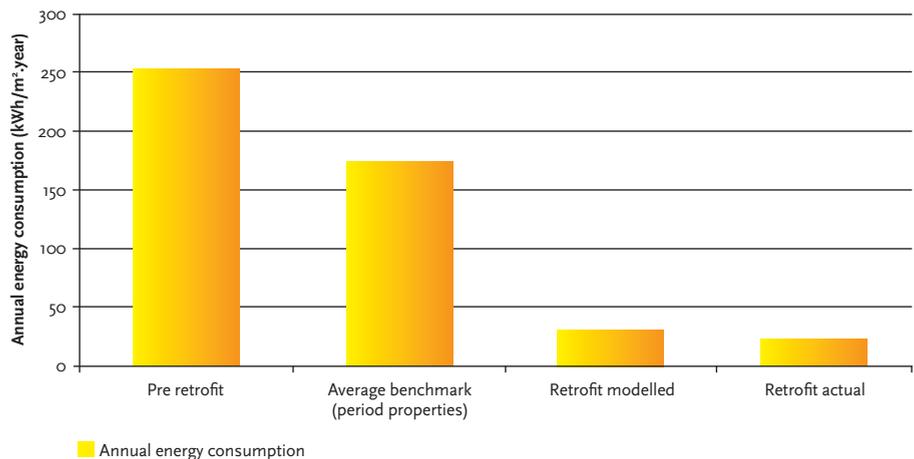
The party walls were also insulated to eliminate thermal bridges and to protect against low temperatures in the neighbouring property. Internal walls were then rebuilt inside the building's insulated shell. The team faced some challenges over predicted condensation risks because of the high levels of insulation, which resulted in the scheme being modelled extensively and the risks minimised through design.

Similarly, there were concerns that the building might overheat in summer, because it faces south and solar shading was not permitted within the conservation area. As an alternative, temperatures have been managed using a combination of night purging and cross-ventilation, which post-occupancy evaluation has shown to be effective.

The roof was rebuilt as a mansard loft extension, incorporating the same two-layer insulation system as in the walls.

Replacing the windows was more of a challenge. At the time of the scheme's construction, there were no manufacturers producing high-performance, air-tight triple-

### Annual energy consumption at Lena Gardens



glazed windows that looked identical to the building's original sliding sash units. As a consequence, a second project was initiated with the UK Technology Strategy Board and Ryder Strategies to develop and manufacture a suitable replacement.

The result was a new triple-glazed window, indistinguishable in appearance from the original, but with a fixed upper triple-glazed unit and a tilt-and-turn opening lower section. The tilt-and-turn solution of the casement windows enables the building's overall airtightness levels to achieve Passivhaus standards.

The timber floor on the building's ground floor was lowered to allow insulation to be

“The project team were ‘privileged’ with the Lena Gardens Passivhaus refurbishment because they had a client that let the team experiment”



## 10 lessons learned from Lena Gardens

### 1. Teamwork is essential

'What is absolutely key on a retrofit project is that the contracting and design teams have to work closely together to overcome site issues and to share knowledge,' says Marine Sanchez, building physics engineer and Passivhaus designer at Green Tomato Energy. 'The projects that work best are when everybody acknowledges that there are things that they don't know, and that we're only going to achieve the best outcome if we all work together.' Designs must be buildable and contractors must buy-in to the concept, since they will be delivering the project.

### 2. Allow sufficient design time

The Passivhaus concept requires a whole-house approach. This means actions taken in one part of the building have consequences elsewhere, which could affect performance. 'Use as much time as possible to work through the details. This will reduce time and cost during the on-site phase, where choices might be more limited,' says Sanchez.

### 3. Investigate potential problem areas in advance

Examine key areas to expose the existing form of construction and prevent surprises once work starts. 'A lot of schemes we work on are in conservation areas in London. As you have to insulate internally, you need to know how the building has been constructed – otherwise you risk developing a design that will increase the risk to the fabric or causing an escalation in cost,' says Sanchez.

### 4. Be prepared to adapt the design

Provision must always be made for unforeseen problems with the building fabric. For example, don't expect walls to be straight, or build quality to be high, which can add to costs.

### 5. Develop the most energy-efficient design possible, based on the client's requirements, the building, its location and the retrofit budget

Renovation is the best opportunity to make significant, cost-effective improvements to the building's energy performance. 'We're not saying every building retrofit should be Passivhaus, because existing buildings are hard to work with and costs can escalate,' says Raja. 'On most projects, where we've not gone as far as Passivhaus, we've managed to achieve at least 50% improvement on what was there before'. If no renovations are planned, there are many measures that can be applied in the meantime to reduce energy consumption and cost.

### 6. Provide the client with sufficient information to enable them to make informed decisions

'The beauty of using a Passivhaus approach is that PHPP is an Excel spreadsheet, which enables you to show clients how different measures will impact on the scheme's performance,' says Raja. If reliable cost information is factored into the discussion, the works can be considered in terms of a potential payback period, which allows clients to decide where best to spend their money. Client engagement with the proposals is important and Green Tomato Energy recommends adopting an energy target early in the project. 'We're not forcing people to go down a particular route – we're just giving them the figures they need to make a decision,' adds Sanchez. It is also a good idea to make the homeowner aware of the scale of disruption caused by a whole-house retrofit.

### 7. Be aware that some historic elements will not be Passivhaus-compliant

'To achieve an airtight building with an air change rate of less than 0.6 per hour, you

need a good seal on windows, which is difficult to achieve with a sash-style windows,' says Sanchez. Because Lena Gardens is in a conservation area, Green Tomato Energy worked with contractor Philip Proffitt and Princedale EcoHaus to develop a new form of window that looks like a sash, but which has a fixed upper glazing unit with a tilt-and-turn lower section that could take triple-glazing.

### 8. Be prepared to give extra support on site

If a scheme has been poorly designed or installed, the retrofit measures are unlikely to perform as planned, which means that they could fall short of the occupier's expectations for both comfort and energy savings. Passivhaus retrofits require greater attention to detail than is typical in the UK renovation sector. 'One of the lessons we learned from Lena, and other retrofits, was that we needed to provide support on site. All our design expertise will be wasted if the design is not properly applied on site, or if the design doesn't take account of site issues,' says Raja.

### 9. Allow time to show people how to use a low-energy house

One of the most crucial factors is the handover. The original design team should ensure all systems are functioning as designed, and they are there to explain their operation to the client both to ensure optimum performance and to prevent problems occurring in the future. Handover documentation alone is insufficient.

### 10. Treat each project as a learning experience

Measure the performance of everything so you know how well it is working – or not – so that you can learn from it and prevent every project turning into a trial project. Keep an open mind, and continue to learn from every project.

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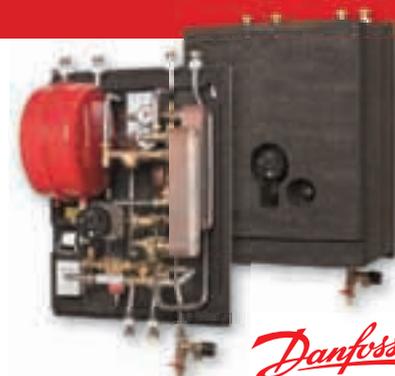
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added. The timber joists of the first, second and third-floors – which would have bridged the wall insulation – were also rehung inside the thermal envelope both to reduce thermal bridges and to eliminate the risk of condensation and rot occurring where the timber would have been enclosed in the wall's insulation layer. Instead, they are supported from steel beams, slotted into insulated pockets set in the party walls at the front, middle and rear of each floor.

In the kitchen, the original concrete floor slab was removed, and replaced with 150mm polyurethane foam insulation topped off by a new slab. The floor in the basement was also replaced. Here the team took the opportunity to install a labyrinthine ground-to-air heat exchanger during the works. The labyrinth pre-heats and pre-cools the fresh air being drawn into the building through the mechanical ventilation heat recovery (MVHR) system.

The tempered fresh air is drawn into a Passivhaus-certified Genvex Combi unit, housed in the basement, which combines an MVHR system with an air source heat pump. The unit supplies fresh air throughout the house via a network of spiral wound ducts hidden within floor voids and stud walls. Air exhausted from the kitchen and bathrooms is returned to the unit, where a heat exchanger transfers its heat to the incoming fresh air, before being expelled.

Because Passivhaus space heat needs are so low, the Genvex unit also heats the Lena Gardens house using the supply air as the heat transfer medium. Heat is supplied from the air-source heat pump contained in the unit to the MVHR supply duct.

The air source heat pump also functions as an air-to-water heat pump to top up the domestic hot water temperature if the building's three rooftop solar thermal array panels fail to provide sufficient heat to the 400-litre tank.

'You reduce the heat load and then use the MVHR system with air heating to warm the house,' explains Raja.

The roof also houses the scheme's 1.1kWp array of photovoltaic panels, which supply 801kWh of electricity annually (based on a two-year average). This provides roughly 16% of the total annual electricity needs.

Raja says the project team were 'privileged' with the Lena Gardens Passivhaus refurbishment because they had a client that let the team experiment; they had a building team that was 'interested' in Passivhaus and – because the retrofit was an in-house project – the design engineer was onsite almost every day. **CJ**

### Summary of work undertaken at Lena Gardens

Element	Strategy	Performance Specification	Details
External walls	Internal insulation	U = 0.10W/m <sup>2</sup> K	180mm phenolic insulation installed internally in two layers. The insulation is mounted on metal battens to straighten the walls and create a cavity to allow any condensation to drain. A continuous OSB air barrier is maintained between the layers to keep the building airtight
Party walls	Internal insulation	U = 0.27W/m <sup>2</sup> K	50mm phenolic insulation installed in two layers to eliminate thermal bridges and allow the air barrier to be maintained
Roof	Internal insulation	U = 0.14W/m <sup>2</sup> K	200mm phenolic insulation installed in two layers between and below rafters, including the airtightness layer. Rafters are ventilated from above according to the Building Regulations good practice guide BR262
Suspended floors	Rehang	U = 0.11W/m <sup>2</sup> K	Floor joists re-hung on new steel beams and lowered to enable 150mm polyurethane foam to be installed, with a floating floor above
Solid floors	Replace	U = 0.11W/m <sup>2</sup> K	Floor slab replaced with concrete slab set on 200mm polyurethane foam insulation
Windows and doors	Replace	U = 0.8 – 1.0 W/m <sup>2</sup> K	New sealed triple-glazed, high performance units installed, custom manufactured to match existing appearance
Airtightness + ventilation	Mechanically ventilated with heat recovery	0.49 air changes per hour @50Pa	Airtight layer installed throughout and tested repeatedly during construction. Whole-house heat recovery ventilation system installed. Ductwork hidden within rebuilt stud walls and ceiling joists
Thermal bridges	Detail	Minimal bridging	Works included re-hanging the floor joists that would have passed through wall insulation on steel beams sitting in insulated pockets in the party walls. Other thermal bridges dealt with on a case-by-case basis
Space heating and hot water	Heat pump	Rated power 600W <sub>e</sub> Seasonal COP = 2.5	Air source heat pump gives a boost to the DHW primarily done by the solar thermal system and provides space heating requirements. It uses heat reclaimed from extract ventilation to increase efficiency
Overheating mitigation	Ground to air heat exchanger	29m <sup>2</sup>	Underground labyrinth heat exchanger installed below basement slab to temper the fresh air supply
Renewable generation	Solar thermal	7m <sup>2</sup>	High efficiency, roof integrated flat plate system
	Solar PV	1.0kW <sub>p</sub>	Small roof-mounted array

### Energy consumption at Lena Gardens pre- and post-works

	PHPP Modelled energy use <sup>*</sup>	Billing period	Metered energy use	Actual annual energy use		Energy saved
Pre-renovation	n/a	Jan 07-Jan 08	49.2MWh	49.2MWh	252.6kWh/m <sup>2</sup>	0%
Post-renovation	29.5kWh/m <sup>2</sup> /y	Jan 11-Dec 12	4.7MWh	5.1MWh	21.6kWh/m <sup>2</sup>	90%

<sup>\*</sup> Energy consumption refers to net annual flow of energy into the house and includes heating, hot water, lighting and appliances (cooking is excluded).

### Energy Costs 2011-2012

Item	Cost
Electricity (debit)	£643.58
Gas (debit)	£72.34
HotROCS (credit)	-£143.46
Feed-in-tariff (credit)	-£383.06
Total energy cost for 1 year	£189.40

# BMS SET TO BOOM

The BMS market is the one to watch, says Bill Wright, ECA head of energy solutions

traditional relay type system. The implementation of the Smart Meter programme and the Smart Grid will have a positive impact, as building controls will need to interact with the energy supply in both commercial and domestic buildings.

There is a noticeable trend toward the integration of the different kinds of technology and application utilised in a building, not just those involving energy; In the latest intelligent buildings, we are seeing HVAC, lighting, security, safety, and energy management all integrated and centrally managed, enabling Facilities Managers to operate the building at maximum

efficiency with full data on all aspects of its operation.

## Market drivers

The requirement for all new homes to be zero carbon from 2016, extended to commercial and public buildings by 2020, will fuel BMS installations.

A further driver for the adoption of BMS is the need for companies to report their environmental policies and impact. Under the Green House Gas (GHG) Environmental Reporting Regulations introduced on October 1 2013, all FTSE registered companies must now declare their consumption and other environmental factors in their annual reports.

And of course, the universal shift to digital technologies and the integration of wired and wireless will see more consumers and building managers reaching for the latest innovations.

## Working with BMS

The opportunities for working with BMS look good, but there remains a shortage of

engineers and skilled operatives nationally who are appropriately trained and experienced in this area.

To find an ECA Member firm with expertise in BMS installations use the advanced search on the ECA website [www.eca.co.uk/advanced-search](http://www.eca.co.uk/advanced-search); and join our free Client Associate scheme for a range of support and guidance on BMS installations. To apply visit [www.eca.co.uk/client](http://www.eca.co.uk/client).

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## Positive signs

The global building automation and Building Management Controls (BMS) industry is set to escalate over the next 5 years, with predicted market growth of almost 12%<sup>1</sup>, says recent analysis; so how might this translate in the UK?

The potential for an earlier BMS boom was stunted by the economic climate, with reduced public expenditure and the lapse of many construction projects due to a lack of financial support.

But after falling to below 1% growth in 2012, UK building refurbishment and retrofit is starting to move again, with renovation in the non-domestic market expected to rise by up to 2% over the next two years<sup>2</sup> and - we believe - at an accelerated rate beyond that.

## A look ahead

The BMS market has split into domestic and commercial with great potential in both. BMS is value for money because the price of basic BMS has come down while capability has increased; and its cheaper to install to perform control functions than a

<sup>1</sup> Markets and Markets (<http://bit.ly/1bqxlpR>)  
<sup>2</sup> Figure collated from BSRIA data

# A RIVER RUNS THROUGH IT

A development that uses heat stored in the water of the Thames could be the prototype for low-cost renewable energy systems all over the world, according to project engineer Chris White. Alex Smith visits Kingston in Surrey to find out more

**A** modest single-storey building on the riverbank in Kingston upon Thames doesn't look like a prototype for an innovative renewable system that, according to its engineer, could be the answer to the world's looming energy crisis.

Its brick walls house part of a heat pump system that harvests naturally stored energy from the River Thames, and then delivers under-floor heating and hot water for 56 affordable homes, 81 private apartments and – later this year – a new 145-bedroom hotel.

According to White Associates managing director, Chris White MCIBSE, it could help provide cheap and plentiful energy, and potentially offer coefficient of performance ratios approaching double figures.

'Every process in this system has the potential – using known and proven technology – to provide a 100% renewable, zero

carbon thermal energy source for the planet if powered by clean electricity,' says White.

The open water source heat pump system at the £70m Kingston Heights development is the first of its kind in the UK, and has been a labour of love for both White and Mike Spenser-Morris, the owner of NHP Group, the developer.

It works by using pumps in the plant building to extract water through intakes positioned 2.5m below the river surface, where the water temperature is relatively constant year-

“The innovation is taking such a high thermal load from an open body of water”



round. After a two-stage filtration process, heat is transferred from the river water to a secondary circuit that links to a plant room on the fifth floor in the apartment block. Water source heat pumps then increase the temperature of the low-grade heat before sending it to mini plant rooms, where the second part of the heat pump upgrades temperatures further. The system is capable of delivering 2.3MW of heat. (See *How it works*, page 38).

The most innovative element of the scheme is the taking of such a high thermal load from an open body of water. This gives far higher load potential than a traditional open loop borehole system, where the abstraction rate on groundwater is limited to how much can be pulled physically without causing instability to aquifer temperatures.

While Spenser-Morris was the driving force in delivering the project – and helped convince local MPs Ed Davey, Secretary of State for Energy and Climate Change, and Zac Goldsmith to back the project – it was White who had to deliver the technical solution. Not only was it the first of its kind in the

The energy source: Chris White by the Thames



#### PROJECT TEAM

- **Developer:** NHP Leisure Developments
- **Building services engineer:** White Associates
- **Contractor:** United House
- **Affordable housing:** Affinity Sutton
- **Private housing:** Redrow London: 56 homes
- **Heat pumps:** Mitsubishi Electric Ecodan heat pumps
- **Specialist river water engineering installation:** B&V Water Treatment
- **Specialist filtration of river water:** Industrial Purification Systems

White had the added complication of having to route the pipes over the roof of the electrical substation

country, but it was also on a very challenging site – the apartments were being built on top of an existing four-storey electrical substation.

As the concept had not been tested in the UK at this scale, White and Spenser-Morris had to convince a diverse number of stakeholders of its viability. These included Kingston Council, affordable housing provider Affinity Sutton, Redrow Homes and the Environment Agency, which is responsible for the health of the river. Indeed, two separate licences – for abstraction and rejection – had to be submitted to the agency as there was no precedent for applying for a joint licence.

‘We had to speak to a lot of people to convince them it could work,’ says White. ‘It was because no-one had done it before.’ To convince others of the technology’s viability, Mitsubishi Electric Europe, the chosen heat pump manufacturer for the scheme, organised a trip to a project in Osaka in Japan, which had used the technology – although in a commercial rather than residential scheme.

White had to start from scratch. He couldn’t find a contractor that had worked on open water source heat pumps, and so employed a ground source equivalent. He soon found that



the knowledge required to extract and return thousands of tonnes of Thames water was embedded – not in a renewables firm – but in a company specialising in water infrastructure. ‘B&V Group worked in water treatment, and was used to industrial precision, which we required,’ says White.

The firm carried out the works to the plant room, including the self-priming pumps,

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The pump house and the heat exchangers transferring heat from river water to a second closed loop

heat exchangers and filters – working closely with Industrial Purification Systems, which developed a double filtration system that met the exacting requirements of the Environment Agency: to return to the Thames clean river water that varied by no more than 3°C from the abstracted water. And it had to do so without harming any marine life.

Working with the agency was a challenge,

says White. ‘There was no available licence from the Environmental Agency for what we wanted to do,’ he says. ‘There was one for extraction of river water – and one for rejection – but none for the combination of both,’ says White. The team also had to ensure that the intakes did not interfere with river traffic.

White had the added complication of having to route the pipes over the roof of the electrical substation. Taking two 315mm pipes up the side of a building was a challenge because of weight on the point loads at fixing intervals, and the overall end load when pipes are full.

The pipework required for transporting the low-grade heat is low cost, says White, who specified medium density polyethylene (MDPE) pipes off the shelf.

He says the next challenge will come with educating occupiers as they arrive in the months ahead. ‘We have to educate people about the differences between heat pumps and conventional gas boilers, and change their mindsets to ensure they keep their heating on. We will be giving them 5kW of heat, but we need to tell them how to look after it.’

NHP is forming a company to oversee the system. It calculates that, for a couple living in a one-bed flat, heating bills will be 15% cheaper

than if energy was supplied by gas boilers.

White is enthusiastic about the potential of open source water heat pumps. He contrasts transporting river water at low temperatures to the potential heat losses incurred by district heating systems carrying hot water or steam at high temperatures. ‘Whereas traditional district heating loses efficiency due to lower ground temperatures, either river, sea or lake water will typically be within a few degrees of ground temperatures at a depth of 1m.’

‘Dependent on where in the world the system is employed, it is probable that the further we distribute the water, we will actually pick up a rise in temperature from geothermal energy, and traditional distribution losses would actually become gains.’

White estimates that the temperature at Kingston Heights will increase by 1-2 °C as it travels through pipework. White says transporting low-grade heat avoids overheating in corridors, which occurs when high-grade heat can’t be contained.

The biggest paybacks will occur when the hotel is built, says White. A heat recovery VRF system will allow heat rejected in the summer to be injected into the development’s primary circulation route, which provides hot water

## Established values, leading edge technology



to the flats and hotel. White says that, with balanced loads between cooling, heating and hot water, there could be COP ratios of six and upwards for this type of mixed-use scheme. 'The more solar energy we collect, the more energy we inject it into our primary circulation, and the more efficient the heat pumps.'

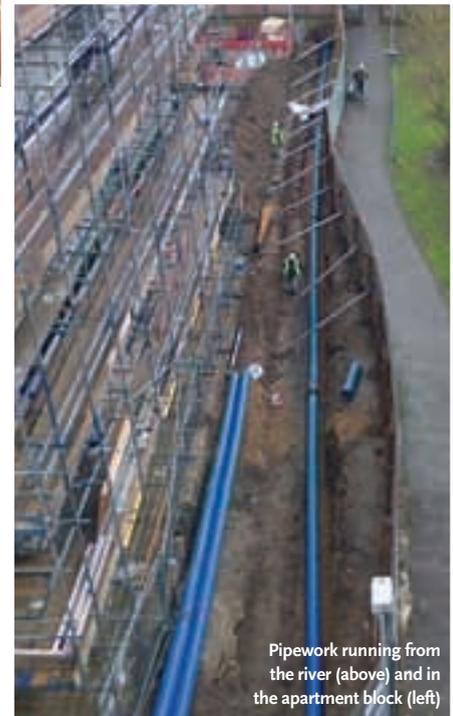
White says the technology opens up the possibility of large-scale town planning on a river or seawater network. This will allow buildings to be heated and cooled with load-matched sites and full heat recovery.

The Kingston Heights scheme costs 10-15% more than an equivalent biomass system. 'The costs were expected, and it was in part because we were using industrial plant,' says White. 'It was the first time it had to be done, and there were a lot of unknowns.'

'A couple of times we were under a lot of pressure to go the tried and tested route of biomass, but we fought on. This is a large-scale change in thinking, which will take years, if not generations, to implement. But, from little acorns mighty oaks do grow – and I hope that, through the system installed here, we have planted the seed in people's minds that this can be done.' CJ



The intake filters are lowered into the Thames



Pipework running from the river (above) and in the apartment block (left)



## How it works

The community heating at Kingston Heights is based on an open water heat pump system, whereby the temperature of low-grade heat from energy stored in river water is increased to provide heating and hot water for residents and hotel guests.

A new plant building on the site of an old coal hopper, houses the pumps that abstract water from the Thames. IPS designed the two intake filters, which connect with the pumping system designed by B&V. These sit above the river bed clear of silt and away from navigation channels. They are 600 mm in diameter, and 1.04 m long, and are barrel shaped to prevent marine life and debris being trapped against the intake openings.

A two-stage filtration system ensures that no river life gets sucked into the system. The 1.5 mm mesh on the intakes is small enough to block eelers (baby eels) and a second epoxy-coated carbon steel mesh of 100 microns prevents other debris from entering the pump house. Having two intake filters provides backup if one fails, and enables them to be cleaned separately.

The Environment Agency stipulated that the temperature must not vary by more than 3°C when it was returned to the river. Chris White calculated that at a flow rate of 150 l/s the system could abstract around 2 MW of low grade energy, and rejected the water back into the river at a

temperature less than 3°C lower.

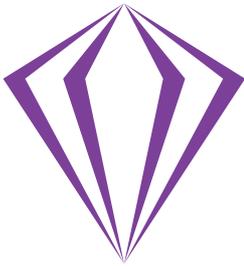
The heat from the river water passes through a high-efficiency heat exchanger, which transfers the low-grade heat to an internal 'closed' water system. This is taken 200m via MDPE pipes over the existing electrical substation to a plant room on the 5th floor of the development.

Here 41 Mitsubishi Electric Ecodan water source heat pumps link to this 'closed' loop and increase temperature up to 45°C, before sending it across the development. In mini plant rooms, the second part of the Ecodan system upgrades the temperature further to deliver underfloor heating and domestic hot water to apartments and hotel rooms.

The heat pumps work by using the vapour compression cycle to upgrade low temperature renewable heat and raise it to usable temperatures. Inside sealed copper piping refrigerant vapour is compressed to raise both pressure and temperature. This hot, pressurised vapour is passed through a condenser where it liquifies and gives off usable heat.

The liquid refrigerant is allowed to expand, which lowers its temperature and pressure. The liquid then absorbs naturally occurring heat from the renewable source - in this case the Thames. Once this has happened the liquid changes back to vapour and the process starts again.

6 A two-stage filtration system ensures that no river life gets sucked into the system



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# WELL WORTH THE PLASTIC IT'S PRINTED ON ...

3D printing can speed up the design process of complex cooling systems, as well as improve their performance, says **James McGowan** of Monodraught

**W**hen the redesign of our Cool-Phase low-energy ventilation and cooling system was first discussed, we knew we wanted to adopt new techniques to help speed up the design process. We already use a lot of 3D modelling in the research and development, so it made sense to explore the latest 3D printing technology. As a result, not only has the new system been designed far more quickly than would usually be the case, but there have been impressive benefits for its assembly time, appearance and power use.

3D printing gave us the ability to bypass the traditional lead times for prototypes. Rather than waiting several weeks for component samples or fabrications from our suppliers, we were able to print the designs ourselves within hours – either to scale or full size. This allowed us to use a physical component rather than the usual computer renders to review designs.

Potential issues were identified and iterations of designs evolved quickly; a rotating mechanism within the air-handling unit was redesigned and operational in our test centre just days after the drawings left the design office – simply because we didn't have to fabricate the parts.

Likewise, early in the development process we printed a modular design for a thermal battery component. This was separated into three modules, each comprising six components. Through the use of 3D printing, we were able to prove that the design concept could be achieved by using just three reversible symmetrical parts. The modular design approach, encouraged by 3D printing, has helped reduce the component count by about 70%, thereby cutting assembly time.

We use a uPrint 3D printer, which is supplied with CatalystEX software. Solidworks is used to create the designs, which can then be transferred into CatalystEX, which communicates directly with the printer.

Part of the challenge of working with



CAD image of Cool-Phase air handling unit component



The Cool-Phase component printed in 3D



Actual component from Cool-Phase air handling unit

innovations is in justifying them to customers. But, fortunately, the same technologies can help to provide the answers to their questions. For example, one of the weaknesses that specifiers have identified in many air handling units is inefficiency in airflow components, which are often fabricated from sheet metal with 90° angles that are not efficient in terms of air movement and energy use. Because of this, we used computational fluid dynamics (CFD)

in combination with 3D printing and injection-moulding processes to test the geometry of our airflow components and demonstrate their performance.

As a result of work we have done, we have been able to manufacture complex sweeps that optimise the flow of air. The Cool-Phase fan is operating with far less power, using between 7W and 20W during typical daytime operation. This means that it is operating more quietly. Neither of these benefits could have been achieved without the technologies we are now employing.

By adopting these new manufacturing techniques, we have also been able to create a very slimline design. The batch-manufactured sheet metal we used wasn't aesthetically pleasing, so we set ourselves a target of improving the system's appearance. During design discussions, we talked about the Pixar film WALL-E, and the contrast between the heavily manufactured, mechanical design of the eponymous android and the seamless Apple-like look of his robot love interest, Eve.

With the Cool-Phase fan, we have achieved the sleek, smooth and contemporary 'Eve' look, partly by reducing the depth of the unit to just 350mm, reducing the building void space required to install it to 400mm. This was only possible by similarly downscaling the size of the system's ductwork and testing the implications for the airflow, going through it using CFD, 3D printing and injection moulding.

Almost every component in the Cool-Phase system has been 3D modelled. At one end of the scale, we downloaded 3D files from suppliers to assess how their products would integrate with ours and, at the other end we printed the entire Cool-Phase unit as a 20:1 scale model to preview design. Predictably, this means that our sales and technical staff want models to help them present Cool-Phase to customers, architects and consultants.

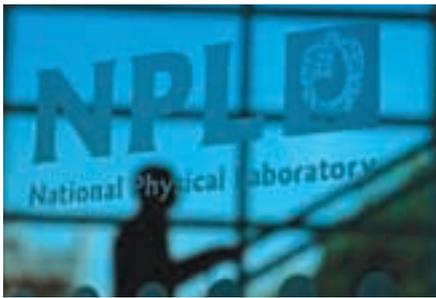
We have many other plans for our 3D printer, including a plan to create scaled down building models to help with daylight simulation testing for new products.

**JAMES MCGOWAN** is R&D product designer for Monodraught



# MEASURE FOR MEASURERS

The National Physical Laboratory in London would not be able to operate without the most stringent levels of environmental measurement and control. **Dr Jeremy Wingate** outlines the key lessons learned from the installation of the lab's new BMS



Regular on-site contact with all stakeholders – from engineers to end users – was vital

The National Physical Laboratory (NPL) in west London undertakes some of the most precise measurements on the planet. As the UK's National Measurement Institute, it is a world-leading provider of measurement standards and metrology research. So when, in 2010, work on replacing the entire building management system (BMS) began, close environmental control of the laboratory spaces was an absolute priority.

Replacement of the BMS was necessary because of requirements for tighter control, greater reliability and easier calibration. Rotronic Instruments (UK) was asked to provide a complete range of temperature and humidity sensors and instrumentation for every part of the project. It was also tasked with fulfilling the calibration and commissioning needs for these instruments.

The project allowed us to draw important conclusions on some of the key issues surrounding the achievement of precise measurement and control on large-scale projects. Commissioning and ongoing calibration of instruments can incur significant project costs – far above those of the initial instrument outlay. But, neglecting system maintenance and calibration will ultimately result in reduced building performance, and a system that will no longer meet originally achievable tolerances. This is all too common, and typically occurs after the installation contractor has handed back the site, often to a separate management firm.

Below, we highlight five key areas that have been vital for the success of this project.

#### 1. Clearly defined project tolerances

Thankfully, the NPL project came with clearly defined tolerance requirements. We were able to work with project stakeholders – including facilities manager Amey – to match instruments to project requirements. These could only be developed with a detailed understanding of:

- End user requirements
- Control system capabilities
- Sensor capability (accuracy and drift)



- Available budget
- Ongoing calibration requirements. Working together, we resolved to provide three ranges of temperature and/or humidity instruments. Each range's accuracy, performance and calibration specifications were selected for the various areas within the NPL, from close-control laboratories to the water systems.

## 2. Calibration is the only way to confirm performance

On-site sensor calibration is traditionally time-consuming and disruptive to end users. However, actual instrument performance cannot be ascertained without calibration. To avoid these issues, in close-control areas, we used interchangeable probes with separate high accuracy digital-to-analogue transmitters. Every probe's digital output was calibrated in our UKAS-accredited laboratory. In addition, each transmitter's analogue output was calibrated using a simulated digital input. This ensured confidence and transparency in the performance of each probe and transmitter, and allowed the use of any calibrated probe with any calibrated transmitter once on site.

## 3. In-situ performance is different from lab performance

Calibrating both probe and transmitter does not account for measurement errors, once installed. To resolve this quickly and efficiently, each installed high accuracy instrument was loop-calibrated and adjusted. A fixed-value probe, designed to produce a single relative humidity (RH) and temperature value (that is, 50%RH and 23°C) was used to inject a known value

to the transmitter and wider BMS. Any error seen on the BMS display had to be related to the installation and associated wiring and/or signal conversions. Offsets could be applied and recorded to correct these errors. Typical installation errors observed to date on the BMS are  $\pm 0.5\%RH$  and  $\pm 0.25^\circ C$  – which is significant for labs requiring tolerances of better than 1%RH and 0.1°C.

## 4. Low accuracy doesn't mean poor reliability or poor support

Not every sensor location or application could justify using the highest performance instruments with extensive calibration. However, replacing failed instruments on site takes up engineers' time and is costly. Even the lowest specification thermistor products supplied were produced with high specification housing and construction, using customised sensor potting to provide long-term performance and low drift. We also ensured that all products were sensor-tested and calibrated before delivery.

## 5. Rigorous commissioning procedures

As a metrology company, we could be guilty of assuming that precise environmental control simply needs precise measurements. Of course this is far from the truth. To confirm the final room performance, a commissioning procedure was developed based around good measurement practice – rather than simply waving a handheld device near an extract duct. Where required, building services engineers underwent training but, ultimately, the goal was to ensure that engineers understood and were committed to quality measurements.

## Final lessons...

To apply these five steps in practice to a project of this size required something very basic – communication. Regular on-site contact with all stakeholders – from engineers to end users – was vital. This was achieved through regular meetings, but the best insights came during the site loop calibration and adjustment work undertaken by our staff with building services engineers. This contact, and constant interaction, is vital to the ongoing success of this project.

Equally key is regular sensor calibration in close-control areas. With interchangeable sensors, precalibrated probes can be swapped in seconds, saving time and avoiding disruption for end users. Inevitably, failed sensors or instruments will occur on a project of this size. All we can offer is speedy repair or replacement, along with a structure to learn lessons from the field and ensure continual improvement of services.

The move from analogue systems to digital is slowly taking place. Digital systems provide better diagnostics and the ability to automate loop calibrations. Meanwhile, the Soft Landings process, which emphasises the importance of contractors and designers staying involved in a building after completion, is also having an impact on the strategies used by installation companies, with longer term performance becoming a bigger issue. Ultimately, each project is unique, and that's what makes it interesting. **CJ**

**DR JEREMY WINGATE** works for Rotronic Instruments (UK), Swiss-based suppliers of metrology and calibration instrumentation, UKAS-accredited calibration, training and consultancy



# FAT IS A SERVICES ISSUE

The food industry's building services designers ignore drainage at their peril. The build-up of fats, oils and greases can have serious implications for hygiene, profits and sewerage infrastructure, as **Martin Fairley** explains

In a busy catering facility or processing plant, hygienic drainage really counts, but is often overlooked. Although building service engineers are constantly vigilant in ensuring that general standards are as high as possible, they sometimes fail to look beyond the immediately visible areas.

At best, having to rectify inadequate drainage will cause disruption to your client's business – they will have little choice but to close temporarily while you rip up floors to investigate the problem. At worst, it can mean food contamination, loss of reputation and profit, and even a major threat to the wider sewerage network.

Many independent studies have shown a significant amount of bacteria present in drainage, so the system needs to be as effective as possible to prevent the harbouring of listeria and salmonella. Bacteria can also be spread by surface liquids. Effective drainage should remove this and will also reduce slip hazards – a major cause of workplace injuries.

Good drainage will limit the build-up of fats, oils and grease (FOG). This is a significant issue, with around 200,000 sewer blockages in the UK every year. According to water industry body Water UK, up to 75% of these are caused by FOG, which sticks to the inside of pipes and tunnels, where it solidifies and accumulates until it restricts the flow of waste water, or even blocks the sewers.

FOG deposited into sewers from the UK's 260,000 food service establishments alone accounts for a significant proportion of this. Indeed, the extent of the issue is particularly apparent in towns and cities where there is a high density of such businesses. For example, in 2010 Thames Water removed a staggering 1,000 tonnes of solidified FOG that had built up over time in the sewers around the Leicester Square area of London.

The problem is being exacerbated by a

number of factors. These include climate change, with increased rainfall leading to greater surface water run-off into a combined sewer system, as well as changes in eating habits, which mean that people are eating out and consuming fast food more frequently. When you consider that the estimated cost of managing FOG in the Thames region alone is around £12m per year, it's clear that urgent action is required to tackle the issue.

## The importance of good design

The optimal design of processing and production facilities is fundamental to food hygiene, public health and ultimately the profitability of a business. Although all food processing facilities have an obligation to manage effluent content under the Water Industry Act (1991), drainage is often one of the last things considered during the design of a building. Of course, the alternative approach – to design out potential hazards from the start – is by far the best option. It is vital for building service engineers, other specifiers and designers to understand the legislative requirements – and BS EN ISO 22000 – which covers pre-requisite planning, or hazard analysis and critical control points (HACCP).

In food processing facilities, long drain runs and multiple sources of FOG locations within



Good drainage will limit the build-up of FOG



The problem of FOG is being exacerbated by people eating out and consuming fast food more frequently

a building require good management. FOG separators should be designed to the correct size and standard. Organisations such as Campden BRI (an organisation that carries out R&D for the food and drinks industry) and the European Hygienic Engineering and Design Group work closely with firms such as ours to optimise product performance.

Successful FOG management requires good communication between engineers and



FOG causes up to 75% of all sewer blockages



CALEB FOSTER / SHUTTERSTOCK

specifiers, and should take into consideration the layout and location of potential FOG sources, operational requirements and maintenance preferences – paying particular attention to hygiene requirements. Solutions covering these aspects will minimise operator costs and prevent this ‘out of sight, out of mind’ problem from becoming too visible.

Another key issue the industry needs to be aware of is CE marking. This is compulsory on a selection of commercial drainage products, but not all – and that’s where the issue lies. Many specifiers, and even some drainage manufacturers, are unclear about what products have to be CE-marked. As a result, there is a danger that the hygienic drainage system you specified a few months ago is no longer legally compliant. One solution is to use a supplier that both CE-marks all of its products, and employs its own specification team who understand the latest legislative requirements.

The best way to future-proof a business is to increase the understanding of hygiene issues and to employ a team of suppliers who are working with the food and drinks industry to identify key issues and develop specific products and systems. Only then can organisations be sure that the worst thing that could happen to their business never does. **CJ**

**MARTIN FAIRLEY**  
is research director  
for ACO Building  
Drainage



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## Measuring the thermal performance of glazing

### This module explores factors that determine the thermal performance of glazing

The newly published Approved Document L: Conservation of fuel and power<sup>1</sup> of the Building Regulations for England sets out requirements aimed at reducing carbon emissions by 6% for domestic buildings and 9% for non-domestic buildings (relative to Part L 2010). The challenge of delivering such savings cannot be met simply through improvements in active environmental systems. The explicit use of fabric energy efficiency targets – as added to Part L for domestic buildings – is there to ensure that the underlying permanent building components will provide a minimum level of performance, irrespective of any active systems, as well as meeting the target emissions rate that is also required under Part L.

So it is particularly appropriate that this CPD will continue the occasional series on assessing the performance of building fabric.

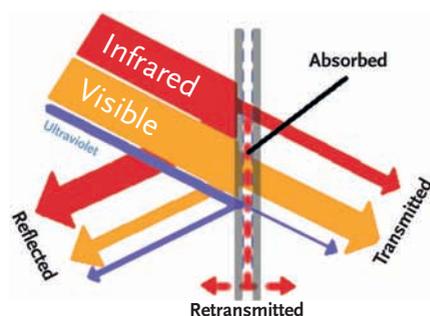


Figure 1: The simplified passage of incident solar radiation through the glazing of a window

This article will consider what determines the thermal performance of glazing, and undertake some basic window modelling, using a freely available calculation tool. This will be further expanded upon in a future CPD by comparing relative integrated performance using the free (CIBSE admittance method) PDA tool.<sup>2</sup>

#### The window as a thermal attenuator

The normal, primary purpose of windows is to admit daylight for practical, aesthetic and psychological reasons, while maintaining a barrier against the outdoor environment to prevent external 'weather' encroaching into the internal space. The thermal attributes of that barrier (the aspects that attenuate conductive and radiative heat transfer) will be part of the window's performance criteria, alongside light transmission and noise attenuation – and all these attributes may well have consequential effects on building services. For example, the amount of useful daylight that a window will admit to a room may affect the requirement to use artificial lighting, so influencing the installed cooling load due to heat gain from the resulting luminaires and controls. Therefore, as with most architectural and building services engineering decisions, the impact of any window element must be considered holistically with the rest of the systems. This article will, however, just

focus on thermal performance.

Windows present a particular thermal challenge since, when there is a cooling load in the room (that is, the room is rising in temperature beyond the internal design temperature due to heat gains) – and while there's a need to admit as much as possible of the visible solar energy (the higher frequency, shortwave radiation wavelengths between 380 and 700 nm) into the space (Figure 1) – it is beneficial to reduce the incoming (low frequency wavelengths between 700 nm to 1 mm) infrared radiation. Conversely, when there is a room heating load, any heat that can be provided by the sun's infrared energy being admitted into the room might reduce the room's heating requirements, while at the same time there may also be a need to reduce loss of (longwave infrared) radiant heat from the room to the outdoors. And at all times – subject to not causing problems of discomfort and disability glare – there is a need to promote daylight into the room. The amount of heat radiated (and absorbed) will be dependent on the emissivity of the various surfaces of glass and the surface temperatures.

Concurrent with this radiant heat conundrum there is a quandary with the conductive (and convective) heat flows through the window – both the glazing and frame. At some times of the year (typically winter), it is preferable to reduce heat flow (from room to

Type	Indicative U-value / $W \cdot m^{-2} \cdot K^{-1}$	
	Glazing only	Window (including frame or sash)
Single	5.7	5.0
Double	2.8	3.0
Double (low emissivity)	1.8	2.2
Triple	1.8	2.2

Figure 2: A sign of the advancing requirements for building performance – indicative U values for conceptual design, taken from the 2006 CIBSE Guide A

outside), while at times of high room cooling load (and high room temperature) it may be beneficial for heat to be readily lost from the room through the window. Heat is passed from the warmed glass surfaces by radiation and conduction (being moved from the surface by convection), while some heat will be transmitted directly through the glass – as will a proportion of the visible light. The spacing between panes of glass is critical in reducing the convective forces. As the space gets wider, there is more opportunity for convective forces to move heat from one pane to another. Gases such as argon or the denser, more expensive, xenon or krypton – or even a partial vacuum – are used in place of air to reduce the convective (and conductive) heat flow between the panes. The vacuum option is particularly successful when slim retrofit windows with a small spacing between the panes are required.<sup>3</sup>

The transmitted component will depend on the optical properties of the glass, together with any reflection at surface coatings. The loss of transmitted energy will heat the glass to increase its temperature and so drive the radiant, conductive and convective heat transfers.

For older, or poor standard, installations there can be an additional significant heat loss or gain

by the direct infiltration of outdoor air around the window sections.

### The window U value

When a window thermal transmittance (U value) is published, it would normally be for the complete window unit, including the frame, the glazing and any glazing bars. The U value of the complete window will be dependent not only on the centre pane U value of the glazing ( $U_g$ ), but also on the material used for the frame, and on the performance of the frame in thermally separating the external and internal environments. The multiple panes of glass must be thermally separated rigorously by spacers – these are typically made of low conductivity polymer or aluminium with thermal breaks. The performance of these small but essential elements can affect the thermal transmittance significantly.

CIBSE Guide A<sup>4</sup> tabulates some basic U values (shown in Figure 2); due to the intervening changes in required minimum U values (in the seven years since publication), only two of these would be now be appropriate for use as the minimum standard for the Building Regulations AD Part L 2013 that

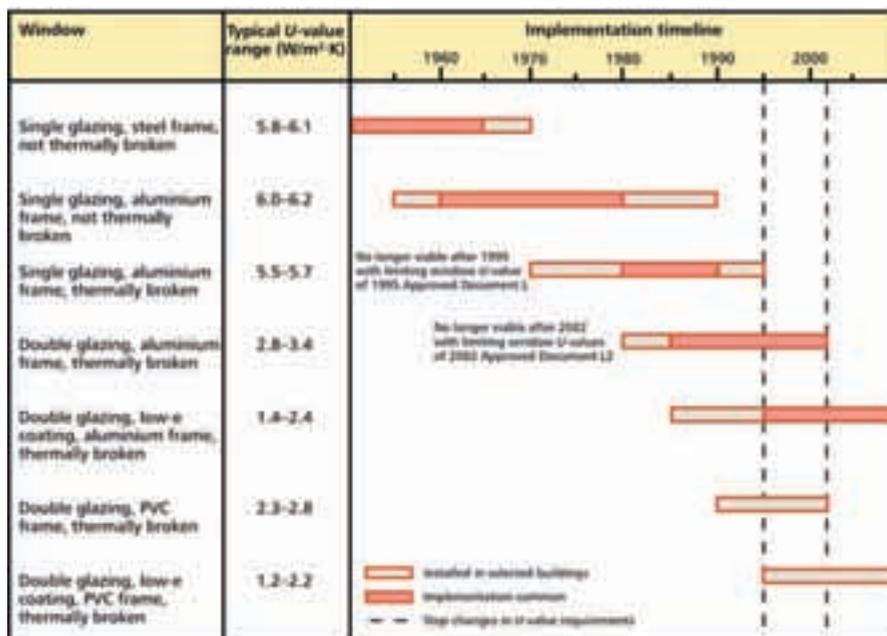


Figure 3: The evolution of UK windows over the last 60 years [CIBSE TM53:2013<sup>5</sup>]

allows a normal maximum window U value of  $2.2 W \cdot m^{-2} \cdot K^{-1}$ . The accelerating pace of change in the requirements for window thermal performance is illustrated by the window ‘timeline’ in Figure 3.

In Figure 4, the impact of the frame is shown for an extreme example where an aluminium frame with thermal breaks (with a frame U value of  $3.4 W \cdot m^{-2} \cdot K^{-1}$ ) influences the overall U value of a window. The figure illustrates the use of different glass combinations (and their respective values of  $U_g$ ) with variations in percentage of the window area occupied by the frame, indicating that – even with relatively high performing glazing – an increasing proportion of high thermal transmittance frame can produce unacceptably high U values. Frames are available with far lower U values than this simple aluminium example, including those made of timber and glass fibre.

U values for windows well below the UK’s Part L requirements are readily achievable. A notable example was the recent work on the Empire State building in New York, where refurbished windows contributed about an eighth of the predicted 38% saving in the refurbished building’s energy use.<sup>7</sup> All 6,514 of the double glazed windows were upgraded. The north-facing windows were refurbished using low emissivity film suspended between the two panes of double-glazed windows (using the original frames) to provide a U value of below  $0.8 W \cdot m^{-2} \cdot K^{-1}$  (using 90% krypton gas to fill the cavity), as shown in Figure 5.

### Glass solar heat gain coefficient

Glass is naturally relatively opaque to infrared (the heat), so the first pane will absorb radiated heat and potentially re-radiate that heat from its other surface, depending on the emissivity of that surface. ‘Low-e’ glass is commonly employed to reduce the emission – where one surface of the glass (often the surface facing the cavity) has been treated during manufacture with a specific coating. The emissivity of plain glass is about 0.84; depending on the coating, this could be cut down to 0.02 – so reducing the radiant heat transfer to just a few per cent of that of plain glass. Broadly, where there is a need to reduce

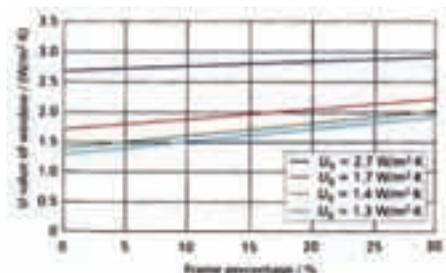


Figure 4: Framing percentage effects on window U values [CIBSE TM35 2004<sup>6</sup>]

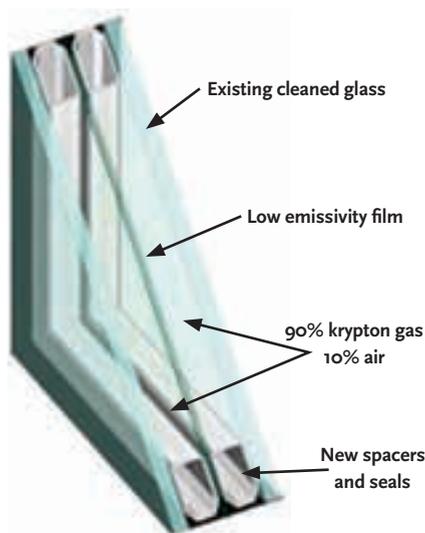


Figure 5: The Empire State Building's existing windows were removed, cleaned and retrofitted with an intermediate low-e film – the refurbished windows were kilned to shrink the film to provide a taut finish

solar gain, the coating would be on the inner surface of the outermost pane, and where heating is the key requirement, the inside pane would incorporate a low-e surface. Traditionally, the coatings that were used were 'hard' pyrolytic (added while the glass was soft) and 'soft' sputtered (metal deposited on glass sheets). The soft coatings could produce the most effective low emissivity surfaces but were less durable. However, the durability of some 'sputtered' coatings is now such that they may be used on the exposed – typically indoor – surfaces and can contribute to a very low  $U_g$  value for the glazing.

The total solar heat gain coefficient,  $g$ , (or SHGC), is the proportion of heat from incident solar irradiation that enters the room. Where windows are predominantly used for passive solar heating, a high SHGC could be appropriate; conversely, windows designed primarily for situations where cooling prevails must have a low SHGC, to exclude

significant amounts of the solar radiation. There is normally some trade off, as the visible transmittance (VT) – the fraction of the visible spectrum of sunlight that passes through the window – will drop as the SHGC reduces.

The characteristics of glass may be dynamically altered with the advent of mass produced photochromic glazing systems. These are being evaluated in many parts of the world.

Historically, the shading coefficient (SC) was used to define the glass performance (relative to the solar thermal performance of simple 3 mm glass). This term is practically redundant, but if needed for approximate purposes,  $SC = g/0.86$ .

### Computer modelling to compare potential window performance

It is possible to use tabular data and look up tables to determine the values required to model the performance of windows in a building. CIBSE Guide A includes such a method for the calculation of window U values (as illustrated in the *CIBSE Journal* CPD article in June 2011) that accounts for both the frame and glazing. However, in practice the values would be provided by the glazing system manufacturer or, if more concept detail needs to be investigated, by undertaking a calculation in accordance to the BS ISO 10077.<sup>8</sup>

However, the profiles of the materials that make up the frame, the interaction between each layer of glazing and the other parts of the window, together with the complex path for radiant heat transmission through glass and solar control surfaces, means that the task is most appropriately undertaken by computer-based tools. There are some excellent (and free) pieces of software that can be used to explore and compare the potential performance of windows, such as the freely available LBL WINDOW<sup>9</sup> package

### Shining example

The summer 2013 headline-hitting problems at 20 Fenchurch Street, London (the 'Walkie Talkie'), where car bodywork was melted by reflected solar energy from the building façade, illustrates the reflective qualities of solar control glass. However, this phenomenon does not require a substantial convex array of glazing (as in the Walkie Talkie and other notable international buildings such as the Disney Concert Hall in Los Angeles and the Vdara Hotel in Los Angeles) but can be exhibited from windows that appear flat but are mildly concave, as shown in this news report from Massachusetts: <http://bit.ly/1bdCOUi>

to determine the thermal properties of the glazing unit. (This would probably be used in conjunction with a tool such as THERM that is used to establish the frame thermal performance – again, see *CIBSE Journal* CPD, June 2011.)

Such a tool is useful to evaluate, simply and quickly, different glass, solar film and glass coatings that can then be applied with a variety of frame solutions. The data can then be used as an input to a building thermal model. As an example, using WINDOW software as shown in Figure 6, the impact of changing the frame from aluminium to wood may be examined.

The CIBSE admittance method applies solar factors that fit in with its 24-hour cyclic modelling technique, known as the mean, and the alternating solar gain factors that have been further developed to consider the proportion of radiant and convective heat flows. Practically, these may only be established with software that is normally embedded into admittance method tools.

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- 5 CIBSE TM53 *Refurbishment of non-domestic buildings*, CIBSE 2013.
- 6 CIBSE TM35 *Environmental performance toolkit for glazed facades*, CIBSE 2004.
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- 8 BS EN ISO 10077, *Thermal performance of windows, doors and shutters. Calculation of thermal transmittance. Numerical method for frames*, BSI 2012.
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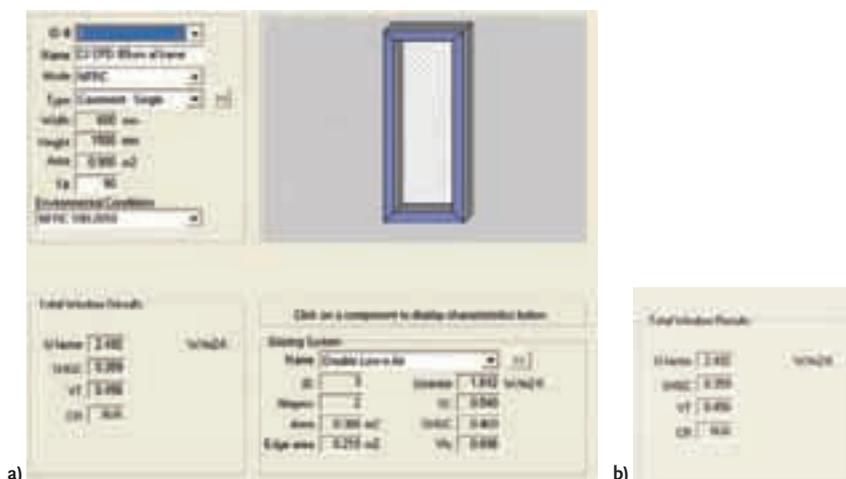


Figure 6: Screenshot from WINDOW software when modelling 600 mm x 1,500 mm window with 80 mm wide frame and double pane low-e glass – a) results with aluminium frame; b) results with wooden frame

Turn over page to complete module ➤

# Module 60

January 2014

**1. Which of these spectral frequencies would be in the infrared range?**

- A 100 nm
- B 600 nm
- C 900 nm
- D 1,200 nm

**2. Why is krypton used in the cavity of double-paned windows?**

- A To reduce convection as it is denser than air
- B It is cheaper than using argon
- C It reduces the emissivity of the adjacent surfaces
- D It is more transparent than air
- E It creates a vacuum

**3. In the Empire State Building window refurbishment, which of the following were reused from the original windows?**

- A Spacers
- B Low-e film
- C Seals
- D Air filling
- E Glass

**4. What is the limiting maximum U value allowed for (general) windows in 2013 Part L?**

- A  $0.7 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$
- B  $1 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$
- C  $2.2 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$
- D  $2.8 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$
- E  $5.6 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$

**5. Which freely downloadable computer package may explicitly assist in investigating the thermal performance of window frames?**

- A THERM
- B WINDOW
- C PDA
- D BS ISO 10077
- E ADMITTANCE

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**N Walsh, CIBSE, 222 Balham High Road, London, SW12 9BS**

## Big Foot Systems has right prescription for Cromer Hospital

Big Foot Systems has supplied support solutions for rooftop plant at the new Cromer and District Hospital in Norfolk as part of a £14.9 m redevelopment project to replace the original hospital on Mill Road, which opened in 1932. Run by the Norfolk and Norwich University Hospitals NHS Foundation Trust, the new dynamic two-storey building was built by main contractor Mansell Construction, designed by Purcell Miler Triton & Partners, with building services installed by M&E contractor Eyre Building Services Group.

● Email [enquiry@bigfootsupport.com](mailto:enquiry@bigfootsupport.com) or call 01323 844355



## Tate Britain unveils Grundfos pumps

When the Tate first opened to display a small collection of British artworks in 1897, it was Henry Tate's private art collection that was at its core. Back then it would have been impossible to envisage that the Tate would, from these humble beginnings, grow to encompass four major sites and 70,000 artworks.

The most recent £45 m project has involved leaving the classical façade of Tate Britain in place but radically redesigning the interior to match its modern day needs. With new galleries, educational space and the opening up of additional space on upper and lower floors, this project has translated into an extensive and intelligent refurbishment, incorporating the introduction of a new up-to-date M&E system that has a complete pump solution from Grundfos Pumps at its heart.

With such a high dependency on an accurate and consistent internal temperature, choosing from the wide range of single and twin-pump energy efficient Grundfos TPE single-stage, in-line centrifugal volute pumps, was the ideal solution for this type of complex commercial heating and cooling applications.

● Email [grundfosuk@grundfos.com](mailto:grundfosuk@grundfos.com), call 01525 850000 or visit [www.grundfos.co.uk](http://www.grundfos.co.uk)



## Private school heat pumps supported by new electric technology

A heat pump installation in a private school in Surrey has benefited from a stand-by boiler supplied by Atlantic Boilers. Halliford School in Shepperton is a small independent day school. The heating services of the new building were carried out by Omega Building Services of Caterham-on-the-Hill and they installed five heat pumps. The Atlantic Multi-Elec Compacte 60kW provides an excellent backup to the pumps as it is also powered by electricity.

● Visit [www.atlanticboilers.com](http://www.atlanticboilers.com), email [info@atlanticboilers.com](mailto:info@atlanticboilers.com) or call 0161 621 5960



## There's even more to Multikwik

Multikwik's famous claim to offer 'more than just pan connectors' now holds more water than ever with an expansion of its range to include sanitary frames, floor drainage, cisterns and flush plates. The products have been added to the range to make Multikwik the ultimate supplier of sanitary items. The range, which includes some pioneering products from across the Aliaxis Group, is all made to the quality and finish that installers have come to know, expect, and rely on when they buy Multikwik.

● Call 01622 852563 or email [lea.beilcke@multikwik.com](mailto:lea.beilcke@multikwik.com)



## Remeha Commercial announces warehouse move

Commercial heating manufacturer Remeha Commercial has moved its distribution hub to a giant warehouse in Erdington in the West Midlands to meet the continued growth of the business. 'The new distribution hub

has the capacity to hold our entire product range as well as new projected lines, allowing us to ensure our customary excellent service,' said managing director Mark Northcott. The company also anticipates a substantially reduced carbon footprint due to lower delivery mileage from the central location of the distribution hub.

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



## MHS Boilers fighting fit at leisure centre

Staff and visitors at the newly built Portway Lifestyle Centre in the West Midlands will benefit from a low-carbon heating and hot water system from MHS Boilers, which is expected to contribute to a BREEAM Very Good rating. The building has been installed with four R607 floor-standing gas boilers and 32m<sup>2</sup> of Auron DF evacuated tube solar collectors, supplying heating and hot water to the entire complex including a hydrotherapy pool, sports hall, gym and multi-purpose activity room.

● Visit [www.mhsboilers.com](http://www.mhsboilers.com)





## Hitachi Air Conditioning Europe announces Hi Efficiency Chiller with ECA status

Hitachi Air Conditioning Europe SAS's Hi Efficiency Samurai Chiller RCME has received Enhanced Capital Allowance (ECA) scheme status, joining Hi Efficiency Set Free VRF that was listed earlier this year. The modular Hi Efficiency RCME Chillers build on the success of the previous RCU2E-AG2 Samurai Chillers and – thanks to a number of unique Hitachi technologies – the new models represent an optimal solution for all European medium to large-scale applications, with one of the highest seasonal energy-efficiency ratios on the market.

● Call 01628 585 394, email [aircon.enquiries@hitachi-eu.com](mailto:aircon.enquiries@hitachi-eu.com) or visit [www.hitachiaircon.com](http://www.hitachiaircon.com)

## Panasonic range at the centre of BMS connectivity

The Panasonic range of heating and cooling systems includes greater flexibility for integration into building management systems (BMS) allowing for full bi-directional monitoring and control of commercial heating and cooling applications. The interface has been designed for Panasonic and provides the user with full control to monitor the functions on the complete line up of the Aquarea, Etheera, PACi, ECOi and ECO G ranges. Integrating the various control systems in a building through a BMS means there is a single point of information for the whole building.

● Visit [www.panasonic-heating.co.uk](http://www.panasonic-heating.co.uk)



## Titan Products launches TPZ-Net Zigbee wireless range to monitor buildings' health

The TPZ-Net is a new range of wireless environmental goods from Titan Products. Incorporating Zigbee wireless technology, the range claims extremely stable, self-healing mesh networking capabilities. The TPZ-Net range is designed to wirelessly monitor temperature, CO<sub>2</sub>, humidity, light and occupancy levels, and to convey this information back to the Titan Products coordinator, where the information can be transferred onto a BACnet network, to other Titan Product controllers, or to input/output (I/O) devices.

● Visit [www.titanproducts.com](http://www.titanproducts.com) or call 01614 066480



## Over and out

Pentair Thermal Management has been specified to provide its Raychem Winterguard frost protection and HWAT water temperature maintenance system to 20 Fenchurch Street (The Walkie Talkie). The building's hot water services are based in a hybrid system with recirculated pipework in the risers with a single pipe on each floor to the outlets. 2500 m Raychem's HWAT-R has been used to maintain the water at a temperature of 55° degrees. Thirty HWAT-ECO controllers were employed to ensure accurate temperature control, economy setback features as well as the option of a periodic legionella prevention cycle.

● Call 0800 969013, fax 0800 968624, email [SalesUK@tycothermal.com](mailto:SalesUK@tycothermal.com) or visit <http://www.pentairthermal.co.uk>

## Controls extends design team with key appointment

SE Controls has reinforced its design, R&D and product growth team with the appointment of Chris Iddon, who joins as design manager to spearhead the company's product innovation programme.

While Chris's initial academic studies focused on biochemistry, in which he was awarded a PhD in 2001, his career has since been concentrated on the construction industry and the built environment, specifically in a design management capacity in the contracting sector, notably with Kier Construction. After six years in design management he embarked on the Low Carbon Building Design and Modelling master's degree course at Loughborough University, led by Professor Malcolm Cook, before joining SE Controls at a key time in the company's growth and development.

'SE Controls already has a strong track record for innovation, including the recently launched NV LogiQ data logger and room controller, but we are already working on further advances in natural ventilation control solutions,' said Iddon.

Chris was shortlisted for the 2013 CIBSE/ASHRAE prestigious Young Engineer of the Year Awards.

● Visit [www.secontrols.com](http://www.secontrols.com) or call 01543 443060



## Remeha helps Knauf Insulation slash energy use by two thirds

Energy consumption at Knauf Insulation's offices in Cwmbran, Wales, has plummeted from 574,560kWh to 186,960 kWh, saving 74 tonnes of carbon, since MII Engineering introduced two Remeha Quinta Eco Plus 115 passive flue gas heat recovery heating systems. Annual energy use and heating bills have fallen by 67% since Knauf Insulation installed Remeha's 'super condensing' technology and added smarter controls. The savings are particularly relevant, given the colder-than-average winter and spring.

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



## Crane Fluid Systems launches BIM valves

Crane Fluid Systems (Crane FS) has become one of the first valve manufacturers to develop a comprehensive offering of BIM-ready product components, primarily in the Autodesk Revit platform. Building information modelling (BIM), is a computer based tool which is increasingly being adopted by engineers, architects and builders to design buildings intelligently by creating a digital representation.

BIM can be used to design any type of construction, from houses to hospitals and from football stadiums to bridges, regardless of complexity or scale.

At present, Crane FS has made some of its traditional and balancing valves available as BIM content, with others to follow shortly. Unlike CAD drawings, BIM models have the ability to provide simulation of a design and share specific information about a project, which is at the core of the 'BIM' philosophy. Access to this information also aids commissioning, operation and maintenance activities – It is a full lifecycle process.

● Visit [www.cranefs.com/bim-components](http://www.cranefs.com/bim-components)



## ADT safeguards new jewel in Cork's crown

ADT Fire & Security has delivered an intelligent fire detection and alarm system as part of the £15 m Mater Private Hospital development in Cork, Ireland.

The firm worked closely with Suir Engineering to design and install four MZX fire control panels, a TGX graphical user interface, a 64-Zone Atheis public address voice alarm (PAVA) system, four Vesda smoke-detection systems, and a damper system to help prevent the spread of fire.

The 280 fire dampers, closely monitored through visual displays, are controlled automatically to prevent smoke spreading. The MZX digital addressable fire alarm system also has multi-sensor virtual detection, while the cause-and-effect programming and ADT's TSM 800 fail-safe door control isolates any fire and protects predetermined escape routes by activating electronic fire doors.

● Visit [www.adt.ie](http://www.adt.ie)



## Vent-Axia's Lo-Carbon Heat Recovery wins at Retro Expo Awards

Vent-Axia is celebrating winning the Building Services Product Innovation of the Year in this year's prestigious Retro Expo Awards. Scooping the award for its revolutionary Lo-Carbon Temptra the company received the accolade at an awards ceremony held at the Business Design Centre, London on 5 December following the UK's only retrofit exhibition and conference: Retro Expo and the Retrofit Summit. The awards recognise excellence in retrofit products, projects and people across the domestic, commercial and public sector markets.

● Call 0844 856 0590



## Inspiring design in Knowsley schools

An ambitious scheme by Knowsley Borough Council to build world-class education facilities in the heart of its local communities has resulted in seven new learning centres that replaced 11 existing secondary schools. Multikwik Sanitary Frames were the answer for creating the modern, clean bathrooms to fit these learning environments.

One of the schools is the 900-place Christ the King School in Huyton. Winner of the 2009 British Council for School Environments (BCSE) Awards for Inspiring Design, it offers pupils and staff a contemporary, light and bright spatial experience.

● Call 01622 852563 or email [lea.beilcke@multikwik.com](mailto:lea.beilcke@multikwik.com)



## Toshiba rolls out extension of warranty

Six months after launching a seven-year 'Total Peace of Mind' warranty to accredited installers, Toshiba Air Conditioning has announced it is expanding the scheme to include qualified installers. This gives five years' full cover at the new enhanced level, and opens up the scheme to more

companies. David Dunn, general manager, said: 'We have had an enthusiastic response to our pioneering warranty. Accredited installers really appreciate the assurance it provides. We now want to extend the offer to qualified installers so they can apply and benefit from the upgraded warranty.'

● Call 0870 843 0333, email [general.enquiries@toshiba-ac.com](mailto:general.enquiries@toshiba-ac.com), or visit [www.toshiba-aircon.co.uk](http://www.toshiba-aircon.co.uk)



# PRODUCTS & SERVICES

Telephone: 020 7880 7614 Email: Patrick.Lynn@redactive.co.uk



## Pro-Temp wins Green Gateway award for Anfield efficiency drive

Pro-Temp Air Conditioning was awarded the Green Gateway award from Mitsubishi Electric for its work replacing old R22 air conditioning at Anfield.

The awards, created by Mitsubishi Electric, recognise the important contribution of its partners in encouraging energy efficiency in the built environment.

Liverpool FC had many types of air conditioning and equipment from multiple manufacturers, and Pro-Temp explained the issues with R22, which will be banned in the

UK from the end of 2014. Pro-Temp predicted that the club would cut its carbon emissions by more than half by upgrading, and achieve a 53% reduction in running costs for each unit.

● Visit [www.crohnsandcolitis.org.uk/get-involved/local-groups/Mersey+Group](http://www.crohnsandcolitis.org.uk/get-involved/local-groups/Mersey+Group) and [www.jdrf.org.uk](http://www.jdrf.org.uk)



## Mikrofill brings a warm welcome to St Peter's, Hereford

With St Peter's Church having had no heating for the past 30 years, Communion Architects of Hereford, took on the mammoth task of renovating the medieval building. Engineering Services Design Practice, of Redditch, incorporated a comprehensive heating package from UK designer and manufacturer Mikrofill Ethos Boilers. The installation was skilfully carried out by TH Haskett of Gloucester and consisted of two Ethos 70kW stainless steel condensing Boilers, a Mikrofill pressurisation package and a Mikrovent low loss header/air & dirt separator.

● Call 08452 606020 or visit [www.mikrofill.com](http://www.mikrofill.com)

## Record-breaking tunnel project for Fläkt Woods

The recently opened Marmaray railway tunnel, linking Asian and European shores for the first time, has been fitted with 48 bespoke tunnel ventilation systems supplied by Fläkt Woods – including fans, attenuators, transitions and dampers. Stretching 8.5 miles under the Bosphorus Strait, the tunnel is the only one in the world connecting two continents and has been designed to develop important trading routes. The rail service will be capable of carrying 75,000 people per hour in either direction.

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



# DIRECTORY Your guide to building services suppliers

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See: Taking Control - CIBSE Journal Dec 2011  
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**Mechanical Design Engineer**  
£27k - £34k + Benefits,  
Hertfordshire

This position represents an excellent career development opportunity gaining increased exposure to projects, liaising with clients, and developing leadership skills. The successful applicant will have previously worked on projects in a variety of sectors with a focus on delivery including initial and detailed design of building services, attending design and client meetings, conducting site surveys, and writing specifications. 1541/JA

**Public Health Design Engineer**  
£28k - 35k + Benefits, London

A consultancy at the forefront of the building services industry is looking to expand their already well-established public health team in London with an addition of an intermediate level public health engineer. Our client operates across the UK and throughout the globe working on a variety of high profile and innovative projects. The position exists as the London office is especially busy with continual project wins. 1552/JA

**Intermediate Mechanical Design Engineer**  
£35k + Benefits, West Sussex

Established Building Services & Sustainable Design Consultancy in West Sussex seeking an experienced engineer with a project history within the education, commercial, and residential sectors, to join their thriving design office and award winning team. If you are seeking an opportunity with a forward thinking company that will progress your career to the next level, then look no further. BAR1524/TA

**Intermediate Electrical Engineer**  
London, £35k - £39k + Excellent Package + CEng Sponsorship

A rare career opportunity has arisen with the world's leading engineering consultancy for a dynamic, motivated electrical engineer looking to make a name in the building services industry. You will be MSc qualified and member of IET or CIBSE, proficient with technical software and experienced in detailed design. In return you will receive exposure to high profile projects, first-rate mentorship, and excellent benefits with a company that lead the way in building engineering. BAR1434/CB

**Senior Mechanical Engineer**  
Central London  
£40 - £45k + Benefits

An exciting opportunity has arisen to join one of London's leading design consultancies who are renowned for their creative approach, low carbon, and economical operational performance. Due to continued project wins they are looking to add a senior mechanical design engineer to their busy mechanical team. A structured career path and excellent salary will be offered to the successful applicant. BAR1570/KH

**Mechanical Engineers (Senior to Associate Director)**  
Dubai, UAE, 32,000 - 45,000 AED PCM

We have a fantastic opportunity for degree qualified mechanical engineers from Senior to Associate Director level. The announcement of Expo 2020, and the Qatar World Cup have led to a significant increase in workload for our client, an international multi-disciplinary consultancy that is well established in the region and possess a solid reputation. BAR1047/PA

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**HVAC Design Engineer**

Hertfordshire | £35-45k + Benefits | Ref: 14012

Our client has been established since the early 80's, they operate in the principal areas of mechanical, electrical and public health engineering related to building services. The engineer will be required to deal with projects in the UK and continental Europe from concept/feasibility stage, through design and construction to commissioning and handover. The candidate will report directly to the director. This role gives the right individual the opportunity to develop within the company as it grows. Contact: [michael.vieira@bsvrecruitment.co.uk](mailto:michael.vieira@bsvrecruitment.co.uk)

**Junior / Intermediate Electrical Design Engineer**

Kent | £24-32k + Benefits | Ref: 13995

Due to high demand, an M&E Design Consultant are looking to recruit. They require a design engineer for a confident and established company that has been active in the building services sector for over 20 years. You will be working in all sectors within building services which include commercial, residential, industrial and local authority's designs. Contact: [matthew.baker@bsvrecruitment.co.uk](mailto:matthew.baker@bsvrecruitment.co.uk)

**HVAC Associate**

Hampshire | £45/55k & Excellent Benefits Package | Ref: 13966

A multi-disciplined Consultant is keen to strengthen their Division by recruiting an HVAC Associate. You should be able to demonstrate regional business knowledge, have a relevant industry qualification, be a Chartered Engineer or close to achieving CEng. LCC accreditation and experience of IES, Hevacomp and Microsoft Office is greatly beneficial. Their Project portfolio is diverse and includes Mixed-use, Commercial, Residential, Retail, Heritage, Healthcare and Education. Contact: [paul.bartlett@bsvrecruitment.co.uk](mailto:paul.bartlett@bsvrecruitment.co.uk)

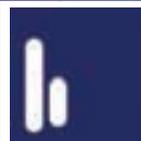
**HVAC, Electrical & Sustainable Design Engineers**

London | £30/40k | Refs: 13696/70/71

Exciting opportunities in this Multi-disciplined Consultant based in Central London, looking to strengthen their Building Services team by recruiting HVAC, Electrical & Sustainable Design Engineers. Projects are diverse and are based in worldwide locations. Contact: [darren.warmington@bsvrecruitment.co.uk](mailto:darren.warmington@bsvrecruitment.co.uk)

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**blueprint**  
recruitment

**Mechanical Associate Director | London | £Competitive | ref: 4746**

Market leading, industry recognised consultancy with an enviable reputation for project delivery and engineering excellence. Projects include some of the most admired and innovative International developments. Ideal candidate would be expected to have an extensive, proven background in running projects as an associate, lead or project engineer. Exceptional opportunity for a highly motivated, driven individual.

**Electrical Design Engineer | West Midlands | to £40K | ref: 4700**

Our client is a large International multidisciplinary consultancy, designing and delivering bespoke solutions for high profile National and International projects. Ideal candidates will be Chartered, keen to take on new challenges and have commercial and healthcare experience. Excellent opportunity for career progression.

**Senior Mechanical Design Engineer | London | to £45K | ref: 4681**

Excellent opportunity for an ambitious Mechanical Engineer to join a market leading consultancy. Working within the heart of the design team you will influence designs from the outset of projects. The Ideal candidate will be Chartered or working towards and proficient in the use of hevacomp. Outstanding self-development and progression.

**Sustainability Engineer | East Anglia | to £35K | ref: 4460**

An award winning multidisciplinary consultancy working on high profile projects across all main market sectors. As the successful candidate you will assist in the design of low carbon solutions in relation to new and existing non-domestic and residential buildings. Experience of working on a variety of projects is desired.

**Public Health Engineer | London | to £45K | ref: 4651**

A world renowned multidisciplinary consultancy working on prestigious projects including data center, leisure and commercial. Candidates will have an understanding of sustainable design principles; solar hot water, rainwater harvesting and grey water recycling. Long term opportunity.

**t: 02392 603030**

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# New Year, New Potential...

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**Senior Electrical Engineer** | Birmingham  
£40,000 Plus Package

A large international consultancy, who are one of the leading pioneers in the industry, is currently looking for a Senior Electrical Design Engineer. This office is now entering a planned expansion period, which will create some great career opportunities for a Senior Electrical Engineer. Candidates should be able to lead projects, and have a keen interest in sustainable building solutions.

**Associate Designate Mechanical Engineer**  
London, Victoria | £50,000 Plus Package

Fantastic opportunity for a Mechanical Engineer to join a department renowned for working on some of the most iconic projects within the City. They require a senior mechanical engineer to join their expanding team, and are looking for someone who is wanting to progress on to an associate position within their practice. You will be given the opportunity to work on some of the most iconic projects within the residential, commercial aviation industry.

**Electrical Design Team Leader** | London  
£50,000 Plus Package

A large but traditional building services consultancy who have a great reputation in the UK are currently looking for an Electrical Engineer to lead a team of electrical engineers, working on commercial and residential developments in the South East. Candidates should have experience leading project design teams and mentoring junior engineers. This consultancy is well known for looking after and retaining their staff.

**Senior Mechanical Engineer** | Reading  
£45,000 Plus Package

A large international, multi-disciplined engineering practice are currently expanding their building services department at their Reading office. Candidates will be heavily involved with decision making throughout the expansion process, and will have the opportunity of progression within a short period of time. Candidates should be CEng and have experience on large scale mixed use projects.

**Electrical Engineer** | Manchester  
£30,000 Plus Benefits

An award-winning top 10 building services consultancy is currently looking for an electrical design engineer to join their well-established team in Manchester. Within this role, as an intermediate level engineer, you will be working alongside a successful Senior Engineer on commercial, retail and mixed use developments. Candidates will have the full support of the team to gain Chartered Engineer status, as well as other industry specific qualifications.

Find more jobs online at:  
[www.conradconsulting.co.uk](http://www.conradconsulting.co.uk)



For a confidential discussion about your career, contact [george@conradconsulting.co.uk](mailto:george@conradconsulting.co.uk) | 0203 159 5387



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## UNIVERSITY OF CAMBRIDGE

### Invitation to tender

*The University of Cambridge is seeking experienced contractors to design, supply and build the mechanical and electrical elements of an energy centre for the North West Cambridge Development.*

The contract is for the installation of an initial 10MW combined heat and power (CHP) plant to serve the first phase of the development. Further plant, not a part of this contract, will be installed over a number of subsequent years to provide an estimated 22MW which will serve the entire development. Tenderers will also be invited to offer operation and maintenance services for an initial period. Please note that the design and construction of the energy centre shell structure is not part of this contract.

In order to qualify, applicants will need to have successfully undertaken work similar to this nature in the last five years.

For information about the development please see [www.nwcambridge.co.uk](http://www.nwcambridge.co.uk)

For further information please register as a supplier by visiting our e-tendering system at <https://in-tendhost.co.uk/universityofcambridge> by 20 January 2014 and follow the on-screen instructions.



## NORTH WEST cambridge

# Events & training

## NATIONAL EVENTS AND CONFERENCES

### CIBSE Building Performance Awards 2014

11 February, London

The prestigious awards evening returns to recognise the businesses, team, products and projects that demonstrate engineering excellence in the built environment. Table bookings now accepted. [www.cibseawards.org](http://www.cibseawards.org)

### CIBSE/ASHRAE Technical Symposium

3-4 April, Dublin

Recognising that system and plant performance is a global issue, this joint CIBSE and ASHRAE symposium will give a platform to the latest practice and research in active and passive building systems that will shape an effective future for the built environment with minimum resource impact. Booking now open. [www.cibse.org/symposium2014](http://www.cibse.org/symposium2014)

## CIBSE GROUPS AND SOCIETIES

For more information visit [www.cibse.org/events](http://www.cibse.org/events)

### International conference on intelligent systems, structures and facilities (ISSF2014)

7 January, Hong Kong

Intelligent Buildings (IBs) aim to optimise the built environment by looking at: energy efficiency; safety; friendliness; and cost effectiveness by integrating building management and communications to serve people and to enhance a building's intelligence. An event organised by the AIB, with support from the CIBSE Hong Kong Branch, invites you to share your innovative ideas, experiences and research achievements in green buildings, repairs and maintenance, energy efficiency, and intelligent building design and other related areas. [www.cibse.org.hk/event.php](http://www.cibse.org.hk/event.php)

### Adiabatic cooling

09 Jan, London

Mike Groves, from Menerga, will review: the principles of adiabatic (evaporative) cooling; its history in HVAC design; compare direct and indirect adiabatic cooling systems; and review how it performs under UK conditions. An evening event organised by the HCNW Region. [www.cibse.org/events](http://www.cibse.org/events)

### Safety in design

11 Feb, WA, Australia

Presented by Alan Meager, GHD. The latest in a line of monthly seminars arranged by the Western Australia chapter of the ANZ Region. [www.cibse.org/anz](http://www.cibse.org/anz)

### Part L and BIM

14 January, Northampton

An evening technical event organised by the East Midlands Region. [www.cibse.org/events](http://www.cibse.org/events)

### BIM: an opportunity for unity

14 January, Leeds

Janet Beckett, from Carbon Saver UK, and Mo Isap, from Hobs Repographics, will be exploring how we can benefit from BIM in our industry. An evening event organised by the Yorkshire Region. [www.cibseyorkshire.org](http://www.cibseyorkshire.org)

### The construction process - a practical step-by-step guide for clients

15 January, London

A full-day event for anyone looking to begin a refurbishment or new build in the near future, and who would like some impartial guidance on how to start. Ten experienced speakers will share their knowledge and experience on the process. Organised by the HCSE Region and the Construction Industry Council. [www.cibse.org/events](http://www.cibse.org/events)

### An introduction to the competitive utility connections market

15 January, Birmingham

An evening event featuring a presentation by Emma Gibboney from Energetics. Organised by the West Midlands Region. [www.cibse.org/events](http://www.cibse.org/events)

### Conex experiences and continuous improvement over the years

15 January, Manchester

A free-to-attend SoPHE event, with presentations from Dave Dickson and Colin Taylor (Conex Banninger). [www.cibse.org/sophe](http://www.cibse.org/sophe)

### Making water work - demystifying water storage calcs

16 January, Ipswich

An afternoon event organised by the East Anglia Region. The technical presentation will be followed by a networking session with wine and cheese. [www.cibse.org/events](http://www.cibse.org/events)

### YEN NW Chartered Engineer workshop

16 January, Manchester

An opportunity to learn about progressing to become a Chartered Engineer. [www.cibse.org/events](http://www.cibse.org/events)

### Mission critical

23 January, Chichester

An evening event to be held at the South Downs Planetarium and Science Centre, organised by the Southern Region. [www.cibse.org/events](http://www.cibse.org/events)

### Noise law and guidance

28 January, London

Noise related planning requirements can have significant cost implications. Richard Collman, from Acoustical Control Engineers, will discuss different approaches to applying noise legislation and his good and bad experiences of working with local authorities. An evening event organised by the HCNE Region. [www.cibse.org/events](http://www.cibse.org/events)

### Wills memorial building site visit

29 January, Bristol

A toured site walk around this historic 24-hour library - with an outline of the difficulties of installing in a listed building (2 star) and the design solutions. An evening event organised by the South West Region. [www.cibse.org/events](http://www.cibse.org/events)

### Society of Light and Lighting Masterclass: Quality UP, Energy DOWN

30 January, Bristol

In the 10th year of the SLL Masterclasses, the

theme will focus on energy reduction in quality lit environments. The five Sponsors in Partnership - Helvar, Thorn, Trilux, Philips and Wila - will each deliver a presentation followed by an SLL guest speaker focusing on daylight. There'll be a chance for a debate following the presentations. [www.sll.org.uk](http://www.sll.org.uk)

### Battle of the blues pool tournament

31 January, Ipswich

A YEN event. [www.cibse.org/events](http://www.cibse.org/events)

### Ventilation technical workshop

5 February, East Anglia

YEN East Anglia holds its first technical workshop of the year featuring a speaker from Elta Fans. [www.cibse.org/events](http://www.cibse.org/events)

## CPD TRAINING

For more information visit [www.cibsetraining.co.uk](http://www.cibsetraining.co.uk) or call 020 8772 3660

### Practical controls for HVAC systems

8 January, Manchester

### Energy strategy reports

14 January, London

### Practical project management

15 January, London

### Delivering operationally-ready buildings

17 January, London

### Mechanical services explained

21 January, Birmingham

### Introduction to building services

21 January, London

### Construction project management

21 January, London

### Electricity at work regulations explained

22 January, London

### Low and zero carbon energy technologies

22 January, London

### Introduction to energy efficiency

28 January, London

### Practical approach to LV fault level analysis

28 January, London

### Fire safety in purpose built blocks of flats

29 January, London

### The commissioning process

29 January, London

### Energy surveys

30 January, London

### Introduction to Legionella control

30 January, London

### Air con 3: Air conditioning plant

31 January, London

## ENERGY ASSESSOR TRAINING

For more information, visit [www.cibsetraining.co.uk/energyassessor](http://www.cibsetraining.co.uk/energyassessor)

### EPC training

28-29 January, London

## CIBSE yacht rally ahoy

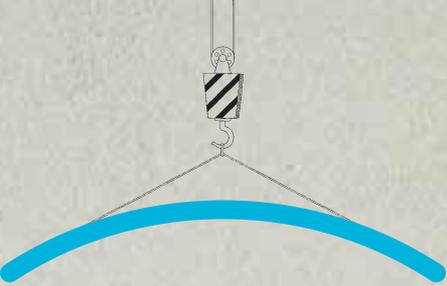


The 2014 CIBSE Southern Region yacht rally will be held on 7 June to coincide with the region's 50th anniversary celebrations.

Following the rally in the eastern Solent, crews will join the wider body of

the institution for an evening dinner on *HMS Warrior* in Portsmouth Historic Dockyard, dining at the mess tables between the guns on *Warrior's* Gun Deck.

The rally is open to all connected with building services. Corporate sponsors and owners of fossil-fuelled craft who would like to offset their emissions - or anybody interested in a place on a boat - should email [d.pope@popeconsulting.co.uk](mailto:d.pope@popeconsulting.co.uk)



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INTERNATIONAL PORTFOLIO



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31 March-03 April 2014, SNEC, Shanghai  
[www.ecobuildchina.com](http://www.ecobuildchina.com)



**ecobuild**

India

9-10 May 2014, Nehru Centre, Mumbai  
[www.ecobuild-india.com](http://www.ecobuild-india.com)



**ecobuild**

Southeast Asia

17-19 Sept 2014, PWTC, Kuala Lumpur  
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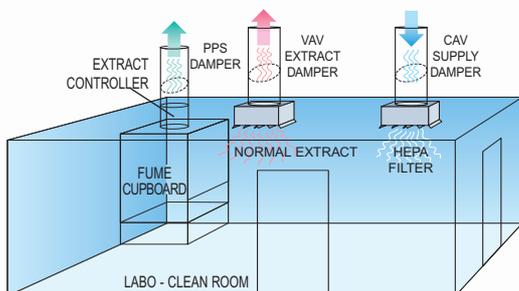


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