CIBSE JOURNAL

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GREENING THE VALLEYS

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Smart moves

The world's governments are in danger of knowingly drifting towards climate disaster. A new report from the Intergovernmental Panel on Climate Change (IPCC), summing up five years of its climate assessments, warns that actions in current plans on climate change are insufficient to stop runaway global warming.

The planet is at around 1.1°C of warming since 1990 and current policies are projected to increase global warming by 3.2°C by 2100, according to the report. It says rising greenhouse gas emissions mean the 'unprecedented' challenge to keep warming to 1.5°C has become 'even greater' over the past five years,

Low carbon technology is becoming more widespread and cost-effective, the report says, with progress around policies and legislation. However, like the boy with his finger in the dyke, the reduction in carbon intensity of energy sources is being exceeded by higher levels of economic activity, leading to more energy demand.

To put the brakes on global warming, the IPCC says a substantial reduction in overall fossil fuel use is required, along with carbon capture and storage, energy conservation and efficiency, and greater integration across the energy systems.

With buildings making up 39% of global carbon emissions, the construction industry and building services engineers have the opportunity, and responsibility, to design and deliver net zero buildings.

Last month, Conservative MP Chris Skidmore, author of *Mission Zero: Independent Review of Net Zero*, announced he was setting up a Mission Zero Coalition to involve more engineers in the policy drive towards net zero. One of the four networks announced so far is a Buildings Mission Zero Network and, on page 15, Skidmore invites engineers to join the coalition.

Some of the challenges of achieving net zero are laid out starkly by Alex Hill, a consultant designing heat pumps in city locations. On page 53, he describes some of the logistical difficulties of fitting heat pumps in tight urban locations, and the issue of limited Grid capacity for all-electric schemes.

Visitors to Futurebuild last month heard about the technologies that could help solve such issues (see page 24). The audience at the keynote speech heard how smart grid technology was reducing peak loads on a large, all-electric St Modwen housing scheme in Birmingham by 50%. St Modwen's chief executive, Sarwjit Sambhi, estimated that, if all new developments had smart grids, the necessary spending on electrical infrastructure in the UK could be reduced by half, saving a colossal £130bn. That's very smart thinking, indeed.

ALEX SMITH, EDITOR asmith@cibsejournal.com

CONTRIBUTORS

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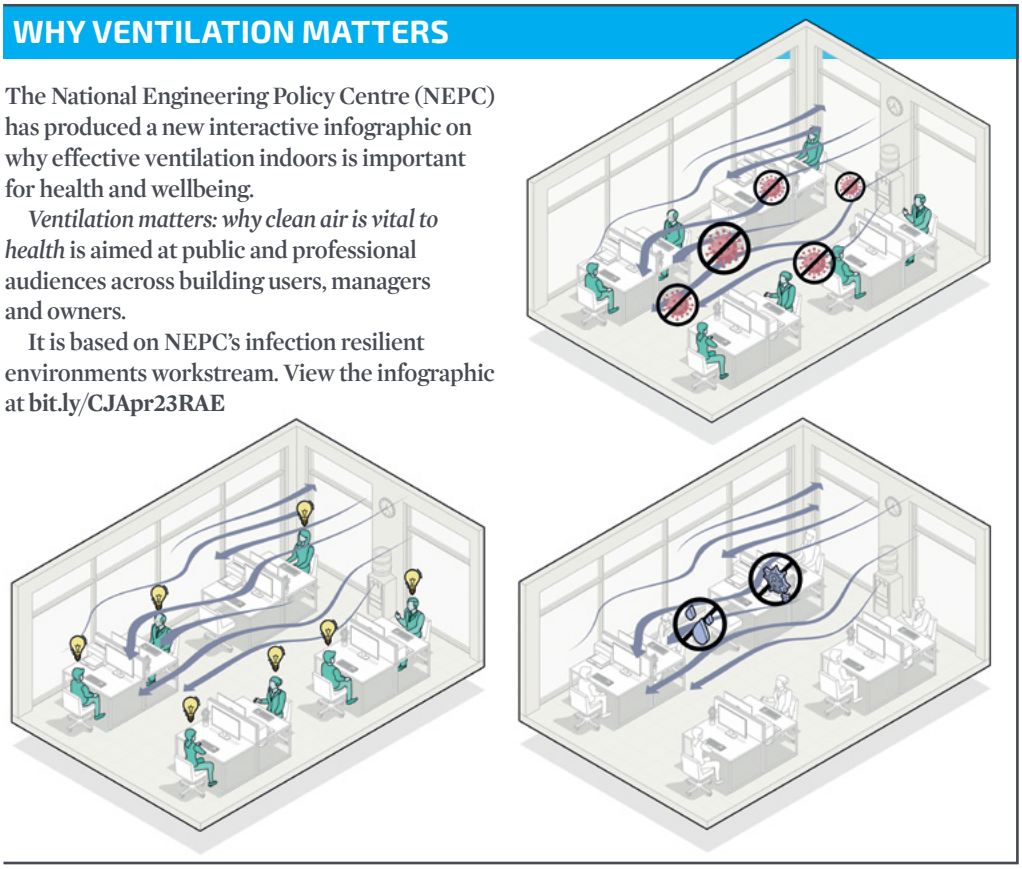
WHY VENTILATION MATTERS

The National Engineering Policy Centre (NEPC) has produced a new interactive infographic on why effective ventilation indoors is important for health and wellbeing.

Ventilation matters: why clean air is vital to health is aimed at public and professional audiences across building users, managers and owners.

It is based on NEPC's infection resilient environments workstream. View the infographic at **bit.ly/CJApr23RAE**



Current climate plans 'won't stop runaway global warming'

IPCC report says challenge has become greater over the past five years

Climate-resilient development is key to preventing runaway global warming, according to the latest report by the Intergovernmental Panel on Climate Change (IPCC).

The report, released on 20 March, is a synthesis of the UN body's work over recent years. It warns that the pace and scale of actions and current plans on climate change are 'insufficient' to tackle the problem.

There is a 'substantial gap' between government commitments to cut emissions, which were announced at the COP 26 UN global climate change summit, and the levels required to limit warming to 1.5°C above pre-industrial levels.

It says a continued increase in greenhouse gas emissions means that the 'unprecedented' challenge required to keep warming to 1.5°C has become 'even greater' over the past five years, since the current round of IPCC reports began.

The concluding document says accelerated action to adapt to climate change is essential to close the gap between existing adaptation and what is needed during this decade.

Keeping warming to 1.5°C above pre-industrial levels requires deep, rapid and sustained greenhouse gas emissions (GHG) reductions in all sectors.

Emissions should be decreasing by now, and will need to be cut by almost half by 2030 if warming is to be limited to 1.5°C, the IPCC warns.

Even a 'limited overshoot' to 2°C would require 'immediate' action and 'deep' global GHG emissions reductions this decade. Governments' existing COP 26 pledges would lead to global warming of 2.8°C by 2100.

The solution, says the report, lies in climate-resilient development that involves the integration of measures to adapt to climate change, with actions to reduce or avoid greenhouse gas emissions.

Designing and planning settlements and infrastructure to achieve greater co-location of jobs and housing will help to mitigate wider warming.

But, adds the report, while low carbon power is becoming 'increasingly cost effective', the reduction in carbon intensity of energy sources is being outpaced by greater demand resulting from higher levels of economic activity.

IN BRIEF

Climate committee backs heat pumps for efficiency

Using hydrogen instead of heat pumps for heating buildings would be a 'much less efficient' use of domestic energy resources, the Climate Change Committee (CCC) has warned.

In last month's report on the decarbonisation of the power system, the statutory climate change advisory body says a reliable and resilient decarbonised electricity system can be delivered by the target date of 2035.

This includes allowing for a 16% increase in electricity consumption by that date, to meet demand.

However, achieving this predominantly from hydrogen, the other low carbon heating option being considered by the government, would rely on imports of natural gas or electricity to manufacture the low carbon fuel.

High levels of hydrogen use outside of the electricity generation power system, such as for heating buildings, are a 'key risk' for meeting future targets, says the CCC.

The report identifies a vital role for hydrogen in providing back-up electricity during periods of low renewable electricity output.

Skill shortage 'putting net zero at risk'

The UK risks falling behind on net zero in part because it lacks the workforce to deliver low carbon developments, according to Chris Skidmore, author of *Mission Zero – Independent Review of Net Zero.*

The Conservative MP for Kingswood, was the keynote speaker at the CIBSE Building Performance Awards last month.

He said: 'How we train a future workforce that can deliver on the climate technologies of tomorrow for low carbon buildings is the main issue in the room.'

He added that the passion and enthusiasm for engineering demonstrated at the awards needed to be engendered in the next generation, and politicians had an important role to play.

'We need to recognise that we have to work together across parties to depoliticise net zero,' said Skidmore.

Last month, Skidmore announced a Mission Zero Coalition including four sector networks, which includes one for buildings and infrastrucutre. He has invited engineers to join (see page 15).

Changes to MEES threaten thousands of commercial buildings

Nearly a tenth of inner London's stock of commercial buildings could be unlawful to let from next month, according to new figures.

An analysis of inner London data from the government's non-domestic EPC register, conducted by BNP Paribas Real Estate, shows that nearly 8% commercial stock is Grade F and G, meaning that it could be unlawful to let from April 2023.

A further 43% could, under proposed changes to MEES (Minimum Energy Efficiency Standard) regulation, be unlawful to let from April 2027 because it is Grade D and E. This means that more than half of inner London's total commercial stock could be barred from letting from April 2027 (Grades D, E, F & G).

A further 26% or so is rated C and could therefore be unlawful to let from April 2030.

Only 23% of inner London commercial stock is rated A+, A, or B and currently fully MEES-compliant, according to current legislation.

Replace EPCs and update SAP for homes, says report

Future Homes Hub report calls for heat pump competency schemes

Government should update the SAP system for assessing and comparing the energy rating of residential dwellings ahead of the planned 2025 introduction of its Future Homes Standard (FHS), according to a wide-ranging new report.

The Future Homes Hub has released its *Ready for Zero* report, which brings together evidence from across the industry to help inform development of the FHS for new homes in England.

The report outlines 26 recommendations. These include early provision of a stable and consistent version of SAP11 'at least six months' before FHS comes into force in 2025.

Authors of the report say delays to SAP 10, following 2021's update of building regulation, have caused 'major issues' to the sector.

The report also recommends the introduction of a Home Energy Performance Calculator Supplement or the replacement of the Energy Performance Certificate with a web calculator, using SAP11, to give householders personalised projections of expected energy bills for new and existing homes.

It goes on to say that once further consultation on the FHS has concluded – expected to be in later this spring – key decisions should be 'rapidly' announced and in 'sufficient detail and clarity to enable the industry to confidently plan and prepare'.

The report recommends the formation of interest groups on airtightness, heat pumps, energy and ventilation, and the establishment and enforcement of competency schemes for design and installation.

In addition, new design standards should be developed for heat pump systems.


The energy rating system must be updated ahead of the planned Future Homes Standard, says a report

Government announces heat pump training grant

The government is offering £5m worth of heat pump training grants. The Department for Energy Security and Net Zero has announced that the new grant will support 10,000 trainees over the next two years.

The £500 Heat Training Grant will cover most of the cost of a Level 3 heat pump maintenance and installation course, which takes around a week for an experienced installer to complete.

In addition, heating manufacturers including Baxi, NIBE, Panasonic, Vaillant, Ideal Heating and Worcester-Bosch are expected to offer additional discounts to participating trainees.

These benefits could be worth up to a further £500 in product vouchers, additional training and other support.

Trainees must demonstrate competence in the sizing and selecting of low-temperature heating systems to receive the grant. They will typically also have an existing Level 2 or 3 qualification in plumbing or heating engineering.

The grant is part of a package – worth more than £14m – designed to accelerate the installation of heat pumps across the country.

Gove set to bar developers who don't fix unsafe buildings

Eleven developers fail to meet initial deadline to sign remediation contracts

As *CIBSE Journal* went to press, the government was on the verge of publishing details of its new scheme barring developers from new projects unless they have agreed to fix unsafe buildings that they have built or refurbished.

Michael Gove, Secretary of State for Levelling Up and Housing, had given developers until 13 March to sign the developer remediation contract. A total of 39 developers, including the UK's 10 biggest volume house builders, signed the agreements in time, which the levelling up department says will raise at least £2bn for meeting remediation costs.

The signatories are required to fix all life-critical fire-safety defects in all buildings in England above 11 metres tall that they had a role in developing or refurbishing.

The contracts also require them to reimburse the taxpayer where government funds have already paid for remediation.

Eleven developers failed to meet the 13 march deadline to sign the contract, and were named by Gove. Lendlease, Ballymore, London Square, and Telford Homes have since signed but as the *Journal* went to press Abbey Developments, Avant, Dandara, Emerson Group (Jones Homes), Galliard Homes, Inland Homes, and Rydon Homes had not done so. Those refusing to sign will be prohibited from carrying out major developments or receiving building control approval for projects already under way, under powers in the Building Safety Act 2022.

Developers that sign the remediation contracts will be eligible to join the government's Responsible Actors Scheme, the details of which were due to be published in the week that the *Journal* went to press.


Michael Gove

Announcing the latest steps in the drive to improve building safety, Gove said those developers yet to agree the contracts would be given 'a little leeway' to sign up.

The Secretary of State also told the Commons that he would be writing to major investors in the firms that have not signed to explain the commercial implications of their directors' current decisions.

Gove said: 'Those developers that have failed to sign the contract without good reason, let me be very clear – we are coming after you. If you do not sign, you will not be able to operate freely in the housing market. Your investors will see that your business model is broken – only responsible developers are welcome here.'

IN BRIEF

Hunt extends energy subsidy until July

Chancellor Jeremy Hunt has announced that the government's Energy Price Guarantee (EPG) subsidy will be kept at its current level for another three months.

Ahead of his first Budget last month, the Chancellor confirmed that the EPG will remain at an annual average level of £2,500 until July. He had previously announced that the EPG would rise to £3,000 in April.

Ofgem's price cap for April to June, which sets the rate for default tariffs, will still be £3,280. This is the maximum consumers would pay if the EPG was not in place.

Lower wholesale gas prices are expected to drive down the level of the price cap to £2,100 a year for a typical household from July onwards, consultancy Cornwall Insight has estimated.

Training grant pledged for building control

The UK government has announced a £42m funding package to support the implementation of the new Building Safety Act.

The package includes a £16.5m grant to Local Authority Building Control, and £26m to support the fire and rescue services in England and the National Fire Chiefs Council.

The funding will enable local regulators to recruit, train and employ new building control inspectors and fire inspectors.

They will support the work of the new Building Safety Regulator in overseeing the safety and standards of the design, construction and management of higher-risk buildings.

Action wanted on non-compliant pumps

The government has been urged to clamp down on the 'swarm' of non-compliant central heating pumps being imported into the UK, which could leave consumers out of pocket.

Heat pump manufacturers are concerned that 100,000 such pumps are being sold in the UK every year. Steve Schofield, chief executive of the British Pump Manufacturers Association, said: 'It is a swarm; it is blatant and it is now over-the-counter. Once fitted, they are costing consumers hundreds of pounds every year on their heating bills, and it is seriously impacting the UK's ability to meet its net zero obligations.'

The imported pumps use old-style AC motors, which are less than half the price of those with microchips. However, they use around three times as much electricity. Wholesalers have been encouraged to source non-compliant products by restrictions in the supply of microchips, said Schofield, who added: 'We have been very lax in the UK in terms of policing the market.'

Heat pumps three times more efficient than boilers

Monitoring reveals high efficiency of air source heat pumps, even in cold weather

Air source heat pumps (ASHPs) are three times more efficient than gas boilers and are effective even on very cold days, according to new data.

As part of the government-funded Electrification of Heat Demonstration Project, Energy Systems Catapult (ESC) monitored 742 heat pumps, installed in a broad spectrum of housing types and ages, between November 2020 and August 2022.

Results show that the ASHPs' real-world performance has increased significantly compared with past trials. The Seasonal Performance Factor, which indicates in-situ efficiency of a heat pump system over the course of 12 months, was 2.80, an increase of 0.3-0.4 since trials undertaken between 2011 and 2014.

According to ESC's analysis, innovation in heat pump systems is probably a leading factor in this improved performance.

The demonstration project also found only a 'marginal' decline in ASHP performance on some of the UK's coldest days, when mean daily temperatures fell to as low as -6°C. Median system efficiency in these conditions was 2.44, indicating that the devices continued to operate at high efficiency and provide the requisite heat in a wide range of property types.

Manufacturers warn of F-gas threat to heat pump growth

European vote brings forward phasedown of refrigerants in heat pumps

An accelerated phaseout of fluorinated gases (F-gases) would 'significantly limit' the availability of heat pumps in some markets, according to European heat pump manufacturers.

The European Parliament's Committee on the Environment, Public Health and Food Safety (Envi) voted last month to ban F-gases by 2050, with stiffer targets for heat pumps and air conditioning units. The text adds staggered dates for bans on the use of F-gases for sectors in which it is 'technologically and economically feasible' to switch to non-F-gas alternatives, such as refrigeration, air conditioning, and heat pumps.

The European Heat Pump Association (EHPA) said Envi's position fails to consider current manufacturing and installation capacity. It said: '[The decision] risks significantly limiting the number of heat pumps available in certain market segments, pushing consumers back to fossil fuels.'

The EHPA is urging the EU not to put obstacles in the way of heat pump adoption

Thomas Nowak, secretary general of the EHPA, said: 'MEPs should not slam down both the accelerator and the brake pedals at once. The EU needs to decarbonise and get off fossil fuels in heating. It has recognised heat pumps as the solution – so the road ahead needs to be cleared of obstacles, not blocked off.'

The report was scheduled to be adopted in the European Parliament as the *Journal* went to press. It will constitute its negotiating position with EU governments on the final shape of the legislation.

EU: zero-emission buildings from 2028

The European Parliament has adopted new rules stipulating that, from 2028, all new buildings should be zero-emission and equipped with solar technologies where feasible. There is a stiffer 2026 deadline for new buildings occupied, operated or owned by public authorities.

MEPs voted by 343 to 216, with 78 abstentions, to endorse a revision of the Energy Performance of Buildings Directive, which aims to substantially reduce greenhouse gas emissions and energy consumption in the EU building sector by 2030, and make it climate-neutral by 2050. The directive also says member states should phase out plans for fossil-fuel use in buildings by 2035 and sets out tougher emissions targets for buildings undergoing major renovation.

MEPs will now enter into negotiations with the EU member states' Council of Ministers to agree on the final shape of the bill. Jozefien Vanbecelaere, head of EU Affairs at the European Heat Pump Association, said: 'Today is a huge step towards decarbonising buildings. National governments can now make them healthier and more affordable for all.'

IN BRIEF

Sand helps cool tropical buildings

Overheating in tropical buildings could be reduced by using walls built from recycled, sand-filled plastic bottles, according to research published in the journal *Building and Environment*. The study, which compared the 'bottle house' with four that were built using traditional mud and sandcrete walls in the Nigerian capital of Abuja, showed that it overheated in 30-46% fewer hours. Overheating occurred in all houses, but was lowest in the bottle house, which was 0.8°C to 2.4°C cooler than traditional dwellings. On the day with the highest maximum outdoor temperature (38.2°C), the bottle house was the coolest dwelling during night-time sleeping hours.

CPW continues East Midlands growth

CPW has continued its expansion in the East Midlands following the recruitment of 24 new starters, nearly doubling its headcount in the region. The sustainability and M&E firm's offices in Leicester, Derby and Nottingham now boast more than 50 members of staff, an increase of almost 100% in the past 12 months. Appointments have ranged from graduates to senior professionals. Carl Hubbard, director and Nottingham office co-lead at CPW, said the new additions will 'further solidify' the company's presence in Derby, Leicester and Nottingham, where the company opened a new 3,500ft² office space late last year.

IN BRIEF

New membership benefit: CIBSE Mentoring

CIBSE members can now browse the new online CIBSE Mentoring directory to connect with a mentor. Currently, more than 100 mentors are registered.

To find the most appropriate one, members can define a professional goal on which they want to focus and filter their search by region, experience and contact method.

Mentors can provide personalised advice to navigate the industry, support career growth, and help members achieve professional registration.

Find out more at **www.cibse.org/training/cibse-mentoring**

This new membership benefit is only available to current members. You can reinstate your CIBSE membership if it has lapsed by paying the subscription fees on your **MyCIBSE** account. If you want to become a member of CIBSE, you can join via **our Affiliate grade**.

Diary of an ASHRAE attendee

Jake Lenahan, CIBSE Young Engineers Network/Young Engineers ASHRAE (YEA) liaison rep, has created a blog of his experiences while attending the ASHRAE winter conference in Atlanta in February.

Highlights of his trip included: meeting other members of the YEA committee at a dinner on his first evening; attending his first YEA committee meeting and learning more about how it is run and the importance of collaboration between CIBSE and ASHRAE; a YEA Student Mixer; and a tour of the Kendeda Building, one of the only 'living buildings' in Georgia.

The packed itinerary provided Lenahan with valuable experiences and he hopes to continue to promote collaboration between the two institutions.

Read his blog at **bit.ly/CIBSEblog**

In memory of Paul Yunnie

Former CIBSE Heritage Group vice-chair was MD of Andrews Water Heaters

It was with great sadness that the CIBSE Heritage Group and his friends and colleagues in the industry learned of Paul Yunnie's death in February, in Sydney.

Paul was born in Southampton, but lived for many years around Worcester before moving to Australia. He was vice-chair of the Heritage Group from 1985 until 2006, and was awarded the CIBSE Silver Medal in 1998 for organising the CIBSE centenary publication, *The quest for comfort*.

Paul arranged group visits and lectures, including the Christmas Lectures, and organised the publication of *HVCA@100* in 2004 for the then Heating & Ventilating Contractors Association. He was chair of The Rumford Club in 2001.

During Covid lockdown in 2020, Paul researched and wrote the definitive book titled *The Gurney Stove – A Victorian icon & the London Warming and Heating Company*.

He was managing director of Andrews Water Heaters, which sponsored the Major M&E Contractor of the Year Building Services Award. He served on the Institute of Gas Engineers Panel for the History of the Industry, and as chair of the Historical Committee of ASHRAE. He later took on the role of business development manager for Haden Australia and, in 2006, wrote its story in *A history of an engineering enterprise*. His significant contributions to the Heritage Group and our industry will not be forgotten.

By Brian Roberts, former chair and archivist of the CIBSE Heritage Group.

Paul Yunnie loved the history of HVACR

- Roderic Bunn, building performance analyst, said: 'Paul was a friend to everyone he met. Nothing was too much trouble for Paul. He helped me raise money for the CIBSE Benevolent Fund and Registered Engineers for Disaster Relief.'
- Bern Nagengast, past member, chair and consultant to ASHRAE Historical Committee, said: 'Paul shared a real enthusiasm for HVACR history and had a true love for it. I admired his encyclopaedic knowledge.'

Remembering Ron Simons

Ron Simons

The Society of Light and Lighting (SLL) is saddened by the death of Ron Simons, past chair of the CIBSE Lighting Division, who died in February at the age of 93.

Ron was chair of the CIBSE Lighting Division (previously the Illuminating Engineering Society and now the SLL) in 1992. He was involved in the SLL events committee for many years and was the recipient of the Lighting Award in 2002.

Ron also contributed to the SLL's *Lighting Research & Technology* journal, and, in 1962, authored a publication for a series known as the IES Monographs. His publication was No. 5: *Factors governing the light output ratio of lighting fittings*. Ron also co-authored *Lighting engineering: applied calculations* with past president Bob Bean.

Hugh Ogus, past chair of CIBSE Lighting Division, said: 'I always enjoyed working with Ron. It was always a pleasure to see him and he will stay in my memory as a gentle man, highly intelligent, focused, and good company.'

SLL past president Mike Simpson, said: 'I remember working for Ron at Thorn, when I was a student, in 1976. He was always very supportive of those of us students studying lighting. Later on, we worked closely on the British Standard for road lighting. Ron was one of those who gave my early career direction, and for that I will always be grateful."

Iain Macrae, SLL past president, said: 'He gave me my first laboratory job while I was still at university. Always a gent, he will be sadly missed.'

CIBSE President Kevin Mitchell (4th from right), flanked by Ruth Carter and Dr Hywel Davies, with Hong Kong Region officers

CIBSE President's tour strengthens global ties

CIBSE Hong Kong Awards launched during tour, which also visited New Zealand ministry

CIBSE President Kevin Mitchell visited Hong Kong, Australia and New Zealand (ANZ) last month, to meet with members and gain a deeper understanding of how CIBSE can best support them and forge stronger relationships.

CEO Ruth Carter and chief technical officer Dr Hywel Davies were also on the tour, which coincided with the CIBSE Hong Kong Region AGM on 7 March. The AGM celebrated the achievements of outgoing chair TC Chan, and welcomed incoming chair Gary Chiang, who – in addressing the AGM – focused on growth for the region and welcomed opportunities for collaboration.

The 2023 CIBSE Hong Kong Awards were also launched at the meeting. These build on the success of the CIBSE Building Performance Awards, celebrating building services engineering in delivering efficiency, quality and safety, and reducing operating costs, for the benefit of business and society.

Hong Kong is CIBSE's largest international region, with more than 2,800 members. For more information, visit **cibse.org.hk**.

The presidential trip then moved on to the ANZ region, and a meeting with the Ministry of Business, Innovation and Employment, in Wellington, New Zealand, to discuss how CIBSE can support professional registration.

It was a topic also discussed in Sydney, Australia, where the tour party met with Romilly Madew, CEO of Engineers, Australia, and Evelyn Storey, board member of the Professional Engineers of Queensland.

The visitors also attended the CIBSE ANZ AGM, where Mark Crawford handed over the role of ANZ regional chair to Phil Senn. Mitchell delivered a short address, reflecting on his presidential year to date. Referencing the CIBSE 125 Challenges, he praised the regional committee for its support, in particular on the work that CIBSE ANZ is doing with Future Australia, which matches teachers and volunteers, enabling them to share knowledge and experience.

The President commented on the changes to CPD requirements in Australia and New Zealand earlier this year, and CIBSE's commitment to supporting members in meeting these following the launch of the new mycareerpath online portal.

Outgoing regional chair Crawford thanked the committee and ANZ members for their support since he took up the post in February 2020. He highlighted that CIBSE is now accredited to assess engineers for professional status within Queensland, with plans to apply for this status in other states, including New South Wales (NSW), Victoria and Western Australia.

The CIBSE tour party also spoke at several technical events, and attended the NSW technical seminar, focused on cladding fire-risk management, sharing insights on the Building Safety Act and regulatory reform. During the event, Mitchell presented ANZ regional treasurer Mat Klintfalt with a CIBSE Bronze Medal.

Mat Klintfalt (left) receives his Bronze Medal from CIBSE President Kevin Mitchell

IN BRIEF

Wanted: responses to WLCA consultation

The Royal Institution of Chartered Surveyors (RICS) is seeking responses from CIBSE members to its consultation on the second edition of its Whole Life Carbon Assessment (WLCA).

Created by RICS in consultation with other professional bodies, including CIBSE, the WLCA is set to be one of the leading standards for carbon measurement in the built environment.

RICS is consulting on the second edition and values the views of industry professionals involved in all phases of construction projects.

For more information and to respond to the consultation, visit **https://bit.ly/CJApr23WLCA**

Façade awards focus on sustainability

The Façade 2023 Design and Engineering Awards are now open for entries.

Prioritising sustainability, this year's accolades include Project of the Year (UK and international) – Sustainability, while other categories cover new build, refurbishment, and innovation.

Sponsored by Patrick Ryan Associates, which also sponsors the UK New Build category, the awards recognise and reward excellence and achievements in façade engineering, as well as the next generation of engineers with the Young Façade Engineer of the Year category.

The awards dinner will take place on 8 November 2023, at the Hilton Park Lane, London, and will again be co-located with the Zak World of Façades London conference. For more information and to enter, visit **facade.awardspro.co.uk**

Clarification: Code of Professional Conduct

In the article 'Who's standing up to inequality' in the March issue of the *CIBSE Journal*, the text suggests individual CIBSE Members can revise the code. This is incorrect. Maintenance of CIBSE's Code of Professional Conduct is solely within the purview of CIBSE's Professional Conduct Committee.

Papers announced for the CIBSE ASHRAE Technical Symposium 2023

Highlights will include research on district heat networks from London South Bank University and the findings of Aecom's Building for 2050 project

Presentations on district heat networks and low carbon homes will headline the annual CIBSE ASHRAE Technical Symposium on 20-21 April, at the University of Strathclyde in Glasgow.

Supported by ASHRAE, the symposium's theme is 'Delivering sustainable, safe and healthy buildings for a net zero future', and it will feature peer-reviewed papers and presentations showcasing the latest in practice, technology, and policy.

Highlights from the programme include a paper by researchers from London South Bank University that examines district heat networks and the alternatives to combined heat and power systems. The research is


University of Strathclyde

geared to overcoming barriers to the broader deployment of low-carbon heat networks in the UK.

Similarly, Aecom will give a paper on its Building for 2050 project, which aims to identify drivers and barriers to the large-scale construction of low-cost, low carbon homes, to try to increase uptake.

Former ASHRAE regional chair Ben Skelton will present his paper on the decarbonisation of industry logistics centres, presenting a case study that benchmarks typical designs for various industrial buildings, including cold storage. 'Much of the discussion applies to other buildings often overlooked in net zero design discussions, such as retail, small office and light commercial,' Skelton said.

Gold sponsors of this year's symposium are Elco Heating Solutions, Hamworthy Heating, and Swegon.

CIBSE President Kevin Mitchell said: 'CIBSE is committed to supporting researchers who are informing the future of our industry and the built environment.

'The symposium provides a platform for researchers and engineers to learn from each other, sharing their work and expertise in delivering a safe, healthy, and sustainable future.'

- **For more information and to register for the symposium, visit bit.ly/Techsym23**

Join our mission to net zero

To realise the ambition of the Net Zero Review, MP Chris Skidmore is calling on engineers to join the Mission Zero Coalition for Buildings and Infrastructure to help build a regulatory framework to promote sustainability

Achieving a net zero carbon emissions trajectory is a crucial goal in the fight against climate change. The UK's 30 million buildings are responsible for 30% of our greenhouse gas emissions. The built environment and construction activity are significant contributors to carbon emissions in the UK.

It has been estimated that around 43% of UK emissions are from the built environment (both buildings and infrastructure), mostly from the heat and energy that buildings consume, but also from the production of energy-intensive products and materials that are widely used within the industry, such as concrete.

As the buildings industry is responsible for a significant portion of global emissions, engineers and industry professionals have a vital role in achieving the UK"s net zero target.

The Net Zero Review recognised this and provided a range of recommendations for reducing emissions from buildings and infrastructure.

"As the building industry is responsible for a significant portion of global emissions, industry professionals have a vital role to play"

Improving the energy efficiency of buildings

In the Net Zero Review, we found that it was the government's responsibility to establish a comprehensive national programme to retrofit existing buildings, which included the option of providing financial incentives to households and businesses to make those vital upgrades.

Additionally, the review called for a new buildings standard to be implemented with the highest possible energy efficiency standards, with a minimum Energy Performance Certificate (EPC) C rating by 2033.

There are many issues with the EPC rating system, which is why government urgently needs to create a new Net Zero Performance Certificate (NZPC). Net zero homes are the only homes of the future, and the fact that homes are allowed to be constructed now that will have to be retrofitted in just a few years time is a national scandal.

From artificial intelligence (AI) to insulation, the review found that the development of new energy-efficient technologies, such as carbon capture and storage and smart energy systems, would be key to achieving net zero goals.

The review recommended the government accelerate the transition away from fossil fuel heating systems, such as gas boilers, by promoting the use of low carbon alternatives, such as heat pumps and district heating systems.

Both government and the private building sector have a responsibility to employ and encourage the use of renewable energy technologies, such as solar panels and wind turbines.

This is especially prevalent for residential buildings and factories, both of which currently face incredibly detrimental planning frameworks and red tape. As is so often the case, government needs to get out of the way of the private sector and allow the natural adoption of these technologies, which will undoubtedly foster a solar rooftop revolution.

Another critical aspect of achieving a net zero carbon trajectory is the need for collaboration between industry stakeholders, policymakers and community organisations.

The opportunity to achieve net zero through decarbonisation of buildings requires an end-to-end approach that recognises the need to reduce emissions and the carbon content of buildings, from materials and construction through to the maintenance, retrofit and installation of energy efficient and low carbon insulation and heating systems.

During the review, we heard that the government's *Heat and Buildings Strategy* does not go far enough to ensure all households benefit from the transition: long-term support to low-income households with upfront capital costs, electricity rebalancing, electric vehicle charging price, and access to finance.

I have set up the Buildings & Infrastructure networks for the Mission Zero Coalition. This coalition will be dedicated to bridging the information gap by working with communities to promote sustainable building practices and encourage the adoption of renewable energy systems.

Engineers will also be able to work with policymakers to develop building codes and regulations.

Buildings services engineers and the construction industry have a crucial role to play in helping to achieve a net zero carbon trajectory as the world moves towards a sustainable future.

If you would like to get involved in the coalition, please get in touch at secretariat@missionzerocoalition.com

CHRIS SKIDMORE is the Conservative MP for Kingswood and author of *Mission Zero: Independent Review of Net Zero*

Transition time

The property sector is on the cusp of a tsunami of change with building safety reforms, net zero carbon transition and the renewed focus on damp and mould in social housing. Hywel Davies considers the implications

As you read this column, the Building Safety Regulator is on the brink of coming into operation, along with the reforms under the Building Safety Act. The new register of higher-risk buildings (HRBs) opens on 1 April and all existing HRBs must be registered by 30 September this year. Other new provisions will come into effect later this year that will create new duties for construction and design professionals, accountable persons, building control professionals, and clients – in other words, for most UK readers!

The Climate Change Act requires our homes and buildings to be net zero carbon by 2050. New homes will not be on the gas grid from 2025 and targets are being put in place for the energy efficiency of the existing rented building stock. We need to upgrade around 27m homes to the requirements of net zero.

We have unfinished business from the pandemic and the Awaab Ishak case around effective ventilation of many buildings. Readers know the challenges of balancing energy efficiency and effective ventilation to avoid damp problems and maintain good indoor air quality in our homes. There are challenges for us all on multiple fronts.

"We have entered a period of unprecedented change in our industry. There is no time to lose"

On 22 March, the new Building Safety Regulator held its inaugural building safety conference. The new regulator presented to around 1,000 delegates on the important changes that will come into effect under the Building Safety Act, starting this month.

With registration of higher-risk residential buildings now open, it was a chance for accountable and principle accountable persons to develop their knowledge of what is now required of them and their organisations under the new regime for regulation of higher-risk buildings in occupation.

The conference also heard more about the changes due to come into effect later this year, with various new roles and responsibilities for clients, construction and design professionals, accountable persons and building control professionals.

It was made clear that the industry needs to step up and take action to prepare for the new regime now, not wait to be told what to do and how to do it.

For anyone in any doubt that the new regime means a sea change, on the day of the conference the Health and Safety Executive (HSE) issued a press release reporting on the outcome of a prosecution over a building failure that left a Derbyshire worker with life-changing injuries[1]. The property owner has been given a community order after a father of two sustained horrific injuries when a wall collapsed on top of him during a barn conversion. Nigel Edwards failed to have a structural assessment of the outbuildings carried out when planning for the project at his home. They were being converted into holiday-let accommodation when the wall collapsed. For those tempted to think that the Building Safety Act is all about high-rise flats, this case – and the timing of the news release– should make them think again.

This case was brought against the client under the Construction Design and Management Regulations. The Building Safety Act extends the duties of clients to all aspects of regulated building work. Those tempted to ignore this do so at their peril. And not just client duties, but designers and contractors too. It is all part of the drive to refocus on safety and quality, not just cost and time.

These requirements apply in England, but building safety and net zero are global challenges. Building safety is a major issue in Australia and New Zealand.

The ongoing investigation into the Champlain Towers collapse in Florida has global implications for management of older high-rise structures. It is being watched closely by the authorities worldwide.

The latest IPCC Assessment Report[2] reminds us yet again of the urgency of tackling carbon emissions and the importance of the net zero carbon building standard.

We have entered a period of unprecedented change in our industry. There is no time to lose.

Day two of the CIBSE Scotland Conference will focus on the Building Safety Act as it applies to Scotland: **bit.ly/CJAprHD3**

DR HYWEL DAVIES
is chief technical officer at CIBSE
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References:

1 Property owner sentenced after builder suffered life-changing injuries, HSE, March 2023 **bit.ly/CJApr23HD1**

2 AR6 Synthesis Report, IPCC, March 2023 **bit.ly/CJApr23HD2**

FEEDBACK

Empowering women

Further to last month's feature on gender equality, after a chance meeting I mentored a woman onto two charterships. She is now a very good friend. Exchanging strong views in good humour, we can talk about anything, except equality, diversity and inclusion (ED&I) in the built environment industry. In her career she experienced repeated, unwelcome sexual advances and ED&I is still a powerful trigger for her. She felt commodified, objectified, stereotyped. She dreaded the subject coming up in her chartership interviews, fearing she would explode. Fortunately, the answers we prepared weren't needed.

After several years of reflection, we've shared a conclusion that ED&I isn't about diversity. Its strands revolve around the exercise of power, and someone's informed consent to have power exercised over them. Some say that psychological safety has much more influence over business performance than simply achieving diversity.

Chris Jones FCIBSE

Digging in

I have recently completed or have in progress the installation of about 5MW of new gas boiler plant in residential premises, where it would be impossible to install heat pumps.

I have firsthand experience of dealing with the renewal of supplies from local electricity grids in London, which are already overloaded in many parts, partly because of the evolution of shops into restaurants needing huge supplies. This can be remedied only by digging up all the streets of London, or by the installation of numerous new sub-stations.

Where, however, are all the new sub-stations to be located to mitigate the incapacity and age of the street mains, and who will pay for them? Is the high-tension grid (voltages above 1,000 volts) capable of supplying the sub-stations or do the streets have to be dug up to expand the grid?

There are battles looming with local authorities where proposals have been drawn to cover the roofs of listed buildings with heat. A case in point is a project in Portland Place requiring about 350kW of new boiler plant, for which I did a study into the application of heat pumps using commercially available kit.

The roof would not take the weight without major restructuring and alterations to demised areas, not least for the works, but also for subsequent, safe access to the plant. I didn't bother to make a planning enquiry, knowing how Westminster City Council would react to the violation of local conservation and listed-building regulations.

The impression is increasing among the populace and managing agents that all you have to do is change the boilers for heat pumps, without a moment's thought as to the technical and logistical difficulties that engineers such as myself have to address.

Can we please see a more balanced dialogue on the subject, such that the politicians are properly educated and a realistic course adopted for the progressive reduction of CO_2, while we wait for nuclear and wind-sourced energy to be fully developed.

Robert Dwyer, MCIBSE

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or write to: Alex Smith, editor, *CIBSE Journal*, CPL, 1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PB, UK.
We reserve the right to edit all letters.

Impact of Act is starting to show

The Building Safety Act requires that projects engage with specialists at an early design stage to ensure safety is baked into the scheme. Exyte's **David Fitzpatrick** says he sees evidence of this in the smoke control industry

Over the past month, I have been lucky enough to witness some of our industry's work from staying at Battersea Power station and looking at the different fantastic styles of buildings created.

They have modernised the power station, but managed to keep the history. I have also attended the CIBSE Building Performance Awards and the CIBSE HVAC group AGM, where they had some shortlisted projects and people talking about these in more detail and what the Engineers of the Year have been doing.

I mention this because, when you are involved in the day-to-day demands of a project, from design and construction, you spend your time solving the project's challenges and not spending time celebrating what has gone well. Why is this?

The end product we construct is often excellent, but the journey to get there can be hard work. Is this down to the years of projects being 'build and design' rather than 'design and build'? Often, the design has been going on while the concrete is being poured.

With the Building Safety Act and the golden thread, are we starting to change this mindset so that, in future – before M&E contractors and their subcontractors step on site – a large percentage of the design has been completed? Ideally, this would mean everybody knowing what is required from them and what products are being installed to meet the latest legislation.

From a smoke-control perspective, we are seeing much earlier engagement with the design teams, and the detail of components requirements, and approvals of such items, are much better recorded because of the principles of the golden thread.

An excellent example of this is being asked to get involved with the architect, contractor and the fire engineering company after the initial fire strategy has been written, but before the CFD modelling has been done. It means we can assess the different options available and look at some of the key issues on the building, such as positioning of doors and whether the structure impacts the design. This allows some of the site issues to be resolved right at the start of the project.

However, we are not there yet, as all parties still require more knowledge, and we cannot afford to stop pushing. Looking forward, maybe we will still create fantastic buildings with fewer challenges.

DAVID FITZPATRICK is director at SfS business unit, Exyte Hargreaves, and an elected CIBSE Board member

Housing and hardship

Households hit hardest by the cost-of-living crisis are those most likely to live in unhealthy homes. UCL's Professor Anna Mavrogianni considers the relationship between the built environment and health inequalities

There is increasing recognition of the role the built environment plays in people's health and wellbeing. A wide range of health determinants is contingent on the quality of the built environment, including neighbourhood conditions, green infrastructure, and outdoor and indoor environmental quality.

It is expected that health inequalities will be exacerbated by the ongoing cost-of-living crisis. A hike in energy prices, a reduction in disposable income and low thermal efficiency levels of the housing stock mean almost a quarter of UK households are now facing fuel poverty, with large families, lone parents and pensioner couples most affected.

Beyond the impacts of rising fuel costs on health and wellbeing, there are also interactions between building energy efficiency and building services, financial choices, occupant behaviour, indoor air quality (IAQ), and comfort.

One example is the increase in mould risk because of reduced heating. English Housing Survey assessments say that damp and mould risk is almost four times higher for the poorer quintile group compared with the wealthiest group.[1] Another example is the emerging trend of switching to solid-fuel heating. The rapid rise in domestic burning of solid fuels, such as wood, for heating can cause outdoor and indoor air quality to deteriorate.

Currently, there is lack of financial mechanisms to support the installation of energy efficiency measures. According to a recent letter by the Climate Change Committee (CCC), the number of government installations of energy efficiency measures fell from 2.3 million a decade ago to fewer than 100,000 in 2021.

While it is imperative we decarbonise our building stock, single-focus policies can potentially lead to unintended consequences if other aspects of building performance are neglected. As buildings become more thermally insulated and airtight in the path towards net zero, 'unintended ventilation' air exchange paths will be diminished. Unless energy efficiency interventions are combined with sufficient means of controlled ventilation, this could lead to air pollutants and heat trapped indoors.

A recent BMJ paper called for empirical longitudinal data to be collected in energy efficient buildings, to quantify the effects of low carbon measures on health and inequalities.[6]

"46% of the most deprived London areas experience NO_2 concentrations above recommended EU limits"

The effects of outdoor air pollution are not equally distributed: it is estimated, for example, that 46% of the most deprived London areas experience NO_2 concentrations above the recommended EU limits; thresholds are exceeded in only 2% of the least-deprived areas.

Although the distribution of indoor air quality exposures across building types and socioeconomic groups was less understood until recently, research studies have demonstrated that households of low socioeconomic status are exposed to higher levels of indoor air pollutants on average. This may be the result of overcrowding or solid-fuel cooking causing increased particulate matter, or the use of lower-quality consumer products that may emit volatile organic compounds. Lower-income households may also live in lower-quality housing where ventilation systems are not repaired regularly.

This summer, the UK experienced an unprecedented 40°C heatwave and, across Europe, the hot spell caused more than 20,000 excess deaths. The effects of extreme heat can hit the most vulnerable the hardest. Older people and individuals suffering from ill health are generally most at risk, but social isolation and low income can also limit one's capacity to identify a hazard and reduce exposure.

Poorer households may have lower thermal-adaptive capacity, as they may have limited access to cool spaces and be less able to afford to modify their surroundings through retrofit or air conditioning.

The potential of natural ventilative cooling may be less in lower-income neighbourhoods, where concerns about crime, noise and traffic-related air pollution may hinder window opening. Although fuel-poverty research and policy generally refer to winter, summer fuel poverty may soon become a significant issue too. A recent CCC-commissioned report by Arup found that the cost of implementing passive cooling measures in existing homes is appreciable.

Integrating health, wellbeing and equity with net zero goals and building safety is critical to achieving a healthy and sustainable built environment for all.

References

Please see this article at **www.cibsejournal.com**

ANNA MAVROGIANNI is professor of sustainable, healthy and equitable built environment at the Bartlett's UCL Institute for Environmental Design and Engineering (IEDE) and a member of the CIBSE Health and Wellbeing working group, chaired by Dr Milena Stojkovic (Foster + Partners) and Dr Marcella Ucci (UCL IEDE)

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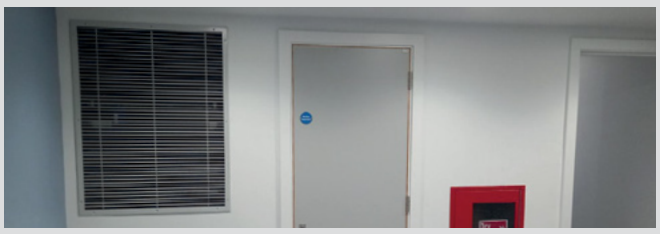

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GETTING REAL WITH RETROFITS

To meet its net zero targets, the UK has to get to grips with carbon emissions in its ageing houses, and fast. The Welsh School of Architecture's retrofit programme is doing just that and its pioneering work was recognised last month when it was named CIBSE's 2023 Building Performance Champion. Andy Pearson reports

Retrofitting existing housing stock for energy efficiency is one the UK's most challenging issues. It is a topic that the Low Carbon Built Environment (LCBE) team, Welsh School of Architecture (WSA), Cardiff University, has been grappling with over the past 12 years through a series of projects.

Now, working together with Wales and West Housing (WWH) and other social housing and local authorities, the WSA has delivered a series of whole-house retrofits across South and West Wales that demonstrate that by adopting a systematic approach it is possible to use off-the-shelf systems to significantly reduce the energy consumption and improve occupant comfort.

Savings vary depending on original heating system, condition of the home and occupancy among other things. Net operational carbon has fallen by up to 95% with a reduction in residents energy bills of 75% and beyond where residents are conscious of their behaviour.

Its approach clearly impressed the judges at this year's CIBSE Building Performance Awards, where the WSA won the Collaboration category and the coveted Champion of Champions award. The judges described the entry as 'an exemplar project demonstrating true collaboration with multiple stakeholders on a challenging retrofit', and said learnings from this collaboration 'will have far-reaching impacts in Wales and beyond'.

A key aspect of the project is that it builds on WSA's learning from earlier retrofit projects, including the Technology Strategy Board's Retrofit for the Future programme in 2009, when the School applied its whole-house approach to retrofitting a 1980s urban end-of-terrace house. 'Whole-house energy systems are about considering the house holistically, rather than focusing on individual elements,' says Professor Joanne Patterson, Professorial Research Fellow at WSA.

Alongside its retrofit research, the WSA has applied its whole-house approach to new builds. Completed in 2015 and targeted at social landlords, the Solcer House claimed to be the first affordable energy-positive house built in the UK.

At the same time, the WSA started its retrofit collaboration with WWH, on a project – supported by the Welsh European Funding Office – to deliver whole-house energy systems in 10 representative homes. 'We wanted to get as close to zero carbon as we could while keeping costs down, by optimising the use of low carbon technologies in each of the homes,' says Patterson. It was this collaboration that formed the basis of the WSA's awards entry.

Properties retrofitted were in need of major refurbishment. 'We tried to choose a range of homes of various ages and types to deliver a suite of outcomes, but the push factor for refurbishment in each case was that either the property's boiler or roof was nearing the end of its life and was in need of replacement,' Patterson explains.

Driven by data

Success for the whole-house energy systems approach depends on informed, data-driven decision-making. The starting point is a survey of each home using the WSA's Practical Retrofit Early Stage Survey tool (Press). This is a structured data-collection spreadsheet, designed for use by non-experts. It is intended to help speed up and formalise accurate data collection. The School developed the survey specifically for the domestic sector through its work with social housing providers.

'A brief initial survey is carried out on each of the homes, and the pre-retrofit questionnaire is used to help understand how residents use their homes

and the comfort level they expect,' says Patterson.

This information is then used to inform the choice of retrofit measures. In addition, the WSA undertakes comprehensive pre-retrofit monitoring of the building fabric – including airtightness tests, U-value measurements and thermal imaging – to identify fabric issues that the retrofit would need to address.

This decision-making process is supported by a thermal and energy model for each home, created in the university's HTB2 energy modelling software suite and calibrated using the pre-retrofit monitoring data.

Best fit

Using the model, different combinations of retrofit measures are tested, and the energy use, energy cost and carbon emissions calculated for each mix. 'We're not aiming for a particular carbon saving; we're just trying to achieve the best that we can with the technologies and products available that suit the needs of the social landlord and the type of resident,' says Patterson.

She uses the example of a cul-de-sac of six 1950s homes studied by the WSA, to explain the value of assessing each home on an individual basis. 'From the street, all the homes look the same but, because it's a cul-de-sac, each orientation is different, so the opportunity to add PVs [photovoltaic panels] varies enormously,' she says.

'At the house at the end of the cul-de-sac, you might only get 2kW output from the PVs, so, if the occupants were at home all day, there would be no benefit from battery storage because they'd be using the 2kW of generated power. Whereas, on a home with a large south-facing roof, the PVs might generate 7kW of energy, so a battery would be beneficial to store surplus energy to help make the house energy positive for a large part of the year,' Patterson adds.

> "We are not aiming for a particular carbon saving; we're just trying to achieve the best that we can with the technologies and products available"

A conventional approach of first minimising demand through the addition of internal or external insulation has been adopted by the WSA. Then, if a new heating system is needed, its selection is the next incremental step. Finally, the impact of adding PVs, mechanical ventilation with heat recovery (MVHR) and energy-storage batteries is assessed. 'This approach means we can see the incremental impact of each of the different technologies,' Patterson explains.

In addition to technologies the WSA had considered most appropriate, the School used the model to test alternative technologies suggested by WWH, to see their impact.

'At a high level, we were being driven by low carbon solutions, but we were also trying to choose elements that were as affordable as possible, so we selected products that were applicable to the social housing sector,' says Patterson.

Outputs from the model enabled the WWH and WSA to make a decision based on the most appropriate technologies for each particular home, tailored to its location, orientation, shape and occupancy. It also enabled the WWH team to assess potential energy savings against capital cost. »

"A benefit of the residents remaining in place is that they become embedded in the process by engaging with those carrying out the work, which gives them a sense of ownership of the installation"

» Using this assessment, the WSA and WWH produced a series of options. 'We sat with the residents and said "we've got these suites of choices: this one costs more but the carbon performance is better, or this option has lower running costs", which enabled us, as a team, to make a decision on which options to go for based on the type of occupant.'

It is this process of considering each property individually that makes the work of the WSA applicable to domestic retrofits nationally, says Patterson. 'It is the thinking process rather than the actual solutions that is relevant,' she says.

The first retrofit carried out under the project was of a two-storey, pitched-roof, solid-wall, three-bedroom, end-of-terrace house orientated to face east-west. Completed in 2018, the works included: the addition of internal insulation on the stone-front façade, with external insulation applied to the gable and rear wall; loft insulation; a new roof incorporating building-integrated photovoltaic panels; battery energy storage; and a MVHR system (see diagram below). The home's existing gas heating system was retained as it was relatively new.

The project demonstrated that PV panels could be used effectively in Wales on east- and west-facing pitched roofs, although the panels on this home were found to be oversized and generated more energy than required by the home for most of the year. It would have been advantageous to install an electric heating system to use the excess electricity. Unusually, the retrofit also included a transpired solar collector on the south-facing gable wall. This proved to be effective at pre-heating the MVHR supply air; however, as a one-off; it was expensive and Patterson says the technology 'would be better suited to new-build projects', which would benefit from economies of scale.

Another lesson learned was the importance of having a construction manager to oversee the programme of works, because they provided a single point of contact for the residents, contractors and the social landlord, and they understood how the various interventions were interconnected.

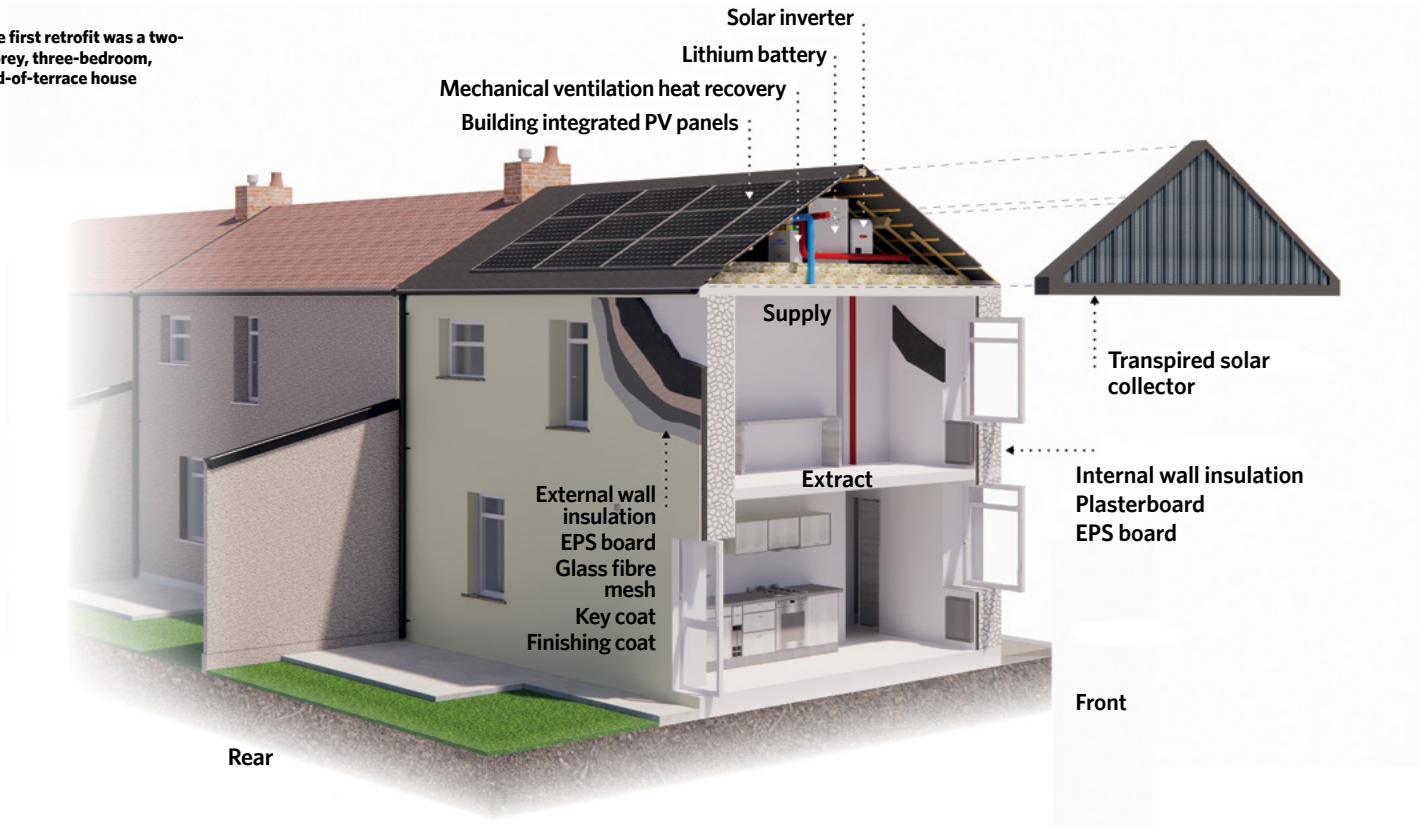
A significant issue for social housing providers is the need for occupants to remain in the properties throughout the works. 'Generally, social landlords are unable to decant residents because it is costly, disruptive and requires a property to be vacant for their relocation,' explains Patterson.

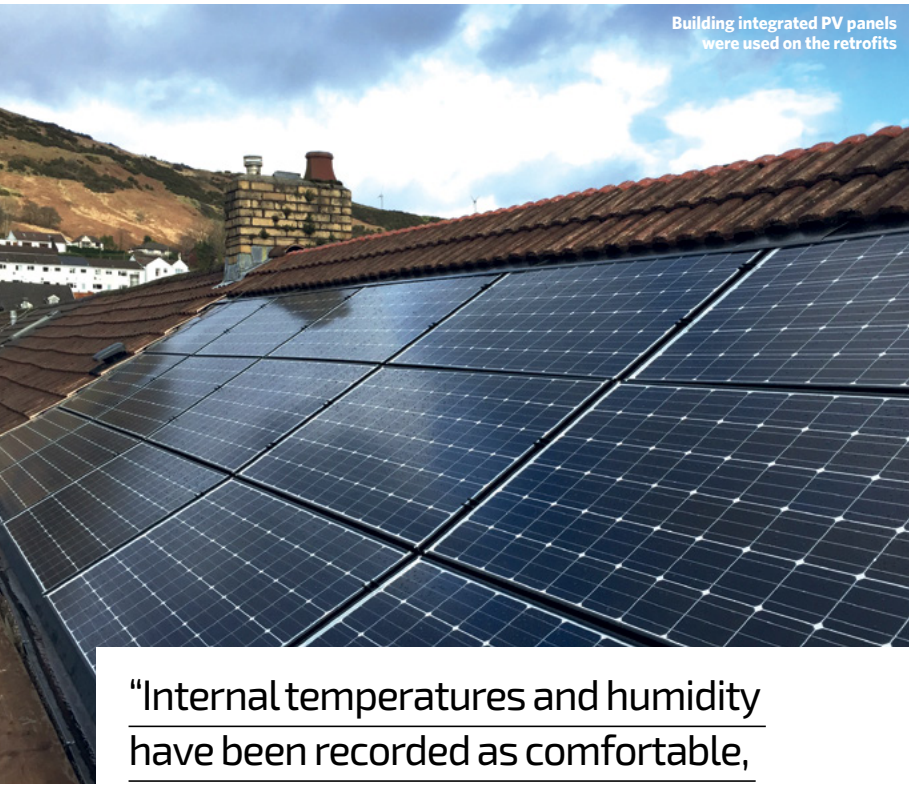
As a compromise, the works were undertaken in two phases for some properties. Although residents might grumble, she says the benefit of this approach is that they become embedded in the process by engaging with those carrying out the work, which gives them a sense of ownership of the installation. 'Unless people are engaged, they don't understand why the work is being undertaken, which is important for the ongoing operation'.

Another benefit of the residents remaining in place is that they can see and experience the benefits of the interventions as they happen. The WSA obtained feedback from residents after completion of the works, and is continuing to do so on an annual basis. In addition, the School is in the process of interviewing the supply chain to get its feedback on the project.

To ensure correct operation of the systems, residents are provided with a simple, non-technical user guide developed by WSA after spending time talking to occupants about their concerns in operating the retrofitted technologies.

The first retrofit was a two-storey, three-bedroom, end-of-terrace house




Building integrated PV panels were used on the retrofits

"Internal temperatures and humidity have been recorded as comfortable, easily reaching the desired temperature, as well as remaining consistent"

After completion of each retrofit, the School continues to undertake environmental and energy monitoring to see how the building is performing. This post-retrofit monitoring also serves to highlight commissioning issues, including – in one instance – the incorrect installation of a MVHR unit. The monitoring also showed that the output of some of the heat pumps were better than the manufacturer's predictions.

The retrofits were carried out sequentially using the same whole systems approach, which Patterson says became more streamlined over time. What has changed over the course of the project is her awareness of the positive impact of the interventions on the occupants in improving living conditions, eliminating mould, and reducing energy bills, which means residents worry less about the cost of energy.

'We have retrofitted three houses where, before the works, children were suffering from asthma and now they are not. It's only three houses, so its not enough to be statistically significant, but we will be investigating this further under another project,' says Patterson.

Far-reaching impacts

The WSA's collaboration with WWH is ongoing. Importantly, the outputs from these projects have informed other WWH retrofits. The WSA is now working with the social housing provider on solutions to reduce energy used for hot water in homes to further reduce energy costs and carbon emissions.

In addition, the WSA is talking to the Welsh Government about its work and the School is starting to work with other social housing providers to help them develop similar retrofit programmes.

All of which confirms what the CIBSE awards judges predicted: that the learnings from this collaboration are indeed having far-reaching impacts in Wales and beyond. CJ

EVIDENCE FROM SIX WHOLE-HOUSE RETROFITS

Alongside its work with WWH, the Welsh School of Architecture has also worked with Swansea Council on the retrofit of six energy-inefficient bungalows.

The bungalows are representative of many Welsh homes in that they are off the gas grid, of cavity wall construction, with poorly insulated windows and fabric with damp and mould problems, and were expensive to heat.

The objective was to reduce energy demand and maximise the contribution from renewables to help reduce carbon emissions, while ensuring the homes were comfortable and affordable to heat.

The School used its Press tool to assist in data acquisition and planning-stage decision-making, and, again, a whole-house energy systems approach was taken.

Energy efficiency measures included: installing external wall insulation; reducing the glazed area and installation of high-specification double-glazed windows; loft insulation; a ground source heat pump for each dwelling; building-integrated solar PV panels; battery storage; and MVHR.

These were installed over two phases to enable the bungalows' older residents to remain in place while the work was being carried out. Fabric improvements took place during winter 2018, with the supply and storage technologies were completed during winter 2019.

WSA monitored the homes in detail before and after the work, and the reductions in operational energy consumption and carbon emissions are impressive. Post-retrofit, the net operational carbon emissions are 197kg CO_{2e} per year, compared with 3,312kg CO_{2e}. The Energy Performance Certificate rating has improved from G to A and the SAP rating increased from 12 to 95.

Internal temperatures and humidity have also been recorded as comfortable, easily reaching the desired temperature, as well as remaining consistent throughout the day and night. Air quality, thermal comfort and humidity level have all been rated excellent by residents living there.

Two years of monitoring showed that 95% of the home's energy is provided by the PV panels and batteries out of the heating season.

Average annual energy consumption is 5MWh, compared with the UK average of 15MWh; 2.8MWh of the total is provided by the PV panels and battery, with 2.2MWh drawn from the Grid. During summer, 2.0MWh of excess electricity is generated, which can be sold back to the Grid.

This scheme deservedly was named Project of the Year – Domestic by the judges at this year's CIBSE Building Performance Awards.


The bungalows retrofitted by the WSA with Swansea Council

Katie Clemence-Jackson is project manager for the Net Zero Carbon Buildings Standard

NAVIGATING A PATH TO NET ZERO

The built environment industry gathered at the Futurebuild conference last month in London, to discuss various paths to decarbonisation. **Alex Smith** and **Molly Tooher-Rudd** report

Futurebuild returned to ExCeL London last month, with leading academic and industry figures discussing how the building industry would meet the challenges of delivering net zero.

The opening address was by Sarwjit Sambhi, chief executive at developer St Modwen, who discussed how smart grids could potentially halve the peak loads in new all-electric housing developments.

St Modwen is building 350 homes on the old Mini factory site at West Longbridge in Birmingham, and each one will have an air source heat pump, EV charging point and a connection to communal battery storage.

As well as reducing the peak loads by 50%, Sambhi said a smart grid, created by electrical infrastructure firm SNRG, will reduce energy bills by 30%. The reduction in demand reduced project infrastructure costs and put less pressure on the Grid, he added.

'It's brilliant for the owners of the new homes, but also brilliant in terms of not needing to invest as much in copper wire in the ground, which all the distribution networks would like us to do,' he said.

If all new developments were built using smart grids, the necessary spending on electrical infrastructure could be halved over


The site of ExCeL London by the Royal Victoria Dock

the next 30 years, saving £120bn, said Sambhi. 'The impact of this is groundbreaking if it becomes the norm – and there's no reason why it shouldn't,' he added.

Some of the best attended sessions at Futurebuild were on the UK Net Zero Carbon Buildings Standard (NZCBS). Katie Clemence-Jackson, the standard's project manager, said more than 150 organisations had responded to the NZCBS call for evidence, supplying operational energy and embodied carbon performance data for their buildings. This will inform and guide the development of an agreed definition and methodology for the industry to determine what constitutes a net zero carbon building.

In a session on heat networks, Charlotte Large, director of decarbonisation and strategy, urban energy, at Equans, spoke of the challenge of decarbonising existing heat networks powered by combined heat and power gas boilers. She said Equans had installed a 3MW heat pump at the Olympic Park, which will allow new developments to connect to the heat network. 'We can't grow the networks until we get rid of gas. By installing heat pumps we can offer low carbon heat to new connections,' Large added. (**bit.ly/CJApr23Equans**)

Antony Meanwell, from E.ON, called the Heat Network Zoning regulation, due in 2025, a 'key catalyst for the growth of heat networks'. It would create heat zones in areas where heat networks were suitable and any development in these areas would have to connect. Any waste heat would also need to be piped into these networks.

Cantor Mocke, head of market growth at the Department for Energy Security and Net Zero, said the government's drive for energy security meant making better use of local energy sources. 'When it comes to heat, the only system that can do that is heat networks,' he said, adding that the government had to make sure customers got a 'good deal'.

The appointment of Ofgem as the heat networks regulator would help protect customers, Mocke said, and the government's latest Heat Network Efficiency Scheme will offer £32m of grants to improve existing networks. He referred to the Heat Training Grant, announced last month, which will offer a discount of £500 to those taking short courses relevant to heat pumps (see news).

> "If all new developments were built using smart grids, the spending on electrical infrastructure could be halved over the next 30 years"


Standing room only at a UK Net Zero Carbon Buildings Standard panel discussion

In a debate on lessons learned in improving energy performance of buildings, Paul Ruyssevelt, professor of energy and building performance at UCL Energy Institute, said there was a significant gap between knowing how to achieve net zero buildings and doing it. Over the past 10 years, the focus has shifted to existing stock, he said, but stop-start government policies have prevented real progress in this area. However, there have been successes, particularly with improved standards, guidance and training, and more interest from banks and financiers.

Ruyssevelt added that the widespread adoption of heat pumps was problematic because the electrical distribution system capacity was limited, especially as the growth of electric vehicles adds more load. A whole-system approach that considers the cost of installing renewables, the electric network's capacity, and when refurbishment makes sense is needed, he said.

The Sustainable Energy Association led a discussion on how buildings can be fit for the future, with a focus on sustainable energy and decarbonisation. Panellists agreed it required a better understanding of the basics of building insulation and the need for a fabric-first approach. 'Only by closing the performance gap can we have buildings that perform as expected,' said Simon Blackham, technical manager at Recticel Insulation. 'There is no point installing heat pumps or solar panels unless the building is well insulated to begin with.'

Russell Dean, residential product group director at Mitsubishi Electric, said a national retrofit strategy was needed to improve homes to meet future standards and provide the industry with some clarity. 'The Chris Skidmore report dispelled myths that net zero isn't the way forward. However, we need to redouble efforts to meet our targets,' he said.

In a session on minimising and mitigating overheating risk in homes, Lynne Sullivan, chair of the Good Homes Alliance, stated that, in a scenario where temperatures increase by 2°C, 90% of homes in the UK will overheat.

'We need to be ready for more frequent heatwave scenarios with no night-time cool off, which will lead to more mechanical ventilation,' said Tom Dollard, partner – sustainability and innovation, at Pollard Thomas Edwards.

Rajat Gupta, professor of sustainable architecture and climate change at Oxford Brookes University, added: 'There is a risk that developers will see comfort cooling as a luxury that adds value to the sales price. However, we shouldn't put a value on this; everyone should be kept comfortable in their homes.' CJ

ACCELERATING CHANGE

The use of emerging technology will speed the delivery of net zero buildings, according to CIBSE President-elect Adrian Catchpole, who was one of the speakers in a CIBSE seminar at the ASHRAE Winter Conference in Atlanta. **Tim Dwyer** reports

The CIBSE ASHRAE liaison committee supported a seminar at the 2023 ASHRAE Winter Conference in Atlanta, titled 'Accelerating change in building design and operation towards a decarbonised and net zero energy future'. It considered a cross-section of skills, tools, systems and methods that are driving buildings towards net zero. Two of the presentations touched on a common theme and are briefly reported in this article.

Adrian Catchpole, CIBSE President-elect, spoke on how the application of contemporary tools and emerging technologies may be used to deliver energy efficient, environmentally responsible projects.

He argued that the key starting point was to ensure a clear direction in the brief, and – although 'not rocket science' – it might require the design team to take the client 'on the journey'.

The whole team needs to carefully consider and discuss desired project outcomes, and establish clear success factors that can be used to measure key work stages to ensure the project is delivered effectively.

The monitoring of key outcomes can feed a collaborative process of feedback and continuous improvement throughout the whole life of the project.

When the goals have been defined properly, the dynamic simulation model begins to emerge – a developing 3D representation of the building that reflects shape, form and hygrothermal characteristics, providing the core model, preferably based on a common date environment (CDE). The model can be used to run numerous simulations, optimisations, daylight modelling, overheating assessments, compliance checks, systems evaluations, life-cycle evaluations, and so on.

Catchpole said the model should underpin the whole life of the project and then move onto the client's asset team for commissioning, post-occupancy operation, and maintenance. He noted that, typically, a concluding simulation by the design team would provide a prediction of energy use in operation, based on the final building and systems, as represented by the model.

This increasingly accurate assessment of the predicted energy use, informed by CIBSE TM54, requires information relating to the operational phase – such as lift information and catering specialist equipment. This provides a better interpretation of the likely energy consumption and typically gives a higher figure than

Fully volumetric modular construction was used on a Shetland hotel project

may have been otherwise expected from the output of compliance checking.

Catchpole gave an example, illustrated in Figure 1, of a predicted energy use informed by CIBSE TM54, compared to Building Regulations Part L.

Depending on the software used for the project, in parallel with the 'thermal' model there will probably be an architectural model, a structural model, and one that is employed to develop the mechanical, electrical and plumbing systems, he explained.

Working within a single common data environment – where underlying building definitions are common to all models – allows integrated cross-discipline analysis, such as clash detection. Designers, for example, can see if ductwork is cohabiting the same space as the structure and, if necessary, make a swift, pre-construction resolution between the building services and structural engineers.

The CDE-connected models also enable detail-rich information to be readily shared from the model to, for example, user-friendly reader software that allows clients and staff responsible for the eventual building operation to take a look at their prospective buildings with virtual walkthroughs and plantroom visualisations.

Catchpole noted that producing construction operations building information exchange (COBie – a non-proprietary data format) output from the model provides product data information on the physical assets that can be exported to spreadsheets and, ultimately, imported into software (often referred to as BIM models) used for building operation and maintenance.

This product data can be searched to produce plant and equipment schedules, and, in an ideal world, used by contractors to create materials lists and pricing information. The rich data sources also enable and extend the opportunities for modern construction techniques, including prefabrication. Catchpole extolled the advantages of modular construction, noting that 'high-quality, precision engineering, constructed in a factory, has to be the future'.

Encouragingly, he remarked that, in the UK, there are buildings coming into operation that have been fully designed and built employing a BIM platform and the facilities management teams are starting to see some real operational benefits. This fully integrated approach opens up opportunities to assess whole carbon impacts of design and operation throughout the whole building life, he added.

Catchpole finished his presentation by noting that the industry is not yet in a place where digital tools can be used on every job. Where they can, however – particularly in conjunction with prefabrication and modularisation – it is more likely to produce cost-effective, sustainable built environments.

A platform for building services

In the next presentation, Stuart Cameron, director and MMC lead at the Hive Group, was keen to illustrate how applications of new methods of construction – design for manufacture and assembly (DfMA) and modular mechanical, electrical and plumbing (MEP) – were changing the status of MEP. He said modern methods were altering the perception of MEP from simply 'an installation' in the programme to one of a prioritised product, and this was improving the quality, speed and sustainability of projects and buildings significantly.

Cameron explained that modules designed for construction within a factory environment remove the uncertainties of the building site; the completed module or sub-assembly is delivered and installed on site to contribute to a completed building.

This can also better enable a circular economy – with closer control of materials and sub-assemblies – reduce waste, and help mitigate the shortage of skilled site workers. Modular buildings maximise resources and promote the reusing and recycling of materials, thereby closing the loop and meeting the requirements of a circular economy.

Cameron illustrated the application of modular construction with examples including an off-grid hotel project in a remote island location just off the Shetland Islands. This was a fully 'volumetric modular' construction (large building elements that can be linked »

> "Working within a single common data environment allows integrated cross-discipline analysis, such as clash detection"

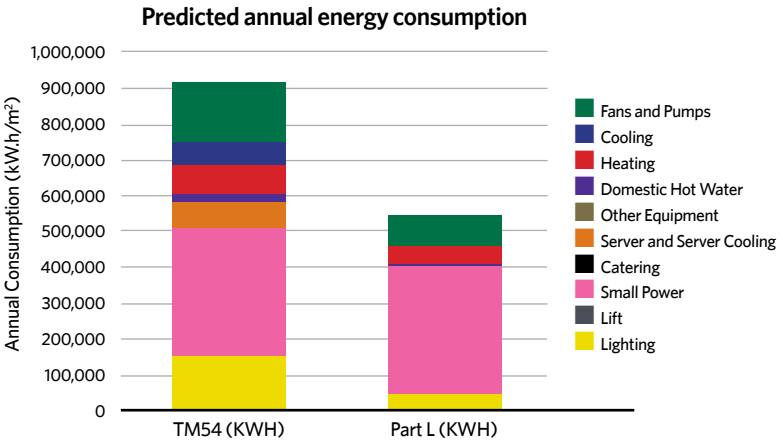
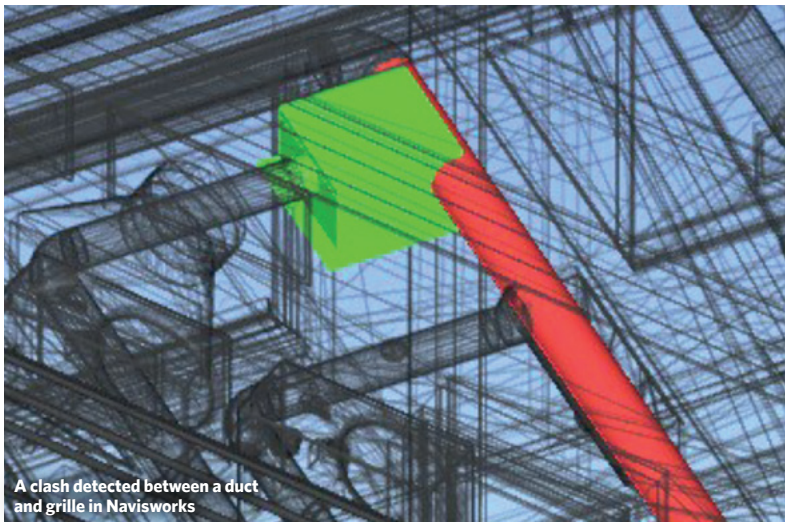


Figure 1: In-use energy prediction based on CIBSE TM54 compared with output from an England and Wales Building Regulations, Part L assessment. TM54 requires a high level of detail and information not required for Part L (lifts, catering, specialist equipment, servers and so on)



A clash detected between a duct and grille in Navisworks

» together to form complete buildings without the need for an additional superstructure) using cross-laminated timber, with the MEP installed as sub-assembly units.

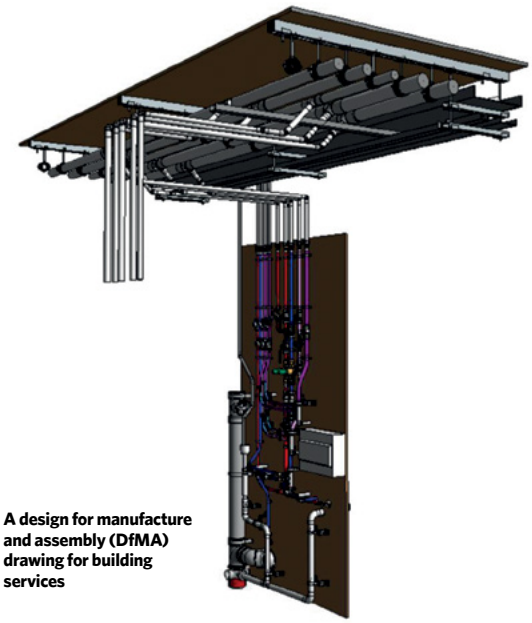
These assemblies were prefabricated off site, in a factory 650 miles south of the site, in Sheffield, where 95% of the MEP was installed, requiring only final connections on the island, including horizontal and vertical connections.

The method allowed improved accuracy in digital modelling and optimisation, while the quality benefited from being fabricated in a clean, dry, warm environment. When delivered to site as an assembly, the construction becomes more of a product insertion rather than a full, component-based MEP installation.

Cameron reported that the accelerated construction programmes provided swifter returns on investment for developers, and delivered the completed project more quickly to building users.

When applied to housing projects, he considered that up to 90% of construction installation works may be completed within the factory. By referencing a 2019 independent report, Cameron suggested that they require 67% less energy than traditional building techniques, with lifetime energy savings of up to 90%, and up to 60% less waste across all disciplines, including MEP, so delivering reduced carbon footprint.

A recording of the complete seminar, including all five speakers, is available to watch (for a registration fee) in the virtual ASHRAE 2023 Winter Conference at **bit.ly/CJMar23TD** CJ



A design for manufacture and assembly (DfMA) drawing for building services

"Assemblies were prefabricated off site, in a factory 650 miles south of the site, in Sheffield, where 95% of the MEP was installed"

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Water solution firm is hosting tutorials on the Water Regulations for designers and installers

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The Water Regulations were introduced on 1st July 1999 in England and Wales. They have recently been updated to incorporate the latest guidance. Our team at Arrow Valves is BPEC qualified in the Water Regulations, enabling them to provide accurate advice on specific applications, no matter the situation.

We have created a series of Water Regulations tutorials, aimed to educate designers and installers on how to comply with the regulations. These are covered on our website and in our CPD-accredited Seminars and Arrow Academy training days. The most recent Arrow Academy was held in November 2022. This took place at Warehouse Pizza in Berkhamsted, on the same road as our head office, and included a factory tour and lunch.

Looking to the future, we are organising a seminar in Manchester in June of this year, as well as one to be held in central London towards the backend of the year. We are also flexible as to when and where these can take place; due to Covid-19, we have held many successful seminars via Zoom and are happy to continue this in the future.

Our professionals are always looking at ways to expand our selection.

In previous months we have introduced a range of new items including the BTAB Low Flow Unit, a category 5 unit suited to single outlets e.g., commercial washdown points. We have also launched the SPHUDSC, our self-closing pillar standpipe, perfect for filling buckets or watering cans. Our most recent new product launch was the Boost-A-Fill Digital pressurisation unit. This is a Fluid Category 5 pressurisation unit for filling and maintaining the pressure of larger commercial sealed heating systems.

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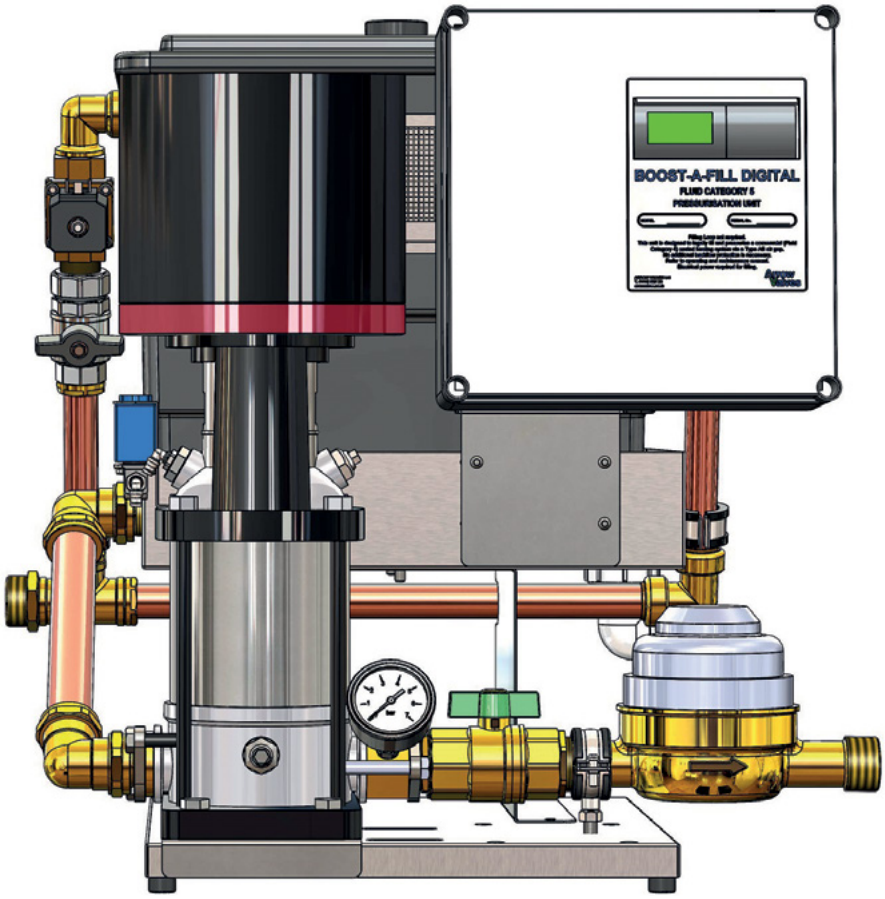

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Lighting for dark skies CPD

LSBU's cool hub

More than half of all UK building services engineers studied at London South Bank University, so BDP's services retrofit of the main building on the campus had to demonstrate best practice in every function. BDP's Laura Smith reports on the steps taken to transform a tired teaching facility into the collegiate LSBU Hub

Building services engineers who studied at London South Bank University (LSBU) may no longer recognise their old lecture halls, after an extensive refurbishment of the biggest academic building on the university's Elephant and Castle campus.

Making up 20% of the LSBU's teaching and learning space, the London Road building has been given an extensive, sustainable refurbishment and redesign, to increase the amount of flexible teaching and learning space in the heart of the university.

Designed by architect Wilkinson Eyre, the LSBU Hub, as it is now known, was overseen by building services engineers, acousticians, lighting designers and sustainability consultants from BDP, who vastly improved the buildings's acoustics, lighting and thermal performance.

LSBU has a long-standing connection with the built environment. More than half of the building services engineers in the UK studied there, including many of those working on the project, including three apprentices who worked on it while studying at the university.

The existing building suffered from poor ventilation, and poor acoustic and thermal performance, which needed to be overhauled by BDP. The retained structure of deep concrete downstand beams posed several challenges for the project team, so careful coordination of services, and innovative solutions, were required. As well as ensuring the building is accessible and comfortable, the project team had to keep carbon emissions to a minimum.

LSBU Hub has a wide range of functions. It is the new home of the Perry Library, which takes up most of the top two floors, while some new catering provision has been added through a grab-and-go café and a refectory bar. Eight lecture theatres, fitness facilities, teaching rooms, informal learning spaces, and other catering amenities have been refurbished, and small cellular teaching spaces have been replaced with larger classrooms.

Redefining the building use

A feasibility study, undertaken in 2018, identified the negative impact on building users of the blank external façades, warren-like interiors, and poor accessibility. The university recognised the need to allow the building to work in a communal, cooperative and collaborative way, with larger open-plan spaces.

The upgraded envelope achieved U values of between 0.2 and 0.35·W m^{-2}·K^{-1} for the opaque elements, and 1.42 and 1.55W m^{-2}·K^{-1} for the glazed bays, and provided improved acoustic and thermal performance, including solar-glare control. Because of the central London location, the majority of spaces are sealed with demand-controlled mechanical ventilation (based on CO_2 sensor readings).

Displacement ventilation is installed in the double-height library spaces. On the quieter façades, there is natural ventilation, with occupancy control for the small

LIGHTING STRATEGY

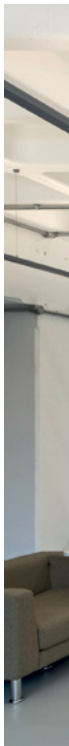
The approach to the lighting design process was to complement the architecture with minimal intervention and ensure bright soffits, particularly in areas where daylight is low.

The waffle slabs are exposed in many spaces and now form an integral part of the lighting strategy. A custom suspension luminaire was engineered by Zumtobel (Stratus) to project 100% indirect light to the slabs from a slim profile.

This creates an enhanced perception of spaciousness and, through inter-reflection, provides the required illumination in the spaces where it is used. The lit effect is calm and blends well with daylight, with excellent light uniformity to walls, soffits and floors.

Warm-white light was used throughout the library areas (with neutral white uplight) to enhance the extensive wood cladding and differentiate the space from other parts of the building.

All luminaires are fully dimmable and controlled in response to occupancy and daylight.



The LSBU Hub is part of a wider regeneration of St George's Quarter

> "Multidisciplinary coordination, using a full Revit model, was crucial to resolving clashes as construction progressed"

group rooms and automatic control (including night cooling) for the atrium.

Acoustics were an important part of the design considerations, and BDP's acousticians have used their experience from previously successful projects, including the University of Roehampton Library, to ensure the quality of the acoustic environment is maintained throughout the full range of spaces, from lively café areas and sports halls to silent study areas. (See panel, 'Cut the waffle'.)

The building services solutions had to work with the existing downstand beams and the project team worked with manufacturers to develop an ultra-low profile luminaire. As part of the Stage 4 design process, multidisciplinary coordination, using a full Revit model, was crucial to resolving clashes as construction progressed on site and as 'discovery issues' manifested themselves.

The exposed waffle slab is integral to the lighting strategy

Simple, robust design solutions were implemented throughout the building, and mechanical ventilation was provided for the majority of spaces, with minimum fresh air (12 $L \cdot s^{-1}$ person) supplemented by space heating and cooling.

Cooling has been introduced into more spaces to provide a flexible, resilient strategy for the future. Two high-efficiency packaged air cooled chillers were installed on the roof using refrigerant HFO1234ze. There is a GRP enclosure on the roof which contains the chilled water (CHW) pump sets and auxiliary plant. The CHW operates at 6/12°C flow and return, and runs across the roof to serve the rooftop air handling units (AHUs) and connect to the risers. Within the building, the CHW is distributed to upper- and lower-ground plantrooms to serve the AHUs, and across the floor plates on all levels to serve fan coil unit (FCU) and trench cooling. There is separate direct expansion cooling for the IT server rooms.

The low temperature hot water (LTHW) is provided via modular gas boilers (premix condensing gas boilers) in the basement. Gas boilers were selected to avoid upgrading the electrical substation, which would have placed significant constraints on the wider masterplan. An academic project is investigating how to decarbonise this building and monitoring is taking place.

Separate circuits come off the LTHW header for LTHW and domestic hot water. »

The two-storey library is at the heart of the building

BDP carried out acoustic modelling of the waffle ceiling

» The system has been designed as constant temperature, variable flow, incorporating 2-port motorised pressure independent control valves (PICVs). Domestic hot water is provided via plate heat exchangers and associated buffer vessels.

The ventilation system consists of around 20 variable speed-controlled AHUs across the buildings with demand-controlled ventilation using variable air volume boxes as the primary strategy for the system.

The AHUs for the classrooms, library and sports hall provide tempered air into the space, with space heating/cooling via FCUs and trench heating. There are radiators in circulation spaces, WCs and sports changing areas. The AHUs in the basement use the cycle parking area (converted from the car park) as part of an exhaust air plenum to avoid additional ductwork in an area with low floor-to-ceiling heights.

As a principle, MEP systems were integrated into existing services zones, although additional horizontal and vertical routes were required, resulting in extensive use of prepared service openings within the existing waffle concrete structure.

All building services systems are designed to be compatible with estate-wide systems and maintenance strategies, using LSBU design guidelines and liaison with the estates team to agree and ratify manufacturer selections and systems choices.

Life-cycle assessment

A detailed life-cycle assessment (LCA) was conducted to evaluate the embodied carbon intensity of the 'retained structure' renovation. The model was created in One Click LCA, based on the project's bill of quantities and specification documents. To measure the benefit of retaining the structure, a 'new building equivalent' scenario was modelled using One Click LCA's Carbon Designer tool.

Results showed that the 'retained structure' model presented an overall 39% saving compared with the 'new equivalent' model. The largest carbon emissions for the 'retained structure' model were associated with the new building services (MEP), comprising 38% of the embodied carbon emissions, followed by the superstructure (façade, upper floors, roof and stairs, 21%), internal finishes (13%) and external walls (12%). The embodied carbon savings from reusing the existing structure means total embodied energy is half the 2030 RIBA target benchmark.

The majority of the risers were re-used, despite room layouts and functions changing significantly. Building services in areas of the LSBU Hub that had been recently refurbished were retained where practical, including kitchen ventilation hoods, ventilation grilles, lighting, ductwork and electrical distribution.

The refurbishment has created bright, well-ventilated, and comfortable spaces. A simple, but innovative and environmentally conscious approach has been executed, from large-scale interventions through to smaller-scale solutions. CJ

LAURA SMITH is the engineering director, BDP

CUT THE WAFFLE

The acoustics were designed to new-build standards where designs permitted, considering sound insulation, external noise ingress, building services noise and room acoustics.

A key part of the acoustic design was controlling external noise ingress, with the site being located off the busy London Road. The new façade provided the opportunity to incorporate the necessary acoustic performance requirements, to ensure internal spaces were adequately protected from external noise, particularly the main open-plan library spaces.

With a mechanically ventilated building, it was important to ensure noise from building services was controlled so internal noise levels were suited to the room use.

Detailed calculation and modelling of the retained structural waffle slab was carried out to inform airborne sound insulation, and to make enhancements to achieve the criteria.

Extensive acoustic modelling of the open-plan library areas and lecture theatres was carried out to advise on room acoustics and comfort, specifically, the location, quantum and performance of acoustic finishes.

Designing net zero for pupil wellbeing

Cundall has created new premises for Beormund Primary School that not only meet net zero aspirations, but also cater for the social, emotional and mental health needs of the school's pupils. Andy Pearson reports

'Children with social, emotional, and mental health [SEMH] needs have often been overlooked, so it is great that this is being addressed with the design and construction of a new site for Beormund Primary School,' says Paul Sperring, project lead for engineering consultants Cundall.

Working with architect Cullinan Studio, Cundall is responsible for the building services, acoustics, sustainability and fire engineering design of the new school for 56 students, which is to be constructed in the London Borough of Southwark, on the site of the former Bellenden School. It will replace the current school's premises in Bermondsey.

The brief was to provide a calm, tranquil and welcoming environment that would cater for the practical needs and wellbeing of pupils and staff. Equally challenging, was the requirement for the school to be net zero carbon, in line with Southwark's target to be a carbon neutral borough by 2030.

Cundall's starting point in developing the design was engagement with the school. 'We talked to the teaching staff, teaching support staff, the head teacher and the caretaker responsible for looking after the premises; it was important because it gave us a detailed insight and understanding of what was needed for staff and pupils,' says Sperring. SEMH pupils are generally taught by three teaching staff in classes of no more than eight pupils. One of the things Sperring says came as a surprise from meeting the staff was that they wanted manual control over the services in each classroom. 'They didn't want things like windows opening automatically, because they knew that would distract the children,' he says.

Cullinan Studio's design is for a two-storey building with a pitched roof, and it is orientated so that most teaching spaces face south. Classrooms are predominantly located on the ground floor, each with direct access to an external play space and an outdoor teaching area beneath the over-sailing roof. Above, on the first floor, there are specialist rooms such as music and food-tech and quiet spaces for staff and administration use. The first floor also incorporates a secluded, planted roof terrace, to provide a space where staff can unwind and recharge. A central corridor running the length of the building is the link between rooms on the ground and first floors with natural lighting to both. »

The new school will be built predominantly from wood to minimise embodied carbon

» To minimise operational carbon, the school is designed to Passivhaus standards for both fabric thermal efficiency and airtightness, even though it will not be Passivhaus certified. 'It's not full Passivhaus because of budget concerns about the cost of targeting certification,' Sperring explains.

To minimise embodied carbon, the building will be constructed predominantly from wood. 'There's no point having a building that is super energy efficient in operation if we have to use loads of energy to build it,' says Sperring. The walls and upper floor will be assembled from highly insulated modular timber SIP cassettes supported by a predominately glulam frame. The prefabricated timber SIP cassettes will help reduce build time, reduce site traffic during construction in a residential area, minimise waste, improve build quality and, because they are assembled from wood, make the school feel less institutionalised.

'It is a really good solution because it delivers super-low U values and, inherently, the large pre-assembled modules will help the building achieve Passivhaus-level airtightness, plus you will see elements of the wood structure in the interior, so it feels warm,' says Sperring.

The challenge for Cundall was to develop a building services solution that would work with the minimal thermal mass inherent in the wooden cassette units. Sperring says the building services design is developed to comply with *Building Bulletin 101: ventilation, thermal comfort and indoor air quality* and *Building Bulletin 93: acoustic design of schools guidance*, which Cundall has 'enhanced' with the addition of Passivhaus requirements.

BB101 requires an adaptive approach to thermal comfort based on CIBSE TM52 metrics. 'Everything we do around thermal comfort has to be modelled using a digital model and an appropriate CIBSE Weather File for the location, and, for the DfE [Department for Education], we also have to look at future weather data for the 2020s and two options for the 2080s, to future-poof the school against the effects of global warming,' Sperring explains. 'We did Passivhaus modelling, dynamic thermal simulation modelling, and CIBSE TM54 modelling for operational energy in use.'

"The school's status as an SEMH school means that it has to perform better than a typical school, with temperatures in the classrooms limited to a maximum of 25°C"

The school's pitched roof is orientated so teaching spaces face south

Dynamic thermal simulation modelling and TM52 thermal comfort studies helped optimise the building's thermal envelope and establish the maximum glazed area. 'We wanted as much daylight as possible for wellness without spaces overheating, so we undertook a lot of modelling to check thermal comfort and glazed areas with Cullinan Studio – the final design hits the sweet-spot,' says Sperring.

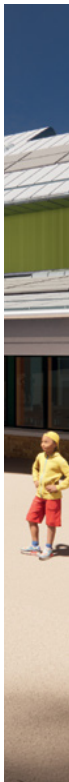
Entrances to classrooms are also naturally lit via skylights and lightwells, to flood the corridors with daylight so these appear as bright as the teaching spaces they connect.

Daylighting is supplemented by LED lighting throughout. In the teaching spaces, daylight sensors help keep lighting levels constant, but with provision for teacher override. Absence detection turns off the lights when spaces become unoccupied.

Air quality is another key aspect of pupil comfort, so the design is based on the Passivhaus approach of constant ventilation to classrooms. Two central air handling units (AHUs) serve the teaching spaces, while a separate AHU serves the first-floor offices and staff spaces. All AHUs incorporate thermal wheel heat recovery except for the kitchen unit that uses a run-around-coil.

Air is ducted to the classrooms along the corridor. Duct sizes are optimised to keep air velocities low and minimise fan-power, and to reduce air turbulence noise. Noise control is further enhanced with sound attenuation where ducts enter the classrooms. This is to stop noise transferring between the classroom and the corridor, so children can sit and work with a teacher outside the classroom if necessary. Inside, diffusers disperse the air. 'We're pushing air in at a high level so it will have mixed with the warmer air within the classroom, tempering it before it reaches the pupils,' says Sperring.

Air returns to the AHUs along the corridor, via an attenuated air-transfer grille located at high level in the classroom.



In summer, classroom temperatures cannot exceed 25°C

WHAT SEMH MEANS AT BEORMUND PRIMARY SCHOOL

Beormund School is currently sited in Bermondsey, and is a specialist school providing support and learning for primary-aged pupils with social, emotional and mental health needs. It will offer an additional outreach class for Year 7 pupils to aid their transition into secondary education.

The school provides education and support for children who have experienced adverse childhood experiences that have impacted their emotional wellbeing. The staff teach in classes of no more than eight and look beyond the challenging behaviours displayed by children and attempt to establish trends, patterns and triggers to better understand each child.

The school aims to empower children to hold a positive view of themselves and reignite their love of learning. Pupils are taught the National Curriculum and teachers hold the same aspirations for their children as their mainstream colleagues – to make accelerated levels of progress and to meet, or even exceed, age-related expectations.

Maintaining a stable temperature is key to a calming environment to stop children from being hot and agitated. 'The school did not want large temperature fluctuations,' Sperring says. Room air supply rates are controlled by CO_2 sensors and temperature sensors within the classrooms. Ventilation rates can be supplemented or further enhanced by staff manually opening the windows. On a warm day, the teacher has the option to open the windows and the mechanical ventilation rates will automatically ramp back.

In winter, the ventilation system will also provide heat to the classrooms. 'I didn't want underfloor heating because it can encourage some children to lay on the floor – and I didn't want to use radiators because they take up usable wall space for storage and they can become a dust trap. Having no radiators also removes an object that could be vandalised or used to self harm' says Sperring.

Instead, heat is supplied by heater batteries housed within the main AHUs. Teachers can also 'tweak' the supply air temperature to each classroom with a small heater battery added to the air supply duct.

The PV array measures 260m² and includes battery storage

The school's status as an SEMH school means that, in summer, it has to perform better than a mainstream school, with classroom temperatures limited to a maximum of 25°C. Engineers have included a cooling coil in the AHUs to provide what Sperring describes as 'peak lopping cooling'. He says the school is not air conditioned, but is using cooling to 'temper' the supply air to keep conditions comfortable within the classrooms during those peak summer days.

Reversible air source heat pumps (ASHPs), integral to the AHUs, supply both the heating and peak-lop cooling throughout the building.

Energy balance

The units that serve the classrooms have a thermal wheel that operates at >80% efficiency and includes a modulating summer bypass. The units have a nominal 29/27kW cooling/heating duty. During the mid-season, with external temperatures between 15°C and 20°C, the heat pumps will be switched off. When the outdoor air temperature exceeds 25°C and room temperature is also elevated, the cooling coil is active to help maintain the internal space temperatures. There will also be a simple signal panel in the classrooms to advise teachers when to open or close windows to optimise energy performance.

A third ASHP will supply heat to the domestic hot-water system for the school's kitchen. 'The kitchen has a dedicated air source heat pump, which is designed to run at a higher temperature to help protect the domestic hot-water system against legionella infection,' explains Sperring.

In terms of energy use intensity (EUI), he says the design exceeds the DfE's figure of 52kWh·m^{-2} per year for a special educational needs school. 'We're down at 47kWh·m^{-2} per year, even before we include the PV [photovoltaic] array on the roof,' Sperring says. At 260m^2, the PV array will make a significant contribution to the energy balance of the school. Its output has been maximised by optimising the pitch of the school roof so the panels can be installed without the need for additional framing. The array includes battery storage to capture electricity generated when the school is unoccupied at weekends.

'On a Monday, when batteries will have charged over the weekend, the school will be cooler because it will have been unoccupied for two days, so the stored energy can be used to help bring the building up to temperature,' says Sperring.

Once the expected output from the array is factored into the energy balance, including power generated over the summer when the school is unoccupied, Sperring says he expects the EIU to drop to about 27kWh·m^{-2} per year. Even though the peak output from the PVs is relatively large, Sperring says the array cannot be used to reduce the size of the incoming electrical supply because its output will vary depending on incident sunlight. 'Even though the school is very low energy, we had to include a small substation, because we know the supply to the existing school would not be sufficient for an all-electric school,' he says.

Construction of the new SEMH school is due to start later this year, with completion set for 2024. **CJ**

Targeting net zero ventilation for schools

The Monodraught HVR Zero ventilation unit won a product of the year award at the CIBSE Building Performance Awards because it targets both embodied and operational energy use. Schools are one sector benefiting from the costs savings that the heat recovery unit brings

Monodraught's HVR Zero ventilation unit was the outright winner of the Product or Innovation of the Year – Air Quality at the CIBSE Building Performance Awards (BPA). Judges praised the level of in-depth research and development that minimised in-use operational energy while optimising comfort. The attention paid to embodied carbon in the product's development was also commended by the judges, who thought all manufacturers should be assessing the challenge of net zero over a product's lifetime.

The HVR Zero hybrid ventilation with heat recovery range sets a new benchmark for the future generation of low energy hybrid ventilation systems that integrate heat exchange ventilation strategies. Monodraught claims that the systems consume 90% less energy compared with a typical mechanical ventilation and heat recovery system. The BPA judges said the product challenged traditional centralised air systems in terms of control and efficiency, and that this was, in part, achieved through a well-developed and intuitive user interface.

The system is designed to allow natural ventilation, hybrid mixing ventilation, and low-energy mechanical ventilation with heat recovery through multiple, selectable, segregated internal airways. Each system operates autonomously to ensure that every area has the optimum air quality and correct thermal comfort conditions. During the summer, hybrid ventilation switches on the mechanical fan to boost the natural ventilation and optimise indoor comfort. During winter periods, the system mixes warm internal air with fresh external air to deliver mixed tempered air, while using heat recovery to save energy.

Monodraught's product has been targeted at schools in particular, where indoor air quality (IAQ) can affect the health, comfort and productivity of students and staff. Poor IAQ can lead to a variety of health problems, such as headaches, fatigue, and aggravation of respiratory conditions.

Most people spend about 90% of their time indoors, and studies indicate that indoor levels of air pollutants may be two to five times higher than outdoor levels. Young people are more vulnerable to the effects of this exposure than adults, with reduced classroom air quality causing a reduction in cognitive performance and presenting a safety issue for the health of the pupils.

> "In summer, hybrid ventilation switches on the mechanical fan to boost natural ventilation and optimise comfort"

Elmgrove Primary School

The British Council for Offices *Guide to Specification 2019* states that ventilation should supply 8 litres of fresh air per second per child, and 10 litres per second per adult, totalling 260 litres per second per average classroom. This will keep the CO_2 concentration levels as specified in BB101 and CIBSE Guide A.

Since the development of HVR Zero, Monodraught has supplied approximately 200 school projects with these systems. The system was included in a new-build sports hall and classroom block at Holmer Green Senior School in Buckinghamshire. Data monitoring since the installation has shown that the systems are performing strongly, with low running costs and excellent air quality, and temperatures maintained at an average of 21°C during occupied hours. 'Staff and students enjoy the fresh and comfortable spaces with minimal impact on the aesthetic appearance of the classrooms and no need to constantly adjust the controls for individual comfort requirements,' said Gareth Thomas, mechanical project manager at Whitehead, project contractor.

Both hybrid and natural ventilation solutions were provided to the school. The HVR Zero systems were installed throughout the classrooms, halls, and corridors, but natural ventilation systems were selected for larger spaces, such as the sports hall.

Provision of sufficient fresh air to buildings is essential to meet regulatory standards. BB101 is a set of guidelines, developed in 2006 by the UK Department for Education, that gives recommendations for the design and construction of school buildings that offer comfortable and healthy indoor environments to support learning and wellbeing. Revised in 2018, BB101 (2018) places tougher demands on ventilation strategies. Hybrid ventilation is now suggested to meet more stringent temperature and carbon requirements.

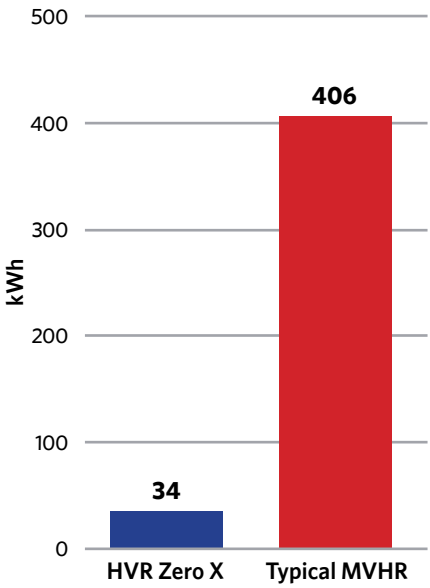


Figure 1: The HVR Zero X uses less than a tenth of the energy of a typical MVHR to ventilate a classroom

Monodraught conducted an energy and running costs comparative analysis of HVR Zero v MVHR systems, which details the ventilation energy required to keep a typical South East-based classroom to BB101 standards. The report compares the carbon emission impact and energy usage of a traditional MVHR installation with the HVR Zero X hybrid ventilation system, with optimised heat recovery core, in a standard theoretical classroom of 60m^2 with 32 occupants.

Figure 1 shows that the HVR Zero X system requires less than 10% of the energy of a typical MVHR system to ventilate a classroom. A large amount of energy is required to ventilate through a high-efficiency heat exchanger, which is designed for extremely low external temperatures of less than -5°C. However, very few occupied hours ever reach this temperature, particularly in the south-east of the UK. Consequently, ventilation systems are typically over-engineered, resulting in energy losses year round as the heat exchangers are used unnecessarily or the inefficient bypass modes are used, which have the same specific fan power (SFP).

Typical MVHR systems have an SFP of approximately 1 W·L^{-1}s^{-1}; the HVR Zero X system has an industry-leading average SFP of 0.09. Further, a running cost saving per classroom of more than £1,400 across 10 years was calculated.

HVR Zero can be used in single-sided or cross-flow ventilation strategies. The leading edge of the system uses the principle of an owl's wing to accelerate and decelerate the distributed ventilation air. This unique design reduces the audible noise of the movement of the ventilation air. It also has intelligent controls as standard, and inbuilt temperature and CO_2 sensors. CJ

TARGETING ZERO EMBODIED CARBON

HVR Zero is the first hybrid heat recovery system of its kind with zero embodied carbon. The materials used have been specially selected to minimise embodied carbon, and to ensure they are fully recyclable at end of life, supporting the circular economy. The residual embodied carbon is then offset via an independently accredited gold standard scheme.

Life Cycle Assessment methods were used to calculate the embodied carbon and quantify the residual CO_2 for offsetting purposes. The carbon emissions were calculated with the IPCC 2013 GWP 100a method, using established life-cycle inventory databases Ecoinvent 3 and USLCI, and the CIBSE TM65 embodied carbon mid-level calculation method. It was concluded that the total carbon footprint of each HVR Zero system is 256kg CO_2 equivalent. To build resilience in the calculation, 300kg of CO_2 was offset.

Monodraught partners with a UK-based tree-planting scheme, Ecologi. For a typical secondary school comprising 50 classrooms, with two HVR Zero systems in each, 30 tonnes of CO_2 is offset, and 100 trees are paid for and planted. This is equivalent to 30 long-haul flights, 90m^2 of sea ice saved, or 70,000 miles driven in a car.

The HVR Zero systems installed in classrooms

Monodraught provided ventilation to a new-build sports hall and classroom block at Holmer Green

I SEE DARKNESS IN YOUR FUTURE

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Regaining dark skies

This module considers the challenges of lighting populated environments while respecting the increasing demand for dark skies

Figure 1: The night sky as viewed from Ynys Enlli (Bardsey Island), located two miles off the tip of the Llŷn Peninsula, north Wales, that recently received International Dark Sky Sanctuary certification
(Photo credit: Steve Porter/Bardsey Island Trust)

In February 2023, Ynys Enlli (Bardsey Island), two miles off the mainland of north-west Wales, became the first site in Europe to receive International Dark-Sky Association (IDA) Dark Sky Sanctuary certification. This recognises the importance of the exceptional quality of starry nights and a protected nocturnal environment on what is a sparsely populated island (Figure 1). This is not an admonishment of the benefits, and the potential beauty, of artificial lighting, but a celebration of how environments can prosper with careful design and management. This CPD will consider the significant challenges of lighting the more normal, populated environments while respecting the increasing appeal of dark skies

Whereas an IDA Dark Sky Sanctuary designation increases awareness of fragile sites and promotes the long-term conservation of, principally, depopulated areas, the more densely occupied world can present greater challenges. The US-based IDA reports that light pollution is increasing worldwide at twice the rate of global population growth, with 80% of people and more than 99% of the US and European populations living under a light-polluted night sky. As illustrated in Figure 2, a screenshot from **www.lightpollutionmap.info**, the wider impact of light pollution stretches far beyond city centres.

As discussed at length in CIBSE SLL Lighting Guide 21 (LG21) *Protecting the night-time environment*,[1] pollution from the excessive, uncontrolled, or inappropriate use of artificial light is affecting human health, wildlife behaviour, and the ability to observe stars and other celestial objects. Lighting installations on industrial and commercial sites, outdoor advertising, roadways, and conurbations all need careful consideration to ensure that the design and operation of the numerous and various artificial light sources minimise the creation of adverse conditions.

Human vision during periods of darkness (normally at night) is known as scotopic vision (as explained in the boxout 'Human scotopic vision'). LG21 notes that the impacts of outdoor lighting at night affecting human perception (which otherwise would be dominated by basic scotopic vision) can be described in terms of three principle factors:

Sky glow refers to the increase in the brightness of the sky at night that overpowers light produced by natural sources, such as moonlight and the stars. Sky glow results from light that is emitted directly from a fixture, as well as light that is being reflected from the ground, from buildings or other sources. The light traverses the atmosphere, being scattered »

» by air molecules, suspended water droplets and dust particles. Sky glow is diffuse, so it can affect both people and wildlife over great distances. Light that travels near the horizontal is the most difficult to control, as it travels furthest through the lower, denser atmosphere.

Sky glow is most evident over cities and towns, but can also be a blight in less populated areas (as illustrated in Figure 2). In large conurbations, sky glow is evident in all directions, so people living in cities do not experience complete darkness. Circadian entrainment (where physiological or behavioural events match the normal light-dark cycle) is less evident in conurbations compared with rural areas, where there is little or no sky glow.

Light nuisance (often speciously referred to as 'light trespass') causes disturbance to individuals and the wider environment, such as when light from a lighting installation enters a nearby residential window or garden (although LG21 points out that some complaints are likely to be because of the activity rather than the lighting itself). The common feature of these complaints is that a significant amount of light crosses a property boundary and impacts on the ability of the adjacent property owner to enjoy, in the legal sense, the use of that property during the evening and into the night.

Glare from lighting is typically divided into one of two categories: disability glare or discomfort glare. Disability glare has an effect on visual capabilities, whereas discomfort glare is more often as a result of being in the presence of bright luminaires. The feature that separates glare from light nuisance is that glare causes discomfort, whereas light nuisance causes disruption. Also, glare can be associated with high-brightness luminaires at a distance far enough away that, while light nuisance is negligible, glare is still evident.

People who are subjected to glare frequently report headaches and fatigue, and it has been found to cause migraines. LG21 reports that this has been shown to impact productivity.

An additional consideration is **'presence'**, where – even if a lighting scheme was designed to avoid sky glow, nuisance and glare – there still exists the possibility of significant impact on dark and sensitive landscapes and wildlife because of the mere presence of the lights. This applies to impacts from both exterior and interior lighting. It is not just humans who can be affected. All wildlife needs darkness, and light does not need to be obtrusive in the most literal sense to affect both plants and animals. For example, the presence of artificial light was recently reported[2] as providing an inconsistent and confusing alternative to the celestial map as a direction-setting compass for dung beetles (and undoubtedly other animals) to reliably and repeatedly guide them to an area where they can store their dung, rest and feed. It has been estimated that artificial light at night may impinge upon two-thirds of the world's natural habitats.

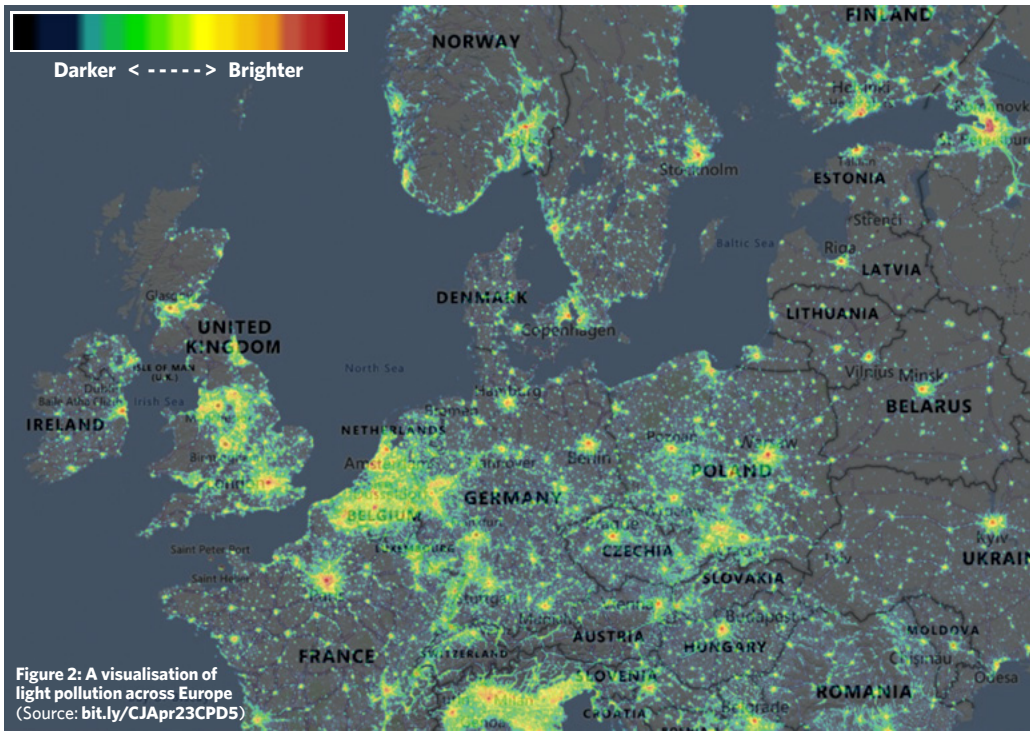

Figure 2: A visualisation of light pollution across Europe (Source: **bit.ly/CJApr23CPD5**)

Work recently reported by Kyba[3] suggests that the average night sky got brighter by 9.6% per year from 2011 to 2022, which is equivalent to doubling the sky brightness every eight years. As noted in the recent review paper[4] by the IDA, the adoption of solid-state lighting has changed the colour of artificial light emitted into the night-time environment. LG21 reports that the heavily-weighted blue light content of 'neutral' and 'cool' white LEDs can have a very harmful impact on the night-time environment. For example, a 4,000K LED source typically has a blue-light content of about 33%, whereas a warmer 2,700K or 3,000K source has 16% or 21% respectively. Blue-rich white light disturbs nocturnal creatures more than warmer monochromatic or narrow-waveband sources, so it is essential to consider the spectral distribution of a source, rather than just its colour temperature. When blue light gets into the sky, the scattering is much greater than that from the warmer end of the spectrum associated with older, traditional light sources. This may make sky glow more severe even when lighting levels are the same as they would have been with historical lamps, and may extend the impact of city lights much farther into adjacent, ecologically sensitive areas. It also impacts the utility of ground-based astronomical observatories. Existing satellites are not sensitive to blue wavelengths, so they can underestimate the light pollution coming from LEDs.[3] However, the IDA review notes research indicating that when LED retrofits are planned carefully, they can hold light pollution steady or even reduce it.

The CIBSE SLL *Lighting Handbook* (2018) and CIBSE SLL *Lighting Guide 6: The exterior environment* (2016) give recommended design criteria and guidance for a variety of exterior scenarios. The International Commission on Illumination (CIE) has a classification system[5] to help formulate guidelines for assessing the environmental impacts of outdoor lighting, and to provide recommended limits for relevant lighting parameters to contain the obtrusive effects of outdoor lighting within tolerable levels. The five CIE levels range from 0, intrinsically dark (as in Ynys Enlli) to 5 for high district brightness (as found in town and city centres). However, LG21 notes that the lighting designer must judge the zone carefully, as what may seem like a town centre might be separated from a woodland simply by a road or river – thus, bridges that cross them will effectively fall into two zones.

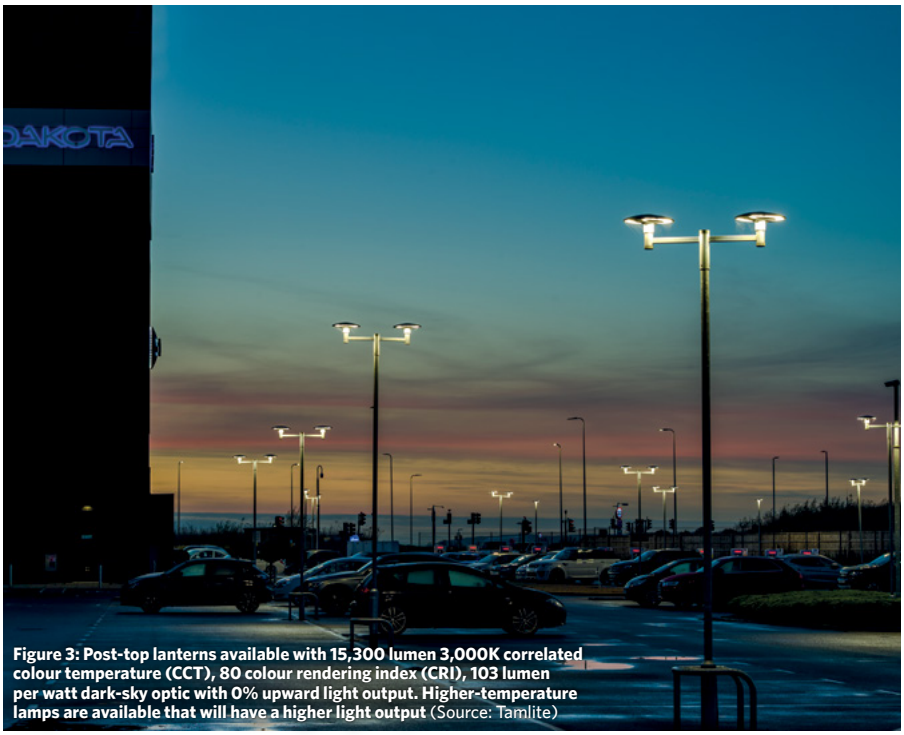

Figure 3: Post-top lanterns available with 15,300 lumen 3,000K correlated colour temperature (CCT), 80 colour rendering index (CRI), 103 lumen per watt dark-sky optic with 0% upward light output. Higher-temperature lamps are available that will have a higher light output (Source: Tamlite)

A significant cause of light pollution is the use of streetlights and other outdoor lighting. A practical measure is to employ properly shielded and directed lighting fixtures that are designed to direct light downward and minimise upward and outward scatter. Energy-efficient lighting fixtures that have low-glare or 'full cut-off' designs (such as those shown in Figure 3) minimise the amount of light that is wasted and reduce the amount of glare that is produced. This not only helps to protect dark skies, but can also save energy and potentially reduce life-cycle costs.

Lighting fixtures that are designed to be dimmed or turned off when they are not needed can provide significant benefit. For example, outdoor lights can be set to turn off or dim automatically during certain hours of the night. However, care is needed to ensure switching frequency is not so high as to increase annoyance.

IDA's Fixture Seal of Approval programme certifies independently tested outdoor lighting fixed-mounting luminaires as being dark-sky friendly. This sets requirements such as: upward light output ratio (ULOR) of less than the lower of 0.5% light output or 50 lumens; a dimming capability to 10% of full rating; and a maximum correlated colour temperature (CCT) of 3,000K. Practically, this can provide opportunity for narrow spectrum amber LEDs with CCT ≤2,500K where illumination for safety or security is not the primary concern and good colour rendering is unimportant. These also have the appearance of legacy low-pressure sodium lamps (which have a characteristic wavelength of 589nm), but with better colour rendering, by having a wider band of output wavelengths, centred around 590nm. However, higher-temperature LEDs that are still less than 3,500K CCT (warm white) – potentially used at lower lighting levels – are likely to be more appropriate where colour rendering is important to the acceptable use of the space, such as for historic and cultural applications, and for areas that are designed for regular, high use night-time pedestrian traffic, and spaces where activities such as maintenance take place.

The approaches outlined above may not be sufficient, as any new light, even if shielded, will add pollution to the night environment after being reflected off the surfaces being lit. New metrics are being investigated that may better interpret the holistic polluting impact of artificial light, such as those discussed in the recent work by Falchi and Bara[6] suggesting new approaches that treat light as a true pollutant, which could include defining a suitable set of sky-quality indicators and agreeing their acceptable limits.

LG21 highlights that, in the UK, light is recognised as a potential statutory nuisance in the Clean Neighbourhoods and Environment Act 2005 – although some facilities are exempt, including roads, airports, military facilities, transport hubs, goods vehicle operating centres, lighthouses, and prisons. Regional authorities, councils and parishes in a dark-skies area can set local planning requirements for evidencing that proposed lighting of new developments is limited to that required for specific needs of access, utility, safety and security, and that it is appropriately designed, controlled and – importantly – includes a workable, measurable maintenance plan. As noted by the UK's All-Party Parliamentary Group for Dark Skies,[7] new legislation is likely to be necessary to truly protect the UK's dark skies and night-time landscape. It recommends: strengthening the National Planning Policy Framework to make extensive specific reference to the control of obtrusive light; expanding the scope of the planning permission process by introducing regulations for exterior lighting that are similar to those that currently cover advertisements; and strengthening the Statutory Nuisance Provisions, removing exemptions to give local authorities a more effective method of preventing nuisance lighting.

With a holistic approach to planning, installation and operation – combining lighting solutions that are properly and thoughtfully matched for the local environment with an increasingly available range of reputable dark-sky luminaires, fittings and controls – there is great opportunity for a truly dark future.

Turn to page 44 for references

HUMAN SCOTOPIC VISION

The retina of the eye contains two types of photoreceptors – rods and cones. The rods are the most numerous and are more sensitive than the cones; they are responsible for dark-adapted, or 'scotopic', vision – from the ancient Greek *skotos*, meaning 'darkness', and *opia*, meaning 'visual condition'. Rods are not used to discriminate colour, although they are most sensitive to wavelengths of light around 498nm (green-blue) and insensitive to wavelengths longer than about 640nm (red).[8] The rods are incredibly efficient photoreceptors, at more than a thousand times as sensitive as the cones. Optimum dark-adapted vision is obtained only after a period of darkness, possibly 30 minutes or longer, because the rod adaption process is much slower than that of the cones.[9] The threshold for scotopic vision is around 0.001lux, which is about 1/1,000th of the brightness of a typical full moon.

Module 213

April 2023

1. What proportions of US and European populations are thought by the IDA to live under a light-polluted night sky?

- ☐ A Fewer than 50%
- ☐ B 51%-65%
- ☐ C 66%-80%
- ☐ D 81%-95%
- ☐ E More than 95%

2. Which of the following countries would appear to suffer from the most widespread light pollution?

- ☐ A England
- ☐ B France
- ☐ C Germany
- ☐ D Northern Ireland
- ☐ E Scotland

3. Which of these is not included in the article as one of the four factors that are used to describe light pollution?

- ☐ A Glare
- ☐ B Light nuisance
- ☐ C Presence
- ☐ D Sky glow
- ☐ E Switching frequency

4. In the illustrated post-top lanterns, what was the upward light output?

- ☐ A Below 5%
- ☐ B 6%-40%
- ☐ C 41%-60%
- ☐ D 61%-85%
- ☐ E More than 85%

5. What is the approximate threshold for scotopic vision?

- ☐ A 0.0001lux
- ☐ B 0.001lux
- ☐ C 0.01lux
- ☐ D 0.1lux
- ☐ E 1lux

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Further reading:

CIBSE SLL LG21 provides a great reference for this area and is free for CIBSE members. Institution of Lighting Professionals Guidance Note 01/20 *Guidance notes for the reduction of obtrusive light* provides some excellent succinct information and is freely downloadable.

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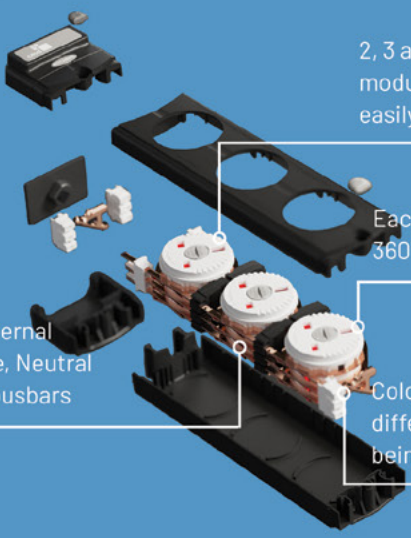

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walraven.com/en/fire-stopping-checklist

COLLEGE CONNECTS TO BOUYGUES HEAT NETWORK

A heat network of ground source heat pumps has been installed by Bouygues at Comberton Village College in Cambridgeshire, cutting carbon by 70%.

Bring forward decision on hydrogen, says Toogood

Industry needs more clarity on support for hydrogen, says champion

Government-appointed hydrogen champion Jane Toogood has urged ministers to consider the use of hydrogen blends in the national gas network this year, to help develop the nascent hydrogen economy.

The recommendation was put forward in Toogood's independent *Hydrogen Champion Report*, which calls on the government and industry to accelerate the development of the UK hydrogen economy.

Toogood was appointed by the government following the publication of the Energy Security Strategy last summer. She is co-chair of the Hydrogen Advisory Council and chief executive of catalyst technologies at Johnson Matthey.

Toogood has called for early clarity on whether hydrogen heating should be adopted for homes – including how it will be funded – to give networks time to begin planning. She said it should be made clear when and where hydrogen can legally be used, subject to the safety case being proved, as soon as reasonably practicable. The report calls for an early mandate for 'hydrogen ready' boilers to be considered.

Among other recommendations is the incentivisation of the construction of hydrogen refuelling stations.

Groupe Atlantic invests in Clade

HVAC manufacturer Groupe Atlantic has agreed a partnership with Clade Engineering Systems, manufacturer of natural refrigerant CO_2 heating and refrigeration systems.

The French owner of Ideal Commercial Heating, Hamworthy and ACV said it had made an investment in the Bristol-based Clade, but did not reveal how much its stake was worth.

Groupe Atlantic said Clade's expertise in natural refrigerant technology and heat pumps substantially upscales its commercial offering, providing customers with more choice on an industrial scale.

Clade manufactures all of its products at its Technology Hub in Leeds, which is located near Groupe Atlantic's commercial offices.

ABB launches smart tracker for UPS

ABB has launched a new tracker for the remote monitoring of critical uninterruptible power supply (UPS) systems, which it says will help users improve energy efficiency and system resilience.

A plug-and-play ANC Network Card connects ABB's UPS systems to cloud-based data analytics and tech support, and monitors the users system at any time and from anywhere.

Providing 24-7 remote monitoring of critical UPS systems, the tracker uses cloud-based infrastructure to provide remote supervision of multiple UPS devices and the electrical system.

Heat pump water heater targets gas-replacement market

Lochinvar's Amicus Aquastore has an output of 8kW and 455 litres of hot-water storage capacity

Lochinvar has introduced a new heat pump water heater aimed at the replacement market for gas-fired water heaters in commercial buildings.

The Amicus Aquastore is designed to minimise disruption by avoiding the need for wholesale changes to existing heating and hot-water systems.

The water heater has an output of 8kW and 455 litres of hot-water storage capacity, in a compact monobloc package combining heat pump and storage vessel. Lochinvar says it can deliver up to 65°C hot water in both efficiency and hybrid modes, and can deliver up to 490 litres in a peak hour with a 50°C temperature rise.

The units are tested according to EN 16147:2017. As such, the coefficient of performance (COP) and seasonal coefficient of performance (SCOP) are the same, at 3.2. Lochinvar says that, because it's an internal product, the standard testing only requires the unit to be tested in a room at 20°C, so it has not tested COP-SCOP at different plantroom temperatures. It will be testing the unit at different plantroom temperatures, but says it will take time, as it has to book laboratory time.

Refrigerant R134A is used with a very low charge of 1.85kg. This has a lower global warming potential than some, more traditional, refrigerants – such as R410A – but it is A1 class, stable and reliable at higher temperatures.

The Amicus Aquastore from Lochinvar

Lochinvar says Amicus heat pumps can be used as standalone replacements for conventional heating products, or as part of an integrated system providing pre-heated feed water to gas-fired condensing boilers, water heaters and thermal stores in buildings with large heating or hot-water demands.

Installation can be completed by any competent plumber; as the unit is monobloc, with a very small refrigerant charge (1.85kg), installation/commissioning can be completed without any F-gas qualifications. General yearly maintenance on the unit can also be carried out by a competent plumber as, again, there are no F-gas items that need regular maintenance. Should a fault occur on the refrigerant side, a F-gas-certified engineer would be required.

As a monobloc heat pump, might there be some trade-off against using a split – such as losing some efficiency, more noise or vibration, and ducting requirements?

The monobloc unit is designed to be fitted inside without ducts. Noise is not an issue, as the level is probably no higher than lots of other equipment within the plantroom. The unit does need to be ventilated sufficiently if it is in a small area, as the heat pump will cool the plantroom down. Efficiency is kept high by using the refrigerant gas directly to heat a gas coil around the outside of the storage vessel, rather than using a plate heat exchanger.

In terms of cost, compared kW for kW with a natural gas system, our closest gas condensing unit, at 11kW, is roughly half the capital cost. However, it would be more expensive to install because of the flue and commissioning, so the gas unit would work out a third cheaper to purchase and install.

Lochinvar says it is not able to provide embodied energy estimations for the equipment yet, but is looking at using CIBSE TM65 to calculate the figure.

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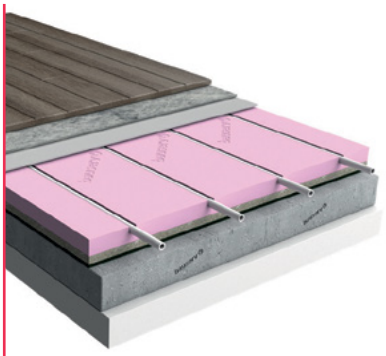

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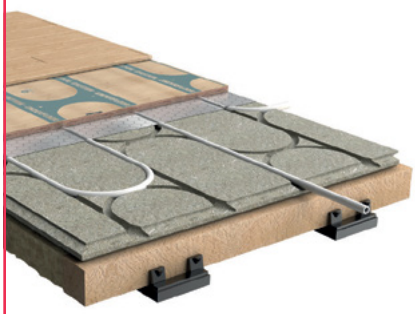

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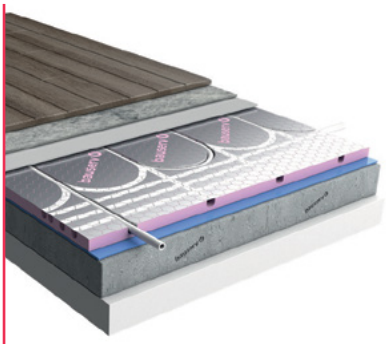

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HEATED DEBATES

Decarbonisation of heat is a hot topic at this year's CIBSE ASHRAE Technical Symposium. We look at some of the papers that had been approved before we went to press

Casey Cole will speak on digitising heat network commissioning

With building heating responsible for a quarter of all carbon emissions in the UK, it is imperative that the building industry finds a way to decarbonise heat in new and existing buildings if it is to meet its 2050 net zero goals.

CIBSE ASHRAE Technical Symposium offers a platform for researchers in academia and industry to share their latest developments in practice and technology, and this year's event – at the University of Strathclyde from 20-21 April – has a strong leaning towards decarbonising heat.

With the UK aiming to raise the ratio of heat distributed by heat networks from 2.5% to 20%, it's not surprising that talks on heat networks feature heavily at the Technical Symposium.

Giving a keynote in the opening session is Casey Cole, of Guru Systems. The title of his talk is 'Digitalising heat network commissioning – using apps to deliver well-performing heat networks', and it focuses on a mobile and web app that is designed to make acceptance testing of heat networks quicker and more cost-effective. Acceptance tests help verify that dwelling performance matches the design and performance specification. Cole's talk will feature three developments in London.

Aya H Heggy, from London South Bank University (LSBU), reviews the status, potential, barriers and opportunities of district heat networks in London. Her presentation will identify those heat networks most in need of upgrading, and consider possible solutions.

Dr Ángeles Rivero Pacho's case study of Smart Square at the University of Warwick looks at data from 17 buildings connected to the university's heat network to understand the dynamic behaviour and peak heat demands of the facilities. The assistant professor's paper says this will allow smart control of the heating network by predicting demand, controlling peak loads and using thermal storage capacity.

Heat network consultants FairHeat are again well represented at the symposium, with three approved papers so far. Last year, Gareth Jones, managing director at FairHeat, won the award for 'Most significant contribution to the art and science of building services engineers' for his paper 'Field trial and design approach for improving hot-water delivery time'. Papers being presented by FairHeat engineers this year are 'Hourly load modelling for heat pump and thermal store sizing in a hybrid energy centre', by Ellie Hiscock; 'Heat network optimisation opportunities – key outcomes from an assessment of existing heat networks', by Nikzad Falahati; and 'Optimising electric peaking plant capacity with oversized thermal stores', by Jake Adamson.

Last year's award for the 'Most effective delivery of material' went to LSBU's Graeme Maidment for his presentation 'The generation gap! Are 5th generation district energy schemes better or just different?'. This year, his presentation considers the use of supermarkets as local energy centres by capturing heat from the supermarket condenser via an ambient water loop.

Professor Yunting Ge, also from LSBU, shares research carried out on extensive energy storage of a phase change material (PCM) heat exchanger for space heating. Measurements from a PCM heat exchanger were compared with a 3D CFD model to help guide the operations of a PCM-filled heat exchanger and its integration with renewables and heat recovery systems for heating purposes.

Meanwhile, LSBU's Maryam Ghaffari will look at the potential for using sustainable energy from the human sewage network, and share research on modelling of methane formation in a gravity sewer system. Her paper considers whether methane can be captured and used as a source of energy.

Mott Macdonald's Dr Narguess Khatami will discuss a methodology to develop a heat decarbonisation pathway plan for existing buildings. Estimated baseline energy use and carbon performance are used to make comparisons with recommended intervention scenarios. Optimum solutions were based on the cost-energy benefit of interventions and the technical practicality of implementing solutions.

LSBU visiting professor Phil Jones concerns himself with developing technical standards for heat networks in the UK. His paper sets out progress in developing a scheme that will provide credible assurance of the performance of heat networks and demonstrate compliance to technical standards.

Professor Neil Hewitt, from Ulster University, will consider current research on high-temperature heat pumps delivering heat at more than 100°C and will look at the systems being developed. CJ

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Heat pumps are the best solution, for now

Green hydrogen is being hailed as a home-grown super-fuel that will help the UK achieve net zero carbon emissions. But until it becomes available, Whitecode Consulting's Alex Hill says heat pumps are the only way to decarbonise buildings – however challenging they are to install

To reduce reliance on fossil fuels, the government plans to turn to hydrogen. This offers a good alternative to natural gas because it can be added to the current gas network and sent to our homes in the same way.

However, we do not currently have adequate infrastructure to accommodate hydrogen in the UK.

The extraction of hydrogen is a highly expensive process, making it difficult to sustain a national infrastructure. Additionally, the physical properties of hydrogen make it hard to store and transport. It is also highly volatile, which complicates its usage.

Moreover, there are two methods used to extract hydrogen: electrolysis (green hydrogen) or steam-methane reforming (blue hydrogen). Blue hydrogen is not made from renewable resources and, therefore, causes pollution. This is a huge issue because the majority of the global hydrogen supply is blue. So, while research and development is done to find more sustainable methods of harnessing green hydrogen, it is imperative to look to alternative sources of energy, such as air source heat pumps (ASHPs) in the interim.

"ASHPs must be located externally, on a roof or at the back of a building. However, this causes conflict"

Whitecode is at the forefront of integration of ASHPs after the effective ban on natural gas boilers in the Greater London Authority (GLA) region. Nevertheless, their integration is not straightforward. One client told me: 'After 15 years, we have just got used to combined heat power, district heating and heat interface units, and now this. I can see it being a disaster.'

First, boiler rooms tend to be in basements, at ground level or in areas not suited to any other use. If you are lucky, the plantroom might have an external wall. Conversely, ASHPs must be located externally, on a roof or at the back of a building. However, this causes immediate conflict between building services engineers, architects and planners. We are now regularly seeing plantrooms on roofs, necessitating staircases and lifts to go up to these levels as well. Moreover, schemes have often grown in height as new applications or amended applications are introduced. In some cases, the plant on the roof is more than a storey high when acoustic attenuation is added.

The next problem is temperature. Heat pumps have a high flowrate and operate at low flow and return temperatures. This is particularly relevant to the application of heat pumps in residential buildings, where the hot-water demand means a second heat source is needed to raise the primary flow temperature so that instantaneous heat interface units can generate hot water at 50°C. Typically, this is achieved using a higher-temperature water-to-water heat pump, or electric boiler.

The biggest challenge we have faced is working within the confines of the building footprint. For example, a 10x10m plantroom could easily house 6mMW of gas boiler plant. For the equivalent output using an ASHP, you would probably require a space six times greater to fit the ASHP on a roof. We often find on larger schemes that the client expects the team to find space at ground level or lower levels, as the weight of ASHPs has structural implications, increasing the cost of implementation.

The lack of roof space and structural capacity often leads to solutions using ambient loops, much smaller external ASHPs and water-to-water heat pumps in the apartments. This solves the external planning problem, although the GLA did not approve of them initially.

Whitecode has found that the majority of its client base does not like these solutions because of their cost and size, as they fill the apartment service cupboard.

The second-biggest issue we have encountered with heat pumps is noise. Extracting heat from air generates a high level of noise, which creates a significant problem. In addition to the overheating requirements set out in Approved Document L, some councils have stated that the exterior plant must be 10dB below ambient noise. So, minimising noise is a priority. »

Green hydrogen is not yet ready to be pumped into the gas grid

» Attempting to reduce noise output can lead to large amounts of attenuation and, in some cases, we have had no option but to move the plant because we cannot provide enough attenuation to reduce the noise adequately.

We have noticed that this is not as much of a problem in office buildings, as most sites already have a large rooftop louvre area for the cooling plant. This generally means we are able to increase existing plant areas rather than introduce new ones.

As a result, we often have roof plantrooms instead of conventional basement plantrooms. In addition, we are now supplying these sites with reversible chillers or chillers that can produce hot and cold water simultaneously, to minimise the pressures on space.

Electrical capacity is the biggest challenge relative to costs. The use of heat pumps shifts the demand from the gas network to the electrical network. The power consumption is minimised because of the ratio of the heat output to energy input of the heat pumps, but we still run into the problem of the extra load placing a strain on the network.

For example, a residential development with gas boilers would use around 1.5kWe per unit as a diversified load; with heat pumps, this could now be as high as 3-4kWe – and, with car charging, the peak load could exceed this.

The same applies to commercial developments. The 1MW of energy produced by a boiler could be replaced by a reversible chiller, but while the electrical demand for the site when being served by gas heating could be minimal, at least 350kW of additional electrical demand would be needed just for supplying pumps and ancillaries, which often requires network reinforcements.

One of our sites in West London has been advised that the electrical network will only be able to supply them with 1MW per year. The project has a total load of around 10MW, meaning their site now has a minimum 10-year build programme unless we find a solution. We are beginning to talk about battery banks to support the network, or generating our own power using generators until the Grid catches up. This raises more questions about sustainability and what fuel source would be used – oil or gas? These are real conversations we are having with our clients.

I wish that the price of ground source heat pumps was more accessible. At this point, the capital cost is a barrier unless the client is prepared to accept that the ground source solution will provide a long-term return.

With all the material cost increases, everyone is looking for the cheapest solution, but we should all consider heat pumps as the most efficient solution, even if they cost more to run.

ALEX HILL is the managing director at Whitecode Consulting

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Modular approach

As demand for computing power grows, designers and specifiers must focus on reducing energy demand in data centres. Kohler's Alex Emms says modular uninterruptible power supply can improve energy efficiency

Data centres are responsible for almost 1% of global electricity demand and 0.3% of all global CO_2 emissions. Energy efficiency has been brought into focus by the volatility of the energy market – but for most data centres, it has been on the agenda for a long time.

The efficiency of an uninterruptible power supply (UPS) has been gradually improving, but mechanical cooling systems have attracted the most attention regarding energy overheads reduction.

Many data centres have had to react to fast-growing demand and, in doing so, have been replacing or installing newer equipment. Integrating more efficient, modular systems and having a better understanding of power usage effectiveness (PUE) and other emerging units of measurement – such as total power usage effectiveness (TUE) – have become the driving forces behind the improvement in energy efficiency of data centre infrastructures.

PUE can be defined as a measure of how efficiently power is used within a data centre, by measuring the ratio of total amount of power used to the amount of power delivered to computing equipment. Although originally an innovation by The Green Grid – a not-for-profit consortium of end-users, policy-makers, technology providers, architects, and utility companies – the thinking behind what capacity is required for a given ICT load in a data centre has always been one of the first tasks of the designer.

It is the de facto measurement for power currently, although, as we aim for wider energy efficiency, other measurements are coming into play, including water usage effectiveness (WUE) and carbon usage effectiveness (CUE). The others, although valid, are still being talked about rather than implemented, including TUE, which can be a more effective metric for calculating a data centre's overall energy performance, but requires a greater understanding of the IT hardware in place. PUE remains the measurement needed for power consideration.

A 2020 global survey found the average data centre achieves a PUE of 1.59. In the UK, a PUE of less than 1.5 can be expected, but the lower the better. Newer, larger data centres tend to be more efficient, but there is still a need for older data centres to be aware of the changes they can make to influence their critical power support and their energy efficiency, particularly as they replace legacy systems.

"Instead of monolithic standalone systems, UPS suppliers can offer resilient, flexible, modular ones"

Newer models of UPS have very advanced, multi-level and interleaved inverters with no output transformers, power management systems, and smart modes, to help reduce energy loss.

Nowadays, instead of monolithic standalone systems, UPS suppliers can offer resilient, flexible, modular systems that are contained within a single infrastructure cabinet and can be run smarter. For example, spare modules go into standby mode when not required to support the load, while still maintaining the required level of active redundancy.

Expansion of capacity is a matter of adding a further module, and contraction is a simple matter of turning off modules, reducing the need for systems to be always on, powered to the max 100% of the time. The aim is to allow the UPS to be loaded to 30-60% at any given load – where the UPS will be able to provide its highest efficiency rating.

Data centre managers need to be informed to ensure the choices they make are right for mission-critical data centre applications – for today and for the future. This means collaborating with suppliers and consultants who understand current and future challenges, and who can make this decision-making process much simpler. In-depth knowledge and extensive experience, as well as a comprehensive choice of solutions that will fit the data centre's specific needs, should be considered.

This level of expertise must be continued throughout the life of the protected power installation, to meet the challenges of providing timely UPS maintenance and adapting to evolving site requirements.

As energy costs rise and the reliability of smart-mode UPS operation is proven, data centre managers are aiming for the typical PUE to be less than 1.10 across all of Europe. This is good for business and for the planet. But research and the right partnership are key to obtaining energy efficiency and critical power backup with no compromise on reliability.

ALEX EMMS, is operations director at Kohler Uninterruptible Power UK

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IMPERFECT HARMONY

Ultra-low harmonic drives ensure disturbance-free electrical power, as well as better efficiency and reliability, says ABB

Electrical equipment runs most efficiently and reliably when it is supplied by clean, disturbance-free electrical power. Often, however, power networks – for multiple reasons – are subjected to continuous or transient electromagnetic disturbances.

The most frequently seen continuous disturbances in almost any network are harmonics, which can have a significant effect not only on power-network efficiency, but also reliability.

Harmonics can cause damage to sensitive electronics and interference in communication equipment, and give false readings. They can trip circuit breakers, blow fuses and cause capacitor failures.

Harmonics are electromagnetic pollution in the power network resulting in current and voltage waveform distortion that makes it different from the pure sinusoidal waveform generated by the electrical supplier. Harmonics are generated by non-linear loads such as LED lighting, uninterruptible power supplies, computers, or variable speed drives (VSDs) as a result of the constant switching of power electronics elements in their design.

VSDs help to save a tremendous amount of energy in processes with varying loads, such as data centres, and they do this by adjusting application motor speed to the exact process need.

At the same time, it is important to remember that, just as with other non-linear loads, drives generate harmonics in the power line that, as already mentioned, can have an adverse effect on the network and the connected equipment when they exceed certain limits. Hence, the VSD harmonic content level needs to be considered at the project stage to evaluate its effect and its consequences for the facility.

The presence of harmonic content is measured as a percentage value, known as the total harmonic distortion (THD) – which is the relationship between all the current or voltage harmonics and the fundamental current or voltage. Where no voltage or current harmonics are present, THD is 0.1%.

The higher the harmonic content, the higher the line current, which means higher losses in the network, including its components, such as transformers, switches, circuit breakers and cables. Increased line current also means that power network equipment overheats, which causes premature failure – and because a current with harmonics in it is a distorted current, there is a risk of connected equipment malfunctioning.

Harmonics may not cause immediate issues; malfunctions may take time, or may only happen when certain combinations of equipment come 'on line'. Often, site issues are not even attributed to harmonics by the users. But it's important to understand that, in mission-critical facilities, such as data centres, harmonics can lead to serious consequences, causing financial and reputational damage.

When selecting equipment, therefore, it's crucial to make sure it does not have an adverse effect on the power system or connected devices, which, in turn, ensures higher process reliability and efficiency.

Instead of trying to tackle harmonics by often ineffective actions, such as adding cooling or over-dimensioning equipment, one solution is to employ equipment that does not cause harmonics in the first place.

ABB's ultra-low harmonic (ULH) drives are based on active front-end technology with DC bus capacitors, and they produce a harmonic content that is less than 3%. In systems that require minimal harmonic content, this can lead to improved overall efficiency and contribute to process reliability. With a passive filter, the typical total harmonic distortion is between 5% and 10%.

The compact drive features built-in harmonics mitigation. This includes an active supply unit and a low harmonic line filter. As there is no need for external filters, multi-pulse arrangements or special transformers, the simple installation offers significant space, time and cost savings.

As there is less risk of overheating with lower harmonic currents, there is no need to over-dimension equipment, such as transformers and cables.

The possibility to stabilise the output voltage of a ULH drive is an advantage compared with passive filters. At nominal loads with a passive filter, there is typically a 5% voltage drop. On partial loads, the voltage over the passive filter can rise by up to 10%, creating the possibility of an over-voltage fault occurring.

ULH drives achieve a unity power factor, indicating that electrical energy is being used efficiently.

They offer the possibility for network power factor correction to compensate for the low power factors of equipment connected to the same network. They can also help avoid penalty charges set by electrical utilities for poor power factors.

Lower harmonics and full motor voltage at all times mean reduced system losses and better overall system efficiency. CJ

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Electrical environmental systems in homes to meet low carbon regulations

This module explores the output of SAP modelling for combinations of systems that include a variety of heat pumps

Opportunities and enthusiasm for the application of electrical systems in buildings – and particularly homes – are on the rise where, until recently, the standard selection of environmental services would have probably included the combustion of fossil fuels. This CPD will examine some modelled scenarios to evaluate whether a sample of currently available electrical systems can be applied to meet the demands of regulatory performance standards.

In systems designed for new dwellings, a mixed mode of delivering hot water and space heating will probably prevail, which will use several electrical technologies to meet both the heating and hot water load – the provision of hot water being the dominant heat load. The systems that have been considered in the modelling, as described later in this article, are listed in Table 1. These are based on well-established principles and technology, with some of the systems' components having been more recently refined and developed into products that can deliver high performance with flexibility and a lower environmental impact than traditional systems.

Whichever combination of systems is employed, the success of the whole building will be dependent on the method of control and how 'smart', well integrated and accessible it is for the building occupants. The systems and sub-systems will typically include linked sensors and local control (including independent timing/zoning), which communicate via wireless communication (using, for example, Wi-Fi, Bluetooth, ZigBee and proprietary protocols). These can apply a variety of regimes including timed, optimum start, weather compensation, adaptive and predictive control. Heat pump compressors will typically have variable speed control to satisfy a wide range of operating conditions.

There are three variants of heat pump applications in Table 1. The **ambient loop + heat pump** arrangement was discussed in CPD module 190 (*CIBSE Journal* January 2021). This employs a local or district heat network, typically circulating treated water with a flow temperature of between 15°C and 25°C to supply heat (or coolth) to an indoor unit. The ambient heat network might receive low-grade heat from any suitable source, such as waste heat recovery from processes and buildings; high efficiency low temperature heat pumps (water, ground and air source); sewage treatment; and mine water sources. Although there are a number of possible permutations for moving the heat into the residence, a flexible arrangement, allowing individual occupier control (and billing), is to provide a compact monobloc heat pump and water cylinder in each residence, which is connected to the central ambient water loop. The heat pump is designed to supply both the domestic hot water and hydronic heating systems (and, optionally, cooling).

Units are designed to fit within a standard utility cupboard or kitchen unit. The connected heating distribution may be any suitable hydronic sub-system (such as underfloor heating, fan assisted or plain radiators, or fan coils).

The **air source heat pump (ASHP) + store** is an external monobloc heat pump that, using inverter speed control, is able to »

» supply variable temperature primary heating water to an internal unit (as in the example of Figure 1). The internal unit controller sets the external unit to supply water at the correct temperature to either service a hydronic space heating sub-system or to heat the domestic hot water store. This particular R290 system, available with 6kW and 8kW output, can operate in outdoor temperatures down to -20°C and produce hot water in the 170-litre integral store up to 60°C with a seasonal coefficient of performance (SCOP) for the heating up to 4.85 at 35°C and up to 3.93 at 55°C.

(The wider modelling exercise also included a similarly sized split ASHP system and integral store employing R32 refrigerant that provided comparable results to the monobloc system.)

A dedicated **hot water heat pump (HWHP)** is designed to meet the hot water needs of the dwelling (with the space heating being supplied by other means, such as electric radiators). The example shown in Figure 2 is a R290 monobloc heat pump with COP up to 3.36 (at ambient 7°C, water 53°C), integrated with hot water stores up to 270 litres, supplied with heat from the outdoor air via circular ducting and which rejects cooled air from the evaporator through a separate duct (smaller units employ concentric, single conduit, ducts). Since this is a completely independent unit, it can be employed in a mixed-mode installation with other fuel types.

To illustrate the opportunity of employing electrical-powered environmental systems, a selection of example homes with a variety of environmental systems were modelled (on behalf of the supporter of this CPD article) with the method provided by SAP 10.2 (see 'SAP' boxout). The resulting data illustrated in this article are the individually modelled dwelling primary energy rates (DPER). Primary energy is useful for performance comparisons between various building systems, and is described by the Building Research Establishment (BRE) as being 'energy from renewable and non-renewable sources which has not undergone any conversion of transformation process'.

The target primary energy rate (TPER) is the regulatory annual maximum primary energy use, expressed as kWh_{PE} per m^2 per year. This is determined for a notional building (as part of a SAP10.2 assessment), and the resulting TPER is compared with the DPER calculated for the actual dwelling, using the method in the SAP guidance. Other metrics are provided as output from SAP assessments including carbon emissions and fabric energy efficiency, which similarly have set maxima for compliance.

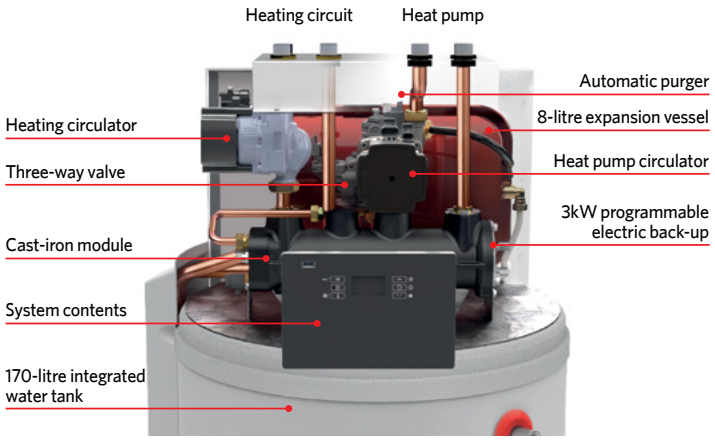

Figure 1: Internal controller, heating circulator and integrated domestic hot water store that is supplied with primary hot water from an external monobloc heat pump (Source: Dimplex)

Ambient loop + heat pump	Ambient water loop (potentially linked with district heat network) with individual dwelling R290 water sourced monobloc, internal, heat pumps integrated with 172-litre hot water storage in each dwelling
Air source heat pump (ASHP) + store	Air sourced, external, R290 monobloc heat pump servicing 170-litre hot water store and separate low-temperature heating system
Hot water heat pump (HWHP)	R290 air sourced hot water monobloc, internal, heat pump complete with integrated 200-litre hot water storage
cMEV	Continuous mechanical extract ventilation
Electric radiator	Wall-mounted, electric radiator
Gas boiler	Natural gas boiler as provider of heating (not hot water)
Natural vent	Natural ventilation
MVHR	Mechanical ventilation and heat recovery system

Table 1: Example component system types as applied in the modelling reported in this article

Figure 2: Hot water heat pump installed in the top section atop an unvented, stainless steel, 200-litre domestic hot water cylinder (this particular model also available with 170- and 270-litre cylinders) (Source: Dimplex)

SAP – STANDARD ASSESSMENT PROCEDURE FOR ENERGY RATING OF DWELLINGS

SAP[1] is a UK methodology to determine the energy compliance of dwellings. It sets out the requirements for the energy efficiency of new and existing buildings, including the amount of primary energy use and carbon emissions. The methodology takes into account factors such as the building's fabric, heating and cooling systems, ventilation mode, lighting, and energy sources. SAP is occasionally updated to reflect changes in building regulations and advances in technology, and its use is a requirement for compliance with England and Wales Building Regulations. The most recent update is SAP 10.2, introduced in 2022. (For existing dwellings, a simplified version of SAP – Reduced Data SAP (RdSAP) – is used to assess energy performance.)

For SAP calculations, dwellings have a standard occupancy and usage pattern, which applies typical values that in practice vary substantially between dwellings of similar size and type.

SAP calculations are not suitable for design purposes.

Wall U value	0.18W·m^{-2}K^{-1}
Roof U value	0.10W·m^{-2}K^{-1}
Floor U value	0.12W·m^{-2}K^{-1}
Window U value	1.2W·m^{-2}K^{-1}
Window G value	0.71 for houses
	0.55 for flats
Air permeability	4m^3·h^{-1}·m^{-2} @ 50Pa for mechanically ventilated homes
	5m^3·h^{-1}·m^{-2} @ 50Pa for naturally ventilated homes
Lighting	105 lumens per circuit watt
Party walls	Houses and flats had fully-filled and capped party walls.

Table 2: Common characteristics of modelled homes

	Two-bed	Three-bed	Four-bed
Main system type	**Number of 250W PV panels included**		
Electric panel heater with HWHP and MVHR	0	0	1
Electric panel heater with HWHP and cMEV	0	0	5
Electric panel heater with HWHP and natural ventilation	1	2	10

Table 3: Number of roof-mounted 250Wp PV panels

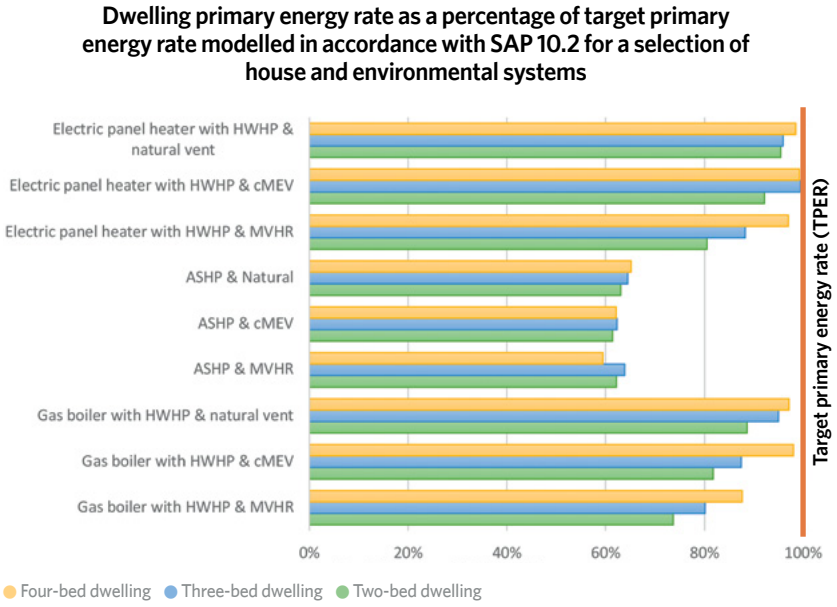

Figure 3: Dwelling primary energy rate (DPER) as a percentage of target primary energy rate (TPER), modelled in accordance with SAP 10.2 for selection of houses and environmental systems

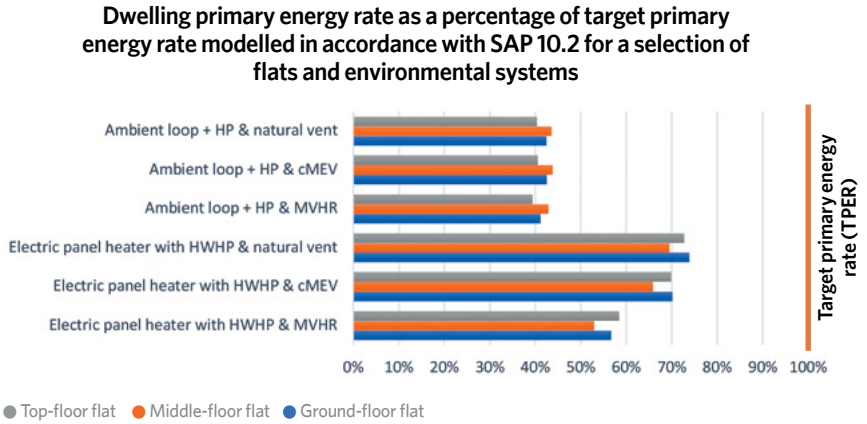

Figure 4: Dwelling primary energy rate (DPER) as a percentage of target primary energy rate (TPER) modelled in accordance with SAP 10.2 for selection of flats and environmental systems

The modelled dwellings included the following residences, all east facing:

- Two-bed and three-bed end of terrace or semi-detached dwellings with 57m^2 and 77m^2 floor area, respectively
- Four-bed detached dwellings with 122m^2 floor area
- Two-bed flats with 61m^2 floor area – situated on the ground floor, intermediate floor and the top floor.

The fabric and lighting specification used for the models are shown in Table 2 and the component environmental systems in Table 1. The modelled houses with electrical panel heating were also selectively fitted with 250Wp solar photovoltaic (PV) panels, as shown in Table 3.

As with any modelling exercise, the output is dependent on the assumptions that were made in creating the digital representation of the building and the systems. The modelling output was used to create the charts in Figures 3 and 4. (The complete output from the model included the full set of metrics used for compliance purposes.)

The TPER indicated by the orange line is the maximum that is deemed acceptable in normal new dwellings to meet the requirements of the England and Wales Building Regulations. While acknowledging that this is not a design tool, but a method to test regulatory conformance, the results still indicate that there are potentially significant variations in the operational energy use between systems. For all these cases, the combination of fabric, systems and energy source met the standard – with the selective use of PV ensuring that all the houses with electric panel radiators met the requirement. The all-electric houses that employed ASHPs had the lowest DPER. In the flats, perhaps surprisingly, the installations that included radiant panels were clearly well within the limit set by the TPER. However, it was the flats employing the ambient loop and heat pump solution that achieved the largest modelled reduction in the DPER compared with the TPER.

The smaller properties performed better. For larger homes that have a greater space-heating demand, performance is likely to require improving with increased fabric performance, renewable systems (such as PV) or systems such as waste-water heat recovery. From this sample of modelled dwellings, a hybrid (and/or mixed mode) approach appears to provide a reasonable solution to meet the requirements of SAP – but, as ever, each particular project requires careful consideration.

Turn to page 64 for references »

Module 214

April 2023

1. Which of these was not included as an example of wireless communication protocol for controls?

- ☐ A Bluetooth
- ☐ B Ethernet
- ☐ C Proprietary
- ☐ D Wi-Fi
- ☐ E ZigBee

2. Which of these is most likely to be flow temperature in an ambient network?

- ☐ A -4°C
- ☐ B 4°C
- ☐ C 14°C
- ☐ D 24°C
- ☐ E 34°C

3. For the ASHP + store system, what is the quoted SCOP when supplying heating water at 55°C?

- ☐ A 1
- ☐ B 3.3
- ☐ C 3.93
- ☐ D 4.83
- ☐ E 10.2

4. Which dwelling type required the most renewable additions (in the form of PV panels) to meet the requirements of SAP10.2?

- ☐ A Two-bed house
- ☐ B Three-bed house
- ☐ C Four-bed house
- ☐ D Top-floor flat
- ☐ E Ground-floor flat

5. Out of all the scenarios illustrated, which of them had the lowest DPER compared with the TPER?

- ☐ A Ambient loop + HP & MVHR (flats)
- ☐ B ASHP & MVHR (houses)
- ☐ C Electric panel heater with HWHP & cMEV (houses)
- ☐ D Electric panel heater with HWHP & MVHR (flats)
- ☐ E Gas boiler with HWHP & MVHR (houses)

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References:

1 **bit.ly/CJApr23CPD26** - accessed 28 February 2023.

Products of the month

Continuous flow water heaters installed at Premier League club

Rinnai claims the installation costs 20% less to run than 20-year-old hot-water storage systems it replaces

The installation of a new hot-water delivery system at a top London Premier League football club has just been completed. It replaces the old, traditional, stored cylinder configuration with specifically designed, energy-efficient, Rinnai continuous flow delivery on-demand water heaters.

The installation was completed at a stadium that is less than 20 years old and was once considered state of the art. The new system is capable of delivering more than 9,000 litres of temperature-controlled hot water every hour, non-stop. With the huge peaks of demand on match days, the site cannot afford to run out of hot water for the kitchens, catering, hospitality, toilets, and extensive wash and showering facilities.

Continuous flow systems heat water on demand, so fuel is only used when the system is operational. Compared with heated storage systems, Rinnai claims the system can yield financial reductions of nearly 20% of the running cost and more than 30% of the upfront cost, as well as reductions of more than 15% in carbon footprint, 75% in space, and 85% in weight, creating a highly practical and economic solution for the client, while lowering onsite carbon.

The installation includes a manifolded bank of 10 Rinnai Sensei N series 1600i continuous flow water heaters, together with Nexus scale protection and BMS integration. All units featured Rinnai commissioning to secure long-term warranty guarantees.

Rinnai continuous flow water heaters are an integral part of the organisation's H1 initiative, which aims to use natural gas, hydrogen blends, hydrogen, liquefied petroleum gas (LPG), and BioLPG to lower onsite emissions. Units are typically 30kg – a one-man lift, making the entire installation process far easier – and two sizes are available: 47kW and 58kW, which produce 774 and 954 litres per hour at a 50° rise, respectively.

The H1 continuous water heaters and boilers offer practical and economic decarbonisation delivered through technological innovation in hydrogen and renewable liquid gas-ready technology. Rinnai's H1 option is centred on hydrogen, as it is anticipated that clean hydrogen fuels will become internationally energy market-relevant in the future. Rinnai water heaters are hydrogen 20% blends-ready and include the world's first 100% hydrogen-ready hot-water heating technology.

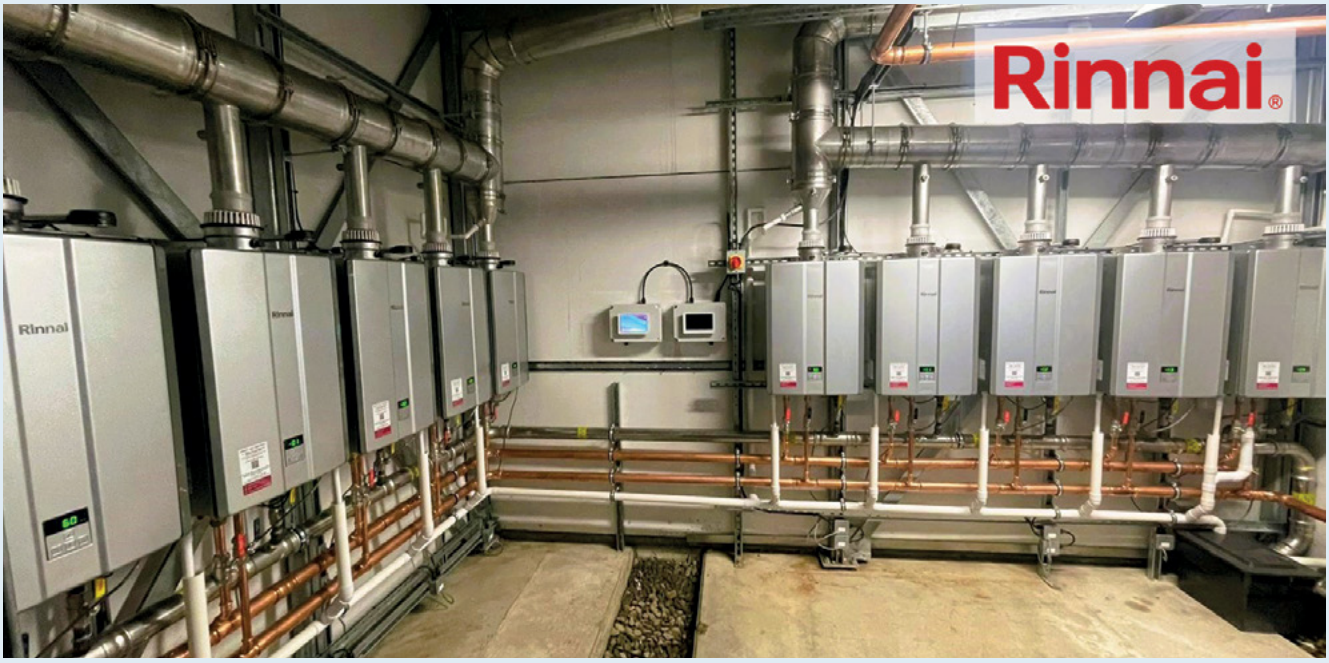
"It is anticipated that clean hydrogen fuels will become internationally energy market-relevant in the future"

Rinnai's complete range of hot-water heating units are available for next-day delivery on orders placed before midday.

In addition to the H1 range, Rinnai has introduced its H2 and H3 ranges of decarbonising products, which includes hydrogen/BioLPG-ready technology, hybrid systems, a wide range of low global warming potential (GWP) heat pumps and solar thermal. The Infinity hydrogen blend-ready and BioLPG-ready continuous flow water heaters are stacked with a multitude of features that ensure long life, robust and durable use, customer satisfaction, and product efficiency.

Rinnai's H3 range of decarbonising products offers pathways and customer cost reductions for commercial, domestic and off-grid heating and hot-water delivery. The range covers all forms of fuels and appliances currently available – electric, gas, hydrogen, BioLPG, rDME solar thermal, low-GWP heat pumps, and electric water heaters. Rinnai's H3 range of products offers contractors, consultants, and end users a range of efficient, robust and affordable decarbonising appliances that create practical, economic and technically feasible solutions.

Visit www.rinnai-uk.co.uk



› Products of the month

New 12-year warranty for Rinnai products

Manufacturer says range of commercial and domestic water heaters align with present and future energy sources

Rinnai has introduced a comprehensive 12-year warranty on all of its fully certified I2HY20 continuous flow hot-water heaters in the UK. The warranty is expected to give heating engineers, contractors, consultants and end users a practical, technically and economically viable solution, while enabling lower onsite carbon when blending commences.

The heaters are hydrogen blends-ready 20% and are designed to accept the proposed 20% blend of hydrogen/natural gas. Rinnai is one of the first manufacturers to display the I2HY20 gas category certificate for all its products.

Rinnai's H1, H2, and H3 solutions offer potential pathways to net zero, decarbonising the energy question and easing the cost-of-living squeeze. Rinnai's H1 solution is centred on hydrogen, as it is anticipated that clean-hydrogen fuels will become internationally energy market-relevant in the future. Rinnai water heaters include the world's first 100% hydrogen-ready hot-water heating technology. Its H2 range is designed to introduce a practical and low-cost option, while Rinnai's H3 range offers low global warming potential (GWP) heat pump technology made easy.

The H3 range of decarbonising products includes hydrogen/BioLPG-ready technology, hybrid systems, a wide range of low-GWP heat pumps, and solar thermal. Its products offer contractors, consultants and end users a range of efficient, robust and affordable decarbonising appliances that create practical, economic, and technically feasible solutions. The range covers all forms of fuels and appliances currently available, including electric, gas, hydrogen, BioLPG, rDME, solar thermal, low-GWP heat pumps, and electric water heaters.

In 2022, Rinnai announced the global launch of the world's first designed and developed 100% hydrogen combustion for continuous flow hot-water heating units and systems for domestic and commercial applications. This development complements the firm's current range of water heaters that are hydrogen blends-ready, right now, and able to use both BioLPG and rDME without any adjustment.

Chris Goggin, Rinnai UK's managing director, said: 'The warranties give heating engineers, contractors, consultants and end users a solution that is practical, and technically and economically viable, while enabling lower onsite carbon when blending commences. When these continuous flow water heaters approach end of life, it is expected, within policy documents, that 100% hydrogen could be entering the grid system and we shall be ready to ease this transition.'

Rinnai products are UKCA certified, A-rated for water efficiency, accessed through multiple fuel options, and available for purchase 24/7, 365 days a year. Any unit can be delivered to any UK site within 24 hours. Rinnai offers carbon- and cost-comparison services that will calculate financial and carbon savings made when investing in a Rinnai system. It also provides a system-design service, BIM and CAD drawings and schematics, life-cycle analysis and carbon footprint, and comprehensive training courses and CPDs, which are all available for free.

Rinnai is a world-leading manufacturer of hot-water heaters and produces more than two million units a year, operating on five continents. The brand has a reputation for products that offer high performance, cost efficiency, and extended working lives. Rinnai's commercial and domestic continuous flow water heaters offer a limitless supply of instantaneous temperature-controlled hot water, and all units align with present and future energy sources.

Visit www.rinnai-uk.co.uk

Products of the month

Innovative piping solution for district energy schemes

Aquatherm claims range is ideal for distributing water over long distances

Aquatherm has introduced its thermally insulated (TI) range of pre-insulated piping systems, designed specifically for underground installation in district energy schemes. The TI range is ideally suited to transporting heating and cooling water safely and efficiently over longer distances.

It consists of a medium pipe made of either Aquatherm blue or green pipe, insulated with polyurethane rigid foam and enclosed in a jacket pipe made of polyethylene. The pipes offered are diverse, ranging from 32mm to 630mm, making them suitable for different district energy schemes.

The pipes are made of corrosion-resistant Fusiolen PP-R/PP-RP material, known for its excellent weldability and high inherent insulation value. The innovative Fusiolen within Aquatherm pipes ensures flexibility to navigate around existing services, leading to additional time savings during installation.

One significant benefit of the TI range is that it eliminates the need for expansion provisions, such as expansion loops and foam pads, because of the low expansion force of polypropylene. This enables the pipe system to absorb expansion forces without detrimental effects on the service life of the pipework, resulting in significant cost savings on material and civils, and less disruption when roads and pavements are closed.

The TI range is connected by heat fusion, which melts the plastic into a homogeneous cohesive unit, and the double-material thickness at the connection point ensures double safety.

The thermal conductivity of Fusiolen PP-R is 0.15 W/mK, which offers a significantly higher degree of self-insulation, leading to lower heat loss. The innovative Fusiolen within Aquatherm pipes is made from a chemically inert material that ensures the pipe is anti-corrosive. The pipes are also non-transparent, eliminating the risk of microbiological growth within the pipework.

The range claims to be a great solution for aggressive or high-purity water systems, such as deionised and reverse-osmosis systems, and would not be degraded when used in these applications. Aquatherm's Environmental Product Declaration demonstrates the positive environmental impact of its products.

Call 01444 250500 or email enquiries@aquatherm-uk.com

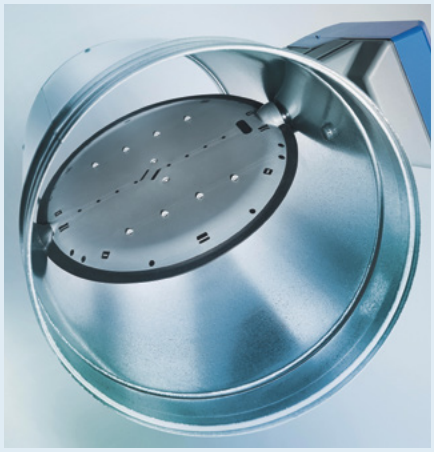
New TVE flow controller sets standards for energy efficiency

TROX range for variable air volume systems claims to cater for lower airflow velocities than any other circular VAV

TROX has unveiled its latest TVE range of flow controllers for variable air volume (VAV) systems, which aims to set a new standard for energy efficiency in air handling units (AHUs). The TVE range of controllers is the most energy-efficient to date, accommodating lower airflow velocities than any other circular VAV.

Advanced technology for measuring airflow is built within the damper blade, removing the need for a separate flow grid and allowing airflow measurement in both directions. The expanded TVE range also incorporates design features for faster, more cost-effective installation, and easy cleaning benefits for long life with minimised maintenance.

It now includes volume flow controllers in nominal dimensions 100, 125, 160, 200, 250, 315, and 400mm. The two larger-dimension models were recently introduced to meet a broader range of air handling applications.



Energy efficiency is a key advantage of the TVE range; it can measure airflows from 13m/s right down to 0.5m/s.

This large turn-down ratio allows significant reductions in airflow volumes to be implemented when rooms are unoccupied, allowing the AHU to operate at lower pressure/speed than usual and only ramp up to design parameters when required.

Ease of installation was a priority when designing the TVE range, and many innovative features contribute to fast, simplified fitting. The space-saving design, combined with the fact that there is no requirement for a straight upstream duct, mean that the TVE offers greater flexibility during installation. Airflow rate can be measured accurately in both directions, so the risk of incorrect fitting is significantly reduced.

Throughout the unit's life, routine maintenance is minimised, as there are no interfering components in or on the duct. These features combine to create a volume flow controller that excels in all aspects of life-cycle performance, from energy efficiency to long-term reliability.

Andrew Fletcher, product technical manager, said: 'With the ever growing concern around global warming, everyone is striving to reduce energy usage. One of the best ways to do this within HVAC systems is by reducing ventilation during idle times. This is made possible by the large 1:25 turn-down ratio achievable with the new TROX TVE range, measuring flows down to 0.5 m/s.'

Call 01842 754545 or email sales@troxuk.co.uk

Hamworthy release new Tyneham heating brochure

Hamworthy Heating has launched its new *Tyneham Heat Pumps* brochure, which showcases the company's latest monobloc air source heat pump offering, designed to meet the increasing demand for energy-efficient heating solutions.

The Tyneham range comprises seven models, with nominal outputs ranging from 14kW to 70kW, and a coefficient of performance of up to 4.85. The range features an inverter controller compressor that matches heat demand accurately, and uses R32 refrigerant for greater efficiency and lower global warming potential.

The 32-page brochure is divided into easy-to-read sections with detailed information on heat pumps, refrigerants, and the benefits of each model in the Tyneham range. It also includes charts displaying technical information, minimum installation clearances, and lists of suitable accessories and options.

The brochure highlights how the Tyneham range of heat pumps can be combined with Hamworthy Heating's modular gas boilers for those seeking a hybrid system. This option enables customers to match heat demand in the most effective and energy-efficient way.

The *Tyneham Heat Pumps* brochure is a useful resource for those seeking energy-efficient heating solutions that meet UK net-zero goals.

Call 01202 662 552 or email sales@hamworthy-heating.com

Multivent MEV installed in zero carbon student accommodation

Vent-Axia has supplied more than 60 of its Lo-Carbon Multivent MVDC-MSH units to new student accommodation in Manchester that features 62 studio apartments. The Church Inn development was designed to meet Manchester City Council's zero carbon target by creating accommodation close to educational establishments, reducing the need for travel and emissions.

The accommodation offers energy-efficient, quiet ventilation using the Multivent MEV unit, which has low energy and noise levels, essential for achieving Breaam VG scheme credits.

Call 0344 856 0590 or visit www.vent-axia.com

Optimum system efficiency with Modutherm controller

Modutherm has released the NordFlex+ Wi-Fi controller, designed for use with its AW Monobloc heat pump range. The BMS-compatible controller can simultaneously manage up to 16 units and uses cascade logic to maximise efficiency in line with heating demand. The NordFlex+ can manage up to four mixed heating and cooling circuits with different temperature zones, for simultaneous cooling, heating and domestic hot water production. It is multifunctional, and can be designed into a range of projects without additional programming.

Visit www.modutherm.co.uk

Condair celebrates 75 years

Humidity control specialist Condair will mark its 75th anniversary this year. Founded as Defensor AG, in Switzerland in 1948, by chemist Dr Bernhard Joos, the company has been at the forefront of the humidification sector, offering market-leading technology and expert knowledge to its customers.

Condair has developed a range of humidification technologies, including the electrode boiler steam humidifier, which is now one of the most widely used industrial humidifiers in the world. Operating in 23 countries, with manufacturing facilities in Asia, Europe and North America, the company distributes its products to more than 50 regions worldwide.

Visit www.condair.co.uk

Pressurisation units for commercial buildings

Aquatech Pressmain's Spillpress pressurisation units are designed to maintain water pressure in heating and chilled water systems while minimising pressure rise in commercial buildings.

With a lower-pressure hot system increase than traditional sealed system pressurisation units, the Spillpress uses near-atmospheric diaphragm spill vessels and can handle system temperatures ranging from 3°C to 120°C, fill pressures from 0.8 to 8.0 bar, and system contents of up to 87,000 litres.

Email sales@aqpm.co.uk or visit www.aquatechpressmain.co.uk

RAINFOREST TRUST ·UK·

Rainforest Trust donations from Pump Technology

Berkshire-based Pump Technology has pledged to donate £5 per unit to the Rainforest Trust for the first 1,000 units of DrainMajor/DrainMinor wastewater pumping systems specified and sold.

The entire DrainMajor/DrainMinor range is made from recyclable polyethylene, in contrast to other tanks, which are made from non-recyclable glass reinforced plastic.

To support the environmental cause, email **davidj@pumptechnology.co.uk** each time you specify DrainMajor/DrainMinor wastewater pumping system.

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Wiesheu Elektronik is renting lighting at its German head office

Leighton James

Hire calling

A 'light as a service' rental model from Trilux allows customers to rent the latest lighting systems without a large upfront cost. The company's Leighton James explains how it works

Trilux's 'light as a service' rental model is an innovative financing option that allows clients to install modern, energy-efficient lighting systems without the burden of high investment costs. The model involves Trilux planning, installing and operating the lighting system, including all service and maintenance tasks.

The service has already been put into use by Wiesheu Elektronik, a specialist in the development and manufacture of electronic control systems for industrial applications. The project converted lighting in the storage and production areas, and in the company's 2,000m² head office building in Burgstetten, Germany.

Trilux combines individual components into customised complete solutions to match the customer's requirements and the area of application. Leighton James, product and marketing director at Trilux Lighting UK, outlines what the rental scheme involves.

What is the cost compared with buying outright?

There is a cost reduction, with customers seeing savings from day one. This is because, in most cases, the monthly fees (rent + maintenance) and the reduced energy costs of the new installation are not as high as the energy and maintenance costs of the old installation.

A small amount of financing costs must be added, compared with a standard purchase solution. However, there are other advantages, such as balance sheet-neutral solutions when renting the light, protection of the credit line, preservation of liquidity, and maximum planning security over the term of the contract.

Trilux also takes care of design, installation and operation, including dismantling the old system, and so supports the customer in their efforts to conserve resources.

What happens at the end of the contract?

The lighting is loaned to the customer for seven years, at a set monthly fee. If the customer wishes to continue with the lighting after the contract term has ended, the rental contract for the existing installation can be extended. Alternatively, there is the option of a new rental contract for the most up-to-date lighting installation.

If the lighting is no longer needed by the customer, the company has various next-step options, as ownership of the lighting installation and the raw materials contained within it remains with us. Lighting can be re-used, installed in a second market; refurbished, with certain components changed and 'refreshed'; or, recycled, with resources taken from the old luminaire and repurposed for secondary use.

Do the components get upgraded as more efficient technology evolves?

The decision to install Trilux lighting is risk-free, as the company bears the product and liability risk, and will guarantee smooth operation of the installation. Additionally, service and maintenance work are included in the rent. Customers can be assured that, throughout the entire contract period, the lighting installation will function perfectly and that the assured lumen output is achieved at all times. We guarantee a smooth operation without the need for replacements during the run-time of the contract.

Has it been done in the UK?

No, we are yet to do a full financing model in the UK. This is still a new model, designed to enable refurbishment and materialise savings for the client quickly. It is applicable to all countries and we are beginning to offer the model to UK clients.

Are there any regulatory drivers in Europe pushing the concept?

There are several drivers encouraging companies to focus on sustainable lighting. These include, in particular, the ban on fluorescent tubes that will apply in the EU from August 2023.

In addition, the EU taxonomy for sustainable activities increasingly obliges companies to focus on sustainable business practices. Sustainable building certifications are also becoming more important for companies to achieve their sustainability goals.

Our lighting can help achieve sustainability goals and, especially with a 'light as a service' model, make it easier for companies to make a risk-free investment in a new lighting installation.

EVENTS AND TRAINING

NATIONAL EVENTS AND CONFERENCES

CIBSE Technical Symposium
20-21 April, University of Strathclyde, Glasgow
Titled *Delivering sustainable, safe and healthy buildings for a net zero future*, the 2023 symposium will focus on the challenge of decarbonising our buildings and infrastructure, and delivering net zero carbon buildings over the next 25 years.
www.cibse.org/technicalsymposium

Golden Thread series and Scotland Region Conference
7-8 June, Glasgow
CIBSE Scotland Conference, plus a one-day conference focusing on building safety and regulations specific to Scotland.

Society of Façade Engineering (SFE): North America Launch
28 April, New York
Launch of SFE in North America, with three panel discussions focusing on sustainability, innovative materials, and globalisation and procurement. With façade engineers, contractors and specialists.

CIBSE REGIONS AND GROUP EVENTS

Check the website for up-to-date information on regions and groups meetings, webinars and podcasts. Visit **www.cibse.org/events**

North West AGM
5 April
AGM for CIBSE North West Region, at 6pm. Meeting at BDP Manchester and online.

Home Counties South West (HCSW); AGM
6 April
CIBSE HCSW Region AGM, live online event

Home Counties North West AGM
10 April
Live online AGM for the CIBSE Home Counties North West Region

Southern: AGM and Decarbonising the estate, fabric-first approach
17 April, Chichester
Hybrid event

West Midlands: AGM
18 April, Birmingham
Hybrid event

Yorkshire: AGM
20 April, Leeds

Home Counties South East AGM
27 April, Live online
AGM for the CIBSE Home Counties South East Region.

West Midlands: Water treatment masterclass
7 June;
and 20 June for West Midlands Young Engineers Network
One-day event covering water quality, scale control, bacteria and legionella control, filtration, and reverse osmosis, with visual demonstrations from Hydrotec.

TRAINING COURSES

CIBSE's courses are run as in-person and live online training. Corporate delivery is also available in-house face to face, or remotely online. Courses are finalised two weeks before the training. See all upcoming courses at **www.cibse.org/training**

Energy efficiency-related building regulations: Part L
3 April, remote

Introduction to the Building Safety Act
4 April, remote

Building services explained
11-13 April, Balham, London

Energy surveys
11 April, Balham, London

Fire safety building regulations: Part B
12 April, remote

Below-ground building drainage
14 April, remote

Energy efficiency-related building regulations: Part L
18 April, remote

Low carbon consultant building design
17-18 April, remote

Mechanical services explained
18-20 April, Balham, London

Low carbon consultant building operations
20-21 April, Balham, London

ISO 50001:2018 Energy management system / low carbon consultant
24-25 April, Balham, London

CIBSE JOURNAL PODCASTS

The latest *CIBSE Journal* webinar, sponsored by Grundfos, titled *Designing new pump technology into existing spaces*, is now available to listen to on CIBSE Soundcloud at **bit.ly/CJApr23Event1**, as well as on Apple and Spotify.

Mechanical services explained
25-27 April, remote

Electrical services explained
25-27 April, Balham, London

Heat networks Code of Practice (CP1)
26-27 April, live online

Energy efficiency-related building regulations: Part L
2 May, remote

Fire safety building regulations: Part B
4 May, Balham, London

Design of heating and chilled water pipe systems
9 May, Balham, London

MEMBERSHIP WEBINARS

- **18 and 25 April**
- **16 and 23 May**
- **6 and 13 June**

CIBSE Membership hosts free two-part webinar series to support members with applications for the Associate and Member grades and registration with the Engineering Council at Incorporated Engineer and Chartered Engineer level.

To register for these and for all other membership webinars, go to **bit.ly/CJApr23Events2**

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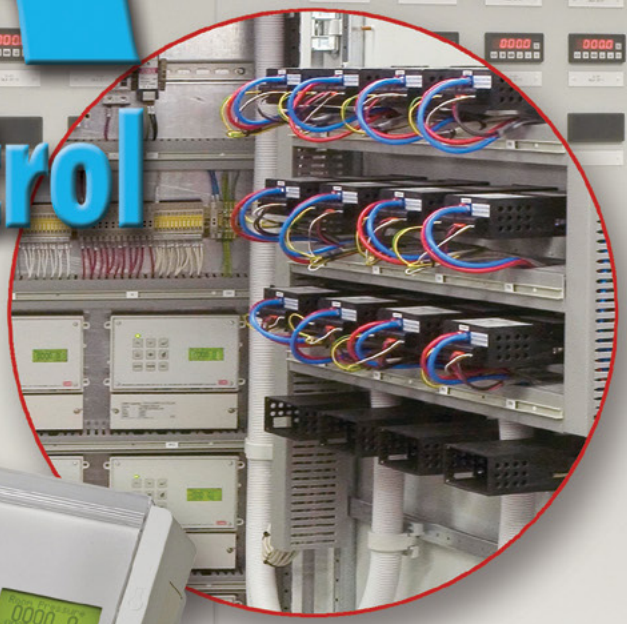

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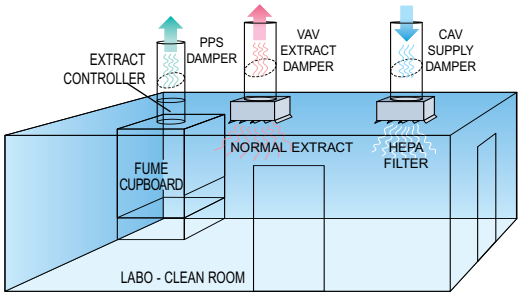

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