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CRUNCHING THE NUMBERS

Max Fordham sets new benchmark for energy performance at award-winning Ravelin Sports Centre

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CIBSE Journal is written and produced by CPL One
Tel: +44 (0)1223 378000.
www.cplone.co.uk
1 Cambridge Technopark, Newmarket Road,
Cambridge CB5 8PB.
Editorial copy deadline: First day of the month preceding the publication month

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Scenario planning

There was plenty of thought-provoking content at the 2024 CIBSE Technical Symposium, not least from Professor Graeme Maidment, who, in his keynote address, shared research from the Department for Energy Security and Net Zero (DESNZ) that will form part of the evidence base for the UK's cooling strategy.

He revealed the results of a study that showed 15% of UK energy consumption in 2021 was from cooling. Not all refrigeration is from buildings, of course, but Maidment told the audience that a substantial source of emissions was from commercial and residential buildings – and this is with air conditioning currently only installed in 2% of UK homes.

This figure is set to get much higher – scarily so in a high-emissions scenario that was demonstrated in another DESNZ study, which looked at potential cooling energy demand and consumption by 2100 under 4°C of global warming. It was calculated that 75-80% of homes could have active cooling in this scenario.

The same study looked at a scenario in which the government did not intervene, compared with adopting passive-first policies or pushing for more efficient cooling. The modelled scenarios showed passive first as the most cost-effective route, but DESNZ's Melanie Jans-Singh said a combination of active and passive policies would be needed to keep carbon to the minimum and provide comfort for occupants.

Other hot topics at the symposium included embodied carbon, indoor air quality, building simulation, the use of data in optimising performance, heat pumps (including retrofits), and heat networks, which had a number of papers supporting the upcoming Heat Network Regulations, due in 2025 (see page 40).

One pioneer of heat pump retrofits was named Engineer of the Year at the CIBSE Building Performance Awards. Our interview with Phil Draper, on page 30, shows how the replacement of gas-fired boilers with heat pumps in large buildings can be done in a cost-effective way with early collaboration and good engineering.

Compared with the domestic market, the penetration of heat pumps in the commercial sector is relatively low. A new tool being developed by a UK-led International Energy Agency project is looking to give building owners a clearer picture of the retrofit options available, and encourage more to opt for heat pumps when their boiler is due for renewal or replacement (page 45).

Another CIBSE award winner profiled in this edition is the Ravelin Sports Centre (page 20). It is an exemplar project, and its low energy use intensity of 87kWh·m^{-2} per year sets the benchmark for all leisure centres. Its well-considered mix of passive design and active technologies is a lesson for anyone designing for net zero.

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CONTRIBUTORS

Anastasia Mylona
Why the government needs tighter controls on embodied carbon in the built environment

Julie Godefroy
Where the Future Homes/Buildings Standard proposals missed two opportunities to tackle carbon emissions

Phil Draper
The CIBSE Building Performance Engineer of the Year on his pioneering work on heat pump retrofits

Tim Dwyer
Module 232 looks at the benefits of a properly matched energy system for residential applications

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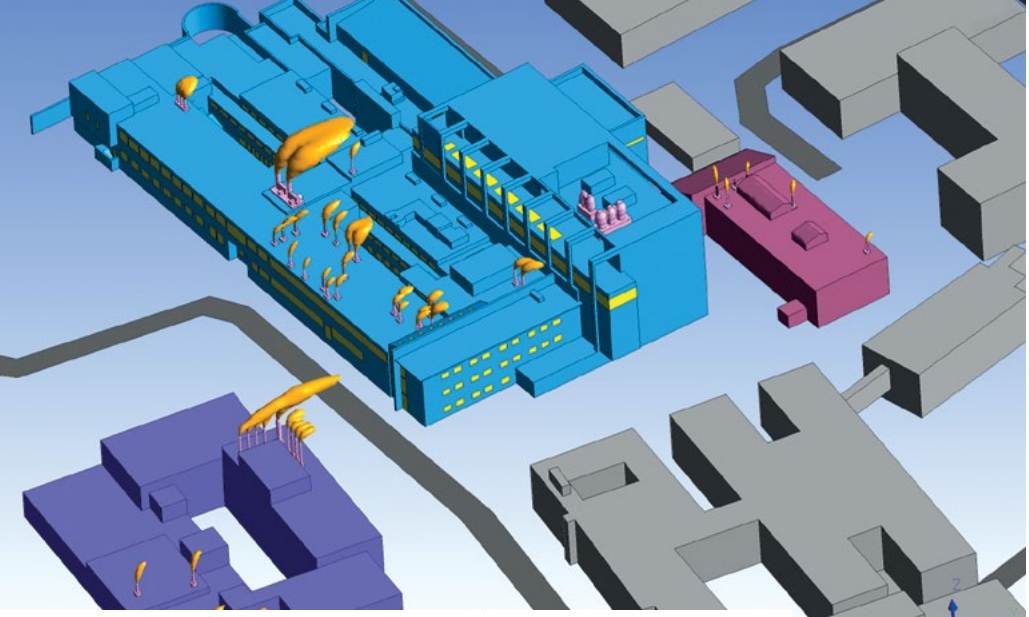

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 ISSN 1759-846X

SUBSCRIPTION ENQUIRIES

If you are not a CIBSE member but would like to receive *CIBSE Journal*, subscribe now! Costs are £80 (UK) and £100 (international). For subscription enquiries, and any change of address information, please contact Nicola Hurley at **nhurley@cibse.org** or telephone **+44 (0)208 772 3697**. Individual copies are also available at a cost of £7 per copy, plus postage.

CIBSE Journal, ISSN 1759-846X (USPS 4070) is published monthly by CPL One, 1 Cambridge Technopark, Newmarket Road, Cambridge CB5 8PB, UK.

Subscription records are maintained at CIBSE, 222 Balham High Road, London, SW12 9BS, UK.

ISSN 1759-846X (print)
ISSN 2756-1895 (online)

CREDITS

Cover image Credit / © Hufton + Crow
P10 iStock.com / BlackJack3D
P18-22 Credit / © Hufton + Crow
P45 iStock.com / Peter Carruthers
P66 iStock.com / Intpro

ABC audited circulation:
18,351 January to December 2023
Printed by: Warners Midlands PLC

Research and tech body backs hybrid heating

Hybrid heating systems, which combine heat pumps with gas boilers, could help manage peaks in electricity demand, according to a new report by Energy Systems Catapult, the government-backed energy and decarbonisation body.

Innovating to net zero 2024, published on 16 April, says the deployment of nuclear and renewable generation – as well as the electrification of heat and transport – must occur at 'rapid pace', and 'much faster' than in the past decade.

It adds that electrifying heat in most buildings remains the 'most cost-effective pathway to net zero'.

However, meeting the need for electricity at times of low renewable generation and most demand will determine the cost of the future energy system, and is the 'biggest system innovation challenge' for net zero.

Different sources and vectors of energy must be developed at different times to keep overall system cost down, the report says.

The modelling finds value in the use of hybrid heating as the energy system transitions.

Government challenged on local efficiency targets

The High Court allows legal challenge from the Good Law Project

The High Court has given the green light for a legal challenge to what have been labelled 'unnecessarily draconian' planning rules that limit the scope for councils to set local energy efficiency standards.

The Good Law Project (GLP) is supporting non-governmental organisation Rights Community Action (RCA) in its judicial review of a written ministerial statement (WMS) issued by the Department for Levelling up, Housing and Communities (DLUHC) in December. The GLP has described the guidance as a 'massive overreach of central government power'.

The High Court has said the hearing into the challenge must take place as soon as possible after 20 May.

The WMS, issued by DLUHC junior minister Baroness Penn, prohibits councils from setting energy efficiency standards in their local plans that are above those outlined in the national Building Regulations.

RCA argues that this statement is unlawful, because it cuts across the objectives of the Climate Change Act 2008. Other grounds for challenge include whether the government has failed to assess the environmental impacts of the policy, which is required by the Environment Act 2021.

The WMS states that 'local plans must be consistent with national policy' and adds that 'any planning policies that propose local energy efficiency standards for buildings that go beyond current or planned national Building Regulations should be rejected at examination'.

The WMS has generated a widespread backlash, with *Grand Designs* presenter Kevin McCloud branding the move a 'policy disaster' and a letter, co-signed by more than 50 bodies, describing it as 'unnecessarily draconian'.

Timber Square in London, engineered by Hoare Lea, has a five-star Nabers UK Design for Performance target rating

CIBSE takes over as scheme administrator for Nabers UK

Institution was a founding member of scheme's steering committee

CIBSE has taken over from BRE as administrator of the Nabers UK scheme.

Adapted from the Nabers environmental performance rating programme that was developed in Australia more than 20 years ago, the UK scheme was launched in 2020.

CIBSE has supported its development and is one of the founding members of the Nabers UK steering committee.

Nabers UK offers ratings, ranging from one to six stars, based on the measured and verified energy use of operational offices.

CIBSE will work closely with BRE to enable a smooth transition and support the next phase of the scheme's growth in the UK.

Nearly 150 new and refurbished office buildings are setting Nabers UK Design for Performance targets, representing a 'significant portion' of UK office developments.

Following the collection of 12 months' operational energy data, existing buildings are also pioneering the verification of performance in-use through Nabers UK.

Around 90% of Australia's office space has been certified under Nabers, resulting in energy-use reductions of more than 40% across the sector.

CIBSE chief executive Ruth Carter said: 'We are delighted that CIBSE is now overseeing the administration of Nabers UK. This strategic move aligns with our commitment to advancing energy efficiency in the built environment. Nabers UK plays a crucial role in bridging the performance gap and enhancing transparency. We are excited to contribute to the continued success and impact of Nabers UK.'

Nabers director Carlos Flores said: 'CIBSE has an illustrious history of leadership in building sustainability and decarbonisation, and an unmatched track record in certification and the development of technical standards.

'Buildings in the UK can and should lead the world in tackling the climate crisis, and we are excited about the role Nabers UK can play with an organisation of CIBSE's calibre at the helm.'

Scotland scraps 2030 climate target

The Scottish government has scrapped its flagship target to reduce greenhouse gas emissions by 75% of 1990 levels by 2030.

Màiri McAllan, cabinet secretary for wellbeing economy, net zero and energy, announced on 18 April that the government remains 'steadfastly' committed to its target for Scotland to be net zero by 2045, five years ahead of the UK as a whole. However, responding to a recent Climate Change Committee (CCC) progress report on Scotland's carbon-reduction plans, the minister said the Scottish government accepted the watchdog's verdict that the 2030 target is 'out of reach'. The CCC report describes the acceleration required to meet the 2030 target as 'beyond credible'.

McAllan said the Scottish government will expedite new legislation to introduce five-yearly carbon budgets, such as those that the UK government has in place.

Dave Pearson, Royal Academy of Engineering visiting professor at Edinburgh Napier University, urged the Scottish government to pass, by the end of 2025, its Heat in Buildings Bill, which contains tough new energy efficiency and low carbon standards. The Passivhaus Trust also wants the Scottish government to resist pressure from housebuilders to water down its proposals to introduce a Passivhaus Equivalent Standard, which the Trust says would cut heating demand in Scottish new-build homes by up to 79%.

IN BRIEF

Sunak has 'set back' nation's efforts to decarbonise

Prime Minister Rishi Sunak's moves last year to water down targets for the electrification of heat and transport have set back efforts to decarbonise the UK, according to the outgoing chief executive of the Climate Change Committee.

During an interview for the BBC's *Sunday with Laura Kuenssberg* show, Chris Stark said Sunak had 'clearly not' prioritised the issue as much as his predecessors.

'It's set us back,' he said, referring to the Prime Minister's relaxation of targets for phasing out sales of electric vehicles and gas boilers.

Stark also said the UK has moved from 'the forefront' of international efforts to tackle rising emissions.

ECHR rules against Switzerland on global warming

In its first ever ruling on global warming, the European Court of Human Rights (ECHR) has found against Switzerland.

A near-unanimous verdict of the court found that Switzerland had breached Article 8 of the European Convention on Human Rights, which the judges ruled encompasses a right to effective protection by states from the adverse effects of climate change.

The court also found 'critical gaps' in Switzerland's policies to tackle climate change, including failures to quantify reductions in greenhouse gases.

The case was brought by a group of more than 2,000 elderly Swiss women.

UK construction on the up again

The UK construction industry returned to growth during March, ending a six-month decline, according to the latest S&P Global UK Construction Purchasing Managers' Index.

It scored 50.2 on the index in March, up from 49.7 in February and the highest level since August last year. In a further fillip for the sector, the index showed that new orders expanded at the fastest pace since May 2023, with the rate of growth accelerating since February.

IN BRIEF

Put battery systems outside dwellings, new guide advises

The best place to locate electrical battery energy storage systems is outside dwellings and away from habitable rooms, according to a new best-practice guide. PAS 63100:2024, issued by the British Standards Institution in March, is designed to help installers meet the 'sharp rise' that is expected in the number of battery systems being fitted in homes, often to store surplus electricity generated by domestic solar panels. Where it is 'not practicable' to locate batteries outdoors, they should be separated from habitable rooms, with a means of escape for inhabitants and suitable fire compartmentation, the PAS says.

Landlord may have to spend £20.5m on safety fixes

The government has lodged its first action to force a landlord to pay up for building safety works, the *Financial Times* has reported. The levelling up and housing department has applied to a property tribunal for an order to require companies in the Yianis Group to contribute £20.5m to fixing safety issues at the Canary Riverside development in east London. It is the first move by the department to use new legal enforcement powers under the Building Safety Act.

Confusion over safety responsibilities

Nearly half (43%) of construction professionals are unsure or have no idea about what they need to do if carrying out a project that falls under the Building Safety Act, a new survey by specification and product information platform NBS has found. The same proportion is unclear about the responsibilities of duty holders regarding the three planning gateways, as defined in the new legislation. The survey also found that 31% of specifiers are uncertain about the type of projects that would come under the new building safety laws.

TECHNICAL SYMPOSIUM'S WELSH ASSEMBLY

London South Bank University's Aya Heggy gave an award-winning presentation

The 2024 CIBSE Technical Symposium was held in Wales for the first time last month – at the Welsh School of Architecture, Cardiff University – with 196 delegates taking in 87 presentations over the two days. See page 18 and 49 for highlights from the event.

Grenfell Tower report delay as 250 expected to be criticised

High number subject to criticism adds complexity to final stages of inquiry

The final report into the Grenfell Tower fire will not be published by the seventh anniversary of the disaster, in June, because more people than expected must be notified about potential criticisms.

In its latest newsletter, published in April, the inquiry team says it is in the 'final stages' of notifying those who may be subject to criticism in its report and considering their responses, as required under rule 13 of the probe's rules.

About 250 people have been written to and the process has been 'significantly larger and more complex' than the inquiry team had expected. Although the notification process is now reaching its end, the team admits it will not be in a position to publish the report before the next anniversary of the fire, as originally hoped.

However, it remains 'determined' to publish the report 'as soon as possible' and is working 'as hard as it can' to ensure that no time is lost.

The inquiry is following the Maxwellisation legal practice, which allows those criticised in an official report to respond before its publication. Some of those mentioned in the report, and their lawyers, are likely to challenge its conclusions.

The inquiry was instigated by former Prime Minister Theresa May in the immediate aftermath of the Grenfell Tower disaster, which resulted in 72 deaths on 14 June 2017.

The second and final phase of the inquiry heard 85 weeks of evidence over three years.

Two stairs for residential high-rises

New residential buildings over 18m high should contain two staircases, according to updated government guidance.

The government announced last year that it intended to set a threshold height of 18m, above which a second staircase should be provided in residential buildings. This has now been taken forward as a recommendation in updated guidance outlining amendments to Approved Document B, published on 29 March by the Department for Levelling Up, Housing and Communities.

Under the guidance, interlocked stairs should be considered as a single escape route and are not an alternative means of escape. The recommendations will apply from 30 September 2026.

The new regulations on staircases are part of a wider package of measures to enhance building safety, introduced in the wake of the Grenfell Tower disaster in 2017. Lee Rowley, minister for housing, said: 'The change in guidance provides clarity for developers and ensures new and existing buildings provide safe and secure homes for all residents.'

ENERGY TRANSITION GOES ON DISPLAY AT SCIENCE MUSEUM

The Science Museum, London, has opened a new gallery dedicated to the energy transition and decarbonisation. Energy Revolution: The Adani Green Energy Gallery displays a range of historic and contemporary objects. Entry is free.

A model of energy generation in the Orkney Islands

'Opportunities missed' in Future Buildings Standard proposals

Institutions call for regulation of existing buildings and embodied carbon

The government has 'missed an opportunity' to improve existing buildings in its proposals for new energy and carbon regulations, according to CIBSE.

In its response to the Future Homes/Buildings Standard (FHS/FBS) consultation, the Institution said that, with no regulation of existing buildings, a huge part of the UK building stock's emissions were being omitted.

Embodied carbon was also not included in the FHS/FBS, and CIBSE called on the government to come forward with proposals as soon as possible.

In a letter to the Department for Levelling Up, Housing and Communities, IStructE also expressed concern that regulation of buildings' embodied carbon has been omitted.

Patrick Hayes, technical director of IStructE, said: 'Introducing embodied carbon regulation provides certainty, consistency and efficiency for all parties on how to meet our legal obligations.'

The letter includes a policy paper from IStructE and other major organisations (including CIBSE). It calls for political leaders to commit to reducing construction embodied carbon emissions within two years of starting a government.

The Construction Industry Council (CIC) is also disappointed that measurement of embodied carbon is not being considered as part of the consultation on the proposed standards, given that it could make up 70% of a new home's whole life emissions.

In its response to the consultation, the CIC said it too supported post-occupancy evaluations and the use of a delivered energy metric. It also highlighted the need for a government strategy to ensure appropriate, accredited and trained professionals are available to oversee properly the installation and maintenance of energy-saving measures such as heat pumps.

In addition, the CIC's response stresses the importance of improving standards for homes converted through permitted development, particularly on areas such as overheating.

Professor Stephen Hodder, chair of the CIC's climate change committee, said: 'This standard is likely to be the government's legacy and, having waited so long, we need to ensure that we get it right, as we could be building or converting millions of homes under the proposals.'

CIBSE praised the FHS/FBS package for moving away from fossil fuels for heating and hot water in new domestic and non-domestic buildings, and for giving more attention to post-completion testing..

See page 14 for CIBSE's response

IN BRIEF

ChapmanBDSP appoints Joergensen as associate director

Dr Dorte Rich Joergensen FCIBSE is the new associate director of the sustainability team at building services consultancy ChapmanBDSP. Beginning her career as a mechanical building services engineer, Joergensen's background encompasses academia and industry, and she has completed a PhD on improving energy efficiency to close the performance gap. In her new role, she will lead on sustainability initiatives. Ray Upjohn, chief executive of ChapmanBDSP, said Joergensen's appointment reflected the 'fast-moving nature of sustainability today'.

Ideal Heating opens heat pump training centre

Ideal Heating has opened a new £1m low carbon installation training site in Bedfordshire. The manufacturer says the 16,000ft^2 Training and Technology Centre near Luton will form part of its bid to equip installers with the skills to fit and service systems such as domestic and commercial heat pumps. The new site will complement the company's existing Training and Technology Centre in East Yorkshire, which opened last year. Both centres feature a training suite for Ideal's heat pump products and thermodynamic fault-finding simulators.

Beama launches net zero service

Beama, the manufacturing trade association for energy-related infrastructure and building systems and services, has launched its new Net Zero Service. It includes dedicated educational toolkits covering topics such as climate commitments, transition plans and finance, offsetting, and guidance on reduce scoped emissions. In addition, Beama is establishing a technical sustainability committee to review and participate in the development of relevant standards and best practices.

IN BRIEF

Retrofit main focus at Scotland conference

CIBSE Scotland's annual conference takes place on 28 May, and will address the challenges associated with retrofitting our existing building stock. It will also look at the opportunities this presents for building services and built environment professionals to move the retrofit challenge forward at pace and scale.

Patrick Harvie MSP, Minister for Zero Carbon Buildings, Active Travel & Tenants' Rights, will be the keynote speaker at the conference, which is being hosted by the University of Strathclyde, Glasgow.

For more information and to book, visit: **bit.ly/3Udh72G**

City of London opens two key consultations

CIBSE is urging members to respond to two City of London Corporation consultations: Planning for Sustainability SPD and City Plan 2040.

The corporation is keen to capture as much industry experience and feedback as possible. Responses can be submitted through its consultation portals – **bit.ly/3Q7lUBq** and **bit.ly/3UkAY11** – or by email to: **PlanningPolicyConsultations@cityoflondon.gov.uk**.

To contribute to CIBSE's response, email: **technical@cibse.org** by 9 May – or you can respond directly to the Planning for Sustainability SPD consultation by 17 May and the City Plan 2040 consultation by 31 May.

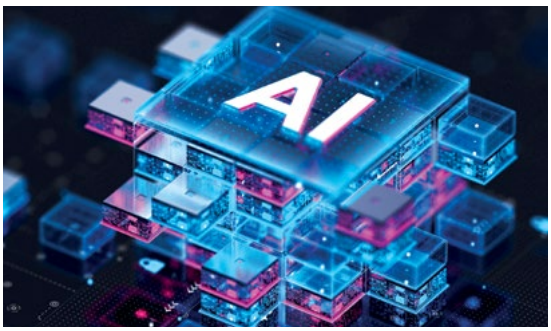
For more information on all current and closed consultations visit **www.cibse.org/consultations**

Digital engineers explore power of AI at tech event

Experts discuss game-changing technology at new digital gathering

The first Society of Digital Engineering (SDE) Technical Gathering took place at Sweco's newly refurbished London office on 20 March. Around 50 people attended the session, titled 'What can AI do?', to hear about the latest developments in artificial intelligence (AI) in buildings services.

Sweco's head of AI innovation, Shah Muhammad, explained the deployment of AI technologies in the Sweco GPT tool, while Steve Butler, industry strategy manager at Autodesk, gave an overview of new and emerging AI technologies in architecture, engineering and construction software.



Emma Weller, digital practice manager at Introba, presented an outline of the groundbreaking work the SDE has been doing with CIBSE, and the evening concluded with a panel discussion on the implications of AI on day-to-day work and for organisations. Joining Butler and Weller as panellists were Alain Waha, chief technology officer at Buro Happold, and Poppy Harrison, co-founder of SheCanEngineer.

'It is amazing to see such an energised and knowledgeable audience at our first ever event,' said host and SDE chair Andrew Krebs. The SDE thanks Autodesk for sponsoring the food and drink, and Sweco for providing the venue. A second event is set to take place in the second quarter of 2024.

New prizes for façades awards

Three new categories have been announced for the Society of Façade Engineering's (SFE's) Façade 2024 Design and Engineering Awards. They are Digital Innovation, and Special Structures Awards for the UK and International.

The Digital Innovation Award will recognise the best digital innovation product or project that supports façade engineers, while the Special Structures accolades will reward smaller-envelope interventions, such as a bridge, canopy or sculpture.

The awards ceremony will take place at Old Billingsgate, London, on 6 November, when excellence and achievement in façade engineering will be celebrated.

Among the other categories up for grabs are New Build, Refurbishment, Products, and Young Façade Engineer of the Year. The deadline for entries is 31 May 2024 – for more information, see **bit.ly/4d3WUF2**

CIBSE President Adrian Catchpole at the launch of the Chartered Organisation Programme

CIBSE reveals pathway for Chartered Organisations

Focus on competency at heart of Institution's new programme

CIBSE has launched a new programme, offering organisations a pathway to being chartered with CIBSE to demonstrate their dedication to best practice.

The Chartered Organisation Programme represents a commitment to professionalism and excellence, and is a significant step towards shaping the future of the profession and fostering a culture of unparalleled standards.

It provides a robust framework for showcasing levels of competency, professionalism and adherence to the highest standards. By participating, organisations can differentiate themselves in terms of quality, ensuring that they remain at the forefront of an ever-evolving legislative landscape.

Speaking at the programme's launch last month, CIBSE President Adrian Catchpole emphasised the significance of this groundbreaking initiative. He said: 'The CIBSE Chartered Organisation Programme aligns perfectly with our focus on competency, a crucial aspect of the Building Safety Act. Drawing inspiration from successful programmes in other professional bodies, we have tailored this initiative to meet the unique needs of our industry.'

Extensive market research – involving consultation with organisations ranging from one-person consultancies to tier-one multidisciplinary firms – has helped develop a programme that caters for every organisation's journey towards excellence. With its comprehensive framework and dedication to professionalism, it is poised to set new benchmarks and elevate standards within building services engineering.

- **For more information on the programme, visit bit.ly/3U6ir7a**

Remembering past president James Ernest Fretwell

James 'Jim' Ernest Fretwell was born in Stratford, East London, on 21 October 1933, one of four siblings and the eldest son. He attended Ilford Grammar School and South West Essex Technical College, before starting his career working for the family business – The Fretwell Heating Company.

In 1952, Jim joined Sulzer Bros, where he trained as a design project engineer, becoming a member of the Sulzer management team in 1964 and sales director in 1983. He studied at night school to achieve the qualification of Chartered Engineer while working full-time. During his time at Sulzer, he was associated with projects for hospitals, airports, schools, public buildings, offices and business development, in the UK and the United Arab Emirates. He was appointed to the board of Sulzer Infra (UK) in 1987 before taking early retirement in May 1992.

Following in the footsteps of his grandfather, W E Fretwell, who was President of CIBSE in 1935, Jim became a CIBSE Fellow. He was the first board member of the Building Services Publication to be elected chairman, and has served on numerous IHVE and CIBSE committees, as well as on the CIBSE Council. He was elected CIBSE President in 1999 and guided the Institution into the new millennium. He was a member of the Institute of Management and a founder member of the District Heating Association.

Jim married Jean in July 1955, and they had two children, Laurence and Susan. He adored his children, five grandchildren and four great-grandchildren.

Ramboll wins CIBSE T&D approval in Middle East and Asia

Ramboll has been approved by CIBSE as a Training & Development (T&D) provider for the United Arab Emirates and India. It is the first consultancy firm in the Middle East and Asia to achieve this.

CIBSE T&D is an approved in-company training programme that develops engineers' skills and competence towards achieving Engineering Council registration and corporate membership of CIBSE.

Developing engineers are paired with an experienced mentor, who provides guidance and acts as a sounding board as they develop their competence for Engineering Council registration.

The T&D programme is a way for trainee engineers to gain real-world experience and learning opportunities, right from the start of their careers.

For the full list of companies on CIBSE's T&D scheme, and for more information, visit: **bit.ly/CIBSENEWSM1**

Ameon's Martin wins Alfred Leung Award

The 2024 Alfred Leung Award has gone to Michaela Martin, who works for Ameon.

Having joined the company as an administrative assistant nine years ago, Martin developed an affinity with the industry and is now in the first year of a building services engineering degree at the University of Central Lancashire.

The Alfred Leung Award was created by the CIBSE Merseyside and North Wales committee, in honour of Dr Alfred Leung, to recognise the academic achievement of aspiring building services students at the City of Liverpool College, where Leung was a lecturer. Martin was nominated for her outstanding academic achievement in 2022/23, and received a £150 bursary.

Leung joined the CIBSE Merseyside and North Wales Regional Committee in 2003 and made a significant contribution to its activities in the following 17 years. He was a respected mentor, who pursued professional excellence throughout his career, as well as an ambassador for and passionate leader of the building engineering services industry and CIBSE.

Grow your knowledge

The very popular GrowYourKnowledge webinar series will return in May, with three new webinars focusing on lighting planned across the month.

- **Control of electric light | 8 May**
- **Lighting for offices | 15 May**
- **Sports lighting | 22 May**

Each webinar takes place between 12:00-13:00 (BST) and they can be booked at **cibse.org/GrowYourKnowledge**

CIBSE Decarbonisation Conference

26 June 2024 BMA House, London

Keynote speaker

David Partridge

Chair of the Governance Board for the UK Net Zero Carbon Buildings Standard

Taking a lead on decarbonisation

- Hear the latest updates on delivering the **UK Net Zero Buildings Carbon Standard**
- Hear from key members of the **cross-industry standard coalition**
- Discover the **latest research** on decarbonisation and challenges that face built environment professionals
- **Network** and engage with members of CIBSE and other built environment industry experts

Book now

Scan the QR code to get your early-bird discount before **15 May 2024**

cibse.org/decarbonisation-conference

Embodying good policy

With embodied carbon emissions in construction set to make up 80% of total emissions in buildings, CIBSE is calling on the government to regulate them. Anastasia Mylona reports

Construction materials' embodied carbon emissions are responsible for 10% of the UK's total greenhouse gas emissions. At 64 million tonnes of CO_2e per year, the total is more than the country's aviation and shipping emissions combined.

With the industry reducing operational energy in buildings through more energy efficiency measures, tackling embodied carbon is the next big challenge.

CIBSE believes that there is an urgent need for regulation and, in February, it joined forces with other institutions and construction bodies to send a consistent message to UK political leaders.[1]

Together with the UKGBC, IStructE, ICE, CIOB, CIC, RIBA, RICS, ACE, UK Architects Declare, and Part Z, the Institution called on party leaders to commit in election manifestos to reducing construction embodied carbon emissions within two years of taking office. By 2028, it wants them to introduce legal limits on upfront embodied carbon emissions for projects with a gross internal area of more than 1,000m² or more than 10 dwellings.

"Engineers should first reduce the need for MEP kit by prioritising passive design options"

Embodied carbon is the carbon emissions of a building before it becomes operational. It is associated with materials and construction processes throughout the whole life-cycle of a building, including during the manufacture of building materials, their transportation, and the construction process. It also refers to the carbon produced in maintaining the building and, eventually, demolishing it, transporting the waste and recycling it.

Embodied carbon represents 30% of a building's total carbon on average, the rest being operational carbon. Our efforts to reduce operational carbon could increase the proportion of embodied carbon to 80% of a building's total carbon over time.

According to Greater London Authority's Whole Life-Cycle Carbon Assessment guidance, the embodied carbon of building services in new projects is, on average, 25% – and, in retrofits, up to 75%. This is because of complex systems containing multiple components created using intense manufacturing processes. The use of refrigerants, high replacement rates, and a global supply chain also contribute to high embodied emissions.

Understanding the embodied carbon of products and their components is crucial to creating less carbon-intensive products. This information is usually provided in environmental product declarations (EPDs). However, these are available for few products because of the high cost of producing EPDs due to the complexity of MEP equipment.

CIBSE's *TM65 Embodied carbon in building services: a calculation methodology* provides a simple way to estimate the embodied carbon of building services equipment where an EPD is not available. It has been adapted for use in Australia and New Zealand, and two further regional addenda are due in 2024 (USA/Canada/Mexico and UAE).

TM65.1 Embodied carbon in building services: residential heating, published in December 2021, provides the embodied carbon for residential heating systems.

TM65.2 Embodied carbon in building services: lighting, published in August 2023, gives lighters a tool to estimate the embodied carbon of lighting products.

CIBSE is set to launch the next in the series – *TM65.3 Embodied carbon in building services: logistics* – and one covering HVAC in offices is due later this year.

To reduce embodied carbon, engineers should first reduce the need for MEP kit by prioritising passive design options, and avoid overengineering by carefully considering the design and location of systems. Also avoid oversizing by understanding the building requirements (indoor environment, occupant profiles, HVAC demand cycles) and sizing systems accordingly. We tend to size systems for the worst-case scenario, adding further capacity, which leads to oversizing.

Finally, we need to understand the embodied carbon of products, including reusability and recyclability, to help us select the ones with a lower carbon footprint. By minimising the need for MEP equipment, capital and operational costs can be reduced significantly. Reducing dependence on equipment can also increase the resilience of buildings and the built environment to extreme weather.

Decreasing the use of MEP equipment plays a pivotal role in mitigating the carbon footprint of buildings. This aligns with our decarbonisation goals and supports our efforts to reduce our environmental impact.

References:

1 Embodied carbon regulation – alignment of industry policy recommendations, CIBSE February 2024, **bit.ly/ECRFeb2024**

DR ANASTASIA MYLONA is technical director at CIBSE

Glaring omissions

As the consultation period closes for a slew of regulations that will determine the sustainability of building stock for years to come, Julie Godefroy summarises CIBSE's response to government proposals, and says they should have gone further to cut energy use and carbon

CIBSE has submitted responses to one of the largest consultation packages for energy and carbon regulations in buildings in recent years. It comprised the Future Homes Standard (FHS), Future Buildings Standard (FBS), Part O, and homes created through material change of use (MCU)[1]. A consultation was also published on the Home Energy Model (HEM) and its application to the FHS (HEM:FHS)[2].

Apart from proposals for homes created through MCU, the package only addressed new buildings. There are currently no proposals for revising the regulations on works to existing buildings, which means that improvement opportunities continue to be missed when substantial works are carried out.

This adds to the government's backtracking on minimum Energy Performance Certificate (EPC) ratings in rented properties in late 2023.

The consultation did not address embodied carbon. The Department for Levelling Up, Housing and Communities has been considering regulatory options on this for a couple of years. CIBSE continues to support the Part Z campaign[2], an industry-proposed amendment to Building Regulations, and the government should come forward with proposals as soon as possible.

Both of these omit huge parts of the building stock's carbon emissions, on which the Climate Change Committee has urged action.

"In large part, the proposals lack ambition and are a missed opportunity to create buildings that will deliver low energy use"

HEM, the replacement for SAP

The consultation introduces HEM, and HEM:FHS, as a replacement for the Standard Assessment Procedure (SAP). HEM has added functionality and (hopefully) accuracy compared with SAP, but also added complexity and user inputs. A useful change is the distinction between the calculation methodology (= HEM), and the set assumptions and inputs to the calculation (= the FHS 'wrapper' – for example, the number of occupants and their activities). This paves the way for other useful applications – for example, wrappers for EPCs.

HEM could also be used outside of compliance calculations, with completely flexible inputs that would allow for the modelling of a home with its specific characteristics, such as number of occupants, heating patterns, and so on.

Positive moves

There are a few positive elements in the FHS/FBS package: a clear move away from fossil fuels for heating and hot water in new domestic and non-domestic buildings, and more attention to post-completion testing. The latter should be welcome, even if the proposals are somewhat vague. CIBSE recommends examining the feasibility of a rating scale, based on tested performance, that could be used across the stock and support householders' decisions for rental, purchase and retrofit, rather than for new-build homes only.

Another positive move is more requirements on homes created by MCU, including energy and carbon, airtightness testing, and Part O. This is welcome to protect householders, as homes created through permitted development rights are often sub-standard.

In large part, however, the proposals lack ambition and are a missed opportunity to create buildings that will deliver low energy use and good indoor environments, and not need future retrofits.

FHS and FBS

CIBSE repeated a number of comments made in previous consultations and supported by others, including LETI, RIBA and the Good Homes Alliance.

There is a need to review the approach to metrics and targets, to drive improvements and better relate to measurable, in-use performance.

Fabric and ventilation requirements should be more ambitious to deliver low space-heating demand and better air quality. The proposals for fabric in new-build homes were the least ambitious of the Future Homes Hub options, and less ambitious than in the 2021 consultation, despite 84% of respondents at the time recommending more ambition.

The requirements for an 'energy forecast' for non-domestic buildings of more than 1,000m² can be met by methods that are not intended or suitable for it. This

DR JULIE GODEFROY
is head of sustainability at CIBSE

risks confusing designers and building owners, leading to work of little or no additional value being created. These forecasts should require energy performance modelling (for example, Passive House Planning Package, Nabers, or other methods in line with CIBSE TM54).

The FBS consultation acknowledged industry concerns about the National Calculation Methodology (NCM), including its tendency to underestimate space-heating demand (see the CIBSE-LETI response to the 2022 call for evidence[3]). However, the proposed changes seem very limited and insufficient.

A substantial review of the NCM should be carried out, so that the NCM better supports the implementation of energy efficiency measures in new and existing buildings.

Heat networks

The proposals came alongside the Heat Zoning consultation. CIBSE is concerned that the current proposals do not ensure that new-build networks offer a low carbon solution compared with onsite alternatives, or that they will drive the decarbonisation of existing networks. This is for a number of reasons, including the setting of the notional building when connected to a heat network, and the calculation methodology for carbon content of heat from networks.

References:

1 The Future Homes Standard (FHS), Future Buildings Standard (FBS), Part O, and homes created through material change of use (MCU), CIBSE consultation response, **bit.ly/CJCIBFHS**
2 The Home Energy Model (HEM) CIBSE consultation response, **bit.ly/CJCIBSHEM**, and Home Energy Model: Future Homes Standard Assessment CIBSE consultation response to its application to the FHS (HEM:FHS), **bit.ly/CJCIBHSA**
3 NCM Call for Evidence – Joint Submission by CIBSE and LETI **bit.ly/3Uq8Tp9**
4 'Zoning in: the new Heat Network Zoning consultation', *CIBSE Journal*, April 2023, **bit.ly/49ZPMa5**
5 Part Z, **part-z.uk**
6 Consultation on the introduction of a UK carbon border adjustment mechanism, **bit.ly/3QezmmX**
7 City of London 2040 City Plan and Sustainability Supplementary Planning Guidance, **bit.ly/3UkAY11**

CURRENT CONSULTATIONS

Carbon border adjustment mechanism is a tax reflecting the carbon impact of imported products and materials. CIBSE is not currently planning to submit a response, but may contribute to the response of others. The consultation closes on 13 June. Please contact CIBSE by 31 May to feed into this.

The City of London 2040 City Plan and Sustainability Supplementary Planning Guidance includes a proposal for a 'retrofit first' approach. The consultation closes on 17 May, and contributions should be sent to CIBSE by 10 May. For more, see CIBSE News on page 10.

Decarbonising large commercial buildings

Recent innovations in heat pump technology are enabling cost-effective retrofits of heating systems in commercial buildings, as Mitsubishi Electric's **Richard Venga** explains

Around 80% of the buildings that we will be using in 2050 are already built, yet many of these are old, draughty, and consume a lot of energy to keep them warm.

We can't just knock them down and build new ones, however, even if we wanted to. For a start, we want to keep the buildings we know and love, which make up the very nature of our towns and cities. The amount of carbon it would take to demolish and then rebuild these properties would also make the whole exercise pointless.

Decarbonising the built environment is not, therefore, just about designing new and greener buildings; it must also be about adopting innovative solutions to modernise and decarbonise the existing building stock.

Retrofitting is the best way to address this challenge, and heat pumps are seen as a key technology to support the UK in its transition to a low carbon future, because they are proven and available, and the skills to install, commission and maintain them are here.

Public and private sector building owners and tenants have a rising interest in addressing gas emissions from the built environment. From hospitals and schools to large commercial premises, each client has specific technical needs.

In a recent webinar with *CIBSE Journal*, Matthew Philo, product manager – central plant, at Mitsubishi Electric, and I looked at the solutions offered by recent technological developments and innovations in heat pump manufacture.

We also sought to explain how these innovative technologies adapt to the evolving demands of the commercial sector and help each client meet its green objectives, and how they can influence the path towards decarbonisation.

The presentation discussed the legislation and initiatives that are driving changes to the way we will need to heat, cool and ventilate large buildings. It also included real-world applications of commercial heat pump technology, with a deep dive into a case study where heat pump systems have been applied successfully.

You can watch the recording of our latest *CIBSE Journal* webinar, 'Decarbonisation of large commercial buildings in the UK', at **bit.ly/CJRFMit**

● **Richard Venga** is head of engineered solutions at Mitsubishi Electric

Greater expectations

A survey of occupants at CIBSE's Balham headquarters reveals that visitors and staff disliked the indoor environmental quality, but appreciated the collaborative nature of the space. **David Fitzpatrick** reports on the results and explains how they will be used when considering a new HQ

CIBSE's head office has been in Balham for more than 45 years and there have been many discussions about moving the organisation's HQ to Central London. Recently, the focus of these discussions has shifted to include the premises and not just the location.

Questions have been asked about whether the CIBSE office reflects the Institution's vision, and whether it is a suitable building for employees to work in and for members to use.

To assess needs and understand how the building works for these needs, CIBSE commissioned a BUS survey, the methodology of which provides advanced insight into building use through assessing and tracking occupant wellbeing. The survey delivers both qualitative and quantitative results of the data, which is presented as a histogram on a sliding scale, marked against a percentile plot that shows how the building compares with the benchmark result for that question. An example of how the quantitative results are presented is shown right.

These benchmarks incorporate 1,300 responses worldwide, representing 80,000 individuals and more than 30 years of industry best practice. This allows us to look beyond a single point, such as the height of summer, to gain a truly reflective analysis of overall performance of the building in key areas, including: safety and accessibility; comfort and ambience; modern infrastructure; office layout; and image to visitors/membership.

The summary for each group consists of questions on sub-groups, such as noise, lighting heating, cooling, summer and winter conditions, and control of building services/building design.

The results

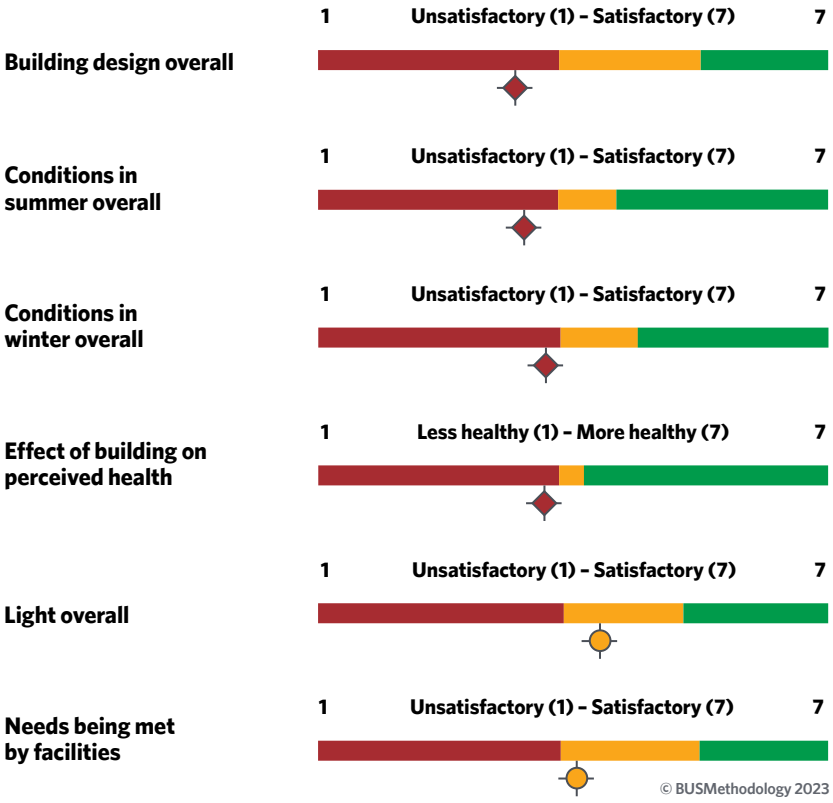
The BUS survey was completed in late 2023 with a 75% response rate, which is considered excellent.

The CIBSE Balham office's summary index is in the bottom 10% of our data set when compared against the BUS 2023 UK non-domestic benchmark. Results show the building does not meet modern expectations for office space. There is a clear desire for updates in many areas, such as heating, cooling, ventilation, lighting, decoration, furniture, fire safety, layout, and sustainability. See facing page for the key areas of concern and positive elements, and the implications of these findings for the future workspace.

The office's dated appearance, lack of inspirational elements, and visible signs of wear

Questions have been asked about whether CIBSE HQ is a suitable building for the Institution's staff and members

Example data presentation: summary variables



contrast with employees' expectations. They want an environment that motivates and inspires, which clearly shows a significant gap between the current state of the workspace and the ideal. The substandard results in many areas, alongside multiple safety concerns, highlight the pressing need for improvements to the office environment.

It's important to understand why the survey was done: the results will influence the decision-making on what building we should be looking for and will help inform the design team on the building services design for the new premises.

The requirements of the building today are very different from three years ago as we embrace a more modern, hybrid working arrangement. This has fundamentally changed the use of office buildings; they now need quiet places for teams calls, more meeting rooms and breakout areas for collaboration. Yet, it was interesting to discover that employees still prefer a level of individual control on heating and lighting, for example, which directly impacts morale and productivity.

It is recommended to conduct the survey again after the move, to assess the impact. CIBSE is currently reviewing and appointing a design team to consider the design needs and how these can be incorporated.

In the future, the construction industry will need more genuine collaboration between designers and contractors. Within CIBSE, this can showcase how the different design elements should collaborate, from the client's requirements to the design of how the new premises work for staff and membership. One of the key parts of this is ensuring that such as facility management are part of the process.

POSITIVE COMMENTS

Location and accessibility: Convenient location, proximity to public transport, and free car parking.

Team collaboration and space management: Despite small room sizes, colleagues enjoy being near each other.

Desk infrastructure: Employees value large desk sizes and adequate plug/electrical access.

NEGATIVE COMMENTS

Indoor environmental quality: Respondents noted overheating in summer and cold conditions in winter, where heating systems can be ineffective and unreliable. The lack of adequate ventilation results in a stuffy work environment.

Technological and connectivity issues: Several respondents emphasised persistent problems with IT infrastructure, including unreliable internet connectivity.

Impractical and outdated structure: The building was frequently described as impractical, outdated, and unsuitable for modern work. The layout is counterintuitive, and the design does not facilitate cross-team collaboration because of many small and disconnected workspaces. It is not viewed as a space conducive to providing incidental interactions.

FITNESS FANATICS

Making buildings fit for the future was the theme of the CIBSE Technical Symposium, which took place at Cardiff University last month. **Alex Smith** and **Molly Tooher-Rudd** report on the sold-out event, at which 86 peer-revewed building services papers were presented

For more information on the 2024 Technical Symposium and to register your interest for the 2025 Symposium at UCL London visit **www.cibse.org/technicalsymposium**

Cardiff University welcomed the CIBSE Technical Symposium to Wales for the first time last month. The Grade II-listed home of the Welsh School of Architecture (WSA) was a handsome backdrop to a sold-out event at which 86 peer-reviewed papers on building services were presented to 196 delegates over two days.

CIBSE President Adrian Catchpole opened proceedings, saying that 'leadership, driving innovation, demonstrating competency, and working in collaboration were at the heart of the Technical Symposium'. He told the auditorium that construction professionals need to be driving change. 'Our leadership is needed now if we are to have the impact required,' he said. 'As engineers, we must move the built environment from being a significant contributor to global emissions to being an exemplar of how to reduce them.'

Professor Graeme Maidment, of London South Bank University (LSBU), gave a keynote speech on the impact of cooling on UK carbon emissions. He revealed that 15% of UK electricity consumption (in 2021) was attributable to cooling buildings, according to government research (see page 49).

The winners of the prizes for best papers were both women: former Cardiff University student Shweta Salvankar won 'Most significant contribution to the art and science of building services engineering', while Aya Heggy, of LSBU, was recognised for 'Most effective delivery of material'. The awards were presented by CIBSE technical director Anastasia Mylona, who completed her PhD at the WSA.

Both winning papers were in tune with the symposium theme – 'Fit for 2050 – Delivering buildings and defining performance for a net zero built environment' – and focused on challenges facing building services engineers in achieving better buildings.

Salvankar's paper looked at how net zero carbon standards could be established in a region that lacks a carbon assessment framework. Her focus was on India, another paper – by Raed Alshammari, University of Reading, – had a similar theme, but looked at the development of a framework for net zero energy residential buildings in Saudi Arabia.

LSBU's Aya Heggy won the award for 'Most effective delivery of material'

Anastasia Mylona (right) with Shweta Salvankar, who won the 'Most significant contribution' award

Heggy's paper, 'Bridging the gap: from disparate data to decarbonisation strategies in UK heat networks', is particularly relevant as the government moves towards imposing mandatory performance standards for heat networks from 2025. She said a crucial first step in decarbonising heat networks was understanding what currently exists. 'If we don't know what we have, how can we do anything to improve it?' she said.

Heat network papers were prominent at the symposium and included a presentation by Phil Jones, Building Low Carbon Solutions & DESNZ, on the new regulatory framework being developed by the government. This includes the Heat Network Technical Assurance Scheme, based on the CIBSE Heat Networks Code of Practice, to help heat network operators demonstrate compliance with new requirements (see page 40).

Other subjects covered at the symposium included embodied carbon, indoor air quality, building simulation, the use of data in optimising performance, and heat pump technologies, particularly retrofits (see page 45 for Roger Hitchin's paper on a UK-led project on retrofitting heat pumps in non-domestic properties.)

Professor Jo Patterson was part of the Cardiff University Low Carbon Built Environment Team, WSA, which won overall Building Performance Champion at the 2023 Building Performance Awards, for its work on retrofits. As well as taking part in the retrofit debate (see panel), Patterson presented posters on the university's real-life retrofit experiences and delivered a paper on delivering whole-house retrofits. She said it

is important to understand the limitations of homes – joists preventing MVHR installations, for example – and that flexible whole-house energy systems are required. High-quality design must be followed through to installation and beyond, Patterson added, and independent commissioning is essential: 'You can't mark your own work.'

The WSA also won CIBSE Project of the Year – Residential category, and the 2024 winner, Bryn Bragl, another Welsh retrofit housing project, was represented at the symposium by Hoare Lea's Ashley Bateson FCIBSE and Brogan Watkins, of Legal & General Investment Management.

Research papers from the Technical Symposium will be available at **www.cibse.org/technicalsymposium** and some will be covered in detail in the *Journal*. For industry to meet its net zero goals it is important to disseminate as much of this peer-reviewed research as possible. **CJ**

The event's gold sponsor was Eaton, and silver sponsors were Adey Commercial, Carrier, IES, Mitsubishi Electric, Strebel and Klima-Therm.

HOW TO SPEND £20,000 TO CUT CARBON


Professor Jo Patterson

This year's symposium debate, expertly chaired by Hywel Davies HonFCIBSE, asked five panellists how they would spend £20,000 on reducing carbon in their home.

Tony Day (LSBU) highlighted his own experience with a heat pump retrofit in an 18th-century property, which achieved six tonnes of carbon savings over the past year. He stressed the need for cost-effective measures. 'The fabric-first approach must become cheaper, with a focus on airtightness.'

Ewan Jones (Aecom) said he'd spend £8,000 of the money on fabric upgrades 'before getting a heat pump'. He said the answer depended on the individual's priorities, but he urged the audience to keep future-proofing in mind as they develop their designs. 'For example, cooling. There's a potential tidal wave of demand in the domestic sector,' he said.

Marlena Swan (Loughborough University) criticised the piecemeal policy on retrofitting, advocating for one-stop shops to provide comprehensive advice. 'There isn't just one approach,' she said.

Professor Jo Patterson (Cardiff University) broke down her spending plans into a shopping list. 'I'd allocate £500 for data collection to inform planning; £500 for design to identify the best solutions; £1,000 on a new consumer unit; £9,000 on improving the worst windows and doors; £7,500 on PV panels; £1,000 on top-ups and repairs; and £500 on monitoring, to ensure that the changes have made a difference.'

Ted Pilbeam FCIBSE (Volker Fitzpatrick) offered prudent advice. 'You don't have to spend the money all at once. New tech may become available down the line that's cheaper and more suitable; find out what works for you.' The speakers called for cost-effective solutions, context-specific approaches, and comprehensive advice.

Designers behind the Ravelin Sports Centre have crunched its energy-use numbers down to an impressive 87kWh·m^{-2} per year, less than half that required to achieve a DEC 'A' rating. **Andy Pearson** discovers how an innovative mix of passive and active technologies produced a sector-leading building that won a CIBSE Building Performance Award

USING LESS ENERGY TO KEEP FIT

The University of Portsmouth's Ravelin Sports Centre is setting new standards for low-energy design. Leisure centres are often associated with high energy use, but with an energy use intensity (EUI) of just 87kWh·m^{-2} per year, this pioneering facility uses one-tenth of the energy of a typical centre, saving the university more than £800,000 on its annual energy bill.

It won Project of the Year – Leisure at the 2024 CIBSE Building Performance Awards with judges impressed by its careful, low carbon design and application of technology.

What's more, the performance data has been used as an exemplar case study by the UK Net Zero Carbon Buildings Standard, to help establish a best-practice benchmark for operational and embodied carbon for future leisure centre buildings.

To achieve this remarkable feat, building services engineers Max Fordham – working with architects FaulknerBrowns, the client and main contractor – have taken every design decision as an opportunity to minimise energy consumption further.

As such, the building incorporates a range of passive and active environmental technologies, including the extensive use of daylight and mixed-mode ventilation. In addition, heat is provided by air source heat pumps (ASHPs) incorporating load-shedding controls, while the complex is crowned by a giant biosolar roof that provides up to 20% of the building's electricity needs.

The £57m sport centre's low-energy design is a response to the university's campus energy and sustainability masterplan. Developed by Max Fordham under a previous project, the masterplan includes a requirement for all new buildings to achieve Breeam Outstanding and a Display Energy Certificate (DEC) 'A' rating in operation.

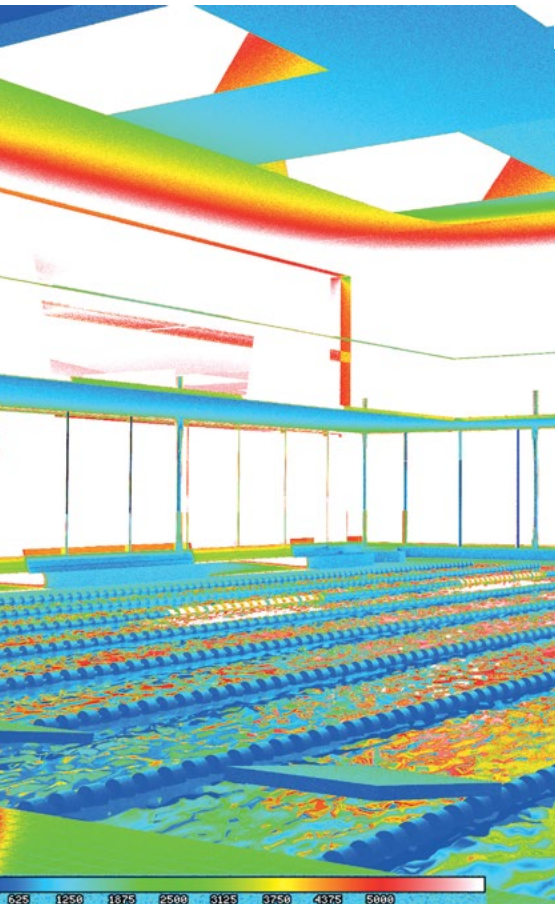
To achieve DEC 'A', the design had to target a maximum EUI of 218kWh·m^{-2} per year. Ambitiously, Max Fordham set out to meet this already challenging target without the use of fossil fuels. 'When we started to develop the design in 2016, gas boilers were the standard solution, but we said "this building is not going to complete until 2022, when Grid carbon will be lower, so we should not be basing our design on fossil fuels",' says Mark Palmer, director and sports leader at Max Fordham. Opting for

CARBON

Target annual energy use: 218kWh·m^{-2} GIA/yr
Actual metered energy use: 87kWh·m^{-2} GIA/yr
Reliance on fossil fuels: No
Onsite renewable energy systems: 1,000m^2 photovoltaic installation design output: 207MWh/yr (20% of building energy demand) measured output after 1yr: ~215MWh/yr

The Ravelin Sports Centre in Portsmouth won a CIBSE Building Performance Award

"The building incorporates a range of passive and active environmental technologies, including the use of daylight and mixed-mode ventilation"



Large rectangular rooflights supplement daylight in the pool area

an all-electric solution would also ensure the building's carbon emissions fall further as the Grid continues to decarbonise.

The university's brief to the design team was for a sports centre with a 25m swimming pool, an eight-court sports hall, 175-station fitness suite, climbing wall, ski simulator, and fitness studios, along with offices and teaching spaces.

Palmer says the starting point in developing the building's form was to separate the swimming pool from the 'dry' areas (the sports hall, fitness suite, and so on), so that the circulation space between can form an environmental buffer zone.

Unusually, the design places the sports hall on top of the ground-floor fitness suite and changing rooms. 'One of the key decisions was to put the sports hall on the first floor, to ensure that it and the swimming pool could benefit from rooflights, to provide passive heating and daylight, which saves energy and is good for wellbeing,' says Palmer.

Flexibility is key to keeping the building's footprint and embodied energy to a minimum. The swimming pool, for example, has a floating floor, to do away with the need for a learner pool; the squash courts are separated by a moveable partition to enable them to be converted into additional studio space; and the studio spaces incorporate a moveable partition that allow them to flex to accommodate a variety of class sizes and activities. The compact building's high-performance envelope has been kept deliberately simple to avoid complex junctions and cold bridges. In addition, the swimming pool envelope has been fortified with additional insulation, to deal with the higher air temperature and humidity in the space. Employing a simple, system-build envelope solution made it easier to build and, Palmer says, gave contractor Wates Construction 'a fighting chance of delivering on the design airtightness and thermal performance in practice'.

The rooflights in the sports hall and swimming pool are designed to open. They are arranged in strips in the sports hall, strategically positioned between the badminton courts to allow daylight in while minimising the impact of glare on the players. (See panel, 'Open-minded'.)

Max Fordham has eschewed natural ventilation for an innovative cooling and mechanical ventilation solution for the intensively used, 175-station fitness suite. Alongside a conventional fan coil cooling »

OPEN-MINDED

In the swimming pool, four large, rectangular rooflights supplement daylight from the full-height glazing on the north and east elevations that allow views out over the surrounding parkland. The impact of daylight was analysed for the pool to ensure glare and reflections from the water surface would not impede the lifeguards' views of swimmers on and below the surface of the water.

For the majority of the year, the pool hall rooflights remain closed, Palmer says, to provide 'free heat and light' – but, on hot days, they can be opened, along with intermediate-level ventilation dampers. 'The space operates more like an outdoor pool on a hot day, so we can turn off the heating, ventilation and lighting,' explains Palmer. When the temperature drops, the rooflights close and the space reverts to mechanical ventilation with heat recovery to maintain occupant comfort.

In the sports hall, conditions are maintained year-round using a natural ventilation solution. Here, outside air is introduced through a 'generous area of opening louvres' midway up opposing walls, to ensure air movement does not affect the flight of badminton shuttlecocks.

Driven by stack-effect ventilation, air exits through the rooflights. Palmer says: 'Our light and air modelling team undertook computational fluid dynamics (CFD) analysis for all the hall's activity scenarios, from badminton games through to a basketball competition watched by 250 spectators.'

» system, a series of large-diameter, high-volume, low-speed horizontal fans have been recessed into the ceiling, like the slowly spinning rotor blades on a series of upturned helicopters. These giant fans have been designed to generate air movement to reduce the need to drive down the fitness suite air temperature. The large fans are supplemented by 13 smaller fans concealed above the ceiling.

The conventional way to deliver comfort to a fitness suite is to lower the air temperature to help people lose heat. Sport England's guidance, for example, suggests maintaining temperatures as low as 16°C-18°C. But Palmer says this can result in 'very high energy use' that often 'fails to deliver occupant comfort' because, when we are sedentary, radiation is the primary mechanism of heat exchange. As exercise intensity increases, however, convection and, eventually, the evaporation of sweat become the dominant modes of user heat loss. 'If the air in a gym is cool, still and humid, your sweat is unable to evaporate to cool you down,' Palmer explains.

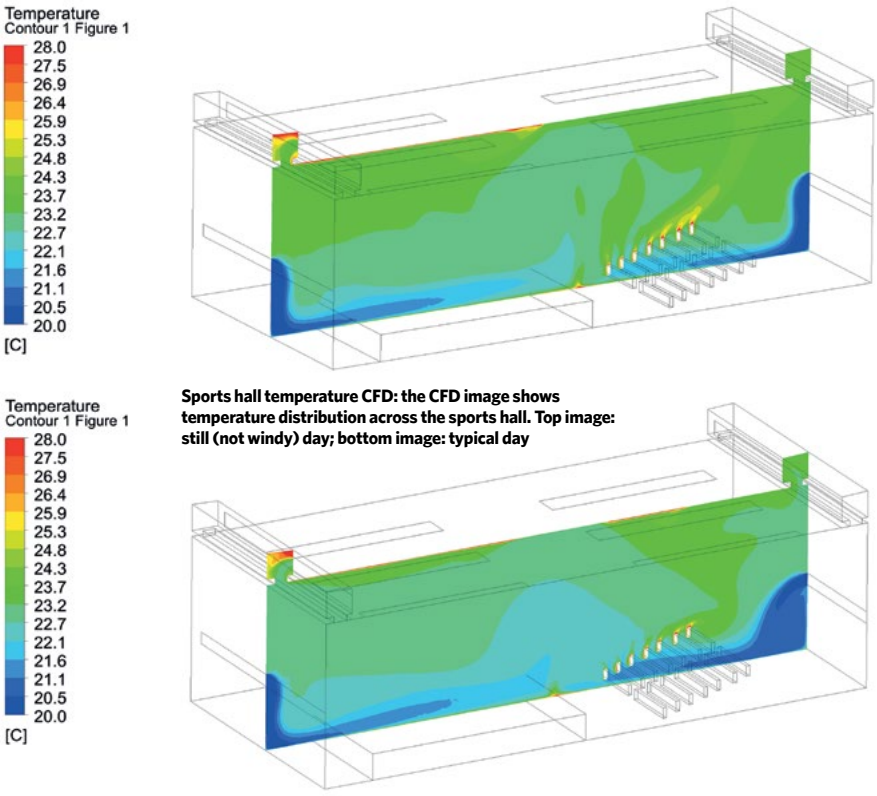
For those undertaking high-intensity exercise, convective and evaporative transfer of body heat are increased significantly by air movement. 'By creating air movement and controlling humidity, we are able to achieve much better levels of comfort at temperatures that are not as cold,' Palmer adds. See 'Fit for purpose', *CIBSE Journal* October 2018 for more on this **bit.ly/CJRav**.

In addition to the giant fans, four-pipe fan coil units (FCUs) have been tucked out of sight above the suite's slatted wood ceiling. The FCUs provide the space with heating and mechanical cooling. 'The client was a bit nervous about the effectiveness of our giant fan solution, so the fan coil units have been sized to cool the space conventionally without the need to run the fans,' says Palmer, who adds that the client need not have worried. 'Everyone loves this solution: it's striking to look at and it's proven to be very effective.'

In addition to ensuring the university's management and operations teams have a good understanding of the building and its systems, soft landings enabled the engineers to tweak the fan system once the fitness suite was fully operational. They estimate that increasing air movement in the fitness suite, as opposed to relying on a lower temperature setpoint, will result in a 10% reduction in energy use in peak summer conditions.

Heat for the building is supplied by five ASHPs via a low-temperature buffer vessel. To maximise ASHP efficiency, heating is at 45°C flow/40°C return, which, Palmer says, is 'quite challenging when we need to heat the pool hall to 30°C. To operate the system at these low temperatures relies on high levels of heat recovery and a high-performance building envelope'. The solution also required non-standard fan coils, air handling unit coils and heat exchangers to exploit the low flow temperatures.

The ASHPs incorporate load-shedding controls to minimise peak heat loads and



Sports hall temperature CFD: the CFD image shows temperature distribution across the sports hall. Top image: still (not windy) day; bottom image: typical day

Left: One of the striking giant fans set into the ceiling in the gym. The fans have been designed to generate air movement to reduce the need to drive down the fitness suite air temperature

reduce their size, capital cost and embodied energy. Palmer says minimising heat loads, maximising heat recovery and using load shedding 'has allowed us to squeeze the combined capacity of the heat pumps down to 525kW, around a quarter the capacity of boilers in a typical leisure centre'. This ensured the heat pump solution was space-efficient and economically viable.

The pool water heat exchanger, for example, has a heat demand of 500kW, which, under the usual control regime, would take up the full heat capacity of the ASHPs, leaving nothing for space and water heating. However, Palmer says the only time it needs to deliver this output is when it is heating the pool water up from cold.

For the majority of the time, the heat exchanger is only required to output about 50kW to maintain the water at a steady temperature – and because the pool water acts like a huge thermal battery, the system can wait until the demand for heat is lower. 'We put a lot of work into ensuring the heat pumps are not oversized, because it would have been easy to think we needed four times as many heat pumps. But if you are in control of where the heat is going, it allows you to shed some of the loads,' Palmer explains.

Two additional water source heat pumps are used to raise the water temperature from 45°C to 60°C to supply the hot water calorifiers.

In addition to the five heat pumps dedicated to heating, the sports centre has five, four-pipe heat pump chillers optimised to provide cooling, but which can also provide free heat to the building. These supply the FCUs with chilled water at 6°C/12°C. The units can simultaneously top up the thermal store using heat reclaimed from the cooling side. The heat generated by activity in the fitness suite and dance studios is captured and used to keep the pool warm and preheat hot water for the showers, explains Palmer.

There is a heat recovery unit on the pool water filter backwash system, too. The backwash is used to clean the water filters. In addition, to maintain pool water quality, 30 litres of water is added to the pool per bather, with a corresponding amount removed. This

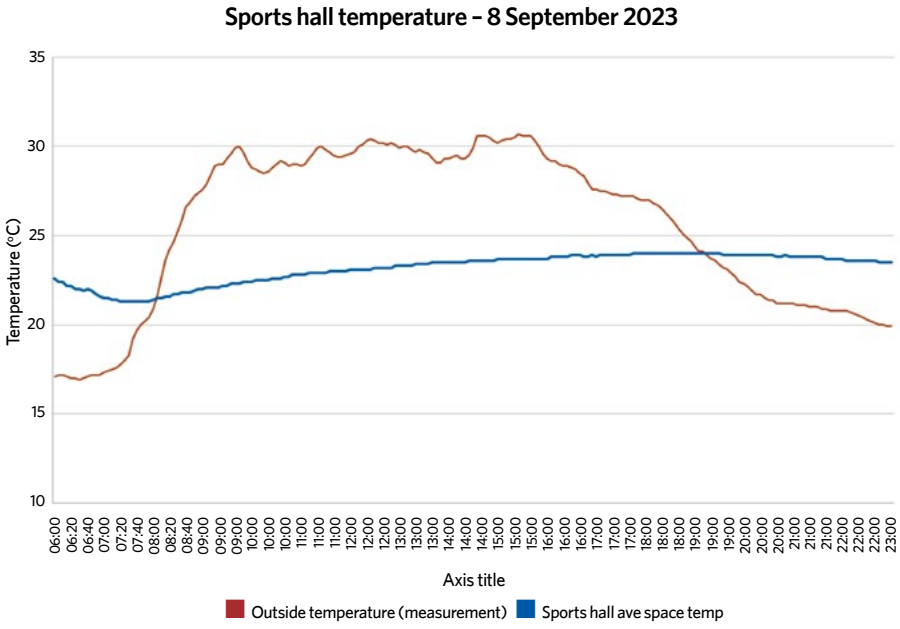
MINIMISING EMBODIED CARBON

Alongside operational carbon, embodied carbon was targeted at RIBA Stage 3 to minimise the sports centre's whole life carbon.

This was undertaken before the publication of CIBSE TM65, so the focus was on reducing the building footprint and refining the building structure, where most of the embodied carbon was concentrated. The building's concrete basement car park box – which Palmer describes as 'the biggest single contributor to embodied carbon' – was an unfortunate planning requirement.

Key design changes to the structure included the use of ground-granulated blast-furnace slag binder in the concrete basement construction, and changing the basement retaining wall construction from one based on a continuous flight auger-pile wall to a much slimmer retaining wall, constructed using temporary sheet piling.

Interestingly, Palmer says the green roof marginally increased the scheme's embodied carbon because of the larger steelwork frame required to support the roof's additional weight. However, he says this has to be considered in the context of the roof's other benefits, such as helping attenuate rainwater run-off and increasing biodiversity.



Indoor temperatures in the naturally ventilated sports hall are consistent despite high external temperatures

» water is used to flush the centre's toilets.

Engineering the sports centre's low-energy design was 'the easy bit', says Palmer, who adds that it is often the execution, rather than the design, that prevents schemes from achieving predicted energy performance. For Ravelin, Max Fordham was novated to Wates Construction under the two-stage design and build contract, and appointed by Wates Building Services to develop its installation and record drawings in Revit. The engineer also worked with Wates' offsite manufacturer, Prism, to integrate prefabricated service modules and plant skids. 'It meant we were able to take responsibility for the design from concept to installation,' says Palmer.

Max Fordham also produced drawings for the client, with all CoBie asset information, as a full BIM project. Palmer is complimentary about how Wates Building Services (now SES) tackled the project. A two-stage procurement route ensured the contractor was able to price 'every bit of kit specified, to avoid compromises with lower-efficiency alternatives'. Execution was also helped by the soft landings specification insisting that Wates appoint an independent commissioning manager (Banyards). Its task was no doubt helped by the building having more than 200 electricity and heat meters. 'At completion, the building was properly and fully commissioned so that it performed well from the get-go,' says Palmer.

Post-occupancy, the soft landings initiative requires Max Fordham to monitor the building and report each month on how the various spaces are performing – a task aided by the engineer having remote access to the BMS and meters.

There were also monthly meetings to gather client feedback. Palmer says: 'If something was not working, it was raised at the meeting so that, by the next meeting, it had been resolved, which helped ensure the client never lost faith in the design and remained engaged in the low-energy strategy.'

A major challenge with sports buildings is the huge variation in occupancy throughout the day. In the evening, they are usually full and everything is running flat out, whereas, in the middle of the day, they are relatively empty. 'M&E designs often only focus on meeting peak conditions and do not consider the other times when occupancy drops off,' explains Palmer. 'But you have some pretty powerful kit in this building, so you will waste a lot of energy if you don't turn things down or off when occupancy drops.'

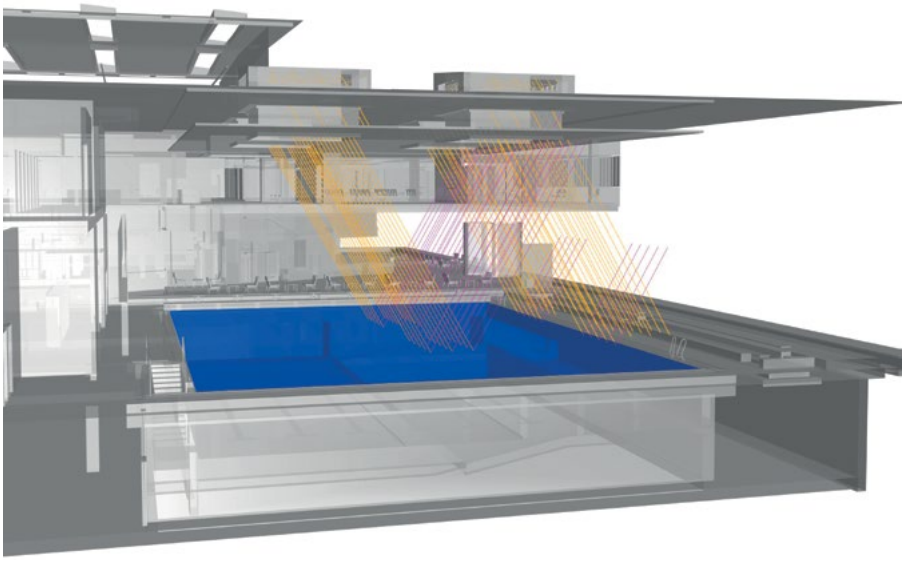
One issue raised post-occupancy was the level of local control that users should be given, particularly over the temperature of the fitness studios after complaints that these were either too hot or too cold.

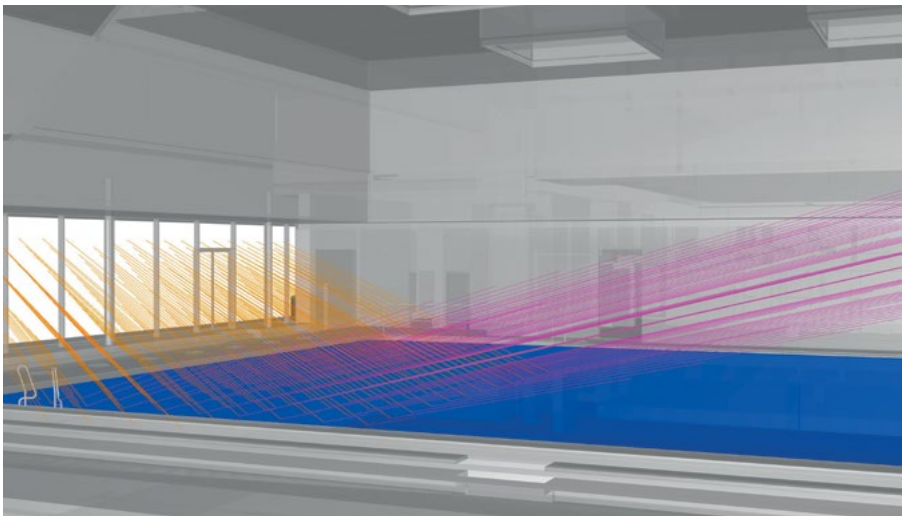
Post-occupancy evaluation monitoring showed the rooms were performing as designed, with temperatures being maintained at 18°C, and CO_2 levels rising and falling, and the fresh air fans responding accordingly, depending on occupancy. After questioning users throughout the day, however, it became clear that when the spaces were used for high-intensity exercise classes, users found them to be too hot, whereas when they were used for a zen yoga class, for example, users were too cold. 'We've now added a button to each studio to allow the temperature to be changed up or down a couple of degrees for an hour,' says Palmer.

This approach has clearly worked, and highlights the benefits of a soft landings approach. Perhaps more impressive is that the scheme improved significantly on the original, challenging EUI target of 218kWh·m^{-2} per year. CJ

REDUCING GLARE

Plots in the simulations below show the direct sun penetration at two points during the year. They are conducted using a bespoke tool, Beam Tracer, created by Max Fordham to calculate specular reflections. Orange represents the direct sun transmitted through the glazing; pink is the reflection from the pool surface. Due to the steep angle, reflections from direct sun remain at a high level and do not enter the occupied zone where they can cause glare (top picture). At low sun angles, some direct sun penetrates into the pool area and can cause glare to occupants. By carefully mapping the path of the sun, lifeguards can be positioned to avoid areas that experience glare from direct sun.





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

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

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Heat revolution

Decarbonising heat in the UK will be key to reaching 2030 emissions targets. Phil Draper's journey in pioneering heat pump retrofits for commercial buildings has resulted in recognition as CIBSE's Engineer of the Year 2024. His work on large commercial heat pump retrofits with British Land exemplify the innovation needed to drive sustainable solutions (page 30).

To help developers select optimal solutions, a UK-led International Energy Agency project is under way to develop a tool based on potential cost and carbon savings. While there are limited examples of commercial retrofit projects, this initiative seeks to spotlight large-scale retrofit successes and offer guidance on effective heating solutions (page 45).

Monitoring heat pump performance remains pivotal. As seen in Baxi's recent article on swimming pool decarbonisation, achieving optimal efficiency can be complex (page 36)

Looking ahead, new regulations set to be introduced in 2025 promise to revolutionise the design and operation of heat networks in the UK. This technical assurance will establish performance standards for both new and existing networks (page 40).

MOLLY TOOHER-RUDD, REPORTER

CONTENTS

Engage early to reach net zero

As we march towards 2050, building services engineers have a vital role to play in driving net zero through well-designed, low carbon and energy-efficient heating systems. Decarbonising heat in many of the UK's existing commercial buildings is still a huge challenge, however, often because of site and budgetary restrictions.

One means of accelerating progress is to encourage greater knowledge exchange across the project team from the outset. This includes early discussions with heating and hot-water solutions providers, whose specialist product and technical expertise is becoming increasingly important as system design grows more complex. This is particularly true with hybrid or part-decarbonisation approaches, as a higher degree of technical support will benefit optimal results.

In addition to evolving product portfolios to provide the technologies required for the energy transition, forward-thinking solutions providers such as Baxi are shifting the focus from product to full solutions support.

By producing complete engineered solutions, backed by predicted energy and carbon savings based on low carbon technology generators, we are able to provide precise, validated advice to end users and designers in the early stages.

The purpose of this digitally produced pre-contract design guidance, which draws on our knowledge and experience, is to help make the move to low carbon heat more seamless.

It's just one example of how we can step up our efforts to set harder-to-heat commercial buildings on the road to net zero by being flexible in approach and encouraging early engagement.

JAMES MATTHEWS, director of building solutions at Baxi

BAXI

Plantroom pioneer

Phil Draper has been pioneering heat pump retrofits in commercial buildings since 2012 and has now been recognised as CIBSE's Engineer of the Year. Andy Pearson finds out what the industry can learn from his innovative and collaborative approach

CIBSE's 2024 Engineer of the Year, Phil Draper, is well known at the Institution. Through his work for CIBSE, he has done much to disseminate practical knowledge around innovative systems, and has been forthright in his encouragement of apprenticeships.

Renowned for his work in retrofitting commercial heat pumps, Draper has made substantial reductions in carbon and costs in large commercial properties, using an innovative and lean engineering approach.

The award judges praised him for encouraging others to make the changes necessary for large buildings to decarbonise in a cost-effective way. 'While we saw many great examples of leadership and development of teams, the winner stood out for his creativity and practical delivery of innovation,' they said. 'He clearly has a passion for the development and growth of engineering.'

British Land's 350 Euston Road was the first large-scale heat pump retrofit in a commercial office building. The project was led by Draper who, in 2012, was working for British Land. 'It was a really steep learning curve,' he recalls.

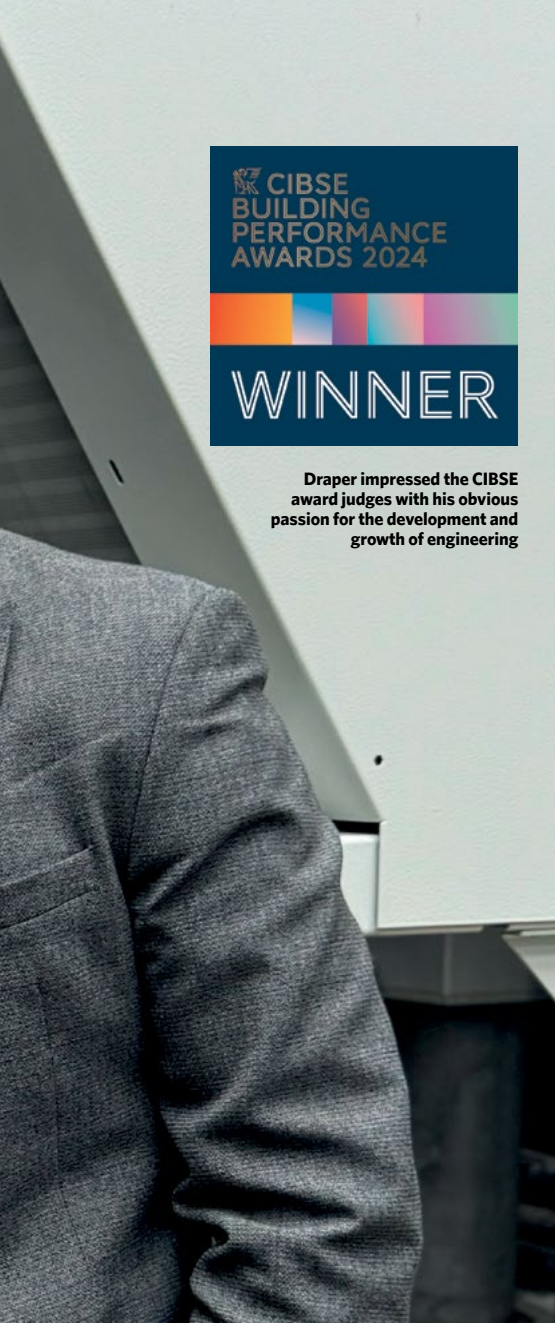
British Land was on a mission to reduce its energy use by 40% by 2015. The seven-storey office building's three gas-fired condensing boilers and two air cooled chillers were approaching the end of their life. Retrofitting heat pumps was the obvious solution, Draper says, because, like most commercial offices, this one required concurrent heating and cooling for a large part of the year.

'If you have a building that needs heating and cooling simultaneously, why would you run a separate heating and cooling plant when you could run a 4-pipe heat pump unit to help improve the building's energy performance and reduce its carbon footprint,' he says.

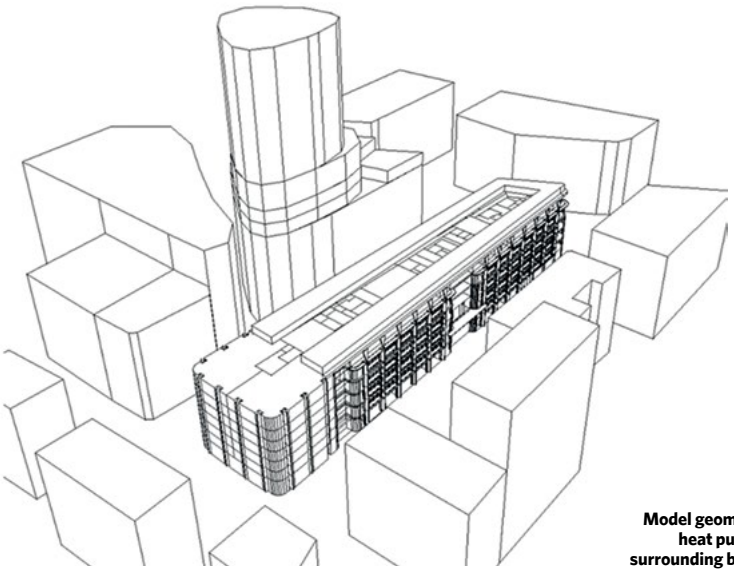
A major challenge in replacing the gas-fired boilers with an air source heat pump (ASHP) is the lower temperature of the heating supply. At Euston Road, the boilers supplied fan coil units (FCUs) on the office floors with water at 70°C. While heat pumps can now produce water at this temperature, at the time they did not. Instead, the heat pumps were designed to operate at a much more efficient system temperature of 45°C; with the FCUs supplied with heat at this lower temperature.

The project uses a Climaveneta ASHP, which has three basic operating modes: chilled water only; hot water only; and simultaneous hot and chilled water production. 'When simultaneous heating and cooling demand occurs, heat energy can be obtained almost for free,' Draper says.

In 2014, ASHP technology was unable to deliver a sufficient quantity of high-grade heat to meet the heating demand when ambient temperatures were low. For the Euston Road project, when ambient drops



Draper impressed the CIBSE award judges with his obvious passion for the development and growth of engineering



Model geometry for dynamic heat pump analysis with surrounding built environment

new-build projects. 'With new-build applications, there is generally more space and it is much easier to design systems from the outset to operate at a lower system temperature of 45°C/50°C to maximise heat pump efficiency,' Draper explains.

He says the challenges for heat pump retrofits include 'restrictions on plant space using existing plantrooms, limitations on the electrical power available, and the need to provide sufficient heat to existing equipment sized to operate at a higher supply temperature'. In addition, heating demands in offices tend to be higher now than they would have been in a 1990s office, because heat »

> "Heating demands in offices tend to be higher now than they would have been in a 1990s office, because heat outputs from computer monitors and lighting are less and office densities are generally lower" – Phil Draper

below 5°C the building's gas boilers kick in to meet the heat demand.

The solution worked. 'The additional expenditure to retrofit the air source heat pump achieved payback within a year and now saves occupiers £60,000 every year,' Draper says. In addition, the switch to using an electric heat pump as the primary heat source, as opposed to gas boilers, is helping to reduce carbon emissions by 470 tonnes a year and improve local air quality.

Ten years on and the installation is still delivering. 'What this first project demonstrated quite successfully is the use of a heat pump as a means of recovering heat,' Draper explains.

Having proven the methodology, Draper has continued to build on this experience and the lessons learned from that initial project, both as an employee of British Land and, subsequently, as managing director of his own consultancy, Twenty One Engineering. He says retrofitting heat pumps is more demanding than installing them in

Draper frequently works with Darren Coppins, of Built Physics

» outputs from computer monitors and lighting are less, and office densities are generally lower. On the plus side, with a retrofit you will have the benefit of detailed metering information from the building, 'so there will be far fewer unknowns', he says.

To assess the viability of a heat pump retrofit, Draper often works with Darren Coppins, of Built Physics, to model the building and its systems. The model references the metered operational data to confirm its accuracy. When the metered energy data does not match that predicted by the model, the team must assess whether the problem is with the building or the model, says Coppins. He adds that it might be down to problems with the existing controls or excessive infiltration, or parts of the building may not be working as they were intended.

'We can drill into that data to see if it is something that needs to be addressed with building maintenance or whether the model needs to be tweaked to factor in something I've not allowed for,' Coppins says.

When all parties are happy with the accuracy of the model, it is used to assess the operation of the proposed heat pump retrofit.

For an effective heat pump installation, Draper believes designers have to start to think differently about a project. 'The historical approach to heating and cooling design was focused on meeting peak loads, but the average temperature in the UK probably sits between 8°C and 15°C,' he says.

It's a point on which Coppins picks up. 'We've got very used to using gas, which can be turned on and off very easily, but a heat pump does not work like that,' he says. 'With heat pumps, if we size them for peak capacity their lowest turndown won't be low enough for them to operate efficiently or, potentially, reliably.'

For this reason, Coppins says it is important to optimise the heat pump for how it will run for the majority of the time: 'We can predict that through building physics; rather than saying this building has a peak load of 3MW, for most of the time its load might actually only be half of that peak.' He says a smaller-sized 4-pipe heat pump – 'with a bit of top-up' from an additional reversible heat pump – can be used to boost the heating and cooling outputs as required, and can provide a more reliable installation. »

A heat pump being craned into position

MY JOURNEY FROM APPRENTICE TO CIBSE ENGINEER OF THE YEAR

Draper has gone from 'worst apprentice' to 'true leader'

I started out on an engineering apprenticeship, as a tool maker for e2v. Unfortunately, I cannot stand still, so, at the age of 18, I was told I was the worst apprentice they'd ever had and I was moved to facilities, where I undertook an electrical apprenticeship.

The e2v factory manufactures semiconductors and specialised components for medical, space and industrial applications. It has Class 10 and Class 10,000 clean rooms, and 11 substations – all high-end stuff. Learning about building services on a complex scale changed my mindset and I progressed to factory service engineer.

I left e2v to work for metering company EP&T, as technical lead. Our first big win was for British Land, where I designed and installed the metering system for nine of its buildings. I subsequently drove the energy management process for each, based on the operating data.

In 2011, British Land asked me to join them as senior engineering manager of its Regent's Place complex. With experience of operating a Class 10 cleanroom, it is easy to transfer these skills to operating commercial office buildings. For the next three years, I drove operations at Regent's Place to make the multi-let campus one of the most efficient.

In 2012, I started work on retrofitting a heat pump to 350 Euston Road – the first large-scale heat pump retrofit in a commercial building. By 2014, I was in a more central role, advising on how more of British Land's buildings could target net zero. I started to engage with CIBSE and the Better Building Performance Group.

I left British Land to work, briefly, for a company called Cavendish, before setting up my own company, Twenty One Engineering, to use my skills and experience to deliver turnkey solutions for clients. These included British Land, where I continue to be involved in heat pump retrofits.

I'm a big advocate for apprenticeships, because that's the route I've taken. Until now, no winner of CIBSE Engineer of the Year had done a hands-on apprenticeship – I should not be the only one.

The CIBSE BPA Judges said: 'While we saw many great examples of leadership and development of teams, the winner stood out for his creativity and practical delivery of innovation. He clearly has a passion for the development and growth of engineering. A true leader by example and a genuine practitioner of engineering leadership.'

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» The downside of this type of solution is that the plant has to be hydraulically separated. For his latest project, however, Draper worked with Coppins to develop a conceptual retrofit design without the need for additional kit. 'The system has been designed to work efficiently at 50°C, but – to meet peak demand – we're planning to boost the heat pump system temperature from 50°C to 70°C,' he says.

Innovative solutions such as this are feasible because Draper is keen to involve manufacturers. 'Before we finalise our design, we will get the manufacturers in to have a conversation, because not every heat pump is the same and not every application is the same,' he explains.

Another reason the team at Twenty One Engineering is able to develop innovative solutions, Draper believes, is 'the open relationship we have with British Land as the customer and with Built Physics'.

In the 10 years since Draper became involved in retrofit heat pump installations, he says the biggest technological advance has been with refrigerant gases, because these allow higher circuit temperatures.

'At Euston Road, we could achieve a circuit temperature of 50°C at an outside air temperature of 5°C. When the outside temperature dropped to 0°C, the system only achieved a temperature in the low-40s – while, at -5°C, you would struggle to get up to 40°C,' he says.

'Now, with different refrigerant gases, heat pumps can give us a system temperature of 55°C at -5°C ambient.' CJ

- **DARREN COPPINS** was a judge at the Building Performance Awards, but did not judge the Engineer of the Year category
- **PHIL DRAPER** is the new chair of CIBSE's HVAC Group

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Lessons in heat pump optimisation

Decarbonising heat in existing schools is vital to UK net zero targets, but optimal heat pump efficiency is not always straightforward. Baxi's Andy Green discusses lessons learned from decarbonising three swimming pool buildings for a multi-academy trust

According to the latest government research, schools and universities across the UK account for 36% of public sector building emissions[1]. Taking action to reduce the carbon footprint and lead by example is understandably high on the school agenda – and with funding from the government's Public Sector Decarbonisation Scheme (PSDS) making the energy transition more affordable and achievable, astute school trusts are seizing the opportunity to start their net zero journey.

The Priory Federation of Academies Trust, for example, has recently carried out a programme to decarbonise the swimming pool centres at its secondary academies in Lincoln. Renewable energy installer Oakes Energy Services collaborated with heating and hot-water solutions provider Baxi to assist the Trust with its ambitious sustainability initiative, replacing existing standard gas boilers with air source heat pumps (ASHPs).

Proposals for the decarbonisation programme began in 2022, with the Trust identifying an opportunity to reduce the high energy demand in three swimming pool buildings. Typically, swimming pools are extremely energy-intensive because the water needs to be heated continuously to maintain comfortable temperatures.

Gas boilers were heating the water in the pools at Lincoln Academy, Witham Academy and LSST Academy – but, today, two 88kW ASHPs supply all the heat demand in the swimming pool buildings at Witham and LSST, feeding underfloor heating and radiators, and providing hot water for the changing rooms and the swimming pool plant.

Two Remeha 88kW ASHPs supply all the heat to Witham Academy's swimming pool building

At Lincoln Academy, which has a larger 25-metre pool, five 88kW ASHPs are supplying heat to 500-litre calorifiers for the hot-water system, as well as to the swimming pool heat exchanger, in the first phase of the decarbonisation programme.

Oakes Energy Services, which specialises in decarbonising existing buildings, was approached by the Trust to develop initial proposals to secure PSDS funding for the programme. Director Nik Smith FCIBSE describes the process: 'We start each project with an initial assessment of the building's energy profile. We then review decarbonisation options and the anticipated carbon savings – which were considerable across the three schools – and present these in a design proposal.'

The proposal for each academy was designed to meet the individual requirements of each building, but all involved retrofitting ASHPs and calorifiers supplied by Baxi. In total, the design of the entire scheme is projected to save 227.5 tonnes of CO_2 a year.

Detailed design

PSDS funding was successfully secured through Salix in 2023. With the competitive tender process won, the starting point when developing the detailed design was to produce comprehensive building heat-loss calculations.

Understanding the thermal performance of a building is important to develop solutions to improve its operational efficiency. The problem with existing buildings, however, is the lack of thermal modelling and legacy issues, says Smith. 'You can inherit all sorts of problems, including what has happened between when the existing plant was fitted and now.'

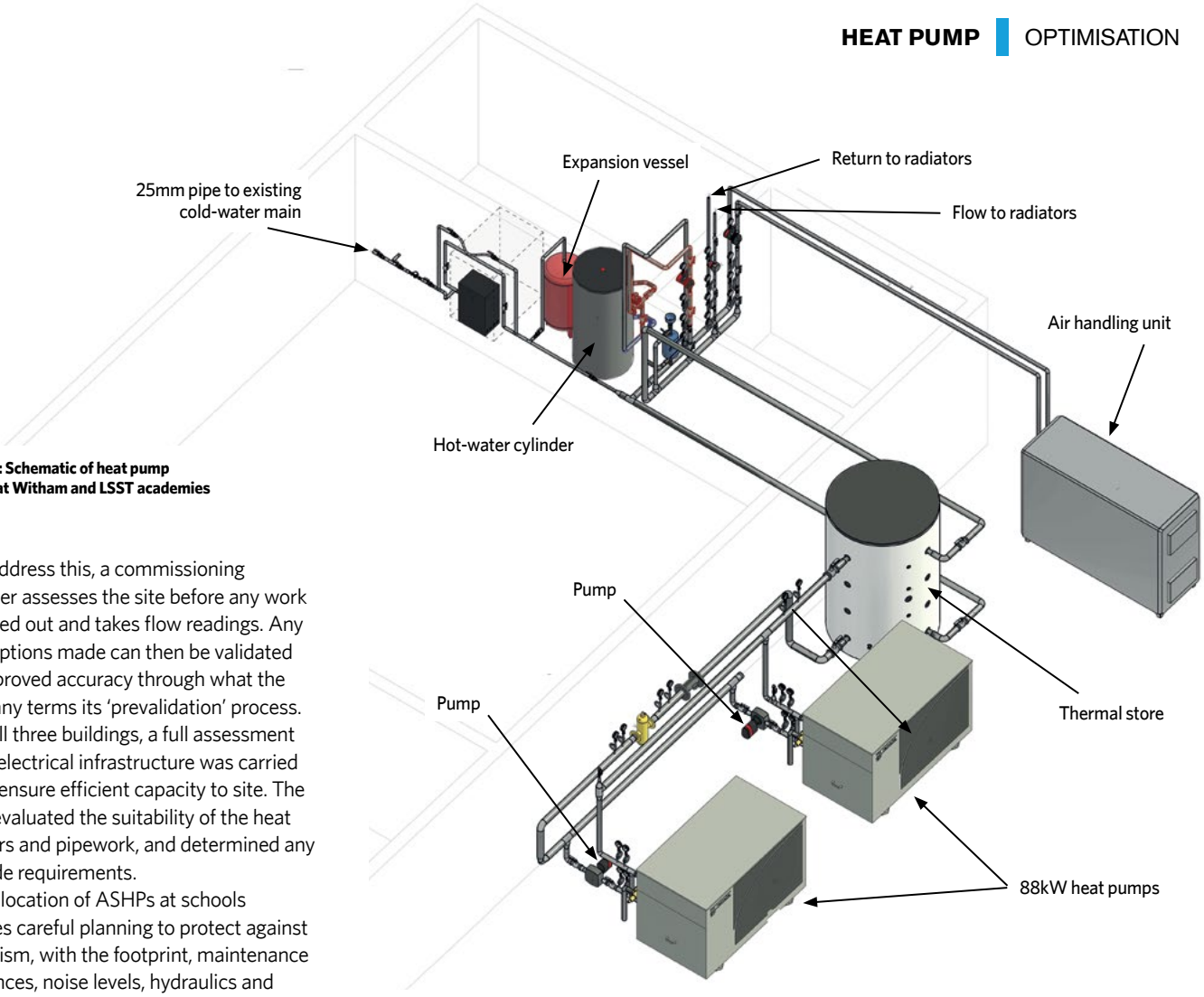

Figure 1 : Schematic of heat pump system at Witham and LSST academies

To address this, a commissioning engineer assesses the site before any work is carried out and takes flow readings. Any assumptions made can then be validated for improved accuracy through what the company terms its 'prevalidation' process.

At all three buildings, a full assessment of the electrical infrastructure was carried out to ensure efficient capacity to site. The team evaluated the suitability of the heat emitters and pipework, and determined any upgrade requirements.

The location of ASHPs at schools requires careful planning to protect against vandalism, with the footprint, maintenance clearances, noise levels, hydraulics and electrical connections, general aesthetics, and any necessary planning permissions all factored in.

The final design proposals included new pipework, inverter-driven variable speed high-efficiency pumps, thermal stores, air handling unit upgrade, power and BMS controls, upgraded internal heat emitters, water treatment, and balancing.

The BMS controls philosophy is programmed to use the reduced overnight electrical tariff to pre-charge the thermal stores so the system is at full capacity, ready for operational hours. The temperature setpoints are designed to deliver changing rooms, offices and corridors at 21°C.

Within the pool hall, the water temperature setpoint of 30°C and air temperature setpoint of 31°C allow the most suitable environment for students. To maintain hot-water temperatures outside of the legionella band, the domestic hot-water temperature needs to remain above 50°C, and up to 60°C for an hour daily, with pasteurisation carried out weekly.

Using a cascade of heat pumps can improve the overall performance of the system by offering adequate turndown to meet the system load requirement throughout the year, preventing excessive cycling of the heat pumps, as well as improving overall efficiency by operating a number of heat pumps at part load. The new units were commissioned in September 2023, ahead of the start of the new academic year.

Lincoln Academy's larger 25m pool requires five ASHPs

Benefits of early collaboration

Retrofitting ASHPs brings opportunities and challenges in schools because of the need to minimise disruption and keep the buildings operational during term time. This typically leads to works being carried out during the summer holiday shutdown period.

Smith outlines two factors that helped keep the programme on schedule to provide heating ready for the school's return in early September. One was collaborating with the supplier to ensure availability. 'Knowing heat pumps were in stock was a big selling point, as we could get ahead with preparatory works before the holidays while keeping the building and academy operational.'

This included preparing the heat pump locations' bases and external pipework before removing the existing boiler system to make space for the new systems' »

» proprietary equipment. 'Collaborating with the manufacturer from the outset also meant we benefited from great support throughout, from onsite technical support during the installation stage to pre-commissioning support and final ASHP commissioning by its engineers to meet the handover date,' Smith continues.

The second tip Smith offers is to notify the local Distribution Network Operator (DNO) and complete the necessary connection application form as soon as the heat pump design is locked in. 'Applying immediately can avoid potential delays waiting for DNO approval, so it's advisable to do this at the outset,' he explains.

Energy monitoring and revisiting

There can be challenges when retrofitting ASHPs in an existing building because of the need to achieve hydronic balancing. Reviewing the system regularly and monitoring energy usage – a Salix requirement – will enable anomalies to be identified and rectified immediately, to keep operational efficiencies high.

One of the challenges was calculating previous energy usage in the buildings, according to Smith. 'The swimming pool centres are separate from the main school buildings, but none of them was being metered independently,' he says. 'This meant that, while actual data can now be included, a lot of data prior to installing the ASHPs had to be predicted.'

A temperature comparison has been carried out from 2022, when the gas boilers were providing the energy, and 2023, when the ASHPs were providing the energy. This shows that average external October temperatures were 5-6K colder in 2023 than 2022 and, in November and December, around 2-3K colder in 2023. Both LSST and Witham are tracking exceptionally well against predicted performance. (Energy data for LSST is shown in Figure 2).

However, original data for Lincoln Academy indicated issues that, on investigation, were the result of thermal balancing. These have been corrected.

'The importance of monitoring reliable energy data and going back to make sure the system is operating as anticipated can't be overstated,' says Smith. 'Retrofitting ASHPs is complicated. This project involved a number of commissioning engineers for hydronic balancing, water treatment, and the BMS, as well as the ASHP manufacturer. But as we saw at Lincoln Academy, it's essential to commission as a whole system to achieve the right thermal balance.'

He suggests that recommissioning in winter is critical to optimise operational efficiency during the months when the system has to work hardest. 'On most school refurbishments, commissioning takes place during the summer,' he says. 'But how are they performing in winter? It points to a need for recommissioning in the winter months to keep operational efficiencies high.'

In addition to spending time educating estates managers and BMS operators on the ASHP system, the project highlighted the benefit of ongoing review to optimise ASHP performance. 'Issues might come to light – for example, the timing of the pasteurisation cycle during an occupied period, or the pool cover not being fitted – that can be addressed quickly, to bring the energy back under control,' says Smith.

The location of ASHPs requires careful planning to protect against vandalism

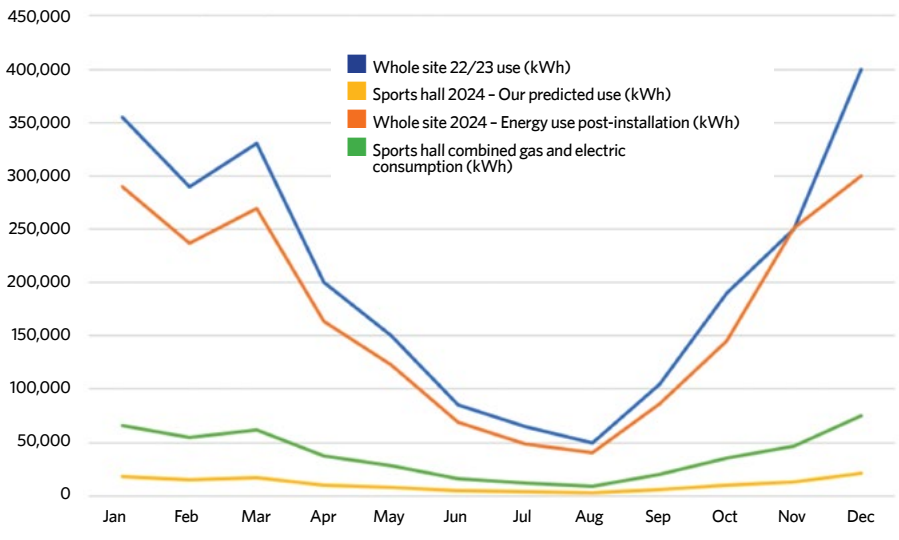

Figure 2 : Energy data for LSST showing reduction in energy use in sports hall and on whole site

Importance of funding to drive energy transition

The Priory Federation of Academies Trust is delighted with the outcome in its three swimming pool centres, and its decarbonisation programme has caught the eye of Salix Finance, which has nominated the Trust for one of its sustainability awards.

PSDS funding is vital to drive the energy transition in the education sector, says Smith. 'ASHPs on school retrofit projects will deliver vital carbon savings, but are currently not financially viable without government funding, especially where special deals have been negotiated on gas prices.'

'Fortunately, we have recently received confirmation from the Department for Energy Security and Net Zero that Phase 4 of the PSDS, amounting to £1.17bn, is now available,' he adds.

When embarking on an ASHP retrofit project, a good understanding of the building and its energy usage is essential to produce design options for improvement, as well as to predict operational and carbon savings. Monitoring the system and tracking actual energy data against predicted outcomes then provides the opportunity to revisit, and ensure the control strategy and balancing is optimal after a time of operation. CJ

ANDY GREEN is technical director at Baxi

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1 Sustainability and climate change: a strategy for the education and children's services systems, Department for Education, 2023 **bit.ly/CJCCEd**

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New regulations due next year are set to revolutionise the design and operation of heat networks in the UK. Phil Jones and Gareth Jones look at the latest rule proposals and explain the importance of technical assurance in setting performance standards in new and existing networks

Heat networks: countdown to regulation

Huge changes are coming to the UK heat network sector, with regulation due in 2025. Heat networks will be a regulated utility, similar to gas and electricity, with Ofgem as the regulator, minimum technical standards, consumer protection, and heat network zoning. The scale and pace of change cannot be overemphasised.

Regulations will require minimum technical standards, under a Heat Network Technical Assurance Scheme (HNTAS), for all new-build heat networks from 2025, including the 50,000 residential connections already happening each year. This could rise to 100,000 heat interface units being installed annually in the foreseeable future, partially driven by the regulations themselves.

All 14,000 existing (legacy) heat networks will also be covered, including the 500,000 residential customers currently supplied by heat networks. However, the number of networks is probably a significant underestimate, and improved data could easily indicate there are more like 18,000 legacy networks.

Both communal and district heat networks will be included in the regulations, with the majority of legacy networks being relatively small, communal (single block) networks. The regulations will recognise that many of these communal systems are old and not in the best state of repair, often resulting in poor performance and customer outcomes.

HNTAS is addressing how we can bring these up to a reasonable performance standard over a reasonable period of time. The technical standards will be outcomes-based, so networks will need to meet key performance indicators (KPIs) to gain Heat Network Certification.

For the past 18 months, the Department for Energy Security and Net Zero (DESNZ) has been developing HNTAS, building on CP1 (2020). The work has been led by technical author FairHeat, in partnership with Gemserv, which is focusing on procedural aspects of the assurance scheme.

Normative documents have now been developed, setting out the necessary governance, structures, procedures and technical standards required to ensure a minimum level of performance and reliability for heat networks.

HNTAS core principles are that the scheme will be outcomes-orientated, preventative, proportionate, deliverable, adaptable, and enforceable. See 'Assuring quality of heat networks', *CIBSE Journal*, May 2023.

The technical normative documents set out clear and measurable KPIs (technical minimum requirements) to be met for each element of a network, plus the evidence required and depth of assessment, along with 'key failures' that need to be avoided.

Draft normative documents have been developed in collaboration with sector stakeholders through an extensive series of technical sub-working groups. This involved 25 technical sub-workshops, bringing together 69 stakeholders from 44 diverse organisations, including manufacturers, housing associations, local authorities, consultancies, developers, contractors, energy service companies, trade associations, and professional bodies. This industry engagement will continue with a HNTAS consultation in the summer.

HNTAS's proposed approach is to certify individual heat networks. Our work-in-progress model is shown in Figure 1. It combines a series of assessment gateways (orange) that, ultimately, lead to certification (blue). Most of the detailed technical assessment work, carried out by registered and trained assessors, will take place across the orange stages, with the clipboards showing assessment points, and the dotted lines as gateways to proceed to the next stage.

The normative documents set out the detailed minimum requirements at each assessment through design, construction and commissioning. These design/construct/commissioning gateways aim to ensure the network is likely to meet future operational performance targets and gain full certification. There is a clear requirement to have binary yes/no decisions, with certification (authorisation to supply heat to customers) awarded to networks that meet minimum technical

"Heat network operators will be required to submit a Heat Network Improvement Plan, setting out how they will achieve certification within a set period following the installation of metering"

requirements. By requiring responsible persons to demonstrate that their heat network performance meets KPI thresholds, before allowing a network to pass through each assessment gateway, the scheme is 'preventative' and 'outcomes-based' (two of the core principles of HNTAS).

This approach aims to ensure that the great majority of heat networks pass at the point of certification, and that key failures in the market are avoided. There are 28 KPIs, categorised into six categories, that set a framework for measuring and monitoring heat network performance. The six categories are: energy centre; district distribution network; thermal substation; communal distribution network; consumer connection; and consumer heat system.

Existing legacy networks will, inevitably, find it harder to meet the HNTAS minimum standards than new networks. So, HNTAS is taking a pragmatic transitionary approach to bring legacy networks as close to full standard as possible, as soon as possible. HNTAS will set out a transition period, during which improvement plans will need to be submitted and minimum levels of metering will need to be installed. Once metering is in place, networks will be in a position to evidence-measure performance accurately and move to full certification.

Fixing legacy networks

For legacy networks, HNTAS aims to ensure the market is able to comply and that the very worst-performing networks are addressed early. »

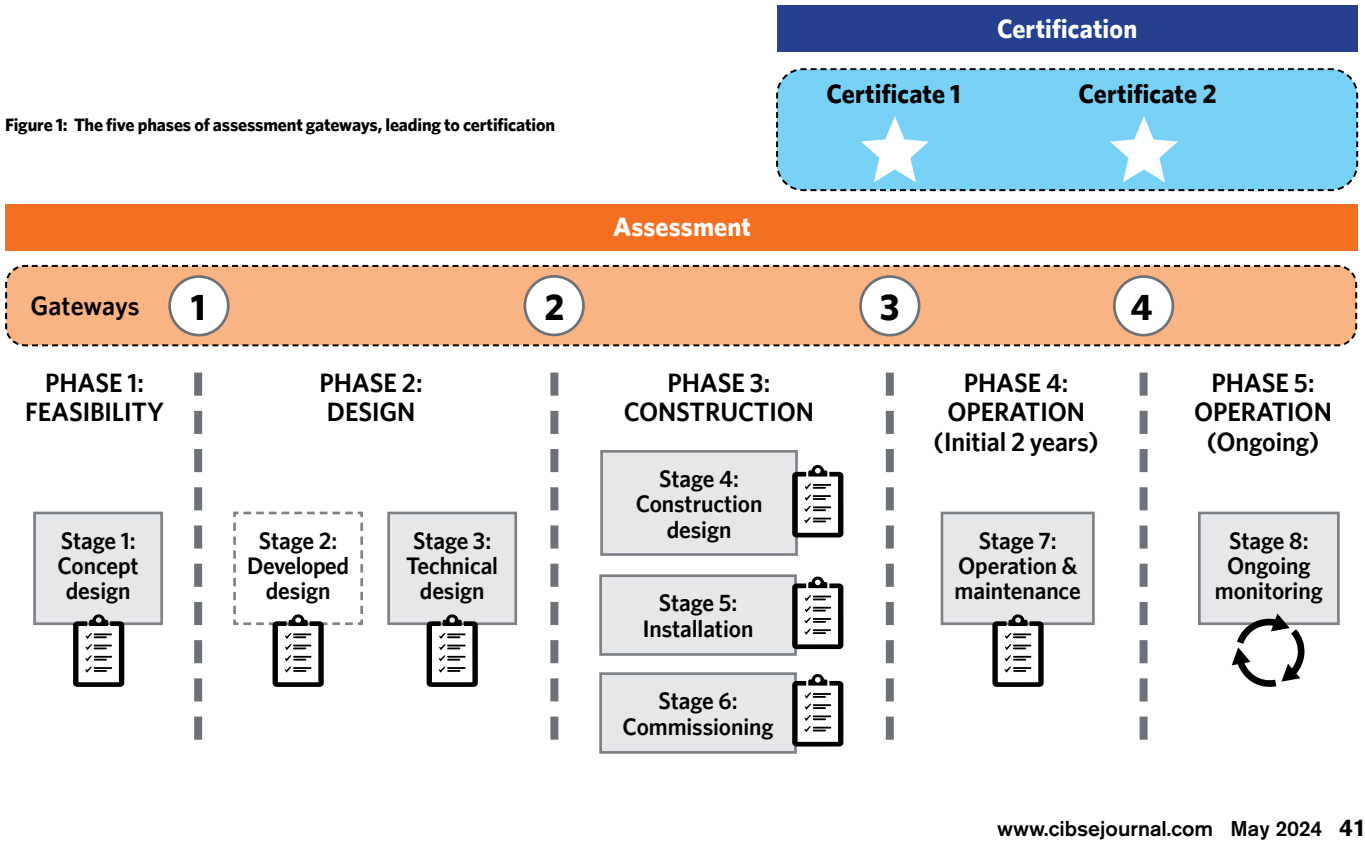

Figure 1: The five phases of assessment gateways, leading to certification

HNTAS is proposing that a single 'responsible person' be accountable for each heat network

» To achieve a steady improvement in performance over time, the goal is for every network to be fully certified to a minimum level of performance by a set future date. The proposal for legacy networks is a two-stage transitional approach, which will require minimum levels of metering and monitoring to be installed, followed by the need to report performance, with a minimum threshold that all heat networks must meet within a set period.

Operators will be required to submit a Heat Network Improvement Plan, setting out how they will achieve certification within a set period following the installation of metering, and will need to prove in-use performance after two years of operation, based on real data. It is proposed that networks installed before 2015 will be allowed more relaxed targets than those installed post-2015, when the Heat Networks (Metering and Billing) Regulations came into force.

HNTAS is proposing that a single 'responsible person' – such as the owner or developer – be accountable for each heat network. Duty holders of the designated designer, contractor and heat network operator are accountable to the overall responsible person for the day-to-day running of each project stage. This designation of duty-holder responsibilities is similar to the requirements in the Building Safety Act.

The project team is keen to ensure that this is a deliverable scheme, which is proportionate and does not place too much burden or cost on heat network operators or consumers.

During the operational stage, if the network achieves HNTAS minimum performance standards it moves into a stage where the heat network operator regularly submits data to the HNTAS portal (currently being developed), to show that it is still meeting the HNTAS KPIs.

More detailed assessments are only triggered where it falls outside the KPIs. Essentially, this allows a level of ongoing self-assessment for networks that meet minimum performance levels.

Evidence and data requirements will form a 'golden thread' throughout all stages of a network's life, requiring submission of data into the HNTAS and Ofgem digital platforms. It is hoped much of this data submission will be automated, to minimise time and cost.

It is clear that significant change is coming in 2025 as the sector transitions to a regulated heat network market, and setting minimum technical standards is a key part of this. Assessing and certifying heat networks that meet the minimum standards will raise sector performance.

HNTAS is moving into a pilot phase across 2024, to test that it works in practice on real networks, before final implementation in 2025. Engagement with stakeholders throughout this process will continue, as this is key to achieving sector buy-in for the assurance scheme.

"Design, construction and commissioning gateways aim to ensure the network is likely to meet future operational performance targets and gain full certification"

There are significant benefits and opportunities that will come from HNTAS: a commercial market for trained and registered assessor services; a general improvement in heat network performance, with consumers seeing improved reliability and service levels; social landlords and local authorities being able to provide more affordable heat; and investors viewing networks as more investable.

There is still a great deal to do to develop heat network regulations, through consultations and secondary legislation. DESNZ aims to publish the HNTAS normative documents in some form this year. HNTAS piloting will take place throughout the year, and DESNZ is seeking heat network operators and assessors that would like to take part. Plans to update CIBSE CP1 are also being put in place, to ensure alignment before regulations are implemented in 2025. A methodology to calculate the carbon content of heat should also be in place by that date.

Heat networks are complex and introducing regulation is not straightforward, so it is important to give this sector early sight of direction of travel. As such, this is a work in progress and does not represent government policy. A DESNZ HNTAS consultation this summer will continue sector engagement, and this work will put in place the missing piece of the heat network jigsaw, namely heat assurance. **CJ**

■ Based on a paper presented at the 2024 CIBSE Technical Symposium **www.cibse.org/symposium**

■ **Professor Phil Jones** is an independent consultant working on the DESNZ HNTAS team; **Gareth Jones** is managing director of FairHeat, the HNTAS technical author

IN THE ZONE

The other huge area of change the regulations will introduce is Heat Network Zoning, to designate geographic zones where heat networks are expected to be the lowest-cost solution to decarbonise heat. It is anticipated that multiple networks will be built in these zones, with the opportunity to connect these to create larger, city-wide networks.

Mandating building connection within zones will give developers 'connection assurance'. Buildings mandated to connect may include: new buildings; large public-sector buildings; land-large, non-domestic buildings, such as office blocks or shopping centres; and domestic premises that are already communally heated – such as flats with a communal building-level heating system.

Nineteen English cities are currently in a pilot project to refine and test the proposed methodology. A recent DESNZ consultation on zoning shows the direction of travel.

For CIBSE's response to the consultation, see 'Delivering low carbon networks', *CIBSE Journal*, April 2024.

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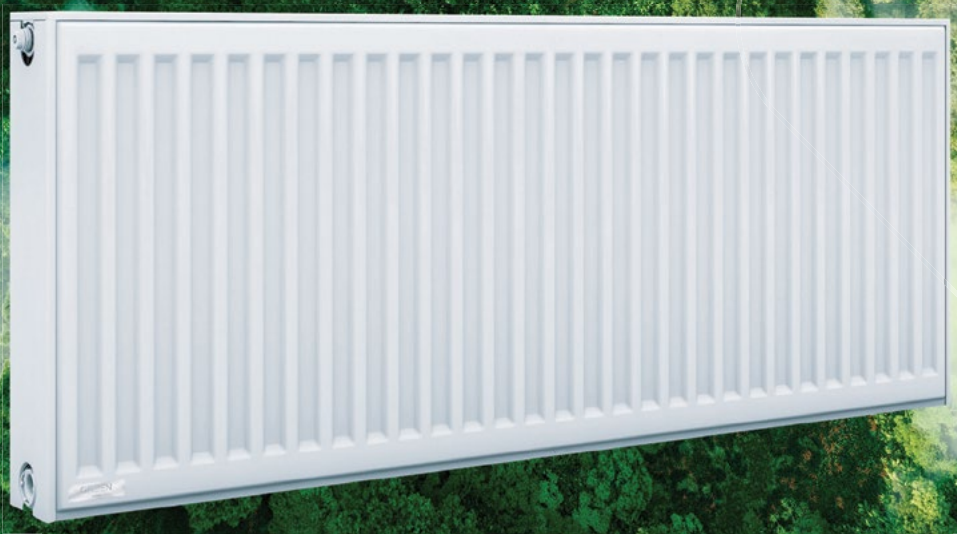

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Heat pump retrofits: the bigger picture

Retrofitting heat pumps in non-domestic buildings will be key if the UK is to meet its net zero targets. To help building owners assess the best solutions, a UK-led International Energy Agency project is developing a tool based on potential cost and carbon savings. Roger Hitchin reports

Non-domestic heating makes up 30% of all UK heating systems

The mass deployment of heat pumps in buildings will be key to eliminating the carbon emissions produced by gas-fired boilers if the UK is to meet its target for net zero carbon emissions by 2050.

The rollout of heat pumps powered by low carbon electricity is a central feature of climate change policies in many countries, including the UK, usually with an emphasis on their use in dwellings. Much less attention has been paid to non-domestic buildings, though their aggregate energy consumption for space and water heating is comparable with that in dwellings, and non-domestic heating makes up 30% of all heating systems in the UK.

To encourage the uptake of heat pumps in these buildings, an ongoing UK-led International Energy Agency (IEA) project, *Developing the market for retrofitting heat pumps to non-domestic buildings*, is looking at providing tools and guidance for building owners and managers of non-domestic buildings. Following a review of literature in the sector, the project felt that there was a particular gap in guidance for building owners, whereas building service engineers are partially catered for by *CIBSE AM17: Heat pumps for large non-domestic buildings*, one of the few documents on heat pumps in non-domestic buildings.

The project – headed by the Department for Energy Security and Net Zero, alongside organisations in Austria, Canada, Ireland, Italy, and the Netherlands – aims to address the gap in high-level guidance for non-specialists, and collate and share exemplar case studies.

An interactive tool is being developed that will ask users about their existing buildings and systems, and their principal objectives and constraints, before offering them a shortlist of possible system types.

The tool interface will guide users towards the options that appear to be most promising; these can then be evaluated in more detail, using expert advice as necessary. Their shortlist will be linked to generic descriptions of the relevant system types and their principal characteristics, and to two-page summaries of case studies in buildings that resemble their own.

The most suitable choice for a retrofit heat pump system depends on a complicated interplay between: the size, use and complexity of the existing building and its heating system(s); the range of heat pump system options that are possible; and the priorities and concerns of the building owner.

It is likely, especially for smaller organisations, that initial decisions around replacing heating systems will fall to individuals who are not experienced in navigating this maze. At the current low levels of market penetration, they are also unlikely to be familiar with existing heat pump installations. These are the individuals and organisations that this project aims to help.

The decision-support tool will need to map a large number of possible system configurations against the information provided by a tool user. Its basic logic structure – which has been agreed and is now being developed – has three stages that progressively reduce the number of options being considered (see Table 1).

Initially, the tool identifies constraints that limit the range of practicable options; then it focuses on those that are compatible with the existing heat-distribution system; and, finally, it produces the shortlist of options that best match the priorities identified by the tool user.

In most cases, it is expected that the initial two stages will reduce the number of feasible options to a manageable number that can be ranked according to the priorities of the tool user. The third ranking stage requires a set of comparative »

Option tool logic stages	Examples
1. Filter by constraints	Access to heat source, electricity supply constraint, extreme climate…
2. Preferred extent of system replacement	Heat generator only, modify distribution system, whole-system replacement…
3. Ranking based on user priorities and preferences	Maximise carbon saving, minimise capital cost, minimise disruption…

Table 1: Outline logic of the decision-support tool

costs and seasonal efficiencies, such as would be used during design evaluations.

It is expected that tool users will have varied backgrounds, priorities and levels of prior knowledge, reflecting the multiple and sometimes complex procurement procedures that could be used for various levels of retrofit and type of organisation. Guidance will need to be accessible and relevant to, and understandable by, a wide range of 'decision influencers'.

Exemplar case studies

More than 70 case studies have been identified across the participating countries (including a few in other countries). About 25% are in the UK and are predominantly public sector buildings supported by the Public Sector Decarbonisation Scheme (for which measured performance data is not yet available). In the UK, the projects are predominantly air source heat pumps, often bivalent or high-temperature.

Case studies illustrate the practical application of particular combinations of systems and buildings. With sufficient measured data, they can also provide evidence of performance in use. As the portfolio of case studies grows, the guidance provided by the tool will be compared with systems that were actually selected, which will provide an indication of whether this logic needs modifying.

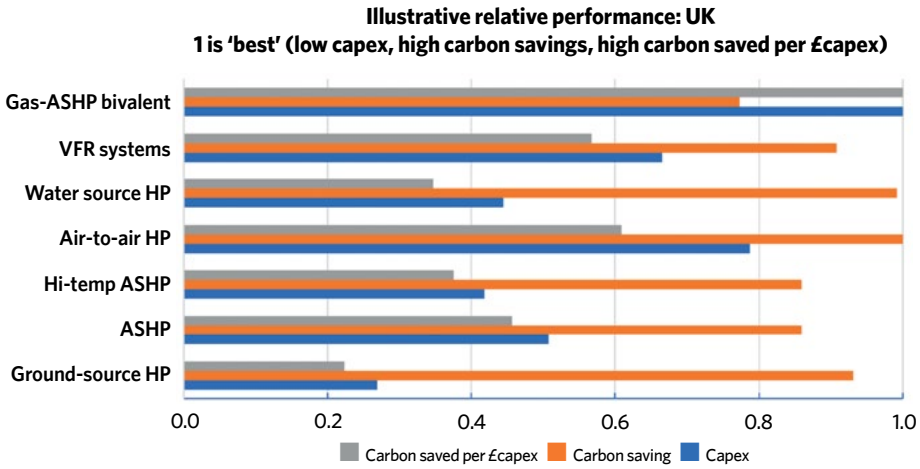

Figure 1: Preliminary comparative savings

Preliminary comparative ratings have been carried out on the UK case studies to assess the heat pump types with the lowest capital cost, highest carbon savings and highest carbon savings per £ of capital expenditure (capex). See Figure 1. CJ

- We are keen to collect information from building owners, facilities managers, system designers and contractors who have already been involved in retrofitting heat pumps in non-domestic buildings, or who are thinking about a retrofit. Contact **roger.hitchin@hotmail.com**
- The project website is: **heatpumpingtechnologies.org/annex60**

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Artus Air adds to its energy-efficient cooling line-up

A new, larger air conditioning unit has been introduced to the Artus Air product line-up. The AR75, measuring 730 x 730 x 300mm, offers up to 4kW of sensible cooling, and – along with the AR60 model – is aimed at commercial spaces such as offices, retail, and hotels.

The company says both models reduce energy consumption and carbon emissions significantly compared with industry standards. The AR75 offers heating and cooling options and maintains the low-energy, low-noise design of Artus Air's previous models, said the company.

'If the construction and development industries are to meet 2050 net zero targets, innovation in design is essential,' said sales director Ed Sayce. 'The AR75, hand in hand with the AR60 unit, can support this and we are excited to see the impact it will have.'

Refrigerant leak-detection product

Horsham-based manufacturer Aquilar has launched its next-generation AquiTron AT-SRG platform for air conditioning and heat pump refrigerant leak detection.

The platform features MPS sensor technology, developed by NevadaNano, and offers a 'fit and forget' solution with a sensor lifetime of more than 15 years.

Its compact design and multiple alarm outputs make the AT-SRG suitable for new installations and retrofit options, said the company.

Cooling accounts for 15% of UK electricity consumption

Research finds cooling also contributes 4% of GHG emissions


Professor Graeme Maidment

New government-led research has found that cooling accounts for 15% of UK electricity consumption. 'It's a big number and we need to do something about it,' said Professor Graeme Maidment, who revealed the figure during the CIBSE Technical Symposium keynote address at Cardiff University.

Maidment, who worked on the study for the Department for Energy Security and Net Zero (DESNZ), said air refrigeration technologies also account for 4% of greenhouse gas (GHG) emissions in the UK. The figures are based on a study of 2021 energy consumption in the built environment and other sectors, such as transport refrigeration, medicine and cold stores. A report will be published by DESNZ soon.

DESNZ lead technical energy adviser Melanie Jans-Singh, who presented alongside Maidment at the symposium, said climate change requires 'a massive shift in how we develop cooling policy'.

The government is gathering evidence on cooling energy consumption and demand as part of the UK's commitment to the Global Cooling Pledge, which was made at COP28 in Dubai last December. A Cooling Outlook report will be published as part of its long-term strategy on cooling.

See opposite for more from the cooling keynote at the 2024 Technical Symposium.

Women in Cooling finalists

Three UK entrants are among eight finalists in the 2024 Women in Cooling European video competition, which aims to spotlight women in the refrigeration, air conditioning and heat pump sector.

The top prize is €1,000, awarded by the World Refrigeration Day campaign, and the winner will be announced at AREA's General Assembly in Belfast on 23-24 May. This year's videos discuss challenges such as compressor failure and system maintenance.

The UK finalists are: Charlotte Robinson, industrial refrigeration engineer at Catalent Pharma Solutions; Chloe Jennings apprentice engineer, Delta T Refrigeration; and Joanne Mitchell, HVAC design engineer, Principal HVAC.

SUSTAINABLE COOLING IN A WARMING WORLD

As carbon emissions from cooling spiral upwards, Professor **Graeme Maidment** reveals the latest research underpinning government strategy on air conditioning and refrigeration

The keynote address at the Technical Symposium

Cooling was centre stage at the 2024 CIBSE Technical Symposium, as Professor Graeme Maidment gave insights into government work on air conditioning and refrigeration strategy at the event's keynote address.

Maidment is professor of heating and cooling at London South Bank University, and works part-time at the Department for Energy Security and Net Zero (DESNZ) on cooling research associated with the government Mission Innovation project. He reminded the symposium that 2023 was the warmest year ever and that, in the UK, a record temperature of 40.3°C was reached.

Extreme heat has a much greater impact on those who are disadvantaged, said Maidment; in 2022, it led to 5,017 excess UK deaths among the over-70s. He explained that cooling isn't just essential for comfort, but has many critical applications in other sectors, such as hospitals, preserving food and medicines, industrial processes, and data centres.

He showed projections from UN Global Cooling Watch that indicate dramatic rises in cooling demand and energy consumption of cooling over the next 25 years. Without action to promote sustainable cooling and adaptation, air conditioning and refrigeration could contribute half a degree to global warming, Maidment said.

Moving south

The symposium was shown how much more energy has been used for cooling in the UK in recent years, with Maidment explaining how the number of cooling degree days for Gatwick has increased to an average of 46 per year over the past four years, compared with 29 for the past 20 years. This is similar to Rouen, in France, meaning the Gatwick climate is moving 50 degrees south each year.

Two of Maidment's DESNZ colleagues, lead technical energy adviser Melanie Jans-Singh and senior energy adviser André Neto-Bradley, described how buildings in their hometowns of Pau, France, and Porto, Portugal, respectively cope with warmer temperatures. Jans-Singh said nearly all windows had shutters and are wider apart, to allow them to be opened, and Neto-Bradley emphasised how building layouts are designed to minimise solar gain.

Jans-Singh said the UK government has been building up evidence on which to base future cooling strategy, and she shared a study on three cooling scenarios for a 4°C temperature rise by 2100. With no policy interventions, energy demand would quadruple and consumption double.

The two other scenarios were if the government pursued a passive-first policy or increased use of efficient technologies. Each of these scenarios was costed: no intervention would cost £60bn, passive first £30bn, and more efficient technologies £75bn.

A mix of passive and active solutions would be required, said Jans-Singh, who went on to describe the Global Cooling Prize. This partnership between the UK government and the Rocky Mountain Institute encourages the development of more efficient air conditioning and some recipients have developed systems that are 10 times more efficient than current ones.

Global Cooling Pledge

Maidment spoke about the CSNow project, looking at the energy consumption and emissions from cooling in the UK in 2021. It found that 15% of all electricity is used for cooling, very close to a figure for Germany that was calculated for 2017. The per capita amount of kWh going into cooling for both countries for those years was near identical at 789/790. The full report will be published soon, said Maidment.

Adaptation will be key to mitigating the risks of a warming climate, added Neto-Bradley, and the UK Climate Change Committee has highlighted as a priority the risks to health from overheating buildings. He said the cooling team is working to support evidence-based action to address these risks, and gave details of the Global Cooling Pledge signed by 60 countries at COP28 last December, when nations committed to – among other things – more energy efficient systems, a phasing out of high global warm potential refrigerants, promoting passive-first approaches, and collaborating on innovation and research.

Unified outlook

Maidment ended the keynote by describing how the UK government is meeting one of its pledges to produce a strategic overview of cooling. It will take a sector-by-sector approach to gathering evidence and he is keen for CIBSE Members to join the initiative.

'This unified outlook will be a chance to identify gaps and opportunities for sustainable cooling,' he said. 'We need to be fit for 2050 and beyond – and, to do that, we need a clearer plan of what we're doing in the UK on cooling.' CJ

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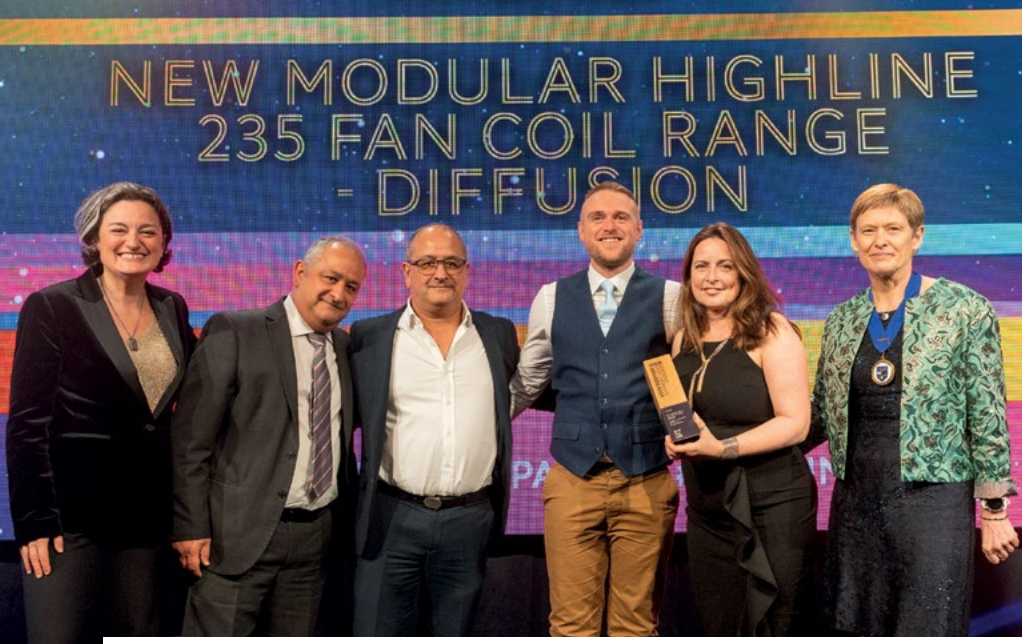

HIGH FIVES FOR HIGHLINE 235

The Diffusion Highline 235 modular fan coil range won CIBSE's Product or Innovation of the Year – Thermal Comfort award because of the emphasis on minimising embodied carbon, as well as optimising performance

Diffusion's modularisation of its fan coil product impressed judges at the 2024 CIBSE Building Performance Awards, who gave it the Product or Innovation of the Year – Thermal Comfort accolade. They described it as 'a practical, well thought-through design' that delivered on customer feedback.

Thorough research and testing of the Diffusion Highline 235 modular fan coil range has resulted in a product that considers whole life costing through the use of TM65 and local sourcing to reduce transport miles, the judges added. Energy, acoustics, performance, and the flexibility modularisation brings to deployment and onsite repairs have also been considered.

Working closely with customers, Diffusion researched every UK fan coil on the market to assess how it could improve the design to meet the changing needs of the industry.

As a result, its Highline range has been increased to eight, the modularity of which now allows almost 300,000 configurations. This means customers can select a unit that exactly matches their performance requirements rather than having to over-specify, ensuring the lowest energy consumption.

At design stage, the emphasis was on using fewer materials, reducing the volume of materials transported, minimising carbon footprint, and lowering running costs per unit size.

Leveraging high-efficiency EC/DC motor and fan assemblies, the units achieve a specific fan power as low as 0.14W·L^{-1}·s^{-1}, significantly reducing energy consumption and operational costs. Forward-curved centrifugal fans provide the most efficient airflow and acoustic performance in all models. Further acoustic benefits are achieved through '0' fire-rated foam insulation.

The unit's heat exchangers are manufactured from solid drawn copper tubes, mechanically expanded into pre-formed collars in rippled plate aluminium fins. Multi-circuit design ensures maximum thermal performance. For optimum heat transfer into the airflow, electrical elements are 8mm-diameter, fully sheathed, stainless-steel rods, with spiral-wound fins.

Highline 235 is supplied with Diffusion's Lifetime Eco wire-mesh filter, which can be simply vacuum cleaned in situ. It lasts the lifespan of the unit.

ISO-grade media filters are also available. When filters need to be cleaned or replaced, they can be easily removed from either the side of the unit or from beneath it.

In spaces where noise levels significantly influence occupant satisfaction, the Highline 235 range can achieve noise levels ranging from NR25 to NR40. Discharge plenums are available in rectangular or circular spigots, and inlet and discharge attenuators are available in lengths to meet requirements.

British designed and manufactured with a short supply chain, 70% of Diffusion's fan coil units (FCUs) are transported less than 24 miles to end users in London, keeping carbon emissions to a minimum. The modular, configurable design means building owners can reuse the FCUs by repositioning them.

The CIBSE TM65 data-collection methodology was used to collect accurate and detailed embodied carbon information about the system. Working from a component level, this methodology ensures data is comprehensive and up to date.

Diffusion uses its in-house test facility to offer volumetric, acoustic and thermal performance testing, and customers can watch their chosen products being tested and certified. They can also input their building's design parameters into Diffusion's software to select the ideal FCU for their required temperature and flowrate. This includes data on correct heat exchanger selection.

The judges said the range of innovations among award entries this year showed that innovation doesn't need to be 'epic' to be influential and beneficial. They also illustrated the importance of product testing. CJ

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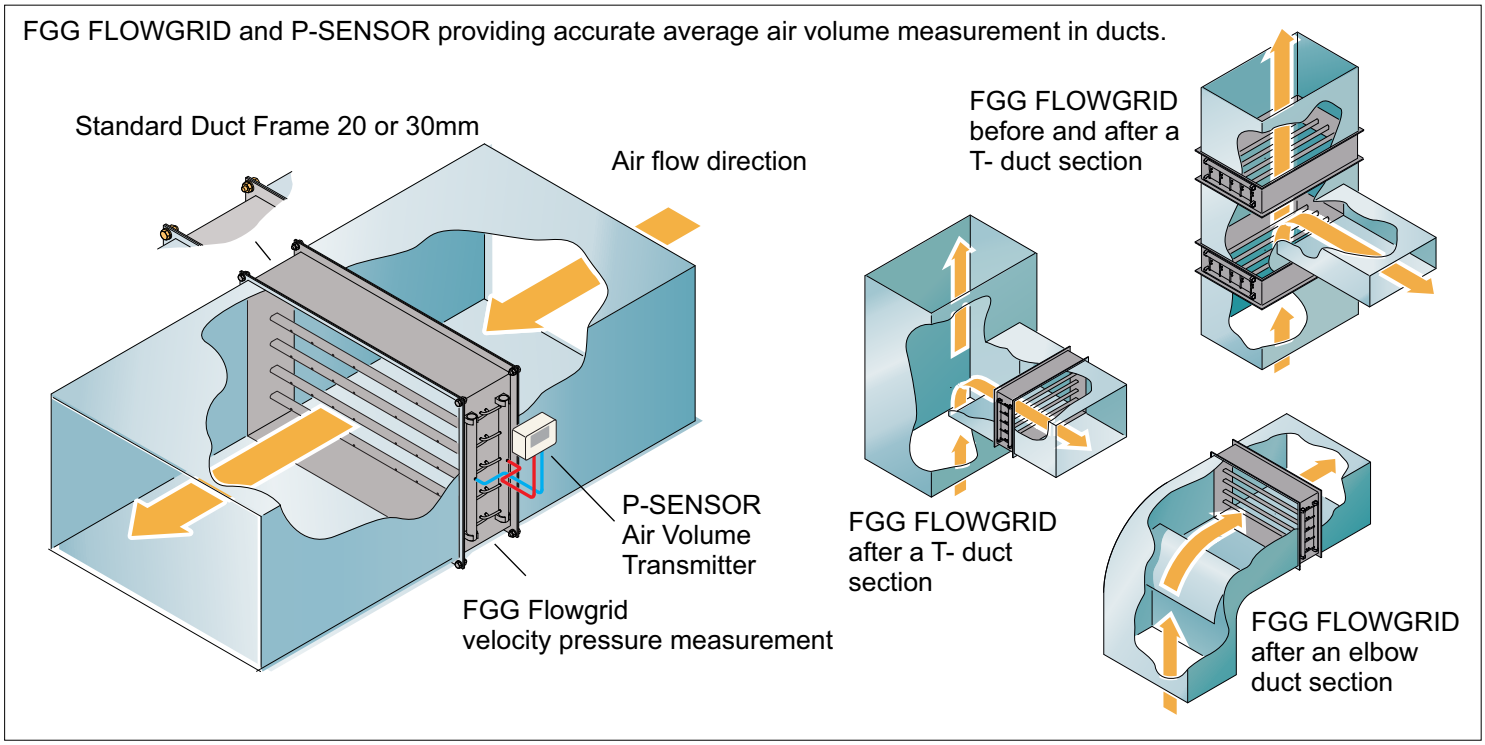

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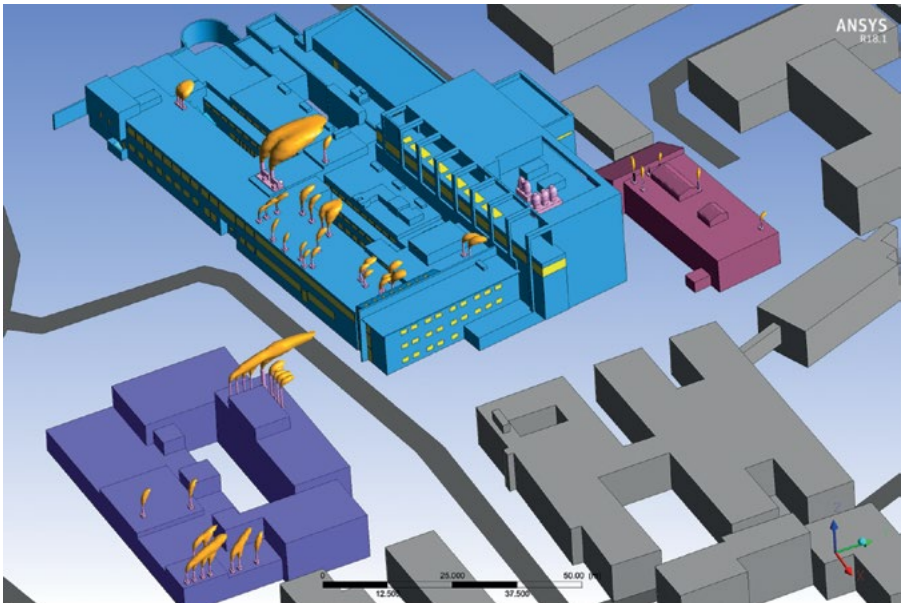
SCIENCE IN THE CITY

Empty retail space in the UK is attracting the attention of the booming life sciences sector. Cundall's **Rob van Zyl** looks at the trend for retrofitting laboratories and, in particular, the challenge of ventilating them in built-up areas



Fumes from labs modelled using computational fluid dynamics

The life sciences sector has seen a massive surge in public and private funding in the past few years. This is driven by an increased demand for biotech facilities because of advancements in technology, and a demand for personalised treatments and therapies as the world grapples with an ageing population.

Retrofit has also become a companion to life sciences development, mainly because of a lack of new spaces that can handle the structural and services demands of life sciences buildings. There has also been a shift in demand for city-centre locations, driven by proximity to universities, hospitals and a skilled workforce.

Cambridge, Oxford and London, deemed as the life sciences' 'golden triangle', are great examples of this. Both offices and retail have seen a decrease in demand, creating an opportunity to repurpose these spaces for science laboratories, where the demand remains strong.

The retrofit challenge

All types of laboratories need supplementary ventilation and some form of fume extraction, and this can be a particular challenge for a retrofit in a built-up area.

The higher ventilation rates required to extract fumes from laboratories means risers need to be larger than those for offices to accommodate more intensive services, and ceiling void space needs to increase by 50cm to make room for larger duct work. Existing buildings that already have high floor-to-floor space, such as shopping centres, are more easily retrofitted as laboratories.

In the past, a lot of buildings were thought to be structurally unsuitable, as external vibrations hindered the ability for optical microscopes in labs to achieve stable images. However, recent technological advancements such as active vibration damping, which operates in a similar way to noise-cancelling headphones, have helped overcome such structural issues.

Specification of ventilation starts with a suitable selection of fume cupboards and biosafety cabinets, for the specific application and chemicals that are anticipated to be used. Ducted fume hoods are typically the most effective for removing fumes.

The placement of hoods must be carefully considered to capture contaminants effectively, by ensuring that there are no obstructions blocking airflow to the hood. Computational fluid dynamics (CFD) modelling is often needed to validate the design before implementation.

A minimum air change rate must be achieved for safety purposes in laboratories and this is typically three times more than conventional office buildings, requiring larger HVAC facilities.

It is important to consider where the fumes are discharged and their proximity to other air intakes and receptors.

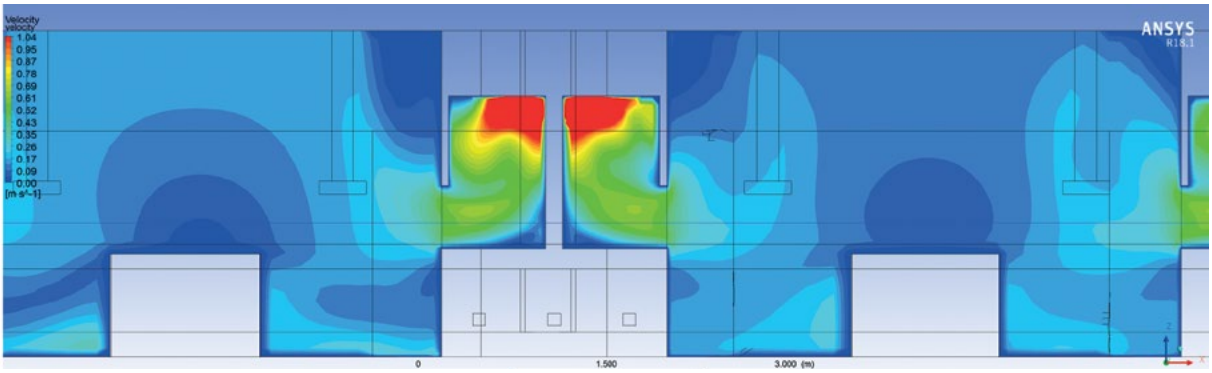
Conventionally, air intakes must be separated from discharges by at least 10 metres, and fumes are discharged vertically at least three metres above other parts of the building. However, for city centres with an abundance of developments, more detailed assessments are often required.

When direct, ducted systems cannot be incorporated, recirculating systems with activated charcoal air filters and scrubbers can be considered, although these are expensive alternatives.

Higher ventilation rates and fume-extraction systems will have a significant impact on a building's energy use, so it is essential that buildings services pay particular attention to energy efficiency.

As a first step, it is important to work with the scientists who will be occupying the buildings in the design stages, to optimise the parameters and the airflow design, and prevent overdesign.

Where possible, spaces should be lab-enabled, rather than fully fitted-out. This will provide end users with an adaptable blank »



Velocity of air being extracted from fume cupboards

"A minimal air change rate must be achieved for safety purposes in laboratories and this is typically three times more than conventional office buildings, requiring larger HVAC facilities"

» template they can fit-out however they want. This is more attractive than receiving a fully fitted-out space that may not meet specific requirements and could put occupiers off at due diligence stage, or lead to expensive refit financial and carbon costs.

Modulating the airflow to match actual demand reduces energy consumption during low-activity periods, while still providing adequate ventilation when needed.

Variable air volume flowrate systems and demand-control ventilation can adjust the ventilation rates based on real-time occupancy and contaminant levels. Implementing scheduling controls can also optimise ventilation operation based on occupancy patterns and laboratory usage schedules.

Natural ventilation can be used in certain situations. There are other considerations such as prioritising recirculation over full ventilation by using activated charcoal filters or liquid scrubbing to wash the air as it passes through. Heat recovery systems must also be implemented wherever practical, to capture and reuse heat or coolness from exhaust air to precondition incoming fresh air.

Typically, the requirement for safe removal of fumes is to discharge fumes at least three metres above the highest point of buildings, and this means having tall and unsightly stacks.

In the UK, planning regulations impose restrictions on the height of stacks and exhaust vents as part of the overall planning permission process. This is primarily to address concerns of air pollution, visual impact, and potential adverse effects on the environment and neighbouring properties.

Planning authorities need evidence to show that vertical stacks are tall enough to adequately control the dispersion of pollutants and they will want to see how the visual impact of stacks on the surrounding landscape have been considered.

NEW TECHNOLOGIES IN THE SECTOR

Some of the most noteworthy technologies in the sector are recirculation fume cupboards, liquid scrubbing, and active vibration control, which are particularly helpful in retrofit.

Innovations in heat exchanger design and materials are improving heat transfer efficiency and durability. Technologies such as microchannel heat exchangers, enhanced surface coatings, and additive manufacturing techniques enable the development of compact, high-performance heat exchangers that can effectively recover waste heat from various sources.

The integration of smart sensors, data analytics, and control algorithms enables real-time monitoring, optimisation, and predictive maintenance of heat recovery systems based on changing conditions. They can be used to identify opportunities for energy savings and performance improvement.


Rob van Zyl

Stack heights need to be specified to minimise impact on air quality. They will be based on factors such as the type of emissions, local air quality standards, and the proximity of sensitive receptors, such as residential areas, schools, or hospitals.

The speed at which air is discharged from a ventilation system – the efflux velocity – can determine stack height. By increasing the velocity of vertical discharge, fumes can be pushed higher and the stack height reduced. CFD modelling can be used to predict whether or not the concentration of released fumes will exceed the required parameters of the nearby receptors. It should be borne in mind that higher efflux velocities require more energy.

The importance of heat recovery

As there is a requirement for labs to have a lot of air circulating in the building, it is important to recover as much of its heat as possible. However, effectively capturing and using waste heat can be difficult in practice. In some cases, the temperature difference may be insufficient to extract heat efficiently, limiting the feasibility and effectiveness of heat recovery.

Integrating heat recovery systems can be difficult, as it will introduce pressure drops. It can also create foul air that can be corrosive, which means the ductwork must be made with corrosion-resistant materials that will not be damaged by this.

Science buildings are one of the sectors being considered by the Net Zero Carbon Buildings Standard (NZCBS). Simon Wyatt, sustainability partner at Cundall, is leading the NZCBS[1] sector group and is collaborating with market leaders to create assessment frameworks for buildings in the sector. It is still early days for the sector, and there is a lot more data that is needed before benchmarking of life sciences buildings is taken seriously. CJ

ROB VAN ZYL is a management board partner at Cundall

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1 UK Net Zero Carbon Buildings Standard **www.nzcbuildings.co.uk**

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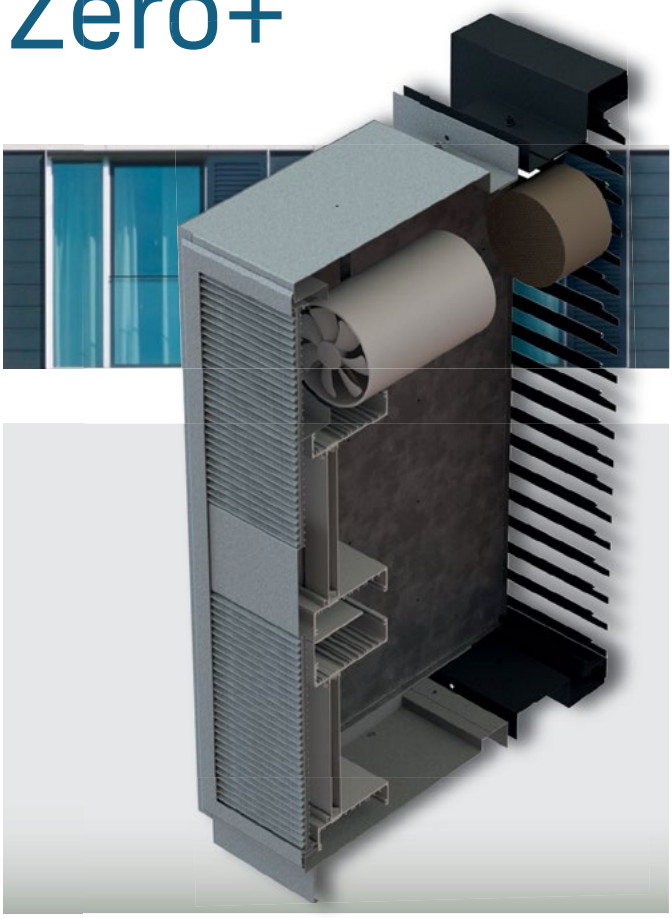

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50 YEARS ANNIVERSARY

RANGE ZERO

Assessing the realistic performance of new homes and systems

This module explores the benefits of a properly matched energy system for residential applications

Reliable methods are essential to assess the realistic operational energy performance of new homes, particularly when they include innovative applications of building services systems. By drawing on a recently reported study, this CPD illustrates the benefits of a properly matched energy system and how the misinterpretation of output from current regulatory tools can dissuade building purchasers and users from moving towards systems that can otherwise help move towards net zero homes.

Beyond passive measures, such as improving the thermal performance of the building envelope, the England Building Regulations AD Part L 2021[1] enhanced the requirements for mechanical components that contribute significantly to primary energy use and CO_2 emissions. It can therefore be challenging to satisfy the present regulation (as determined by the UK's standard assessment procedure[2] (SAP)) and achieve carbon reduction with the most advanced condensing conventional gas boilers. (The consultation has recently closed on the UK government's draft home energy model (HEM), which will provide a more flexible steady-state calculation methodology designed to assess whether homes meet the Future Homes Standard; in 2025, it will replace the UK's SAP – see the boxout 'SAP and HEM'.)

A recent study[3] by Monodraught employed dynamic simulation modelling (DSM) for two example new-build, high-specification, four-bedroom homes to assess the energy and CO_2 performance for a novel 'energy module' package (using commercially available products) compared with a 'conventional' system. The conventional (baseline) system comprised a high-efficiency condensing gas boiler, hot-water cylinder and continuous operation extract fans. The factory-tested packaged 'energy module' included an air source heat pump (ASHP), mechanical ventilation with heat recovery (MVHR), and a hot-water thermal battery, all as discussed in the panel 'Packaged "energy module"'). The two services variants for each of the two homes – detached house type A (Figure 1) and semi-detached house type B (Figure 2) – were also evaluated using the UK government's SAP calculations.

The fabric U values in the homes were at least as good as – and most improved upon – Part L limit values.

In the baseline case, outdoor ventilation air is drawn through ventilation slots incorporated in the windows of bedrooms and living rooms. The bathrooms, the utility room and kitchen are fitted with decentralised mechanical extract ventilation (dMEV) fans with two-speed control that meet the AD F boost ventilation requirements. The specific fan power (SFP) of extract fans was taken as 0.3 for kitchens and 0.25 for other wet areas. With the 'energy module' MVHR, air is supplied to each bedroom and living room, and extracted at bathroom, toilet, utility room and kitchen areas.

Using the guidelines in England Building Regulations AD Part F,[4] the required supply »

THE DEMANDS OF PART L 2021

Current England Building Regulations AD Part L[1] requires that new homes must, at least, meet three target requirements that are determined using the SAP (as annual figures). These are the target emission rate (TER) (maximum CO_2 emission per m^2); the target primary energy rate (TPER) (maximum primary energy use, $kWh_{PE} \cdot m^{-2}$); and the target fabric energy efficiency rate (TFEE) (minimum fabric energy efficiency, $kWh \cdot m^{-2}$). TFEE relates solely to fabric performance, whereas TER and TPER are additionally impacted by fuel choice.

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Figure 1: Detached house type A floor plans (ground floor, first floor) – image courtesy of Woodall Homes

Figure 2: Semi-detached house type B floor plans (ground floor, first floor, mansard) – image courtesy of Woodall Homes

» and extract ventilation rates were calculated for each space. For house type A, the total 'high rate' for extract ventilation exceeds the required minimal supply, so background ventilation was set to 37L·s^{-1} and the boost rate of 43L·s^{-1} during the active occupied hours in the kitchen and bathrooms. House type B can always operate with 37L·s^{-1}, which meets both the minimum total ventilation rate for the dwelling and the boost extract rates of the wet areas.

The houses have an airtightness of 4.0m^3·h^{-1}·m^{-2}@ 50Pa that translates to a total of 10.5L·s^{-1} and 6.7L·s^{-1} for house type A and house type B respectively. Although the minimum ventilation is provided by mechanical means, temperatures may be controlled by opening the windows. The modelling of natural ventilation was set so windows were activated whenever room temperatures exceeded 23°C, to avoid overheating, although CIBSE TM59[5] (assessing overheating risk) and England Building Regulations AD Part O[6] (mitigation of overheating) were not part of this study.

Occupancy and equipment gains were distributed over 24 hours according to profiles detailed in CIBSE TM59.[5] Internal lighting efficiency was set to 80Lm·W^{-1} in accordance with AD Part L1 2021,[1] and standard lighting levels were applied according to occupancy type. Lighting was simulated to operate based on photosensors whenever the natural light decreased below the desired level within each occupied room, except bathrooms where the lighting is controlled according to a fixed occupancy schedule at the start and end of the day.

The baseline configuration of the houses includes gas-fired condensing boilers with a seasonal coefficient of performance (SCOP) of 93%, or seasonal efficiency of domestic boilers in the UK (SEDBUK) rating of 89.4% for heating and domestic hot water (DHW) employing a 180L hot-water cylinder with a standing loss of 67W at 60°C. Based on CIBSE Guide G,[7] the daily hot-water demand was calculated as 115L per person at 65°C for six occupants, which equates to a modelled 31.15L·h^{-1} hot-water consumption at 60°C. The baseline DHW power demand was 1.81kW. Adding the standing loss and a 0.93 boiler efficiency, 2.02kW will be needed for hot-water production – an annual demand of 17.67MWh.

The phase change material (PCM) battery delivers DHW at 40°C without water storage and no risk of legionella to the consumer, and is targeted at an end use of 40°C. The hot-water flowrate was increased to 46.72L·h^{-1} @ 40°C, which is equivalent to 31.15L·h^{-1} @ 60 °C. The energy necessary to heat up 46.72L·h^{-1} mains water from 10°C to 40°C is 1.628kW, slightly lower than the baseline system.

Taking account of storage losses, 0.22kW of power can be potentially saved with the PCM battery, which means a 1.58MWh annual saving in hot-water production with the new technology.

CO_2 emission and primary energy factors for electricity were based on the latest figures of the National Calculation Methodology (NCM) guideline , which varies

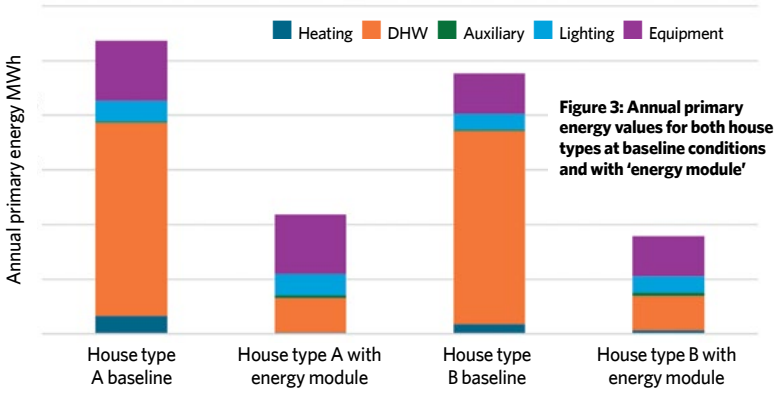

Figure 3: Annual primary energy values for both house types at baseline conditions and with 'energy module'

slightly in each month. For natural gas, typical figures were employed of 0.21kgCO_2·kWh^{-1} and 1.126kWhPE_{PE}·kWh^{-1}.

The annual primary energy figures for the studied scenarios are summarised in Figure 3. The DHW energy is the driving factor in the annual energy consumption, comprising 90% of the whole system energy compared with only 4% energy spent for space heating and 6% for fan/pump energy. The heating energy and all other energy categories are relatively small compared with the DHW consumption.

The envelope heat losses are small for homes designed for net zero so, in energy simulation, heat generated by equipment offsets much of the fabric and infiltration heat loss. When swapping the gas boiler with an ASHP the heating energy at house type A and house type B decreased by 91% and 64% respectively. Changing the location of the homes to Southampton (which has milder weather) did not significantly impact the overall system energy. Although the space-heating demand dropped by 36%, there was just a 1.4% drop in the overall energy consumption in the 'energy module' applications, as 91% of energy was attributed to DHW.

The heating and ventilating energy reduction in both house types resulting from applying the 'energy module' was 80-82% lower than the baseline case. When including the unchanged equipment and lighting energy requirement, the overall energy saving came to 74% in both house types. In terms of carbon savings calculated for systems and lighting, both house types emitted 82% lower CO_2 for the 'energy module' system compared with baseline.

The main indicators of the SAP calculations in Figure 4 show the CO_2 emissions and primary energy for the actual dwellings (dwelling emission rate (DER) and dwelling primary energy rate (DPER)) were significantly reduced in case of the 'energy module', while the dwelling fabric energy efficiency rate (DFEE) remains the same.

The DPER reduced by 52% and DER CO_2 emissions by 75% when applying the 'energy module'. The SAP environmental impact (EI) rating went from Category B to Category A when the buildings were served by the 'energy module'.

Despite the significant energy and CO_2 performance improvements of the homes that employed an 'energy module', it did not improve the SAP rating, as that is contingent on the notional running costs of a home. The dynamic model showed that the system energy for the 'energy module' is a third of the baseline case. However, the SAP fixed cost for electricity is 4.53 times higher than gas, so an ASHP system is unable to demonstrate an improved SAP rating. (The current UK residential price cap sets electricity at 3.85-times the cost of gas.) As the SAP rating is a key indicator for property purchasers and landlords, it will remain challenging to encourage the investment needed in 'alternative' technologies if future homes decisions are made on a regulation compliance rating dominated by nominal energy prices, rather than primary energy and the increasingly pressing considerations of the environment.

Turn to page 60 for references.

SAP AND HEM

The standardised test offered by SAP 10.2 (the current version of the UK government's standard assessment procedure) provides a relative benchmark for testing compliance with Building Regulations. It considers annual space and water heating costs for a standardised heating regime when assessing the energy performance of dwellings. SAP's promised successor for 2025, the home energy model (HEM), aims to improve the modelling process in an open software environment, employing 'wrappers' (or, in software parlance, 'objects') making it adaptable to many more scenarios. A significant change will be the adoption of 30-minute intervals compared with SAP's monthly analysis, and the flexibility to model individual energy systems under various conditions. The increased granularity promised in HEM will allow more incisive steady-state assessments of energy consumption patterns, to promote more effective energy-saving strategies.

However, SAP, and in the promise of its new form, HEM, are not primarily designed to provide a forecast of a home's energy performance – this requires a more detailed assessment of the thermal performance of the home, systems, and occupation.

SAP CALCULATION	TER	DER	TPER	DPER	TFEE	DFEE	SAP	EI
House A baseline	8.48	17.85	45.75	98.78	36.99	50.58	B (81)	B (82)
House A 'energy module'	8.73	4.50	45.45	47.31	36.99	50.59	C (78)	A (96)
House B baseline	8.98	16.49	46.82	91.71	31.18	43.49	B (82)	B (84)
House B 'energy module'	8.93	4.19	46.53	44.14	31.18	43.52	C (80)	A (96)

Figure 4: SAP calculation efficiency indicators for notional (TER, TPER, TFEE) and the actual dwelling (DER, DPER, DFEE), and the resulting SAP and EI rating

PACKAGED 'ENERGY MODULE'

The offsite manufactured and factory-tested 'energy module' incorporates an air source heat pump (ASHP) for space heating and DHW production linked with whole-house mechanical ventilation with heat recovery (MVHR).

The ASHP may originate from one of several market-leading manufacturers – the modelling considered a commercially available product with a SCOP of 4.58. The extract air from the MVHR is used to maintain high working efficiency of the heat pump, even during cold weather conditions.

The DHW is provided through a hot water thermal battery using phase change materials (PCM) to achieve a compact module equivalent to 185L water volume at 40°C and 28W standing loss. The hot-water module could potentially be charged by any renewable source, but this study used the ASHP as the main heat source.

The whole-house ventilation is provided by a commercially available MVHR unit with a working SFP of 0.88 (supply and extract) and heat recovery efficiency of 90%.

Module 232

May 2024

1. What does the acronym 'HEM' stand for?

- ☐ A Home energy management
- ☐ B Home energy measure
- ☐ C Home energy method
- ☐ D Home energy model
- ☐ E Home energy monitoring

2. Which CIBSE publication was used as a source when estimating the occupancy and equipment gains?

- ☐ A CIBSE Guide A
- ☐ B CIBSE Guide B
- ☐ C CIBSE Guide G
- ☐ D CIBSE TM59
- ☐ E CIBSE TM66

3. Which of these was not incorporated into the energy module discussed in this article?

- ☐ A Air source heat pump
- ☐ B Commercially available products
- ☐ C Mechanical ventilation and heat recovery
- ☐ D Phase change materials
- ☐ E Solar PV

4. How much energy saving was predicted by the model, taking into account all the services in the house when the energy module was employed?

- ☐ A Less than 50%
- ☐ B 50%-60%
- ☐ C 60%-70%
- ☐ D 70%-80%
- ☐ E More than 80%

5. What was the SAP rating when applying the energy module (with the baseline being a 'B' rating)?

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

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Products of the month

Rinnai to launch new range of instantaneous electric water heaters

Compact and lightweight units will be available in 21kW, 24kW and 27kW models

Rinnai is set to expand its product lineup with the introduction of a new range of instantaneous electric water heaters. These new models, available in 21kW, 24kW, and 27kW variants, are designed to meet the growing demand for decarbonising technology across the commercial and domestic sectors.

The innovative approach taken in developing these water heaters focuses on direct heating capability. Harnessing advanced bare-wiring technology that rests in the water, the systems can quickly and accurately achieve the pre-set water temperature. Despite their powerful performance, these electric, on-demand water heaters are lightweight and compact, weighing less than 4kg and measuring just 450 x 235 x 94mm.

One of the standout features of this new range is its scalability, with kW ratings ranging from 21-27kW. This versatility ensures that the heaters are suitable for a wide variety of applications, from small households to large commercial establishments. The compact design not only facilitates easy installation, but also contributes to increased energy efficiency, leading to reduced operational costs. Ease of installation and handling are major benefits of this range.

The new electric water heaters offer an adjustable temperature range from 20°C to 60°C, with adjustments digitally possible in 0.5°C increments. They are also compatible with preheated water, further enhancing their efficiency.

Safety and convenience have been prioritised in the design of these water heaters – for example, overheat protection is built in. Further features include a multifunctional display, full electric control, rapid heat-up capability, quick reactions to sudden shifts in Grid capacity output, and solar compatibility.

All models come with LCD screens that provide real-time visual information on water temperature, operational performance, and Eco Mode, which confirms the appliance is operating economically, helping to minimise energy wastage and costs.

The range has a renewable system operation setting that recognises incoming water temperatures of more than 30°C, then applies only the correct amount of energy to achieve the required temperature uplift. This makes them an ideal solution to use with solar thermal and renewable systems.

"The compact design not only facilitates easy installation, but also contributes to increased energy efficiency, leading to reduced operational costs"

Rinnai's new range is timed to support the UK's goal of reducing electrical costs to the lowest in Europe by 2035. UK energy strategists view clean and sustainable electrification as the safest route to achieving lower customer costs and reducing carbon emissions.

Rinnai has anticipated this trend and adapted its product offerings of low carbon commercial and domestic products to include technologies that support electrification.

This launch is part of Rinnai's broader strategy to expand its range of low carbon commercial and domestic products. Earlier this year, it launched several new products in its H1 – Hydrogen and DME-ready water heaters, H2 – Hybrid systems, and H3 – Low-global warming potential (GWP) heat pump categories.

These additions aim to complement the existing lineup and ensure that Rinnai offers a comprehensive range of heating and hot-water solutions that can be tailored to commercial and residential applications.

Rinnai's H3 range offers diverse decarbonising solutions for commercial, domestic, and off-grid heating and hot-water needs. The H3 lineup includes hydrogen/BioLPG-ready tech, hybrid systems, low-GWP heat pumps, and solar thermal options. This range features Infinity hydrogen-blend and BioLPG-ready water heaters, known for durability and efficiency.

The H1/H2/H3 series provides heat pumps, solar, and hydrogen technologies for various applications. H1 focuses on hydrogen, being 20% blend-ready and offering 100% hydrogen-ready tech. H2 offers renewable gas-ready units and hybrid options, while H3 provides low-GWP heat pumps with a range from 4-115kW.

The company's commitment to sustainability is further reflected in its upcoming launches, which include low-GWP air source heat pumps with R290 refrigerant, a range of electric cylinders in multiple sizes, and the KCM and E Series of condensing gas-fired water heaters for light commercial and residential use.

Additionally, Rinnai plans to introduce plate heat exchangers for larger commercial and industrial sites later this year.

Rinnai's dedication to providing it's UK customers with cost-effective, low carbon solutions for commercial hot water and building heating provision.

To request a brochure on the Rinnai range of electric on-demand water heaters and low carbon technologies, and to receive a goody bag, visit www.rinnai-uk.co.uk/contact-us/request-brochure

› Products of the month

Stockport College receives new Rinnai heat pumps

Equipment integrated into training facilities at recent £25m campus redevelopment

Stockport College has unveiled its £25m campus redevelopment programme, marking a significant milestone in its commitment to excellence in education. This ambitious project was designed to elevate the standards of facilities and resources across all courses, providing top-tier education and enriching experiences for students and stakeholders alike.

As part of its mission to be a sector-leading employer, Stockport College has integrated Rinnai hot-water heating products into its state-of-the-art training facilities. Renowned for their efficiency, reliability and innovative features, these products will serve as crucial training equipment for the next generation of plumbing and heating engineers. By equipping students with hands-on experience on industry-leading technology, Stockport College is ensuring that they are well-prepared to meet the evolving demands of the industry.

The Rinnai products chosen include the 11i light commercial/domestic tankless continuous flow water heaters, the i32 Inverter Monobloc low-global warming potential (GWP) heat pump (4kW), and the 150-litre Heat Pump Thermal Cylinder Single Coil. The i32 Inverter Monobloc, a standout product from Rinnai's Monobloc air source heat pumps range, offers versatility, with variants ranging from 4kW to 110kW.

The air source low-GWP heat pump technology allows up to seven units to be cascaded together, making the Rinnai heat pump range an ideal choice for any heating or hot-water demand.

The innovative ability of the system to switch between heating, hot water and cooling modes ensures that the range has flexibility and durability as standard.

A key advantage of Rinnai's heat pump range is its ultra-low sound capability, ensuring minimal noise disturbance and compliance with stringent sound standards. This is particularly beneficial for educational environments where concentration and focus are essential.

The units use R32 or R290 refrigerants, known for their reduced electricity consumption and lower GWP. The A+++ rating of the HPI commercial heat pump range further emphasises its energy efficiency and adaptability, with the ability to switch seamlessly between heating, hot water and cooling modes.

Stockport College's training facilities have also integrated the Zen and Zen Plus home hot-water and heating systems. These combine durable manufacturing with advanced technology to offer energy-efficient solutions that enhance user comfort and control.

Some notable features of Zen and Zen Plus include an internet of things controller as standard, fast heating mode, domestic hot water pre-heat function, energy monitor function, and a user-friendly Rinnai boiler app, available for Android and IOS platforms.

Students at Stockport College's training facility will benefit immensely from these Rinnai products, gaining hands-on experience in installation, maintenance, and various technical aspects.

The 11i units, an advanced version of traditional multipoint water heaters, stand out for their efficiency and versatility. They are particularly well suited for light commercial or domestic applications requiring high volumes of water to be delivered at precise temperatures. Their efficiency and reliability make them ideal for venues such as restaurants, small hotels, day care centres, and more.

The 11i units boast a range of key features that make them a preferred choice for many applications. These include being hydrogen-ready for 20% hydrogen and methane blending, ultra-low-NOx compliance, internal wall mounting, room sealing, and a temperature range of 37°C to 65°C.

Additionally, their lightweight design – at just 14kg – coupled with features such as push-fit flue systems, simple wiring, and in-built frost protection, ensure ease of installation and maintenance.

Rinnai's H1, 2, and 3 range further enhances the college's offering, providing a comprehensive suite of domestic and commercial heating and hot-water solutions across all fuels and energy vectors. These products not only meet immediate decarbonisation needs, but also contribute significantly to lowering carbon levels in properties, aligning with Stockport College's sustainability goals.

Rinnai's commitment to offering cost-effective, low carbon solutions remains unwavering. By continuously innovating and developing efficient heating and hot-water solutions for domestic and commercial buildings in the UK, Rinnai is shaping the future of the industry.

Information on Rinnai products, technologies and training opportunities, including CPD courses, is available on bit.ly/RinnaiTraining

Products of the month

Potential of 'drop-in' renewable liquid fuels in off-grid heating and DHW

Rinnai's Chris Goggin looks ahead to the advent of renewable liquid fuels in the mass market

As the world increasingly shifts away from fossil fuel consumption, the UK is exploring alternative energy sources. Among these, renewable and recycled carbon dimethyl ether (DME) stands out as a promising contender that could revolutionise off-grid heating and domestic hot water (DHW) systems.

DME is a sustainable fuel that can be produced from a wide variety of renewable feedstocks, including waste materials. Its production process allows for quick and long-term sustainable production, making it an environmentally friendly alternative to fossil fuels. Chemically similar to liquefied petroleum gas (LPG), DME can be seamlessly blended, or 'dropped in', to existing LPG supply chains without requiring modifications to existing equipment. This compatibility makes DME an attractive option for upgrading existing systems and appliances.

DME can also be used on its own, as a 100% pure fuel, particularly for industrial or commercial uses.

Moreover, its clean combustion process results in no 'soot' emissions, offering a cleaner and more efficient energy solution. With a high cetane number, which measures a fuel's ignitibility in compression ignition engines, DME proves to be a viable alternative for sites and appliances that currently rely on diesel.

One of the most significant advantages of DME is its environmental impact. Not only is it safe, but it can also reduce greenhouse gas emissions by up to 85%, significantly improving local air quality compared with traditional fuels. DME also leads to reduced NOx, SOx, and PM emissions, further contributing to a cleaner environment.

With the future capacity of European DME production expected to rise sharply, the likelihood of its national introduction in the UK is increasing.

Dimeta, a Netherlands-based producer of renewable and recycled carbon DME, is leading the charge towards a sustainable future. A collaborative effort with two global LPG distributors, SHV Energy and UGI International, Dimeta aims to decarbonise the LPG industry in the UK, Europe, and the United States. The company is actively working with Rinnai to raise awareness and promote the use of renewable and recycled carbon DME for off-grid properties.

As part of their collaboration, Dimeta and Rinnai have signed a memorandum of understanding. The partnership aims to explore blending DME with LPG for use in existing appliances and developing dedicated 100% DME appliances, including RDME water heaters, boilers, and hybrid heating systems.

The initial focus of this collaboration will be on the European market, to further understand the potential and importance of renewable liquid fuels across the value chain.

Rinnai is committed to designing and producing RDME low carbon heating solutions for properties not connected to the UK National Grid. The company offers technical, economic, and practical solutions to UK customers seeking to decarbonise DHW and property heat, supporting installers by sharing valuable information.

Renewable and recycled carbon DME, along with DME, BioLPG and LPG, are vital energy sources for off-grid properties. Rinnai and Dimeta recognise the importance of replacement fuels that not only match the performance of traditional off-grid fuels, but also ensure decarbonisation. Together, they are working towards providing UK off-grid customers with a range of energy options that promote carbon neutrality.

Rinnai's H3 range of products – which includes domestic and commercial gas-fired water heaters, solar thermal systems, electric cylinders, and low-global warming potential heat pumps – offers immediate property decarbonisation solutions.

As the UK continues to explore and embrace renewable energy options, the potential of 'drop-in' renewable liquid fuels such as DME could be pivotal in shaping a sustainable and environmentally friendly future for off-grid heating and DHW systems.

"Not only is DME safe, but it can also reduce greenhouse gas emissions by up to 85%, significantly improving air quality compared with traditional fuels"

To stay informed about the evolving energy landscape and policy changes in the industry, sign up for the Rinnai Pathways newsletter at www.rinnai-uk.co.uk/contact-us/newsletter-sign

Rinnai operations director Chris Goggin

Products of the month

Website showcases low carbon technologies and free customer services

Rinnai's site helps customers choose and install the best technologies for their project

Rinnai has a user-friendly website aimed at enhancing customer access to its range of low carbon domestic and commercial technologies. The website serves as an interactive platform, offering valuable information, product training, CPDs, and free customer services.

Designed with customer convenience in mind, the website showcases Rinnai's technologies, which are proven to reduce costs and carbon emissions. Customers can explore a variety of products tailored to domestic and commercial use, all of which contribute to a greener and more sustainable future.

For those seeking additional information on clean energy technology, Rinnai offers a free brochure upon request. Customers can also access a call-back service at their convenience.

Furthermore, there is a Site Consultation Form and a Carbon Cost Comparison form, allowing customers to gather essential data for informed decision-making. All these customer services are provided at no cost and can be found on the 'Contact Us' webpage.

One of the standout features of the website is the 'Help Me Choose' service option. Customers can request advice on purchasing options tailored to the unique layout of their property, with Rinnai professionals available to contact via home number, mobile, or email.

Rinnai prioritises customer service by offering a Site Consultation Form that collects onsite data on current heating and hot-water systems. This data enables Rinnai's professional team to provide rapid low carbon replacement suggestions, ensuring efficient and effective solutions.

Additionally, the website hosts product training and approved CPDs aimed at educating customers, installers, system designers, and specifiers about decarbonising technologies. This comprehensive approach ensures that stakeholders have access to the latest information on hydrogen, solar hybrid, and heat pump technologies for domestic and commercial applications.

As part of its commitment to advancing sustainability, Rinnai continues to refine its website and customer services. The company aims to make detailed information easily accessible to UK customers seeking low carbon products, reaffirming its position as a frontrunner in the green technology sector.

Visit www.rinnai-uk.co.uk

DIRECTORY

Your guide to building services suppliers

New stainless steel water heater from Hamworthy

Hamworthy Heating has introduced the Dorchester DR-SG stainless steel condensing water heater, offering enhanced durability and efficiency.

With 10 power outputs across three capacities, it's ideal for hotels and sports facilities with high hot-water demands. Operated via Siemens LMS mini controls, it features an intuitive digital panel with LEDs for fault identification.

Compact and light, for easy installation, it's approved for multiple flue systems and convertible with LPG.

Call 01202 662 552 or visit www.hamworthy-heating.com

Jung Pumpen announces factory training course in Germany

An exciting new wastewater and sewage pumping system training course has been announced by Jung Pumpen, in collaboration with Pump Technology, the UK's leading authorised division.

Scheduled for 11-13 December 2024, at its Steinhagen, Germany, plant, the course targets public health engineers. It aims to equip them with comprehensive knowledge of typical pumping solutions for commercial wastewater and sewage applications.

To reserve your spot, contact David Johnson, marketing and business development director, at **davidj@pumptechnology.co.uk**

Visit www.jung-pumps.co.uk

New members, fellows and associates

FELLOWS

Khan, Yasser Ali
Dubai, United Arab Emirates

Ng, Wai Hung
Tin Shui Wai, Hong Kong

Skeen, Peter
Redhead, Australia

Thomas, Llewellyn
Colchester, United Kingdom

Xing, Yan
Birmingham, United Kingdom

MEMBER

Aravind, Akhil
Wolverhampton, United Kingdom

Badulla, Tumkeen
Manchester, United Kingdom

Bailey, Nicholas
Alexandria, United States

Belham, Mark
Kent, United Kingdom

Caramizaru, Alina-Daniela
Boulogne-Billancourt, France

Cartey, Francis Kweku
Tyldesley, United Kingdom

Chan, Ka Shing
Didcot, United Kingdom

Cheung, Chi Kin
Kellett Bay, Hong Kong

Clochet, Jean-Baptiste
London, United Kingdom

Dorrington, Ryan Kenneth
Romsey, United Kingdom

Fazliu, Leon
London, United Kingdom

Fedosov, Denis
London, United Kingdom

Fok, Kin Pong
Kowloon, Hong Kong

Gonzalez Ferreiro, Carolina
Surrey, United Kingdom

González Garrido, Maria Yaiza
Tynemouth, United Kingdom

Gursen, Remzi Baris
Norwich, United Kingdom

Hamed, Moawia
Riyadh, Saudi Arabia

Hashem Mohamed, Samir
Al Mamzer, United Arab Emirates

Hayre, Taljinder
London, United Kingdom

Henry, Dave
Enniskillen, United Kingdom

Hewlings, Joseph
Fairfax, United States

Horsfield, Tom
Farnham, United Kingdom

Humphrey, Bernard
Bristol, United Kingdom

Ipiotis, Konstantinos
Syros, Greece

Jesahar, Roshan
Riyadh, Saudi Arabia

Jones, Bethan Jane Marie
Leeds, United Kingdom

Joseph, Earnest
Mernda, Australia

Joshi, Sarang Rajendra
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Kebble, Thomas
Dorking, United Kingdom

Kenny, Jack
Birmingham, United Kingdom

Knabe-Nicol, Cyril
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Lee, Siu Yan
Kowloon, Hong Kong

Lo, Yan Yuen Johnnie
NT, Hong Kong

Longhurst, Andy
Kirkcaldy, United Kingdom

Majed, Ahmad
Lagos, Nigeria

Maletka, Marek
Jelenia Góra, Poland

Matheson, Fraser
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McCarthy-Carroll, Oscar
London, United Kingdom

McGinnity, Christopher
Castleblayney, Ireland

Morgan, Kingsley
London, United Kingdom

Moric, Ivana
Southampton, United Kingdom

Ng, Cheuk Lam
Tseung Kwan, Hong Kong

Ng, To Kan Kenneth
Ma On Shan, Hong Kong

Nuss, Kyle
Round Rock, United States

Parkinson, Jacob
Woking, United Kingdom

Parrett, Michael
London, United Kingdom

Pervez, Asif
MBZ City, United Arab Emirates

Pickthorne, Andrew
West Drayton, United Kingdom

Picmaus, Tomas
Chertsey, United Kingdom

Pillai, Noamson Sebastian
Sheffield, United Kingdom

Policella, Matteo
Maidenhead, United Kingdom

Prifti, Sofika
East Finchley, United Kingdom

Quirke, Redmond Anthony
Cork, Ireland

Radovanovic, Petar
Secanj, Serbia

Relf, Helena
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Revie, Sam
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Ruggeri, Francesca
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Saqib, Samima
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Thomas, Ben
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Titulaer, Rick
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Tong, Man Him
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Tsang, Riban
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Tsang, Shun Kit
Tseung Kwan, Hong Kong

Tso, Chi Yan
Kowloon, Hong Kong

Urquhart, Alan
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Wat, Shang Yee
North Point, Hong Kong

Wright, Tobias
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Yammine, Emile
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Yeung, Yik Chun
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Yung, Wai Yl
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Summerell, Harry
Dartford, United Kingdom

Thistlethwaite, Sam
Cheshirem, United Kingdom

Thurston, Scott
Bexley, United Kingdom

Tilley, Alexander Joe
Leeds, United Kingdom

To, Chun Yeung Ocean
Reading, United Kingdom

EVENTS AND TRAINING

NATIONAL EVENTS AND CONFERENCES

CIBSE Scotland Annual Conference: Retrofit2Perform
28 May, University of Strathclyde, Glasgow
The conference will address the challenges associated with retrofitting our existing building stock and the opportunities this presents for building services and built environment professionals to move the retrofit challenge forward at pace and scale. With keynote speaker Patrick Harvie MSP, Minister for Zero Carbon Buildings, Active Travel and Tenants' Rights.
bit.ly/3QexbzJ

CIBSE AGM
10 June, Royal Society, London, and online
The CIBSE AGM will be a hybrid event, both online and in person, and will be followed by incoming President Fiona Cousin's Presidential Address.
www.cibse.org/agm

Decarbonisation Conference
18 June, Royal College of Surgeons, London
David Partridge, chair of the Governance Board for the Net Zero Carbon Buildings Standard (NZCBS), is keynote speaker at this conference, which will provide an update on CIBSE's work on decarbonisation. This includes collaborative work on the UK NZCBS, retrofit, refrigerants, district heating and heat pumps. It will also outline what the new net zero standard means for those working in related fields.
www.cibse.org/events

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**

CHP and District Heating: AGM
7 May
Online AGM

IT and Controls: AGM
7 May

Yorkshire: Comply, stay alive
8 May, Leeds
CPD event with Honeywell Gent, investigating a tragic fire that occurred at a care home in Scotland, and looking at the key stages involved in the life of a fire system and at the latest standards.

SLL: Scottish Lighting event
8 May, Edinburgh
A joint event with ILP, HEA and SLL, with expert speakers and an exhibition of lighting products and services.

SLL AGM, Awards and presidential address
14 May, Leeds
Online and in-person AGM, followed by SLL Annual Awards and presidential address from incoming president Dan Lister.

CIBSE Patrons AGM
6 June, London

HCSE: End-to-end heat network solutions
19 June, online
This event will highlight the features and benefits of hybrid packaged energy centres, including the cascaded heat pumps, back-up boilers, thermal stores, and controls contained within.

Lifts Group: Seminar
26 June, Manchester
Michael Bottomley will present on accessible goods-only lifts, and Adam Scott will cover BS 7255.

On-demand training

CIBSE has a portfolio of on-demand courses that contain interactive online content, with quizzes and additional resources to support your learning. **go.cibse.org/training-mycibselearning**

Benefits include:
- **Online platform accessible on desktop and mobile devices**
- **Courses and modules available offline when using the app**
- **Flexibility**
- **Interactive content**
- **Corporate training exclusive tools (dashboards, reports)**

CIBSE JOURNAL WEBINAR

The next *CIBSE Journal* webinar, sponsored by Airflow and titled 'Understanding MVHR for residential buildings', will take place on 29 May at 13:00 BST. Register at **www.cibsejournal.com/webinars**
All previous *Journal* webinars are also available on demand.

TRAINING COURSES

All CIBSE's courses will be run as live online training for the next few months because of the relocation of CIBSE's offices. Corporate delivery is also available in-house, face to face, or remotely online. See **www.cibse.org/training**

Mechanical services explained
21-23 May, remote
11-13 June, remote

Design of ductwork systems
6 June, remote

Energy surveys
7 May, remote

Electrical services overview
6 June, remote

Standby diesel generator
4 June, remote

Low carbon consultant building design
21-22 May, remote
4-5 June, remote

Energy strategy reports
30 May, remote

Building Regulations Part O: Overheating
30 May, remote

Introduction to Heat Networks and Code of Practice
16 May, remote

Heat Networks Code of Practice full course
8-9 May, remote

Fire safety in purpose-built blocks of flats
28-29 May, remote

Fire safety building regulations: Part B
4 June, remote

The importance of energy-efficient buildings
15 May, remote

Emergency lighting to comply with fire safety requirements
5 June, remote

Commissioning Code M: Commissioning management
14 May, remote

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

Understanding the law for engineers
29 May, remote

MEMBERSHIP WEBINARS

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.
For upcoming dates and to register, visit: **bit.ly/CJMemWeb**
Upcoming dates: **7** and **21 May**; **4** and **11 June**; **9** and **23 July**

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EVENT PROGRAMME

09:00	Registration & Refreshments
09:30	Welcome *IAN PENNEY, WMSOC CHAIR*
09:35	Exhibitor 1 Minute Introductions *FIRST SET*
09:45	The Critical Concentration Factor and Conductivity *GILES GREEN, WMSOC COUNCIL MEMBER*
10:15	The Soft Sell - Scale and Water Softening *IAN WALL, WMSOC TUTOR*
10:45	Coffee & Networking
11:15	Exhibitor 1 Minute Introductions *SECOND SET*
11:30	Top Tips for Tank Inspections *COLIN SHEKLETON, WMSOC COUNCIL MEMBER*
12:00	pH what equipment should I use? *MATT MORSE, WMSOC TUTOR*
12:30	Corrosion Coupons Explained - For those who are a bit rusty *TOM LAFFEY, WMSOC COUNCIL MEMBER*
13:00	Lunch & Networking
14:00	Interpreting Water Treatment Service Reports for Cooling Towers *GARRY KERIN, WMSOC COUNCIL MEMBER*
14:30	Navigating the Minefield of Chemicals Compliance *SEAN FORSYTHE, BCA WATER TREATMENT GROUP CHAIR*
15:00	Q&A Session
15:30	Coffee & Networking

CIBSE members are invited to attend the Water Management Society's one day seminar

Tuesday 18 June 2024
Cranfield University, Bedfordshire

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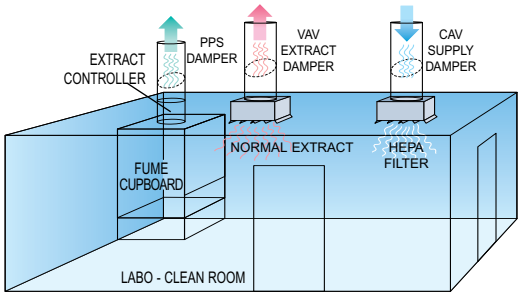

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