

# CIBSE JOURNAL



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TARGETS HEAT NETWORKS

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LOOMES' PLANS FOR 2023

DIGITAL TOOL AIMS TO  
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August 2023

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# Innovative thinking



The August holidays are the busiest time of year for school refurbishments. With colleges empty for the summer months it's an opportunity to deliver the decarbonisation projects made possible by funding initiatives such as the school rebuilding programme and the Public Sector Decarbonisation Scheme.

Last summer, Bouygues Energies & Services (E&S) took advantage of the summer break to install a large heat network at Comberton Village College in Cambridgeshire (page 24). Two 500kW ground source heat pumps lie at the heart of the project, which also required 60 boreholes to be installed across three school car parks.

The heat network replaces a mix of oil and liquefied petroleum gas boilers, and is expected to cut carbon emissions by around 70%. One big benefit for the college is that Bouygues E&S is responsible for funding any energy costs beyond an agreed level. This provides an extra incentive for Bouygues to monitor the system's operation closely and it de-risks the project for the client.

Another initiative aiming to de-risk the decarbonisation of buildings is Travis Perkins' WholeHouse concept. This digital tool allows small to medium-size housebuilders to design their homes in 3D to strict parameters set by 20 suppliers and consultants, who have looked to optimise and standardise the design and installation of buildings systems such as air source heat pumps (ASHPs) and hot-water cylinders.

Baxi was a partner on the project, and worked with staircase manufacturer Staircraft on designs that allow its ASHP, cylinder and pump to fit under stairs. The prototype of the staircase and modular system will be moved to a Baxi training centre so installers and developers can understand how the design will work.

WholeHouse includes the latest standards and Building Regulations, so if there is a design change the software will ensure the house is still compliant. Baxi's heating system is modular and can be prefabricated in its factory, which means there is less waste and fewer skilled labourers are required on site.

These innovative approaches, combining intelligent technology with collaborative design, will be necessary to help the UK decarbonise its building stock. This is recognised by those tasked with delivering the UK's new hospitals, who are calling for a more standardised approach to design and procurement (page 44). There are plenty of opportunities to rationalise – for example, there are currently 27,000 different door types in use across the NHS estate, and the team wants to reduce this to a mere 700 to improve efficiencies and ease of maintenance.

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## CONTRIBUTORS



**Hywel Davies**

How improvements to the Energy Savings Opportunity Scheme will allow government to regulate energy use



**Helen Loomes**

The new SLL president on why she is aiming to bring fun and science back to lighting across two big events



**Kristina Allison**

How the LET Diploma in Lighting, supported by CIBSE, can further the knowledge of non lighters



**Tim Dwyer**

CPD module 219 focuses on air source monobloc heat pumps for refurbishment applications



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## Reduce energy use with behaviour change campaign, says EST

The government should introduce a 'comprehensive' behaviour change campaign to reduce energy demand, a review of international policy responses to the issue has recommended.

The study, carried out jointly by Energy Saving Trust (EST) and the Green Alliance, says the UK has 'no plans' to introduce such a wide-ranging behaviour change campaign, unlike many other countries that did so in response to gas shortages following Russia's invasion of Ukraine.

The report recommends a campaign targeted on businesses and households, centred on the UK government's aim of a 15% reduction in energy demand by 2030.

By combining 'quick win' energy-bill saving actions and wider and longer-term actions to achieve carbon reductions and promote energy security, the campaign could engage people with different priorities – such as those who are less responsive to net zero-focused messages, it says.

## Government scraps Whitby hydrogen trial

### Energy secretary says hydrogen 'less likely' to be used routinely to heat homes

The government has scrapped plans for a village hydrogen heat trial as Secretary of State for energy Grant Shapps has downplayed the role that the fuel will play in homes.

The Department for Energy Security and Net Zero informed gas network Cadent last week that it has decided not to press ahead with its proposal to use the Cheshire village of Whitby as a test bed for hydrogen in home heating.

Junior energy minister Lord Callanan tweeted that there was 'not strong local support' for the trial, which would have seen hydrogen replace natural gas in up to 2,000 homes over two years.

The village-scale trials for which Whitby was earmarked are a key staging post in the government's programme to test how

hydrogen works in home heating. The trials are designed to inform decisions on future options for home heating in 2026. However Cadent's plan sparked a fierce backlash among Whitby residents.

The announcement means that only a pilot at Redcar in Teesside is in the running for the village hydrogen home heat trial.

A Cadent spokesperson said: 'While Whitby won't be the location for the trial, the information we have gained over the past 12 months will still play an invaluable role in shaping how the UK heats its homes and businesses in the future.'

While hydrogen would form part of Britain's overall energy mix, it was 'less likely' to be routinely used in home heating, said Shapps, who added: 'It's not that we won't do trials. We will. But I think hydrogen will be used for storing energy.'

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# Government lacks urgency on tackling climate change

**Independent committee says there is over-reliance on unproven technology**

Hydrogen should be given 'at most' a 'small' role in home heating, the Climate Change Committee (CCC) has said in its latest progress report on the UK's decarbonisation. The annual update, published last month, warns that the government displays a 'lack of urgency' on tackling climate change and that policies are not being developed at the 'required pace' for meeting future targets.

The CCC says its confidence that the UK will meet its Fourth Carbon Budget, which covers the period up to 2027, has 'slightly increased' over the past year, largely because of an approximately 5% post-pandemic drop in driving and continued growth in sales of electric vehicles. But its confidence that the UK will meet longer-term emissions-reduction targets has decreased, partly because of 'over-reliance' on technological solutions yet to be deployed at scale.

The committee says the government must back up its 'strong' commitments – such as to decarbonise the electricity system by 2035 and install 600,000 heat pumps per year by 2028 – by moving 'as swiftly as possible' to delivery.

'Immediate' action is needed to overcome the 'systemic uncertainty' being caused by the government's position that a decision on the role of hydrogen in heating will not be made until 2026. Postponing this decision for three years is 'hindering' the growth of supply chains for low carbon heat, says the CCC. 'Waiting three more years to set a clear direction will lead to further lost progress in buildings, and hinder infrastructure development more widely.'

What the report describes as 'no and low



Lord Deben, who has stepped down as chair of the CCC after 11 years at the helm

regret' options, which the government should push forward on, include electrification of heating with 'at most – a small, focused role for hydrogen use in buildings'.

The CCC also says the government's decision to take environmental and social levy costs off power bills, as part of last winter's wider energy support package, means the ratio of electricity prices to gas prices has fallen over the past year. It is now 'essential' that this improvement in relative prices is made 'permanent', it adds, as part of the rebalancing of electricity and gas prices that the government has committed to implement by March next year.

● Professor Piers Forster has been appointed interim chair of the CCC, after Lord Deben stepped down last month.

## Sunak 'simply uninterested' in the environment, says Lord Goldsmith

Lord Goldsmith has accused the government of 'apathy' on the environment and Rishi Sunak of being 'uninterested' in the issue.

In a letter sent to the Prime Minister on 30 June, the peer outlined the reasons for his decision to resign as foreign minister with responsibilities for energy and environment. He wrote: 'The problem is not that the government is hostile to the environment, it is that you, our Prime Minister, are simply uninterested. That signal, or lack of it, has trickled down through Whitehall and caused a kind of paralysis. This government's apathy in the face of the greatest challenge we have faced makes continuing in my current role untenable.'

Lord Goldsmith warns that the Conservative Party risks losing votes if it fails to take action on climate change before the next general election: 'Even if this existential challenge leaves you personally unmoved, there is a world of people who do care very much.'

His resignation from government follows critical comments that he made about last month's Privileges Committee inquiry that triggered former Prime Minister Boris Johnson to step down from the House of Commons.

## IN BRIEF

### King Charles sets radiators to 19°C

The royal household cut its natural gas and heating emissions by 19% last year, the latest Sovereign Grant report shows.

The report for 2022/23, which was presented to the House of Commons on 28 June, says the reduction was achieved by a set of targeted initiatives. These included a 'concerted effort' to reduce temperatures in occupied rooms to 19°C during the winter and educate staff to turn it down to 16°C in vacant rooms and be more aware of the potential for reducing heat loss.

Other initiatives included further optimisation of BMS systems across the household's London sites and Windsor Castle, switching off historic gas lamps when safe, and procuring a larger proportion of renewable electricity.

### China five years ahead of renewables target

China is likely to hit its 2030 wind and solar power targets five years ahead of schedule, according to a new study.

The report by the Global Energy Monitor says approximately 379GW and 371GW of prospective large utility-scale solar and wind capacity respectively is scheduled for installation by the end of 2025.

The study says China has already installed 228GW of large utility-scale solar and 310GW of wind. A combination of installed and planned capacity means that China is likely to 'achieve and potentially surpass' its 2030 target of 1,200GW of cumulative wind and solar power five years ahead of schedule.

### Water infrastructure schemes get go-ahead

Ofwat has given final approval to 33 infrastructure schemes worth a total of £2.2bn, with work due to begin in the next two financial years. Ten schemes to tackle storm overflows, worth nearly £1.7bn, make up the biggest chunk of the investment that was given the green light by the water regulator for 2023-30. These schemes are designed to reduce overflow spills by around 10,000 per year. They include work to improve water quality at the bathing site at Ilkley, on the River Wharfe, in Yorkshire, and significantly reduce spills into Lake Windermere.

**IN BRIEF****Search is on to find best small modular reactors for the UK**

The government has launched a competition to identify the best small modular reactors (SMRs) for meeting the UK's nuclear power needs. Companies can register their interest with Great British Nuclear, to participate in the competition for government funding support to help design and develop SMRs, which are smaller than conventional GW-scale atomic power plants.

**£230m for public sector decarbonisation**

The latest phase of the Public Sector Decarbonisation Scheme has been launched, says government agency Salix Finance. The government has committed up to £230m for the financial year 2024/25, for projects to reduce carbon emissions in public buildings across England, including hospitals, schools, museums and universities. Additional money has been budgeted for the scheme in 2025/25, to enable projects to be delivered over two years.

**University solar farm gets green light**

Local planners have approved an application by Cambridge University to build its own solar farm on green belt farmland to the south-west of the city. It will supply 30,457MWh per year, meeting more than a quarter of the university's electricity needs.

# Carbon offsetting guide aims to prevent greenwashing

**UKGBC guidance enables a 'more holistic' approach for practitioners**

The UK Green Building Council (UKGBC) has launched new guidance on carbon offsetting in construction, which updates previous UKGBC guidance on offsetting at individual asset level.

The publication, which tied in with London Climate Action Week 2023 at the end of

June, says 'responsible' carbon offsetting has a crucial role to play in the transition to net zero carbon buildings once efforts to reduce embodied carbon and energy use intensity have been exhausted.

However, purchasing offsets from the voluntary carbon market can be challenging because of its lack of maturity and transparency, increasing exposure to accusations of 'greenwashing'.

The guidance emphasises the importance of setting an internal carbon price for projects, given that the cost of accredited carbon credits on the voluntary market do not 'accurately' reflect the full societal and economic cost of emissions into the atmosphere. It aims to enable practitioners to take a 'more holistic' approach to carbon offsetting that goes beyond procurement of voluntary offset credits.

The publication sets out three levels of ambition for industry - minimum requirements, good practice, and leading approach.



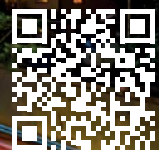
## Boiler Upgrade Scheme misses target

The government's flagship heat pump scheme barely met half of its target in its first year, according to official statistics. Only 16,052 vouchers were awarded to support the installation of low carbon heating technologies by the end of May 2023, according to the latest Boiler Upgrade Scheme (BUS) monthly progress report, published on 29 June. Of the vouchers awarded, 96% were for installing heat pumps.

The figures mark the end of the first year of operation of the BUS, which was launched in May 2022 and is meant to support the installation of 30,000 low carbon heating devices per year from 2022 to 2025. Its shortfall in delivery means the government will claw back nearly half of the £150m budget for the first year of the scheme, which offers grants to households that replace fossil fuel boilers with low carbon alternatives.

Earlier this year, the House of Lords environment and climate change committee described uptake of the BUS as 'disappointingly low', and said the scheme had been bedevilled by uncertainty over the direction of government policy on future home heating.

# Future Proofing Heat Networks for Good.

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The Constructing Science tool will help decision-makers choose the right type of lab space

## Science test ensures buildings are fit for laboratory work

**Constructing Science online tool helps confirm spaces are suitable**

New guidance has been published to help speed up decisions on whether laboratory buildings are suitable for the scientific work for which they have been lined up.

A consortium of health, life sciences and construction consultants announced the launch of Constructing Science last month, an online model that is free to use. It is designed to enable decision-makers to quickly determine whether an existing or proposed lab building is suitable for the scientific work planned for the space.

Users are guided through a 'pathway' of prospective development options, site/asset credentials and building performance specifications, depending on parameters such as required floor space and type of lab required. An accompanying report offers guidance on the infrastructure required for lab-capable buildings.

The consortium hopes having a baseline for building quality laboratories will help overcome

'significant' problems stemming from a lack of readily accessible and universally agreed design and construction standards for the sector. This is seen as especially critical given high demand for lab space, with agents Cushman & Wakefield estimating active demand for more than 2 million ft<sup>2</sup> of laboratory space in the 'Golden Triangle' of Cambridge, London and Oxford.

Engineers Buro Happold, Hoare Lea and Ramboll Group are members of the Constructing Science consortium, which also includes life sciences cluster body MedCity, construction consultants Gleeds, Cushman & Wakefield, architects Gensler, project managers CPC and EEDN, and developers Mission Street.

Richard Walder, UK science and technical director at Buro Happold, said: 'The market for speculative science development has grown rapidly within the UK. This guidance provides clarity on specifications and approach for developers and tenants, bringing a level of consistency to the market that has been missing to date.'

### IN BRIEF

#### City planning eased to allow for office conversions

City of London planners have unveiled proposals to tighten up on where tall buildings should be located in the Square Mile, while easing the process for converting office blocks for other uses. City of London Corporation officers have presented a report to councillors on changes to the authority's offices and tall buildings policies, as part of the process for preparing its draft local plan. New tall buildings will be appropriate in just two of the nine areas into which the City has been divided. In addition, there will be a new 'fast track' approach for conversions of offices to 'complementary' uses, such as hotels and cultural spaces.

#### Bhatt becomes Elta Fans' new building services MD

Elta Fans has appointed Vikrant Bhatt as its building services managing director. Bhatt joined Elta Group in 2013 as sales manager for Fantech in New Zealand, where he rose to director level before moving to Australia to oversee operations at Fantech across the state of Victoria. He will collaborate with David Millward, Elta group product manager, to relaunch the Fan Selection Programme, which allows customers to select the best fans and ventilation systems to meet their specific requirements.

#### Heating and Hotwater Industry Council gets first female chair

Karen Boswell OBE, managing director of Baxi UK and Ireland, has been appointed chair of the Heating and Hotwater Industry Council, the first woman to hold the position. Boswell joined Baxi as MD nearly three years ago and has worked with the government on making training more affordable and attractive to installers through the Heat Training Grant, which was launched this month. She succeeds HHIC's outgoing chair Steve Keeton, director of external affairs and future portfolio at Vaillant.

## Curran takes up role as BESA president

The Building Engineering Services Association (BESA) has elected Claire Curran as its president for 2023/24.

Curran has been managing director of M&E maintenance and project engineering specialists Linaker since 2018, but has worked in the building services industry for nearly 25 years. She has previously worked for GSH, ISS, Kier, and Wates.

In her speech to this year's BESA annual general meeting, Curran said her presidential year would be marked by acceleration in the adoption of digital systems and a deepening of the impact of new safety legislation.

'The way we are regulated is changing in the most profound way since World War II through the Building Safety Act, which is not just about safety,' she said.

'It is about the whole process of delivering projects, because you can't make buildings safer if you keep working in the same way. So, for compliance, we must take a close look at everything we do.'



Claire Curran

## IN BRIEF

### Patrick Bellew addresses Fellows

Founder of Atelier Ten, Patrick Bellew FCIBSE, spoke at last month's CIBSE Fellows Network event, 'Environmental engineering masterclass – 40 years of moving the dial'.

He gave a retrospective of his career, describing the people and things that have influenced and inspired him, and how he has dealt with innovation and risk. He also talked about the development of the language and communication of environmental design that is the hallmark of Atelier Ten's success.

One attendee said the event was 'an extraordinary experience, filled with valuable insights, thought-provoking discussions, and wonderful connections'.

● For more information on the Fellows Network visit [bit.ly/CIBSEFN](http://bit.ly/CIBSEFN)

### Legislation is focus of golden thread event

With another round of regulatory changes coming into force on 1 October, the next event in CIBSE's Golden Thread series will set out the breadth of the regulatory changes, the new requirements of Building Regulations, and details of the new regime for the golden thread and key building information that will apply to all those who are accountable persons for a higher-risk building.

The event, which takes place on 28 September at The Royal Society, London, will help clients and the supply chain to understand the new requirements in much more detail.

● Book your place at [bit.ly/CBG28](http://bit.ly/CBG28)

### Help shape the future of CIBSE

It's time to make your mark and help influence the future direction of your Institution. Keep an eye out for a link via email asking for your views on CIBSE.

Your contribution is pivotal in defining our journey. By getting involved, you become an integral part of the transformation that will shape CIBSE.

Together, let's build a stronger, sustainable, and more inclusive future for CIBSE. The deadline for completion is 31 August.

If you don't receive a link, request one from [websupport@cibse.org](mailto:websupport@cibse.org).

# SFE launches international hubs

## New centres for members in Italy, North America and the Middle East

Three new regional hubs have been created by the Society of Façade Engineering (SFE) to provide a better service and more community engagement at a local level, and to better serve its network of more than 1,000 members worldwide.

Building on the success of its existing hubs in London and Birmingham, the SFE has launched three new ones in Italy, North America, and the Middle East.

The SFE North America hub hosted its launch event in New York in April.

This included three panels that focused on the themes sustainability, innovative materials, and globalisation and procurement. The panel consisted of façade designers, contractors and specialists, and the event was sponsored by Walter P Moore, Permasteelisa North America Corp, Eckersley O'Callaghan, Arup, and Focchi Group.

In June, the SFE Middle East hub held its launch event in Dubai. More than 120 people registered for the event, sponsored by Kuraray, which contained talks on: laminated glass challenges and prevention of delamination; quality control during laminated glass processing; blast and bullet-resistant glazing from classification to fabrication; and a presentation on the world's first adaptive high-rise test tower.

The Italy hub, which had interest from more than 100 façade engineers, was officially launched at ZAK World of Façades in Milan, in June, when it hosted its inaugural event – a façade walk around the city. The event attracted a high level of engagement between attendees and speakers from Focchi and AGC Interpane on the urban development of city life.

● For further information about the SFE visit [www.cibse.org/sfe](http://www.cibse.org/sfe)



## Call for papers for 2024 Technical Symposium in Wales

Abstracts for papers and presentations are being sought for the CIBSE Technical Symposium 2024, which has the theme 'Fit for 2050 - Delivering buildings and defining performance for a net zero built environment'. The event is scheduled to take place at the Welsh School of Architecture in Cardiff from 11-12 April 2024.

The focus of the symposium is on redefining building performance in the light of social, environmental and digital change. Papers are invited on digital technologies, modern methods of construction, health and wellbeing design standards, the role of occupants, and meeting net zero standards.

The Technical Symposium will feature a range of peer-reviewed papers and presentations outlining the latest developments in practice, technology and policy, and showcase the latest guidance for building services engineers.

It will also provide practitioners with up-to-date information about digital innovations and developments in meeting net zero carbon imperatives, as well as on developing knowledge of and practice in healthy buildings.

Short abstracts of proposals for research papers, posters, technical reviews, case studies and opinion presentations based on recent or current project work, research or application – as well as those that examine actual or potential impacts of our work on the built environment – are invited. Submissions must be received by Monday 11 September 2023.

● For more information, visit [www.cibse.org/technicalsymposium](http://www.cibse.org/technicalsymposium)



Vital Energi's Ibrahim Qadir plans to travel to Abu Dhabi, Amsterdam, Singapore and Sweden

## AI research apprentice wins travel bursary

**Integrating artificial intelligence into renewable buildings is winner's research topic**

This year's CIBSE Ken Dale Bursary winner is Ibrahim Qadir, building services engineering apprentice at Vital Energi, with his proposed research project *Technical challenges and opportunities of future AI technology in buildings: A comparative study*. This will look at the potential to integrate artificial intelligence (AI) technology and automation for renewable energy in buildings.

'With a focus on technical challenges, economics and environmental impact, I aim to provide practical solutions, attract investment, and raise awareness,'

said Qadir. 'Together, we can drive sustainable advancements for CIBSE and the wider community.'

Qadir intends to use the bursary to travel to Abu Dhabi, Amsterdam, Singapore and Sweden to carry out his research.

The Ken Dale Travel Bursary commemorates Ken Dale's contribution to CIBSE and the wider building services profession. Members of CIBSE in the early stages of their career are encouraged to submit their research proposal to enter the competition. The bursary, of up to £4,000, allows the winner to travel and research areas of particular interest and application to the Institution.

● For more information about the bursary, visit [bit.ly/KenDaleCJ](https://bit.ly/KenDaleCJ)

## Panellists post net zero views to future generation

CIBSE South West and YEN South West, in collaboration with Women in Property (WiP), hosted a net zero carbon time-capsule event and panel discussion in June, titled 'Letters to the designers of tomorrow'.

The event brought together professionals from across the built environment sector to discuss the progress that has been made on net zero in recent years, and, more importantly, the progress and innovation yet to come. It posed the questions: Have you thought about where our industry might be in 10 years? How about in 30 years? What kind of future do you imagine for us? Have we reached and surpassed our carbon targets? Attendees were asked to note down their thoughts, hopes and questions sparked by the panel discussion, and write a short letter to future designers. These were then sealed in a time capsule, to be reopened in 2030.

The panel chair was Ros Trotman, partner and head of development of land, Things Solicitors, and the panellists were: Hannah Kissick, innovations and sustainability associate, CPW; George Taylor, principal sustainability consultant and Chartered Environmentalist, Hydrock/WiP; Dr Natasha Watson, UK embodied carbon lead for structures, Buro Happold; and Councillor Nicola Beech, Bristol City Council cabinet member with responsibility for strategic planning, resilience and floods. Thanks to organiser Rebecca Ellul Vincenti and sponsors Baxi and Things.

## Call for nominations for officers, Board and Council members

New CIBSE officers, Board members and Council members take office from the AGM in May each year.

The CIBSE Board is the governing body of the Institution. It is made up of the seven officers (President, president-elect, three vice-presidents, honorary treasurer and immediate past president) and five elected members.

The vice-presidents and honorary treasurer are appointed by the Board, but the president-elect and Board member positions are subject to election if there are more candidates than vacancies.

The Council of the Institution is a much larger consultative body, which advises the Board on CIBSE policy. It includes several elected members, in addition to representatives of all regions, societies, groups and standing committees.

There are usually three vacancies for candidates each year as the elected members rotate through their three-year term.

CIBSE Members are invited to propose candidates for the positions of president-elect, Board members and Council members, to take office at the AGM in May 2024.

All suggestions received will be considered by the CIBSE Nominations Panel, and the Board will consider the panel's advice before deciding which candidates to recommend for the vacancies.

Any candidates nominated to the panel but not recommended by the Board may also choose to go forward for election, subject to obtaining the support of 10 corporate members, in which case a ballot will be held.

Members may put themselves forward for consideration or suggest colleagues who are willing to be considered and who meet the eligibility requirements.

Further information on the process, role descriptions and eligibility requirements can be found on the CIBSE website at [www.cibse.org/nominations](https://www.cibse.org/nominations), along with the nominations form that must be completed for all candidates who are put forward for consideration.

To meet the timescales required, all suggestions must be received at the CIBSE offices by 15 September.



President-elect  
Fiona Cousins

# In memory of Dr Gina Barney HonFCIBSE 1936-2023

Gina Barney HonFCIBSE spent her working life in the lift industry and, for 50 years, was a world-leading and renowned international vertical transportation consultant.

She was the driving force behind five editions of the CIBSE guide to vertical transportation, Guide D. Without doubt, the rate at which Guide D has been updated and refreshed, and the rigour with which it has been maintained, are due to the energy, commitment and enthusiasm of Gina.

None of those editions would have been published on time without Gina keeping the Steering Group in check.

Gina called a meeting in April,



Gina Barney

months earlier than usual, to plan the next edition. Although unwell, she ploughed through the planning meeting, repeatedly saying 'of course, this will all be down to you lot, as I won't be here'. The next edition will be a testament to Gina, and none of

the contributors will dare be late.

Gina, nominated by the Lifts Group, was awarded a CIBSE Honorary Fellowship in 2014, in recognition of her work on the Guide. It was an honour of which she was truly proud. She received a President's Commendation in 2021 for her work on the lifts section of CIBSE's *Emerging from Lockdown* guidance, undertaken at no notice and which continued at all hours.

Gina served on MHE/4, the BSI lift committee, for nearly 35 years, and her work rate on that was as vigorous as everything else. She was a Liveryman with the Worshipful Company of Engineers, in which she was equally active.

Gina could be cantankerous, and knew it. Opponents in legal cases knew that she could, and would, debate for hours.

Gina was not only a brilliant engineer, but a true friend to a number in the industry.

When she transitioned, some were quite unpleasant to her, while others adapted to getting a hug when parting.

Gina had a strong sense of fairness. She wanted to be a force for change and for good - especially for those in need. She was co-chair of the CIBSE LGBTQI+ Panel and she enriched the lives of those around her. She was a kind soul, always supporting those who needed it.

Gina was active in her community and, as an engineer, got involved in the provision of broadband to remote homes, arriving on site in appropriate gear to help with installations well into her ninth decade.

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Alison, Technical Co-ordinator

# CHALLENGE ACCEPTED

New ASHRAE president Ginger Scoggins has made the battle against climate change the cornerstone of her year in office. At the ASHRAE Annual Conference in Tampa, Florida, **Tim Dwyer** listens as she recalls female icons who brought man-made global warming to public attention



Ginger Scoggins

**W**hen new ASHRAE President Ginger Scoggins was growing up in the 1970s, she was made aware that the world was experiencing an energy crisis in two ways: the enduring long lines at the gas station and her mother curtailing the use of air conditioning at home and in the car. With prophetic reasoning, she told Ginger that she did not want her daughter to grow used to the comforts of a controlled environment.

Scoggins recounted her story at the launch of her presidential year in a sizzling Tampa, Florida, USA, in her presentation *Challenge accepted: tackling the climate crisis*.

As a startling statistic of how households have evolved in the past 50 years, Scoggins highlighted that 'we've gone from approximately 20% of homes in the US having central heating and air conditioning to more than 70% now'. This is a transformation, seen in many other parts of the world, that is like building the equivalent of a New York City every month across the globe.

Of the 1970s, she remembered: 'It was hotter inside than it was outside: we went outside to cool down. Now, in many locations, it is much hotter outside than it used to be, driving people inside to controlled environments to escape.'

Undoubtedly reinforced by participating in the recent COP meetings in Glasgow and Sharm el-Sheikh, Scoggins reasserted her firm opinion that we are living in a climate emergency. Mitigation efforts may slow the rate of increase, but were not likely to reverse the trend.

She named the overlooked pioneering scientist of the mid-1800s, Eunice Foote, who was the first to have suggested that an increase in carbon dioxide in the atmosphere would change the atmospheric temperature and have an effect on climate. Her work preceded discoveries made by other scientists by five years, making her the rightful first vocal climate change advocate – although, for reasons unknown, her work at the time was presented by a male colleague.

Scoggins noted that, although women in scientific fields had made significant strides from the 1880s to the 1980s, there were still challenges for women in our industry. She told delegates how the patriarchy of her engineering consultant employer in the late-1990s spurred her to leave and start her own business, which is now a multi-million dollar concern that competes with her old company.

She said the sector has come a long way in terms of gender acceptance, recruitment and recognition, and that she could see a day when 'being a woman' in this industry will not be an anomaly, but the norm, with equal representation among genders.

As well as Foote, Scoggins referenced Margaret Thatcher, in part because of the late UK Prime Minister's early acceptance of climate change caused by humans (see

panel). In her speech – which could have been aimed at any climate deniers in the audience – Scoggins said: 'Whether you believe we are in a human-made crisis or experiencing a natural climate transition, based on scientific evidence, there is no doubt that humans are accelerating the change in the climate that we are experiencing.'

She outlined ASHRAE initiatives that aim to improve 'understanding of how climate change and the resulting natural disasters affect building planning, design, construction and operation'. These include developing member knowledge and tools to design resilient new and renovated buildings, to lessen the impact of the built environment on climate change and develop an understanding of 'all aspects of carbon reduction in buildings, including embodied carbon, refrigerant use and reduction, and end-of-life carbon.'

Scoggins confirmed a philosophical shift in ASHRAE, having 'expanded our focus from providing guidance on energy-related carbon, or operational carbon, to focusing on the whole life cycle of carbon in buildings'. There is a long way to go, however, and as Thatcher reportedly opined, she may have to 'fight a battle more than once to win it'. **C**

**GINGER SCOGGINS'** full presidential address can be watched at [bit.ly/CJGSPres23](https://bit.ly/CJGSPres23)

## MARGARET THATCHER: FORESEER OF CLIMATE CHANGE

In her 1988 speech to the Royal Society, Margaret Thatcher said: 'For generations, we have assumed that the efforts of mankind would leave the fundamental equilibrium of the world's systems and atmosphere stable. But it is possible ... we have unwittingly begun a massive experiment with the system of this planet itself ... which has led some to fear that we are creating a global heat trap which could lead to climatic instability.'

# DRAFT MINUTES FOR CIBSE ANNUAL GENERAL MEETING 2023

The Annual General Meeting (AGM) of CIBSE was held on 13 June 2023 and was conducted as a hybrid model, with participants both in person and online, via Teams. Kevin Mitchell, CIBSE President 2022-23, chaired the meeting.

Chief executive Ruth Carter read the Notice of Order convening the meeting, and then explained that it would not be possible to share the CIBSE Annual Accounts for 2022 at this AGM. As members were aware, the accounts are usually shared for information purposes, as well as being sent out at the same time as the Calling Notice for the AGM. However, significant staffing and resourcing challenges within the finance team and at our auditors had delayed completion of the audit. Copies of the draft income and expenditure account and balance sheet were available to those attending the meeting and would be presented by the honorary treasurer. As soon as the accounts have been fully audited, and signed off by the CIBSE Board, they will be made available to all members to review, and members will be given in excess of 21 days' notice to attend (online or in person) a briefing meeting and ask any questions.

The minutes of the 45<sup>th</sup> AGM of CIBSE, held on 5 May 2022 and published in the August 2022 issue of *CIBSE Journal*, were then accepted as a correct record of the meeting.

## ANNUAL REPORT

Kevin Mitchell introduced the Annual Report for 2022 by stating that it reflected both the Institution's performance and the impressive efforts of CIBSE volunteers, members and staff, and illustrated the ongoing work to lead and support members with the transition to net zero and to deliver a safe, healthy and sustainable built environment. The report not only lists award winners and members of the Board and Council, but its images also capture the atmosphere of CIBSE events and the varied and inspiring work of members.

### Highlights include:

- 2022 marked 125 years of CIBSE, a milestone that was marked by the President's call to action to inspire the next generation, with five challenges to Celebrate, Inspire, Boost, Share and Engage. The challenges provoked an incredible response, which is reflected in the structure of the report.

- The new CIBSE website has had real impact: 3.3 million page views from 150 countries. CIBSE's online presence has 95,000 followers across social media platforms. *CIBSE Journal* receives 29,000 monthly views, and the Grow Your Knowledge series has achieved 45,000 registrations.
- CIBSE Knowledge produced 21 new titles, with notable releases including guidance on heat pump installation for large non-domestic buildings, and a new edition of TM54 evaluating operational energy at design stage. TM65, our embodied carbon methodology, can now be used internationally, with local versions being developed.
- Further progress included revision of CIBSE's Climate Action Plan, CIBSE/LETI Net Zero FAQs, and involvement in a cross-industry coalition of professional bodies to develop a UK Net Zero Carbon Buildings Standard.
- The Building Safety Act received Royal Assent in April 2022 and is the priority for the industry: Dr Hywel Davies has led in communicating the scale of changes that government is looking to drive through this legislation. CIBSE works closely with other sector groups to respond to related government consultations and has developed a one-day training course to introduce the act and the new competence requirements for higher-risk buildings.
- CIBSE continued to develop initiatives to increase professional competence, including engaging with more than 2,000 members through webinars, workshops and company presentations. CIBSE Societies support alternative routes to professional registration and progress in professional accreditation outside the UK; CIBSE was approved as an assessment body for Engineers Queensland and is applying for Victoria.

## "The Annual Report reflected the Institution's performance and the impressive efforts of CIBSE volunteers, members and staff"

- 2,300 delegates received remote, face-to-face or on-demand training (up from 1,500 in 2021); CIBSE Regions organised 180 events with 14,000 registrants; and our Special Interest Groups now have a combined membership of 50,000.
  - The Building Performance Awards, President's Awards, SLL Young Lighter of the Year, the Façade Awards, and the Young Engineers Awards showcased talent and expertise within the industry.
- In closing, the President encouraged members to read the Annual Report, thanked volunteers, members and staff for their dedication and efforts, and expressed his excitement for the future of the Institution and its members.

### Kevin Mitchell then invited questions:

- Chris Jones asked what research CIBSE is relying on to illustrate whether global reserves and production of critical metals and minerals are sufficient to support the electrification of buildings to achieve net zero, pointing out that some research shows concerning shortfalls. Kevin Mitchell agreed with the point made and stated that part of CIBSE's work with the Engineering Council, Royal Academy of Engineering and

Construction Industry Council is starting to address this.

- William Orchard expressed concern that government was giving inadequate attention to the existing building sector generally, and specifically to the cost of external insulation on the many thousands of terraced houses. Kevin Mitchell advised that existing housing stock is a big focus for CIBSE and noted that the Welsh School of Architecture won a Building Performance Award for its work in this area. Ted Pilbeam, chair of the Knowledge Management Committee (KMC), confirmed that housing retrofit is a key priority.
- Mike Smith asked whether the move from Balham would lose the connection that members have with the physical entity that the Balham site represents. In response, Kevin Mitchell pointed out that moving from Balham had been on the agenda since 2017 at least, and that all options have been considered, with the Board concluding that replacing one physical home with another was the best option.

The Annual Report is available at

[www.cibse.org/annualreport](http://www.cibse.org/annualreport)

## REPORT OF THE AUDITORS

Julia Poulter, from Crowe UK LLP, confirmed that she was not able to report a full audit opinion on the Financial Statements for the year ended 31 December 2022 as a result of delays caused by the resourcing challenges at CIBSE. Crowe had been working closely with the CIBSE team, and the audit will be completed to meet statutory deadlines, including Companies House and the Charity Commission. At this time, Crowe had no points to bring to the attention of the meeting on the income and expenditure account and the balance sheet, which would be presented at the AGM, and had not highlighted any material mis-



The new CIBSE Board: from front row left to right: Vince Arnold, Kevin Mitchell, Adrian Catchpole, Les Copeland, Ruth Kelly Waskett, Laura Mansel-Thomas, Lionel James, Mike Burton, Mark Walker and David Stevens

statements from its audit work completed to date. It did not envisage any issues with completing the audit on the draft financial statements and will be able to present its audit opinion in due course on completion of the audit.

## FINANCIAL STATEMENTS

Vince Arnold, honorary treasurer, thanked Crowe for its work and the help that it had provided, before presenting a statement of the annual accounts as at 13 June. He noted CIBSE's very strong financial performance in 2022, with highlights including:

- Group Income rose from £6.891m to £8.471m (23%) with Trading Subsidiaries (Services, Certification, Hong Kong) increasing by £1.276m. Income from members' subscriptions rose by £190k to £3.782m, largely the result of growth in End Point Assessment activities for apprenticeships. Fees for charitable services (CPD and Events) rose by £160k to £544k. In addition, a £39k bequest to SLL by its Past President Liz Peck was gratefully received.
- CIBSE Services Ltd grew Training activity, with more courses and delegates, with Online Learning up by £67k, and other Training up by £197k. *CIBSE Journal* grew revenues by £101k, Publications revenues were up by £251k, with strong Weather Data sales. The Building Performance Awards (up £134k), Build2Perform (up £313k), and other Events, including the Façade Awards and Golden Thread conferences (up £199k), resulted in an overall increase of £646k.
- CIBSE Certification Ltd grew revenues by £25k in Information Systems, £33k overall.
- Group Expenditure reflects the increased activity, with Trading Subsidiaries up by £809k with improved surplus margin, Membership up by £111k with increased spend on face-to-face activities and travel, while Technical was down by £79k, reflecting resource phasing. Regions, Societies and Special Interest Groups up by £240k with increased activities and resource.
- Group Income (up £1.58m) and Expenditure (up £1.092m) therefore shows an operational surplus of £767k (£279k in 2021). Weaker investment performance in 2022 resulted in investments and the pension fund showing a loss of £494k in line with economic trends. The final surplus for 2022 was therefore £273k against £442k in 2021, and the fund balance carried forward was £3.289m (£3.016m in 2021).

## BOARD AND COUNCIL FOR 2023-24

Ruth Carter announced the Officers, Board and Council Members for the forthcoming year.

### Officers:

**President:** Adrian Catchpole

**President-elect:** Fiona Cousins

**Honorary treasurer:** Vince Arnold

**Immediate past president:** Kevin Mitchell

**Vice-presidents:** Les Copeland, Laura Mansel-Thomas, Dave Cooper

**Continuing Board members:** Lionel James, Ruth Kelly-Waskett,

David Stevens. **Newly elected Board members:** Mike Burton, Mark

Walker

**Newly elected Council members:** Peter Anderson, Aleksandra

Krstanovic, Emeka Osaji

Continued on p53



# Renewed energy

The government plans to improve the Energy Savings Opportunity Scheme and has revised its powers to regulate energy use in buildings. Hywel Davies has been reviewing the Energy Bill

When the UK was in the European Union (EU), EU directives had to be transposed into UK law. Sometimes, specific UK laws were used, as with energy performance certificates and calculation of carbon emissions from buildings – requirements of the Building Regulations. More often, powers granted under section 2(2) of the (now repealed) European Communities Act 1972 were used to make regulations to transpose EU directives into UK law. That mechanism was employed for the Energy Savings Opportunity Scheme (ESOS) and the Energy Performance of Buildings Regulations, which implemented aspects of EU Energy Policy introduced more than a decade ago.

The Energy Bill, just completing its passage through parliament, transfers arrangements for the ESOS and the energy performance regulations firmly into UK law. Part 10 enacts the ‘power to make energy performance regulations’. Paragraph (1) enables the Secretary of State to make regulations for either:

- (a) enabling or requiring energy usage or efficiency of premises to be assessed, certified and publicised
- (b) enabling or requiring possible improvements in the energy usage or efficiency of premises to be identified and recommended.

There are also powers to restrict or prohibit marketing and sale of property where energy performance has not been assessed, certified or publicised.

This will enable the department responsible for energy policy to regulate energy efficiency and usage across the whole building stock. It provides a firm legal basis for extending the current coverage of energy certificates for public buildings in use to all buildings, whether using the same methodology or developing new ones.

The powers also explicitly include regulating ‘the anticipated energy usage and energy efficiency of new premises’. This means that, as well as meeting the requirements of Part L of the Building Regulations, there may, for certain types of buildings, be additional requirements relating to energy use in operation – something that has never been done using the Building Regulations, although the legal basis for doing so



“This is heady stuff and could give a future government significant powers to intervene in the activities of businesses”

has often been debated. That debate is now closed, as government has those powers and they do not sit with the Department for Levelling Up, Housing and Communities or the new Building Safety Regulator.

The bill also creates new sanctions for those who fail to comply, with fines of up to £15,000 and, in some cases, imprisonment for up to a year. This nails another long-standing debate over the previous regime under building and energy performance regulations, which has never knowingly been enforced.

Part 11 of the bill creates the enabling framework for future ESOS schemes (and is clear that there may be more than one scheme). The Secretary of State may regulate ‘for the establishment and operation of one or more energy savings opportunity schemes’. These may impose obligations as listed below:

## POTENTIAL OBLIGATIONS IN ENERGY SCHEMES

- Enable or require energy consumption or consequential greenhouse gas emissions for which an undertaking is responsible to be assessed, audited, reported and published
- Enable or require possible energy savings or emissions reductions to be identified and recommended; enable or require costs and benefits of those energy savings or emissions reductions to be assessed
- Encourage or require plans or targets for achieving energy savings or emissions reductions
- Encourage or require action to achieve energy savings or emissions reductions
- Encourage or require the achievement of energy savings or emissions reductions.

This is heady stuff and could give a future government significant powers to intervene with renewed energy in the activities of businesses. It will enable the plans, consulted on last year, to strengthen the ESOS regime for its next phase. Taken together, these two unheralded parts of the bill create a much more robust regime for regulating energy use of buildings in operation.

Anyone involved in the current ESOS is strongly advised to download the bill (or act) and read Part 11. It will constitute an hour’s CPD at least, and give a clear view of the direction in which this policy is likely to go.

**DR HYWEL DAVIES**  
HonFCIBSE  
is chief technical  
officer at CIBSE  
[www.cibse.org](http://www.cibse.org)



# Beyond prescriptive solutions

Dame Judith Hackitt's report has had a transformative impact on fire safety regulations. Exyte Hargreaves' **David Fitzpatrick** looks at the debate around having two staircases in high-rise buildings

**D**ame Judith Hackitt's report marked a significant milestone in reshaping regulations and the mindset of designers regarding fire safety in residential buildings. It introduced 53 recommendations covering competencies, distribution of responsibility, processes, and the credibility of product testing, shifting away from a purely prescriptive approach to legislation.

In 2021, the draft document BS9991 was released, which focuses on fire safety in residential building design, management and use. Notably, it addresses the issue of two staircases in high-rise buildings, which has been a subject of considerable discussion. The Department for Levelling Up, Housing and Communities proposed an amendment to Approved Document B to prohibit single staircases in new flats more than 30 metres in height, and the Mayor of London ordered that residential buildings over this height be required to have a second staircase for planning permission.



This move aligns with the National Fire Chiefs Council's opinion that having a second staircase reduces the risk of single points of failure during emergencies. However, there is an ongoing debate about whether this prescriptive solution alone is sufficient for ensuring evacuee safety. There are concerns that such measures might exempt building owners from seeking active, performance-based solutions, such as pressurisation systems. (See this article at [www.cibsejournal.com](http://www.cibsejournal.com) for an example). While these solutions overcome significant challenges, their successful implementation requires a comprehensive approach to product and system design. The ability to overcome basic physical challenges with advanced solutions is a big step towards a fully operational pressurisation system. Equally important is approaching the system as a whole - product- and design-wise.

● **DAVID FITZPATRICK** is director at SfS business unit, Exyte Hargreaves



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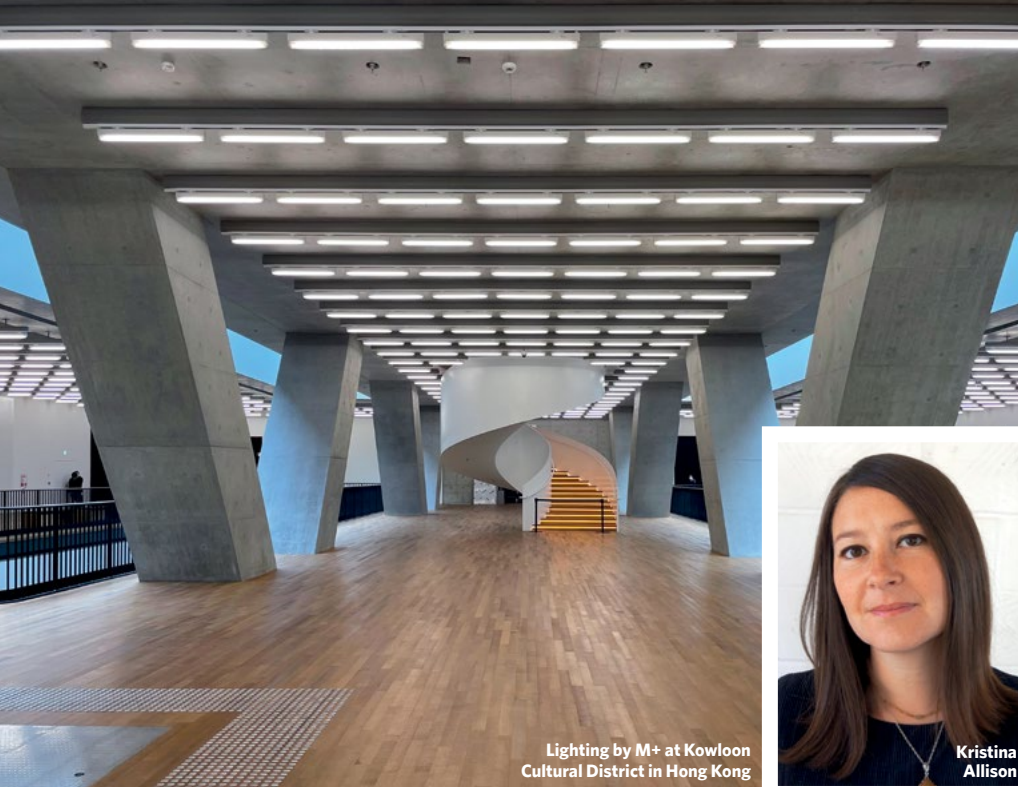
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Lighting by M+ at Kowloon Cultural District in Hong Kong

Kristina Allison

## Beacon of learning

The Diploma in Lighting Design is open to anyone with an interest in furthering their knowledge of lighting technology and research. Atkins' Kristina Allison MSLC MCIBSE answers questions on an enlightening career move

The Lighting Education Trust's (LET's) Diploma in Lighting Design teaches the latest lighting design, technical developments and research in light and lighting, and focuses on environmental issues affecting the sector. It takes a modular, distance-learning approach and is a recognised qualification to one of the routes to Society of Light and Lighting (SLL) Membership (corporate status). Students are enrolled as student members of the SLL, gaining access to the CIBSE Knowledge Portal.

The diploma was originally developed to provide a pathway for students applying for admission to the Master's degree in lighting at University College London, and is affiliated to the university. CIBSE is a Trustee of the LET.

Kristina Allison MSLC MCIBSE, senior lighting designer at Atkins Global and SLL vice-president, is technical course coordinator at LET, and here she talks more about the diploma.

### What is the LET Diploma?

It is a distance-learning course delivered via an online platform. Exams are held in London; however, when necessary, alternative locations can be arranged for overseas students.

### How long is the course?

The course is two years, starting in September, and is based on about 8-12 hours' study time per week to complete the 13 modules. The actual time will vary between students and they may find some modules easier than others.

### Who is the LET Diploma aimed at?

The content has a broader appeal than its original intent, and the course is helpful to anyone with an interest in lighting the built environment – from electrical engineers furthering their understanding of lighting, to computer game developers wanting to finesse lighting effects. It will benefit anyone

involved in designing lighting schemes, or the design and development of light sources. Those working on the manufacture of luminaires, and their application, maintenance and use, should also consider the course.

### What does the course cover?

It gives an introduction to lighting design, light sources and luminaires, interior lighting, and architectural/exterior lighting, as well as an introduction to industry-standard lighting software packages, environmental issues, daylight, and emergency lighting.

There are also guest lectures by leading lighting professionals on topics such as lighting design for human-centric inclusivity, the circular economy and embodied carbon, and dark skies.

### Do I already need to know about lighting?

No; there are no prerequisite skills or education needed for this course. Its set up to be an introduction to lighting design developed on the basis that the student has no previous knowledge. Having a familiarity with mathematics is helpful, but is by no means essential. We provide a 'maths primer' if it's not your strength.

### I will be working as well as studying; will I keep up?

The course is designed to be suitable for people who work full-time – so, if you have the discipline, you should be absolutely fine to take part. You may find the 'study at home' guide useful; if you have not studied for a while, it has tips on getting back into the habit.

### Could I be too old?

There's no age limit for the course. If you have the desire to learn, you're never too old. Course administrators are always on hand to support and encourage all students.

### Is lighting design art or science?

Most probably both – and the diploma reflects this attitude. Without a sound knowledge of the nature of light, it is difficult to develop lighting solutions that are sustainable, sympathetic to nature and energy efficient.

- Contact [let@cibse.org](mailto:let@cibse.org) for more information about the course or if you are interested in enrolling.

# LIGHTING THE PATH

Innovation, sustainability, and health and wellbeing will take centre stage during Helen Loomes' term as President of the Society of Light and Lighting. Molly Tooher-Rudd hears about her plans for the year, which include two new lighting events

**H**elen Loomes FSLI wants to use her 12 months as president of the Society of Light and Lighting (SLL) to bring science and fun back into the discipline. 'I want to create a space where we can enjoy each other's ideas; spark off each other. I want people to feel they can be creative and use their imagination – it's not just about the standards and policy,' she says.

The role of president is often described as a figurehead, representing the society at events and chairing meetings. 'I'm there as a support,' says Loomes, 'as most of the significant decisions are made through the various committees.'

As well as creating a platform for the lighting industry at Build2Perform, Loomes wants to use her year in office to organise a new SLL conference, with a particular focus on the science of lighting.

'Lighting encompasses art and science, and the design side is crucial. However, our big breakthroughs have come from scientific research and evidence,' she says.

Planning and executing a conference within one year will be a challenging task, but the structure of the SLL allows Loomes to set the wheels in motion and be around next year to help see it through.

'I want to bring the fun back into lighting,' she says. 'It's exciting when new discoveries



New SLL president Helen Loomes with immediate past president Andrew Bissell

come along; you can create some spectacular designs.' She feels that the SLL has had a bit of a reputation for being stuffy and just focusing on regulations. 'In reality, the lighting industry is a fascinating space, with so much going on. I want to show people what we are all about and what they can gain by becoming a member.'

This year, the SLL's presence at Build2Perform will be bigger, with a dedicated Light2Perform section. 'Our aim is to foster better connections between the lighting community and the wider built environment,' says Loomes. Several exciting papers have been lined up, and there will be a daily panel discussion just before lunch, which will get the audience involved and prompt conversations that can continue over the break (see panel, 'Light2Perform').

There are certain areas of scientific research that Loomes believes will be important for the industry, and these form

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**“There are fascinating developments in 3D printing and new plastics that can be leveraged. We need to start... getting creative”**

the three pillars of the conference's theme.

The first is health and wellbeing. While we know a lot about our reaction to daylight and how it controls our circadian rhythms, we're yet to implement this knowledge into a normal lit environment, Loomes says. Projects looking at circadian lighting in care homes for the elderly has demonstrated significant differences to occupants. 'It's been fantastic to see scientific progress translating into a practical application. However, there's a lot more we could do.

'It's important to understand the impact of lighting when choosing the right solution.

### HELEN LOOMES' CAREER PATH

Loomes' journey in the lighting industry began after seeing an advert for a laboratory assistant at a local lighting company. With a keen interest in physics and science, Loomes found she had a genuine passion for lighting. This led her to study illuminating engineering and lighting technology at Southbank Polytechnic. In 1974, she joined the Illuminating Engineering Society - which later evolved into the SLL.

She went on to be involved in various areas of the industry, from sales and marketing to teaching and education, and each role brought something new.

'It's important to have a fundamental understanding of lighting to excel in any of these positions,' says Loomes. 'This also brings an excitement into the job because I'm still interested in lighting and what it can do.'

In spaces where you have people mixing for the evening before going home to sleep, you want the lighting to be a warmer colour temperature. Conversely, on motorways, the priority is to keep people awake, and lighting should be bluer enriched.'

Loomes says this links to discussion on the effect of night-time lighting on the planet. Dark skies are a big topic because of the effect that light pollution has on wildlife. 'We need to look beyond the aesthetics and increase awareness to light responsibly.'

The second pillar of the conference is the environmental angle. 'Sustainability poses numerous challenges; I believe the answers lie within the research that various academics are doing,' says Loomes, who feels it is vital to bridge the gap between academics, practitioners, and funding sources. 'We need better communication about new findings and their possible applications.'

One example is the development of luminaires that can be used for longer and then be recycled easily. LEDs are made with rare earth metals, which are a finite resource, and Loomes says there are lots of exciting new alternative materials emerging that people are not fully aware of yet.

This leads into the third element of the conference: innovation. 'There are fascinating developments in 3D printing and new plastics that can be leveraged,' says Loomes. 'We need to start thinking outside

the box and getting creative. For example, we could look at the potential of covering the outsides of our buildings with bioluminescent plants that glow at night, eliminating the need for street lighting.'

She adds that CIBSE is well positioned to help the SLL expand and tackle some of the problems with sustainability and manufacture. One big issue is the installation of lighting fixtures in large office buildings during the CAT A fit-out phase. When a tenant is confirmed, they often want something different, so brand-new light fittings are removed and sent for scrap.

'We need to work together to reevaluate our building model to prevent this,' she says. 'We shouldn't just carry on doing what's always been done.'

In terms of the energy challenge of lighting and embodied carbon, Loomes acknowledges the value of tools such as TM65 in promoting sustainability. These enable informed decision-making by assessing the embodied carbon of lighting designs and comparing different products based on environmental impact. She stresses the importance of longevity and making choices aligned with specific building or project requirements.

While her one-year term may not change the world, Loomes believes that combined efforts and future presidential terms can make a significant contribution to creating a sustainable lighting industry. **C**

### LIGHT2PERFORM

This year, there will be a dedicated area for lighting at CIBSE Build2Perform Live, called Light2Perform.

Featuring leading lighting manufacturers, contractors, wholesalers and retailers, Light2Perform will have its own dedicated theatre and content programme running over the two days.

All technical content will be organised by leading lighters Bob Bohannon, Helen Loomes and Sophie Parry.

The featured sessions will look at how the lighting sector is responding to eco-design requirements, embracing the circular economy, and working to reduce the embodied carbon in lighting systems.

There will also be a focus on night-time lighting and the impacts this is having.

For more information on the event, visit [build2perform.co.uk/light2perform](http://build2perform.co.uk/light2perform)

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## UK falls behind with heat pump installation rates

**Report calls for exponential increase of UK heat pump market to match Europe**

The rate of heat pump installations in the UK is 10 times lower than in France, a report by the MCS Charitable Foundation has found.

France is surging ahead, with 620,000 heat pumps sold last year, reaching 20 for every 1,000 houses, compared with only 55,000 – 1.9 for every 1,000 houses – sold in the UK.

This trend has resulted in the UK falling behind 20 other countries across Europe. If uptake continues at the current rate, the chances of it meeting the 600,000 heat pumps by 2028 target will not be met.

The report's findings have led to a call for government to make heat pumps mandatory for all new homes, as well as scaled-up funding grants for retrofits.



The UK is not on track to reach its heat pump target

## Expanded Vitocal heat pump models run on R290 refrigerant

Viessmann has added three variants to its Vitocal 150-A/151-A domestic air source heat pump range. The 4kW, 6kW and 8kW models join the existing 10kW, 13kW and 16kW ones.

The models provide heating and cooling functionalities and are designed for connection to single-phase electricity supply, with three-phase models also available for the 10kW to 16kW variants. They run on R290 natural propane refrigerant, boasting a global warming potential of only 0.02.

The wall-mounted Vitocal 150-A and the floor-standing Vitocal 151-A, equipped with an integral 190-litre domestic hot water cylinder, deliver a maximum flow temperature of 70°C, ensuring superior hot water comfort for customers. In cases where the existing cylinder is not suitable, the Vitocal 151-A, with its integral cylinder, is recommended as a replacement option.

## Dakin announces renewables training facility

Training will be offered to hundreds of heat pump installers at Daikin's new low carbon heating skills centre.

Dakin has partnered with specialist training provider Quantum Group to open the facility, with the aim of addressing the green skills gap in the UK. The company said it hopes to attract young engineers into the renewable heating industry by giving them an opportunity to specialise.

Students will gain valuable practical experience working with state-of-the-art low carbon technologies, including air source heat pumps, alongside solar thermal, solar photovoltaics, electric vehicle charging, and battery energy storage.

## Brussels forum aims to boost heat pump strategy

The 2023 heat pump forum, 'The Heat Pump Accelerator: Advancing REPowerEU in a HeatBeat', is set to take place on 27 and 28 September in Brussels.

Heat pumps are at the centre of the push for a greener Europe and the race for independence from fossil gas. The forum puts heat pumps at the centre of the green, digital, cost-effective energy transition and industrial transformation.

Dedicated to widening horizons, the forum will bring together high-level policy-makers, major industry players and stakeholders, creating a platform for accelerating the heat pump strategy.

Registration for the event is now open online at [bit.ly/HPA23](https://bit.ly/HPA23)



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Comberton Village College is a large secondary school six miles to the west of Cambridge

# DECARBONISING COMBERTON

The installation of a new heat network at Comberton Village College is set to significantly reduce the heating bill and save 248 tonnes of CO<sub>2</sub>. **Andy Pearson** speaks to Bouygues Energies & Services about how two 500kW ground source heat pumps replaced oil-fired boilers scattered across 16 plantrooms

**C**omberton Village College provides a glimpse into a low carbon future for schools. It shows how retrofitting renewable energy technology to an existing school can help educational institutions across the country decarbonise their heating systems.

In its first year of operation, the £3.1m scheme is expected to significantly reduce the college's heating bill and cut carbon emissions by 70%, saving 248 tonnes of CO<sub>2</sub>. By 2050, with the further decarbonisation of the electrical Grid, that figure is predicted to increase to more than 90%.

Comberton Village College is a large secondary school located close to the city of Cambridge. It is formed from a diverse collection of buildings of various ages, most of which have been constructed as self-contained units, complete with their own plantrooms. The campus has no gas supply, so the majority of buildings were heated by fuel oil, with a few heated using liquefied petroleum gas (LPG).

Bouygues Energies & Services (E&S)

is a contractor under the Greater London Authority and Partnership's energy performance contracting initiative Re.fit. As part of this, in 2018 it was approached by Cambridgeshire County Council and the Cam Academy Trust to develop proposals to decarbonise Comberton Village College.

Bouygues E&S energy design manager Tom McGrath describes the process: 'We start each project by developing an energy baseline that provides us with an overview of the current energy consumption and carbon emissions of the site.'

'We then review potential decarbonisation options and quantify the impact of these for carbon and cost. The most effective options are then presented in a business case that demonstrates that the intervention will save X tonnes of carbon and energy annually, and will offer a financial payback of Y years.'

The metrics form the basis of an energy performance contract (EPC), in which Bouygues E&S guarantees that it will be achieved, says McGrath. 'We undertake responsibility for full design, planning and procurement, and include this in our





Bouygues E&S' senior project manager Ornella Sangermano, and Colin Marchant, site manager – clerk of works

investment-grade proposal, and this provides a significant amount of security to the client,' he adds.

Bouygues E&S was given a blank slate by Cambridgeshire County Council and the Trust, and its proposals included an option to upgrade the college's existing lighting installation to an LED-based solution, which would go some way to reducing its electricity consumption. It also included: the installation of photovoltaic (PV) panels on the roofs of some of the buildings, to help meet a proportion of the college's electrical demand from renewable sources; the addition of insulation to some of the heating circuits; and improvements to the building management system (BMS), to enable it to operate more efficiently.

The proposal also addressed the legacy of the college's ad hoc expansion over the years, which meant virtually every building on the campus had its own plantroom, many of which housed oil-fired boilers that were at the end of life and in need of replacing.

As part of its initial assessment, Bouygues looked at like-for-like replacement of the

various oil-fired and LPG-fired boilers with individual air source heat pumps (ASHPs). However, McGrath says it soon became apparent that this was unworkable for most buildings because of a lack of suitable external space and noise constraints for the heat pump condensers.

Instead, Bouygues E&S came up with a more radical proposal of combining all the satellite plant into a single, centralised system. This also had the benefit of removing the college's reliance on oil heating. 'The big-ticket item was that we saw an opportunity to decarbonise the college's heating significantly by installing a large-scale heat network using centralised plant,' says McGrath.

The decarbonisation programme started in 2019. Initially, what McGrath calls 'the more straightforward elements' were undertaken – replacing the lighting and the installation of 140kW<sub>p</sub> of PVs. 'As soon as the college saw the impact of these interventions on its carbon footprint, its ambitions grew and we were tasked with further developing the heat network proposal,' says McGrath.

The starting point for developing the



» detailed design for the heat network was to make an assessment of the college's peak heat demand. 'All we had to go on was the number of boilers, some of which had known operating efficiencies, and incomplete sets of fuel oil and LPG delivery notes,' says McGrath.

To try to quantify the peak heat demand, external consultants were employed to undertake a heat loss assessment for each of the college's buildings. By combining this information and the fuel consumption data, a notional peak demand of 705kW was estimated. However, when it came to sizing the system, because of the uncertainty about the accuracy of the peak heating, and to increase the system resilience, the system was sized based on two 500kW Carrier ground source heat pumps (GSHPs), providing a total peak output of 1,000kW.

These deliver heat at 65°C to a 15m<sup>3</sup> buffer tank that smooths out the fluctuation in demand and allows the heat pumps to operate at their optimum setpoint. Hot water is then pumped from the thermal store around the campus to 11 individual plantrooms through insulated pipes, which are either buried or attached to buildings.

As an additional contingency, an electrode boiler has been installed, which has the capacity to meet the peak demand and can provide top-up heat as and when required, such as if a heat pump is out of service.

The heat pumps draw heat from ground loops contained in 60 boreholes, each 200m deep, located beneath three of the college's car parks: 30 boreholes in one, 18 in another, and 12 in another. The boreholes are spaced at one per 9m<sup>2</sup>.

'One of the biggest challenges was installing boreholes on a live site where parking is at a premium,' says McGrath. 'To mitigate this,



The two 500kW ground source heat pumps



New pipework installed for the heat network

we spread them over the various car parks and phased the installation to minimise disruption to parking. This was a real success for the project and wouldn't have been possible without the close relationships developed between the client, design team and project managers.'

Bouygues E&S did consider air source instead of ground source, but the same issues of a lack of space and concern about noise from the condenser fans made this impractical. It also considered other heating options, including biomass and direct electric, which would decarbonise the college over time as the Grid decarbonises.



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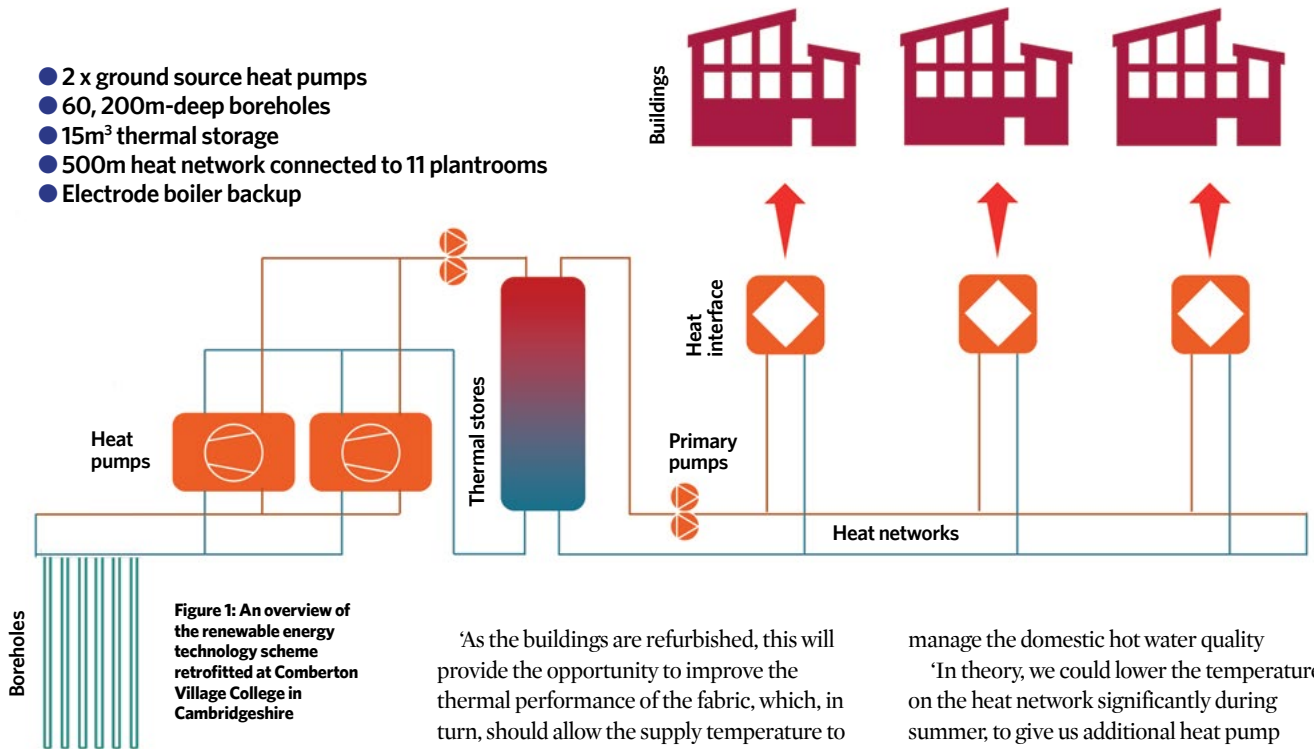


Figure 1: An overview of the renewable energy technology scheme retrofitted at Comberton Village College in Cambridgeshire

‘If you want heating costs comparable with those of gas, then you need to use heat pumps,’ says McGrath.

To maximise the operating efficiency of the GSHPs, the heat network is designed to operate at a system temperature of 65°C flow, 55°C return, which is lower than the existing heating. At these temperatures the heat pumps are expected to operate with a coefficient of performance (COP) of approximately 2.7.

Bouygues E&S had to assess whether the reduced system temperature would render the college’s existing radiators and fan convector units undersized for the space. McGrath says heat loss assessment data showed that it was primarily the fan convector units that would have to be replaced because, at the lower circuit temperature, their output dropped to the point where it was insufficient to meet the heat demand. ‘Generally speaking, 70% of the emitters are able to cope with the reduced temperature, so only about 30% of emitters needed to be upgraded,’ he says.

Improvements to the thermal performance of the building fabric was outside the scope of the project. Instead, fabric improvements will be carried out ‘as and when each building is refurbished’, says McGrath, which will reduce the amount of energy needed by each building over time.

‘What we have said to the school is: “You’ve currently got a boiler supplying, say, 100kW of heat to a building, so – under the decarbonisation scheme – we’re going to install a plate heat exchanger that will deliver an equivalent heat output,’ he explains.

‘As the buildings are refurbished, this will provide the opportunity to improve the thermal performance of the fabric, which, in turn, should allow the supply temperature to drop and further improve the efficiency of the heat pumps’.

An incidental benefit of replacing the large, ageing fossil fuel-fired boilers with much smaller heat exchangers is that the project has improved maintenance access significantly.

Currently, the system is designed to operate year-round at 65°C, while there is no space heating demand in summer, there is a swimming pool, and the system supplies hot water to calorifiers throughout the site.

As a result the domestic hot water temperature needs to remain above 60°C to

manage the domestic hot water quality

‘In theory, we could lower the temperature on the heat network significantly during summer, to give us additional heat pump efficiency improvements, but we’re restricted because of the hot water demand,’ McGrath says. ‘The intention in the future, as the calorifiers are replaced, is that we will be able to drop the system flow temperature to 45°C in summer, and use this to preheat the hot water, and then use electric immersion heaters in the hot water cylinders to top up the water temperatures.’

Altering the system flow temperature in summer is the only major change planned. Although the capacity of the heating system can, in principle, be expanded



“Bouygues E&S had to assess whether the reduced system temperature would render the existing radiators and fan convector units undersized”



**"It will be a showcase for retrofitting renewable energy technologies and heat network installations to deliver long-term carbon emissions reductions"**

» incrementally later to supply other heat demands, constraints on plantroom space and space for new boreholes mean there is no capacity to extend the scheme beyond the college boundaries – to serve local residents, for example.

However, Cambridgeshire County Council, again working with Bouygues E&S, has built a low carbon heat network at nearby Swaffham Prior (see *CIBSE Journal* February 2022), which it may look to reproduce elsewhere in the county.

The heat decarbonisation project at Comberton Village College started in October 2021 and the heat network has been running since January – although the scheme has not yet reached practical completion.

'One of the things we have had to make clear to the college is the importance of

the operational strategy,' says McGrath. 'At the end of the year, when we do the energy reconciliation [see panel, 'Funding the decarbonisation of heat'], if the scheme is using more energy than we anticipated we need to be able to understand whether this is related to design or an intervention from the college's facilities management team.'

The pioneering project is expected to become a showcase for retrofitting renewable energy technologies and heat network installations to deliver significant long-term carbon emissions reductions and future life-cycle costs.

While projects such as Comberton are novel now, they are set to become the new norm as colleges and local authorities continue to move away from fossil-fuelled combustion to heat their buildings. **CJ**

**FUNDING THE DECARBONISATION OF HEAT**

'The only way a decarbonisation scheme like this could work financially is if there is funding available to support the capital cost of the work,' says Tom McGrath, energy design manager at Bouygues E&S UK.

The Comberton Village College project has been funded by a £1.9m government grant from Phase 2 of the Public Sector Decarbonisation Scheme (delivered by Salix Finance) and a £1.2m investment from Cambridgeshire County Council.

The Cam Academy Trust, of which Comberton Village College is a member, has entered into a 'managed services agreement' with Cambridgeshire County Council to fund plant not covered by grant funding. This arrangement allows the council to recover its capital investment while still delivering a net operational saving to the trust.


For its part, Bouygues has to deliver an 'investment-grade proposal'. This defines what the design and build contractor is going to deliver, and at what cost, and puts a figure on how much energy the scheme is expected to consume in use.

Energy consumption will be monitored annually. There is a yearly reconciliation based on measuring and verifying the actual performance of the system. If the performance is within an acceptable variance, everyone is happy. If the scheme uses more energy than it is supposed to use, Bouygues is responsible for funding the overspend – then this is either banked to cover any overspends, or used to pay back the project earlier.


'We're confident the project will deliver as expected, but with the guarantee, it de-risks the project for the client because, if it doesn't deliver what we said it would, then Bouygues will pick up the shortfall,' says McGrath.



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A cutaway view of a WholeHouse design

Travis Perkins' WholeHouse digital design platform allows housebuilders to deliver efficient, repeatable housing to the latest sustainability standards, and includes prefabricated heat pump systems. Alex Smith reports

# 'BEAUTY IN STANDARDISATION'

To meet the UK's carbon-reduction targets, the Prime Minister's Ten-Point Plan established an ambition to grow the heat pump market to 600,000 installations per year by 2028.

The current reality is that a paltry 60,000 were installed in the UK last year – which, at two heat pumps per household, put the country at the bottom of the European heat pump league.

To increase the number of installations in new homes, the government is taking a 'big stick' approach and proposing to ban gas and oil boilers in new homes from 2026.

It's a huge challenge, especially for small to medium-sized housebuilders that are familiar with gas boilers, and may not have the resources to design and develop homes based on alternative heating systems.

Building merchant Travis Perkins has recognised this predicament and launched a

digital platform called WholeHouse, aimed at streamlining the design and delivery of low carbon homes.

Lee Jackson, WholeHouse director at Travis Perkins, says the industry lacks the skilled workers required to meet government heat pump targets, and a new digital approach is required that simplifies design and installation, and encourages the prefabrication of building systems.

'I've opened too many airing cupboards where I've been met by a wall of pipework that's 15 layers deep,' says Jackson. 'The average plumber has spent years installing combi boilers, and now they are expected to put back in a cylinder and install an air source heat pump [ASHP].'

Without help, Jackson believes plumbers will have to learn from job to job, and will deliver inefficient heat pump systems until they have gained experience.

WholeHouse is a 3D online design tool that allows the housebuilder to design any



Baxi's is the only appropriate heating system featured in the software at the moment

size home using a variety of materials and systems, including heat pumps. The software has strict parameters to ensure whatever is selected leads to the most energy efficient and cost-effective design possible. Once a design is settled on by the user, the program produces a set of drawings and the bill of materials in just 45 minutes.

In developing the software, Travis Perkins assembled a team of 20 suppliers and consultants to come up with design parameters that guarantee the software's outputs are optimised for cost and energy efficiency.

'Upfront design is undervalued in housebuilding,' says Jackson, who is a trained architect. 'It's critical, with new technologies, to make sure the design is correct – then we have a fighting chance of delivering what we intend to.'

Some designs, such as the heating system, can be prefabricated off site, which cuts down on waste and reduces the need for



**"It's critical to make sure the design is correct – then we have a fighting chance of delivering what we intended to do"**

people on site. Jackson calls this process 'the industrialisation of design'.

The designs are incorporated in the software, alongside the latest housing standards and calculation methods, including SAP 10 and the CIBSE *TM59 Overheating risk calculation*, which is included in the latest Part L of the Building Regulations. This means that if users change window sizes, for instance, the software will automatically adjust other elements – such as insulation – to ensure compliance with Building Regulations.

Radiator sizes will be adjusted according to whether a boiler or heat pump is used as the heat source, and the system automatically inserts the most efficient pipework runs for plumbing, and ductwork for ventilation, positioning the necessary voids and holes

## ACCOUNTING FOR EMBODIED ENERGY

WholeHouse is looking to include embodied energy figures in the software to allow whole carbon calculations to be made. If a manufacturer has an Environmental Product Declaration (EPD), this will be plugged into the software and replace generic figures in the calculations, to give better overall results for carbon. Recognising the low embodied energy of their products will be a 'commercial benefit for manufacturers to use EPDs', says Jackson, who adds that the accurate designs and prefabrication will help minimise the number of components required and the amount of overall waste.

in the floors and joists. It can include photovoltaics and decentralised mechanical extract fans, while more sophisticated mechanical ventilation with heat recovery units are also included.

One of the design partners is Baxi Heating, which supplied details of 160 understairs configurations featuring its range of ASHPs, water cylinders and pumps. (Gas boilers are also included.)

Andrew Miele, senior application engineer, offsite, at Baxi, was responsible for ensuring the design outputs did not feature a tangle of pipes in the understairs cupboard. By working with other partners on the design, he was able to ensure the plantroom was as streamlined as possible and could be prefabricated in the Baxi factory.

It was decided by WholeHouse team to locate the cylinder under the stairs with the rest of the heating system, because it only took up 0.9m<sup>2</sup> of floor space compared with 1.5m<sup>2</sup> of floor space if it was in an upstairs utility cupboard.

Baxi worked closely with staircase manufacturer Staircraft to devise an efficient heating design that worked in the spaces created by the risers and treads. Staircraft provided Baxi with a staircase to create a

prototype that validated software designs and calculations. The mock-up will soon be installed at a Baxi training facility.

To improve the efficiency of the design, Baxi also requested that a wall be moved 100mm, something that would have been impossible in a regular build, where Baxi would have come onto the project at a much later design stage.

Miele says he was given much more time to optimise the design: 'In other projects, I will try to feed in design suggestions, but you can only make limited changes. Whereas here, everything's up for discussion.

'Going into this amount of design detail was of great benefit to us, because we can then repeat the design in the factory.'

Baxi used its experience with prefabricated utility cupboards and commercial heating and cooling systems to feed into the design discussions.

With more standardisation of design and repetition, offsite manufacturers will be able to achieve better economies of scale, says Jackson. They will also be able to plan for production because WholeHouse knows when working designs have been downloaded and when materials and systems need to be manufactured. 'The visibility >>



**A prototype helped Baxi position its heating system under the staircase**

» means that Baxi can make sure its supply chain is always sized to suit the demand coming through,' says Jackson.

Any manufacturer can potentially have its products featured in WholeHouse – there are a number of suppliers' door kits featured, for instance – but Jackson says Baxi's is the only appropriate heating system featured at the moment.

A digital twin of the house is created, which can be used in the future if, for example, the occupier wants to add an extension (the project teams purposely created designs that could be extended in the most efficient and economical way possible).

It has not yet been decided who takes ownership of the digital twin – it could be WholeHouse or it could be the regional housebuilder. 'It will be whoever adds the most value,' says Jackson.

The first two houses designed using the system are nearing completion and Jackson has ambitious plans for the system. As well as targeting the SME housebuilder market of up to 2,000 companies, he thinks it could also be used by selfbuilders and

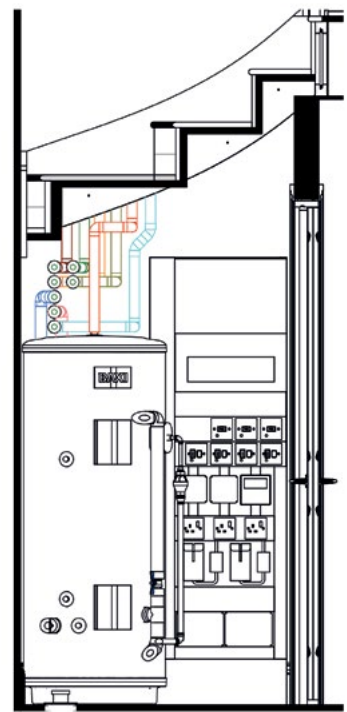
major housebuilders, with whom he is already in discussion about using elements of WholeHouse.

Jackson has also had talks with the Health and Safety Executive about incorporating manuals into the software and highlighting known safety issues. 'We can bring more people to WholeHouse to refine the software further and iron out other issues,' he says.

While Travis Perkins is advocating a standardised approach, it doesn't mean that homes will look the same everywhere. This is part of the appeal to regional housebuilders, as they can reference the local vernacular with their choice of materials, says Jackson.

There is 'beauty in standardisation', he adds, with some of Britain's best, most historical housing being based on only two or three house types, such as the Royal Crescent in Bath and Islington's Georgian townhouses.

'Pattern books are a fundamental part of our history of architecture and the landscape of towns and villages,' says



WholeHouse's drawing of a cylinder under the stairs

Jackson, who is talking to The Prince's Foundation about using WholeHouse in heritage developments.

'We tend to associate the term "house types" with some of the homes that major housebuilders churn out, but we shouldn't think of standardisation in that way,' says Jackson. CJ

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# Considerations for low flow temperature heating

Last June, changes to England's Building Regulations came into force to help the UK meet its net zero carbon emissions target by 2050.

The regulations now stipulate that new and replacement wet space heating systems in domestic and non-domestic buildings must be designed with a maximum flow temperature requirement of 55°C or lower. When a heat pump is installed, they state a flow temperature of 45°C should be used. This is a step in the right direction, but does not go far enough. Heat pumps are much more efficient at lower flow temperatures. At a flow temperature of 45°C the coefficient of performance (COP) could typically be 3.7; at 35°C, the COP could be as high as 5.0. This 10°C drop in design flow temperature increases heat pump efficiency by a massive 35%.

## Choose wisely

Selecting the right emitter that works most effectively at these lower temperatures is crucial. Traditional steel panel radiators have been the go-to emitter for many years. At low flow temperatures however, their surface area needs to be much larger, resulting in overly

large radiators that can be unsightly and take up precious wall and living space.

Underfloor heating can be seen as an option, but its high mass and high water content mean it's slow to react to temperature demand.

## The engineer's choice

Jaga's heat pump radiators have been designed specifically for engineers, to help them maximise renewable technology efficiency. They are smaller, lighter, faster and much more energy efficient thanks to their low water content heat exchanger (90% less than steel panel radiators), and unique dynamic boost hybrid (DBH) technology.

DBH technology consists of a set of low noise thermal activators that sit directly on top of the low water content heat exchanger.

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As well as powerful heating, Jaga's hybrid radiators can provide light cooling (non-condensing) with any heat pump that can supply cooled water – a completely unique function, designed by Jaga in response to increasing demand for comfort cooling in our warmer summers.

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Three CIBSE-accredited continuing professional development (CPD) seminars for HVAC professionals are available from Jaga.

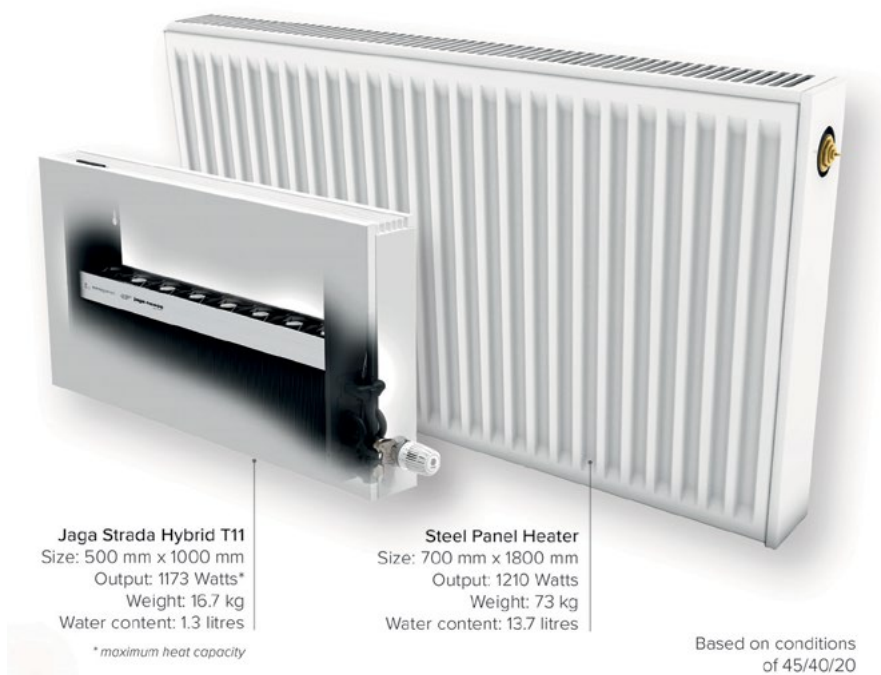
They can be presented to a group in-person, at your premises, or virtually, via Teams. All attendees will receive a certificate of course completion, which counts towards their annual CPD obligations.

- 1 Emitters: considerations for low flow temperature heating
- 2 Design and specification of trench climate convectors
- 3 Ventilation in schools

## Design support

Jaga provides full design support for engineers requiring assistance with emitter selection, sizing and control strategy. Our technical engineers are available across the UK to support from the initial design concept through to final commissioning and handover. BIM files are available for nearly all product ranges.

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# FORMULA FOR SUCCESS: SIZING HEAT PUMPS IN HYBRID ENERGY CENTRES

Reducing the size of heat pumps in hybrid energy centres can cut carbon and capital costs dramatically – but what ratio of heat should they supply? Research by FairHeat's **Ellie Hiscock** used hourly load modelling to come up with a rule of thumb for the optimal heat ratios for heat pumps and thermal storage with electric boilers

**T**he UK is making strides towards decarbonisation of its electricity grid, and heat pumps are playing a crucial role in this transition. Most new heat networks are now shifting towards all-electric heat generation, with heat pumps replacing gas combined heat and power (CHP) as the lead heat generation source.

However, there can be a significant increase in spatial requirements and capital expenditure when using heat pumps as the lead heat-generation source for heat networks, compared with gas CHP and gas boiler solutions.

To tackle this issue, I propose a hybrid approach that combines heat pump and thermal storage with electric boilers. Thermal storage increases operational flexibility of heat pumps and maximises the annual target heat fraction that can be provided by the heat pumps.

My research, *How hourly load modelling is revolutionising heat pump and thermal store sizing in hybrid energy centres*, was presented at the CIBSE ASHRAE Technical Symposium 2023, at the University of Strathclyde, Glasgow, in April ([www.cibse.org/symposium](http://www.cibse.org/symposium)).

It provides a 'rule of thumb' for hybrid energy centres to support designers and developers early in the design stages, ensuring that heat



Thermal storage system in a district heating energy centre

pump size and thermal storage capacity are optimised to achieve the required target heat fraction contribution, which is the proportion of the total annual network consumption that is provided by the heat pumps.

The heat pumps are sized to deliver the majority of the site-wide annual heat demand, with large thermal storage used to reduce the required heat pump size by storing heat during times of lower demand and using it during periods of higher demand. Electric boilers are sized to act as 'top up' during periods of peak load demand.

It is important to consider equipment sizing early on in the design stages, as such decisions could be constrained later by architectural layouts, floor plans and building elevations. This is where my research comes in.

## Modelling heating and hot water use

In my research, an hourly load model was built, which aims to model the domestic hot water (DHW) and space heating usage that can be assumed for each hour across an entire year for any given development.

The model takes into account several inputs to investigate the impact of equipment sizing on the heat pump's annual heat fraction contribution. These include: heat network heat losses; heat interface unit heat losses; DHW hourly profile; space heating hourly profile; and annual DHW and space heating loads.



**“If the heat pump is undersized and unable to meet the required target heat fraction, end users will see a significant increase in costs”**

» To be as flexible as possible, the model allows for easy variation of building size, DHW, space heating loads, expected heat losses, and geographical location. By doing this, the impacts of these factors on heat pump and thermal store sizing can be easily understood and assessed. The final model was then validated against load profiles taken from operational heat networks to provide confidence in the findings of the research.

While there are many benefits to oversizing thermal storage, a key constraint will be the spatial requirement within the energy centre. This is especially key when comparing this with traditional CHP thermal storage, which operates at higher temperatures and, therefore, requires a smaller volume.

The hourly load model allowed the thermal storage size to be modelled against the heat pump to determine the point at which any increase to thermal storage will have minimal impact on reducing the heat pump size. The study found that, as a rule of thumb, thermal storage should be sized at 50-75LkW<sup>1</sup>, as shown in Figure 1. The percentages under the graph represent the annual target heat fraction contributions (for the heat pumps).

Because of the impact of the higher electricity tariffs compared with gas, it is critical that heat pump sizing is considered carefully. If the heat pump is undersized and unable to meet the required target heat fraction, end users will see a significant increase in their cost of heat because of the reliance on electric boiler top-up.

Equally, oversizing a heat pump presents a number of challenges, particularly when considering the spatial requirements against a gas CHP or gas boiler solution.

As such, the hourly load model was used to provide a rule of thumb for a given target heat fraction contribution as a percentage of the site-wide peak load. The findings demonstrate that a target heat fraction that is as high as 99% of the site-wide annual demand can be achieved by installing heat pump capacity of less than 50% of the peak load (see Figure 2).

A summary of the ‘rule of thumb’ findings are presented in Table 1. These findings provide a benchmark to support developers and designers early on in the design stages, to ensure energy

Thermal store size vs heat pump size

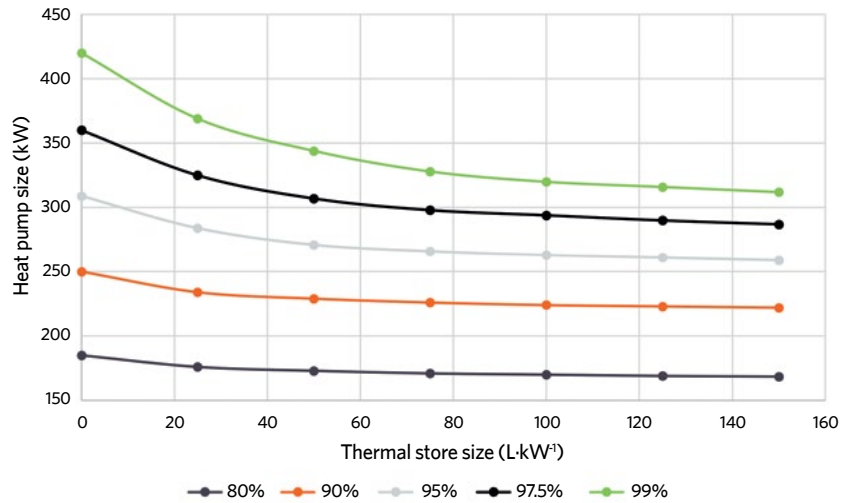


Figure 1: Impact of thermal store size against heat pump size

Heat pump size vs target heat fraction

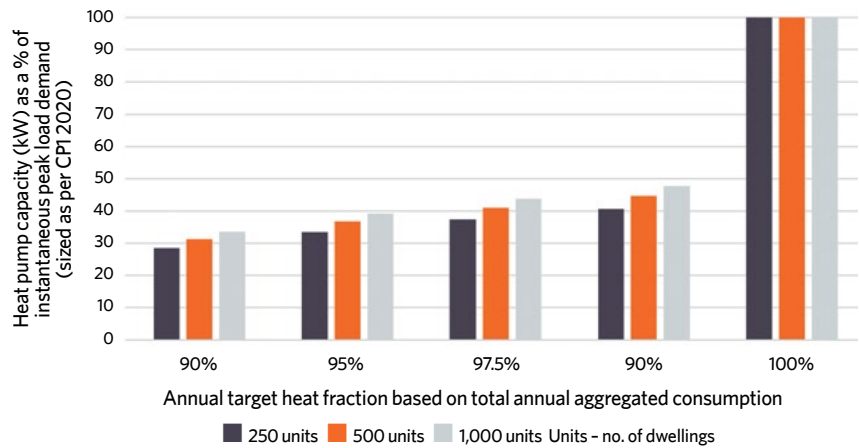


Figure 2: Heat pump size against target heat fraction

centre sizing is fully considered until more detailed design calculations can be carried out at a later stage.

In conclusion, the research demonstrates that sizing a hybrid system for a heat network requires careful consideration of various factors, including the capacity of the heat pump and thermal store. Designers must take spatial limitations into account when estimating the required heat pump and thermal store size, to ensure these will not be constrained later in the design development, when the risk of undersizing will be critical.

The research provides targeted guidance for sizing heat pumps and thermal storage at concept design, in advance of detailed design, helping to pave the way towards more efficient and sustainable heat networks in the UK. To read the research paper, visit the ‘Research & writing’ page on FairHeat’s website: [fairheat.com/research-writing](http://fairheat.com/research-writing)

■ ELLIE HISCOCK is a consulting engineer at FairHeat

Target heat fraction	Heat pump size (% of peak load)
90%	30 ± 10%
95%	35 ± 10%
97.5%	40 ± 10%
99%	45 ± 10%

Table 1: Summary of ‘rule of thumb’ for heat pump sizing

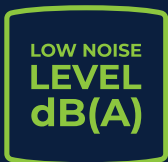
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The government's new *Heat Network Optimisation Guide* aims to improve the performance of existing networks by rigorously analysing performance and making cost-effective interventions that maximise efficiency. **Alex Smith** reports



# PHASED APPROACH: OPTIMISING HEAT NETWORKS

**H**eat networks are a key part of the government's strategy to decarbonise heat. While they currently only provide 2% of the heat used in buildings, the Climate Change Committee estimates that around 18% of UK heat could come from heat networks by 2050, to support cost-effective delivery of carbon targets.

There are around 14,000 heat networks in the UK, but government-funded analysis over the past eight years has revealed a myriad of issues affecting performance that risk undermining the government's goal of providing affordable, low carbon heat. To address the situation, the Department for Energy Security and Net Zero last month published a *Heat Network Optimisation Guide*. Targeted at consultants and specialists, it aims to standardise the performance of existing residential and mixed-use heat networks – but the principles apply to all heat networks.

'The main purpose of this guide is to provide a standardised set of processes and approaches that anyone who is undertaking optimisation can use, with the aim of providing a standard minimum quality,' says co-author and FairHeat lead engineer Tom Burton.

The guide complements the Heat Networks Technical Assurance Scheme (HNTAS) guidance, which – together with the CIBSE Heat Networks Code of Practice – will legally oblige heat network operators to adhere to minimum technical standards from 2025. Its objective is to identify the root of suboptimal performance and outline business cases for improvements (see panel, '16 common reasons for failure').

Burton urges the industry to get behind the guide: 'The more engineers and specialists there are providing operators with the information they need to improve customer experience and efficiency, then the closer we will

be to providing low carbon, affordable heat to residents, and a reliable level of service.'

The guide is based on heat network investigations by FairHeat in two government programmes: Heat Network Optimisation Opportunities and the Heat Network Efficiency Scheme Demonstrator. Key performance indicators (KPIs) based on this analysis capture the underlying performance and resilience metrics of heat networks, and feature in the optimisation guide. 'They feed into both the cost and carbon intensity of heat,' says Burton.

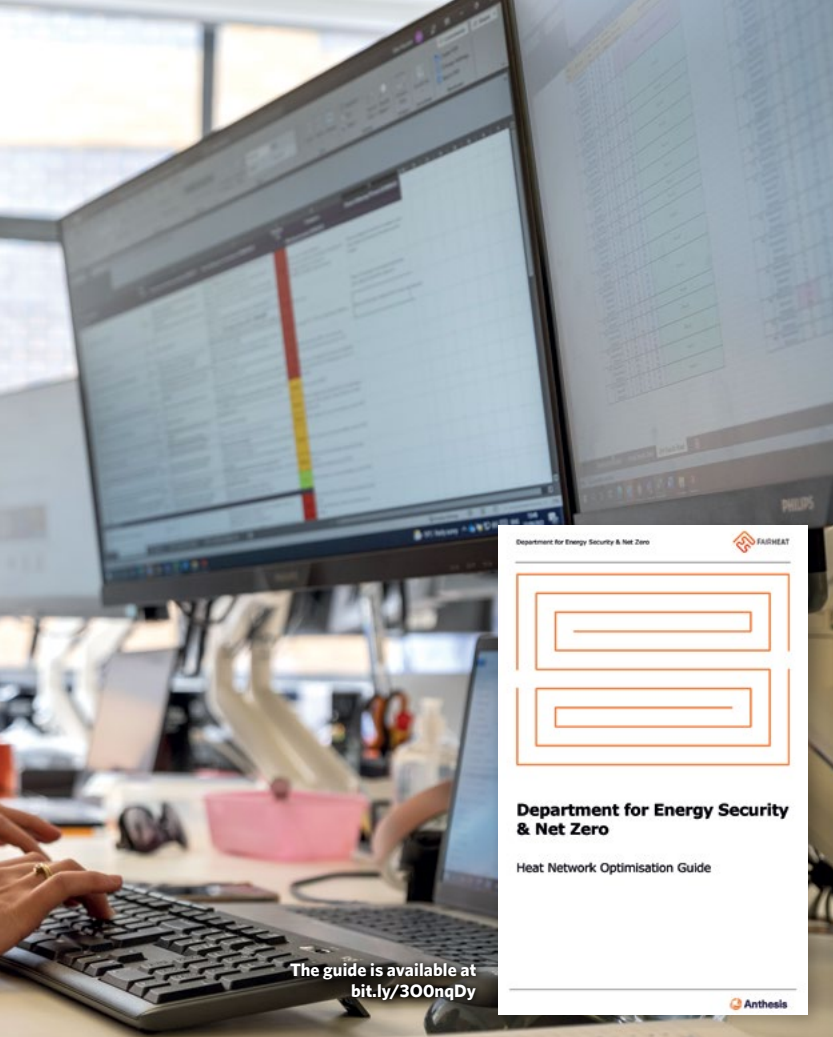
## Four-phase approach

The guide recommends taking a four-stage phased approach: understand; stabilise; easy wins; and continuous improvement. Once root causes have been understood, the stabilisation of a heat network should take place to improve performance and reliability, it says. Easy wins can then be carried out that have short payback times but require more planning and design.

The continuous improvement cycle is designed to enhance performance over a long period. It has four repeating stages – measure, analyse, test, and implement. Consumer heating systems have the biggest impact on performance, followed by district/communal distribution systems and energy centres, says the guide. End users are at the top of the optimisation hierarchy because their requirements dictate the minimum flow temperature at which the network can operate.

Minimising flow and return system temperatures results in the lowest possible heat losses across the entire heat network. As the minimum flow and return temperatures are largely set by dwelling equipment, they are the most important element to optimise, states the guide, which describes typical measures to stabilise the network, and lays out easy wins and continual improvements. Of key importance is stopping uncontrolled network flowrates, which can result in high pump energy consumption and higher heat losses. The three main actions to get network flow under control are: removal of network bypasses; elimination of end user bypasses; and control and/or replacement of pumps.

Often, a small proportion of dwellings are responsible for most of the flow on the network, which means it only takes a few bypassing units to have



The guide is available at [bit.ly/30OnqDy](https://bit.ly/30OnqDy)

a significant effect on performance across the whole network. Poor water quality can also have a significant impact on performance.

Easy wins and continuous improvement measures include reducing flow and return temperatures. The guide says most systems are oversized, offering the potential to reduce flow temperatures and lower heat losses. To cut return temperatures, there should be a focus on the performance of system dwellings and removal of network bypasses across the system.

Over-complexity is a common reason for underperformance, says the guide, such as: unnecessary hydraulic separation resulting in low seasonal coefficients of performance (SCOPs – see Figure 1); separate distribution pumps for each block when one would do; and redundant equipment that

has not been disconnected. It recommends a hierarchy for optimisation improvement, from repair through to recommission, upgrade/improve and, finally, replace.

There is a detailed description of the optimisation process, broken down into nine steps across three phases: initial investigation; techno-economic options appraisal; and implementation plan. There is also a pre-project phase, in which the engineer understands the client's aims and the project scope is agreed.

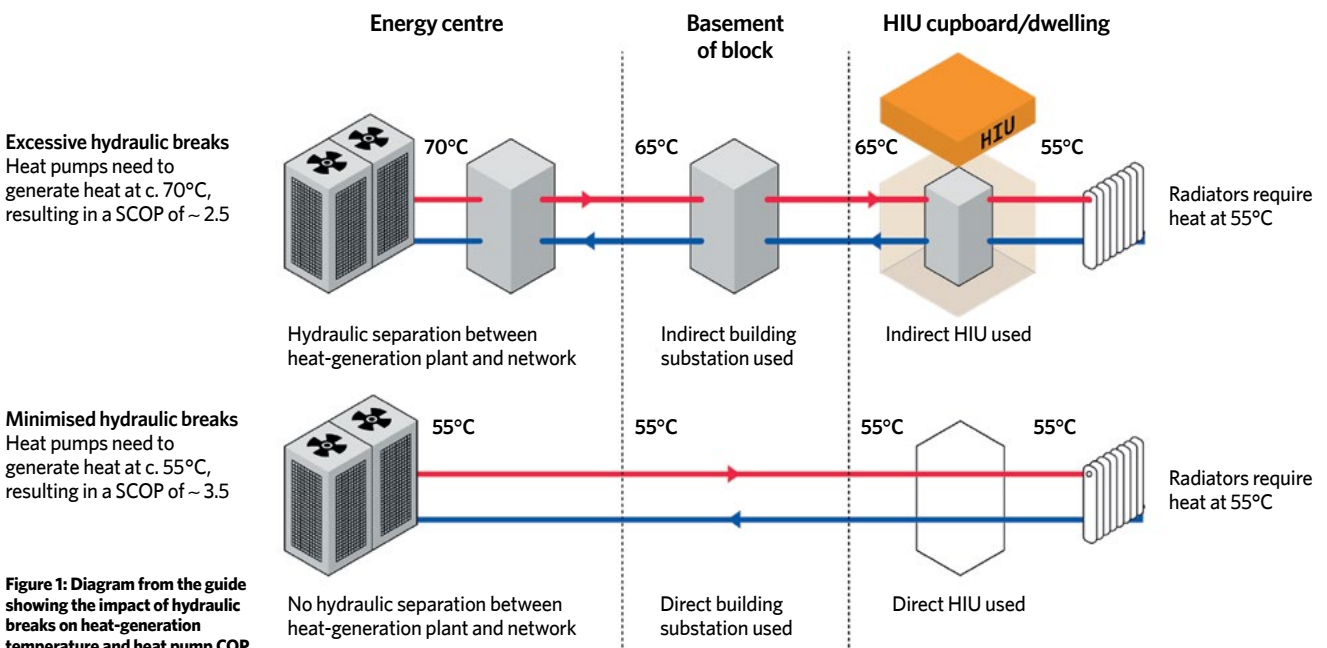
The Phase 1 assessment is to gain a full qualitative understanding of system performance and issues, while Phase 2 is to gain a full quantitative understanding of them, and the impact on system performance of addressing issues. This impact is compared against initial costing to indicate the business case of potential interventions. This includes a root-cause analysis of issues and a KPI assessment of performance and potential interventions.

Phase 3 is to gain an understanding of costs, to develop a business case and implementation plan.

**Key performance indicators**

The guide recommends using KPIs for quantitative analysis of heat network performance using data from the building management system, heat meters and utility bills. This helps with understanding the performance of existing heat networks and evaluating the impact of improvement measures. There are KPIs for energy centre, heat network and dwelling performance, as well as for reliability, costs and carbon/air quality impact. The most important relate to heat loss, which can be compared with other networks.

For the dwelling, there are KPIs measuring overall average return temperatures, as well as figures for domestic hot water and space heating. The energy centre KPIs have a metric for heat generation efficiency, as well as flow and return temperatures. Other KPIs target flow-temperature >>



**Figure 1: Diagram from the guide showing the impact of hydraulic breaks on heat-generation temperature and heat pump COP**

» stability, maintenance frequency, and time below minimum flow temperature, which reflect the reliability of the system for end users.

There is also a KPI for carbon intensity of heat. ‘This is very useful for operators, as they can look at the KPI numbers across portfolios and see the worst-performing systems and where to prioritise spending,’ says Burton.

**Site audits and making a business case**

There is a section in the guide on conducting site audits, which are designed to determine the condition and method of operation of heat network elements. It lays out the audit process, as well as data analysis and modelling techniques that can be used to assess performance.

The section on making a business case looks at two methodologies to analyse financial impacts of potential interventions: simple payback and net present value. There is also a section on interventions that do not have a direct impact on performance, but that reduce operational

risk, such as improvement in water quality. It includes a process for identifying and mitigating risks.

**Knowledge requirements**

For studies, the guidance defines two roles: study lead and study engineer. The study lead is accountable for the technical quality of the report, conclusions and recommendations, and should have more than five years’ experience in the heat network sector. Study engineers, with a minimum of two years’ experience, lead the onsite audit and are responsible for managing the technical and financial analysis of the optimisation study.

**Template scope of works**

A separate version of the optimisation guide, the *Template Scope of Works*, is aimed at operators. It can be used to procure an optimisation study and be appended to a tender pack, and has an outline of the process and knowledge requirements. ‘Operators can ask for a quote based on this document and anyone undertaking the work has to follow the guidance,’ says Burton.

There are also videos for operators, to help them understand the technical language and identify when heat networks are not performing.

The optimisation guide is essential for anyone operating a heat network – and not just because it will cut carbon and reduce heating bills. Burton says a form of the KPIs will be included in the mandatory HNTAS, and adds: ‘It’s likely that there will be a requirement for existing heat networks to put in a plan to get from current to compliant.’

**16 COMMON REASONS FOR FAILURE**

Key failures in heat networks were identified following the review of existing systems by FairHeat. Burton says that many systems will be failing for at least one of these reasons:

- 1 Insufficient consideration of heat network requirements at concept design stage
- 2 Incorrect sizing
- 3 Unnecessary complexity
- 4 Unsuitable hydraulic arrangement
- 5 Poor insulation specification and installation
- 6 Poor planning and civil works for underground pipework
- 7 Poor underground pipework installation
- 8 Insufficient monitoring and data collection
- 9 Inappropriate design and commissioning of consumer connection and/or heat system
- 10 Lack of consideration given to system pressures
- 11 Lack of consideration given to maintainability
- 12 Poor installation and commissioning practices
- 13 Inefficient control
- 14 Uncontrolled network flows
- 15 High return temperatures
- 16 Poor water quality



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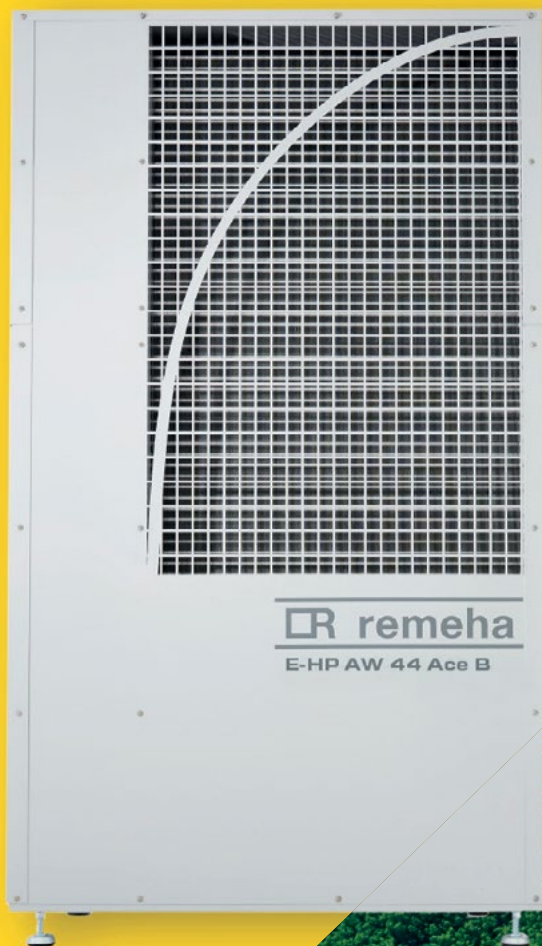
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# LIGHTING'S CRITICAL ROLE IN HEALTHCARE

As well as minimising infection risk, the big trend in healthcare lighting is circadian lighting. HDR's Karen Murphy looks at the latest research

**C**ovid-19 has had a lasting impact on lighting design in healthcare settings, with the minimisation of infection risk, flexibility of space and surge in telemedicine being key drivers in the profession.

Upper-air disinfection using ultraviolet-C (UV-C) light proved highly effective during tuberculosis outbreaks years ago, so it is no surprise that the industry turned to this technology again during the pandemic.

Robotic equipment with germicidal ultraviolet light is becoming more popular in hospitals to provide an extra layer of disinfection after surface cleaning during room turnover, and is used in air handling units to disinfect the supply airstream. It was employed in a new and innovative way to solve a critical problem during the pandemic; UV-C light was used by some institutions to mitigate the personal protective equipment (PPE) shortage by allowing for re-use of PPE.

This heightened public awareness of the disinfecting properties of UV-C, leading to many new products being introduced to the market and several existing products gaining a resurgence in sales.

Different wavelengths of light have different efficacies of disinfection and different risks for human exposure, yet are often marketed in the same manner. Facility staff should consult a trusted adviser who understands the range of products available, and who can guide them through the pros and cons of various methods and equipment, work through specific needs, and ensure these are met.

The CIBSE guide *Covid-19: Air cleaning technologies* ([bit.ly/CJIBCovid](https://www.cibsejournal.com/bit.ly/CJIBCovid)) allows users to assess the variety of air-cleaning devices currently on the market, and to discover which, if any, will reduce

transmission risk in a given space effectively. Evaluating marketing claims requires diving into the data and published research, to decipher which applications lend themselves to which technology.

## Flexibility

The pandemic also highlighted the need for flexibility. A shortage of patient rooms designed for airborne infection isolation and critical care forced hospitals to repurpose standard medical-surgical rooms and revamp protocols. Critical care patient rooms require higher illumination levels on the patient bed than standard patient rooms. The new trend for adaptable patient rooms means that these rooms must be designed with higher illumination capabilities. Fortunately, LED lighting permits easy and smooth dimming to accommodate this flexibility.

Traditional patient rooms have multiple zones of switched lights. Moving to an environment where the lights are dimmable gives patients and staff greater light control, allowing illumination to be tuned to the specific needs of the person and of the task being performed.

## Telemedicine

The third shift is the expanded use of telemedicine, such as video conferencing, which increased at the onset of the pandemic. As the medical community evolved for telemedical visits, lighting specialists worked to develop best practices and new guidelines for video conferencing. By understanding the principles of key light, fill light and background luminance, as well as flicker mitigation and colour rendition, lighting designers can enhance the experience and effectiveness of telemedicine.

## Circadian-supportive lighting design

One trend in healthcare facilities that is not a consequence of the pandemic, but of research, is circadian-supportive lighting design.

Natural circadian rhythms are slightly longer than 24 hours: it is light (and dark) that maintains circadian rhythms on a 24-hour cycle. They can be impacted by five lighting factors: intensity (amount of light), spectral power distribution (wavelength), duration (length of exposure to light), timing (time of day when light exposure occurs) and light experience (accustomed personal exposure to light). More than one-third of the human genome is controlled by circadian rhythms, and more than half of all the drug-response pathways are clock-controlled.

In hospitals, dynamic lighting systems that simulate nature's day-night cycle have proven to be beneficial to patients and healthcare providers. Nightshift workers are at high risk of circadian disruption.

Our body produces cancer-fighting T-cells at night while we sleep. Newborn babies are getting their circadian stimuli through the environment instead of in utero, through their mother's hormones. Lighting is no longer just about visual performance: its physiological impact on our bodies is equally as important.

Implementing the latest lighting technologies and market trends helps create the most supportive healthcare environments for patients, visitors and staff. **C**

■ **KAREN MURPHY** is lighting director at HDR Building Services



# FRESH APPROACH TO HEALTHCARE

Standardisation and collaboration are key to meeting the government's 40 new hospitals by 2030 target, according to leaders of the New Hospital Programme

**S**tandardisation will be at the core of the government's £20bn New Hospital Programme, according to those responsible for delivery.

In May, the government said funding for the programme had been increased to £20bn, to help meet the target of delivering 40 new hospitals by 2030.

Lord Markham, portfolio minister for the programme, and Morag Stuart, chief programme officer, provided an update on the progress being made under a new delivery body, at a webinar hosted by BESA.

Markham told BESA chief executive David Frise that a '2.0 standardisation approach'

was being adopted to streamline processes. 'We will specify routes to market by setting up frameworks for main contractors, and be very explicit about a standard that we want adherence to throughout all our hospitals', he said. 'This is a long-term programme.'

There is political consensus about ensuring consistency, with investment beyond this government's remit. Standardisation extends to components, including room designs, door types, and façade structures. For example, a staggering 27,000 door types are currently in use across NHS hospitals. The programme seeks to reduce this to 700, allowing greater efficiency and ease of maintenance, while retaining flexibility.

Stuart explained how the new-build programme would accelerate this development, emphasising the importance of the 'build-design-operate-maintain' model.


By using modern methods of construction, the programme can facilitate better production, and manufacture at scale and speed, she added. Prioritisation will be given to the mechanical and electrical public health cassettes, façades, and the single-room design and its physical envelope.

The programme aims to create digitally mature hospitals that prioritise patient wellbeing and recovery. Factors such as ventilation, natural light and indoor air quality play a crucial role in the patient experience. 'This isn't just vital to patient wellbeing, but shortens waiting times, and quickens the flow through hospital and how well you can use your beds,' said Markham.

The success of the programme relies on collaboration and engagement from various stakeholders, said Stuart, who added: 'We really need your input; we want to make sure we design with knowledge and expertise in hand.'

She said there is an opportunity for suppliers to invest and scale up while driving innovation in the healthcare sector, and she hoped that as many components as possible could be manufactured in the UK.

However, a lack of industry capacity makes it hard for contractors to invest in the long term. 'We are investigating the level of investment that will be needed to support the supply chain,' Stuart said. Balancing inflation and managing costs are critical factors that the programme aims to address through careful planning and strategic partnerships.

'We want to adopt a Nightingale spirit on this', Markham said, 'The RAAC hospitals urgently need to be replaced, so there is a knowledge we have to do things differently to meet that timescale'. 

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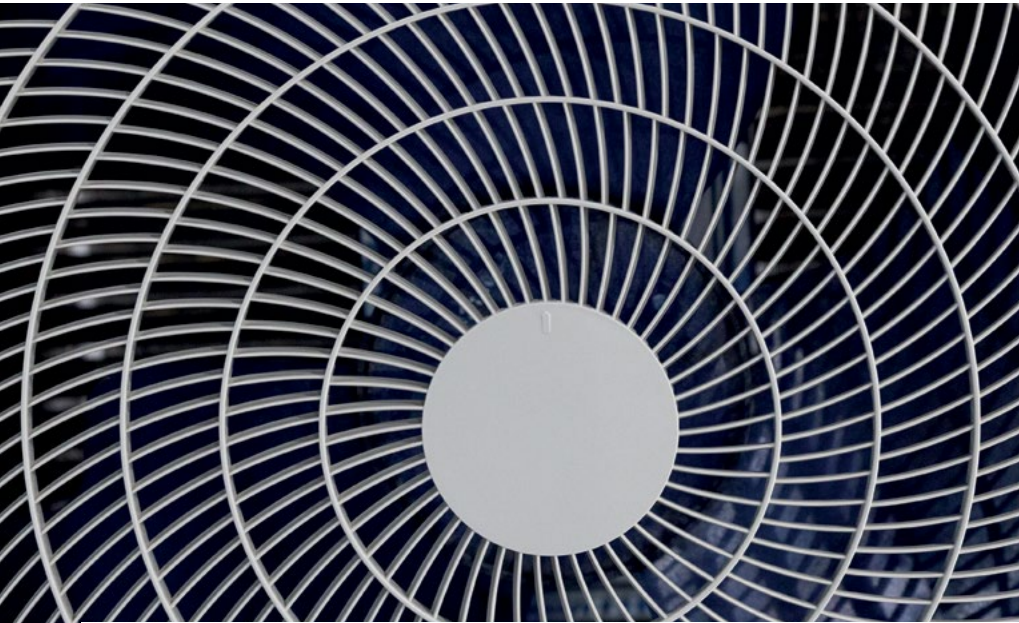
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## Air source monobloc heat pumps for refurbishment applications

This module explores the application of single-stage air source vapour compression monobloc heat pumps, particularly alongside gas-fired boilers, in existing buildings

In the UK, and elsewhere around the world, there are significant incentives for owners and operators of institutional and commercial buildings aimed at encouraging the adoption of heat pumps in new and refurbishment projects. This CPD will focus on the application of simple, single-stage air source vapour compression monobloc heat pumps, particularly where they are employed in conjunction with an existing (or new) gas-fired boiler to meet year-round heating demands in existing buildings in order to reduce operational environmental impact.

The growing demand for the installation of heat pumps is driven by environmental requirements and financial considerations – in terms of both lower operational costs and subsidised, or grant-aided, capital cost and installation. In existing buildings, financial assistance is typically provided to upgrade existing heating plant and, in recent years, several UK government incentives have focused on educational and other institutional facilities. Many such buildings are decades, or centuries, old and use high-temperature narrow ‘delta T’ systems, often designed to the historic low temperature hot water (LTHW) 82°C flow, 71°C return water temperatures that are now considered archaic, as well as wasteful of resources in both capital and operational terms. The current widely employed and commonly available simple heat pump technologies cannot reach those temperatures effectively; the thermodynamics of the vapour compression cycle and the properties of many of the commonly employed synthetic refrigerants make it impossible – or at least inefficient – to do so. Many heat pumps also require a narrower temperature difference across the condenser (which is used to heat the returning LTHW) than the historic 82/71 systems were designed for.

There are a variety of solutions available that can effectively produce higher temperatures and, in some cases, operate with wider temperature differences

across the condenser. These include high-pressure, transcritical CO<sub>2</sub> systems, ammonia and hydrocarbon (HC) systems, bivalent systems (which typically include a gas boiler, as well as a heat pump), and cascaded refrigerant cycles.

As noted in *Heat pump retrofit in London*,<sup>1</sup> before any systems are designed or installed it is preferable to maximise the energy efficiency of the building. Aside from the direct benefit of reducing the overall demand for heating, this will reduce the capital investment required for the heat pump systems, reduce the required LTHW flow temperatures, and potentially improve the useful building thermal capacity in order to store heat that can provide benefits from time-shifting peak loads. The guidance explains that, compared with gas boilers, heat pumps require a more detailed and accurate understanding of the heating and cooling demand. Oversized heat pumps can suffer from lower efficiencies, so correct sizing is essential for efficient operation that meets the building’s needs. This requires appropriate investigation, preferably from contemporaneous records or measurements of the thermal loads. Among the comprehensive and accessible coverage of heat pumps the recently published – and freely downloadable – CIBSE AM17 *Heat pump installations for*



» *large non-domestic buildings* notes that a load survey would ideally be based on continuous metering data.

Unlike gas-fired boilers, the performance of air source heat pumps (ASHPs) will be highly dependent on the source temperature – typically the outside air – and the LTHW flow temperature. So, for example, the monobloc heat pump (described in boxout, ‘Monobloc heat pumps’) shown in Figure 1 has a performance as described in the chart of Figure 2. The range in the coefficient of performance (COP) is such that, even at the lowest outdoor temperatures, it would indicate that, in carbon terms (based on 2022 UK carbon factors of 0.193kg of CO<sub>2e</sub> per kWh of electricity and 0.183kg per kWh of gas), it is still more effective to employ a heat pump rather than a natural gas condensing boiler. Currently, commercial UK electricity prices are approximately three times that of natural gas per kWh. This would mean that, in simple terms, for this example heat pump to be cheaper to operate than a 92%-efficient condensing boiler, the outdoor temperature would need to be higher than around 7°C.

As noted in *Heat pump retrofit in London*,<sup>1</sup> the LTHW flow temperatures required to meet the building heat loads can be reduced through a combination of reducing heat loss through energy efficiency improvements and upgrading heat emitters – for example, through larger or fan-assisted heat emitters. Every 1K reduction in flow temperature can increase heat pump efficiency by approximately 1.5% to 3%. This water flow temperature is a key variable, and there can be great benefit from careful consideration of the real needs of the building and the actual flow water temperature required – which might be quite different from the historic use. On the refrigeration side of the heat pump, the refrigerant condensing temperature is likely to be 2K to 4K warmer than the flow water temperature, and the evaporating temperature likely to be 5K to 8K cooler than the outdoor air temperature. For ASHPs, there are limited opportunities to provide sustained increases in the source temperature, although there may be a chance to benefit from a local warm air discharge from a process or other environmental system. AM17 highlights that ASHPs using common refrigerants (such as R32 with a relatively low global warming potential [GWP] of 675) typically produce water at a maximum of between 55°C and 60°C, with an outdoor temperature of -5°C. ASHPs are designed to operate within a specific range of load flow-return temperature difference that, for many mass-produced heat pumps, is about 5K. At higher

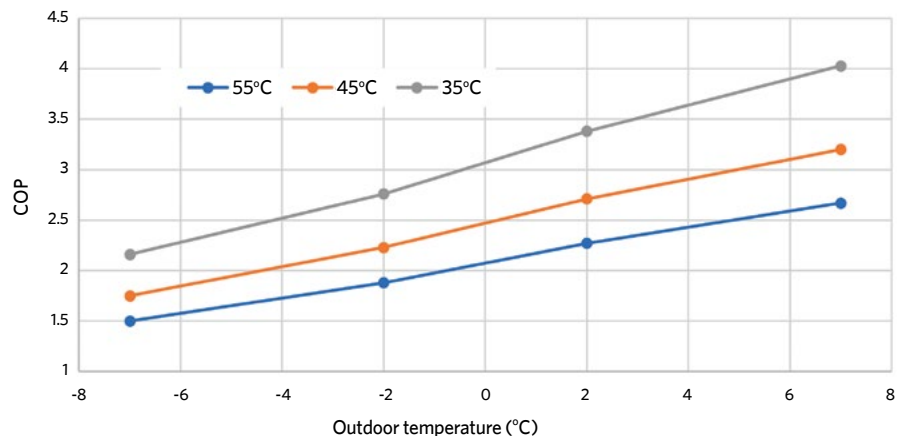


**Figure 1: Monobloc R32, 50kW, air source heat pump with inverter-controlled compressor with COP up to 4.11@water 35°C, air 7°C, SCOP 4.16@35°C, 3.08@55°C. 1.920m wide, 1.110m deep, 1.920m high, 535kg (Source: Hamworthy)**

differences, the counterflow plate heat exchanger, which is used as the condenser in the heat pump, can become less effective. Specialised heat pumps, larger-scale industrial heat pumps, and heat pumps using ammonia or CO<sub>2</sub> are all capable of working at a greater difference. The manufacturer’s recommendations will determine the most effective flow-return temperature difference.

As the outdoor air temperature rises, so does the heating efficiency and the capacity of an ASHP; at the same time, the space-heating loads will decrease. If an ASHP is sized for peak load it will be oversized for the majority of the operational life. In capital terms, heat pumps are significantly more expensive than direct electric solutions, such as electrical backup heaters, or – possibly already existing – gas boilers. In many cases, there is a good case to employ a ‘bivalent’ system where a complementary heat source will be used in conjunction with the heat pump to provide additional heat during the relatively few periods of peak load, or to lift the temperature of the LTHW beyond the efficient limits of the heat pump. In building refurbishment projects, this could be the existing heat source, such as a gas boiler. The heat pump would normally be the primary system that contributes a larger part of the annual load, with the secondary system – the gas boiler, direct electric heater, heat network or other renewable source – supplying the remainder of the peak load or increasing the flow water temperature when required. Relatively low-cost thermal stores can also be employed to spread the load across the day, so reducing the required peak output from the heat pump – but, in themselves, they cannot increase the LTHW flow temperature.

AM17 provides guidance on control systems for heat sources, suggesting that they can be configured to prioritise heat sources based on carbon intensity or operating cost. It is crucial for the control strategy to ensure that the bivalent system operates as intended. The recommended approach is to activate the



**Figure 2: COP vs outdoor temperature at different flow water temperatures – for example, 50kW monobloc ASHP**



priority heat source first – typically the heat pump with the highest efficiency and lowest operating cost – to meet the heat demand. The secondary heat source should only be activated when the priority heat source cannot adequately meet the required load. This trigger point can be determined, for example, by monitoring the temperature sensor of a thermal store to detect if stored heat is depleted.

As soon as the priority heat source is capable of meeting the load, such as when the thermal store is suitably charged, the secondary heat source should be deactivated. Depending on the load profile and emitter requirements, certain heat pump configurations may benefit from adjusting the temperature at the condenser. For instance, during periods of low load, heating emitters may be able to function effectively with a lower LTHW temperature, which may be controlled by weather compensation. On the other hand, higher LTHW temperatures might be necessary only for short periods, such as when charging or pasteurising a domestic hot water (DHW) store.

Manufacturers’ tests to BS EN 14825:2018<sup>2</sup> provide information to compare products and evaluate the performance of various technologies under part-load conditions. However, it is important to note that these seasonal efficiencies should not be used for calculations specific to a particular building application, as the building loads often deviate from the standard assumptions of BS EN 14825. Designers are advised to compute the seasonal efficiency by taking into account the particular building load and heat pump choices. To determine the portion of the load that can be fulfilled by a heat pump, an hourly model can be employed. It is important to conduct a thoughtful evaluation of factors that may introduce uncertainty in the projected loads. The manufacturer’s published COPs should be combined with the building load profile and local weather data to obtain an accurate understanding of the heat pump’s seasonal efficiency for a given application. If a gas boiler is chosen as the secondary system, fluctuations in fuel prices or future price changes could make the secondary system more cost-effective to operate than the primary system. This requires diligent monitoring and policy decisions to strike the right balance between cost and emissions. Adding excessive safety margins to load calculations can result in oversized heat pumps and, particularly where there is no

thermal buffer, this can result in short-cycling (frequent on-off switching) of the heat pump, leading to reduced efficiency and accelerated equipment deterioration.

An example of a simple refurbishment application is provided in Figure 3, where a buffer tank is employed to allow the heat pump to act as the lead heat provider for a weather compensated LTHW system that supplies a thermally upgraded building and heating system. A key role of the buffer tank in Figure 3 is to hydraulically decouple the heat pump from the remaining LTHW heating system, as well as providing a thermal buffer to prevent excessive cycling of the heat pump. Although often identical in shape and form, a ‘thermal store’ would be larger than a buffer vessel and is used to enable a relatively small low carbon heat generator, such as a heat pump, to meet a larger proportion of the annual load (and usually incorporates the functions of a buffer vessel within it). As noted by Palmer in CIBSE AM15,<sup>3</sup> the important distinction between these two terms is often blurred, with the term buffer vessel frequently being indiscriminately used to describe any form of water vessel attached to a heating system

Any hybrid system where the requirement is for a higher flow temperature than the ASHP can provide must be carefully controlled so that the system return temperature from the boilers does not exceed the heat pump maximum flow temperature. The gas boiler may be used at times when peak loads cannot be satisfied by the heat pump or where higher temperatures are needed for DHW calorifier pasteurisation. The electric heater provides backup in case of failures.

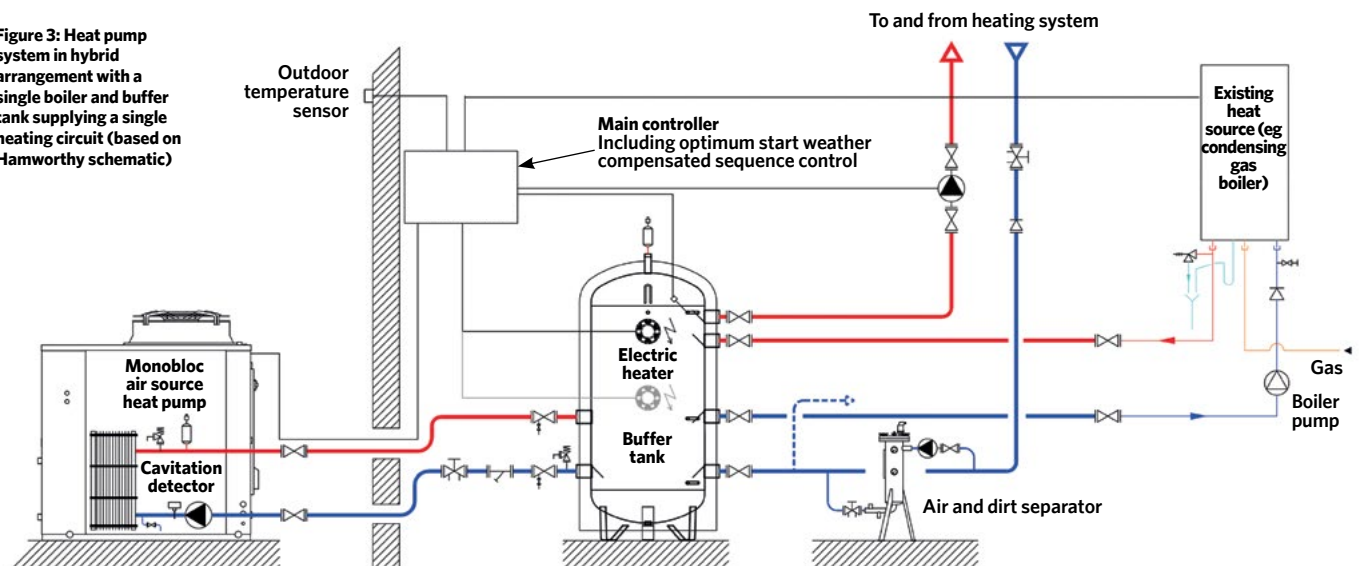
© Tim Dwyer, 2023.

Turn to page 50 for further reading and references. >>

## MONOBLOC HEAT PUMPS

A monobloc air source (to water) heat pump has all its components in a single enclosure, as shown in Figure 1, which is typically located outdoors. It includes the compressor, condenser, expansion device, evaporator and controls. Hot water is produced as return LTHW counterflows with the high-pressure, high-temperature refrigerant across the plate heat exchanger, which forms the condenser. Insulated LTHW flow and return pipework, power, and control connections need to be made to the heat pump. All refrigerant components are part of a closed pre-charged circuit, all within the enclosure of the unit, and do not require F-gas-qualified technicians for installation.

Figure 3: Heat pump system in hybrid arrangement with a single boiler and buffer tank supplying a single heating circuit (based on Hamworthy schematic)





# Module 219

August 2023

» 1. What is the flow water temperature typically in an historic low temperature hot water (LTHW) system?

- A 50°C or below
- B Between 51°C and 60°C
- C Between 61°C and 70°C
- D Between 71°C and 80°C
- E Over 80°C

2. What maximum water output temperature would be typical from an R32 ASHP when outside air is -5°C?

- A 50°C or below
- B Between 51°C and 60°C
- C Between 61°C and 70°C
- D Between 71°C and 80°C
- E Over 80°C

3. For the illustrated 50kW monobloc ASHP, what is the approximate COP when operating at -4°C outdoor temperature and delivering water at 55°C?

- A 1.5
- B 1.75
- C 2
- D 2.25
- E 2.5

4. Which of these is least likely to be true?

- A A 1K reduction in flow temperature can increase heat pump efficiency by 1.5% to 3%
- B As outdoor air temperature rises, so does the capacity of ASHPs
- C In hybrid systems, the priority is to activate the highest efficiency and lowest operating cost heating device
- D The refrigerant condensing temperature is likely to be 2K to 4K cooler than the flow water temperature
- E Thermal stores can be employed to spread the load across the day

5. What is employed in the illustrated hybrid system to create hydraulic separation of the heat pump?

- A Air and dirt separator
- B Buffer tank
- C Cavitation detector
- D Thermal store
- E Weather compensation

Name (please print) .....

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### Further reading:

Further reading: CIBSE AM17 and CIBSE AM16 *Heat pump installations for multi-unit residential buildings* provide excellent references and provide extensive links to other guidelines and standards. The *CIBSE Journal* CPD Module 166 (May 2022) complements this article.

### References:

- 1 *Heat pump retrofit in London*, Carbon Trust, August 2020.
- 2 BS EN 14825:2022 *Air conditioners, liquid chilling packages and heat pumps, Testing and rating at part-load conditions and calculation of seasonal performance*, BSI 2022.
- 3 CIBSE AM15 *Biomass heating*, CIBSE 2015.

## › Products of the month

### Rinnai's heat pump range delivers immediate carbon neutrality

Company provides hot water and heat pump systems for all fuel sources

**R**innai has launched a comprehensive new range of heat pumps and ancillary products, including hybrid hot water tanks, which can now be conveniently delivered directly to the site as a complete system.

These heat pumps are an integral part of Rinnai's H3 solutions, aimed at achieving lower carbon emissions. Rinnai heat pumps are an optimal choice for decarbonisation, providing immediate carbon neutrality for domestic and commercial settings.

The Monobloc air source heat pump comes in variants ranging from 4kW to 110kW. The low-global warming potential (GWP) heat pumps allow for up to seven units to be cascaded together, making them suitable for meeting heating or hot water demands. The system's ability to switch between heating, hot water, and cooling modes ensures flexibility and durability.

The heat pumps are designed to operate with minimal noise, complying with stringent sound standards and making them suitable for areas with noise regulations. All Rinnai heat pumps use R32 refrigerant, known for reducing electricity consumption by up to 10% and having a lower GWP compared with other refrigerants.

The HPI heat pump range from Rinnai has an Energy-related Products (ERP) rating of A+++ . It offers the ability to switch between heating, hot water and cooling settings, catering to various requirements. These heat pumps deliver both domestic and commercial needs while minimising harmful emissions into the atmosphere.

Rinnai products are designed to maintain high operational performance, have a long product life-cycle, and reduce costs and environmental impact for customers. Recently, the company's H3 low-GWP 55kW heat pump/hybrid hot water tanks with cascaded continuous flow hot water units were specified at a new development in Farringdon in London. The development includes a luxury hotel, office complex, and affordable homes.

The site will eventually have a luxury hotel with 150+ bedrooms, almost 20,000ft<sup>2</sup> of office space, and nine new-build affordable residential units. The hotel group already has one hotel in London with two others planned.



The H3 series is made up of a range of products that encompass hydrogen- and BioLPG-ready technology – hybrid systems – as well as a wide selection of low-GWP heat pumps and solar thermal solutions. Additionally, the H3 series includes Infinity hydrogen blend-ready and BioLPG-ready continuous flow water heaters, which boast numerous features, ensuring long-lasting durability, customer satisfaction, and energy efficiency.

The H3 range, consisting of H1, H2 and H3 options, provides various configurations suitable for residential or commercial use. These options encompass heat pumps, solar and hydrogen systems, and hybrid formats, and are designed to offer efficient, robust and affordable appliances that contribute to practical, economically viable, and technically feasible decarbonisation solutions.

The range covers an array of available fuels and appliances, including electric, gas, hydrogen, BioLPG, rDME solar thermal, low-GWP heat pumps, and electric water heaters.

Rinnai's H1 continuous water heaters and boilers deliver practical and economical decarbonisation through innovative technology, with a focus on hydrogen and renewable liquid gas readiness. Anticipating the future relevance of clean hydrogen fuels in the international energy market, Rinnai's water heaters are hydrogen 20% blend-ready and feature the world's first 100% hydrogen-ready hot water heating technology.

Rinnai H2 offers simplified decarbonisation through renewable gas-ready units, solar thermal

solutions, and heat pump hybrids. This option provides a practical and cost-effective choice suitable for specific sites, enabling multiple decarbonisation pathways with high-performance capabilities.

Rinnai H3 features low-GWP heat pump technology, providing easy-to-use solutions for domestic and commercial applications. The range includes a wide selection of appliances, from 4kW to 115kW, all using R32 refrigerant and offering favourable coefficient of performance (COP) and seasonal COP ratings.

As a leading manufacturer of hot water heaters, Rinnai produces more than two million units annually, serving customers across five continents. The brand has gained a solid reputation for delivering high-performance, cost-efficient products with extended lifespans.

Additionally, Rinnai offers a wide range of decarbonising products for commercial, domestic, and off-grid heating and hot water delivery. This includes hydrogen-ready technology, hybrid systems, low-GWP heat pumps, and solar thermal options. Rinnai's H1 range focuses on hydrogen, providing hydrogen blend-ready water heaters and the world's first 100% hydrogen-ready hot water heating technology. The H2 range offers renewable gas-ready units, solar thermal options, and heat pump hybrids, simplifying the decarbonisation process while ensuring optimal system performance.

■ Visit [www.rinnai-uk.co.uk](http://www.rinnai-uk.co.uk)

## Elco boilers boost efficiency at historic school >

The installation of gas boilers at the fourth oldest school in the world successfully transformed its energy efficiency.

St Peter's School in York, founded in 627 AD, was in dire need of a sustainable upgrade to replace its outdated and inefficient boilers.

Elco TRIGON L PLUS 120kW gas boilers were specified by commercial heating contractors S&B Heating.

Gas meter readings have revealed that, with the new boilers, energy savings during the winter exceeded 46% compared with the previous year, accompanied by a significant increase in efficiency from 70% to an impressive 98.2%.

Available in seven models, with outputs from 60-200kW, the TRIGON L PLUS range offers a plethora of benefits, including ultra-low NOx emissions, excellent seasonal efficiencies, and flexible cascade arrangements.

It is designed as a compact floor-standing boiler, thanks to its low water content and lightweight construction. The dual stainless steel heat exchanger technology provides built-in redundancy for enhanced reliability.

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



## Aquatronic's solution to hydraulic shock in water systems >

Aquatronic Group has introduced the Aquavent, a hydraulic shock-prevention device that aims to revolutionise water systems.

By breaking the vacuum, the technology eliminates hydraulic shock – a highly effective solution that tackles the root cause of the problem.

Aquatronic recommends that an Aquavent is installed on all boosted systems exceeding a vertical pipework distance of 10.2 metres.

Versatility is ensured with a universal size that accommodates all boosted water systems.

■ Call 01206 215121



## Arrange a hands-on demo with Pump Technology >

A new demonstration service aimed at enhancing product understanding and knowledge for specifiers is being offered by Pump Technology.

Specifiers can get in contact with David Johnson to arrange a convenient time for him to provide a demonstration of whichever products are of interest.

In just 10 to 15 minutes, most enquiries can be addressed, leaving specifiers feeling much more knowledgeable on wastewater and sewage pumping systems such as DrainMajor and Compli pumps from Jung Pumpen.

■ Call him on 07984 520515 or email [davidj@pumptechnology.co.uk](mailto:davidj@pumptechnology.co.uk)



## Condair offers air handling unit evaporative cooling CPD >

Condair is offering a CIBSE-approved CPD seminar on using humidifiers for evaporative cooling in air handling units (AHUs). The 45-minute session covers the psychrometrics of evaporative cooling, a review of the three main AHU strategies, analysis of real-life case studies, and a comparison of the latest adiabatic humidifiers.

The seminar is tailored to mechanical engineers and consultants, and gives attendees valuable CPD points. It can be held in-house or online.

■ Visit [www.condair.co.uk/CPD](http://www.condair.co.uk/CPD)



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CIBSE PATRONS CPD ASFP

**Continued from p15**

- » ● The Balance Sheet shows Property and Equipment up £66k, reflecting investment in the website, investments down £296k reflecting the stock market, and debtors up £274k in line with increased income. Cash at £234k reflects the full repayment of the £500k received from the Government Coronavirus Business Interruption Loan. Overall, Net Assets are up £273k.
- Governance: part of the remit of the Finance Risk Audit and Governance (FRAG) Committee, was reviewed in 2022, led by Board Member Dave Cooper. The review confirmed that processes are robust and reviews should be ongoing and iterative rather than periodic (five times a year in the past). Dave Cooper has joined FRAG and Governance is now discussed at every meeting. A review is under way into the processes and management of documentation and version control.

**Kevin Mitchell invited questions:**

- Chris Jones wondered about CIBSE's investment strategy and appetite for risk. Vince Arnold advised that the Board had moved all its investments into an ethical

fund because it was felt to be the right action to take and to be consistent with the aims of the Institution.

- Mike Smith enquired about research spending, noting that an accumulated surplus was available to increase spending. Kevin Mitchell advised that CIBSE was prudent in how it spent the fund and that much research is multi-year and not shown in current figures. Ted Pilbeam commented that the surplus is being gradually committed: for example, Weather Data research is a major commitment over the coming years and, with volunteers very time-constrained, new and revised guidance often requires external authoring spends.
- Geoff Prudence requested that more detail on Society and Group expenditure be made available so that examples of those that are more active or creative can be shared. Kevin Mitchell confirmed that this would be done through the Societies and Groups meeting.

**AUDITORS**

The proposal put forward by Vince Arnold to appoint Crowe UK LLP as auditors for the financial year 2023 was passed unanimously.

**SPECIAL RESOLUTION**

The second proposal put forward by Vince Arnold for the annual membership rates for the financial year 2024 was passed unanimously.

**ANY OTHER BUSINESS**

Kevin Mitchell thanked departing Board members Kevin Kelly and PL Yuen for their dedication, commitment and contribution to the development of the Institution and to Building Services Engineering as a profession. He then formally concluded the AGM.

**APPOINTMENTS**

Tel: 020 7324 2755 Email: [cibsejobs@redactive.co.uk](mailto:cibsejobs@redactive.co.uk)

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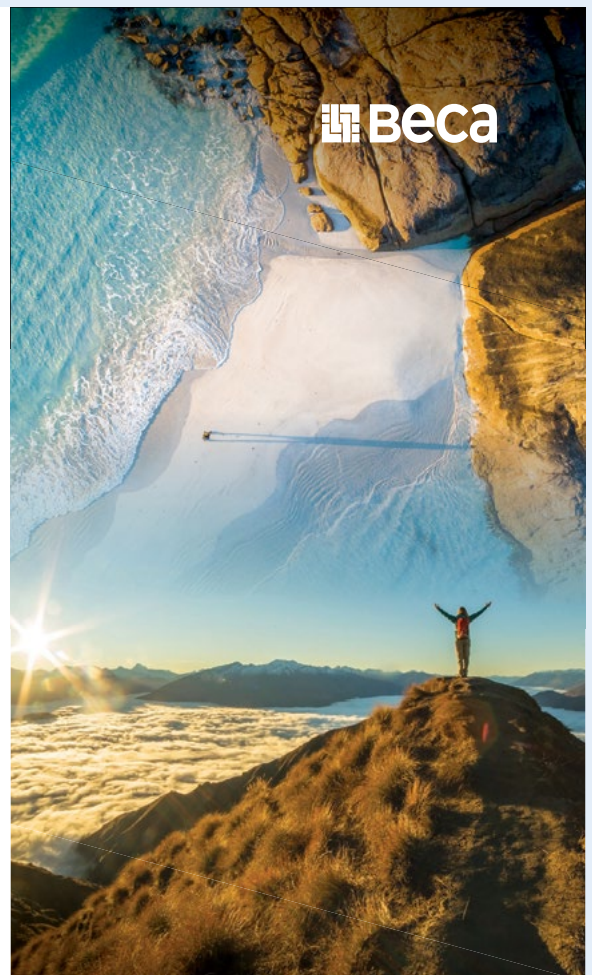
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# EVENTS AND TRAINING



## NATIONAL EVENTS AND CONFERENCES

### CIBSE Young Engineers Awards

12 October, Royal College of Physicians, London

The awards recognise the innovative thinking, hard work and skills of those entering and new to the industry, and showcase those employers who are committed to developing and encouraging young talent.

[www.cibse.org/yea](http://www.cibse.org/yea)

### Façade 2023 Design and Engineering Awards

8 November, London Hilton, Park Lane

For the second year, the Society of Façade Engineering (SFE) and CIBSE have joined forces with Zak to collocate the SFE Façade Awards and Dinner with the Zak World of Façades conference.

The awards recognise and reward excellence and achievements in façade engineering, raising the profile of this important discipline.

[www.cibse.org/what-s-on/facade-2023-design-and-engineering-awards](http://www.cibse.org/what-s-on/facade-2023-design-and-engineering-awards)



## 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](http://www.cibse.org/events)

### SLL: The path to sustainable lighting

15 August

The aim of this event is to learn how to recognise and quantify the circularity of lighting products, and increase their service life. The presentation will take a deep dive into metrics used to quantify the environmental impact of luminaires.

### West Midlands: Carbon steel tubes – intermediate knowledge

26 September, online

Tube specifications and tube manufacturing methods, with an introduction to galvanic corrosion, and installation and commissioning issues. With speaker, Dr Chris Owen, Tata Steel UK.

### West Midlands: Carbon steel tubes – Advanced

24 October, online

With speaker, Dr Chris Owen, Tata Steel UK.

### ANZ: CIBSE ANZ Young Engineers Awards

26 October, Melbourne

The winners of the three ANZ Young Engineers Awards – Student, Graduate and Young Engineer of the Year – will be announced.

### West Midlands: Reflection on the regulation – BRAD O

14 November, online

Roundtable discussion, bringing together experts in the assessment of overheating, and perspectives from a ventilation/cooling supplier and lead designer for a property developer.

### YEN West Midlands: Water treatment masterclass

16 November, online

A full day of CPDs, covering the understanding of water quality, scale control, bacteria and legionella control, filtration and reverse osmosis.

## MEMBERSHIP WEBINARS

CIBSE Membership hosts a 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.

Check the website for upcoming dates and to register: [bit.ly/CJMemWeb](http://bit.ly/CJMemWeb)

## CIBSE JOURNAL PODCASTS

The latest *CIBSE Journal* podcast, sponsored by Lutron and titled 'People, energy and performance: a new approach to office lighting', is now available. The podcast features the Lighting Industry Association's Bob Bohannon, Hoare Lea's Juan Ferrari and Lutron's Miguel Aguado. Listen on Apple and Spotify or on CIBSE's SoundCloud at [bit.ly/CJMay23PC1](http://bit.ly/CJMay23PC1)

All previous *Journal* webinars are also available on demand: [www.cibsejournal.com/webinars](http://www.cibsejournal.com/webinars)



## TRAINING COURSES

CIBSE runs in-person and live online training. Corporate delivery is also available in-house or remotely online. See [www.cibse.org/training](http://www.cibse.org/training)

### Overview of IET wiring regulations (18th edition)

5 September, remote

### Emergency lighting to comply with fire safety requirements

11 September, remote

### Mechanical services explained

12-14 September, London

### Building services explained

12-14 September, London

### Energy efficiency-related building regulations: Part L

14 September, remote

### Low carbon consultant building design

14-15 September, London  
27-28 September, remote

### Power system harmonics

15 September, remote

### Energy strategy reports

18 September, remote

### Low carbon consultant building operations

18-19 September, London

### Electrical services explained

19-21 September, remote

### Fire safety building regulations: Part B

20 September, remote

### Heat Networks Code of Practice (CP1)

20-21 September, remote

### Advanced simulation modelling for Design for Performance

20 September, London

### Introduction to the Building Safety Act

26 September, remote

### Design of ductwork systems

27 September, remote

## On demand training

CIBSE has a portfolio of on demand courses, which contain interactive online content with quizzes and additional resources to support your learning. [go.cibse.org/training-mycibselearning](http://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 latest *CIBSE Journal* webinar, sponsored by Airflow, is now available on demand. Titled 'Understanding MVHR for commercial buildings', the webinar discusses the importance of ventilation and why ventilation with heat recovery is an ideal solution for commercial buildings.





# Building Safety: Meeting the Building Regulations and Delivering the Golden Thread

This event will focus on the new and emerging secondary legislation around building design, construction and operations, and the management of key information about higher risk buildings.

**28 September 2023**  
**The Royal Society, London**

## Topics covered are:

- > What the legislation is and how it will affect you and the projects that you are working on.
- > What may be asked for regarding projects already completed that need to register as Higher Risk Buildings (HRBs).

Registration is discounted for all members of CIBSE. For those purchasing standard-rate tickets, use the code **JOURNAL** to receive a reduction worth £50.



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# CMR

## in complete control

CMR Controls manufactures low air pressure and air volume measurement sensors and control systems for standard air conditioning, clean rooms, sterile laboratories, containment facilities, and fume cupboard extract systems.

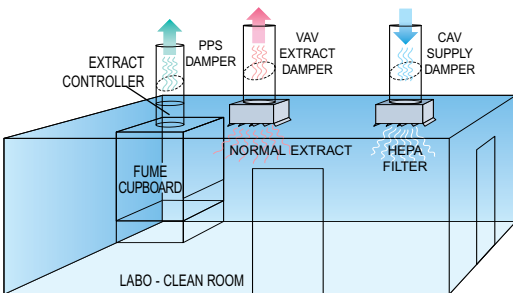


### DPM PRESSURE SENSOR

Panel Mount Pressure or Velocity Transducers with remote alarms, analogue and digital interfaces. Traceable calibration certificates supplied as standard.

### AIR MANAGEMENT SYSTEM

A complete turn-key system to control room pressure to +/-1Pa. Fume cupboard face velocity to 0.5m/s at high speed and provide constant air changes into the labo - clean room.



### PRECISION COMPONENTS FOR VENTILATION AND PROCESS CONTROL

## CMR CONTROLS

A Division of C. M. RICHTER (EUROPE) LTD

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### DPC CONTROLLER

Fast and accurate controls to drive high speed dampers or invertors. Full PID stand alone controls with BMS interface.

### CAV AND VAV DAMPERS

Accurate air flow measurement with the unique CMR Venturi built into the airtight shut-off damper to control room pressure or constant volume.



Metal Damper

### PPS EXTRACT DAMPER

Poly-propelene control and shut off valve incorporating the CMR Venturi Nozzle. This is essential when dealing with corrosive extract air especially from fume cupboard systems.



PPS Damper