CIBSE JOURNAL

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August 2021 www.cibsejournal.com

ENGINEERING FOR A NEW NORMAL AT THE TECHNICAL SYMPOSIUM

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Symposium of ideas

With its focus on engineering for Covid-19, this year's CIBSE Technical Symposium was more relevant than ever. The current wave of infections in the UK has shown that, even with high vaccination rates, the disease still has the capacity to harm individuals and disrupt society. With airborne transmission established as one of the main sources of Covid-19 infection, specialists in ventilation and air movement are much in demand.

In her keynote address at the symposium, Professor Cath Noakes, one of the UK's most prominent ventilation experts, said that industry now needed to establish standards for buildings that focused on health as well as comfort and energy efficiency. To minimise the risk of Covid-19, Noakes believes ventilation rates should be higher than the currently recommended 10 $L \cdot s^{-1}$ per person, which she says were decided for reasons of comfort rather than health.

The challenge of increasing ventilation while minimising energy use was one of the major themes of the symposium, and several papers looked at how computational fluid dynamics (CFD) could be used to model different ventilation strategies to pinpoint the most effective solution. SimScale's Dr Naghman Khan said that CFD could also be used to model the effect of wind on tall buildings. The increasing amount of computational power in the cloud was now making it possible to test multiple scenarios quickly and efficiently, he said.

One of the most impactful presentations was by Beverley Salmon, who highlighted the work done by Doh Eain to sustainably restore heritage buildings in Myanmar. The organisation's work showed how historic buildings in Asia could be improved with simple energy-efficiency methods, such as more insulation and improved airtightness. A study found Doh Eain's retrofits to be better performing than non-adapted buildings and recent new builds. What's more, the improvements were made using local labour and materials, helping to keep embodied energy to a minimum while developing skill-sets in local communities.

Our series of articles on heat pumps and district heating demonstrates the momentum building in the electrification of heating and cooling. Two of the articles focus on new guides from CIBSE on domestic heat pump installations (AM16) and domestic hot-water temperatures from instantaneous heat interface units. These and other new CIBSE guides, including advice on heat networks and air cleaning technologies, will be accessible for free by members at **www.cibse.org/knowledge** They are essential reading for engineers as they look to deliver buildings that protect both occupants and the wider environment.

ALEX SMITH, EDITOR asmith@cibsejournal.com

CONTRIBUTORS

Hywel Davies
The annual Climate Change Committee Progress Report spells out what needs to be done to hit carbon targets

Shaun Fitzgerald
How engineers can boost ventilation rates without increasing energy use in buildings

Katie Clemence-Jackson
Why engineers should be putting their work forward for the COP26 Virtual Pavilion

Tim Dwyer
This month's CPD looks at proportional balancing for circulating water systems

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CAMDEN TO APPROVE EYE HOSPITAL DESIGN

Camden Council is expected to grant planning permission for a new 'adaptive building' that will bring patient-centred eye care, research and education under one roof in London's emerging Knowledge Quarter. A team including Aecom, architects Penoyre & Prasad and interiors specialist White Arkitekter is designing Oriel, a joint initiative between Moorfields Eye Hospital NHS Foundation Trust, UCL Institute of Ophthalmology, and Moorfields Eye Charity. Aecom is leading the design team and is providing building services, civil and structural engineering, as well as sustainability and other specialist services.

Vallance report highlights importance of ventilation

Covid-19 has revealed flaws in building design and operation, says report

A report commissioned by the government's chief scientific adviser, Sir Patrick Vallance, has highlighted the importance of building ventilation in reducing the risk of Covid-19 and other infections.

Infection resilient environments: buildings that keep us healthy and safe was produced by the National Engineering Policy Centre, a group of 43 professional engineering organisations – including CIBSE – led by the Royal Academy of Engineering (RAEng).

The report found that ventilation was often neglected, and that the Covid-19 crisis had revealed flaws in the design, management and operation of buildings. Unless these are addressed, they could disrupt the management of pandemics, impose high financial and health costs on society, and constrain the UK's ability to deal with climate change.

'Clearly identifiable measures that can be implemented at moderate cost will help to ensure that adequate ventilation is prioritised alongside more visible measures, such as surface cleaning and distancing,' states the report, which criticises the lack of building management consistency in healthcare settings. Acceptable minimum standards for ventilation need to be clarified to support regulation by local authorities and others, it adds.

Technological solutions are not a 'silver bullet', the report warns, and uninformed reliance on technology can even have negative consequences. For example, air cleaning using high-efficiency particulate air (HEPA) filters or ultraviolet light can be effective at reducing infection risks where good ventilation is difficult to achieve, but the benefits of other air cleaning devices – often heavily marketed – are less clear.

RAEng report working group member Dr Shaun Fitzgerald said there is a balance to achieve in ensuring Covid-19 mitigation did not lead to large rises in energy use: 'It is not a choice between Covid-19 and net zero; it is a case of improving buildings to meet both goals,' he said.

CIBSE technical director Hywel Davies said: 'We need to support owners and operators with clear and simple guidance, emphasising the importance of improving ventilation while maintaining wider good practice on infection control. Our aim should be to enable everyone managing buildings or transport to understand how to respond in a practical and timely manner, and to establish an appropriate balance of measures to manage infection risks alongside thermal comfort, air quality and energy concerns.'

- Read more from Dr Shaun Fitzgerald on page 20.

- Read the NEPC report at **bit.ly/CJAug21Raeng**

CIBSE publishes Covid-19 air cleaning technology guidance

New guidance on air cleaning technologies has been published by CIBSE.

Covid-19: air cleaning technologies allows users to assess the variety of air cleaning devices currently marketed for the removal of SARS-CoV-2, and to discover which, if any, will reduce transmission risk in a given space effectively.

The guidance, available at **www.cibse.org/knowledge**, says scientific evidence suggests air cleaners could be part of the solution to minimising risks in certain situations, but are not a solution that reduces all risks. 'The primary building systems measure to reduce far field (>2m) airborne spread indoors is increased ventilation,' it states.

The document also includes a Relative Exposure Risk Calculator, an Excel tool that lets users assess relative risk of exposure to Covid-19 in a given space by changing values for dimensions, number of occupants, breathing rate, respiratory activity occupation time and ventilation provision.

CIBSE has updated its *Covid-19: ventilation* guidance, addressing the use of CO_2 monitors and the change in restrictions.

Building safety levy on developers proposed

A consultation on the design of a proposed levy on developers who seek permission to build certain high-rise residential buildings has been published by the government.

The Building Safety Levy consultation – which closes on 15 October – seeks views on the design and calculation of the proposed levy, through which developers will make a contribution to remedy historical building safety defects.

Subject to the passage of the Building Safety Bill through parliament, this levy will apply to developments in England seeking approval from the Building Safety Regulator to start construction of certain buildings: 'Gateway 2' stage of the new building safety regime.

The proposed levy will sit alongside a new residential developer tax, set to raise at least £2bn over a decade towards the costs of making buildings safer.

Access the consultation at **bit.ly/CJAug21Levy**

Safety Bill will deliver biggest reform 'in living memory'

Bill introduces new system of safety cases for existing high-rise homes

CIBSE has welcomed the introduction into parliament of the long-awaited Building Safety Bill, which it said would deliver the biggest reform of regulation across the construction and residential property sectors 'in living memory'.

The more robust safety regime will take a proportionate, risk-based approach to building work, including remediation. It will introduce new requirements for the competence of those who design and build as well as operators of higher risk residential buildings, the Institution said.

The Building Safety Bill has been drafted to reshape how the industry designs, builds and renovates all buildings in future. It introduces changes to the Building Act, Architects Act and Building Regulations and will reform the building control system.

It will also attempt to dramatically increase digitalisation through the whole life-cycle of buildings and includes stronger regulatory powers for construction products, with a new market surveillance and enforcement regime led by the Office for Product Safety and Standards (OPSS).

'This is the most fundamental reform of building-related legislation in decades,' said CIBSE President Kevin Kelly. 'CIBSE is totally committed to working with our members, the firms that employ them, with government, with BSI as the National Standards Body and with all interested parties to deliver a system of building legislation that delivers safe and sustainable buildings.'

Technical director Hywel Davies added that the trigger for this legislation was the tragic fire at Grenfell Tower in 2017, which cost 72 lives and blighted many more.

Safety golden thread to become law in 2023

Legislation to make the collection of 'golden thread' building performance information mandatory will come into effect as early as spring 2023, according to the government's timelines for the Building Safety Bill.

This follows the agreement of a formal definition for the 'golden thread' by the Ministry of Housing, Communities and Local Government in May.

The bill's supporting material includes an outline of the requirement for duty holders to create, hold and maintain the golden thread as part of the secondary legislation that will accompany the bill.

Last month, the Building Regulations Advisory Committee (BRAC) golden thread working group explained how digital tools would be used to enable building safety information to be stored throughout the life of a building (see **bit.ly/CJAug21Brac**).

It offered a detailed definition of the golden thread, which it summarised as the 'information that allows you to understand a building and the steps needed to keep both the building and people safe, now and in the future'.

BRAC outlined the principles underpinning the golden thread, which include being: accurate and trusted; accountable; understandable/consistent, proportionate, durable and accessible.

Less than 1% of buildings have life-cycle carbon record

Firms need to measure carbon footprint of real estate assets, says WBCSD

Less than 1% of buildings have their life-cycle carbon impact recorded or reported, according to a report from the World Business Council for Sustainable Development (WBCSD), supported by Arup.

It said that the vast majority of organisations do not carry out carbon-footprint assessments across their buildings' whole life-cycle and that the main preoccupation was reducing operational energy use.

The WBCSD reported that up to 50% of life-cycle carbon emissions come from embodied sources, including materials, with concrete and steel being major contributors, and the impact of the construction process.

'To get the construction industry on track to reach global climate targets, all companies need to start measuring the full carbon footprint of their real estate assets,' said WBCSD director of sustainable buildings and cities Roland Hunziker.

'The report shows that if all parties in the building value chain collaborate and focus on whole-life carbon emissions reductions, we can start setting this important sector on a path towards net zero.'

Bringing embodied carbon upfront is a follow-up to the Council's Building System Carbon Framework, designed to help organisations understand how to reduce embodied carbon emissions by 40% by 2030.

Operational emissions, including energy used to heat, cool and light buildings, account for 28% of the built environment sector's 39% contribution to global greenhouse gas emissions.

No systemic risk in low-rise flats

The government has announced that External Wall Fire Review forms (EWS1) will no longer be required for buildings less than 18-metres high. The move follows advice from leading fire experts who called for a more 'evidence-based, proportionate approach' to fire and building safety.

In 2020, EWS1 forms were required for buildings with an external wall system to assess whether a property contained potentially dangerous materials. They were designed to reassure lenders, but the lack of qualified assessors meant there was a collapse in sales of buildings with no EWS1 report.

The advice in the *Independent expert statement on building safety in medium- and lower-rise blocks of flats* stated there had been 'an overreaction and excessive risk aversion in some parts of the market'. It said that initial results of surveys of medium-rise blocks of flats indicated that the vast majority are free from serious safety risks associated with unsafe cladding requiring remediation.

Caution urged after 'Freedom Day'

Two engineering services bodies have stepped up their health and safety advice to help construction and building services employers manage the changes introduced on 'Freedom Day' last month.

The Building Engineering Services Association (BESA) and ECA, the engineering and electrotechnical services body, produced free guidance notes alongside a warning that the pandemic had still not relaxed its grip on the industry. This advice draws on the expertise of more than 30 health and safety practitioners, combined with the latest government guidelines.

Although the Construction Leadership Council (CLC) has announced that its Site Operating Procedures (SOPs) were no longer mandatory from 19 July, BESA and the ECA advised site operators to retain some measures.

'Removing legal requirements does not mean it makes sense to immediately drop all the measures that have kept people safe over the past year,' said BESA's head of health and safety Becky Crosland. '

Taskforce publishes green skills plan

A government taskforce says just about every job in the UK could be designated as 'green' in the future if the path to net zero by 2050 is clarified, and the right investment and policy levers are put in place.

In its report to Ministers, the Green Jobs Taskforce has set out 15 recommendations for how the government, the business community, and the education sector can work together to produce the skilled workforce needed to make the transition towards a low carbon future.

The taskforce was charged with setting out skills recommendations ahead of this year's COP26 Conference in Glasgow. Its report includes a strategy for increasing investment in low carbon technologies and developing a skills pipeline.

IN BRIEF

Nabers UK announces national committee

CIBSE is among eight industry bodies to be selected as stakeholder members on the Nabers UK National Steering Committee. While the members are non-voting, they will provide feedback and advice to scheme administrators BRE Group, to ensure Nabers UK delivers against the needs of the commercial real-estate industry.

The members and their representatives are: BCO, Peter Williams, technical adviser, Stanhope; BPF, Alex Green, assistant director; BSRIA, Michelle Agha-Hossein, building performance and soft landings lead; CIBSE, Julie Godefroy, technical manager; IWFM, David Hemming, CEO, CETEC; RIBA; RICS, Paul Bagust, head of property standards; and UKGBC, Karl Desai, senior adviser.

Contract flexibility can help in volatile market

The Construction Leadership Council (CLC) has urged the industry to be flexible and work together to deal with potential contractual problems caused by volatile market conditions.

In an open letter to industry leaders, co-chair Andy Mitchell said CLC and government guidance created in the early stages of the pandemic could help. 'Most forms of construction contract have standard provisions for managing volatility, without the need to make contract amendments,' he wrote. 'These provisions – such as fluctuations provisions in JCT and NEC 4 Secondary XI – provide a means of collaboratively sharing the risks associated with this volatility.'

Cladding installer scheme developed

A certification scheme to improve the process for installing cladding systems has been developed by the National Federation of Roofing Contractors (NFRC) .

The first pilot of the 'independent cladding installer certification scheme' improved operatives' knowledge and understanding of rainscreen cladding systems by 11%, according to NFRC.

It was developed by the NFRC's RoofCERT, a CITB-funded project set up to provide a 'proof of concept' for an accreditation scheme.

Strongest growth for 24 years 'overwhelms' supply chains

Shortages of transport capacity and long wait times for items sourced from abroad are causing delays

Material shortages are putting huge pressure on supply chains as construction product buyers report their fastest increase in activity for almost a quarter of a century.

The IHS Markit/CIPS UK Construction PMI Total Activity Index soared to 66.3 in June, up from 64.2 in May – its fastest growth spurt for 24 years. However, delivery lead times are extremely stretched and price increases have hit record levels.

Stock levels have not been able to keep up with demand for materials

According to researchers, the surge in new orders overwhelmed supply chains to the point where stock levels could not keep up with building work that was accelerating at its fastest rate since June 1997.

'June data signalled another rapid increase in UK construction output as housing, commercial and civil engineering activity all expanded at a brisk pace,' said IHS Markit economics director Tim Moore.

'Total new orders grew at one of the strongest rates since the summer of 2007, mostly reflecting robust demand for residential projects and a boost to commercial work from the reopening of the UK economy.'

Moore added that supply chains could not keep up with demand, with lead times at their longest since the survey began in April 1997. Survey respondents widely reported delays because of low stocks of building materials, shortages of transport capacity and long wait times for items sourced from abroad.

'Escalating cost pressures and concerns about labour availability appear to have constrained business optimism at some building firms. The degree of positive sentiment towards the year-ahead growth outlook remained high, but eased to its lowest since the start of 2021,' said Moore.

Gummer: Scrap VAT on retrofits

The chair of the Climate Change Committee (CCC) has urged the government to make retrofit projects free from VAT to promote the repurposing of buildings.

Former Environment Minister John Gummer told the parliamentary Environmental Audit Committee that changing the VAT balance would encourage a more sustainable approach to building projects. Currently, VAT is charged at 20% for retrofit or extension work, but most new-build construction is VAT-free. He said the government should be leading on the issue of reuse rather than demolition of buildings and added that when people refurbished a building they should also be required to carry out another improvement to further enhance its overall performance.

'The government really ought to have a rule that says it is not going to procure new buildings; what it is going to do is seek to improve old buildings so that, in each case, it is making a contribution to the future of the nation,' Gummer, now Lord Deben, told the committee. 'If it did that, it would begin to set the example to other businesses and groups that make these choices.'

Lord Deben called for the planning system to be reformed to help create new zero carbon buildings, as this would place greater emphasis on the reuse of buildings to cut embodied carbon. He criticised the government for not recognising the importance of embodied carbon in its Future Homes Standard, adding that there was evidence 'some companies have been seeking to slow the whole thing down'.

'A million homes have been built since the government at the time reversed the policy on carbon-zero houses... all of which will have to be retrofitted. That means the housebuilder has passed the cost of this change onto the person who has bought the house,' he said. 'I find this, frankly, scandalous – if the housebuilder had met those standards in the first place the cost would have been significantly less; indeed, it may have been nothing at all.'

Heat Networks and HVAC Insulation Explained

Our new CIBSE Approved CPD looks at heat networks and the CP1 Code of Practice and explains how to implement it effectively using a full HVAC insulation system.

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Results are in for Inclusivity Panel

A survey to better understand the diversity of CIBSE's members, volunteers and those who use its products and services was conducted by the CIBSE Inclusivity Panel in March.

It was the first time a survey of this type had been carried out by CIBSE, and we would like to thank the 1,890 people who participated.

Responses will be used to help monitor and benchmark diversity, as well as to inform and prioritise the activities of the Inclusivity Panel. The results will be shared on the CIBSE website.

The Inclusivity Panel is made up of volunteers from various backgrounds. Its aim is to help advise and support the Institution on all elements of diversity, to ensure that our organisation and profession is welcoming to all, for the benefit of all.

To date, the panel has organised events at Build2Perform, published a set of Inclusivity Guidelines, and offered valuable advice to CIBSE and its networks. If you have any feedback or suggestions for the panel, email **inclusivity@cibse.org**

Call for trainers

CIBSE is looking for new trainers to help support the growing CIBSE training portfolio.

Becoming a CIBSE trainer offers the opportunity to work for a professionally recognised institution with partnerships with other professional bodies, as well as construction and engineering firms worldwide.

Find out more, and apply, at **cibse.org/call-for-trainers**

Lifts Group focuses on carbon and Brexit

Updates from the seminar, Guide D, and Lifts and Escalator Symposium 2021

The CIBSE Lifts Group seminar, attended by more than 80 people in June, considered two key subjects affecting the construction industry generally, and the lift industry in particular – Brexit and life-cycle carbon.

In the first seminar, Michael Bottomley, of VT Consult, and Phil Pearson, of Pearson Consult, presented the logistical challenges that Brexit has brought to the lift industry, and some future problems that are now becoming apparent.

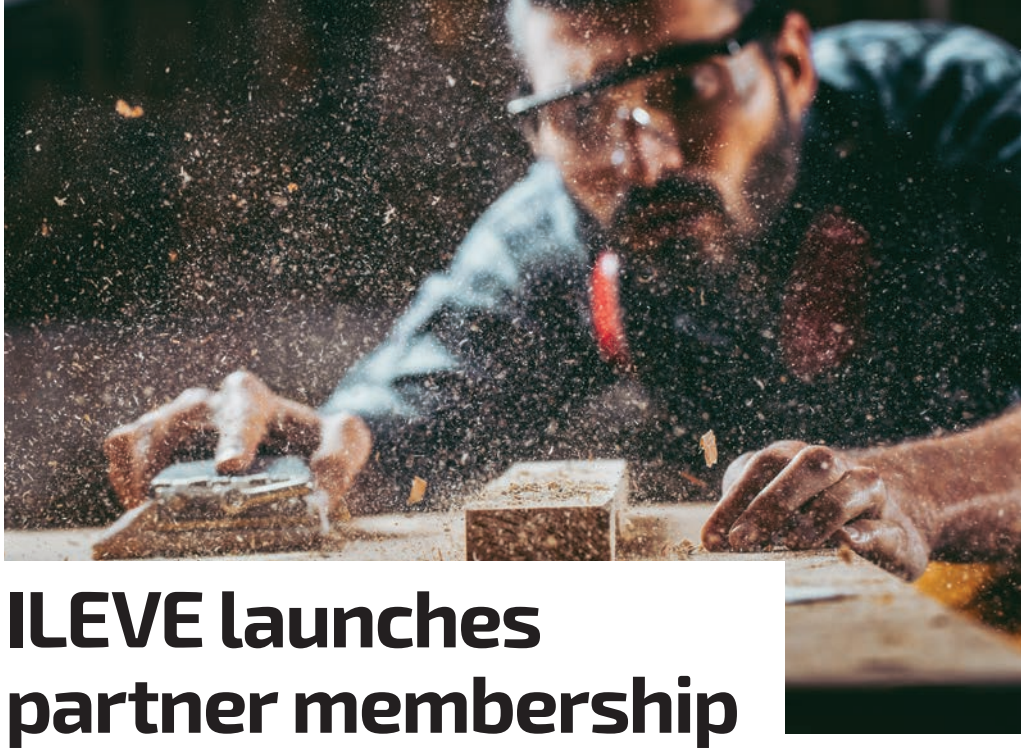
In the second seminar, focusing on energy, Sweco UK's Matthew Mapp, Roaa Babiker and Adam Scott, and Dr Gina Barney, of Gina Barney Associates, highlighted the challenges that are looming for the lifts industry. These include: lifts moving from 'unregulated' to 'regulated' energy as part of the base-build energy within the Design for Performance and Nabers UK framework; the need for the industry to engage with the subject of embodied carbon and operational carbon (particularly standby and idle power); and the need for a consistent and accurate approach to energy modelling using the soon-to-be updated CIBSE TM54 and the excellent ISO standards.

- **The presentations are available at bit.ly/CJAug21lifts**

Other updates

- In September 2020, CIBSE Guide D *Transportation systems in buildings* (2020) was published. The authors of the guide are now putting together an addendum containing *errata* and *corrigendum*. Please send any observations to **liftsgroups@cibse.org**
- Registration for the Lifts and Escalator Symposium 2021 is now open. For details and to register, go to **liftsymposium.org**

Several challenges are looming for the lifts industry



ILEVE launches partner membership

Institute says LEV companies need to make a commitment to raise standards within the industry

The Institute of Local Exhaust Ventilation Engineers (ILEVE) has launched an ILEVE Partner membership for companies that wish to raise standards within the industry and ensure all engineers meet the requirements.

ILEVE exists to recognise competence in the practical application of local exhaust ventilation. It is dedicated to improving workplace air quality and reducing health issues caused by airborne contamination and hazardous substances in the working environment.

CIBSE President Kevin Kelly said: 'ILEVE works tirelessly to raise standards and competence in the LEV industry, and this is a real step towards achieving industry-wide recognition and change.

'The number of deaths and serious long-term illness caused should not be allowed to continue, and the importance of CIBSE fully supporting ILEVE shows the commitment given in helping to achieve this goal.'

There is a major issue of people dying each year from occupational respiratory diseases. The Health and Safety Executive quotes 13,000 new cases of breathing or lung problems caused or made worse by work each year among those in – or recently in – employment. Contributing to these cases is the fact that:

- **~60% of LEV systems are not thoroughly examined and tested**
- **~60% of those that are tested are not tested competently**
- **>60% LEV systems are not checked or maintained.**

ILEVE is dedicated to improving these figures. It has identified a need for a commitment from LEV companies to raise standards, be better connected, and participate with their relevant professional institution. To fulfil this, LEV companies need to have a recognised relationship with CIBSE and ILEVE. Your company should join as an ILEVE Partner to:

- **Show commitment to raising standards within the LEV sector**
- **Demonstrate that your company meets industry requirements**
- **Increase the training and skills of employees**
- **Be better connected and involved with your professional institution.**

For more information, or to join, visit **www.ileve.org**

Views sought on standard for building performance evaluation

BSI has published a draft new British Standard for consultation – BS 40101 *Building performance evaluation of occupied and operational buildings*.

This standard aims to support the mainstreaming of building performance evaluation, to maximise opportunities for feedback and learning, and drive improved performance of new and renovated/retrofitted buildings; accelerate the trajectory to net-zero carbon (in operation) buildings; support and inform the energy-system transition; and reduce waste and running costs.

- Further information and links to the draft standard are available at **bit.ly/CJAug21BS**
- To contribute to CIBSE's response, send comments, by 12 August, to **JGodefroy@cibse.org**

IN BRIEF

UAE design guides published

CIBSE United Arab Emirates has produced two new publications outlining minimum design guidelines for mechanical and electrical and public health services for Abu Dhabi and the Kingdom of Saudi Arabia.

They have been produced by the CIBSE UAE Technical Committee, to assist new engineers working in each of the jurisdictions, building services professionals already working in the areas, and university students studying building services.

The guides will be officially launched during a webinar on 8 September, at 5pm. For further details visit **cibse.org/events**

They will be available on the CIBSE Knowledge Portal at **cibse.org/knowledge**

CIBSE gets funding to update weather files

An Innovate UK funding application for a Knowledge Partnership Transfer to revise CIBSE weather files has been successful.

The grant will provide £143,280 towards the cost of the two and a half year project, in collaboration with the University of Exeter. The funding will allow CIBSE to employ a full-time KTP Associate to undertake a thorough investigation of the ways in which we can revise our most popular knowledge offering and produce new files, based on the most recent UK Climate Projections.

CIBSE shows Pride

CIBSE, alongside other professional engineering institutions, will be showing its support of the LGBT+ community by marching in this year's Pride in London Parade on 11 September.

CIBSE has been allocated a limited number of tickets for the parade and is looking for members and staff to take part. If you would like to march with CIBSE on the day, complete the online ballot by 22 August.

Taking part in the Pride in London Parade is an important and active step in ensuring that those within, and outside, the LGBT+ community are welcomed and supported, and that CIBSE is an active ally.

To find out more, visit **cibse.org/PrideLondon**

CONNECTING CIBSE COMMUNITIES

CIBSE Council is striving to be more representative of the diverse engineering community, and is keen to be a conduit for Members' ideas and aspirations

When Kevin Kelly said, in his Presidential address, 'the more diverse you are, the more likely you are to attract Members. I want this to be a big part of my presidential year', he meant it.

After the first Council meeting since his inauguration, Kelly is keen to raise awareness of the role of Council and to encourage more participation and engagement from a wider membership.

This was echoed by new CIBSE chief executive Ruth Carter in an interview with the *Journal* last month. She emphasised the strength of CIBSE's communities and said a more consultative Council, which represents these communities, would be a way of drawing on their expertise. She said that Council meetings were a good opportunity to put problems to experts representing CIBSE communities.

CIBSE Council acts as a consultative and representative body, while the CIBSE Board is the governing body of the Institution. The Council meets three times a year and works with the Board to help steer the Institution's work and further the interests of Members – for their benefit and for the benefit of the communities they serve.

The Council exists to influence the direction and strategy of the Institution, and receives regular updates on CIBSE progress. It receives update reports from the chief executive and is consulted by the Board on any major proposals for change.

The 83 members of the Council are made up of members of the Board, and representatives from the CIBSE Groups, Divisions, Regions and standing committees. Of these 83 members, 19 (23%) are women, against an overall CIBSE female membership of about 10%.

Only around 7% of Council members are from black, Asian or minority ethnic backgrounds, and there is currently no related data on this for the membership as a whole, although the recent Inclusivity Panel survey hopes to gain better insight into the makeup of membership.

CIBSE chief executive Ruth Carter

CIBSE President Kevin Kelly

There is a drive to encourage more people from under-represented groups to join the Council and the Board, aiming to ensure it is inclusive and diverse. By having a Council membership that better reflects the society CIBSE serves, it can better meet their needs. Kelly said: 'We all benefit from having contributions from more diverse viewpoints, both in terms of professional expertise and personal background. Everyone has something unique to bring and contribute.'

> "You do not have to be on the Council to attend a meeting. Ask a member to take you along"

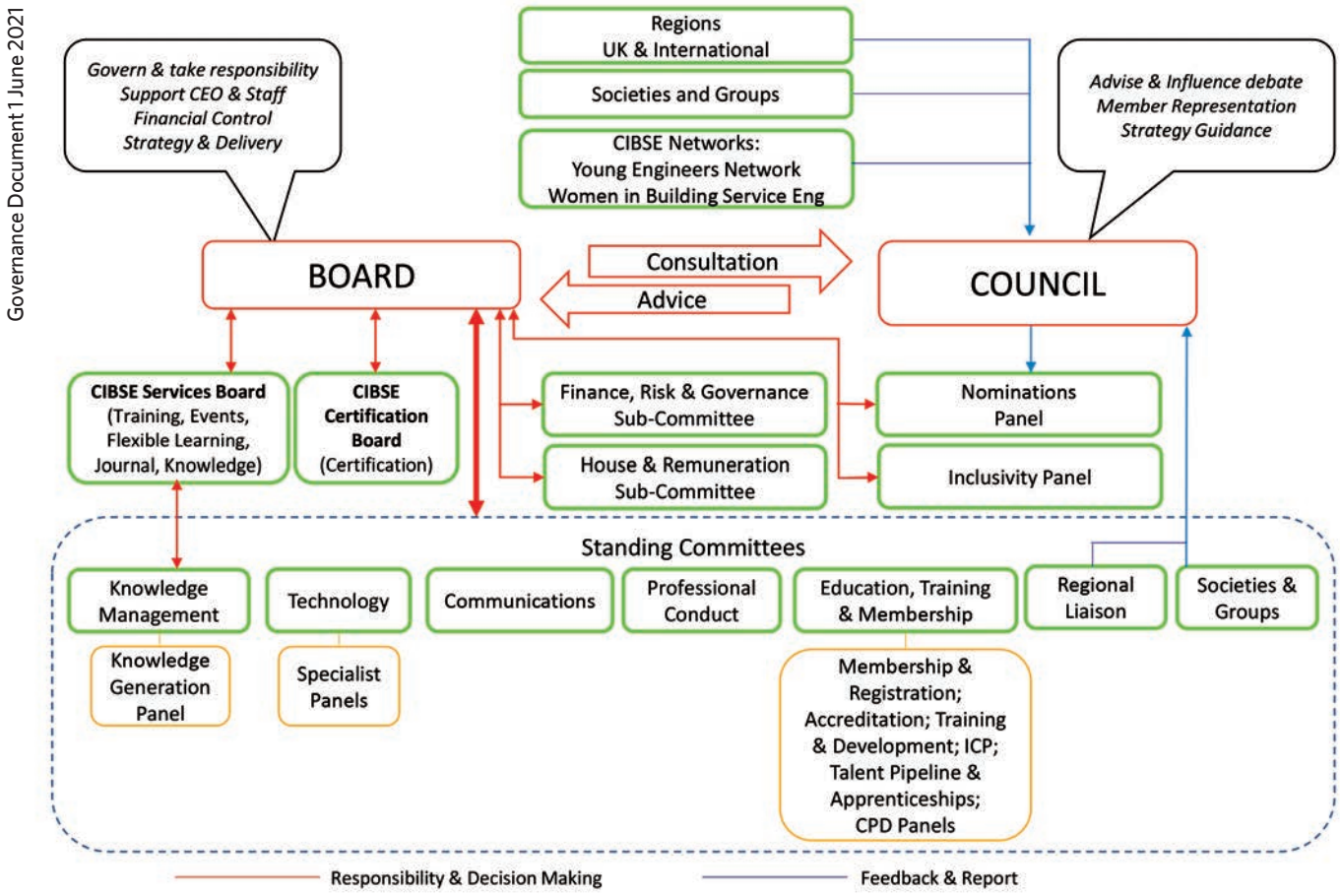
The most recent Council meeting, held in June – the first for Kelly as President and Carter as CEO – was a dynamic and lively affair. Kelly said it was a good illustration of how this engaged group of people can come together to contribute to the development of the Institution on behalf of Members, providing a clear sense of focus for the Board and Executive.

Kelly is keen that as many people as possible get involved. As a CIBSE Member, you do not have to be on the Council to attend a Council meeting. You can approach a sitting Council member and ask that they take you along; likewise Council members are being encouraged to invite others to join and see for themselves what they could contribute and get out of being on the Council.

MOST RECENT COUNCIL MEETING

In her first speech to Council as chief executive, Carter emphasised the strength of the Institution, but also the need to move forward to ensure CIBSE continues to embody a modern professional engineering institution. She talked about how technology was changing the pace of connection, and how CIBSE had to respond by disseminating information efficiently,

CIBSE governance and committee structure



without compromising the quality of information and knowledge. Referring to Kelly's Presidential address, and the focus on diversity and inclusion, Carter said CIBSE must make sure it 'walks the talk'. She made a personal plea to Council members to encourage others to get involved. 'Reach into your communities and seek out new talent coming through that will give us a broader diversity in terms of gender, ethnicity and other groups,' she added.

Carter finished her speech with a commitment to move CIBSE forward, to ensure it is a modern, professional, exemplar engineering institution providing high-quality information and knowledge in a timely manner.

SAFETY FIRST

The Council meeting also included a discussion on the Draft Building Safety Bill, published in July 2020. Hywel Davies, CIBSE technical director, outlined the proposed significant changes in the working arrangements for many in the construction and property sectors, and for many of CIBSE's members.

While much of the reporting is around 'higher-risk buildings' – those more than six storeys or 18m high, with two or more residential units, or for care or hospital use – Davies said the bill is wide-ranging.

This was followed by a discussion about how well prepared CIBSE Members and the firms that employ them are to respond to the bill. It was agreed that it will require a major change in the way that competence of engineers is developed, assessed and recorded. While this will raise the profile of engineers, it will also increase responsibility, and there was concern about how effectively it will be enforced.

The new dutyholder regime introduces significant responsibilities for companies, and there is a worry that small and medium-sized businesses will choose not to take on the new duties because of the increased burdens, including costs. While larger businesses are beginning to prepare, smaller firms may be unaware of the scale of the challenge.

There was widespread support – and already some preparation – for the introduction of mandatory continuing professional development (CPD), although no clear view on regular revalidation of Engineering Council registration.

It is clear that the built environment sector will be much more tightly regulated under the new regime. CIBSE is committed to working with its Members and companies to support them through the introduction of the new legislation.

Other presentations to Council included an update from Society chairs: new Society of Light and Lighting president Ruth Kelly Waskett; Institute of Local Exhaust Ventilation Engineers' Dean Greer; new Society of Façade Engineering's Chris Aspinall; Society of Public Health Engineers' Peter White; Society of Digital Engineering's Andrew Krebbs; and Patrons' Scott Mason.

Summary of actions

- Consult Regions and Groups on best ways to enable effective hybrid meetings
- Invite a wider range of members to »

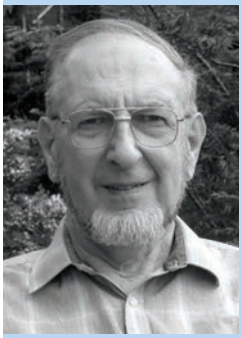
» attend committees to encourage broader participation
- Consider relationship between Societies and Groups, and how they might be able to work together
- Look at how to support companies to improve CPD quality and raise awareness of importance of accredited CPD.

A full list of Council members, and all CEO reports made to Council, are available at **bit.ly/CJAug21council**

If you would like to attend a Council meeting as a guest, approach your Regional, Group or Division chair, or email **cbott@cibse.org**

WHO WE ARE

Newly elected members **Colin Ashford** and **Dimple Rana** explain why they wanted to be involved:



Colin Ashford

Colin has been on the Council for more than 25 years, but has recently been re-elected to CIBSE Council.

There is a joy in sharing the years of experience and knowledge. Being a member of CIBSE Council gives opportunities to mentor younger members and widen their technical and management skills. Combine this with introducing them as visitors to Council, which gives them a real personal advantage by helping them understand the politics and high-level technical requirements of CIBSE as an Institution.

Once involved with CIBSE as a member of Council, there is a realisation of how much more there is beyond being a technical qualifications body.

Dimple Rana

As a Council member, I am keen to encourage a range of people to get involved in CIBSE activities and seek membership. Through this role I would like to engage students and young professionals in particular, as I think they have a lot to contribute, as well as gain, from CIBSE.

In addition, I am keen to support CIBSE as it evolves and responds to changing technology and an increase in digital engineering trends. I think it will be important to ensure CIBSE continues to stay relevant and is a valuable resource for students and professionals in the industry for years to come.

DRAFT MINUTES FOR CIBSE ANNUAL GENERAL MEETING

The Annual General Meeting (AGM) of the CIBSE was held on 6 May 2021. In view of continuing restrictions due to the ongoing Covid-19 pandemic, the AGM was conducted as an online webinar meeting, chaired by Stuart MacPherson, the outgoing President. Chief executive Stephen Matthews read the notice convening the meeting.

The minutes of the 43 AGM of CIBSE, held on 5 May 2020 and published in the July 2020 issue of *CIBSE Journal*, were accepted as a correct record of the meeting.

ANNUAL REPORT AND FINANCIAL STATEMENTS

Stuart MacPherson introduced the Annual Report for 2020, noting that it had been one of the most challenging years for the Institution and the industry in general. The Covid-19 pandemic had been devastating for many in its personal and its economic impact, but the industry rose to the challenges with expertise and determination.

In the UK, professional teams of designers, manufacturers and constructors collaborated to deliver the NHS Nightingale Hospitals, while colleagues in Hong Kong designed and built a temporary isolation disease centre in four months. Aside from high-profile projects, countless businesses had found imaginative ways to continue working in spite of operational difficulties and financial pressures.

CIBSE had continued its work through the pandemic, making its outputs readily accessible to Members and the public and advising government on the safe operation of buildings and homes. Freely published guidance on various aspects of the safe reoccupation of buildings had been issued and were among a record number of publications during the year. Volunteers and the technical team contributed to 16 consultations and worked with government and industry on pre-legislative scrutiny of the Draft Building Safety Bill.

CIBSE's normal programme was adapted for online delivery, including training and CPD courses, and major annual events were reinvented as virtual occasions. While not a substitute for in-person events, these initiatives were highly successful and provided valuable industry insight and connections for our Members during the pandemic's lengthy periods of uncertainty and isolation.

In September, the CIBSE ASHRAE Technical Symposium enjoyed its largest ever attendance, welcoming more than 350 delegates to its two-day programme. The Young Engineers Awards saw the introduction of the Apprentice of the Year Award, in addition to the CIBSE ASHRAE Graduate of the Year, affirming CIBSE's commitment to supporting the next generation to develop and realise their potential.

The CIBSE Build2Perform Live event in November attracted more than 3,000 visitor registrations, an increase of 50% on usual numbers, and the Building Performance Awards, in their 13th year, paid tribute to the exemplary work of individuals, teams and organisations, featuring a string of excellent projects.

Stuart MacPherson concluded that everyone associated with CIBSE should be extremely proud of the achievements set out in the report, and thanked all colleagues, including members, volunteers and the staff. The lessons of the past 12 months would help change the way we work, and help drive a more resilient and sustainable future as we emerge from the shadow of the pandemic.

Richard Willis, audit partner of BDO LLP, informed the meeting that a member had drawn attention to an omission within Note 8 of the Financial Statements in the full version of the Annual Report, in respect of related party transactions with the CIBSE Benevolent Fund. In view of this, the financial statements would be amended and re-signed following the meeting and the updated version would be made available on **www.cibse.org/annualreport**

Richard Willis read the audit report, which confirmed that the Annual Report and Financial Statements gave a true and fair view of the state of the group and the parent charity's affairs, and of the income and expenditure for the year, and had been prepared in accordance with all relevant requirements. He further confirmed that there were no matters to which he would be required to draw attention by exception and no undisclosed material issues or inconsistencies between the Annual Report and the Financial Statements.

> "The lessons of the past 12 months would help drive a more resilient and sustainable future"

Honorary Treasurer Adrian Catchpole then reported in more detail on the Financial Statements, noting that, in spite of the pandemic, the Institution's results for the year were much better than had seemed likely in view of the challenges. He thanked the staff for their efforts in pursuit of savings to offset the inevitable loss of income, and in implementing the necessary decisions made by the Board.

Income from commercial activities in particular had been reduced, with trading subsidiary turnover down from £3.56m to £2.38m. Training, events and advertising had been particularly badly affected. Investment income was stable, there was a small increase in membership subscription income, and there was a decrease in fees for charitable services. Overall, group income was down from £7.36m to £6.12m, with Membership Subscriptions accounting for a much higher proportion than normal.

A more detailed analysis of trading subsidiary income was noted, with online offerings producing lower revenue than in-person activities. It was noted that CIBSE Services Ltd no longer included Certification Trading, as this was now presented separately under CIBSE Certification Ltd. »

» Group expenditure also showed a substantial decrease in trading subsidiary costs, as a result of savings in direct costs through reduced activity. Savings were also made within the Charity, thanks to freezing of staff vacancies, the reduction in face-to-face activities and cost savings achieved. Total group expenditure reduced from £7.29m to £6.20m, compared with the previous year.

Overall, there had been a deficit for the year of £87K, which, in view of the unavoidable reduction in income, was considered a very positive outcome. A further net deficit of £6K in respect of investments and the pension scheme, resulted in a negative net movement in funds of £93K.

Regarding the Balance Sheet, property and equipment had reduced due to depreciation, investments had increased, stocks were at a similar level to the previous year, and debtors had reduced. Cash balances had declined slightly, while creditors had also reduced due to reduced activity, and the pension scheme asset had reduced slightly. Net Assets stood at £2.57m, down from £2.67m in the previous year.

In response to questions, Adrian Catchpole explained that the Institution did not currently conduct formal internal audits, but that internal controls were reviewed as part of the external audit procedure and the Finance, Risk, Audit and Governance Sub-Committee (FRAG) took the views of the auditors on any potential issues. FRAG met six times annually, having increased frequency during the pandemic, and specific issues were considered as required.

Regarding a request for a forward-looking statement on the Final Salary Pension Scheme, Note 19 of the accounts set out the information that was available at present.

It was suggested that a further breakdown of Regions, Societies, Networks and Groups Funding be provided in the *Journal*. It was agreed that this would be considered and could be the basis of a *Journal* article.

AUDITORS

Adrian Catchpole proposed that BDO LLP be appointed as the Institution's auditors for 2021, and that the Board be empowered to agree their remuneration. This was seconded by Kevin Mitchell and approved by a substantial majority.

It had been requested that the name of the Auditors to be proposed be included in the Calling Notice in future years, and it had been agreed that this would be done.

SPECIAL RESOLUTION

Adrian Catchpole proposed adoption of the Special Resolution for Membership Subscriptions for 2022 as set out in the Calling Notice. The proposal was based on a 4% increase to the Member rate, and it was noted that, in view of the pandemic, no increase was applied to subscriptions in 2021. The proposal was seconded by Les Copeland and approved by a substantial majority.

BOARD AND COUNCIL FOR 2021/2022

Stephen Matthews declared the following individuals appointed and elected to serve as Officers, Board members and Council members following the AGM 2021:

Officers:
President: Kevin Kelly
President-elect: Kevin Mitchell
Immediate past President: Stuart MacPherson (takes Office automatically)

Vice-presidents: Fiona Cousins, Susan Hone-Brookes, PL Yuen
Hon treasurer: Adrian Catchpole

Members of the Board:
Elected members: Laura Mansel-Thomas
Continuing members: Vince Arnold, David Cooper, Les Copeland, David Fitzpatrick

Members of Council:
Elected members: Colin Ashford, Andrew Bott, Dimple Rana

ANY OTHER BUSINESS

STUART MACPHERSON paid tribute to the work of Stephen Matthews, who was retiring from the role of CIBSE chief executive after 15 years' service. He referred to the progress made by the Institution and the many achievements during Stephen Matthews' tenure as chief executive of the Institution. He referred to the challenges that had arisen during his tenure, in particular the current pandemic, and acknowledged his contribution in managing the Institution through that challenge and many others.

STEPHEN MATTHEWS responded that it had been a privilege to have held the role. He was delighted with the progress the Institution had made, and the potential he saw for the future. He referred to the importance of CIBSE Knowledge, and paid tribute to those who created and delivered it with the support of the Technical Department. He acknowledged the input of the Institution's members and thanked the staff for their commitment particularly during the pandemic. He wished his successor, Ruth Carter, well for the future, in what he believed would be a very rewarding role.

STUART MACPHERSON went on to introduce CIBSE's newly appointed chief executive Ruth Carter, who was previously managing director of Telegraph Media. She had a track record in managing complex organisations and a particular understanding of publications and events management, and the multi-mode delivery of these. Her expertise in those areas will be highly valuable in supporting the delivery of CIBSE's strategy.

RUTH CARTER said she was delighted to be joining an organisation built on such strong foundations and expressed her thanks to Stephen Matthews. Her ethos was to honour the past but look to the future, and CIBSE faced an era of change and challenge, but also of opportunity. She looked forward to meeting as many members as possible over the coming months.

Testing for net zero

Government has led the way with its 2050 net zero target, but it will take more than targets to decarbonise buildings and construction. Hywel Davies looks at the assessment of policy development in the latest Progress Report

The UK has made significant progress in reducing UK emissions while maintaining growth, with reductions dominated by changes in the power sector. Pandemic lockdown measures have resulted in a record 13% decrease in UK emissions in 2020 from the previous year. However, we are already seeing a rebound in 2021, and the widespread loss of confidence in – and capacity limits on – public transport are likely to lead to a significant increase in vehicle emissions. In the longer term, progress in other areas of the economy needs sustained government leadership, and a clear net zero strategy.

"EPCs have a role to play in promoting quality and robustness"

The annual Climate Change Committee (CCC) Progress Report (**bit.ly/CJAug21CCC**) makes many recommendations about specific policy areas that require further development in the next year. In particular, it calls on the Cabinet Office to commit to a 'net zero test' for all government decisions to increase their compatibility with legislated emissions targets. The CCC also wants the delayed Heat and Buildings Strategy to be ambitious, work for consumers, and be released before COP 26 in November.

The buildings recommendations are also significant. They seek to align the new Building Safety Regulator with the net zero agenda, to 'ensure that the remit of the new buildings safety regulator covers climate change mitigation and adaptation, strengthened through an explicit responsibility for sustainability, and is fully equipped to monitor and enforce compliance with buildings standards'. This is supported by a call to implement 'a strong set of standards – with robust enforcement – that ensure new and existing buildings are designed for a changing climate and deliver high levels of energy efficiency and low carbon heat'.

The CCC wants publication of 'robust definitions' of the proposed Future Homes and Future Buildings Standards to be legislated for before 2023 to 'ensure no fossil fuels are burnt in new buildings'. It notes the need for the standards to be coordinated with those departments that build public buildings, as well as with the Department for Business, Energy and Industrial Strategy (BEIS) and the Treasury.

The warm weather in July served to reinforce the need for an overheating-related requirement in the Future Buildings Standard, which should cover refurbishment of existing buildings and conversions of non-residential buildings to residential. The CCC wants a requirement here, and not just 'guidance'. Residents need homes that are designed to minimise overheating, which is a threat to health during heatwave conditions.

There is a clear call for the Ministry of Housing, Communities and Local Government (MHCLG) to work with BEIS on the Heat and Buildings Strategy, and to use the new standards to set a clear direction for retrofit across the whole building stock. With 27 million existing homes and two million non-domestic buildings, there is a massive challenge ahead to reduce their emissions.

There is also a demand for MHCLG to close loopholes that allow new homes to be built to out-of-date standards. This should be reinforced by requirements for accurate performance testing and reporting that commit developers to standards they advertise.

The CCC wants improvements to the Energy Performance Certificate (EPC) and Standard Assessment Procedure framework. EPCs should drive deployment of energy efficiency measures on a holistic basis that will address overheating, ventilation and moisture risk. They should support improvements in energy efficiency and low carbon heat, and recognise the benefits of low carbon and flexible technologies. EPCs have a role to play in promoting quality, and the CCC wants a commitment to integrate in-use performance metrics from 2023. This will be a challenge, but shows the importance of the consultation on *BS 40101 Building performance evaluation of occupied and operational buildings* (**bit.ly/CJAug21HD**).

There is a lot of talk about the Golden Thread (**bit.ly/CJJul21HD**) for buildings higher than 18m or six storeys. The CCC draws attention to the benefits of collecting and keeping information about other buildings through green building passports, so owners know what has been done to reduce emissions, and what more needs to be done. The CCC wants both closer attention to enforcement and more support for local authorities, which often have enforcement responsibilities. The National Audit Office is also calling for greater clarity on the role of local authorities in net-zero carbon, and the levels of funding to enable them to play their part (**bit.ly/CJAug21HD1**).

There is a growing ambition for net zero, but there is still a long way to go. Stopping to test policies for their compatibility with net zero and with the building safety agenda is important; enforcing those policies to achieve the right outcomes is also necessary.

DR HYWEL DAVIES
is technical director at CIBSE
www.cibse.org

Net zero and Covid resilience

Improving the building fabric will allow for higher ventilation rates to minimise Covid-19 risk even in cold weather, says Dr Shaun Fitzgerald

Covid-19 has wreaked havoc on the world in so many devastating ways over the past 18 months. One of the major learnings about the SARS-CoV-2 virus is that ventilation within buildings can be a really effective way of reducing the risk of its transmission.

Sir Patrick Vallance, the government's chief scientific adviser, commissioned a report from the Royal Academy of Engineering on how to reduce the risk of infection indoors. In the study (see page 7, News) the experts say there is an 'urgent need' to improve ventilation as people return to offices after 19 July.

The recommendations are that multiple-occupancy spaces should be well ventilated to minimise the buildup of virus should there be infectious people present. It is relatively easy to deliver plentiful amounts of outdoor air when it is late spring or early summer. If a building is ventilated with opening windows, throwing these open to flood the space with outdoor air can create a very natural and pleasant space. There are questions, however, about the appropriate amount of ventilation in colder weather, especially as we seek to make a serious dent in the energy consumption associated with the heating and ventilation of buildings in our race to zero emissions. How does increased ventilation in cold weather square with reducing heating energy?

If we look at much of the current building stock, some of the main challenges we face in terms of reducing energy lie in improving the insulation levels, reducing uncontrolled air leakage, and reducing heat losses via radiation.

Improving insulation levels helps cut the heat lost by conduction through the building fabric. The second action, of sealing gaps in the fabric, means a building that is empty at night will not leak warm air from the previous day. This will help keep the building warm overnight and reduce the need for the heating system to come on in the early morning, to pre-heat the building. Finally, installing coatings on windows, or foil-backed insulation in the attic space, can prevent heat loss by radiation.

Once the building fabric has been upgraded to a good level, the space can be well ventilated when the building is occupied, even in cold weather, without excessive energy use. This is because natural heat gains within the space are often sufficient to maintain the interior at a comfortable 21°C and provide ventilation of around 10 $L \cdot s^{-1}$ per person without additional heating or a heat-recovery scheme, even when the external temperature falls down to 5°C.

"By opening high-level windows a small amount you can get good levels of ventilation, but without cold draughts"

The combined heat gains from IT equipment, lighting, solar and the occupants are considerable (often 200W/person). As long as the ventilation system is designed and operating to exploit these heat gains, by pre-mixing the incoming cold air with warm room air, adequate levels of ventilation can be achieved without cold draughts.

Unfortunately, many existing buildings have poorly maintained ventilation systems. If a building has opening windows, for example, not all of the windows may work. Many at low level, and easily accessed by occupants, are better maintained than higher-level windows. Consider sash windows, for example – the bottom sashes are much easier to open than the top ones, so these get used. Top windows can get painted shut, and are then, basically, out of action.

While losing a few opening windows may not seem problematic in normal times, it really is a problem in winter. This is because, by opening all the high-level windows a small amount, you can get rather good levels of ventilation, but without cold draughts. The incoming cold fresh air can mix with the air in the space and be warmed before it hits the nearest occupant.

Without high-level windows, however, people will find it intolerable to be provided with the same level of ventilation in cold weather via low-level windows. Their first instinct will be to close them, and this is what we need to avoid from a health perspective. If there are radiators under the windows, these will be used to ameliorate the cold draughts, even though the heating isn't needed from an energy perspective – and this is what we need to avoid from a climate perspective.

Well-designed and maintained ventilation systems are the answer to the challenges of Covid-19 resilience and net-zero buildings. It is not a choice between Covid-19 and net zero; it is a case of improving buildings to meet both goals.

DR SHAUN FITZGERALD FCIBSE is director at the Centre for Climate Repair at Cambridge and co-author of the CIBSE *Covid-19: Ventilation* guide

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Air flow (m^3/s)

40
34
28
25
22
19
16
14
11
5.5
0

D-AHU
Professional

0.21 m^3/s
up to 40 m^3/s

D-AHU
Modular R

0.13 m3/s
up to 6.95 m3/s

D-AHU
Modular P

0.13 m^3/s
up to 4.16 m^3/s

D-AHU
Modular L

0.07 m^3/s
up to 0.7 m^3/s

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ENGINEERING THE NEW NORMAL

Striving for net zero while making buildings Covid-secure has been challenging academics and engineers since the virus first appeared. Last month's CIBSE Technical Symposium was an opportunity to share experiences in two days of live sessions discussing 64 papers. **Alex Smith**, **Liza Young** and **Phil Lattimore** report

The impact of Covid-19 on the design of the built environment was the dominant theme at the 2021 CIBSE Technical Symposium.

There were 64 papers on the theme 'Engineering the built environment for the new normal', and the keynote address on day one was given by Professor Cath Noakes, one of the world's foremost experts in transmission of airborne infections.

Noakes, who was made an OBE for 'services to the Covid-19 response', told the online audience that the built environment had a big part to play in the management of the virus and other respiratory diseases. She said engineers had the challenge of designing for health, not just comfort and energy efficiency. 'There are a raft of competing priorities,' she said. 'We need to think holistically about how we capture these.'

Noakes added that the multiple routes of transmission made designing Covid-secure buildings very complex, with behavioural factors – such as social interaction – being as significant as environmental ones. 'Building design can't manage all the behavioural factors, such as mask wearing and personal hygiene', she said, but current ventilation standards need to be reassessed to help dilute the virus.

'Higher ventilation rates may need to be increased,' said Noakes. 'We have settled on 8-10 $L \cdot s^{-1}$ per person, but this is for comfort and not managing a disease. I suspect the rate needs to be higher than it is now.'

The paper voted as making the most significant contribution to the art and science of building services engineering was the *Impact of various ventilation strategies on indoor airflow dynamics and the spread of pathogens such as Covid-19* by Ventive's Tomasz Lipinski.

With a 'significant and urgent' need for adaptation of high-occupancy buildings to provide the inhabitants with a safe indoor environment, Lipinski outlined in his paper how this can be achieved through new, safer ventilation strategies.

This targeted research and a practical investigation, delivered in collaboration with BSRIA, used new CFD analysis and a fully monitored office space to analyse the air patterns and contaminant flows within a room with various ventilation strategies implemented. The paper offered a practical comparison between the most prevalent ventilation strategies and their impact on the possible spread of pathogens.

CFD was also used to analysis the impact of a living wall on indoor air quality in a reception area at the Spine building in Liverpool, designed by AHR.

Software was used to track and analyse the distribution of VOC concentrations in key areas of the new HQ for the Royal College of Physicians with and without planting and living walls.

Many papers aimed to understand how Covid-19 is transmitted. In a session on 'Delivering and evaluating air quality in buildings', SimScale's Dr Naghman Khan advocated the use of CFDs to model indoor air quality (see below).

He said it could quickly generate outputs useful for Covid-19 mitigation strategies, such as whole-room ventilation rates, fresh air and fresh air ratio, placement of air supply and exhaust grills, and the air velocities and air mixing in proximity to the occupants.

In the same session, Brendon McManus, of Clean Air Technologies,

CFD model from SimScale showing cold air entering a room from ceiling diffusers and spreading through the room

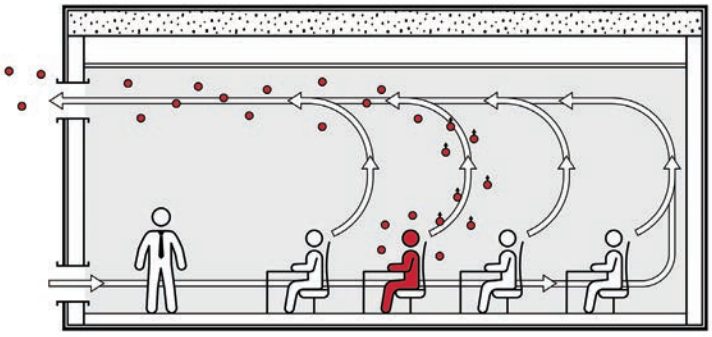
CFD was used to model biophilia at The Spine in Liverpool

took questions on his paper, which explored the opportunity for the successful transfer of clean air technologies used in cleanrooms to open-plan offices. When designing for cleanrooms – such as those found in life-science laboratories – McManus uses filtration and high air-change rates to control environmental contaminants, as this can be validated. 'If you can't measure it, it doesn't count,' said McManus.

In a cleanroom, he added, UV would not be used to control pathogens, because it is impossible to validate, as you don't know how much of the air is passing through the air cleaning unit. However, UV could be used to clean a Hepa filter that may have become contaminated, he said.

Chairing this session was Cundall head of research and innovation Ed Wealend, who has authored a new CIBSE *Air cleaning technologies* guide, which assesses the benefits of an air cleaning option for reducing SARS-CoV-2 transmission (see page 7, News).

Façade-mounted natural ventilation (displacement)



One of the ventilation strategies highlighted in Tomasz Lipinski's award-winning paper

"Building design can't manage all the behavioural factors, such as mask wearing. Higher ventilation rates may need to be increased"

Living with the virus

Ali Shaw and Gwilym Still, from Max Fordham, discussed their paper on ventilation design in the age of Covid-19, *Living with the virus – a low-energy response*. They considered four solution scenarios of equivalent thermal comfort and dilution, and looked at the impact on energy consumption of each. The study found that the recirculation and filtration solution used a lot less energy over a year in the UK climate.

Sara Mohammed, from the University of Nottingham, looked at the indoor environmental quality of new-build, low-energy schools in the context of the pandemic in her presentation. Her study found that the focus on energy led to unintended consequences on indoor air quality, with inadequate ventilation and space overheating occurring because of a lack of cross-ventilation in original designs.

In a session on modelling and deep learning for innovative systems and built environments, Patrick Okolo, of Buildings Fluid Dynamics (B-Fluid), discussed *Crowd evacuation performances of built environments with regards to social distancing measures*. He considered the effect of social distancing rules on safe evacuation times for different building configurations using performance-based case studies, through crowd egress/evacuation dynamic modelling.

The research was aimed at equipping stakeholders with a better understanding of the implications of building layouts – particularly in larger building configurations – and how these could, potentially, affect fire-safety engineering management when strict social distancing measures are applied.

Improving the design of buildings to reduce the risk of the transmission of disease was addressed by Ashveen Jeetun, from Buro Happold, in his presentation *Pathogens management train [PMT] in public health engineering systems*. He explained the concept of PMT, which uses scientific research to identify the exposure pathways to »

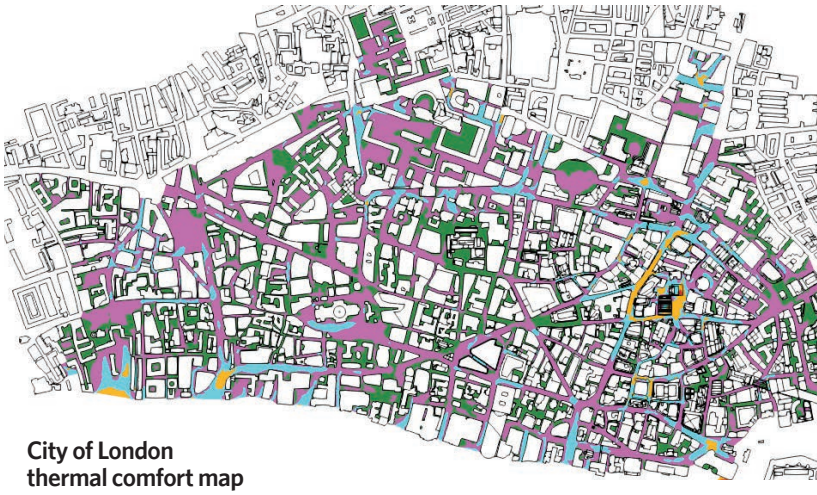
» pathogens at all stages of the public health engineering cycle, so the design can then be improved to mitigate the risk of transmission.

In their paper, *Covid 19 and other influences on the urban heat island of Manchester*, John Parkinson and Geoffrey Levermore considered whether the pandemic could have an impact on energy use, in terms of urban heat island intensity. They found an ambient temperature reduction of up to 0.6K during the pandemic, as traffic levels fell by around 70%, using sensor and measurement technology in several locations across the city centre to compare data during the pandemic with previous years, when temperatures were fairly uniform.

Modelling outdoor conditions

In the session on 'Developing enhanced understanding of external environments', SimScale's Khan made the case for more accurate wind-pressure coefficients in building simulations and, in particular, the mandated use of dynamic CFD simulations. He said the accuracy of wind pressure was more pertinent in buildings that rely on natural ventilation for air quality and thermal comfort.

RWDI's Ruth Shilston described the new *Thermal comfort assessment and guidelines for the City of London*, which aims to help design teams understand the impact of tall buildings on London's microclimate. It combines climate data with solar and wind simulations to provide a measure of thermal comfort through a Universal Thermal Climate (UTC) Index. RWDI worked with the City of London to produce a scale which assessed the % of time that a space would be usable. It developed a colour-coded table showing the percentage of hours the UTC was acceptable. This is reflected in the legend of the map above.



City of London thermal comfort map

Green areas are comfortable for more than 90% of the time, while red areas are comfortable for less than 25% of the time in winter and less than 50% in summer

In the same session, Peter Simmonds discussed the findings in his paper *The influence of outdoor conditions on the heating and cooling loads of supertall and megatall buildings*.

Simmonds explained why it is important to take into account the height of buildings when carrying out heating and cooling simulations, because temperatures and wind change according to the

"Homes in Yangon were in danger of being torn down and replaced with less resilient buildings because the capital and skills were not available to preserve old properties"

number of storeys. Designers need to take account of greater wind pressure in simulations as storey heights increase and changes in airflow can result in exfiltration and infiltration of air at different times, he added – which could mean more heating is required in winter and more cooling in the summer months.

Conserving heat

Nottingham Trent University's Emmanuel Nyabadza gave a presentation on his paper *Thermal destratification: an exposition into a forgotten key solution for heating energy conservation in further and higher education establishments*.

He described the use of fans to circulate heated air at ceiling level via a natural convectional current. The research found that innovative solutions, such as wall-mounted destratification fans, can enable optimised thermal comfort for occupants, reducing the building carbon footprint and saving heating energy expenditure.

In their presentation – *The case for sustainable, environmentally friendly heating and cooling systems – don't take a chance on corrosion. Change!* – James Culbertson, of The Keenan Consultancy, and Gordon Pringle, of Heating Appliances & Spares, gave an overview of the environmental benefits of implementing an alternative, non-chemical approach to water treatment, and using continuous monitoring in the prevention of corrosion in closed systems.

Pringle said corrosion monitoring was paramount because equipment can fail, leaks can develop and diffusion can occur. He said continuous monitoring – using low-cost, real-time corrosion monitors – acted like a 'corrosion smoke alarm', alerting the building operator if events occur that allow oxygen to enter the system.

The rise of machine learning

There were a number of compelling presentations on machine learning, digital and smart technology for internal environments. In his paper, *Predicting the building emission rate of non-domestic buildings using machine learning*, Kareem Ahmed, from Loughborough University discussed research into using machine learning and data to help develop new ways of determining building energy rating (BER) values for Energy Performance Certificates more quickly and efficiently.

Jonathan Reynolds, from Arup, explored the concept of machine learning inference of occupancy using proxy environmental sensors. He outlined a study in the firm's office as a way of potentially determining IAQ through sensors and machine-learning processes.

The use of smart thermostats was the focus of a study by Rajat Gupta, from Oxford Brookes University, in his presentation entitled *Evaluation of indoor temperature and thermal comfort in homes with and without smart thermostats*.

In her paper, *Cybersecurity of smart buildings: a facilities management perspective*, Nikodokht Ghadiminia, of Birmingham City University, highlighted key issues about approaches to security in connected buildings, and how it should be critical in decision-making.

In their keynote, James Pincott, of Hoare Lea, and Paige Wenbin Tien, of the University of Nottingham, discussed their research on using cameras powered by artificial intelligence to detect fire and smoke indoors. They claimed that camera-based detection and recognition systems could recognise fires more quickly than smoke detectors, and played a video showing how a deep-learning model deployed to an AI camera could quickly recognise smoke and flame.

The above has been a snapshot of the many excellent presentations at the symposium, and the *Journal* will highlight many more papers over the next 12 months. This will include *Waste heat recovery from underground railways – evaluating the cooling potential*, by Henrique Lagoeiro of London South Bank University, which won the award for most effective delivery of material. CJ

Read the papers at **www.cibse.org/technical-sympoisum**

PRESERVING AND IMPROVING MYANMAR'S CULTURAL HERITAGE

Doh Eain's Beverley Salmon showed a possible template for sustainably renovating millions of historic properties in Asia. In her keynote presentation, she explained how social enterprise Doh Eain renovates heritage residential properties in Yangon, Myanmar, and shared research on how the buildings perform compared with unadapted buildings and local new builds.

Salmon said the project was helping to preserve the cultural heritage of Yangon, which has a large number of historic buildings. The homes were in danger of being torn down and replaced with less resilient buildings because the finance and skills were not available to preserve old properties. Doh Eain arranges finance for building owners and, on average, payback on investments has been four years. As well as project managing the restoration of buildings, it manages 25 of them for occupants and helps building owners finance retrofits.

The keynote explained how the retrofit projects use local materials and labour, partly because it was more sustainable and partly because Covid-19, and the return of martial law in February, meant importing materials was impossible.

Doh Eain's research on building performance found that their adaptations – double glazing and more insulation – were reducing energy load, particularly in the monsoon period, when a closer temperature range meant the benefit of thermal mass in other concrete buildings was less marked.

By preserving buildings, the city's green environment is also preserved, said Salmon, because, originally, the streets were tree-lined, and new projects don't replace trees that are uprooted during demolition.

An office in Yangon renovated by Doh Eain

LESSON IN CONTINUITY

Collaboration was key for the design and construction teams involved in the low-energy extension of Streatham and Clapham High School, in London, which had to remain fully operational throughout. **Andy Pearson** reports

The Girls' Day School Trust wanted to extend Streatham and Clapham High School by creating a new, flexible sixth-form space, plus a dining hall big enough for use by the entire school. It wanted these spaces to be low-energy and to promote sustainable design to the pupils. The trust also wanted to retain the school's existing buildings, partly to avoid the cost of demolishing and rebuilding, but also because the school had to remain operational throughout the project.

Site constraints

The school's location – on a tight, urban site in a residential South London neighbourhood, adjacent to Streatham Common – meant space was at a premium. The innovative solution, developed by Cottrell & Vermeulen Architecture, working with OR Consulting Engineers, was to place the new sixth-form centre on the roof of the school's main three-storey building and to slot the dining hall into a compact space between the school's eastern elevation and the street.

Collaboration and communication were key to the design and construction teams being able to extend the school while keeping it fully operational. (See panel, right).

In recognition of its use of integrated processes to facilitate this, OR Consulting won the Collaboration Award at this year's CIBSE Building Performance Awards. The judges said the project showed 'a clear structured and collaborative approach with an exemplar use of post-occupancy evaluation'.

Phase 1 was to construct the sixth-form centre. It comprises a row of south-facing classrooms, offices and a science laboratory, all of which are entered from a connecting spine corridor at the rear. The corridor is bookended by a study space to the west and the sixth-form common room to the east.

The centre is constructed from lightweight cross-laminated timber (CLT) panels mounted on a steel subframe. Internally, the CLT panels are left exposed, along with the crossed-glulam columns supporting the roof and the timber window mullions. The exposed timber gives the rooms a warm, natural appearance, enhanced by daylight, which floods the space from a south-facing curtain wall that is set beneath an overhanging roof to limit solar gain.

"Once people understand the controls – why they are there and what they do – they get more comfortable with their use" – Peter Roberts

The south-facing, full-height glazing is supplemented at the back of the spaces by a linear, north-facing clerestory window. 'The clerestory introduces daylight deep into the space, to provide a daylight factor of around 5%,' says Peter Roberts, director and founder of OR Consulting Engineers, the project's building services consultants. 'To save energy, daylight-level sensing is integrated with absence-detection controls; there is also local lighting control for interactive teaching.'

Ventilation strategy

The clerestory window is fundamental to the rooftop extension's ventilation strategy.

PROJECT TEAM

Client: Girls' Day School Trust
Building services and acoustics: OR Consulting Engineers
Architect: Cottrell & Vermeulen Architecture
Structural engineer: Engineers HRW
Project manager: Tuffin Ferraby Taylor
Quantity surveyor: Woodley Coles
Breeam: Method
Main contractor: Rooff
Mechanical contractor: Morgan Clark Building Services
Electrical contractor: Moyne London

The ground-floor extension includes a new dining hall, kitchen, reception and school entrance

In summer, spaces have been designed to be naturally ventilated, with air entering at low level through manually opening windows in the full-height, south-facing glazing and exiting at high level through the north-facing clerestory. The roof profile was developed through modelling to assist with the ventilation strategy.

'We created a roof profile with a flat soffit pitching up to the clerestory window that would create a reservoir of heat at the top of the space. We vent air out through the clerestory window to cross-ventilate the spaces,' says Roberts. 'All teaching spaces are »

COLLABORATION AND COMMUNICATION

At every stage, the project team gave presentations to the client, teachers, pupils and the school's neighbours to communicate the design, inform the developing brief, and engage with future building users, says OR's Peter Roberts.

Workshops with the school gave a detailed understanding of how spaces would be used and how they may change, to ensure solutions would be effective and easily adaptable.

A range of tools and devices were used to facilitate collaboration, including: Breeam, to drive the team to achieve – and in many cases – exceed environmental targets; the development of SketchUp models to communicate ideas; the construction of physical models to communicate design concepts; and Autodesk Revit building information modelling software, to collaboratively develop the design and facilitate installation sequencing. There were also bi-weekly workshops for the team.

The suspended service-raft concept, for example, was adopted only after extensive consultation with the school. 'Once the CLT was up, the contractor rigged up some temporary supplies and we installed the lighting, ductwork and smoke detectors, so we had a mock-up that was representative of what we were proposing,' says Roberts. 'That proved really useful because we used the school's comments to inform the final design.'

The project adopted a two-stage procurement process to benefit from main contractor Rooff's input, including buildability, sequencing and prefabrication advice for the CLT and glulam column installation.

After completion of Phase 1, the team engaged in 'lessons learned' sessions. 'One lesson was the need to protect the CLT from UV light to stop it getting bleached; another was the success of the natural ventilation, acoustics and daylighting, which reinforced the argument for these measures in Phase 2,' says Roberts.

At the handover of each construction phase, separate soft-landing processes were used to communicate the design principles and environmental strategies to enable occupants to operate the building efficiently and to train maintenance staff to operate, maintain, monitor and fine-tune systems.

South elevation showing the new rooftop sixth-form extension and dining facilities in context with the existing building

Exposed CLT gives the school's new dining room a warm, natural look

» naturally ventilated and passively cooled; we modelled them [in accordance with the methods] in CIBSE *TM52 The limits of thermal comfort: avoiding overheating in European buildings* to ensure they would not overheat.'

OR Consulting has exploited an area of pitched south-facing roof that rises over the clerestory window to accommodate a row of photovoltaic panels (PVs). 'There's 80m² of PV, installed as part of our carbon-reduction strategy, connected to the school's electrical infrastructure, with the surplus exported to the Grid,' says Roberts.

To help pupils and teachers understand how the building works, the design team has placed operating instructions – written in what Roberts terms 'layman's language' – next to each element. For example: 'In summer, please open these windows to cool the space'; 'In winter, please keep windows closed to reduce carbon emissions'.

'Once people understand the controls – why they're there and what they do – they get more comfortable with their use,' says Roberts, who adds that the sixth-form spaces are designed to be mechanically ventilated to prevent the need to open windows in winter. 'We've kept the design as simple and passive as possible; it is predominantly a natural ventilation system with heat-recovery ventilation just for the winter.'

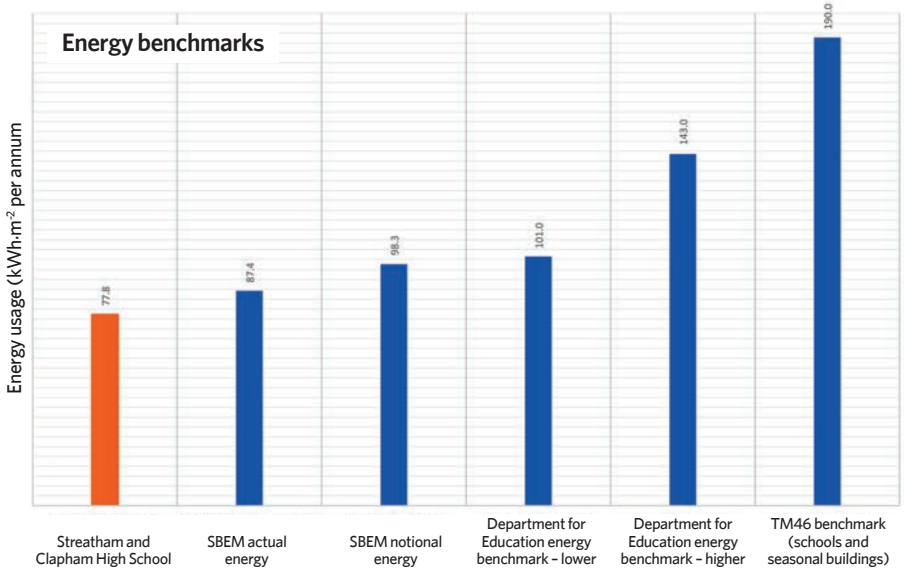
Two large- and three small-capacity MVHR units supply fresh air to, and extract stale air from, the spaces via distribution ducts running at high level in the corridor – an arrangement that required careful acoustic detailing: 'We had to get the acoustic crosstalk details correct to ensure there would be no noise transfer through ventilation ductwork to adjacent classrooms,' explains Roberts.

Within the spaces, the ducts are concealed above a series of suspended service rafts, which incorporate lighting, electrical distribution, acoustic panels and smoke detectors. 'In every classroom, all of the services are integrated into the same element, so you have a polished detail,' says Roberts.

Energy benchmark commentary

- Energy and CO_2 emissions have been compared with benchmarks taken from CIBSE TM46, Department for Education (DfE) Technical Annex 2H: Energy, and the project's SBEM predicted consumption.
- The SBEM predicted energy consumption includes ancillary catering spaces, which act to increase the hot-water usage within the calculation. As such, the SBEM predicted energy benchmark is not a 100% like-for-like comparison.
- The annual energy consumption for Streatham and Clapham High School are:
- 59% below the TM46 benchmark
- 45% below the DfE higher-range benchmark
- 23% below the DfE lower-range benchmark
- 21% below the SBEM notional energy consumption (including equipment usage)
- 11% below the SBEM actual energy consumption (including equipment usage).

From the breakdown of energy loads by end use, it can be seen that the non-fixed equipment loads are higher than for the notional SBEM non-fixed equipment allowances.



Heating and IT strategy

In winter, roof-mounted air source heat pumps (ASHP) provide heat to the classrooms via an underfloor system. Two heat pumps, rather than a large, single unit, were used to add resilience to the system, and, as Roberts explains: 'Low-temperature underfloor heating was necessary to optimise the operating temperature of the heat pumps.'

Stair towers connect the sixth-form centre with the school below, and incorporate new plant areas and a fully accessible passenger lift. The ASHPs are housed in the west rooftop plant enclosure, along with the heating system buffer vessel and one of the heat-reclaim ventilation air handling units. The east rooftop plant enclosure houses the second large MVHR unit, ventilation plant for the new kitchen, and gas-fired hot-water generators selected for their ability to respond to the high, short-term hot-water demand of the kitchen. Between them, the rooftop plant enclosures incorporate most of the plant for the first and second phases of the project.

A new riser links the plantrooms to the second-phase buildings, with services capped off at ground level until completion of the »

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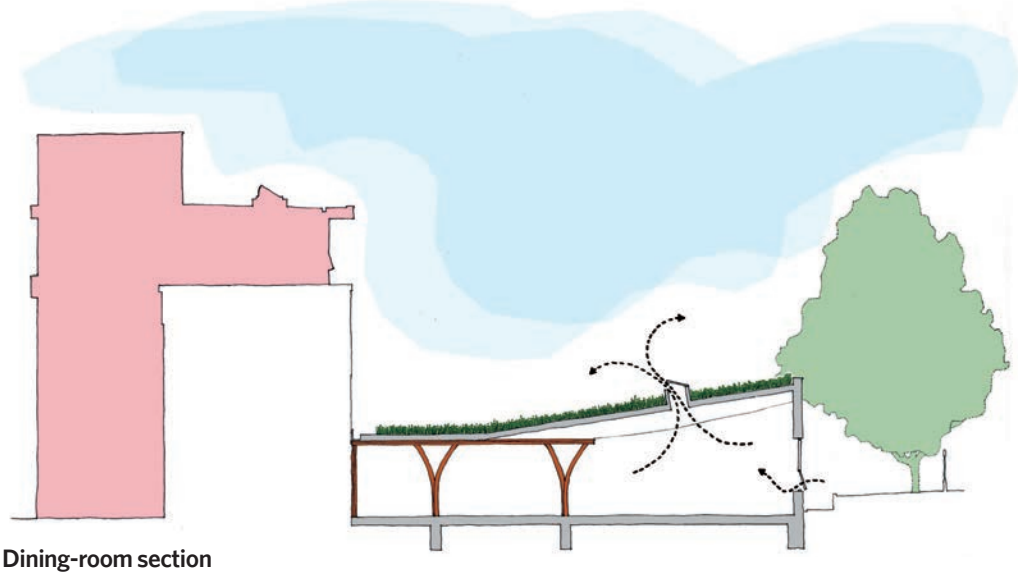


Dining-room section

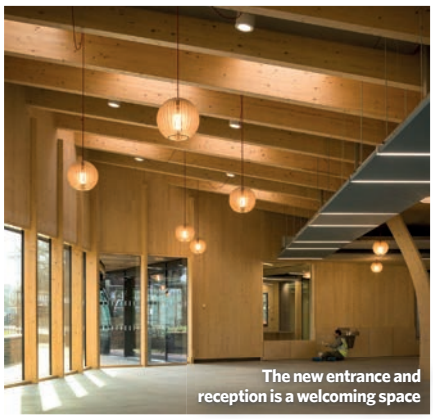
Passive ventilation strategy uses low-level windows and high-level rooflights to create ventilation routes – use of heat-recovery systems with ventilation strategy to increase energy efficiency of proposal. Wildflower roof creates new ecological habitat and slows rate of surface water run-off into mains drainage systems.

» second phase. 'We designed the project in one go and then split it into two construction phases,' Roberts says. 'What was important was establishing the construction phasing early enough to build that into the design.'

Designing the services installation early enabled service cut-outs to be incorporated into the CLT panels during manufacture, to save time on site. 'Things such as builders' work had to be agreed so that they could prefabricate the holes in the CLT as part of the manufacturing process,' explains Roberts, who adds that there was very little opportunity for prefabrication of building services. 'Because the CLT was supplied in sheets, we were not able to crane in completed rooms, so we had to install the systems on site. The shower pods were the most significant elements we were able to prefabricate.'

One of the challenges with using a relatively lightweight material such as CLT for teaching spaces is the need to prevent flanking transmission, for the extension to comply with *Building Bulletin 93: acoustic design of schools – performance standards*. Flanking transmission is when sound transmits between spaces indirectly by going around a wall, rather than directly through it. Usually, when two CLT walls butt up to each other, a plasterboard inner layer serves to mask the joint to prevent flanking transmission. But, explains Roberts: 'Because CLT is a beautiful material, architects want it exposed, so all you have, from an acoustic perspective, is a butted joint, which is capable of flanking transmission.' So, OR Consulting developed a detail based on concealing compressed mineral wool in the joint and attaching plasterboard to one side of the CLT panels.

'This allowed the CLT to remain exposed while preventing flanking transmission; it also prevented sound transmission via the services installed in the walls,' said Roberts.



The new entrance and reception is a welcoming space

Keeping the CLT exposed also impacted the IT strategy. Rather than flood-wire the rooms with data points, the designers limited each classroom to a maximum of two wall-mounted data points and to using Wi-Fi-enabled equipment. 'At the time, this solution was seen as a progressive approach for a school to take,' says Roberts.

After the rooftop sixth-form centre was completed in 2016, construction of Phase 2 began. This comprised a 725m² ground-floor extension, with a new dining hall/multi-use space, kitchen, entrance and reception.

The dining block, with its distinctive, green ceramic cladding, has a green roof to reduce peak rainwater run-off and added insulation to cut heat losses. Like the sixth-form extension, it is naturally ventilated in summer and the roof rises up at the perimeter to create a high spot to vent out hot air and encourage cross-ventilation. The internal space also features an exposed CLT structure supported on glulam columns.

Throughout Phase 1, the existing kitchen remained operational; the school then decanted the sixth form to its new rooftop home to free up space for a temporary dining and kitchen facility, which was installed in the creative arts block for use during Phase 2 works. These were completed in autumn 2018.

'Because of the way everyone engaged in the project, we delivered something special,' says Roberts. **CJ**

■ The 2022 CIBSE Building Performance Awards are open for entries **www.cibse.org/bpa**

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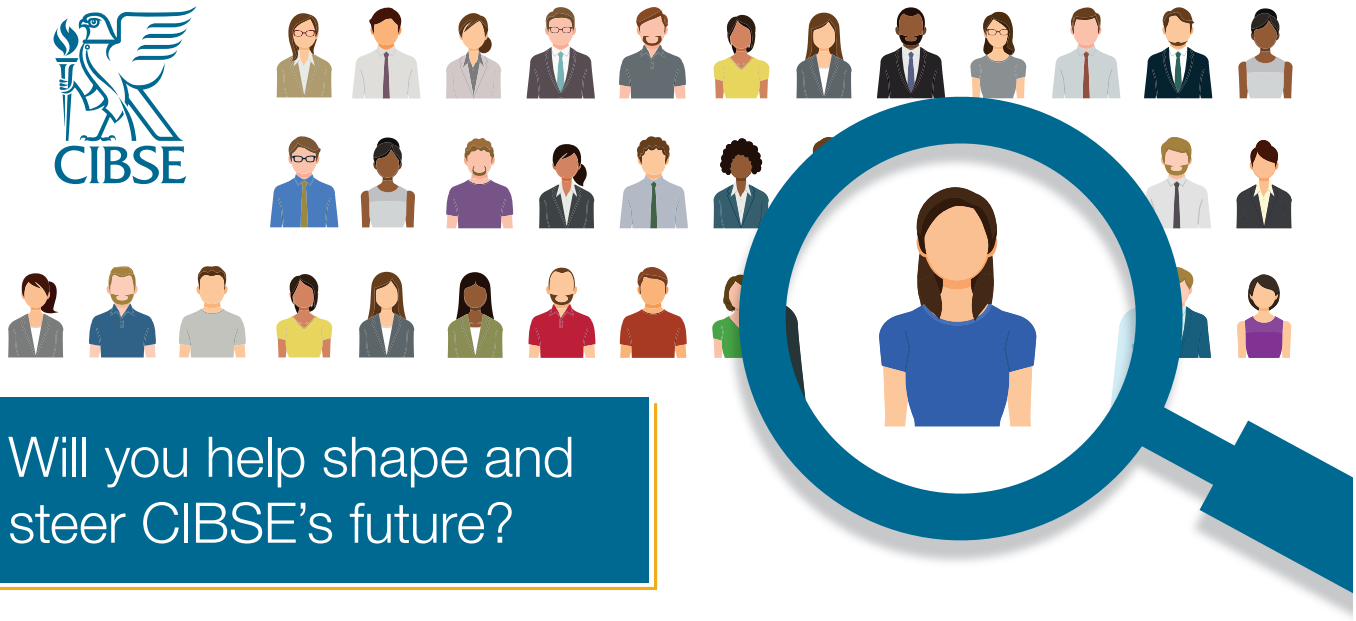

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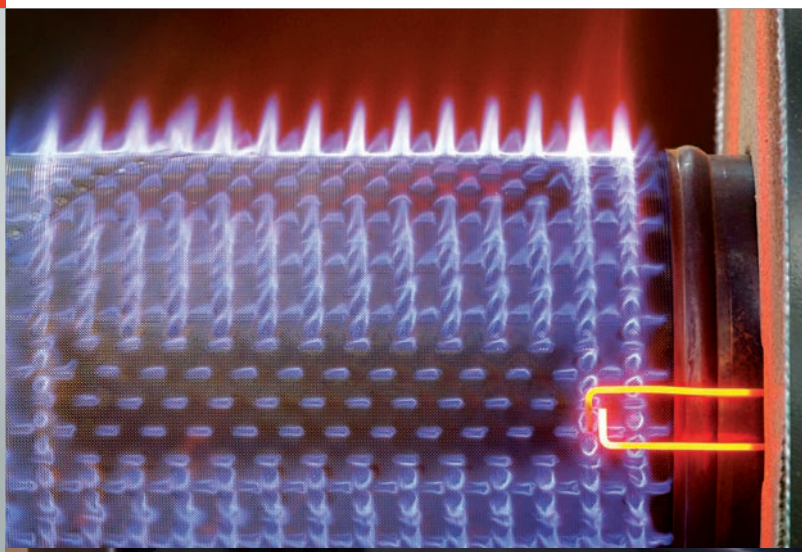

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E.ON plans £4m heat pump scheme in Square Mile

Project aims to capture CHP waste heat from existing energy centre

Businesses in the City of London will benefit from clean heat

E.ON has announced a scheme to install a ground source heat pump at its Citigen energy centre in the City of London.

The £4m project, to be sited in the historic Port of London Authority building on Charterhouse Street, is forecast to give the same amount of heat used by 2,300 homes with half the carbon emissions.

Built by energy company E.ON UK, it will use three 200m boreholes to tap the natural warmth of the earth to offer heating and cooling to nearby buildings.

The project will extend the existing Citigen plant, which uses a heat network connected to two combined heat and power plants (CHPs). The heat pump scheme will capture waste heat from the CHPs.

Energy minister Lord Callanan said: 'E.ON's project is a commercial vote of confidence in heat networks and heat pumps. It means homes and businesses across the City of London will benefit from clean heat, and is another great example of how the pace of rolling out cutting-edge, low-carbon technologies is being accelerated across the UK.'

Michael Lewis, E.ON UK chief executive, said: 'Tackling the environmental impact of heating, especially in densely populated areas, will be key to meeting the UK's 2050 net-zero targets. Part of that challenge means reimagining how energy is provided to homes, businesses and cities.

'In taking the next step and installing heat pump and geothermal technology at Citigen, we're making a powerful statement of what can be done to reduce carbon usage on a large scale.'

Check meters must be a priority

Research by metering and billing agent Insite Energy shows that the majority of heat networks it manages have no check meters.

The company, which works with heat providers and property owners, has stressed the importance of check meters after data loggers across 250 heat networks revealed that only around 20% have at least one connected.

Of these, none is sufficiently reliable to be used in place of industry-standard efficiency ratings – usually because the meter is not labelled and it is not clear to what the data refers, Insite Energy said.

The Heat Network (Metering and Billing) (Amendment) Regulations 2020, which came into force on 27 November 2020, place obligations on anyone supplying and charging for heating, cooling or hot water through a heat network.

Under the regulations, heat suppliers of buildings under the 'open' class must have completed a cost-effectiveness and technical feasibility evaluation by 27 November 2021. Where it is determined that they are required, heat suppliers must ensure heat meters and/or heat-cost allocators are installed by 1 September 2022.

From 1 September 2022, heat suppliers will have to ensure meters or heat cost-allocators (as applicable) are installed as soon as it is determined that a building falls within the 'open' class.

Insite Energy has recommended that the installation of check meters is made mandatory, and that they are used to measure the efficiency of each heat generator in the plantroom.

Heat Trust signs up 100th heat network

The number of sites registered with Heat Trust has grown by 30% over the past year.

Clapham Park heat network, operated by Pinnacle Power under its With Energy brand, is the latest to have joined the voluntary consumer-protection scheme. This means more than 57,000 people on 100 heat networks across the country are now protected under Heat Trust.

Heat networks are set to play a key role in meeting carbon-reduction targets and creating a sustainable energy future, according to Heat Trust. Up to five million homes could be reliant on heat-network infrastructure by 2050.

Heat Trust monitors and audits participating suppliers to ensure they live up to their commitments, and works to promote best practice in customer service in the sector. Managing director Stephen Knight said customers deserve the same rights and protections as those living and working in properties in the regulated sector.

Councils explore mine-water schemes

Sunderland City Council is to submit a bid for government funding for a project with the potential to harness green energy from old mine workings to heat city buildings.

The £2.22m Heat Networks Investment Project grant will allow further studies to take place to understand whether geothermal heat could be extracted from the former Wearmouth Colliery.

Subject to funding and the scheme being deemed viable, the energy from mine water could be used to heat new homes being developed at Riverside Sunderland, as well as other city buildings.

Elsewhere, a scheme designed to heat buildings with mine water has been scaled back by Bridgend Council after it was found to be too expensive.

Experts found that more research was needed for the Caerau Heat Network project, which was supposed to use heat from water in former coal mines – boosted by a ground source heat pump – for heating and hot water in residents' homes.

Instead, council officers recommended moving ahead with a new smaller scale plan that would see mine water being used to heat Caerau Primary School. Two other low carbon heating schemes were recommended: a small-scale heat pump on the Tudor Estate; and a private wire power supply (electricity) from Llynfi Afan Renewable Energy Park, providing low carbon power.

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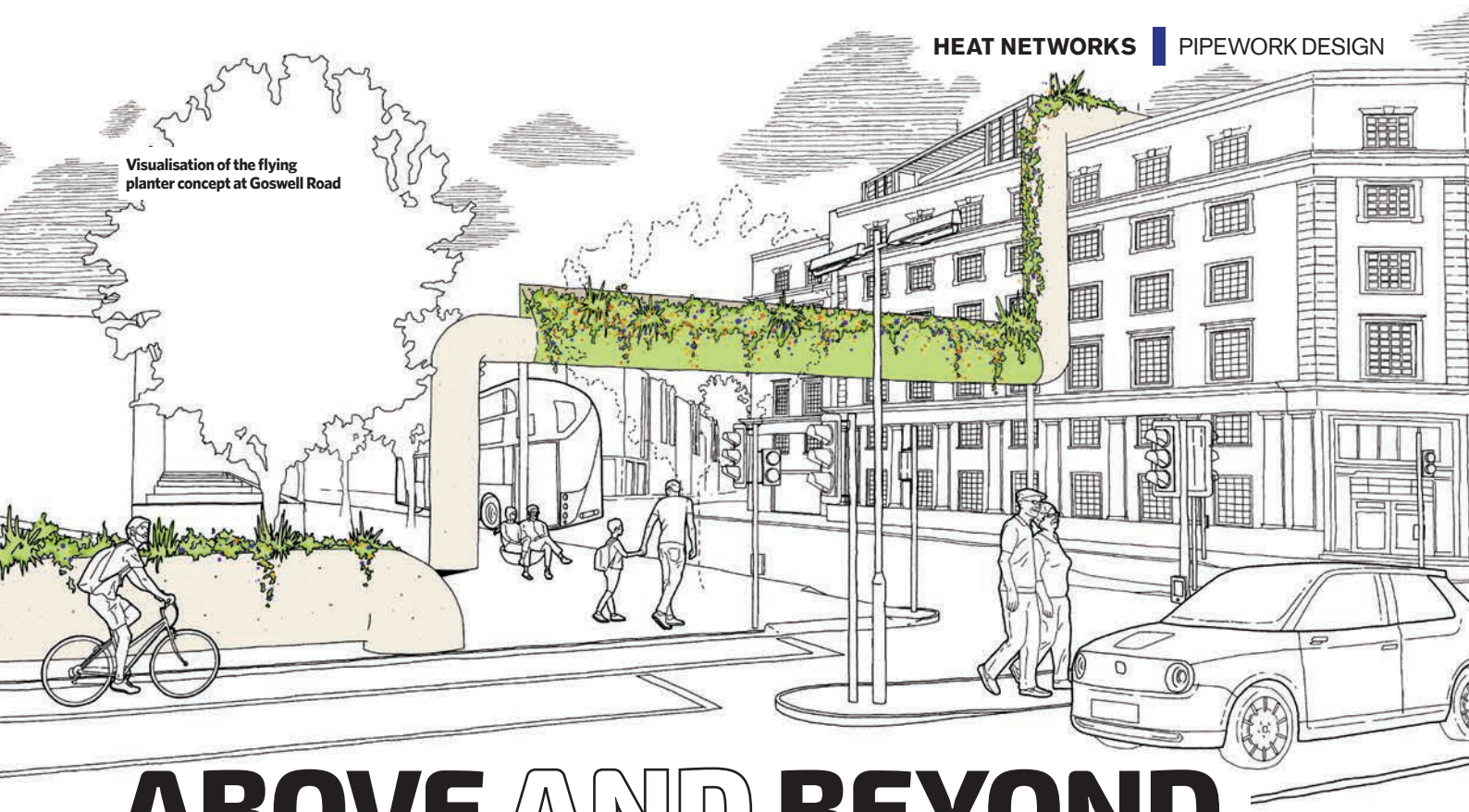


Visualisation of the flying planter concept at Goswell Road

ABOVE AND BEYOND

Implementing innovative approaches to pipework routing, such as above-ground distribution planters, will be critical in future urban energy networks, says GreenSCIES' **Dr Akos Revesz**, in a paper presented at the 2021 Technical Symposium

District heating and cooling can be a cost-effective way of providing reliable, low carbon heat at a fair price to consumers, while supporting local regeneration. The Climate Change Committee estimates that around 18% of UK heat will need to come from heat networks by 2050, and it will be crucial to expand the rollout of low carbon heat networks in heat-dense areas. However, the congested nature of our cities – both above and below ground – is a significant barrier to the installation of large new energy infrastructure.

As part of the engineering value and technical design exercises undertaken by the GreenSCIES team, various design options have been developed, aiming to overcome the challenges presented by congested streets. These include running pipework in above-ground planters, in flying planters, and through trenches shared with other utilities.

The GreenSCIES project (**www.greenscies.com**) is led by London South Bank University (LSBU) and funded by Innovate UK, part of UK Research and Innovation, through the government's Industrial Strategy Challenge Fund Prospering from the Energy Revolution programme.

The aim of the project is to develop a construction-ready design for a scheme that tackles fuel poverty by providing a significant reduction on consumer bills, delivers large reductions in air pollution, and improves local skills, jobs and economies.

Our GreenSCIES consortium is at the forefront of new applications where heat/coolth can be shared across ultra-low temperature networks, and these new approaches present even greater opportunities to move closer to net-zero carbon.

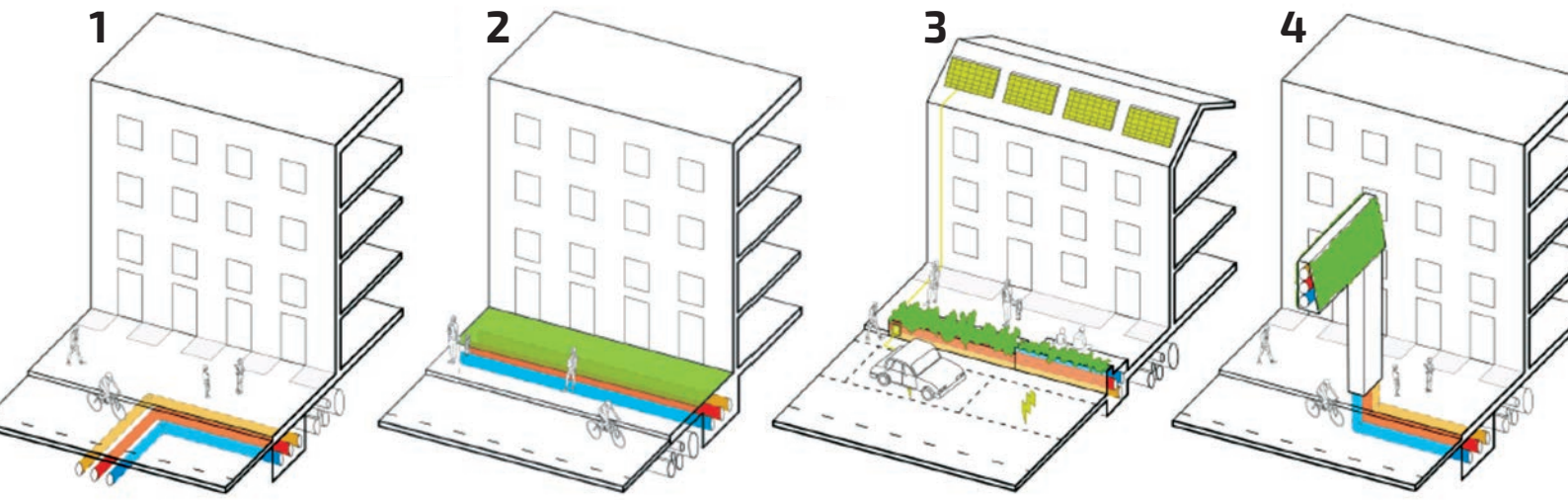
The GreenSCIES system will deliver low carbon heat, cooling, and power, supplying many urban residents and local businesses. It is based around a fifth-generation ambient-temperature heating and cooling network loop (5DHC), a concept that includes decentralised energy centres and heat pumps in each building. The network can share heating and cooling between buildings providing even greater carbon savings than third- and fourth-generation medium-/low-temperature networks.

The GreenSCIES ambient loop, which is designed to be as low as 15°C flow, will be using waste heat from a local data centre and borehole aquifer water to provide the heat source for water source heat pumps that can supply buildings at temperatures up to 80°C. In addition, the aquifer will be used to provide a balancing mechanism for the network and long-term thermal storage through an innovative concept called aquifer thermal energy storage.

Novel heating and cooling distribution

The traditional approach to energy network distribution in existing urban settings is to bury pipework and ductwork in below-ground trenching, typically hidden from view beneath carriageways and footways. From a technical viewpoint, for an ambient-loop network as proposed for GreenSCIES, this approach benefits from the steady environment of the ground cover, protecting pipework from disturbance, and mitigates any visual 'intrusion' at street level.

However, trenching in a dense urban borough – where pavements and roads are already heavily populated with existing utilities and other unknowns – attributes a large risk to the project, particularly »



The four lead distribution pipework routing concepts

> "The addition of plants is proven to improve air quality for people walking alongside busy roads and can mitigate the heat island effect"

» when proposing for construction contracts where allowances for the unknown could push costs to a prohibitively high level.

As the GreenSCIES network has been designed as an ambient loop, there are fewer technical restrictions on locating pipework – for example, less need for preventing heat losses from the pipes because of the near-ambient flows. So, the GreenSCIES team took a hypothesis of routing distribution pipework above ground and explored the technical, economic, spatial and social implications of this approach. A more detailed discussion of the approach and the results were presented at the CIBSE Technical Symposium.

The vision in GreenSCIES is to design a technically viable, smart local energy system while improving the locals' lives by creating more liveable spaces.'

Concept proposals

GreenSCIES consortium member Cullinan Studio has been appraising several alternative approaches, some of which are related to the integration of pipework with public-realm interventions as an alternative to digging.

The options developed for appraisal (shown above) took on board technical guidance from third-party product manufacturers, specialist contractors and engineering consultants.

Kristina Roszynski, of Cullinan Studio, said: 'Cullinan Studio is committed to restoring the connection between nature and people. The 5DHC network infrastructure can provide wider benefits for the local community, such as an opportunity to improve their streets through adding bio-diverse planting as part of above-ground pipework distribution.'

The four lead distribution concepts appraised are:
1. Hard dig trenching in carriageway
2. Soft dig trenching in landscaping/verges
3. Above-ground distribution planters
4. Above-ground road-crossing or building-mounted distribution planters.

These options have been appraised against social, environmental and practical criteria, with a focus on adding value to the public realm, reducing risk and minimising disruption to public life. The Viability Matrix has been published and discussed in detail in the full Technical Symposium paper *Engineering value and innovative design options for smart local energy systems.*

One of the novel concepts developed involved planters that conceal raised pipework, laid parallel to the carriageway, creating a green buffer between people and vehicles (option 3, above). The addition of plants along roadways is proven to improve air quality for people walking alongside busy roads and can mitigate the heat island effect in cities.

Explored alongside these concepts, is the potential to integrate photovoltaic panels, e-mobility and smartphone charging hardware into planters and street furniture at strategic points along the pipework route, to address the mounting levels of 'street clutter'.

Of course, to understand the maintenance requirements of any above-ground options, the long-term horticultural maintenance of the planters, for example, is absolutely crucial and should be considered – and planned for – at the design stage.

In conclusion, we believe that the challenge to develop smart local energy systems around 5DHC networks requires a holistic approach from an integrated technical design team, commercial investigations, and community engagement. We are committed to the co-design of the 5DHC network as part of our community engagement strategy, to ensure that no-one is left behind in the energy transition. Some of the concepts presented are an entirely different way of thinking about the problem of pipework routing and offer a new approach to implementing this form of infrastructure.

The work shows that there are considerable benefits in some of these innovative approaches that have not, generally, been considered in more traditional heat-network projects. Implementing such novel approaches with multiple economic, environmental and community benefits will be critical in future urban energy networks. CJ

DR AKOS REVESZ is senior research fellow at London South Bank University and technical lead at GreenSCIES

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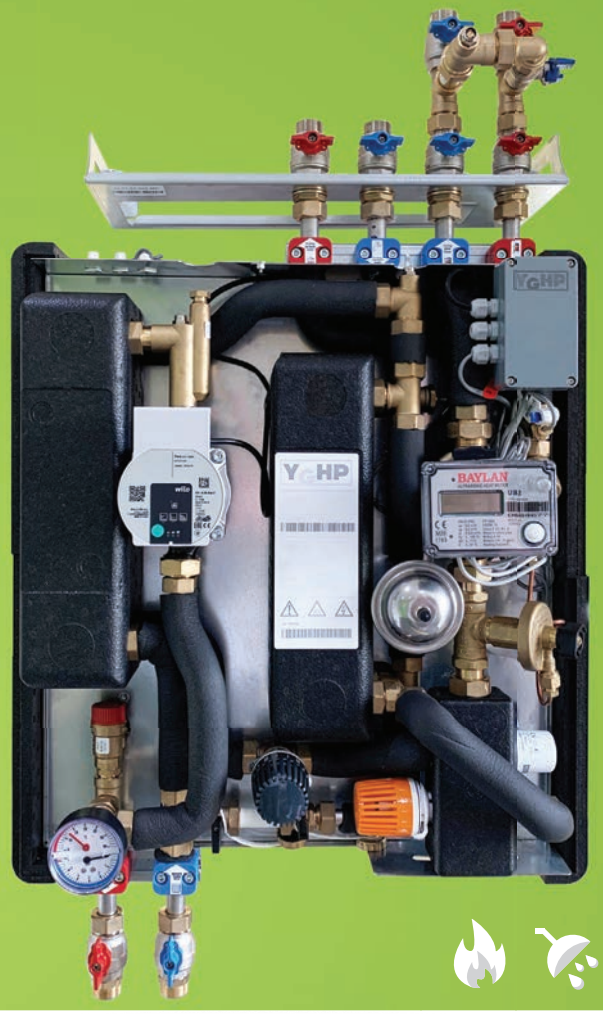

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A NEW ERA FOR HEAT

A large-scale ammonia water source heat pump at the Queens Quay heat network in Glasgow promises to decarbonise heat for new and existing buildings. Vital Energi's **Lee Moran** explains the challenges of maximising efficiency for varied building stock in this innovative scheme

While there is considerable enthusiasm for large-scale water source heat pumps for new-build projects, they aren't always considered as suitable for retrofit buildings with traditional secondary side heating systems. With correct design, however, they are an intelligent solution for most projects or – as in the case of the Queens Quay project, commissioned by West Dunbartonshire Council – a mixture of new-build and retrofit connections.

The Queens Quay energy solution has two 2.65MW ammonia water source heat pumps, built by Star Refrigeration, and a 130m^3 thermal store at the heart of the low carbon system. This provides around 80% of the 51,000MWh annual heat demand, with the remainder supplied by backup, gas-fired boilers. There is also scope for two heat pumps to be added as the build out progresses and the heat demand increases.

The colourfully lit chimney contains the heat pump ventilation system and includes the emergency ammonia purge system, which ensures there is adequate dispersion and no impact on locals in the event of a leak. Three boiler flues also terminate in the chimney.

A riverwater abstraction system has been installed at the Queens Quay Basin, which takes water from the river Clyde and circulates it through the heat pumps, before returning it to the river, with a stipulation that it cannot be returned more than 3K cooler than its original abstraction temperature. The heat pump converts the latent heat from the river into low-temperature hot water, which is distributed via a 1.5km district heat network serving the 23-hectare development. It will eventually serve 1,200 homes, and the associated infrastructure needed to support them, such as health centres and commercial facilities.

Delivering a hybrid district heating system

While the heat pumps were capable of supplying heat at 80°C+, there was strong motivation to lower the low-temperature hot water (LTHW) flow temperature as much as possible, because every 1K reduction resulted in an increased heat-pump efficiency of 1.5%. This created a dilemma for the designers, who would need to keep temperatures relatively high to meet the needs of the existing buildings, but low enough to get maximum efficiency from the pump.

Historical heating systems served by gas boilers operate on 82°C flow and 71°C return temperatures, meaning primary flow temperatures of up to 90°C are commonly used in district heating schemes to satisfy this requirement across a hydraulic break, such as a plate heat exchanger. A detailed review of the existing systems concluded that these buildings can operate at 75°C flow and 60°C return, while new buildings have been designed to operate at 70°C and 45°C return. Weather compensation can reduce summertime temperatures for further efficiency benefits.

The flow temperature has to be high enough to meet the needs of the four retrofit buildings but, as these constitute 10% of the demand, they don't influence the overall network distribution temperature too much and we can still prioritise overall system efficiency. If the balance of loads tended towards a higher retrofit percentage, then the reciprocal would be true. However, reduction in temperature via weather compensation is important to ensure the system

can satisfy the domestic hot-water production, as well as any specialist needs, such as healthcare pasteurisation.

With this blend of new-build and retrofit, our designers achieved a coefficient of performance of 3.1, making it considerably more efficient than traditional solutions, such as gas-fired boilers or combined heat and power.

Building the data model

Initially, the development had the following anchor-load buildings: the Aurora Building, Clydebank College, Titan, a leisure centre and the Queens Quay Care Home. It will create new-build properties, such as 1,200 homes, but there is an opportunity to incorporate significant existing building stock going forward.

Predicting the energy demands of a development is difficult, but necessary because it dictates the sizing of the plant, equipment and district energy network. For new-build connections, understanding the heat demand based on building designs is relatively straightforward – by looking at U-values, for example – but occupants can use energy in a variety of ways, which affects their annual energy demand and profile. Energy data for existing buildings is seldom available in the granularity required to build detailed energy profiles, so calculations often incorporate experience to find a solution with inherent flexibility that can deal with all possible scenarios.

Understanding peak loads to size energy-centre plant is something all district energy designers must consider. The real challenge, however, is understanding the diverse energy profiles across the network to select the most appropriate water source heat pump and thermal storage, to achieve a significant heat fraction. This means accurately predicting the energy demands for all connected buildings, plus the diversity across the network. Without these, the water source heat pump could have been sized incorrectly: too large and it would not operate efficiently; too small and the carbon savings would not be achieved.

A flexible solution

Designing new buildings and properties to connect to a district energy system, which operates at lower temperatures, is relatively straightforward. Building Regulations have helped reduce the heat losses from buildings by improved U-values and lower infiltration rates – all of which means thermal comfort can be achieved with lower temperatures. Existing buildings, particularly ageing ones, usually have higher heat losses and infiltration rates, so higher temperatures are required to achieve the same thermal comfort levels.

The 2.65MW ammonia water source heat pumps

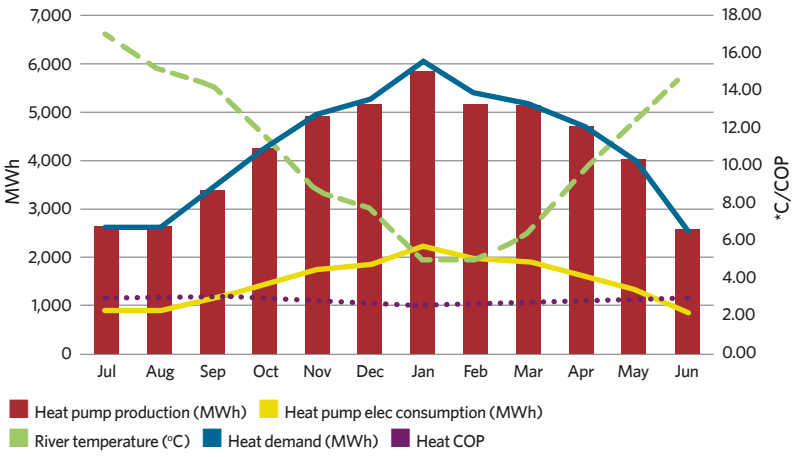

Figure 1: Queens Quay – heat pump production – phase 4+

PROJECT TEAM

Client: West Dunbartonshire Council
Developer: CRL & Dawn Developments
Heat pump manufacturers: Star Refrigeration
Performance specification: Ramboll
Concept design: Howley Energy and Water – worked with Ramboll for the original concept (abstraction etc)
Architect: ADF Architects
Civil structural engineers: Goodson Associates

Connecting these buildings to a network with lower operating temperatures can only be done after a full evaluation of space-heating emitters – such as radiators, fan coil units and air handling unit coils – to ensure heat losses are achieved. While it wasn't necessary on the Queens Quay project, improvements to building fabric, such as insulation and replacing single-glazed windows with double-glazed ones, can help with reducing heat losses and is often a sensible place to start.

Often, older LTHW systems have constant-volume pumps controlled via 3-port valves. This can lead to high return temperatures to the energy centre and to the system not performing as designed, or turning off. This, in turn, can result in increased network losses and higher contribution from gas-fired boilers. Converting these 3-port systems to 2-port ones, employing pressure independent control valves, ensures good control and low return temperatures, although there will generally need to be a change in pump-control philosophy, from constant volume to variable volume, often requiring the introduction of inverters to all pumps.

Another consideration is domestic hot water. CIBSE/Association of Decentralised Energy *Heat network code of practice* (CP1) has recently reduced the temperature required within residential properties. However, commercial and healthcare buildings have different temperature requirements and these influence the minimum network temperatures. This is particularly applicable to the summer operating condition, ie the minimum weather compensated temperature.

A heat pump-ready HIU

Many traditional heat interface units (HIUs) do not have the ability to operate efficiently at lower temperatures. While the Queens Quay development would have flow temperatures of up to 80°C, this would »


The abstraction pumps drawing water from the river Clyde

» be a rarity, and in the warmer summer months – when there is little heating demand – it would be dropped as low as 60°C. To deliver efficiency over these parameters, it was necessary to design a heat pump-ready HIU, with an intelligent core, that could monitor the changes in flow temperature and the domestic hot-water temperature, and compensate to ensure optimum performance.

Vital Energi spent two years developing the new technology to meet these requirements. While it was designed with the next-generation district heating systems in mind, it can perform efficiently at higher temperatures. This, combined with its ability to react to temperature changes, means it will stay optimised as the flowrates change throughout the season, giving real-time optimisation to the project.

Ian Spencer, associate design director, says: 'Reduced temperatures mean reduced losses – and, while losses created by an individual HIU are comparatively small, when you multiply this by 1,200 and operate them over a 20-year period, it can deliver significant savings in operating costs and carbon.'

Retrofit and new-build performance

A review of a building's energy system is essential to understand the changes needed to make it compatible with a lower-temperature district energy system. This, combined with a survey of historical energy consumption, begins to paint a picture of what is necessary, but historical oversizing of heat emitters and antiquated controls systems can actually provide a benefit, as they reduce the need to change the secondary side heating system.

Improved standards and advances in technology mean buildings that are only years old can compare poorly in relation to current buildings. The Queens Quay development has buildings that are a few decades old, but because of their fabric construction and existing heating system design, we need to be able to deliver flow temperatures of 80°C and return temperatures of 60°C. On the new buildings, where we can have an input on design, we can deliver 70°C flow and 45°C, resulting in lower temperatures and a higher temperature differential.

Retrofits require more consideration in the design process, but we believe Queens Quay demonstrates that heat pumps are viable for buildings of all ages. Lowering temperatures, while improving insulation, emitters and controls, can be an extremely efficient energy solution. CJ

LEE MORAN is design director, operations – North & Scotland at Vital Energi

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PUMP PRIMER

CIBSE's new heat-pump installation guide aims to equip designers, installers and operators with the knowledge to successfully deliver the 300,000 annual installations needed by 2025. Arup's **Joshua Bird** summarises AM16

Later this year, CIBSE will publish a new Applications Manual *AM16 Heat-pump installations for multi-unit residential buildings*. The manual will provide invaluable guidance to designers, installers and building operators looking to apply a range of heat-pump technologies to high-density housing.

AM16 addresses areas of design that are crucial for good heat-pump performance, including: the importance of sizing a heat pump correctly, mitigating the loss of capacity caused by defrost cycles and the impact of lower DHW temperatures on design. These themes are discussed briefly in this article

Green industrial revolution

Across all domestic and non-domestic building typologies, the regulatory and policy landscape is driving a transition away from gas-fired heating systems towards electrically powered alternatives.

Heat pumps currently provide the most energy efficient means of heating a building electrically – and with a decarbonising electricity grid, they also represent an almost universally applicable low-carbon heat source.

If the UK is to attain net-zero carbon by 2050, the Committee on Climate Change (CCC) recommends that 19 million heat pumps be installed. This would mean installing 294,000 each year by 2025 and 714,000 per year by 2028, which ties in with the UK government's ambition for 600,000 heat pumps to be installed every year by 2028, as part of its Green Industrial Revolution.

The CCC's drive towards electrification of heating underlines the need for planning and design guidance for the application of heat pumps in the residential sector. The Microgeneration Certification Scheme and other industry bodies already offer a wealth of guidance on the design and installation of heat pumps in individual homes.

However, there is currently a lack of specific guidance on the application of heat pumps to multi-residential settings, such as apartment blocks, care homes and student accommodation.

This new Applications Manual brings together best practice and industry-wide

advice for the use of practitioners, and addresses the all-important issue of user guidance for a technology that offers a very different experience for residents compared with traditional fossil fuel-powered heating systems.

Arup has been appointed as technical author under the direction of an expert CIBSE Technical Steering Group comprising industry stakeholders and representatives, including developers, designers, installers, operators, manufacturers and building control professionals.

A structured process

The document gives guidance on new-build and retrofit applications, and is structured around a generalised design process and project life-cycle. It consolidates and signposts other best practice, building on existing guidance such as CIBSE CP1 (2020): *Heat networks: Code of Practice for the UK*.

As well as guiding the reader through the steps of correctly designing and implementing an effective heat pump system, the manual provides useful information on:

- Architectural considerations
- Stakeholder engagement
- Resident user guides
- Capital and running costs
- The state and future of the refrigerant market
- Energy costs to residents
- End-of-life decommissioning.

Experts from Arup and across the industry are contributing to the manual on topics such as controls, commissioning, user-centred design, and the circular economy.

Understanding the technology

This guidance is partly necessitated by the fast-evolving nature of the heat-pump market; with new products, higher efficiencies and novel capabilities emerging on a regular basis. The Applications Manual endeavours to cover the full breadth of heat-pump technologies and applications:

- From in-home heat pumps (such as ambient loop and heat pumps coupled with mechanical ventilation systems) to larger, centralised units serving communal heating networks
- Different heat/cooling sources, such as ground, water and air
- Heat pump capabilities, such as reversible, high-temperature, and simultaneous and independent (or polyvalent) heat pumps.

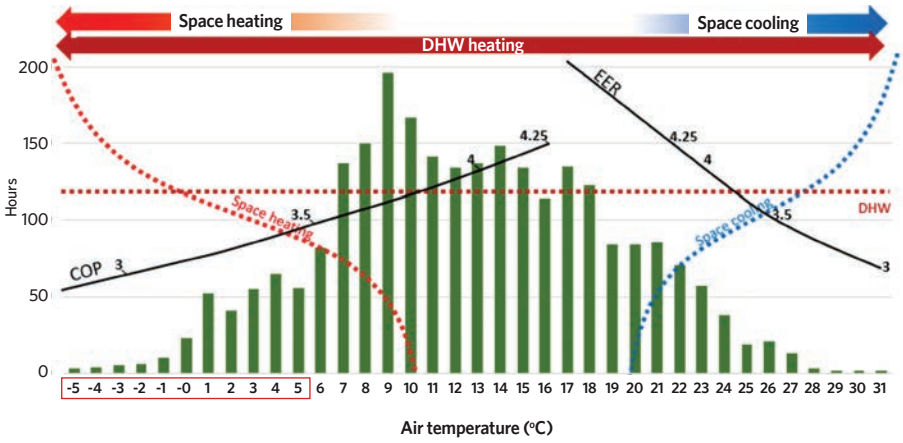

Image c/o Ilaria Ricci Curastro (Arup)

Understanding the variation in external air temperature throughout the year is of particular importance for air source heat pump applications. The frequency distribution of ambient temperatures impacts the heat pump efficiency and thermal demand profile of the building.

The year-round efficiency of a heat pump is a relationship between performance of the unit and the demand profile of the building it serves. New homes with higher performance fabric will require space heating for only the coldest months of the year.

It is widely understood that air source heat pump efficiency (COP and EER) varies with ambient temperature. This efficiency data can be overlaid onto the demand profile of a building to estimate the true efficiency of a heat pump in any given application.

Key: **DHW** – domestic hot water **COP** – coefficienct of performance **EER** – energy efficiency ratio

Figure 1: Frequency distribution of ambient temperatures, demand profile of building, and efficiency of heat pump

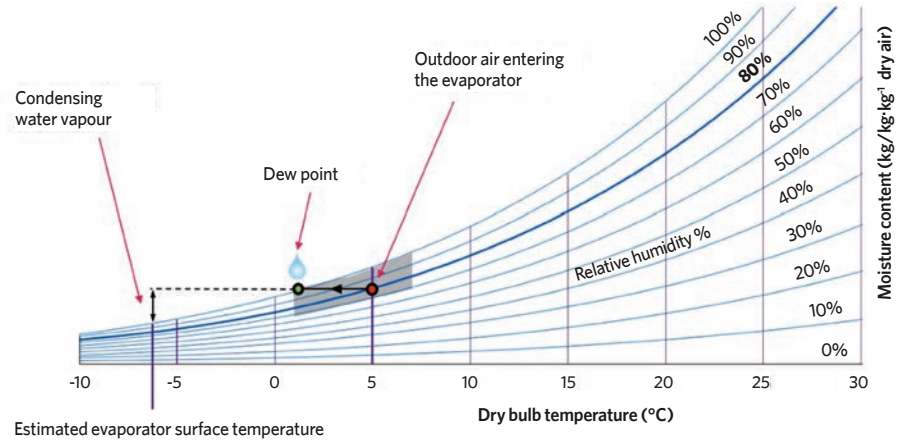

Figure 2: Psychrometric chart showing example condition where an air source heat pump would need to run a defrost cycle

> "This guidance is partly necessitated by the fast-evolving nature of the heat-pump market"

Defrost cycles

This presents a challenge for all air source heat pumps, which use ambient air as a heat source. When the outside air temperature is around 5-7°C, and relative humidity is more than 70%, the water vapour within the air freezes when flowing through the evaporator, forming ice that accumulates on the coil surface.

To prevent the ice build-up at the evaporator that would otherwise compromise the heat pump's capability to operate, the heat pump will operate a defrost cycle. During defrost, the ice is melted via a temporary reversal of the refrigerant cycle.

Each defrost cycle can last for up to five or 10 minutes, with up to 3-4 defrost cycles per hour under full-load and certain ambient conditions. Heat pumps can lose some or all of their heating capacity »

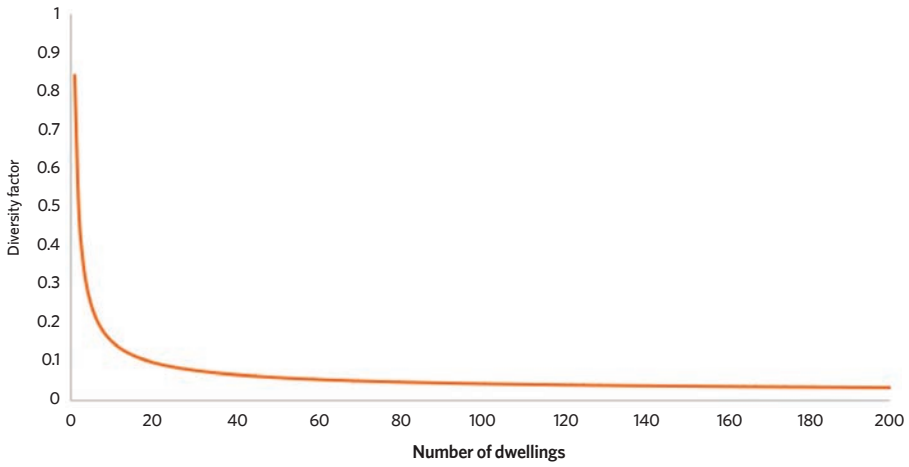

Figure 3: DS 439 diversity curve for DHW demand of an indicative development

» for this period of time, so the design must be able to mitigate this loss of capacity.

The applications manual explains:

- The difference between gross and integrated capacity of a heat pump
- Sizing heat-pump arrays to mitigate the impact of defrost cycles
- Sizing buffer vessels and thermal stores to overcome the effect of defrost cycles.

All about temperature

In new-build residential developments with high-performance fabric, domestic hot water (DHW) represents an increasing proportion of a building's energy use. The provision of DHW also drives the output temperature of the heat pump and often dictates the peak output of a heat pump or communal system.

A recently published guidance note from CIBSE consolidates the legislation and guidance around DHW temperatures and delivery times in instantaneous systems (such as heat interface units). Key findings are that:

- **Generating** instantaneous hot water at a temperature of 50°C satisfies the requirements to reduce the risk of legionella growth and minimise the risk of scalding
- **Delivering** instantaneous hot water to the kitchen tap at a minimum of 45°C within 45 seconds of opening the tap to full flowrate demonstrates an acceptable service level for users and sets a requirement that also limits water use.

This unified guidance on DHW temperatures is key to unlocking the full efficiency of any heat pump that serves an instantaneous DHW system.

Correctly sizing a heat-pump system

In contrast to fossil-fuel boilers, the capacity of a heat pump must be closely matched with the demand it serves. Residential loads are highly variable, throughout the year and across any given day, making this a challenging requirement to meet.

If undersized, the system may fail to heat rooms or DHW to the required temperatures. If a secondary heat source is available (an immersion heater, for example) these may run more than intended, driving up energy consumption, emissions and running costs.

Conversely, if fixed-speed heat pumps are oversized, they will short-cycle at part load, impacting system efficiency. Most inverter-driven units will also see a reduction in efficiency when operating at part load, but not to the same extent as fixed-speed units.

The higher marginal capital cost and space taken by an oversized heat pump underlines the importance of accurately determining the required capacity.

The Applications Manual reiterates the importance of correctly accounting for diversity, particularly of DHW demands, in centralised systems.

The updated CP1 (2020) provides an invaluable reference to an English translation of the Danish DS 439 standard, which readily allows designers to exploit diversity values as low as 2-3% of the connected load (see Figure 3).

The guidance also provides information on how to size buffer vessels and thermal storage, which can provide: System stability, management of defrost, peak lopping, heat sharing and resilience

AM16 Heat-pump installations for multi-unit residential buildings will be released shortly at **www.cibse.org/knowledge** and will be a valuable resource for building designers and operators, as well as heat-pump installers, guiding practitioners in the successful application of this evolving technology to the residential market. CJ

A case study of a Wilmott Dixon project features in AM16

JOSHUA BIRD is a senior engineer at Arup

Acknowledgements
CIBSE would like to acknowledge the support of the NHBC Foundation in the production of this publication.

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THE QUEEN'S AWARDS FOR ENTERPRISE: SUSTAINABLE DEVELOPMENT 2021

Instantaneous hot-water systems can cut energy use and minimise the risk of legionella, says **Huw Blackwell**, co-author of a new CIBSE guide on reducing DHW temperatures safely in heat networks and buildings

TURNING ON ENERGY SAVINGS FOR HOT WATER

Domestic hot water (DHW) is the problem child of low carbon heat. Making hot water is energy intensive and accounts for a greater proportion of building energy use as insulation and renewables continue to reduce energy consumption in space heating.

Some minor gains have been made in production efficiency (in Part L of the Building Regulations) and consumption reduction (through Part G), but the energy consumption of DHW cannot be reduced to minimal levels easily, as with PassivHaus-type interventions.

A new guide published by CIBSE, however, will explain how DHW energy consumption can be reduced by using instantaneous hot-water systems to safely supply water at lower temperatures.

The risks

There are two potential health risks with DHW. The one writ large in the building services world is Legionnaires' disease, which any sensible designer or facilities manager treats very seriously because of its potential implications for public health. This drives professional risk management, water treatment and monitoring for hot-water systems.

The second risk – less debated – is scalding, even though this can cause significant injury or risk of death for the very young, the old, and the vulnerable in society. Typically, this is managed in modern design through the deployment of thermostatic mixing valves (TMVs) locally, on appropriate outlets, which themselves can be assessed within risk management and maintenance processes.

Fundamentally, these two risks drive the operating temperatures of DHW systems. Prevention of Legionnaires' disease requires that water is supplied at 50°C to the outlet and stored at 60°C to pasteurise DHW supply. The risk of scalding increases from 43-44°C upwards, with the duration of safe exposure reducing rapidly as temperature increases. At 60°C, water will scald an adult, leading to third-degree burns in a matter of seconds, and a child much faster.

Balancing act

As may be seen, there is a balancing act to perform between these two requirements in the design of systems. If we add in the energy-consumption factor, it becomes yet more complex. Water has a high specific heat capacity, so there are useful energy gains to be obtained from reduced water heating, particularly if it only requires a temperature of 44°C at the outlet. However, this is not straightforward to deliver when also considering the Legionnaires' risk.

Last year, a group formed within CIBSE started looking at this problem, to understand the scope for clarifying guidance around all three issues, with the potential to unlock energy savings. *CIBSE Journal* covered this discussion ('Taking the temperature', February 2020) and, since then, committee members have worked hard to prepare their first publication on the matter, which will be published imminently.

The premise of the work is based upon what existing design solutions are: currently able to mitigate both risks; generally acceptable to relevant statutory bodies – for example, building regulators and the HSE; and commercially available for wider deployment.

An early observation was that a common approach to reduce the »

"The group hopes to bring a better balance to the risks of Legionnaires' disease, scalding and excess energy consumption"

Bosch Commercial & Industrial's Greenstar heat interface unit

» risk of Legionnaires' and scalding, as well as energy consumption, is the use of point-of-use or low-storage (≤15 litres) water heaters. This was specifically discussed in HSE guidance[1] as a low-risk system. Typically, these are electric systems directly linked to mains potable water beneath a sink, serving a basin or similar with low volumes of hot water within a facility. The challenge with these systems is that, when demand for hot water is high, they usually struggle to provide a reliable supply.

A similar system is the electric shower, a higher-power, instantaneous hot-water supply, where temperature is often regulated by varying the volume of cold water supplied directly. Although they tend to be volume-limited, compared with storage systems, and have a high instantaneous electrical load, these are particularly interesting because they heat water to the supply temperature required with no excess, and no mechanical TMV, with Legionnaires' risk often controlled with a timed flush or equivalent approach.

New guidance

Guidance Note: Domestic hot water temperatures from instantaneous heat interface units seeks to extend this application to mechanical point-of-use systems, where a heat exchanger is used to produce hot water instantaneously from a building's primary hot-water system.

It is understood, that provided the water storage volume within the plate heat exchanger and between pipework and the hot water outlets is ≤15 litres, and the system can produce hot water at 50ºC, this may also be considered a 'low risk' approach, equivalent to systems described above.

None of the approaches in the applications manual are 'zero' risk with respect to Legionnaires' disease, and they do not release the designer or building operator from the need to undertake a risk assessment and appropriate management and maintenance under health and safety law. However, they may be considered acceptable and, at times, preferable design solutions to the production of hot water in certain situations. Together with other good design practices – for example, the elimination or minimisation of cold water storage tanks, use of copper (biocidal) distribution pipework – this may help minimise and control this design and operational risk.

The mechanical approach, then, has the potential to solve the production and volume constraints of conventional point-of-use electrical systems, as well as offer a number of efficiency benefits to mechanical systems.

For example, communal residential heat interface units may be operated to produce DHW at 50ºC (with the 15-litre volume constraints remaining) and, therefore, building primary distribution circuits may be operated at around 55ºC. This, in turn, leads to reduced distribution losses (because of lower flow temperatures), increases the scope for the use of heat pumps in these systems, and improves operational efficiency for them, as production temperatures are also lowered.

Even standalone heat pump systems at the domestic or commercial scale may benefit. Thermal storage is effectively transferred to the primary side (via system volume, a buffer vessel, or thermal store) and may be operated at lower temperatures with the associated energy benefits, including lower losses and higher efficiency production.

Legionnaires' risk may be reduced by removing the storage from the potable water supply. As water-supply temperatures are typically lower (50ºC), scalding risk is also reduced, though TMVs are likely to still be required in some circumstances. The paper covers this in greater detail, particularly considering approaches to compliance with Part G of the Building Regulations, where cut-off of the hot-water supply is required upon cold supply failure.

> "There is a balancing act to perform between these requirements"

System water quality

One thing not to miss in the newer, low-flow system temperatures proposed in the draft Part L and the approaches discussed above is the increased importance of system water quality. Systems operated at below 60ºC primary flow temperatures have an increased risk of biological fouling of the system water, as there is no high-temperature pasteurisation effect. So, this risk also requires managing.

The paper aligns with CIBSE CP1: *Heat networks: Code of Practice for the UK* (2020) with regards to a standard for quality of hot-water supply, with a minimum time to achieve a minimum hot-water supply temperature. This reduces water wastage from waiting for supplies to warm up.

The working group believes it has been able to improve clarity for building service engineers and facilities managers who are applying the current regulations. In doing so, it hopes to bring a better balance to the assessment of the risks of Legionnaires' disease, scalding, and excess energy consumption for hot-water systems. CJ

■ *Guidance Note: Domestic hot water temperatures from instantaneous heat interface units* will be available on the CIBSE Knowledge Portal at **cibse.org/knowledge**

■ **HUW BLACKWELL** is associate director at Anthesis

References:

1 HSG 274 Part 2, HSE **bit.ly/CJAug21DHW1**

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STORAGE BEATER

One barrier to heat pumps in smaller homes is the requirement for a large water cylinder to store hot water. Midsummer's **Jez Climas** looks at how compact thermal-energy storage systems could solve the problem

The size of the Sunamp heat battery compared with a hot-water cylinder

In November 2020, the UK Prime Minister announced an eye-catching plan to ramp up heat-pump installations across the nation, as part of an initiative to decarbonise domestic heating. The headline target was for 600,000 heat pumps a year to be installed by 2028.

New-build homes might account for around 100,000 of these installations, but the majority will have to be retrofitted in existing homes. In many ways, this looks like a challenging target, as current levels of installations – although climbing sharply – are still in the low tens of thousands a year. There are, however, reasons to be optimistic, as the problem is mostly not a technical one.

Domestic air source heat pumps (ASHPs) are a mature technology and are being produced in quantity by large multinational companies such as Mitsubishi, Samsung, Daikin and Vaillant. Installing a monobloc heat pump may require more work, but it's not much more technically challenging than a boiler once installers have built up some familiarity with the technology.

Nonetheless, there are a number of small technical and practical issues to overcome for many heat-pump retrofit projects. These were identified by the Department for Business, Energy and Industrial Strategy as part of its 'Electrification of heat' demonstrator project – a national project in which heat pumps have been installed in a significant number of homes to better understand the issues and investigate solutions (see panel, 'Heat pump challenges to overcome').

Heat storage

One of the participants in the project is Sunamp, an innovative Scottish heat-storage company that has developed a phase-change heat battery system that enables much more compact storage of energy for hot water. It produces a range of heat batteries, designed to act as replacements for direct and indirect hot-water cylinders.

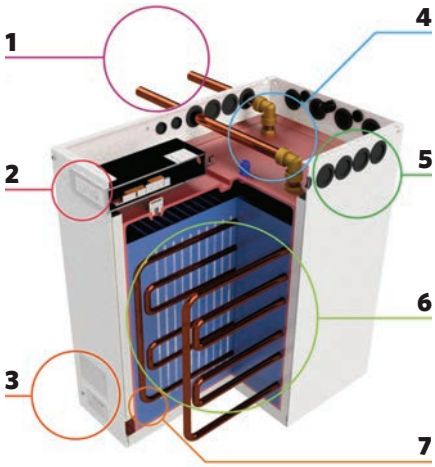
The heat battery is essentially a block of sodium acetate with a melting point of 58°C (PCM58). Energy is stored by melting the PCM58 using heat from an electric heating element or an indirect coil run through the store. To extract the heat as hot water, a second coil is in the block – cold water goes in, hot water comes out just below the melting point of the PCM58, at 55°C. The heat batteries have a smaller surface area and are encased in vacuum insulation panels, so their standing losses are small compared with a cylinder – ~30W depending on size.

The indirectly heated heat batteries work with a range of heat pumps currently on the market, and could be a facilitating technology for heat pumps to be deployed in more dwellings. While a 210-litre cylinder is around 550mm in diameter and 1,500mm high, a heat-battery unit of equivalent storage capacity is 365mm wide x 575mm deep x 856mm high – little more than half the size of a standard domestic washing machine.

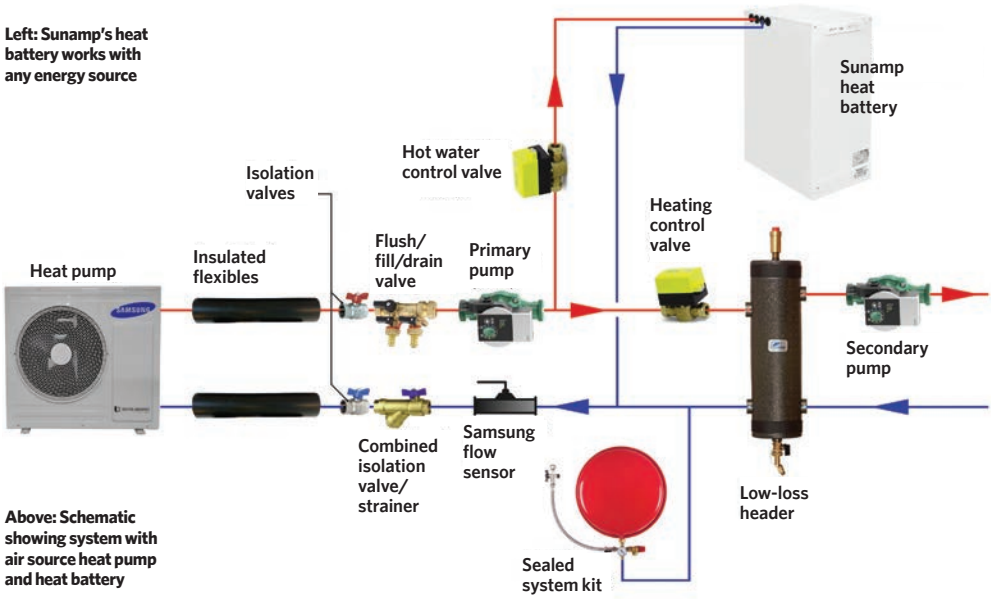
The fact that it is a thermal store, rather than an indirect cylinder, means there are two heat-transfer processes: 65°C low temperature hot water (LTHW) to 58°C PCM to 55°C water. For an indirect cylinder, it is one: 60°C LTHW to 55°C water. So, to get the same temperature of hot water, the heat pump needs to run hotter in hot-water mode, with a resultant drop in coefficient of performance. This is somewhat offset by the fact that heat-battery units do not need a legionella pasteurisation cycle and have lower standing heat losses.

Installation

Installation of a heat battery as hot-water storage with a heat pump is only slightly more complex than installing an unvented cylinder; not



Left: Sunamp's heat battery works with any energy source



Above: Schematic showing system with air source heat pump and heat battery

1 Single and dual-circuit models work with any energy source (electricity, PV, heat pumps and boilers)

2 Simple user interface shows heat battery state of charge and operation

3 Embedded heating element with 10-year warranty as a primary heat source or backup

4 Quick and easy to install, with high-quality, brass, push-fit connectors supplied

5 Flexibility of orientation, with exits on three sides of the product

6 High-powered heat exchanger for high-quality, mains pressure showers

7 Sunamp's patented phase change material formulation – storing 4 x more energy than water

being a pressure vessel, they are inherently safer than an unvented cylinder.

This means that, under *Approved Document G – Sanitation, hot water safety and water efficiency*, there are no safety valves and, hence, no discharge tundish requiring drainage. Wiring the heat-battery unit up with a heat pump is a little more complex, however.

A heat-pump controller normally comes with a temperature probe to put in a pocket in the cylinder, enabling the heat pump to optimise the hot-water cycle – but there is no such pocket with the heat battery. Instead, the heat pump temperature probe has to be cut off, and the wires terminated into the heat-battery controller so the battery's controller can 'spoof' the resistances, making the heat pump think it is looking at a hot or cold cylinder.

The main challenge of this thermal battery is the weight. Whereas an unvented cylinder arrives at site empty, weighing around 50kg, this heat battery arrives at site at its full weight of 184kg for a 212-litre equivalent, so manoeuvring a unit into position can be difficult. Sometimes specialist delivery equipment may be required if the installation location is upstairs. The best option could be to put one in a less conventional place – for example, under the stairs, in a kitchen, or in a utility room.

A whole array of innovations, small and large, will be needed to help us transition away from fossil-fuel heating. Domestic heating engineers will need to adapt as new solutions come to market, and there will need to be a lot of training and upskilling of the workforce. Despite all the challenges that ramping up heat-pump deployment brings, however, a variety of organisations are working hard, innovating and trying to overcome all the obstacles on the path to more sustainable heating solutions. CJ

JEZ CLIMAS is head of renewable heat at Midsummer

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2 *Renewing Britain: the changing landscape of home-grown energy*, MCS Charitable Foundation March 2021 **bit.ly/CJAug21HB2**

3 Electrification of Heat UK demonstration project, Catapult Energy Systems, **bit.ly/CJAugHB3**

4 *English housing survey: headline report 2019-20*, Ministry of Housing, Communities and Local Government **bit.ly/CJAugHB4**

HEAT PUMP CHALLENGES TO OVERCOME

Flow temperatures and radiator sizes – Heat pumps don't run as hot as boilers, and many houses may need radiators replaced when they get a heat pump retrofitted – anecdotally, about 30% of radiators on average. The radiator industry is responding to this challenge; some have three radiator panels and three sets of convection fins, while others have fanned units for getting higher outputs out of small wall spaces.

Noise – Modern ASHPs are very quiet, but care is still needed to ensure they don't cause a nuisance. To meet the requirements for permitted development rights, a heat pump must adhere to the MCS 020 calculation limits. In cases where the requirements are difficult to meet, it may be possible to use acoustic enclosures or screens. Once installed, many units allow the user to schedule quiet-mode (with reduced output).

Outside space – Not all houses have space for a heat pump. This can be overcome by wall-mounting heat pumps or making adaptations to the outdoor space. If this is not possible, electrifying heat will probably require district heating or direct electric heating.

Inside space – Heat pumps have lower outputs than combi boilers, so need hot-water storage of some sort. In most cases, this is an unvented indirect cylinder, heated by a large surface area coil. But with people having switched to combi boilers, only about a third of UK homes now having a hot-water cylinder[4]. Some houses without space need another solution – such as a compact thermal-energy storage system.

Existing pipework – Some existing heating system pipework can make heat pump retrofits extra challenging. Heat pump COPs are best when they can operate at a 5K temperature difference which means a lot of flow. Microbore pipework can require reworking of the heating distribution.

Considering modern methods of construction at the design stage meant Grange University Hospital could open ahead of schedule and respond to rising cases of Covid-19. Aecom's **Sarah Gealy** explains how offsite efficiencies cut hours worked on the project by 23%

EMERGENCY DELIVERY

The Grange University Hospital, in Gwent, was already under construction when the global pandemic took hold in March last year. It was being built using modern methods of construction (MMC), so when Aneurin Bevan University Health Board asked its contractor, Laing O'Rourke, if it could accelerate the opening of several sections of the scheme, in response to increasing numbers of Covid-19 cases in the locality, the project team was able to support the request.

A partial opening of the £350m hospital was achieved in April 2020, nearly a year ahead of schedule. The remaining sections opened to patients in November last year, four months earlier than scheduled in a bid to help the health board respond to winter pressures and Covid-19.

'Early handover was possible because we used MMC from the outset,' said Mike Lewis, Laing O'Rourke project director. 'In doing so, we were able to deliver 50% of the building a year earlier than scheduled." Using MMC also saved 237,099 working hours, or 23% of the planned programme.

The 560-bed hospital provides complex critical care treatment for more than 600,000 people in south-east Wales. It treats the region's most seriously ill patients, or those with significant injuries, and acts as the emergency department (A&E) for everyone living in Gwent.

For Aecom, the project's building services engineer, use of MMC required early collaboration with Laing O'Rourke and Crown House Technologies, the scheme's MEP contractor. Building information modelling (BIM) was key to achieving such close collaboration, with BIM workshops and clash detection used to assist decision-making and communication throughout the design phase.

Many building services decisions had to be made very early. For example, services penetrations through precast floors and walls were coordinated early on, because these were prepared in the factory.

This level of early decision-making would not have been possible without everyone on the project working in a collaborative way. Aecom's designs had to be fixed much earlier than with a traditional build, but BIM facilitated this process.

Ongoing collaboration with Crown House Technologies during the production of its BIM installation models was particularly important, as it helped identify and resolve coordination issues. It also ensured any changes would not impact on MEP systems' performance and compliance with Health Technology Memoranda (HTMs), the design standards for healthcare facilities.

'At the onset of the project, we set out our strategy for MMC,' says Owain Dobson, project leader at Crown House Technologies. 'This has been fundamental to Laing O'Rourke's delivery model for a number of years now, but Grange University Hospital was to use its latest innovations, and learning from previous projects, to maximise impact on site.'

Early workshops between the client, design team and contracting team enabled the strategy to be developed, providing clarity on how to progress. Certain principles were agreed at this stage, including: where to place MEP services modules and MEP prefabricated risers; which plantroom elements would be assembled off site; which areas would have modular wiring; and where to integrate, install and, in some instances, commission the building services off site.

'With the strategy agreed, Crown House Technologies and

PROJECT TEAM

Building services engineer, Breeam and fire: Aecom
MEP contractor: Crown House Technologies
Architect: BDP
Main contractor: Laing O'Rourke
Project manager and cost consultant: Gleeds
Civil and structural engineer: WSP
NEC supervisor: Arup

Left: Grange University Hospital in Gwent, Wales, was completed four months ahead of schedule

Aecom worked together to finalise the MEP design and produce the manufacturing drawings,' adds Dobson. 'This not only ensured that we were meeting the MMC and site objectives, but also that the design met the client objectives.'

MMC requires the involvement of several parties at an early design stage, including for the location of mains distribution boxes (MDBs), which ensured a cost-effective installation. The modular wiring system is made up of home runs from distribution centres to MDBs, with final connections from these to outlets. Spare capacity within the MDBs was also agreed at the early design stage, to support the cost plan.

Early agreement about the thermal performance of the building's façade was also needed to ensure its offsite-manufactured elements met the agreed performance and complied with Part L of Building Regulations. Through this process, improved U-values and airtightness were achieved, resulting in a building with lower heat demand and running costs. The precast concrete façade provides thermal mass that stabilises temperatures, reducing overheating and energy consumption, and contributing to the project achieving Breeam Excellent.

Manufacturers of prefabricated components and specialist installers were selected early, to enable Aecom to design systems in accordance with their requirements. Indeed, every element of the MEP designs considered the needs of prefabrication. Understanding the sequencing of the project was key for our designs to support MMC.

MEP services in ceiling voids and risers were manufactured offsite as services modules. The detailed requirements of these services were factored in as early as RIBA Stage 2, because their sizing needed to accommodate support frames, installation clearances and lighting zones, as well as sterile zones for services installed in situ, such as medical gases. Even the corridor widths were optimised to suit services modules.

Prefabricated ductwork and pipework riser

While cable ladders, trays and baskets were installed off site as part of the services modules, cabling was still installed on site. This sequencing was factored into the design layout of the services modules to provide adequate access during installation. With limited choice available on the market for modular wiring cable sizes, all lighting was designed to use 2.5mm^2, which helped to keep the design cost-effective. Today, this is less of an issue, as modular wiring matching most traditional cable equivalents is more readily available, although early planning and agreements are still essential for benefits to be fully realised.

Aecom's design also facilitated small-power circuits that eliminate the risk of nuisance tripping if equipment earth leakage were to exceed recommended levels. There are many examples of modern equipment with the potential for this to happen, but it was very important to remove this risk and protect business continuity for the hospital.

The design of final distribution centres and boards needed to be flexible to accommodate both pluggable modular wiring and traditional cables, as not all systems can use modular alternatives. Life safety, for example, requires fire-rated cables. Electrical risers and cupboards were designed larger than normal to accommodate pluggable distribution centres. Indeed, flexibility was important throughout the design, and the »

INTEGRAL IT

Aecom's IT specialists focused on developing core design principles and innovations to enable the hospital's IT infrastructure to operate 24/7, 365 days a year. This included reinforcing the resilience of the IT infrastructure itself, as well as the building services systems that support it.

The team built in multiple levels of resilience within the IT infrastructure – for example, providing two core IT rooms located on different levels of the hospital and vertically separate, to increase the resilience of the fibre-backbone and horizontal cabling systems.

In addition, working with the architects, the team ensured that the edge IT rooms were vertically stacked. This design principle leverages benefits, such as physically protecting the space from water-ingress risks, minimising and securing backbone cabling routes, and aiding local management via consistent locations. The fibre-backbone network provides continued connectivity across the hospital and maintains service availability.

In addition to reinforcing the resilience of the fibre-backbone network, the design and careful product selection mean it can evolve to meet increased bandwidth demands in the future, and be upgraded without disrupting the service for users.

» hospital will help the health board realise its 'clinical futures strategy' for sustainable health and care services for the whole of the NHS in Gwent.

Recognising IT as fundamental to the strategy's success, Aecom's IT specialists were an integral part of the design team from the start. They designed the IT of the building, supporting not just the health board's immediate clinical care and IT needs, but also its future ambitions to deliver strategic clinical goals [see box out, 'Integral IT'].

Because we were designing for MMC and bringing in modular MEP elements that are quite different for a healthcare setting, we worked with the health board's estates team to address any concerns they had about resilience, future expansion and maintenance.

Prefabrication requires better coordination of the MEP design, helping to minimise distribution route lengths, omit unnecessary bends, and avoid onsite modifications. This minimises pressure losses in the heating, cooling and ventilation systems, and reduces the energy consumption of fans and pumps, helping to cut running costs.

Prefabricated systems such as the modular wiring and electrical busbar also minimised the depths of ceiling voids, optimising floor-to-floor height and reducing the overall building height. This resulted in a smaller façade area, lowering the energy use associated with heating the building.

We were able to show the client how prefabrication would bring additional benefits, particularly around meeting energy targets and future flexibility. and we believe prefabrication of MEP systems could benefit most medium to large construction projects. Aecom has another hospital project exploring fully modularised plantrooms, and there are opportunities for this approach to go even further. CJ

SARAH GEALY is regional director at Aecom

Prefabricated systems helped minimise the depths of ceiling voids

NHS publishes ventilation guidance for healthcare

HTM 03-01-2021 aims to make natural ventilation the default strategy, followed by mixed-mode and then mechanical

NHS England has published updated guidance on ventilation for healthcare premises providing acute care. The Health Technical Memorandum (HTM) gives advice and guidance on the legal requirements, design implications, maintenance and operation of specialised ventilation.

HTM 03-01 2021 Part A focuses on the concept, design, specification, installation and acceptance testing of healthcare ventilation systems. Part B focuses on the management, operation, maintenance and routine testing of existing healthcare ventilation.

In the new edition, design information for specific healthcare applications has been revised, and information on the reason for ventilation has been given.

The HTM also introduces the concept of the multidisciplinary Ventilation Safety Group in healthcare organisations. Its remit will be to assess all aspects of ventilation safety and resilience required for the safe development and operation of healthcare premises.

The HTM supports UK legislation to bring all greenhouse gas emissions to net zero by 2050, and promotes sustainable methods of ventilation in healthcare facilities.

Its core principle is that the default method of ventilation should, as far as possible, be natural ventilation, followed by mixed-mode, with mechanical ventilation the last option.

As well as specifying solutions with the lowest life-cycle environmental cost, the HTM also recommends using energy efficient electronically commutated fans.

To determine whether this guidance is applicable for non-acute premises, a risk assessment of the nature of the treatment being delivered, condition of the patients, and intensity of use needs to be undertaken by those responsible for the facility.

● Read the HTM at **bit.ly/CJAug21HTM**

MAIN CHANGES SINCE THE 2007 EDITION

- **The client's needs and legal requirements are more clearly explained**
- **A standard method of identifying and labelling ventilation systems, and the creation of an inventory of installed systems**
- **The issues of resilience and diversity are addressed**
- **Guidance on refurbishments or when changing use of existing installation**
- **Guidance on life-cycle and the updating of mid-life plant**
- **Extensively revised design information for specific healthcare application**
- **Issues around rooms where anaesthetic agents are used are addressed**
- **Airflow rates are more tailored to the applications, to take advantage of new fan and control technology and, so, reduce energy consumption**
- **Revised air-quality and filter standards**
- **New and emerging technologies are catered for**
- **Advice on installation standards and the appointment of an independent validator**
- **More detailed information on the commissioning process**
- **Revised validation acceptance standards and methodology**
- **Revised and updated routine inspection and maintenance guidance**

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Proportional balancing for circulating water systems

This module explores proportional balancing methods for setting heating or cooling water systems for effective operation

Despite the increasing application of variable volume systems and pressure independent control valves (PICVs), there are still many systems – old and new – that require balancing to ensure proper performance and efficiency. No matter the skill of the designer, a commercial building's circulating heating or cooling water system, particularly if it includes constant-volume elements, is unlikely to be self-balancing. This CPD will explore the proportional balancing method as a means of setting such systems for effective operation.

Pipework systems, such as those used in cooling and heating systems in buildings, will not operate as intended without proper commissioning. Inadequate balancing of constant-volume systems will lead to poor control of terminals such as fan coils, heating and cooling coils, radiators, convectors and panels.

It is likely that in variable flow systems and, increasingly, systems that employ PICVs, there is limited need for balancing devices. However, for many legacy systems that have been modified or simply need recommissioning, larger systems, and constant volume systems, it is important that appropriate devices are included for regulating and measuring the flowrates in the piping circuits to allow onsite balancing. For all systems, the decisions on commissioning need to be taken at the design stage and well before work commences on site.

Although many contemporary commercial installations are designed as variable volume systems, potentially they still include sub-systems that have constant-volume requirements. Also, where PICVs control a sub-network that serves more than one terminal unit (for example, multiple fan coils), there may be the need to balance these terminal units against each other. For those terminals (hydraulically) furthest from the pump, lack of balance could mean an inadequate flow of water, and those closer to the pump may suffer from poor control as their control valve struggles to overcome a high-pressure differential (which results in a low valve authority). Poorly performing terminals can encourage users and building occupants to 'tweak' the system, which, in turn, is likely to exacerbate poor environmental control, increase unnecessary energy use and lead to poor occupant comfort and productivity.

As discussed by Roger Legg[1] – and as recommended by BSRIA[2] and CIBSE[3] – a standard, methodical way to balance pipework systems is known as proportional balancing. This employs the simplified relationship for fully developed turbulent fluid flow, $\Delta p = RQ^2$, where Δp = pressure drop, kPa, in a particular pipework section, Q = volume flowrate, $L{\cdot}s^{-1}$, and R is a constant of proportionality that reflects the resistance to flow in the particular pipe network from pipe friction, turbulence »

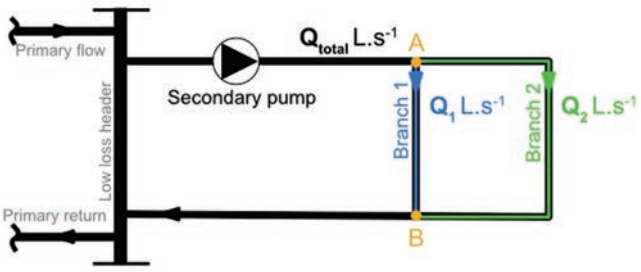

Figure 1: Simplified two-branch pipe network

Figure 2: An example of an orifice plate (OP) flow-measurement device (FMD) (Source: Crane)

Figure 3: An example of a double regulating valve (DRV) (Source: Crane)

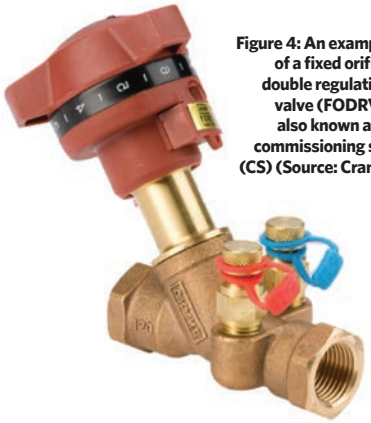

Figure 4: An example of a fixed orifice double regulating valve (FODRV), also known as a commissioning set (CS) (Source: Crane)

» and losses through fittings and components.

A simplified representation of a network with two branches, with no valves or heat exchange devices shown (for clarity), is illustrated in Figure 1.

Branches 1 and 2 have volume flowrates Q_1 and Q_2 and resistances to water flow R_1 and R_2. The pressure drop between A and B is the same for both branches and so $\Delta p_1 = \Delta p_2 = R_1Q_1^2 = R_2Q_2^2$. So, the ratio of the flows $Q_1/Q_2 = \sqrt{\frac{R_2}{R_1}}$, and this will remain a constant so long as there is no change in the resistance in either branch. With no (possibly further) valve adjustment, the ratio of the flowrates will remain the same irrespective of any change in the total flowrate, Q_{total}. Practically, this will mean that once the ratio Q_1/Q_2 is set to match the ratio of the required design flowrates, the flows in those two branches will remain at that ratio. (Typically, this ratio would be obtained by closing a regulating valve.) This is the basis of proportional balancing – methodically setting up pairs of sub-networks to a desired flow ratio. As each, increasingly larger, sub-network is added to the tree of balanced sub-networks, it is set to be in proportional balance with the previously balanced sub-networks. Subsequently, when the total flowrate is adjusted to provide the design total flowrate – by, for example, reducing the pump speed – the relative balance of the flowrates will be maintained, and all branches will receive their design flowrates. (An example balancing process is provided later in this article.)

In the very simple circuit of Figure 1, it *may* be reasonable to guess that, if the pipe sizes are the same, R_2 is greater than R_1 (owing to the extra pipe length) and that, before any balancing, the flow through branch 2 will be least favoured. However, that is not a certainty, as the fittings – such as the bends and tees – and components – for example, control valves and heat exchangers – and the quality of the installation, which can have a significant impact on resistance, may not be fully apparent until the pipe network is installed on site and subsequent measurements are taken. The flowrate through any fixed resistance element is usefully characterised by $Q = \frac{k_{vs}\sqrt{\Delta p}}{36}$, where Q = volume flowrate, $L{\cdot}s^{-1}$, Δp = pressure drop across the element, kPa, and k_{vs} is the flow coefficient for the fixed resistance.

Orifice plates (OPs) – and, more rarely, venturis – can be employed as flow-measuring devices (or 'metering stations'). OPs may be close-coupled to a commissioning valve, or separate items (such as shown in Figure 2). The flowrate coefficient, k_{vs}, for the measuring device will normally be supplied by the manufacturer. Self-sealing pressure tappings allow a manometer (see panel, 'Measuring the flow – digital manometers') to be connected to the flow-measuring device, which are normally suitable for cold and low-temperature hot water (LTHW) systems.

Commissioning valves are used to add resistance to circuits to balance the system, and are usually placed in the return pipework from the load(s). Most commonly in commercial systems, this will be a double regulating valve (DRV) or a commissioning set (CS). A DRV is used for regulation and isolation, and is often an oblique pattern globe valve (Figure 3). Once a branch has been regulated (for example, brought into proportional balance), the valve can be 'locked' at this setting. Then, if the valve is subsequently closed to isolate the circuit, when reopened it cannot be mistakenly opened beyond its original setting. DRVs typically include a scale on the handwheel or valve stem to provide a visual record of the valve setting. The DRV may be close-coupled, or integrated with an orifice plate to form a fixed orifice double regulating valve (FODRV), and is sometimes referred to as a commissioning set (CS), as shown in Figure 4.

The pressure difference measured between the two points on the CS, at a particular opening position, may be converted to a flowrate through a specific flowrate equation for the device or by using the flow chart for the valve.

Before commencing the commissioning process, the installation must have been installed in accordance with the specification; flushed and cleaned; successfully pressure tested; and filled, treated and vented. The whole system should be in a safe and operable condition, and all the commissioning valves should be fully open and control valves set to allow full flow through the terminal units. This method will not

MEASURING THE FLOW – DIGITAL MANOMETERS

Properly calibrated digital manometers, connected by tubing to measuring stations, are typically employed when commissioning systems. Modern variants (such as the example in Figure 5) are available to measure pressure differences up to 600kPa and, because of their ease of application, have practically replaced the previous generation of liquid manometers (the so called 'water box'). Such manometers are able to employ the characteristics of commissioning valves (using the flow coefficient for the device, k_{vs}) that can be pre-programmed in the electronic firmware to provide a direct reading of the water flowrate. The connecting tubes incorporate self-sealing connectors; these may be push-on units for quick connect/disconnect, but more usually a threaded fitting is used with a cap to protect the connection from dust.

Figure 5: Digital manometer kit (Source: Crane)

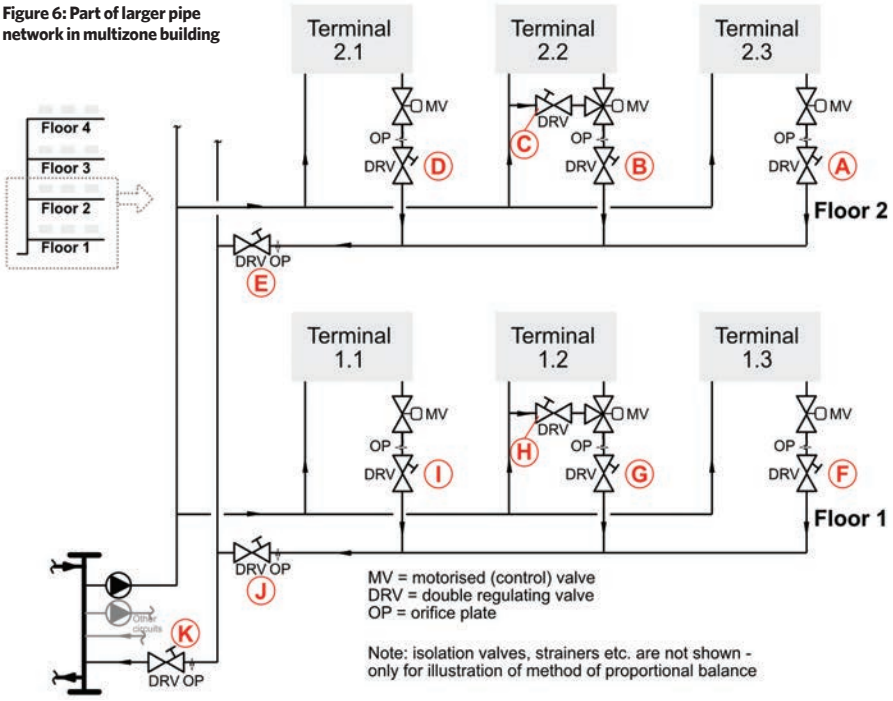

Figure 6: Part of larger pipe network in multizone building

	Terminal 2.1	Terminal 2.2	Terminal 2.3
Design ($L \cdot s^{-1}$)	0.09	0.10	0.11
Initial measured flow ($L \cdot s^{-1}$)	0.17	0.14	0.11
Initial %DFR	189%	140%	100%
Flow ($L \cdot s^{-1}$) after adjusting **B**	Not measured	0.12	0.13
%DFR after adjusting **B**	Not measured	120%	120%
Flow ($L \cdot s^{-1}$) after adjusting **D**	0.12	0.14	0.15
%DFR after adjusting **D**	143%	143%	143%

Table 1: Measured flowrates during proportional balancing of terminals on Floor 2

be appropriate to systems that have been designed with reverse-return pipework.

The pump must first be tested to confirm that it is able to provide sufficient water power to satisfy the demands of the designed system. If the pump had been undersized, it would be impossible to achieve design flowrates and much time could be wasted in futile attempts to commission the system. A 'closed head' test is undertaken by operating the pump and then gradually closing the pump outlet isolation valve, and noting the pressure differential measured across the pump when it is closed. This can then be checked against pump curve from the manufacturer's details, and a parallel, corrected, pump curve (based on the closed head test) can be sketched if the closed head pressure differs from the manufacturer's details. The outlet valve is then gradually opened and the pressure differential at full flow is plotted on the (potentially corrected) curve. The required design flowrate is also plotted on the curve to confirm that it is practically attainable with the pump and, if not, some further investigation will be required.

It is not necessary to balance flowrates within a group of loads precisely. Allowable tolerances of balance are given in CIBSE Commissioning Code W3.[3] Notably, a closer tolerance is required when the heating system temperature difference (ΔT) is greater than 11K.

The pump initially should be set so that it is delivering approximately 110% of the design flowrate. As noted in CIBSE Code W 'it may be necessary to vary the pump speed (if the pump is a variable speed pump) or close valves elsewhere in the system'. Even with this margin, it still may be necessary to open the main balancing valve (valve **K**, if it had been previously partly closed) or increase the pump speed (or potentially, increase impeller size) when the balancing is finished to bring the water flow to design conditions.

With all regulating valves (and control valves) still fully open, the flowrate is measured through each of the branches. The ratio of $\frac{\text{measured flow}}{\text{design flow}}$ is used to determine percentage design flowrate (%DFR). The branch (hydraulically) furthest from the pump will have the lowest %DFR (although it may not be physically the most distant) and so be the index circuit.

If all the branches are of the same configuration, the most distant should be the index run (in this case Floor 4) – if not, it indicates that there may be some blockage, or a control valve is not fully open to the load. To progress through the method of proportional balance, one of the last two (parallel) branches must be the index circuit. If this is not the case, then an initial resistance adjustment will be needed to make it so (for example, by partly closing a commissioning valve).

As an example, consider the proportional balancing of the three terminals on Floor 2, with the steps indicated in Table 1. In this case, the initial measurement confirms the index as Terminal 2.3 (that is, it is the least favoured).

Valve **A** is left fully open and **B** is adjusted to obtain the same %DFR for T2.3 as for T2.2. This would employ two manometers, one connected to the index OP and one to the OP in the branch being adjusted (in this case **B**). T2.2 as for T2.3 are now in balance and valve **B** should have this maximum opening 'locked'.

The same process is undertaken for T2.1 by adjusting valve **D** and comparing the flows through OP **A** and OP **D** until the %DFRs are the same. All three terminals are now in balance, and although all have a %DFR of 143%, any flowrate changes in the system will affect flowrates through these units equally.

Each of the bypass DRVs can then be adjusted in turn (that is, **C** and **H**). The control valve is closed to load and open to bypass, and then the respective OP is used to measure the flow through the fully open bypass. The bypass DRV is adjusted (and locked) so it has the same flow as has already been measured through the associated load (in the previous step).

The same process (which would have commenced on Floor 4) is completed across each of the floors and then the four floors are proportionally balanced with each other using the branch commissioning sets (that is, **E** and **J** plus those on Floors 3 and 4). Once the whole system is in proportional balance, the total flow can be regulated down to the design flowrate by adjusting the pump speed or, alternatively, using regulating valve **K**.

A permanent record of the balancing process should be maintained – BSRIA BG2-2010 includes example sheets that may be used.

Turn to page 60 for further reading and references. »

Module 183

August 2021

1. What is a PICV?

- ☐ A Pressure idealised control valve
- ☐ B Pressure independent control valve
- ☐ C Pressure indifferent control valve
- ☐ D Pressure intermediate control valve
- ☐ E Pressure isolated control valve

2. If water flowing through an orifice plate FMD with k_{vs} of 12 in a 15mm pipe exhibits a pressure drop of 100kPa, what is the approximate volume flowrate of the water?

- ☐ A 0.03L·s^{-1}
- ☐ B 0.33L·s^{-1}
- ☐ C 3.3L·s^{-1}
- ☐ D 33L·s^{-1}
- ☐ E 330L·s^{-1}

3. Which of these is likely to be the most useful as a point to determine a measurement of water flowrate?

- ☐ A DRV
- ☐ B FODRV
- ☐ C MV
- ☐ D IV
- ☐ E PICV

4. In the example of proportional balancing, how many times would valve B be adjusted?

- ☐ A Each time a floor is put into proportional balance (so four times for this four-floor building)
- ☐ B It always needs closing a little at the start of the procedure to allow it to be opened up again to balance with the other terminals (so twice)
- ☐ C It will need trimming each time the pump speed is adjusted
- ☐ D Once
- ☐ E Once for each terminal in the Floor 2 subsystem (so three times)

5. Where can a pro forma sheet be found that can be used to record the balancing process?

- ☐ A CIBSE Commissioning Code W
- ☐ B CIBSE Guide C
- ☐ C CIBSE TM65
- ☐ D BSRIA BG54-2018
- ☐ E BSRIA BG2-2010

Name (please print).....

Job title.....

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Further reading:

See CIBSE Commissioning Code W and BSRIA BG2-2010 for more extensive applications and detail for commissioning water systems.

References:

1 Legg, R C, *Air conditioning system design*, Chapter 16, Butterworth-Heinemann, 2017.
2 BSRIA BG2-2010 *Commissioning water systems*, BSRIA 2010.
3 CIBSE Commissioning Code W: 2010 *Water distribution systems*, CIBSE 2010.

Products of the month

Record numbers attend Rinnai hydrogen CPD – more courses on offer

Manufacturer's latest course attracts 300 people following report on clean energy

Rinnai is reporting 'record' levels of interest in its newest CPD course, 'Hydrogen and hydrogen blends as a means of decarbonising the UK energy network', with more than 300 people attending in one recent six-week period.

Contractors, installers, specifiers and consultants are asked to contact the company direct for bespoke CPDs on hydrogen and related topics. Email **training@rinnaiuk.com** for dates and times of forthcoming courses.

The CPD follows Rinnai's report into hydrogen as a clean source of energy, which can be accessed free at **www.rinnaiuk.com** and is available in hard-copy or PDF formats.

Rinnai offers a range of CPDs for designers, specifiers, building services consultants and engineers working on any type of commercial site that requires limitless flows of temperature-accurate hot water for personal hygiene, laundry, food production

and all other cleaning and disinfecting regimes. The CPDs are available via Microsoft Teams or Zoom or – providing all safety measures are strictly observed and practised – at face-to-face meetings on site.

The current list of CPD subjects is as follows:

- **BioLPG – a cost-effective and feasible blend with zero emissions**
- **Continuous flow hot water – an appreciation**
- **Energy efficiency on-demand hot water – how it works and comparison with other systems**
- **Hot-water heating units and systems – an appreciation**
- **Hot-water system design – using continuous flow mode**
- **Continuous flow delivering low temperature – uses and legislation**
- **Precision temperature control of hot water – for commercial delivery systems**
- **Low-temperature hot water as a means of reducing cost and CO_2.**

Rinnai, through its CPD and training programmes, aims to engage with the market to assist decision-making and understanding of the different messages faced by today's engineers, installers and designers.

Chris Goggin, operations director, said: 'We can demonstrate how innovation can reduce the burden on fossil fuels while maximising renewable gains.'

Call 01928 531 870 or email engineer@rinnaiuk.com or sales@rinnaiuk.com Alternatively, use the smart online contact points 'Help me choose' or 'Ask us a question' on the website homepage at www.rinnaiuk.com

Munters ensures air handling unit is shipshape

EC fan upgrades at SS Great Britain will save energy and protect against corrosion

Munters, leaders in energy efficient climate control, have completed a pioneering upgrade of the dry dock air handling unit (AHU) at Brunel's SS Great Britain, in Bristol.

The upgrade, which was done in one day, ensures long-term protection against corrosion and reduces AHU fan energy consumption by 25-30%. Built-in redundancy also prevents airflow loss, for optimised performance.

SS Great Britain was the world's first iron-hulled, screw propeller-driven, steam-powered passenger liner, and – in the early 2000s – Munters was part of a wider project to preserve the hull. This included installing a specially designed AHU, with Munters' desiccant rotor technology, in the dry dock.

'Looking after the ship and conserving the original iron is the most important thing that we do,' said Nicola Grahamslaw, conservation engineer for SS Great Britain. 'By ensuring the air around the ship is kept at 20% relative

Credit: Adam Gasson / Munters

humidity, we can stop the ship from rusting. This keeps her structurally safe for many years to come.'

With the belt-driven fan coming to the end of its expected life, Munters has upgraded the AHU with three electronically commutated (EC), direct-drive plug fans from ebm-papst. It designed a bespoke bulk head so the new fans could be brought in in component form, flat packed, retrofitted in a fan-wall configuration, and digitally integrated into the ship's control system.

Minimising downtime to a single day was critical to prevent the ship being exposed to humid air.

Greg Frazer, of Munters service sales, said: 'This upgrade brings cutting-edge technology into the original dehumidifier with minimal disruption. There is little maintenance, and predicted energy savings for the fan are 25-30%.'

The SS Great Britain Trust has committed to reach net-zero carbon emissions by 2030, and conserving the ship is one of the biggest energy consumers.

'What you do has to be sustainable,' said Grahamslaw. 'Every time we tweak the system, we are thinking about our carbon footprint, and learning how we can make that energy requirement as small as we possibly can on our journey to net zero.'

To view a video of the AHU upgrade, go to **bit.ly/35Z5q6W**

Call 01480 432243, email info@munters.co.uk or visit www.munters.com

Products of the month

Airmaster smart mechanical ventilation gets Passivhaus Component certification

Decentralised AM 1000 uses aluminium heat exchanger to recover up to 90% of heat

SAV Systems, in conjunction with its Danish partner Airmaster, has announced that the Airmaster AM 1000 has been awarded Passivhaus Component certification.

The AM 1000 is the first decentralised, duct-free, mechanical ventilation unit with heat recovery (MVHR) on the market to be awarded the certification. It enables the unit to be used in Passivhaus school buildings.

The company's time working with the City of Edinburgh Council (CEC) inspired SAV Systems to seek Passivhaus certification. CEC has set ambitious targets to achieve net zero by 2035, leading the council to apply Passivhaus design principles to all new schools. The core philosophy of Passivhaus design is to create a comfortable and energy-efficient building, raising the standard of the buildings to which it is applied.

Ventilation plays a crucial part in two

requirements of passive house standards: airtightness and space heating demand. Openings in buildings, such as windows and porous building materials, can allow heat to escape, wasting the energy generated. Passivhaus buildings have high airtightness and low heat loss. However, by increasing the airtightness of a building to conserve energy, indoor air quality can suffer, so a mechanical ventilation solution is needed to manage indoor air quality without wasting energy.

There are a range of approved MVHR solutions available under the Passivhaus framework. Many are centralised systems, which normally have high specific fan powers. Airmasters are decentralised and air distribution is duct free, so fan power is kept to a minimum. A typical classroom installation requires one Airmaster AM 1000 per room, with intake and exhaust connections to the outside. The AM 1000 can recover up to 90% of a room's heat using an aluminium heat exchanger, reducing the building's heat load and heat loss.

The certification of the AM 1000 makes available an innovative ventilation strategy that can improve indoor air quality without sacrificing thermal comfort. With growing pressure on buildings to become energy efficient and comfortable, decentralised MVHR such as Airmaster should play a vital role in the solution.

For more information on AirMaster SMVs, contact the education team at education@sav-systems.com or visit www.sav-systems.com

Rinnai N series hot-water heating units hydrogen ready – and now UKCA certified

Products awarded new post-Brexit conformity mark ahead of January deadline

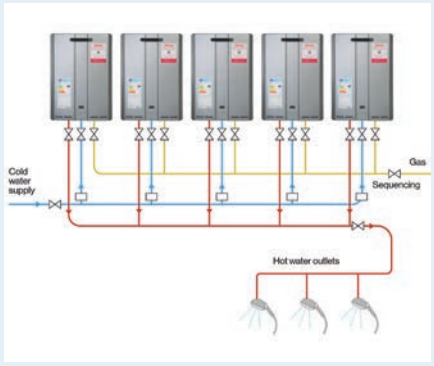
Rinnai's N Series range of hot-water heating units and systems are now fully certified to the new UKCA standard, the successor to the European Union's CE mark.

UK Conformity Assessed (UKCA) marking indicates conformity with the applicable requirements for products sold within Britain.

UKCA marking became mandatory at the end of the Brexit transition period, although the CE mark continues to be accepted as a valid alternative until 1 January 2022.

This news closely follows the announcement by Rinnai that, after an extensive testing and verification process, its N Series product range is ready for the proposed initial supply of natural gas and hydrogen blends set to be fed through the existing gas infrastructure.

All Rinnai units are guaranteed to provide temperature-accurate hot-water flows, as long as fuel and water connections are constant. Multiples of Rinnai's existing ranges are



retrospectively compatible with future hydrogen blending, including all N-series models already installed in the UK.

The Rinnai Sensei N Series offers a more compact, enhanced combustion design that is easier to install, has superior operational performance, and is easy to service. All are accompanied by extended warranties.

The four models are:

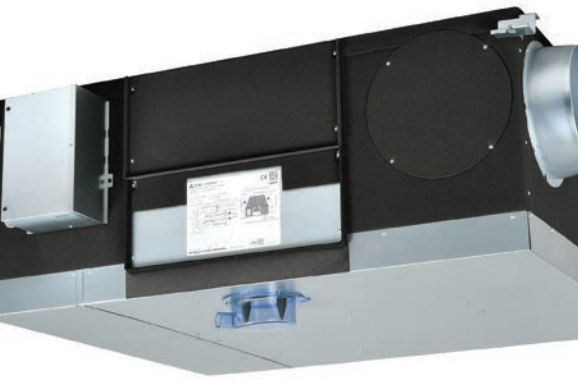
- **N1600i, giving 954 litres per hour**
- **N1600e (external) giving 954 litres per hour (at 50°C).**
- **N1300i, giving 775 litres per hour**
- **N1300e, giving 775 litres per hour of temperature-controlled hot water at 50°C.**

The two 1600s have load profiles of XXL, while the 1300s are load profile XL; all are water-efficiency class A rated.

The entire range is low-NO_x, and the future-proofed continuous flow water heater uses Rinnai's advanced burner technology with a 13:1 turn-down ratio with extremely quiet operation.

Integral controls enable the water heater to achieve high efficiencies because of advanced burner control and high modulation ranges.

For more information on UKCA, hydrogen, including CPD courses, training and hydrogen capability with in situ Rinnai appliances, call 01928 531 870 or email engineer@rinnaiuk.com or sales@rinnaiuk.com Alternatively, use the smart online contact points 'Help me choose' or 'Ask us a question' on the website homepage at www.rinnaiuk.com



Adveco cuts global warming potential of FPi heat pumps by 80%

Adveco introduces the FPi32 range of monobloc air-to-water heat pumps in three variants (6-12kW).

FPi32 is a more efficient, compact, quieter, and easier to install unit, designed for low carbon commercial hot-water applications.

Requiring almost a kilo less refrigerant to operate compared with the first generation FPi, and with gains from using R32, the FPi32 range has just 20% of the global warming potential of its predecessor.

With an above-average coefficient of performance (COP) up to 5.23, and a high seasonal COP of up to 4.74, FPi32 air source heat pumps can make a real difference to a property's energy consumption.

At -25°C (ambient), the FPi32 can still provide hot water up to 55°C, making the range ideal for integration into existing domestic hot-water distribution systems with higher thermal requirements.

Combined with either a gas or electric water heater and controls, the FPi32 helps reduce emissions and increase efficiency without compromising reliability or performance.

Call 01252 551540, email sales@adveco.co or visit www.adveco.co

Plug-and-play CO_2 sensors in Mitsubishi ventilation system

Mitsubishi Electric has launched a new product to improve indoor air quality in a multitude of settings, including schools, restaurants, offices, shops, hotels and factories.

The LGH-RVS-E is the latest in the Lossnay range of commercial ventilation systems, and is designed with a plastic heat exchanger rather than paper. This makes it ideal for humid locations, such as bathrooms and wet rooms. It is also able to address the cooling and ventilation needs of spaces such as offices and schools.

The units are easy to install and simple to interlock with Mitsubishi Electric's Mr Slim and City Multi air conditioning systems.

The LGH-RVS-E comes with a new generation of controls, more flexible commissioning, and two plug-and-play CO_2 sensors that reduce installation costs by taking their power from the fan unit rather than needing a separate power supply.

The units can be integrated with Mitsubishi Electric's AE-200E central control for touchscreen control of products, as well as energy monitoring and automated reporting.

Visit les.mitsubishielectric.co.uk/products/ventilation/commercial-lossnay/commercial-lossnay-series

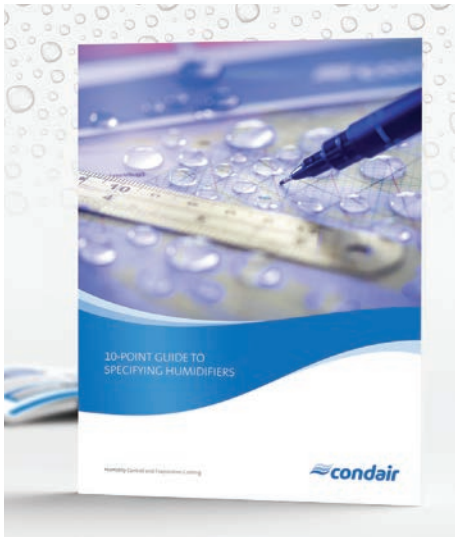
Humidifier help from Condair

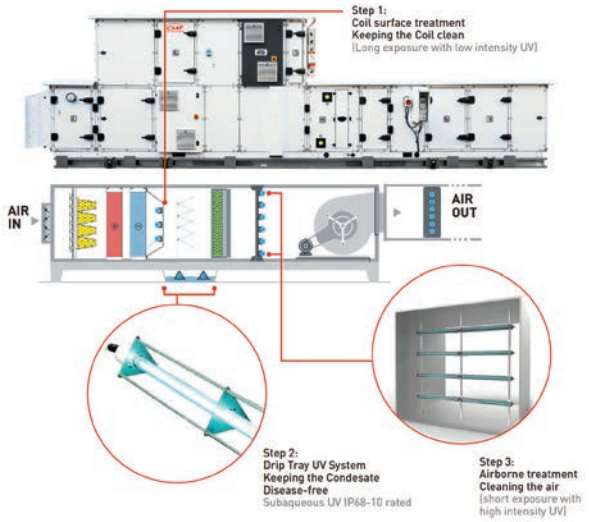
Humidity control specialist Condair has released a 10-point guide to specifying humidifiers. Aimed at HVAC consultants, the illustrated guide covers topics such as air handling unit v in-room strategy, psychrometrics, product sizing, technology selection, installation, and hygiene management.

'It includes some very useful rules of thumb and will prompt a consultant to review important aspects of a project they may not have otherwise considered,' said Dave Marshall-George, sales director at Condair.

The document can be downloaded for free from Condair's website.

Visit www.condair.co.uk/guide





CIAT UV-C system targets better IAQ

A powerful ultra-violet C (UV-C) light disinfection system that targets viruses and bacteria is now an integrated option on CIAT's air handling units (AHUs).

Available on the Climaciat Airtech, Climaciat Airclean and Climaciat Airaccess, as well as CIAT's Airtech and Airclean ranges, the system targets airborne, waterborne and surface microorganisms to improve indoor air quality (IAQ).

UV-C lamps installed within the AHU enclosure flood key areas in UV-C light, and a three-step process decontaminates the coil surface, condensate in the drip tray, and air passing through the AHU housing. The UV-C radiation disrupts the molecular structure of pathogens, reducing risks.

The lamps are highly energy efficient, quiet and lightweight, and as the UV-C system is fully enclosed within the AHU's metal housing, the UV-C light presents no risk to users or building occupants.

Three configurations are available. In critical applications, such as healthcare and food production, UV-C can be used in combination with a HEPA filtration system to remove deactivated particles and other microscopic contaminants from the airstream.

Visit www.ciat.uk.com

Viega launches new compact press tool with app integration

The new Viega Pressgun Picco 6 Plus makes press-connection installation simple, even in the most confined or awkward spaces. It now also features Bluetooth connectivity and app integration for improved safety, security and streamlined tool management.

Scott James, managing director at Viega, said: 'The new Pressgun Picco 6 Plus builds on the success of the previous tried and trusted Pressgun Picco, with a new design and the latest smart connectivity innovations.

The ergonomic, slimline configuration makes it ideal for a wide range of applications, but it is especially suitable for installers working on residential and light-commercial projects, where the size and flexibility are important advantages."

Through the Viega Tool Services app, usage controls can deactivate the tool after a set number of pressings, date or time is reached, while the anti-theft protection can automatically shut down the tool when it is taken outside of a defined area.

Visit www.viega.co.uk

Pump Technology welcomes Kropp

Aldermaston-based Pump Technology, the UK's leading Jung Pumpen distributor, has welcomed the additional market support provided by Sebastian Kropp, area manager UK & Nordic regions at Jung Pumpen, Germany. Kropp, who has worked in the industry for eight years, has in-depth knowledge of wastewater and sewage pumping solutions for commercial buildings, and will give support to public health engineers in this specialist market. For product specification, contact the team at Pump Technology.

Call 0118 9821 555 or visit www.jung-pumps.co.uk

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Online visitors will access a VR space to engage with the decarbonisation of the built environment

Katie Clemence-Jackson

Reality check

Max Fordham's Katie Clemence-Jackson explains the aim of the COP26 Built Environment Virtual Pavilion

Katie Clemence-Jackson is a senior engineer and partner at Max Fordham, and chairs its MF:NetZero task group. She coordinates the practice's approach to net-zero carbon building design, has given numerous presentations to collaborators on the topic, and contributed to the publication of the *Net Zero Carbon Guide*. Clemence-Jackson is also a member of New London Architecture's Net Zero Expert Panel, chairs the CIBSE Technology Committee and inputted to CIBSE and UK Green Building Council's (UKGBC's) responses to the Future Buildings Consultation. She is CIBSE's representative on the UKGBC COP26 Built Environment Virtual Pavilion (BEVP) and chairs the working group for the exhibition aspect of the pavilion.

What is the aim of the virtual pavilion?

BEVP is part of the activities surrounding COP26, the UN Climate Change Conference being held in Glasgow this November. It will represent the built environment's voice, providing a platform to demonstrate that it is both part of the problem and the solution to climate change. It will explore key sustainability themes through a virtual reality exhibition of global projects and places, with a focus on helping people to understand and implement their own steps to a more sustainable future. The pavilion will be accessible from any smart device, and our aim is for it to engage a wide audience and create a legacy that can stretch beyond COP26.

How are you coordinating a virtual event on such a global scale?

Built environment professionals from all round the industry have come together to create the BEVP. UKGBC is acting in a coordinating role and has brought together a coalition of more than 40 industry bodies to co-create and co-curate the pavilion, with representatives such as me feeding into the work. The project is being made possible by more than 60 commercial partners from across the industry.

We have recently announced an Open Call, seeking content for the BEVP, looking for exemplary projects for the exhibition and a sustainability-focused installation that will act as a centrepiece for the pavilion. We are using the networks of each partner organisation, as well as UKGBC and World GBC's wider networks, to spread the word far and wide. We are seeking more international projects to reflect the global nature of the climate crisis, so CIBSE members globally should consider putting forward their projects and showcase the role building services plays in mitigating the climate emergency.

Q&A

Will users walk around buildings?

We are working with a technology partner to make the BEVP an engaging experience that people can access from any smart device, and which can be experienced in virtual reality (VR). Content is being created to capture the attention of the public, as well as built environment specialists and COP26 delegates.

Online visitors will access a bespoke VR space to engage with sustainability and the decarbonisation of our built environment. These concepts will be communicated through stories, projects, films and interactive exhibits. We don't know exactly what these will be yet, because we are using the Open Call to find our content, but the idea is to use this digital platform to make the exhibition as engaging as possible.

We also hope to have a physical presence at COP26, in the Green Zone, where delegates will be able to experience the exhibition via VR headsets or on tablets, depending on Covid-19 restrictions and our ability to sanitise shared devices.

How can building services be given prominence in a VR environment?

I have been working with CIBSE staff to feed in its view of a sustainable built environment to the message of the pavilion. The working groups contain a range of people from different areas of the built environment, and, together, we have defined the themes for the exhibition: climate mitigation, climate adaptation, natural resource use, and nature and biodiversity. Building services is intrinsically linked into each of these, and we expect to see this reflected in the submissions. We felt that the importance of measured performance data should be emphasised – this is embedded into the judging criteria for the Open Call, and will be a factor in deciding which projects are selected.

How can companies get involved?

By submitting work to the Open Call, attending the event series once it is launched, or contacting UKGBC to become a commercial partner. They can help show how built environment projects can deliver exemplary performance in each theme area. We are looking for inspiring global projects that offer solutions to the climate crisis at a range of scales and typologies.

Companies can enter up to two projects and the deadline is 2 August. Go to the UKGBC website for more on how to submit work or become a commercial partner. Visit **bit.ly/CJAug21BEVP** and **bit.ly/CJAug21UKGBC**

EVENTS

YOUNG ENGINEERS AWARDS

14 October

Celebrating the best young talent within our industry, the annual Young Engineers Awards bring together the prestigious CIBSE Employer, Apprentice and Graduate of the Year awards. The accolades recognise and reward the innovative thinking, hard work and skills of graduate engineers, while showcasing employers committed to developing and encouraging young talent.

Winners will be announced at the awards on 14 October.

CIBSE REGIONS AND GROUP EVENTS

For up-to-date information on regions and groups meetings, webinars and podcasts, visit **www.cibse.org/events**

East Midlands: Student research presentation
3 August
Gain insight into the latest research topics carried out by students of the built environment with postgraduates from Loughborough University presenting their work.

Routes to membership student webinar
6 September
Session on the benefits of CIBSE Student membership, and the different membership levels available within Engineering Council Registration.

Home Counties North West: Seminar on managing mental health in the workplace
9 September
Workshop to give you the tools to manage your day-to-day roles and positive steps and changes that will give you coping mechanisms to recognise where small changes can be made.

NEW LIVE ONLINE TRAINING COURSES

CIBSE training courses have been reformatted to work online, with a live trainer, meaning you can expect the same interaction and participation as you would in a classroom setting.

Mechanical services explained
3-5 August

Fire alarm detection and codes BS 5839-1: 2017
6 September

Heat networks code of practice (CP1)
6-7 September

Low carbon consultant design
7-9 September

Below-ground building drainage
7 September

Overview of current fire legislation and guidance
9 September

Earthing and bonding systems
13 September

Emergency lighting to comply with fire safety
14 September

Above-ground building drainage
16 September

High voltage (11kV) distribution and protection
17 September

Energy Savings Opportunity Scheme
20 September

Mechanical services explained
21-23 September

Heat networks (CP1) half-day update
23 September

Building services overview
5 October

Mentoring skills workshop
6 October

Power-system harmonics
11 October

Building services explained
11-13 October

Overview of IET wiring regulations (18th edition)
12 October

Electrical services overview
13 October

Introduction to heat networks code of practice (CP1)
14 October

Low carbon consultant building operations
18-21 October

Electrical services explained
19-21 October

Mechanical services overview
21 October

Fundamentals of drainage
25 October

Heat networks code of practice (CP1)
25-26 October

Mechanical services explained
25-27 October

Fire safety building regs Part B
26 October

For details and the full programme, visit **www.cibse.org/training**

ONLINE LEARNING

CIBSE has a portfolio of online learning courses, which contain interactive content with quizzes and additional resources to support your learning.
www.cibse.org/training

WEBINARS

#Growyourknowledge

CIBSE's free webinar series continues. Taking place every two weeks on Thursday at 11am, the webinars are designed to support the CIBSE community in maintaining their CPD remotely.

All previous webinars are also available to view on demand.

www.cibse.org/growyourknowledge

CIBSE JOURNAL PODCASTS

CIBSE Journal hosts regular podcasts on industry-relevant topics. In the latest, 'How heat pumps are changing the future', sponsored by Mitsubishi Electric, consultants and industry experts discuss how heat pumps are transforming heating and cooling.

All *CIBSE Journal* podcasts are available on the CIBSE SoundCloud – at **soundcloud.com/build2perform** – Apple Podcasts and Spotify.

CIBSE Membership

CIBSE Membership is hosting free webinars to support members with applications for the Associate and Member grades and registration with the Engineering Council at Incorporated Engineer and Chartered Engineer levels.
The two-part webinar series includes: session 1, covering routes to membership; and session 2, focusing on how to write the Engineering Practice Report.

Upcoming webinars:
- **17 and 24 August**
- **14 and 21 September**
- **5 and 19 October**

For further details and to register:
www.cibse.org/webinars

CIBSE Training

Corporate Offerings

What's the most suitable CIBSE Training option for your employees and your business?

Live training and online learning offer different benefits for corporate clients, but the same quality content.

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Live Training

- Live interactive environment for your employees to learn together
- Ask for clarifications and explanations during the presentation
- Tailored training to fit your company's needs
- Updated industry examples from our knowledgeable CIBSE trainers
- Topic and issue discussions that would help your employees with their work performance

*Only applies to core engineering courses

Online Learning

- Flexible learning where your employees can study individually and at their own pace and fit their learning within their busy schedule
- Ask for clarifications and explanations after finishing the online learning course*
- Monitor progress - allocate training and keep track of your employees' learning performance
- Interactive content - quizzes, supportive images, videos*
- Topics broken down into sub-topics - improving the flow and making the content learning more memorable

> Find out more and request a quote at cibse.org/corporate-offerings

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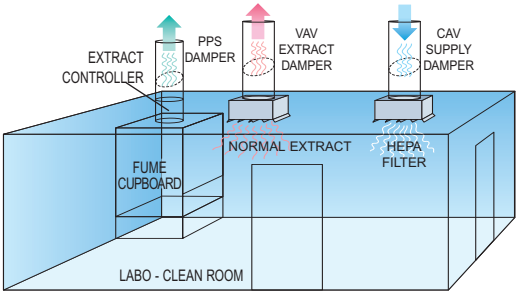

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