CIBSE JOURNAL

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August 2022 www.cibsejournal.com

POSITIVE OUTLOOK

Residents make money from their heating in Welsh housing scheme

Lessons learned from Nabers as property giants embrace scheme

Danish district network taps into industrial waste heat

Carole O'Neil aims to lift Cundall to the next level

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Model for a better world

The extreme heat being experienced in the northern hemisphere this summer is another reminder, if one is needed, of the dangerous consequences of leaving climate change unchecked.

In the UK, temperatures have topped 40ºC for the first time, and in a country unaccustomed to such heat, the effects were more debilitating than elsewhere. On mainland Europe, for example, buildings have long been adapted to protect occupants from the worst of the daytime heat. External shutters are common, but UK architectural trends have favoured large expanses of glazing, which have led to uninhabitable rooms or sky-high air conditioning bills.

It is vital that global warming is limited to a 1.5ºC temperature rise compared with pre-industrial levels, and it's the job of every engineer to aspire to a near future of net zero buildings. Happily, this month, we have many examples of engineering ingenuity that is minimising carbon emissions in building designs.

In Wales, for instance, 14 low-cost social homes have been designed to produce more energy than they consume. Analysis of a year of data has proved the concept of the energy-positive home, and some households actually have negative annual bills, where they are earning money from their energy systems.

The key to the success of the project was accurate modelling of the energy consumption and thermal performance of the homes. It's not straightforward; to model the complex interactions between storage systems, the project team had to create separate thermal-storage and electric-storage models to optimise controls.

The Nabers energy-rating programme, which assigns energy targets to building designs, also relies on complex modelling of building services interactions to provide an accurate prediction of building performance. For building services engineers involved in the process, it has been a steep learning curve. Until recently, models only had to prove that buildings met Part L energy requirements. Now, clients are leaning over engineers' shoulders to see if more energy can by saved by using one services component over another.

It's encouraging to see building services companies still pushing their clients to develop net zero buildings. Cundall's new managing partner, Carole O'Neil, says its aim to only work with clients designing net zero buildings by 2030 remains intact, despite the current economic pressures (page 18). In fact, O'Neil's greatest challenge is to attract and retain the talent to fuel Cundall's growth drive. This is an ongoing quest, and one that will, hopefully, be alleviated over time by CIBSE's new guides aimed at would-be engineers in secondary schools (page 12).

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CONTRIBUTORS

Hywel Davies looks at the progress of workstreams supporting improved fire safety design guidance

Carole O'Neil Cundall's new managing partner on attracting and retaining the talent to expand the business

Lorna Stimpson The LABC chief executive on the impact of Building Safety Act reforms on the building control profession

Tim Dwyer This month's CPD module looks at how recent updates to approved documents affect the provision of HVAC

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IN BRIEF

Construction growth slows in June

Growth in the construction sector was weaker last month than at any point since last September, according to the S&P Global Purchasing Managers' Index (PMI).

The PMI for the sector dropped to 52.6 in June, compared with 56.4 in May. The index's housing component slipped beneath 50, which indicates contraction rather than growth, for the first time since May 2020. Commercial work also 'saw a considerable loss of momentum', according to S&P.

However, new figures from the Office for National Statistics show that construction output grew for the seventh month in a row in May, hitting a record high of £15bn.

The monthly construction output report shows volume grew 1.5% in May, fuelled by new work (2.8%) as repair and maintenance declined by 0.4%. Private commercial new work (12.1%) and private new housing (7.2%) increased.

First operational Nabers UK rating goes to Leeds office

Grosvenor's Toronto Square earns 4.5 stars under energy-rating scheme

The first Nabers UK energy rating that takes into account operational performance has been awarded to an office in Leeds owned by developer Grosvenor.

Nabers UK is adapted from the ratings programme developed in Australia more than 20 years ago, and is already being used to inform the design of buildings under construction (see page 20). It gives ratings ranging from one star to six stars, based on the measured and verified energy use of operational offices.

Toronto Square in Leeds has a 4.5-star Nabers UK rating

The eight-storey, Grade A Toronto Square office building in Leeds city centre - which was refurbished in 2009 – has been awarded a 4.5 star rating after analysis of 12 months' data. The data for the building was collated and analysed by EP&T Global, a Nabers UK licensed assessor, and independently certified by BRE.

Nabers UK ratings have to be measured and verified every 12 months, and demonstrate whether offices are on a net zero carbon trajectory. They give investors and occupiers confidence that the buildings they own and occupy are aligned with their climate ambitions.

The Toronto Square rating will provide more information on the building's performance, helping Grosvenor work with its occupiers to target additional improvements.


Rishi Sunak


Liz Truss

Truss and Sunak's climate credentials under scrutiny

Leadership candidates back net zero, but Truss vows to halt green energy levies

The climate change credentials of Foreign Secretary Liz Truss and former Chancellor Rishi Sunak have come under the spotlight after they were shortlisted in the race to become leader of the Conservative Party, and the UK's next Prime Minister.

Truss – who was Secretary of State for the Environment, Food and Rural Affairs in David Cameron's government – won a place in the ballot of Conservative Party members after securing the second-highest number of votes among Tory MPs, behind Sunak.

She has pledged to maintain the UK's headline target to cut emissions to net zero by 2050. However, she has made a moratorium on green energy levies – such as the Energy Company Obligation, which pays for efficiency improvements in low-income households – one of her signature policies.

In her current role, Truss has been criticised for sidelining climate concerns when negotiating the UK's post-Brexit trade deal with Australia.

As Chancellor in Boris Johnson's government, Sunak announced a reduction in VAT for domestic installations of insulation and low-carbon technologies. He is now pledging to re-establish a dedicated energy department if he wins the race to become Prime Minister.

The department – and a new energy security committee – would be designed to help deliver Sunak's promise to create a new legal goal for the UK to be self-sufficient in power by 2045.

He has also committed to meet the net zero emissions goal by 2050, and, in the first TV debate between rival candidates for the Conservative Party leadership, he highlighted the importance of energy efficiency measures for tackling climate change. However, the Treasury, under Sunak, has been criticised for dragging its feet on bringing forward the cash for energy efficiency improvements pledged in the Tory's 2019 election manifesto.

The leadership contest has taken place against the backdrop of July's heatwave, when the record for Britain's hottest day was smashed.

Act now on heatwaves, scientists urge

The extreme temperatures experienced during last month's European heatwave were a signal for governments to act now to minimise the effects of climate change, leading scientists have warned.

Gerhard Adrian, head of the UN weather agency, said the heatwaves should be a 'wake up call for governments to change'. Friederike Otto, senior lecturer in climate science at Imperial College London's Grantham Institute for Climate Change, said there was still time for societies to act. He added: 'Whether [heatwaves] become a common occurrence is in our hands, and is determined by when and at what global mean temperature we reach net zero.'

According to UK Climate Projections, all summers will see prolonged spells of high temperatures by the end of the century.

CIBSE's Dr Anastasia Mylona said: 'Our buildings are not designed to deal with it, so we have to get used to taking simple, practical steps to help make hot summers more comfortable.'

● For CIBSE's guidance on heatwaves, visit: **bit.ly/CIBSEheat20**


The heatwave triggered wildfires in Essex

IN BRIEF

Have your say on building safety

Consultations on implementing the new building control regime for higher-risk buildings have been published by the government.

The Department for Levelling Up, Housing and Communities has also issued consultations on wider changes to the Building Regulations and the in-occupation regime for occupied higher-risk buildings.

The consultations are part of a series that provide technical proposals to support the law as set out in the Building Safety Act.

They close on 12 October and the government says responses will be used to develop the content of regulations before they are laid before parliament.

To respond to the consultations, visit **bit.ly/CJAug22News1**

Government gives Sizewell C go-ahead

Plans for the Sizewell C nuclear power plant, on the Suffolk coast, have been given the go-ahead by the government.

EDF, the French company providing most of the £20bn funding, said the new plant would generate 3.2GW of electricity, which is about 7% of the UK's electricity needs. It said it would operate for 60 years.

Once operational, the plant will generate 3.2GW of electricity, supplying enough energy to meet 7% of the UK's current demand.

The GMB union said news of the approval was a 'vital step forward for energy and net zero'.

Survey focuses on heat network customer service

The Heat Trust has undertaken a survey to check that the heat network providers who are registered with it are complying with the scheme rules.

Network providers' customer service and support were assessed by the survey – and while the Heat Trust said its findings were mostly positive, the results also underlined areas that need to improve.

The survey found that four out of 14 providers had issues identifying vulnerable customers, and one company resigned from the scheme after being found to have insufficient resources to monitor customers.

IN BRIEF

New minister visits village's pioneering heat network

Lord Callanan has visited the Swaffham Prior heat network in Cambridgeshire shortly after he was announced as the new construction minister.

The minister said the innovative, community-led project was 'breaking new ground and helping hundreds of families with their bills, while showcasing the perks of clean energy to the rest of the country'.

The project is looking to phase out oil-fuel heating and the energy centre features air source and ground source heat pumps, which will be powered by a council-owned solar farm for 90-95% of the time.

The scheme aims to reduce carbon emissions and provide residents with a buffer against rising fuel bills.

'By driving forward new low-carbon technologies like heat networks to warm homes, we can shield households from costly fossil fuels', Lord Callanan said.

Clade partners with thermal store firm

Natural refrigerant heat pump manufacturer Clade has announced a UK partnership with Belgian company IFTech, a specialist in designing, building and operating underground thermal storage systems. IFTech has more than 60 projects in its home country and 10 in the UK. Clade also provides design and project delivery and aftercare services, and the two firms aim to deliver a full range of underground thermal storage services to UK customers.

Lord Callanan takes over as construction minister

Former minister Lee Rowley resigned from Boris Johnson's government

The government has appointed a new construction minister as part of the wide-ranging reshuffle triggered by the mass resignations in the run-up to Boris Johnson announcing that he was to step down as Prime Minister.

Lord Callanan takes over from Lee Rowley, who was one of more than 50 ministers and aides to quit the government in protest at Johnson's conduct.

The Tory peer has been parliamentary under secretary of state at the Department for Business, Energy and Industrial Strategy (BEIS) since February 2020. His responsibilities in this role included energy efficiency, fuel poverty and low carbon heat. He was also heavily involved in preparing the government's Heat and Buildings Strategy, which was launched in autumn 2021.


Lord Callanan

Before joining BEIS, Lord Callanan – a graduate in electrical and electronic engineering from Newcastle Polytechnic – was a minister of state at the Department for Exiting the European Union, until it was abolished on 31 January 2020.

Rowley was the only BEIS minister to resign, but there was much bigger churn at the Department for Levelling Up, Housing and Communities (DLHUC).

Michael Gove, Secretary of State for levelling up, was sacked by Johnson after privately urging the PM to resign. The department also saw the departure of minister for housing Stuart Andrew, who has been replaced by Nuneaton MP Marcus Jones. However, junior housing minister Eddie Hughes, who holds responsibility for energy efficiency and building regulations at DLHUC, remains in post.

Peer slams lost chance to insulate

Money spent on recent household energy bill bailouts could have been used more efficiently if cuts to insulation budgets by the Conservative government after its 2015 General Election victory had not taken place, a minister has admitted.

During a House of Lords debate, Liberal Democrat Lord Teverson said the UK would be in a 'better position than we are now' if the then Chancellor, George Osborn, had not 'massacred various energy efficiency schemes'. Pointing to the £37bn of energy bills support, he added: 'If only we were managing to put that money into these sorts of schemes, those fuel poverty numbers would start to come down rather than inevitably skyrocketing.'

Construction minister Lord Callanan said he 'entirely accepted' the criticism': 'If we had spent some of this money on insulation schemes in previous years, that might have been a more efficient use of it.'

The Citigen district energy network in the City of London

Energy bill aims to boost heat pumps and networks

Government wants quotas and customer safeguards to stimulate markets

The government has announced moves to stimulate the market for heat pumps, and kick-start the development of heat network zones, in its wide-ranging Energy Security Bill.

The bill, the first piece of energy-related legislation to be tabled by the government in a decade, was introduced on 6 July and received its second reading in the House of Lords on 19 July. It takes forward a series of measures proposed in last year's energy white paper and the subsequent British Energy Security Strategy.

The legislation seeks to stimulate the rollout of heat pumps by helping to establish a 'market-based mechanism' for the low carbon heating devices. Based on the mandates used to stimulate the electric vehicle market in other countries, the mechanism would oblige boiler manufacturers and suppliers to ensure they install a certain number of heat pumps. This figure, which would be related to their output of boilers, could then rise over time.

The bill also features provisions to help meet the government's target of nearly one-fifth of homes being connected to a heat network by 2050. These include enabling the establishment of heat network zones in England.

To safeguard households on heat networks, the bill gives Ofgem new powers as the regulator for heat networks across Britain.

The legislation would also give the UK government the powers to make amendments to the EU-derived Energy Performance of Buildings regime.

Other measures in the bill

- Stimulating the carbon capture and storage (CCS) and hydrogen sectors by introducing business models
- Facilitating deployment of electricity storage by classifying it as a distinct subset of electricity generation
- Enabling the delivery of a large village hydrogen heating trial by 2025
- Enabling larger energy suppliers to buy out smaller competitors' obligations under the Energy Company Obligation

Heat pump quotas a 'ridiculous policy'

Proposals by ministers to penalise boiler suppliers if they do not meet quotas to install heat pumps have been criticised by gas fitters.

The Energy Security Bill (see above) includes measures for a 'market-based mechanism' to ensure that a certain number of heat pumps is installed, in line with the volume of boilers that they supply.

In a consultation paper, issued earlier this year, the government mooted imposing financial penalties on boiler manufacturers to ensure they complied with this obligation. Respondents to the consultation said this should be as high as £5,000. However, Mike Foster, chief executive of the Energy and Utilities Alliance of gas fitters, attacked the mechanism as a 'ridiculous' policy.

He said: 'This smacks of Soviet-style planning, with bureaucrats telling industry what they must sell, regardless of what the consumer might want or can afford, and with huge financial penalties facing British businesses if they disobey Whitehall.'

Pointing to research that shows heat pumps are more expensive to run than gas boilers, Foster added: 'In a cost-of-living crisis, successful and innovative British businesses are being forced to put consumers' bills up by around £100 a year, and fined if they don't. You couldn't make it up.'

IN BRIEF

Carbon Trust to lead heat pump plan

The Carbon Trust is leading a consortium, including consultants Technopolis and market research group Ipsos, that aims to accelerate the rollout and installation of heat pumps.

Case studies will be offered to distribution network operators, suppliers, installers and the public to facilitate decarbonisation in the heat-generation sector, and steer towards the UK's goal of net zero by 2050. Around £5m will fund the consortium up to 2050, as part of the government's Heat and Buildings Strategy, which aims to install 600,000 heat pumps annually by 2028.

David Reilly, cities and regions director at the Carbon Trust, said: 'We need a laser focus on innovation and collaboration across the sector to accelerate the rollout at the pace and scale necessary.'

NG Bailey powers to battery contract win

NG Bailey has secured a further contract with pioneering battery cell technology manufacturer Britishvolt. The engineer will provide a full range of construction, mechanical, electrical and plumbing services to the company's new West Midlands facility at Hams Hall, where it will test battery manufacturing methods. NG Bailey is also working with Britishvolt on its new battery gigafactory in the North East of England, where the methods being tested at Hams Hall will be applied.

Elon Musk plans IAQ revolution

Elon Musk says a system to improve indoor air quality in homes is 'on the future product list' for electric vehicle manufacturer Tesla.

Musk told Twitter followers that HEPA filter technology in his cars could be adapted for homes. He claimed he could: 'make a way better home HVAC system that's really quiet and super energy efficient, has a better filter for particles, and works reliably'.

His ambition is to link the system to his electric vehicles to develop a solution 'that knows when you are coming home, communicating with the car when you actually need cooling and heating.'

Ofgem warns of soaring bills

The Ofgem chief executive has admitted that increases in household energy bills this winter will be much greater than he predicted only weeks ago.

In late May, Jonathan Brearley told the House of Commons business, energy and industrial strategy committee that the energy price cap was likely to increase to £2,800 when it is reviewed in October. However, giving evidence to the environmental audit committee on 12 July, he said it is 'clear' that this estimate will be too low. Energy consultancy Cornwall Insight recently forecast the cap will rise to £3,244 per year, a £1,200 increase compared with now.

Shell's CEO, Ben van Beurden, has also warned that energy may need to be rationed across Europe. His comments, at energy consultancy Aurora's conference in Oxford in July, followed a spike in gas prices after Russia closed its Nord Stream pipeline – which supplies Germany – for maintenance work.

Government's 'stunning fail' on decarbonising buildings

Climate Change Committee delivers damning report on emissions strategy

A 'shocking' gap exists on energy efficiency policy, the Climate Change Committee (CCC) has told the government.

In its latest annual report to parliament, the statutory climate adviser has identified energy efficiency as a particular area of weakness in the government's strategy to cut emissions.

'Most critically', the report expresses concern that the government has 'no policies' for improving the energy efficiency of non-fuel-poor, owner-occupier households. Rates of improvement in energy efficiency continue to be 'well below the necessary level', it says.

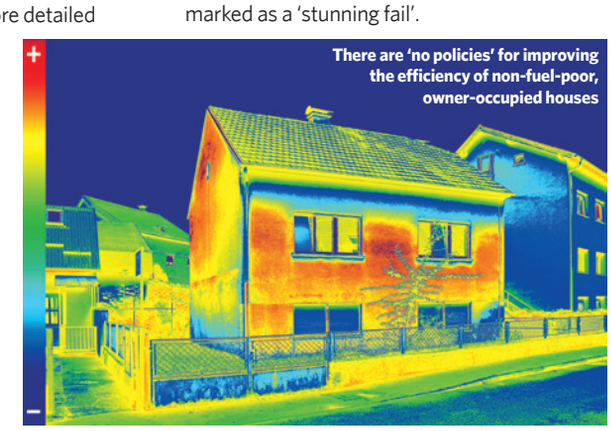
The government's recently published *Energy Security Strategy* also 'failed to offer any solutions' for reducing demand for energy.

In addition, the CCC says 'more detailed plans' need to be finalised on the rollout of low carbon heating. It warns that the government's reliance on stimulating the market for heat pumps by setting boiler manufacturers mandatory targets to sell a progressively rising number of the devices is an 'untested approach'.

'If market participants do not respond to incentives as expected, low carbon heat rollout will not take off,' the CCC says, adding that the government should develop contingency plans in case this approach doesn't deliver as ministers anticipate.

The report adds that 'much now rests' on the promised energy advice service, due to be launched this summer, to reach millions of households requiring efficiency upgrades.

The CCC's chief executive Chris Stark said the government's approach to decarbonising buildings deserved to be marked as a 'stunning fail'.



There are 'no policies' for improving the efficiency of non-fuel-poor, owner-occupied houses

Scotland could make Passivhaus mandatory

All new homes in Scotland would have to meet the ultra-low emissions Passivhaus standard under draft legislation that has been brought forward in the country's parliament.

Alex Rowley, Labour Member of the Scottish Parliament for the Mid Scotland and Fife Region, has submitted the Domestic Building Environmental Standards (Scotland) Bill.

It would mandate a Passivhaus standard or a Scottish equivalent for all new-build housing in Scotland, and includes a process to ensure design specifications agreed in the planning permission stage are verified as delivered. The aim is to ensure there is no 'performance gap' between the design of the building and the energy efficiency and thermal performance when it is completed.

Rowley said proposals for new building regulations – in the Scottish government's *Building a net zero future* strategy – that aim to cut new-build emissions by nearly a third, 'do not go far enough', and contain no measures to close the performance gap.

The bill was out for consultation until 27 July 2022.

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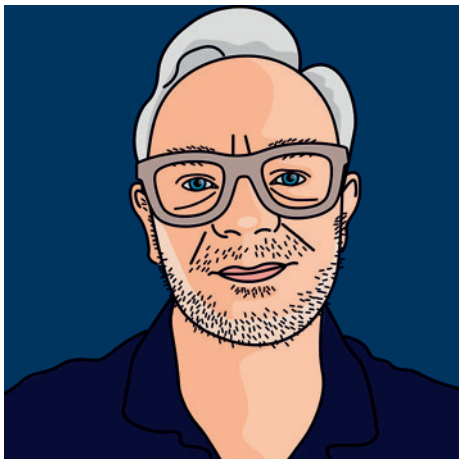

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IN BRIEF

SLL Young Lighter competition opens

The Society of Light and Lighting (SLL) Young Lighter 2022 competition is now inviting entries from anyone under 30 years old with an interest in light and lighting.

It is a high-profile opportunity to help younger lighting professionals in the early stages of their career, and the winner will receive £1,000.

Entries can be based on any light-related topic, and the initial stage requires a short PowerPoint submission. Those who are shortlisted will be asked to submit a short video expanding on their ideas, and the finalists will be selected from this second stage. They will be invited to deliver a 15-minute presentation in front of an online audience.

For more details and to enter, visit **www.cibse.org/sll**. The entry deadline is 25 August.

New CIBSE careers guides

CIBSE has updated its careers guides, which promote awareness of what a career in building services engineering offers.

The four guides each target a different group: students in school years 7-9; GCSE students; AS and A-level students; and parents.

The guides explore what it's like to work in building services, highlighting the wide range of opportunities, the benefits, and the different routes into the industry. They also include links for further resources.

All four guides are available at **www.cibse.org/careers**

CIBSE launches new retrofit group

Aim is to support the retrofit of buildings of historical and architectural interest

CIBSE is forming a new committee dedicated to retrofit and building services interventions in heritage buildings.

A series of webinars is planned as part of the launch of the Retrofit in Heritage group, with the first in September. It will feature an introduction by Julie Godefroy, CIBSE head of sustainability, outlining planned updates to the CIBSE Climate Action Plan, while other speakers will give insights into the first steps to be taken in the retrofit of heritage buildings.

The Retrofit in Heritage committee links to ongoing work that CIBSE is doing around climate change mitigation and adaptation, and linking it to building performance.

It is intended to be a forum for discussion, and plans to hold monthly knowledge-sharing activities, with guest speakers. Its mission is to support the built environment industry in the retrofit of buildings of special architectural and historical interest, working towards the carbon-agenda targets of the wider industry, while avoiding maladaptation.

The committee says it aims to do this by 'creating an open environment for knowledge sharing across the industry, and providing information, guidance and leadership about new developments, innovation, policy and legislation relating to retrofit in the heritage sector'.

The proposed definition of 'retrofit' is 'the upgrading of a building to enable it to respond to the imperative of climate change, avoiding maladaptation'. This is adapted from Marion Baeli's *Residential retrofit: 20 case studies* (RIBA Publishing, London, 2013).

- For more information about the group, visit **bit.ly/CJAug22CN1**

Embodied carbon and safety are focus of new BPA categories

Three new categories, supporting a focus on actual, measured performance outcomes, have been launched for the CIBSE 2023 Building Performance Awards, with all categories now open for entries.

Two embodied carbon categories have been added – Embodied carbon: manufacturer and supplier, and Embodied carbon: consultant – covering a wide range of innovations and initiatives.

There is also a new Building Safety Award, to recognise the introduction of the Building Safety Act and associated changes to Building Regulations.

In total, there are 24 categories, including 11 project awards, which recognise consultancies, individuals, suppliers, manufacturers, teams, and exemplar buildings and projects.

The Building Performance Awards have been running for more than 15 years, and lead the way in recognising and rewarding proven performance in building. They provide a vital platform to celebrate the achievements of people, projects, products and services.

The 2023 awards dinner will take place on 1 March, at the Westminster Park Plaza, London. To enter, visit: **www.cibse.org/bpa**. The deadline is 14 September 2022.

Conferences to give clarity on safety act

Golden thread will be focus of first event on 14 September

A new series of conferences providing clarity and a practical understanding of the Building Safety Act and the 'golden thread' requirements has been launched by CIBSE and the Society of Digital Engineering (SDE).

The series will address who and what the act affects, how it will be regulated, and how to make sure you are working in compliance with it.

Authors of the legislation will talk about how the golden thread affects engineers, building owners, facilities and estate managers, building professionals, and contractors.

The golden thread relates to the management, recording and accessibility of information about a building, enabling someone to understand the building and keep it safe. It also refers to how this information is managed, ensuring that it is accurate, up to date, secure, clear and accessible to those who need it.

The first conference coincides with the launch of BS 8644-1:2022 (*Digital management of fire safety information. Part 1: Design, construction, handover, asset management and emergency response – Code of practice*). This standard describes the requirements for digitally managing building safety information, as asked for by Dame Judith Hackitt in her report *Building a Safer Future*.

These conferences will be platforms to share knowledge and define best practice, to give people confidence in meeting the new requirements. The first – *The Building Safety Act: the consultation and the golden thread* – will be in London on 14 September 2022. See **www.cibse.org/goldenthread**

ANZ Young Engineers Awards


Alex Shan picked up the Jack Pirie Award


Nicholas Wensley was named Student of the Year


Vanessa Luvio won Graduate of the Year

The CIBSE Australia and New Zealand (ANZ) region celebrated its rising stars at the annual Young Engineers Awards in July.

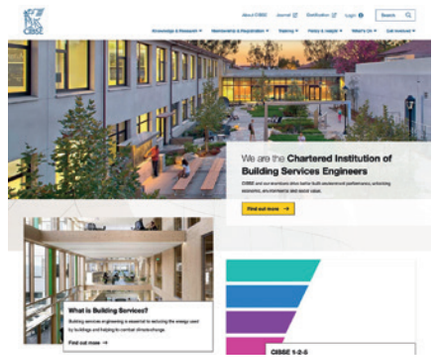
Nicholas Wensley, undergraduate sustainability consultant at Northrop Consulting engineers and University of South Wales, won the Student of the Year award for his video entry that included direct and indirect sustainability initiatives for designing a building with an infinite budget.

Vanessa Luvio, graduate mechanical engineer at Northrop Consulting Engineers, took the Haris Moraitis Award for Graduate of the Year, impressing the judges with her passion for implementing smart and sustainable solutions in building services design.

The Jack Pirie Award for Young Engineer of the Year went to Alex Shan, senior mechanical engineer at Cundall, for his compelling video highlighting how crucial communal spaces are to human flourishing.

The 2022 winners were joined on stage by the 2020 and 2021 finalists and winners, who were also honoured for their achievements, having not been able to have an in-person celebration for the past two years.

- Watch the winners' videos at **bit.ly/EngAw22**



Our revamped website is now easier to use

CIBSE's newly designed website is now live. It has a new look, feel and navigation. There are numerous new features, including a dedicated training section and new 'policy and insight' and 'get involved' sections.

The site also supports a 'related content' function, which enables better cross-referencing of information, helping users find content that is of interest to them.

A new Membership Wizard feature makes it more straightforward for users to find the most relevant grade of membership, and an improved user journey through the Knowledge Portal allows members to download information more easily.

The website is now fully responsive, allowing you to easily read and browse the website from any tablet or mobile device.

Take some time to visit and explore the new site – and if you have any feedback, please let us know by emailing **website@cibse.org** or visit **www.cibse.org**

CIBSE weather data a must for latest NCM Guide

CIBSE's 2016 Test Reference Year (TRY) weather data sets are now a requirement of the National Calculation Modelling (NCM) guide, which came into force in June 2022 and includes several important changes.

The guide provides direction on the use of the government's Simplified Building Energy Model (SBEM), and other approved software tools, when demonstrating compliance with CO_2 emissions, primary energy requirements, and calculating asset ratings as part of Energy Performance Certificates for buildings other than dwellings.

Along with the use of 2016 CIBSE weather data files, dynamic simulation model software must meet or exceed the classification of dynamic modelling outlined in *CIBSE AM11: Building performance modelling*.

The new guidance also refers to *CIBSE Guide A: Environmental design*.

For more information, go to **www.cibse.org/weatherdata**

DRAFT MINUTES FOR CIBSE ANNUAL GENERAL MEETING

The Annual General Meeting (AGM) of the CIBSE was held on 5 May 2022. The AGM was conducted as a hybrid model, with participants both in-person and online via Teams. Kevin Kelly, CIBSE President 2021-2022, chaired the meeting. Chief executive Ruth Carter read the Notice of Order convening the meeting.

The minutes of the 44th AGM of CIBSE, held on 6 May 2021 and published in the August 2021 issue of *CIBSE Journal*, were accepted as a correct record of the meeting. A small addition referring to "related party transactions" was accepted.

Actions arising from the minutes:

1. **A suggestion that a 'further breakdown of regions, societies, networks, and groups' and their respective funding be provided in a *Journal* article. This was considered, but couldn't be provided in sufficient context to give rise to an appropriate article for *CIBSE Journal*.**
2. **Names of proposed auditors will be included in the Calling Notice henceforth.**

ANNUAL REPORT AND FINANCIAL STATEMENTS

Kevin Kelly provided an overview of the 2021 Annual Report, underlining the significant surplus enjoyed this year thanks to the outstanding performance of volunteers and amidst the challenges of a global pandemic. The report reflects on the highlights of the year, emphasises the Institution's values, and celebrates the work of Members, Societies, and Special Interest Groups.

CIBSE's work with the Royal Academy of Engineering, its 5th edition of ventilation guidance, and its numerous contributions to government advisory groups were all recognised. The priority of building safety was reinforced as a critical challenge in the wake of Grenfell. CIBSE has been instrumental in raising public safety standards in the industry.

Upgrading the UK's Building Regulations is an ongoing effort for CIBSE with the updates to Part L (Conservation of fuel and power) and Part F (Ventilation), and the newly added Part O (Overheating) and Part S (Electric Vehicle Charging).

Improving building performance has been at the forefront of CIBSE's work and the CIBSE Building Performance Awards showcased a breadth of industry achievements and innovative approaches.

CIBSE is deeply involved in the transition to Net Zero by 2050, updating its Climate Action Plan. It also played an essential role in the development of the CIC Carbon Zero Climate Action Plan. To support the broader industry in reducing emissions, CIBSE launched a calculation methodology for GHG emissions – TM65: *Embodied carbon in building services*.

A new nominations review process was launched to improve transparency and enhance diversity among nominated candidates. As a result, CIBSE received a record number of high-quality applications. Some of the talented candidates who didn't make it through the process were sought out for other roles. The Diversity and Inclusion Committee was rebooted and has engaged with WiBSE (Women in Building Services Engineering) to improve liaison.

The new committee will be a standing committee of the Board and will set overall policy and direction for CIBSE and oversee the work of four panels representing four minority groups.

The immense talent represented in CIBSE's Young Engineers Awards reassured us of the promising outlook for the future. The Apprentice of the Year Award was extended in 2021 from one to two categories covering 'technician' and 'degree apprentices', allowing for greater recognition of this key route into the industry and a greater diversity of skills and applicants.

The Annual Report is available at **www.cibse.org/annualreport**.

Adrian Catchpole, CIBSE's honorary treasurer, introduced this year's Audit Report and outlined changes. BDO was approved to be CIBSE's auditor at the last AGM. However, having arrived at an impasse regarding fees, BDO and CIBSE jointly decided that the former will step down from this role. The Board issued a tender to fill the resultant vacancy and appointed Crowe U.K. LLP as temporary auditors. The Board has since observed improvements to the audit process and client reporting.

> "The report reflects on the highlights of the year… and celebrates the work of Members, Societies and SIGs"

Julia Poulter, Statutory Auditor at Crowe, presented the Auditors Report on CIBSE's consolidated financial statements, its parent charity, and its subsidiaries for the year ended 31 December 2021. The financial statements were found to provide a true and fair view of the state of the Group and the parent charity's affairs and of the incoming resources and application of resources (including its income and expenditure) for the year, and had been prepared in accordance with the UK's accepted accounting practices and requirements under the Charities Act 2011.

Adrian Catchpole then reported on the 2021 Financial Statements, emphasising that CIBSE has a strong set of accounts despite ongoing challenges due to the pandemic. Catchpole commended the staff's pursuit of savings and initiatives to improve the business.

The overall Group income rose from £6.117m in 2020 to £6.891m in 2021. Trading subsidiaries (Services, Certification and Hong Kong) witnessed an increase of £380k. Investment income (Interest and Dividends) is the only category that saw a minor dip from £64k to £63k. Income from membership subscriptions was up by £137k despite the freeze on the increase to subscriptions in 2021. Fees collected for

charitable services (CPD and Events) increased by £165k. Under donations and legacies, £93k was posthumously bequeathed by former CIBSE President Graham Manly.

CIBSE Services Ltd turnover was found to have benefited from making certain services virtual, such as training, and creating better online learning experiences. As restrictions eased, the *Journal* saw advertising revenues increase. Publication sales increased following the release of key guides like TM65, CP1, and Guide A.

While CPD and online learning did well, events in general saw a deficit. The 2021 Building Performance Awards were the first to be held post-pandemic, so the figures are significantly lower than its February 2020 predecessor. Digital software verifications were down, but are explained by the biennial nature of the renewal process. Certification turnover, bound by regulatory constraints, stayed around the same.

Overall Group expenditure rose from £6.204m in 2020 to £6.612m in 2021. Spending on trading subsidiaries remained the same even as income rose; it was noted that a year of savings from online working offset increased costs. Expenditure on membership was up by £186k. Technical expenditure went down slightly due to staff vacancies. Adrian Catchpole was pleased to declare that increased funding went toward 'Regions, Special Interest Groups and Societies'. Additionally, there was better take up of 'Research' funding as we came out of lockdown.

There was a total £774k increase in Group income and a £408k increase in Group expenditure. Before gains on investment, the Group experienced a £279k surplus this year against an £87k loss last year. In valuation income (Investments/Pension Funds) and net movement in funds, the 2020 statements show a deficit of £6k and £93k respectively. In 2021, these categories display positive increases – £163k and £442k respectively.

Net assets of the Group being carried forward in 2021 were £3.016m, representing a £443k increase from 2020. The investment fund balance went up £293k as the government invested in the economy. The stock market – and by extension CIBSE's investments – also did well. Physical copies of publications will keep decreasing as we move to digital versions. Increased debtors in 2021 reflect increased sales.

Cash at bank and in hand increased by £628k due to increased sales and the 12-month interest-free Coronavirus Business Interruption Loan (CBIL) of £500k. Offered by the government in response to the pandemic, this amount remains unspent by CIBSE. Credit due within one year includes trade creditors and a portion of the CBIL. The Defined Benefit Pension Scheme Asset fell from £24k to £9k due to continuous changes in the asset ceiling.

Although pre-pandemic levels have not yet been restored, revenues across the business continue to improve and CIBSE is in significant operational surplus.

Adrian Catchpole then opened the floor to questions.

Chris Jones asked if there was an exceptional reason why the pension scheme asset had reduced from £24k to £9k, to which Adrian Catchpole reiterated that those running the pension scheme change these things and it is out of our control.

Chris Jones also asked if the extra revenue from subscription fee increases has been outweighed by actuarial losses to the defined benefit pension scheme, and asked about exposure to market fluctuations and if the Trustees see the overall situation as any kind of risk.

Adrian Catchpole confirmed that this is on the risk register, and anyone involved with defined benefit pension schemes knows how difficult and risky it is. For the pension scheme there are different Trustees, distinct from the CIBSE Board, who review this regularly and actively examine ways to reduce risk.

Phil Jones noted that creditors comprise a high proportion of the turnover. More details were requested on the £441k that is outstanding, and if it relates to a particular debt. Adrian Catchpole said this is linked to the government's CBIL. He explained that the decision was taken in March 2020, when members forecast for a worst-case scenario and anticipated CIBSE having to draw down investments, hence the loan was acquired as an additional potential cash fund. However, during this time the stock market, and business, bounced back quickly. The plan is to pay back the loan in the months ahead subject to Board review.

AUDITORS

The proposal put forth by Adrian Catchpole to appoint Crowe U.K. LLP as auditors for the financial year 2022 was passed unanimously.

SPECIAL RESOLUTION

The second proposal put forth by Adrian Catchpole for annual membership subscription rates to be increased by 4% from 1 January 2023 was also passed unanimously.

BOARD AND COUNCIL FOR 2022/2023

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

Officers:
President: Kevin Mitchell
President-Elect: Adrian Catchpole
Hon Treasurer: Vince Arnold
Immediate Past President: Kevin Kelly
Vice Presidents: Fiona Cousins, PL Yuen, Les Copeland
Continuing Board Members: Dave Cooper, Laura Mansel-Thomas
Newly elected Board Members: Lionel James, Ruth Kelly-Waskett, David Stevens
Newly elected Council Members: Mike Burton, Sanjay Modasia, Andy Sneyd

ANY OTHER BUSINESS

Kevin Kelly thanked departing Board Members Alex Logan, David Fitzpatrick, Susan Hone-Brooks, Lynne Jack, and Stuart MacPherson before formally concluding the AGM.

Under review

The Grenfell Inquiry considered the requirements of Part B of the Building Regulations and associated guidance and a review of the Approved Document was announced in 2020. Hywel Davies looks at the progress of workstreams supporting improved fire safety design guidance

In April 2020, the government gave an overview of the research to be commissioned to inform the technical review of the fire safety guidance contained in Approved Document B (ADB).

Ten packages of research or evidence gathering were advertised for tender and contractors appointed, with expert steering groups to support them.

These commissions cover a range of topics based on the call for evidence around Part B that was issued in December 2018. Each of the topics is an area in which we need to know more to improve fire safety-related design in buildings.

The current state of the various workstreams is described below, and provides an overview of the work under way to support the development of revisions to current guidance in ADB.

1. Specialised housing and care homes: A study of current design approaches, and establishing current operational, management and usage practices across the specialised housing and care home sector. This workstream will review the effectiveness of current provisions in ADB and consider international approaches. It will also include further research into alternative approaches to fire safety in these types of buildings. The project is under way with outputs being considered by the Department for Levelling Up, Housing and Communities.

"Each topic is an area in which we need to know more to improve fire safety-related design"

2. Means of escape for disabled people: Research into whether the current provisions in ADB are fit for purpose, based on realistic expectation of management and building use. The research will consider up-to-date evidence and whether current practices are effective in meeting the minimum requirements under Part B1 of Schedule 1 of the Building Regulations (2010). This project is under way.

3. Balconies, spandrels and glazing: This work sets out to develop a comprehensive evidence base of common modern design approaches to balconies, spandrel panels and glazing. It is conducting a review of fire risk from these elements and, where appropriate, is intended to deliver an experimental programme to develop a robust evidence base to support the ADB review. This work is awarded and under way.

4. Structural fire resistance and fire separating elements: This will assess current provisions in ADB for structural fire resistance and fire-separating elements. It will establish the evidence base, and review it in the light of modern evidence on design, technology and fire loading. It will also investigate alternative approaches. This work is under way.

5. Trigger heights and thresholds: This workstream is under way and considering the thresholds now used

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

in the guidance. The workstream is focused on whether they are based on relevant and up-to-date evidence and whether they provide adequate guidance to designers. It aims to identify the basis and underpinning evidence for trigger thresholds used in ADB and Regulation 7(2) of the Building Regulations 2010.

6. Smoke and toxicity: This research aims to provide the evidence base to assess the need and means to regulate toxicity of construction products in the event of a building fire (in England). Work is under way.

7. Construction technologies and design: This work is considering whether ADB adequately addresses common construction practice and developing technologies. It will identify and review modern construction technologies and trends in design and building use, and will review the current provisions in ADB for the application of modern construction technologies and trends in design and building use.

8. Classification of external wall construction review: This is reviewing the assessment methodology for fire performance of external wall systems. It includes a review of the BS 8414 methodology and BR 135 classification to assess whether this testing regime is fit for purpose and based on robust evidence to keep buildings safe and people confident in the regulatory standards.

9. Means of escape in blocks of flats. This is a joint project under way, with the Home Office to review the current evacuation strategy and design principles for means of escape in blocks of flats, and to consider if they are fit for purpose. The project has four elements:

- A review to assess academic evidence on methods of evacuation
- Physical testing of evacuation strategies and interactions with fire and rescue operations
- Building design research to evaluate fire safety provisions in buildings
- A study of human behaviour and public confidence, to better understand public perception and understanding of evacuation strategies.

10. Property protection: This is considering how other countries approach property protection in Building Regulations, and analysing evidence on the costs and benefits of different regulatory approaches to property protection.

All these projects are addressing areas in which we need further evidence to inform policy development and support the provision of up-to-date guidance to building professionals.

The guidance can never replace competent engineering practitioners, particularly for more complex buildings, where the guidance in the ADs may not fully reflect what is necessary to meet the functional requirements.

Anyone with an interest in fire safety design should be aware of this work and that it is intended to inform future updates to the Building Regulations, which will be subject to consultation in due course.

How to improve smoke control system specification

Uncertainty over legislation and lack of understanding of systems has made building safety less of a priority, says Exyte Hargreaves' **David Fitzpatrick**

Any tender for a smoke and fire safety system should have one, ultimate aim: to have a compliant solution that prioritises safety to life above anything else.

However, too many grey areas within legislation, and a lack of understanding of systems and EN-tested products and their tested applications, have made the safety of building users less of a priority, and the tendering process has become about a race to the bottom on price and quality. How can we change that?

1 Make sure the correct tested product is specified for the application

A smoke control system is based on a set of products that should have an EN test and CE marking for the project application. Any good-quality specification regarding smoke control should be asking for a declaration of performance (DOP) for the products being used within that particular application. If the smoke damper is to be fitted into a certain type of wall, the DOP should state that it has been tested within that application. The DOP prevents any confusion and makes sure the tendering specialist is using the right products.

2 Get a smoke safety expert involved

Seek out a smoke and fire expert who is willing to get involved in every step of the fire safety strategy – design, manufacture and installation. They will bring the relevant perspective required to ensure a system is compliant, suitable for the application, and capable of saving lives should a fire occur.

3 Consistency of the entire specification

A detailed specification has many layers, from a general specification quoting British standards, to a smoke-engineered solution for a specific project. Make sure they all tie up as, often, a specification comes out and contradicts itself, creating confusion in tendering and when delivering projects.

CIBSE members can help improve the industry by taking a few small steps within the smoke and fire safety specification to clear up confusion.

David Fitzpatrick is smoke fire systems operations director at Exyte Hargreaves

A focus on developing and retaining diverse talent will enable Cundall to grow its business despite the economic challenges, says new managing partner Carole O'Neil. Alex Smith and Molly Tooher-Rudd speak to the company's first female boss

RAISING THE BAR

Cundall's new managing partner Carole O'Neil is adamant that economic headwinds won't knock the consultant off its route towards its net zero goals.

The multidisciplinary engineering consultancy has pledged to be working only on net zero projects by 2030 and O'Neil says that will continue under her leadership. 'Climate change isn't going to stop simply because we are in choppy economic waters. We have a responsibility to keep pressing ahead,' she says.

While net zero, coupled with excellence in delivery, is at the heart of Cundall's business strategy, O'Neil has been appointed managing partner primarily to grow the business. She was given the same task 15 years ago, when Cundall hired her to help recruit the talented engineers it needed to grow and expand overseas – O'Neil has a human resources background. 'The leadership team felt that it was the right time to bring someone in who could focus on people. We were facing the skills challenges that we face now, in terms of availability, attraction and retention of talent,' she says. After five years, O'Neil was promoted to the board.

On first meeting, O'Neil exudes warmth and openness, and you can see why she has been chosen to lead a company striving to appeal to the best talent in a competitive labour market.

She appreciates the importance of a healthy work-life balance, and helped formalise agile working at the company, allowing employees to pursue passions outside work. For O'Neil, that means having more time to train as a competitive powerlifter. Extra benchpressing sessions during the lunch hour has enabled her to build up her strength and compete at a national level (see panel, 'From strength to strength'.)

Despite rampant inflation and forecasts of an economic slowdown, O'Neil says Cundall is still aiming for growth – particularly in Asia, an area of the business she knows well, having spent 18 months in Hong Kong and Australia until 2020. She describes her role there as peripatetic leadership support, working with local teams to address human resourcing challenges. Providing opportunities for people to set up offices overseas has been key to growing the company, as well as retaining staff, she adds.

'We believe staff are more likely to stay if they are able to pursue ambitions overseas. Moving country and job is quite a big deal, isn't it? But if you only have to do one of those two things, there's more of a safety net.'

Cundall was partially insulated from the effects of Brexit because it has offices in the EU, says O'Neil, which meant employees could move to Cundall offices in countries such as Ireland, Romania and Spain. While the company didn't see an exodus of people returning home post-Brexit, the new restrictions on mobility make recruiting engineers from Europe challenging. 'That's cut off a source of talent for us and made it more difficult,' O'Neil says. 'It's challenging in terms of the practicalities, from a business point of view, and the aspirations that people have to come to the UK.'

As one of the first women to head up a global engineering consultancy, O'Neil's appointment is highly symbolic, and she says reaction has been overwhelmingly positive, both internally and from clients. But she warns there is still a long way to go. 'Although they are getting better, the numbers for female representation are not yet where we want them to be,' she says.

Over the past three years, there has been a big focus on equity, diversity and inclusion at Cundall, O'Neil adds, with a member of the HR team, Kieran Thompson, focusing exclusively on talent, diversity and inclusion. Initiatives include an annual demographic report, an employee network for gender, ethnicity, neurodiversity and LGBTQ (known as the kaleidoscope network), and a diversity leadership programme.

To reach different socioeconomic groups, Cundall does educational outreach with schools, engaging with students who may not otherwise have the opportunities – for example, a programme with Lambeth College offers work placements and mentoring to students.

'The more welcoming and inclusive we can be to a broad cross-section of people, the better off we are and the more ideas are brought to the table,' says O'Neil.

Next generation

Given her background, it's no surprise that O'Neil is keen to develop initiatives to attract and retain staff. She wants to improve what, in HR terms, is called the employee value proposition. This is the unique set of benefits employees receive in return for their skills and experience.

Cundall's includes a learning and development programme, and a commitment to give young staff the opportunity to work on big projects with senior staff.

To achieve net zero, the company is pushing from the bottom up, says O'Neil: 'The people with the ideas and real passion are at the much more junior level of the business. To harness this creativity, teams have been put together that include people with different levels of experience and from different backgrounds.' Early career engineers will also get the opportunity to work across a range of sectors, she adds.

Younger team members have been keener to return to the office post-pandemic, for the social side of work and the comforts of a professional working environment that may not come with a house share, says O'Neil. Cundall has formalised an agile-working arrangement, with employees typically spending 60% of their time in the office. This flexibility offers great advantages, she adds, as it allows for collaboration with colleagues in different time zones and better opportunities for work share.

Cundall has recently occupied a new space in Manchester's Northern Quarter, which has been set up differently from its previous offices, post-Covid. The format lends itself much better to agile working, says O'Neil, with more multipurpose common areas for socialising and collaborative work, along with areas for quiet, more private working.

> "The more welcoming and inclusive we can be to a broad cross-section of people, the better off we are"

Cundall was one of the first companies to pursue Leed accreditation, with their London office receiving a WELL building accreditation in 2016. The accreditation was achieved for the industry-leading innovations that were implemented to enhance health and wellbeing in the office. Similar principles have since been consistently applied in other Cundall offices.

When musing on her promotion, O'Neil admits there was a board-level discussion about whether there should be an engineer at the top – but she says, for companies to be successful, they need a broad range of talent.

'We have fantastic technical engineers, but companies need a mix of skills, including those from an HR and finance background who know how to run a business,' she says.

'There were questions asked about who would pour oil on troubled waters if we have an unhappy client, but we're a multidisciplinary practice, and I will encourage the client to speak to an engineer experienced in the [relevant] discipline.'

Cundall clearly believe that O'Neil's core skills will enable the company to recruit, develop and retain talented engineers and propel them well on the way to achieving its business and net zero goals. CJ

Carole O'Neil is the chair of her regional branch of British Powerlifting in Yorkshire

FROM STRENGTH TO STRENGTH

After 'stumbling' across the sport of powerlifting when researching fitness training, Carole O'Neil entered a novice competition on a whim.

Five years later, she has become more than a hobbyist, competing and winning medals in national masters championships in the UK and Australia.

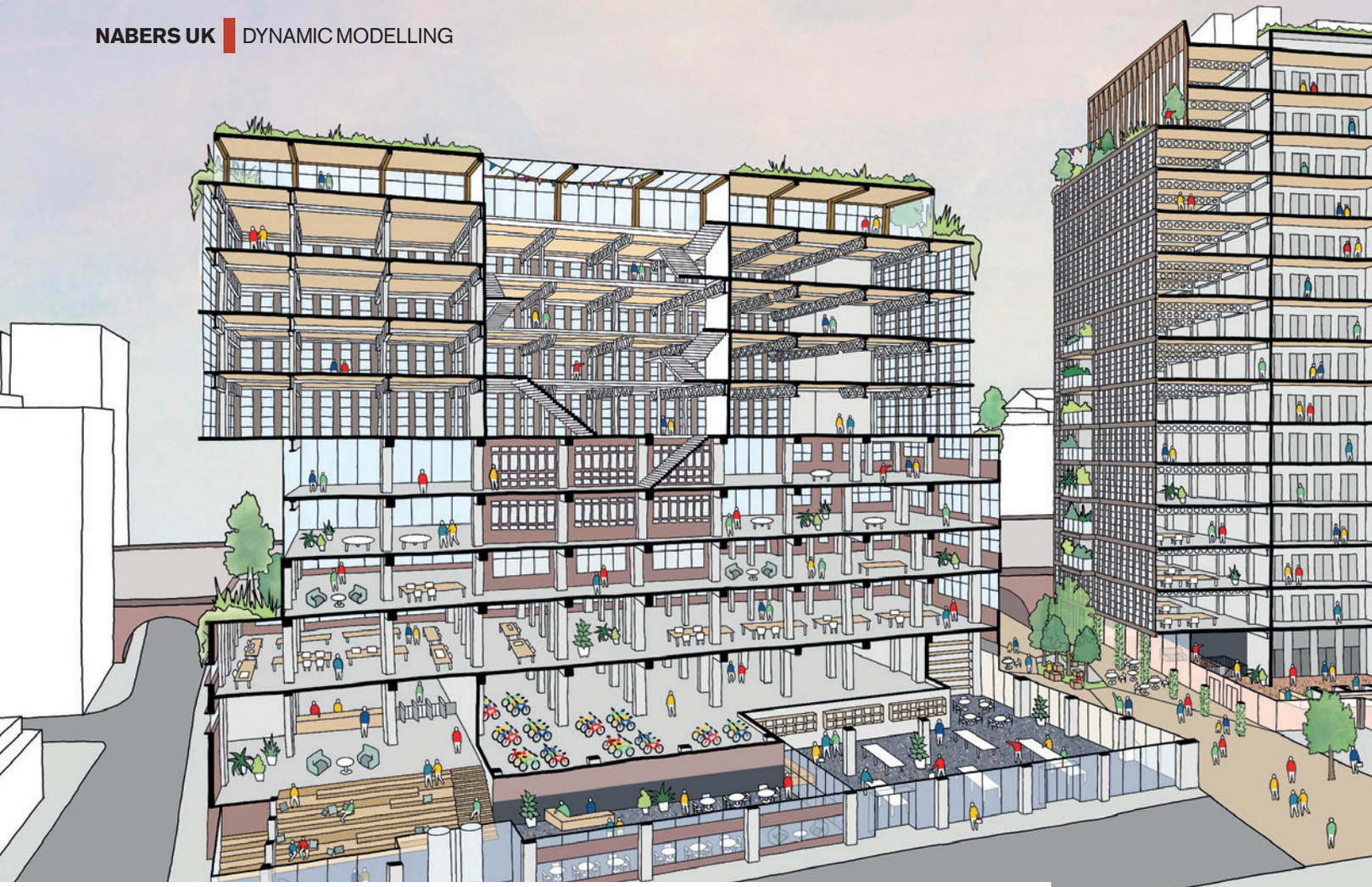
It was the ethos of strong body, strong mind that attracted O'Neil to powerlifting. 'When you're doing a challenging day job, having something that keeps you fired up outside of work is game changing,' she says.

O'Neil won a silver medal in the recent masters classic category at the British national championships in Belfast – and, while on a work assignment in Australia, she entered a competition and won the national championships.

In powerlifting, competitors have three attempts to lift as much weight as they can in three lifts – the squat, bench press and deadlift. Setting up a gym in the garage has taken O'Neil's powerlifting to the 'next level', she says, as hybrid working means she can squeeze 15-minute sessions into the working day.

She enjoys the camaraderie of the sport and, last year, was appointed chair of the Yorkshire and North East Powerlifting Federation. 'I've met some wonderful people who have become very good friends. It is a great community – everyone just wants everyone else to succeed,' she says.

Watch O'Neil in competition at bit.ly/CJAug22CO



MODEL NABERS

Key to attaining a Nabers operational rating for a commercial building is the creation of a dynamic energy simulation model that closely predicts actual operational performance. **Alex Smith** looks at how Hoare Lea modelled Timber Square to achieve the UK's first design target rating

The widespread disclosure of operational energy in UK buildings has taken a big step forward this year, with large commercial developers awarded Nabers UK ratings.

Landsec was the first in the country to achieve a design target rating for its proposed Timber Square office development in Southwark, which received a five-star rating in February, while Grosvenor's 87,500ft² Toronto Square building in Leeds has achieved the first Nabers UK rating for an existing office building. It was given 4.5 stars after 12 months of data was analysed by licensed assessor EP&T Global and independently certified by BRE.

Nabers measures and verifies the actual energy use of commercial buildings, and awards offices a star rating of between one and six. The scheme was imported from Australia, where it has been used for more than 20 years, and where a recent report found that buildings benefited from an average 42% reduction in base building energy intensity after the 14th Nabers rating.

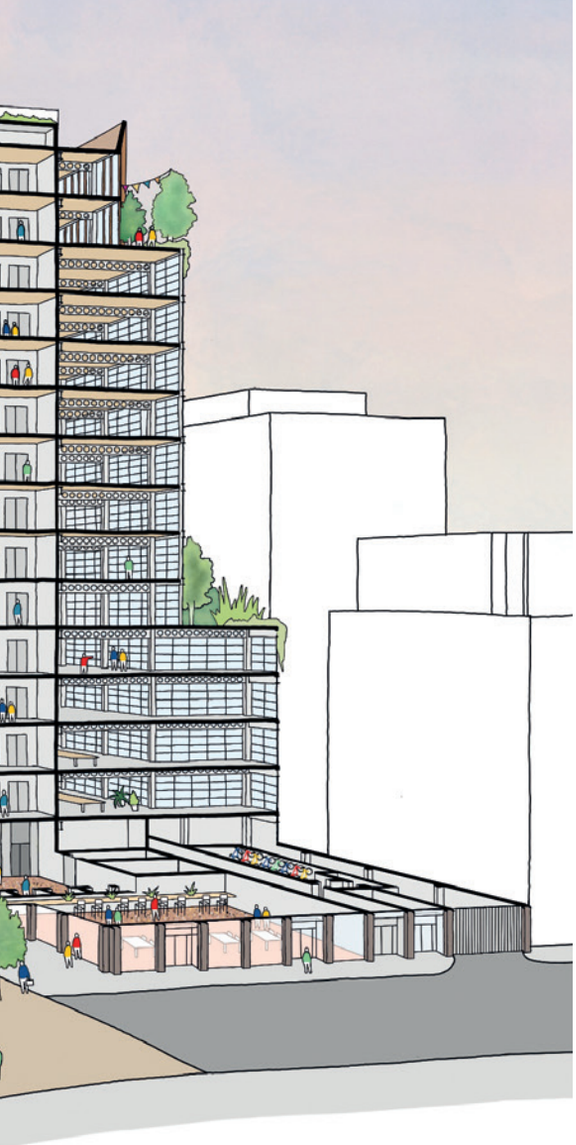
The two rating systems for new and existing buildings are called Nabers Design for Performance (DfP) and Nabers Energy respectively. Nabers recognises buildings at the design stage by awarding a target rating after an independent design review (IDR), which assesses a detailed dynamic energy-simulation model of the building (see panel, right).

The DfP process commits owners to design, build and commission a new development, or major refurbishment, to achieve a specific Nabers UK energy rating (See panel, 'Design for Performace process').

Landsec's Timber Square is an ambitious 335,000ft² development comprising two office buildings plus ancillary retail/leisure uses. The scheme consists of the 15-storey new Ink Building and the 10-storey Print Building, which is a refurbishment and extension of an existing building.

Hoare Lea was involved from project inception and provided building services engineering and a range of other disciplines, including sustainability, acoustics and fire.

There was a clear brief from Landsec that Timber Square would use modern methods of construction and circular economy principles



Timber Square was the first project to be awarded a Nabers UK design target rating

> "A report found that buildings [in Australia] benefited from an average 42% reduction in base building energy intensity after the 14th Nabers rating"

to minimise embodied carbon emissions, while also targeting ambitious levels of operational energy performance.

The response was to partially reuse the existing structure of the Print Building and implement a hybrid steel and cross laminated timber (CLT) structure, resulting in an embodied carbon intensity of about half that of a typical London office.

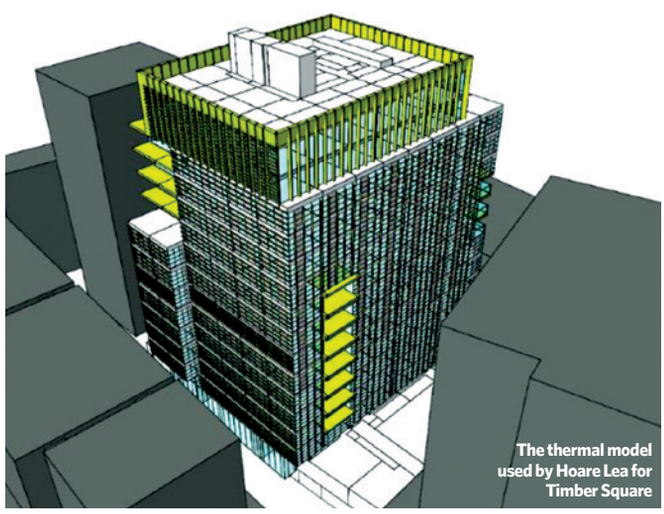
A baseline energy performance target was established at the early stages to achieve the UKGBC's whole building office energy consumption 2020-2025 target, but with an aspiration to meet the 2025-2030 target and achieve a Nabers UK 5-star rating.

Although Nabers UK had not been formally launched when the project started, Hoare Lea were ready to implement the process using experience gained on early pilot studies across the different RIBA stages (Table 1) as one of the very first DfP Delivery Partners. .

At RIBA Stage 2 Hoare Lea worked closely with architect Bennetts Associates to optimise the façade for solar and daylight control. Hoare Lea's analysts carried out parametric simulation using in-house tools to determine the optimum glazing configuration for each 6m façade bay. Each bay consisted of a mixture of solid, translucent and clear glazed panels – which could be used in combination to limit cooling loads while still achieving good daylight levels (in line with the Well standard) across the floorplate.

During concept design Hoare Lea also carried out initial HVAC modelling to evaluate different design options, for example comparing fan coil units (FCUs) to active chilled beams, and mechanical ventilation to mixed-mode ventilation.

At RIBA Stage 3, detailed HVAC modelling was carried out using IES thermal modelling software and the ApacheHVAC module, including »



The thermal model used by Hoare Lea for Timber Square

THE IMPORTANCE OF AN INDEPENDENT DESIGN REVIEW

The Design for Performance (DfP) process starts with developers signing a DfP agreement, which states the target energy rating their building is aspiring to achieve. The building is designed, and a model and simulation report is prepared for an independent design review (IDR).

Once the IDR has taken place, a report is submitted to the BRE. When the report is approved, the developer can promote its target rating. After completion, a Nabers-accredited assessor carries out an assessment based on 12 months of energy data, to demonstrate whether the target has been met.

The two most pioneering elements of the DfP process are the IDR and the detailed dynamic energy-simulation modelling, according to a report presented at the 2022 CIBSE Technical Symposium.

In *Design for Performance: Lessons from the Nabers UK independent design review process,* the authors say that the modelling of building services systems and controls is particularly important.

The IDR identifies whether the design for the base building is likely to meet its operational target. IDRs can be undertaken at multiple stages of the RIBA Plan of Works, though the DfP Guide recommends that an IDR be conducted during Stage 4, when there is sufficient design detail to produce simulation.

The authors recommend that the model be updated and revised in parallel as it progresses from Stages 2 to 5, and a feedback loop put in place from the model to the design team. At Stage 5, the focus of the simulation should be post-construction monitoring and tuning, they add.

Since the start of their review in 2020, the authors observed increasingly sophisticated building simulation models that were leading to more realistic models.

> "In a Part L or TM54 model, you have an estimation. With Nabers you have a huge amount of data, and its granularity means you have more information to evaluate"

» scenario modelling to 'stress test' and refine the design.

The sophistication of the software meant that Hoare Lea could model a large number of variables such as ventilation airflow rates and supply temperatures, fan and pump efficiency curves, ductwork heat losses and gains, demand control ventilation, FCU operation (variable temperature and flow), air source heat pump (ASHP) temperature and load dependant performance, plant sequencing and heat recovery to align with the engineering design.

The richness of the data enabled a level of outcome-focused decision making that would not have been possible otherwise. For example, the HVAC analysis informed the decision to have three heat pumps per building rather than two. Having two would have led to one of the heat pumps running for longer periods at low loads, which would have affected plant efficiency and energy consumption.

Two on-floor climate control options – fan coil units (FCUs) and active chilled beams – were also modelled, says Henry Burrows, lead mechanical engineer for the project.

'As the active chilled beams rely on central ventilation to meet the cooling load, we couldn't utilise the full benefit of demand control ventilation with this solution, which is a key benefit in a post-Covid environment. The FCUs would not conflict with the demand control ventilation, so they were the preferred option,' he says.

Modelling influenced the DHW strategy for the office WCs, leading to the selection of electric point-of-use water heaters after they were compared to a central hot water system connected to the ASHPs.

While incredibly powerful, the modelling required is complex. 'With Nabers quality advanced simulation you have information on every level, and every change affects everything.' says Owen Boswell, Nabers UK assessor and simulation lead for the project.

'In a Part L or TM54 model, you have an estimation. Nabers is now the gold standard. You have a huge amount of data, and its granularity means you have so much more information to evaluate.'

However, Boswell says there is an acute skills shortage in this level of modelling in the UK, which Hoare Lea has been tackling through training and global knowledge sharing, as part of its net zero strategy.

A firm-wide working group made up of representative of all disciplines ensures that lessons learned across Nabers projects are translated to every project in the firm through guidance and specification updates.

'There haven't been the industry drivers to implement this level of modelling at scale in the UK over the last decade. Nabers UK and the drive towards net zero is the prompt to upskill. The talent and enthusiasm is there, but it's a steep learning curve initially,' says Boswell.

CIBSE provides training courses on Advanced Simulation Modelling for Design for Performance. For more details visit **bit.ly/CJAug22Nab1**

Nabers UK – DfP design process

RIBA Stage 2 Concept design	RIBA Stage 3 Developed design	RIBA Stage 4 Technical design
■ Developer to sign DfP agreement ■ Early Stage 2: façade optimisation for solar and daylight control ■ Late Stage 2 once frozen GAs are available: Initial HVAC modelling in line with Nabers UK requirements (include review of façade/ servicing options for impact on operational energy)	■ Client to produce rating-achievement plan ■ Progress detailed HVAC modelling ■ Scenario modelling to stress-test the design ■ Develop metering strategy ■ End of Stage 3: independent design review (IDR). Significant input/documentation required from the design team	■ Address IDR comments ■ Outcomes of IDR used to inform design improvements within Stage 4 design ■ Submit final Nabers UK DfP report to the BRE ■ Full licence to promote target rating

Table 1: What is expected at each of the RIBA design stages when following the DfP design process

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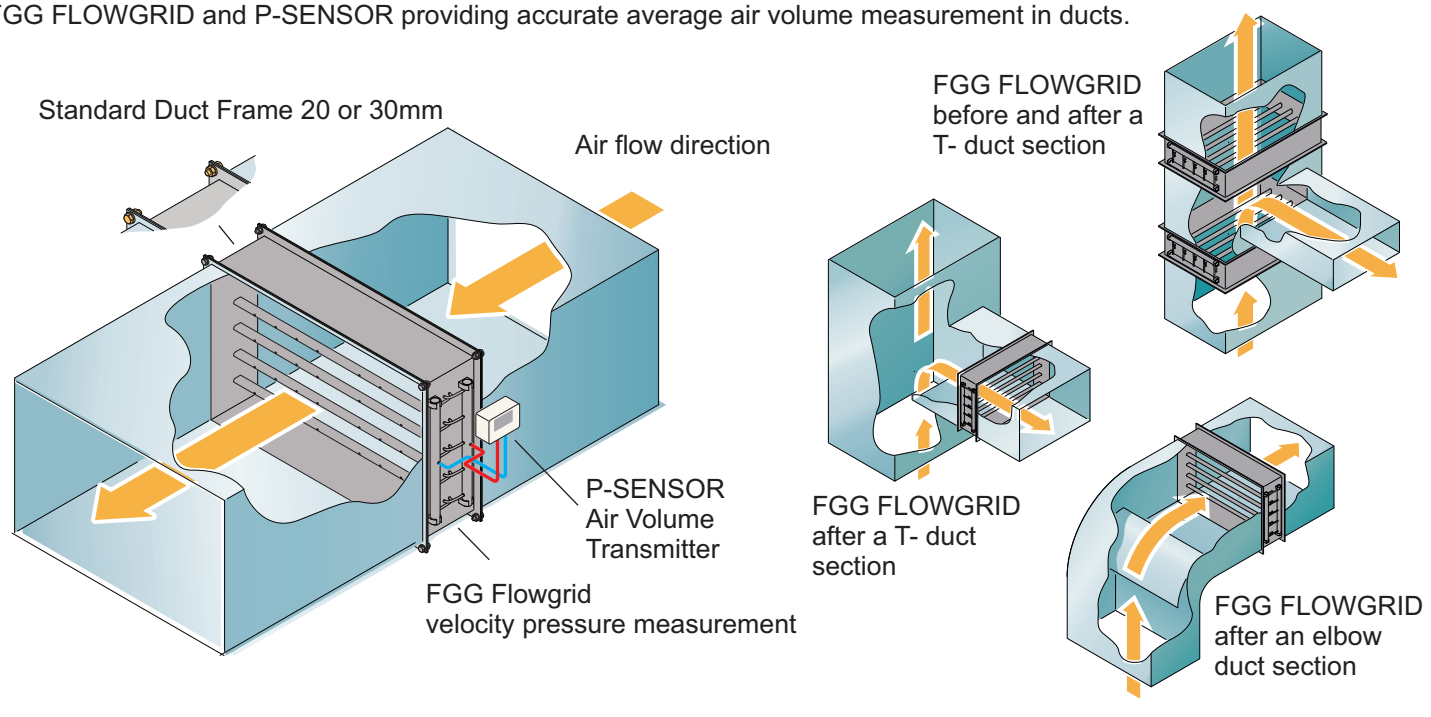

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TECHNICAL RISKS

The authors of a paper on Nabers independent design reviews[1] have identified technical risks that could affect target operational ratings – and have offered potential solutions

Heat-recovery variable refrigerant flow (VRF) system Zonal thermal diversity tends to favour heat-recovery VRF systems. With smaller VRF buildings delivered as a shell-and-core base building design, stress test poor design by the tenant by removing the diversified internal zone loads.

Water-to-air heat pumps Unless enforced via tenant leases or a CAT-A HVAC design, any condenser water valves for the compressor units are likely to be open for long durations. This will lead to the pumping system acting as a constant flow, instead of variable flow, system. This risk is mitigated if continuously modulating condenser water valves linked to compressor load is specified.

Air-to-air heat pumps Where a single heat pump serves interior and perimeter zones with terminal reheats, the high efficiencies of heat pumps in heating mode is not capitalised, and reheat energy will be high. This is because the heat pumps will operate to satisfy the warmest zones, leaving any colder zones to be reheated using terminal reheats. Where this result is not observed in the simulation results, revisit how the air transfer between HVAC thermal zones is modelled by the simulation software engine, or consider adding internal partition walls to ensure this is modelled correctly. From a mechanical design perspective, this system should be designed with separate perimeter and interior zone heat pumps.

Centralised cooling and heating plant Standard designs seem wedded to the use of plate heat exchangers at each tenancy for hydraulic separation. This practice is advantageous to enable tenant fit-outs without affecting the broader hydronic network and pseudomonas risk management.

However, this is at the expense of pressure losses across the heat exchanger (typically between 10kPa and 40kPa) and, more notably, restricts execution of temperature resets that increases chiller and heating plant efficiency during building partial loading. As a result, the system regresses to operating as a constant temperature system, which can perpetuate the 'low delta T' syndrome. While uncommon, some projects did specify a design without plate heat exchangers, suggesting that the alternative configuration without them, the Australian norm, is possible in the UK.

Related to the above issue is the practice of domestic hot water (DHW) calorifiers and space heating sharing the same LTHW plant. Space heating demand is seasonal, while DHW demand is steady-state across the year. The common issue observed was domestic water temperature requirements restricting the ability for the LTHW temperature to be reset downwards when space heating demand is low. Designs should consider the ability to service the DHW load separately from the centralised plant (for example, via a separate hydraulic connection to a dedicated heat pump) or, at minimum, a separate hydraulic riser for DHW, so it is not on a riser shared with space heating.

References:

1 *Design for Performance: Lessons from the NABERS UK independent design review process,* Foo, Bannister, Cohen, CIBSE Technical Symposium, April 22
Download the paper at **bit.ly/CJAug22Nab2**

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EXPERTS IN HEATING

University swaps gas boilers for propane heat pumps

Northumbria University project replaces two gas boilers

Northumbria University has replaced two gas boilers with propane (R290) air source heat pumps (ASHPs) in two buildings, as part of its decarbonisation programme.

The ASHPs have been installed at the Newcastle Business School, Northumbria Law School, and Northumbria School of Design, and will heat lecture theatres, offices and cafes.

In a project managed by Equans, two 150kW and three 200kW R290 ASHPs were designed, made and installed by UK-based Clade Engineering Systems. The installation was officially switched on by the university in May.

R290 is a natural refrigerant with a very low global warming potential of three. Although flammable, propane is cheap, available and performs very well, with high coefficients of performance at 60°C flow temperature. Operating at this temperature, a seasonal coefficient of performance of more than 3.0 is expected.

The hazards of using a flammable refrigerant must be considered as part of the design risk assessment, and measures taken to reduce risk. The heat pump units installed at the university all have automatic leak detection, and the housing is ventilated. Service personnel accessing or working on the heat pumps must have the appropriate competencies.

The heat pumps are on the existing rooftop plant areas. The free air space for harvesting heat, and proximity to the plantrooms, make for an efficient system. Rooftop placement also contributes to noise and safety management.

Clade had to upgrade electrical cables from the incoming supply to provide power to the heat pumps, a common, yet important, procedure in large heat pump installations. Mechanically, the heating systems needed new pumps, control valves, and control strategies. The old boilers were retained to supply extra heating in the extreme cold conditions sometimes experienced in Newcastle.

Clade's aftercare team will regularly clean the evaporators to maintain efficiency. Data, gathered remotely, will also be used to improve performance.

Government reveals £2m funding for 11 trial projects

As part of its Heat Pump Ready Programme, the government has announced funding for 11 projects across England and Wales.

The programme aims to install 600,000 heat pumps annually by 2028, as part of the Department for Business, Energy and Industrial Strategy's £1bn Net Zero Innovation Portfolio.

Stream 1 investigates solutions and the trial of methods for heat pump deployment, and Phase 1 of the programme will provide funding of more than £2m.

The full list of projects are: Heat Pump Ready Newcastle; Utilita Energy Heat Pump Ready Programme, Sunderland; Renewable Heat Infrastructure Network Operating System (RHINOS), Leeds; Clean Heat Streets, Oxford; Greenwich Thermal Infrastructure Motivating Electrification (Greenwich TIME); Bristol Heat Pump Ready; Project Gaia, Teignbridge; PACE Financing for Heat Pumps in Rural Cambridgeshire; SAPPHIRE Solo, Blairgowrie; Prosumer Model for Heat Pump Deployment in Cherwell; and Heat Pump Ready – Bridgend.

Ground source specialist Kensa Group is working with local authorities and energy companies on the projects in Leeds, Greenwich, Teignbridge and Bridgend. Its sustainability director, Ieman Barmaki, said: 'We are trying to break down the perceived barriers to the widescale electrification of heat, and showcase to policymakers and the public that networked heat pumps can achieve mass decarbonisation goals at scale, for the lowest economic and societal cost.'

Renewable heating retrofit breaks ground in Essex

Storage heaters in Essex tower blocks to be replaced with ground source heat pumps

Government investment in a renewable heating retrofit project in Thurrock, Essex, is set to reduce fuel bills by more than 50%.

In the wake of a recent report, by the Climate Change Committee, that criticised the government's poor delivery on targets for net zero, the scheme aims to demonstrate the potential of ground source heat pumps (GSHPs) to rapidly and affordably decarbonise multiple properties at scale.

Across three tower blocks in Chadwell St Mary, Thurrock, 273 storage heaters will be replaced with Kensa GSHPs, which will deliver three times more energy efficiency for the residents.

Kensa Utilities is an infrastructure asset company that funds, owns and maintains shared ground loops that serve heat pump installations. It uses subsidy support to provide these assets at zero cost to the housebuilder or social landlord.

Thurrock Council secured £3.2m from Wave 1 of the government's Social Housing Decarbonisation Fund (SHDF) to help finance the scheme. The SHDF is a £3.8bn 2019 manifesto commitment to support local authorities and social landlords to retrofit their housing stock at scale, over a 10-year period.

More than half of the recipients in Chadwell have been identified as at risk of experiencing fuel poverty. Kensa claims the project will secure 40-50% savings on annual energy bills, with average running costs of a two-bed home calculated at £477 per year.

The new heat pumps will replace 273 storage heaters

More than 34% of all emissions in the UK are attributed to the provision of heat. The installation of the heat pump systems at Chadwell St Mary is expected to provide more than a 70% reduction in carbon emissions.

Total emissions savings are projected to be 7,080 tons of CO_2 over the life of the installation, significantly improving local air quality and reducing the carbon footprint of the residences.

The government has set a target for 600,000 heat pumps to be installed per year by 2028. More than 80% of UK homes will still be in use in 2050, so existing buildings will have to undergo significant improvements or deep retrofitting to meet the challenge of decarbonisation. To support this, the Department for Business, Energy and Industrial Strategy has confirmed that GSHP systems similar to those at Chadwell St Mary are eligible for funding.

Wave 2 of the SHDF is expected to be open for applications in late August/early September this year. Improvement solutions will be given to registered social housing properties with an Energy Performance Certificate (EPC) rating of D or lower and will lift the EPC rating to at least a C.

Taylor Wimpey trials smart heat network

The Chilton Woods housing scheme in Sudbury, Suffolk, will have 950 homes connected to a heat network and thermal store

One of the UK's largest housebuilders, Taylor Wimpey, is partnering with GTC in a pilot project to deliver heat via a community heat hub, to a development site in Chilton Woods, Sudbury.

GTC has designed a heat network solution for new-build, low-rise developments. Hot water is produced centrally in a community hub, using large-scale heat pumps powered by Grid electricity.

Currently in the planning stage, the development consists of 1,150 new homes, of which 950 will be connected to the heat network. The first phase of 200 units is currently planned to be heated by natural gas.

Hot water will be fed to individual homes through a highly insulated plastic-pipe heat network. Flow temperature will be at 60°C, with a return temperature of 25-30°C. Central, large-scale air source heat pumps (ASHPs) are used as the primary source of heat, supplying more than 95% throughout the year.

The thermal water-storage tank in the hub is charged when wholesale electricity costs are lower. This reduces peak demand on the Grid, lessening the need for reinforcement. Back-up electric boilers ensure a resilient supply of hot water. Plant operation is optimised to suit hot-water requirements by deployment of smart control systems developed by Passiv UK. Offering demand-balancing services to the upstream distribution network operator, in return for capacity payments, further enhances this.

The network will operate with heat losses of less than 20%. Independent assessment of the design solution and operating parameters have been undertaken to ensure that the network performs in line with expectations.

GTC claims its network solution will generally be a lower cost to the homeowner than the alternative of running an individual ASHP in the home. By the time these homes are connected to the heat network, the price and the service levels customers receive will be protected through regulation by Ofgem.

Alternative heat sources have been considered; hydrogen could be deployed if this becomes viable. The plant is sized to feed the consented development; however, the modular nature of the heat hub means it can be scaled to accommodate additional homes if required later.

Thermal energy storage will connect with 950 homes at Chilton Woods, Sudbury

Making the transition to electric heat networks

As the electrification of heat networks gathers pace, FairHeat's Tom Burton compares the cost of having a 100% heat pump-led network with that of a hybrid system, which uses top-up electric or gas boilers to cover peak loads

The UK faces a major task to decarbonise the heat demand of its buildings to have any hope of meeting its ambitious, but necessary, carbon-reduction targets. This presents a big technical challenge for the building services and energy sectors to solve: how to transition to more sustainable and lower carbon heating solutions quickly?

Setting legislation and regulatory targets for carbon emissions is one thing, but designing and installing technologies to meet these targets – while delivering reliable and affordable heat to building owners and tenants – is another. The regulatory trajectory is clear: heat must be electrified, but to what degree, and how?

It is estimated that around 18% of UK heat will have to come from heat networks by 2050 if the UK is to meet its carbon targets cost-effectively[1]. This requires around 500,000 new customers on heat networks a year. For these heat networks, gas CHP has been the dominant low carbon generating asset for the past decade. Electrification means the introduction of heat pumps to largely replace and displace CHP, and this presents several challenges:

1. Heat pump technology is more expensive per kilowatt than gas boilers and CHP. Most of the time, demands from the heat network occur at levels significantly lower than the peak design load, so sizing heat pumps to cope with these conditions results in high capital expenditure on plant that operates rarely and for short durations.
2. For the residential sector, heat pumps have not been deployed at the scale required by UK policy ambitions, so, in many applications, they should be considered novel.
3. The cost of heat generated for heat pump systems has the potential to be significantly higher than gas because of its reliance on the electricity Grid. There is a certain inevitable cost to decarbonising heat, but there are also design decisions that can impact on how expensive heat becomes, with many decisions becoming a trade-off against other metrics such as carbon intensity.

"The use of peaking plant to cover the intermittent peak loads can offer major reductions to capital and running costs"

This article investigates how potential heat pump-led energy strategies for heat networks can address these challenges. More specifically, it looks at how to determine the optimal electrification of heat to deliver, or exceed, the required carbon savings, while mitigating the impact of increased costs.

The use of peaking plant, such as gas or electric boilers, to cover the intermittent peak loads on a heat network can offer major reductions to capital and running costs, with marginal impacts to carbon reductions and air quality.

Six energy strategies were compared for a typical 500-dwelling residential heat network scheme: air source heat pump (ASHP) and gas boiler top-up; ground source heat pump (GSHP) and gas boiler top-up; ASHP and electric boiler top-up; GSHP and electric boiler top-up; ASHP only; and GSHP only. All hybrid systems were investigated with heat pump heat fractions ranging from 50-95%. An hourly demand model based on operational data from hundreds of existing heat networks was used to optimise heat pump and thermal store sizes, to achieve variable target heat fractions.

The hourly load profile has the following inputs: annual domestic hot water (DHW) and space heating loads; DHW hourly profile; space heating hourly profile; and network heat loss. The annual DHW and space heating loads, together with the heat-use profiles, have been used to calculate the required demand for every hour throughout the year (see Figure 1).

Many planning authorities, such as the Greater London Authority (GLA), now require carbon-offset payments, which means the cheapest solution is not always the one with the lowest heat pump size. For ASHP-led networks, the increase in capex because of an increase in heat fraction is compensated for by a reduction in carbon-offset payments beyond a 95% heat fraction for a gas hybrid system, and is cost neutral up to this heat fraction for an electric hybrid system. For GSHP-led networks, the increase is compensated for by a reduction in carbon-offset payments up to around 80% heat fraction with gas boilers and around 60% heat fraction with electric boilers.

This shows that the current GLA carbon pricing, at £95/tonne over 30 years, is effective at incentivising onsite »

» carbon reductions through greater heat pump generation contributions. However, this economic incentive is not apparent for 100% heat pump systems, as the total capex and levelised cost of electricity (LCOE)[1] are significantly higher for these compared with hybrid systems.

When reviewed in combination with the additional reductions to carbon intensity of heat, the relative costs to decarbonise increase by an order of magnitude to decarbonise the final 5% of heat once you have reached 95% fraction from the heat pump. This is of major significance to the industry and one of the most important findings of the assessment. As such, because of the large increase in required heat pump capacity to cover peak load in the 100% heat fraction scenario, some form of boiler top-up will probably remain the preferred option, even without the choice of using gas.

From a life-cycle perspective, the optimal heat fraction is around 80% for gas boiler hybrid systems. However, the LCOE for all gas hybrid systems is comparable (<8% from the minimum), so there is a minimal life-cycle impact to maximising the heat fraction while retaining the hybrid strategy to maximise carbon reduction.

The life-cycle cost of electric boiler systems decreases up to around a 95% heat fraction. Electric boiler hybrid systems are better suited for higher heat fractions because of the increased cost of electric boiler heat generation.

Within these optimal fractions, GSHP is a higher overall cost option than ASHP, with a 60-90% greater capex and 8-13% greater 30-year LCOE. The difference between the options decreases as the scheme size increases because of the non-linear nature of GSHP costs. However, initial analysis of a 1,000-dwelling scheme shows that ASHP is still favourable.

GSHP is likely to compare poorly, economically, to ASHP in many scenarios with the withdrawal of the Non-Domestic Renewable Heat Incentive tariffs available to recover their high initial capital cost. They can continue to offer attractive systems though, particularly when a significant cooling demand can be coupled to the ground loop to boost overall seasonal coefficients of performance and, therefore, reduce the cost and carbon intensity of heat beyond the figures presented in this report.

The two major unknowns in the industry that impact capex (and, therefore, the overall costs) are the cost of increased Grid-connection size and of rooftop space. Grid upgrade costs are currently covered, predominantly, by developers and are highly variable between sites based on local infrastructure. This already impacts overall costs with gas hybrid systems, and the impact of this will increase as gas boilers are replaced with electric boilers.

However, the approach to Grid upgrade costs is changing. Decarbonisation of heat and transport require significant upgrades to the electricity distribution network, and there is an understanding in the industry that upfront contributions to Grid reinforcement will probably impact the rate at which this happens. It is likely, therefore, that these charges will be removed, and reinforcement costs recouped via customer electricity bills, removing a key barrier to electric heat generation[2].

Defining costs associated with rooftop space is challenging, as this has wide-reaching impacts on planning conditions, biodiversity commitments, and provision of communal areas. It is, therefore, currently undertaken mainly on a qualitative basis depending on the development size and planning/end-customer requirements.

This research has two clear recommendations for the industry. From a policy and regulatory perspective, local authorities should adopt carbon-offset fees into planning conditions, and set ambitious prices to incentivise low carbon heat generation and accelerate decarbonisation.

On a scheme-specific level, hybrid energy strategies are the correct solution for transitioning to heat pumps while protecting residents and minimising operational risks.

Read the full research paper, presented at the 2022 CIBSE Technical Symposium, at: **bit.ly/CJAug22TB**.

TOM BURTON
is a consulting engineer at FairHeat

Footnote:

1 The LCOE for each energy strategy has been calculated using:

$$\text{LCOE} = \frac{\text{Capex + discounted sum of fuel, O\&M, sinking fund and air quality costs}}{\text{discounted sum of energy produced}}$$

This formula is typically used to compare different methods of electricity generation, but is also applicable to heat generation in heat networks. The aim of this calculation is to determine the average revenue per unit of energy required to recover all heat generation capital and operating costs.

References:

1 Committee on Climate Change, *Next steps for UK heat policy*, 2016
2 Ofgem, Access and forward-looking charges significant code review: consultation on minded to positions, 2021

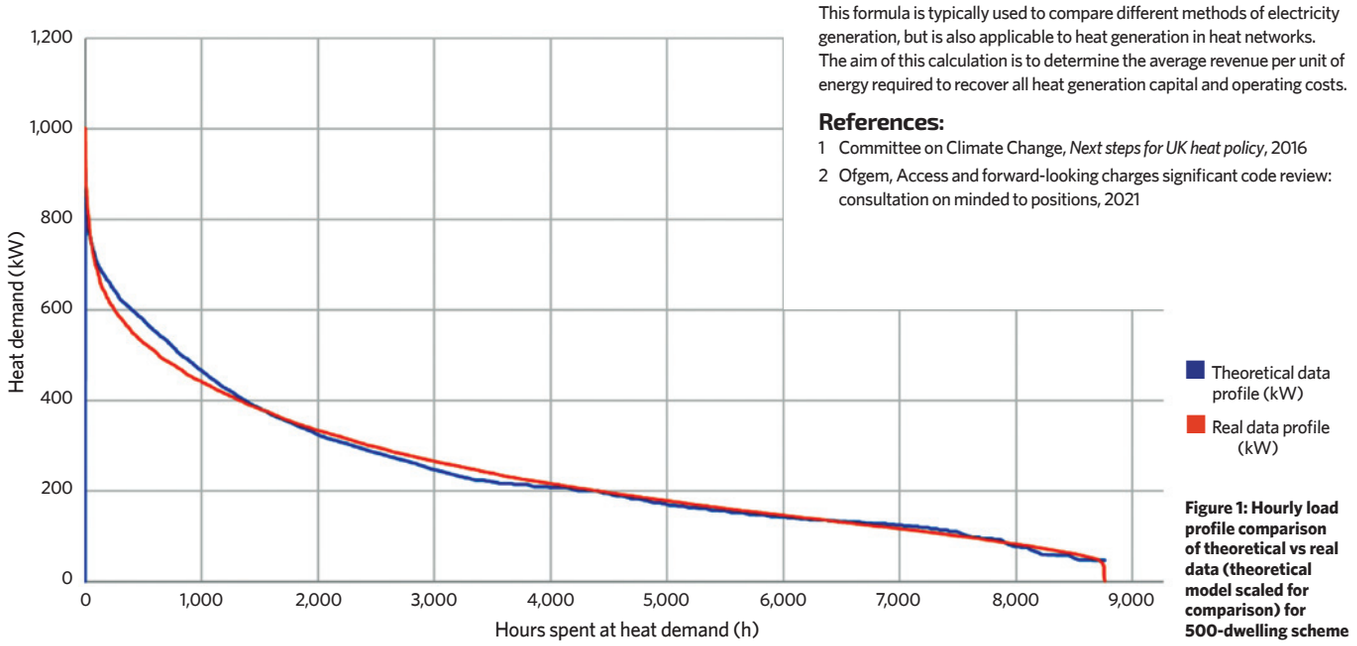

Figure 1: Hourly load profile comparison of theoretical vs real data (theoretical model scaled for comparison) for 500-dwelling scheme

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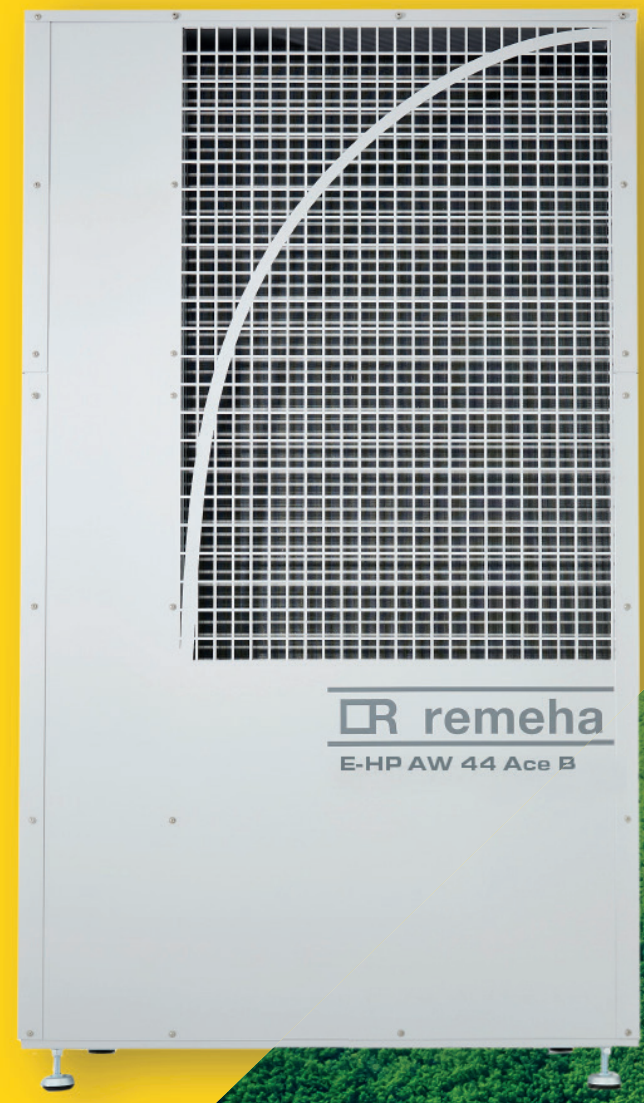

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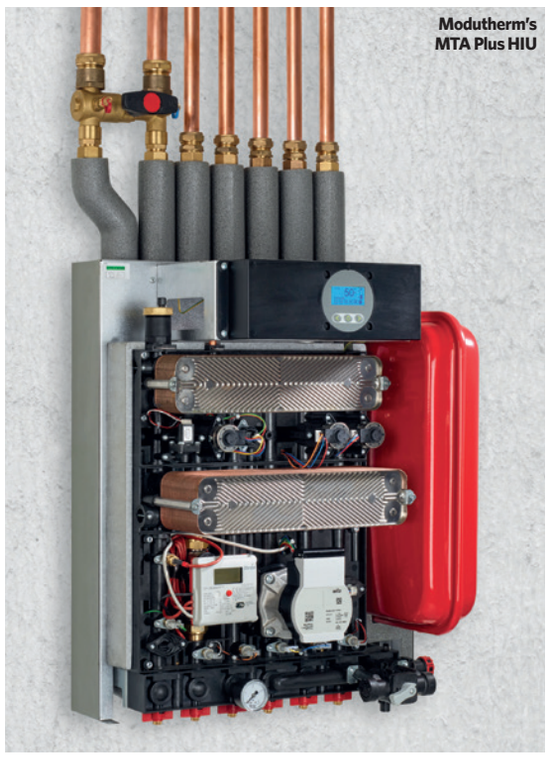
TOUGH NEW STANDARDS PUT HIUs TO THE TEST

Heat interface units that do not meet minimum performance standards will be deemed to have failed under a major revision of the BESA HIU Test Standard. BESA technical committee chair **Gareth Jones** highlights the key changes


Modutherm's MTA Plus HIU

The BESA HIU Test Standard is going through a major revision. As part of this, every parameter (and underlying assumptions) within the test standard (there are more than 100) has been reviewed and either justified or changed. Most require the production of a supporting technical note.

The changes include the introduction of minimum performance standards, which means those HIUs that do not meet these requirements will be deemed to have failed.

First published in 2018, the standard was developed to assess UK heat network operating parameters.

This revision has been carried out by the Technical Committee for the BESA HIU Test Standard, which has been meeting monthly for more than two years. It has generated a vast body of evidence as a supporting reference to the decisions made.

Some of this work has already had a wider impact in the market. For instance, the technical note produced by the committee was the genesis for the CIBSE Guidance Note *Domestic hot-water temperatures from instantaneous heat interface units* (**bit.ly/CJAUG22DHW**).

The test was referenced extensively in the *CP1 Heat networks: Code of Practice for the UK (2020)*. Additionally, the HIU heat loss data from the test is to be entered into the Product Characteristic Database (PCDB), which is used in the SAP 10.2 calculation methodology.

All this work was published as part of a market consultation exercise that was completed at the end of June. Off the back of this, all parameters for the test regime have now been finalised.

A last exercise is being carried out to review what changes are needed to the design of the test rig, given the new parameters of the standard. Once complete, the current three test houses will make changes to the rigs, before beginning a series of round-robin testing to ensure consistency across them all. Testing to the new standard is set to begin at the end of 2022.

There are two key changes to approach that represent a step change for the regime. These are:

1. A change to a 'modular' approach, which, together with various new tests, will allow an expansion of the regime to include different HIU types. These include non-keepwarm HIUs, to be used on heat networks with multiple risers, along with HIUs that have direct space heating.

A non-keepwarm HIU does not include the integral keep warm function where the integral keep warm function allows a trickle flow across the HIU plate. Instead, a thermostatic bypass valve is fitted to the top of each riser. This approach is suitable for a multi-riser approach with minimal lateral runs.

2. Introduction of minimum performance requirements, with a pass or fail. Until now, the test standard has only shown comparative HIU performance. However, HIUs will now be required to pass to have results published.

There have also been some changes to test approach:

- Differential pressure (dP) is being varied, including on a dynamic basis within domestic hot water (DHW) tests. This is to better reflect real-world conditions.
- A test has been introduced to assess maximum DHW load.

Finally, there have been some key changes to test parameters, to mirror the direction of the industry. These include:

- A reduction of primary flow temperatures to 55°C for the 'low temperature' regime, to acknowledge a shift to heat pump-based heat networks
- A reduction in DHW delivery temperature to 50°C, in line with both CP1 (2020) and the CIBSE Guidance Note *Domestic hot-water temperatures from instantaneous heat interface units*
- A reduction in space-heating temperatures to 55°C for the 'high temperature' regime, in line with the change in Building Regulations
- More stringent requirements on DHW temperature fluctuations, particularly in respect of maximum temperatures, to reduce the risk of scalding. CJ

GARETH JONES is chair of the BESA HIU Standard steering group and technical committee, and managing director at FairHeat

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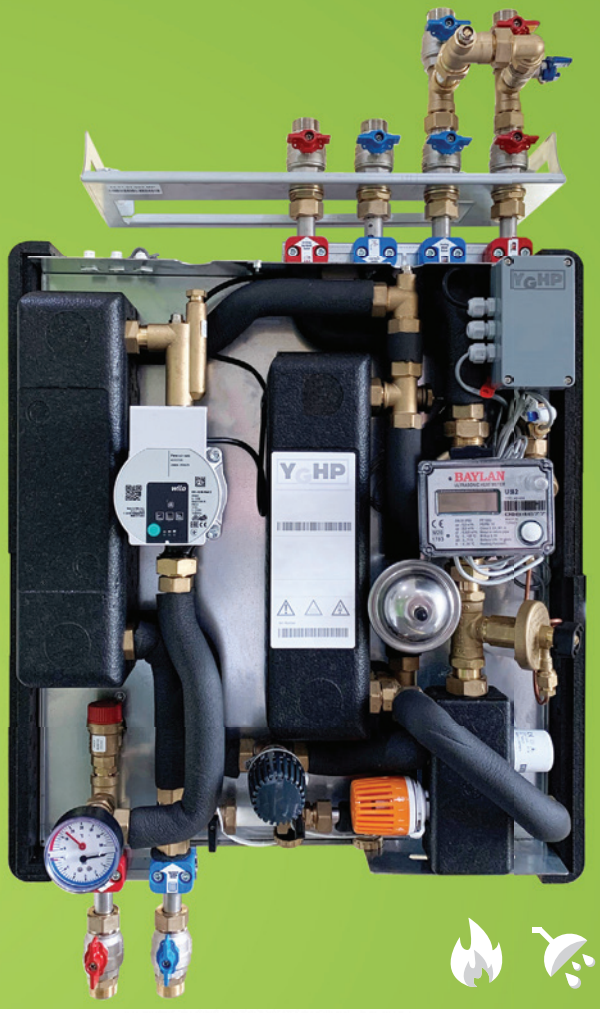

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KEEN BEANS

To meet the country's climate change targets, Danish towns are set to use industrial heat waste to power networks and deliver heat to residents and businesses. **Andy Pearson** describes one such project in Hornsyld

Denmark has a target to reduce greenhouse gas emissions by 70% by 2030 and a goal of climate neutrality by 2050. Fundamental to achieving this is the transition of the Danish heating sector to near-zero CO_2 emissions by 2030.

To assess how the heat sector can transform in a technically, economically and environmentally appropriate way in such a short period of time, researchers at the University of Aalborg (AAU) developed the *Heat Plan Denmark 2021*. This document sets out how the heating sector can transform relatively quickly using technologies that are already available. See panel, 'Heat Plan Denmark: key messages'.

The Hornsyld Project is a good example of how Hornsyld-Bråskov local council is planning to apply the *Heat Plan Denmark 2021* by using heat from industrial processes – specifically from drying beans used for animal feeds –to transform the heat supply for Hornsyld's 1,600 inhabitants, as well as schools, sports facilities and businesses.

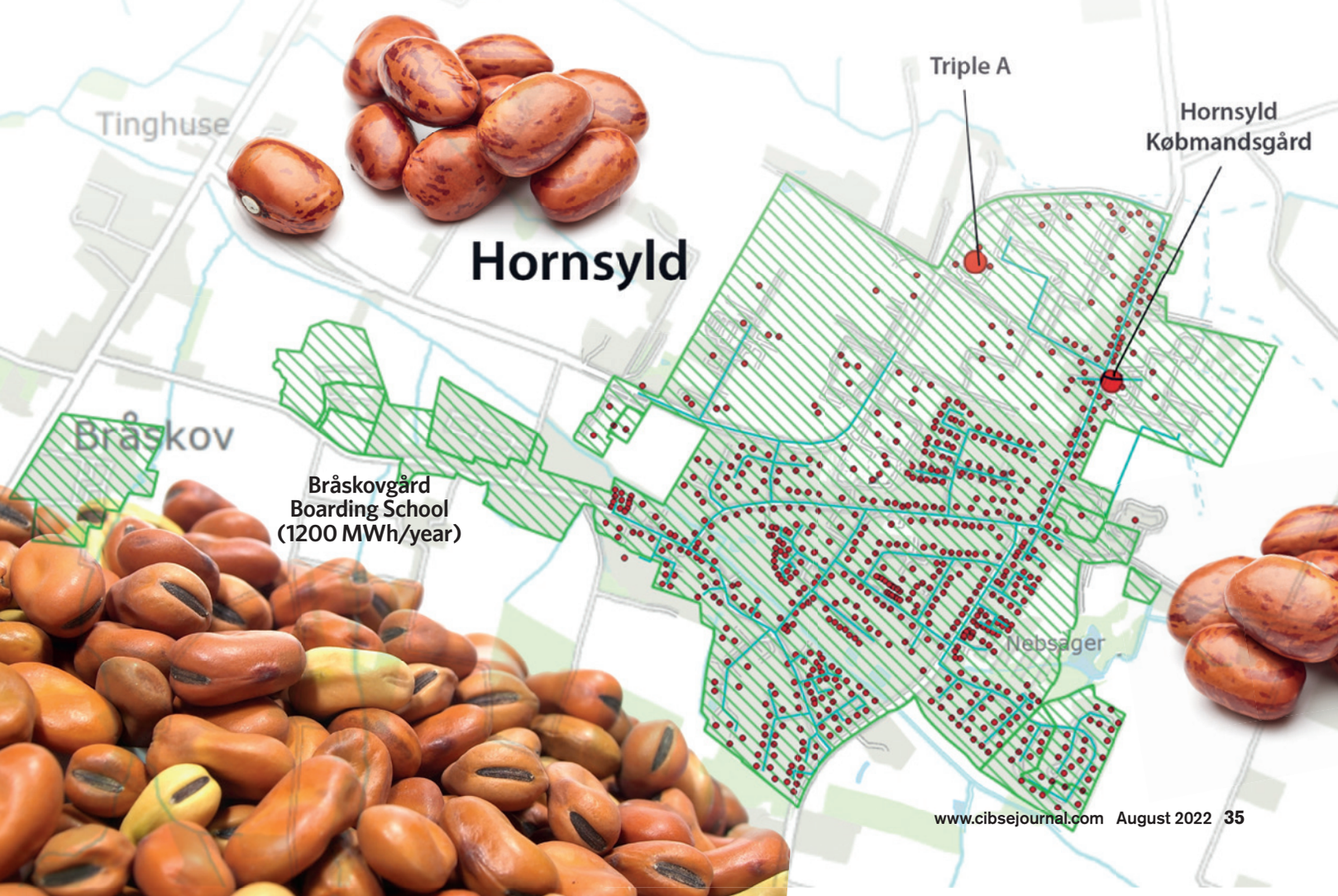
Hornsyld is a compact town with a relatively high density of heat-consuming buildings, with a peak heat load of 5.3MW. Currently, the majority of its dwellings and businesses are heated by individual natural gas boilers.

The local council is proposing to install a new district heating system to use the large amount of heat being lost to the atmosphere by Hornsyld's industries. The two main industries in the town are Triple A, an animal feed producer, and Hornsyld Købmandsgård, a grocer and agro-business that grows horse beans (a member of the broad bean family) for use in animal feed. The waste heat for the scheme will come from a feed dryer at Triple A.

The drying process uses air heated directly by the combustion of natural gas. This air is drawn through the feed, which evaporates approximately 6,000 litres of water an hour. Currently, the hot and humid exhaust air is discharged to the atmosphere at a temperature of approximately 60°C.

Under the council's proposal, a scrubber will be used to wash the exhaust air with cold water to condense the vapour from the air stream. A heat pump will extract heat from the warmed condensate and then raise its temperature to the outlet temperature for the district heating supply.

The process is expected to produce between 4MW and 5MW of heat. However, only 3MW will be used for this project, consisting of 2MW supplied by the heat pump and an additional 1MW from direct exchange. The feed dryer is expected to run for a minimum of 7,500 »




Waste grain products will provide fuel for a 1.8MW biomass boiler

» hours per year. Heat production is calculated to give a system coefficient of performance (COP) of 6.75.

Two boilers at Hornsyld Købmandsgård will be used to supplement the reclaimed heat from Triple A. One is a 1.8MW unit fuelled by biomass – which is primarily waste material from grain products – and the heat is mainly used for process heating for Triple A. When production is under way at Triple A, only 0.9MW of capacity will be available from the biomass boiler.

The boiler is also used to produce heat for Hornsyld School, Hornsyld Købmandsgård, and a few other nearby buildings, all of which are expected to be included in the district heating system, so this element of boiler capacity will be available to the network (see map on page 37).

The other Hornsyld Købmandsgård boiler is a 4MW oil-fired boiler. This will be converted to run on natural gas, and will serve as a back-up to the biomass boiler. It is assumed that 3.5MW of capacity will be available for the district heating supply. The operational and maintenance costs of both boilers will be covered under the scheme.

To provide a buffer between the heat demand, production at Triple A, and the operation of the boilers, the system will incorporate a 1,000m³ thermal store. The addition of a storage tank will allow greater use of the available waste heat and the biomass boiler.

There is currently no heat network in Hornsyld, so a new plantroom will be constructed. Heat will be distributed via a pre-insulated, twin-pipe system.

Planenergi, the consulting engineers responsible for the project, are continuously updating the project as certainty increases around customers numbers, and energy costs rise. SAV Systems are PlanEnergi's design partner in the UK.

Anchor loads

Of the 471 buildings supplied by natural gas in Hornsyld, there are 29 large heat consumers, with an annual heat demand of more than 100MWh. Together, they could amount to a heat demand of more than 9,000MWh annually, which will provide sufficient anchor loads for the heat network. The council hopes that a high connection rate can be achieved by signing up these large consumers so that the project is less dependent on getting a high take-up from large numbers of domestic customers.

The heat network is designed to supply 100% of Hornsyld's heat demand. However, the project has assumed a total connection rate corresponding to 60% of the heating demand, and it is expected to be converted at the rate indicated in Figure 1. A total annual heat loss of 15.2% has also been calculated for the network, corresponding to 2,942MWh/year. This gives a total heat requirement of 19,395MWh/year.

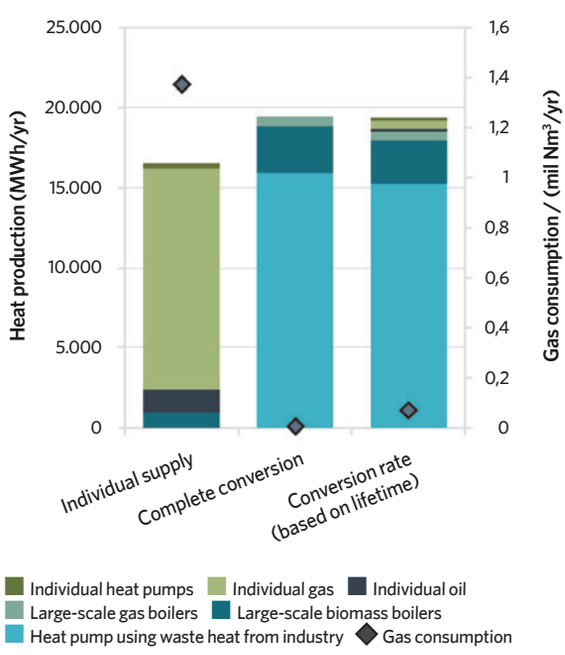


Figure 1: Spread of heat production in Hornsyld

Cost savings

The project is expected to provide an annual cost saving of 6,300 Danish kroner (DKK – about £700) for a typical dwelling currently heated by natural gas, and DKK 5,400 (about £600) for one heated by an air-to-water heat pump. The savings are well above the minimum set by the Danish Project Evaluation Act, which requires a cost saving of £170 per household for a project to be approved.

An estimated socio-economic surplus of £4.1m has been identified for the project over 20 years, largely because of the reduction in natural gas consumption, which more than offsets the investment cost. **CJ**

HEAT PLAN DENMARK 2021: KEY MESSAGES

The heating sector can be transformed quickly using available technologies – the four key messages are:

1. **Energy savings of between 36-40% are required in the current building stock to cost-effectively minimise the demand for heat.**
2. **District heating should be expanded to supply up to 70% of building heat demand, to enable individual building's gas- and oil-fired boilers to be taken out of commission.**
3. **Existing third-generation heat networks should be transitioned to lower-temperature, fourth-generation networks, to enable low-grade waste and geothermal heat to be used efficiently.**
4. **Waste heat and geothermal heat should be exploited to provide up to half of the heat demand from district heating systems in the energy system of the future.**

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Notting Hill Genesis' Goat Wharf housing development in Brentford. See page 40

The government's Heat Network Optimisation Opportunities programme has identified common causes of poor performance in housing associations and come up with cost-effective solutions that will slash residents' bills and carbon footprints

TUNING HEAT NETWORKS FOR HIGH PERFORMANCE

Many existing heat networks in the UK have performance issues that contribute to high operating costs for housing associations and high tariffs for residents. Most of these networks have gas boilers and will need to be retrofitted to meet carbon neutral targets.

In 2020, the Heat Network Optimisation Opportunities (HNOO) programme was set up to analyse existing sub-optimal heat networks. The aim of the programme, funded by the Department for Business, Energy and Industrial Strategy, was to put forward business cases to heat network operators for performance improvements – cost-effective interventions that would decarbonise the network.

FairHeat carried out analysis and produced business cases for 10 heat networks, seven of which were operated by social housing providers. These ranged from 100 to 350 dwellings, and were built between 1980 and 2015.

An example of a heat network improvement was carried out at Goat Wharf, Notting Hill Genesis housing development, in Brentford. High network operating temperatures and poorly performing heat interface units (HIUs) were resulting in overheating, high heat costs and an unreliable system (see panel on page 40).

The analysis carried out as part of the HNOO programme provides a good overview of commonly occurring performance issues across heat networks operated by housing associations.

High-frequency data was accessed at block level and from the energy centre and dwelling heat meters. Using a commercial online analytics platform employing machine learning algorithms, this data was used to identify the root causes of sub-optimal performance, and interventions were proposed for each of the heat networks, to address the performance issues.

A model was then built of each of the seven heat networks and used to 'test' the financial and technical viability of each of the proposed interventions. The viable measures were then collated into proposed work packages and financial analysis was done to determine whether there was a business case for carrying out the improvement works. (See panel, 'Affordable interventions'.)

All seven heat networks had viable business cases for performance improvement works. The simple payback for the optimal work package was between 21 weeks and seven years, with six of the seven schemes having a simple payback of less than five years.

Average performance improvements of 40-50% reduction in heat losses represent an annual average heat cost saving of between £75 and £160 per dwelling. One notable finding was that a carbon reduction of more than 30% was possible though optimisation alone, without major equipment replacement. In addition, the majority of heat networks investigated could be made 'heat pump' ready (that is, a reduction in primary temperatures below 65°C) without additional investment, significantly reducing the costs to decarbonise existing networks. CJ

AFFORDABLE INTERVENTIONS

The most common intervention works that were financially and technically viable included:

- **Recommissioning HIUs and heating systems within dwellings**
- **Closing network bypasses**
- **Reinsulating sections of the pipework within the dwelling and network**
- **Improving plantroom controls, including the pumps**
- **Hydraulic rearrangements**
- **Water-quality works**

AIMING TO BE A HEAT NETWORK GOAT

Improvements made to a heat network at Goat Wharf in Brentford have eliminated overheating and lowered heating costs

Goat Wharf is an 86-dwelling Notting Hill Genesis housing development located in Brentford, with a mix of private and affordable rent. The heating and hot water are provided to residents via a communal heat network.

The performance optimisation project included site audits, onsite testing and inspections, and analysis of performance data.

Once the analysis was complete and the root causes for poor performance were identified, a fully costed business case was developed for the improvement works.

A programme of works was rolled out, which included replacing the poorly performing HIUs with a new HIU unit in every dwelling, reducing the operating temperatures across the network through recommissioning and installing a new metering system linked to an online analytics platform employing machine learning algorithms.

Within the plantroom, the main circulation pumps were replaced with smaller, more efficient units, and a water filtration system was installed to address water-quality issues on the main system.

As this was a retrofit project in an occupied development, resident engagement was critical. So, the project began with an onsite 'kick-off' meeting, attended by all stakeholders.

> "The project achieved a reduction in the heating network flow temperature, from 80°C to 65°C, resulting in much lower heat losses and lower heat costs"

Here, detailed surveys were undertaken to establish the best approach to installation that would cause minimal disruption to residents – including those residents with limited mobility.

Meeting on site meant that the contractor, Sycous, could identify several problems, including the original use of incorrect materials. This allowed a resolution to be agreed before wider installations and without disruptions to the programme.

A commercial hub utility management device was installed in each dwelling. The fine-grained network performance data captured by each hub was then analysed using a commercial online Pinpoint performance monitoring platform, as part of the post-installation monitoring process. This allowed the progress of the installation project to be checked and the impact of the works quantified.

The project achieved a reduction in the heating network flow temperature, from 80°C to 65°C, resulting in much lower heat losses, lower heat costs, and no further complaints of overheating from residents.

In addition, the pump replacement works have resulted in a £2,000 per year saving, which is a cost reduction of 90% compared with the previous installation.

Cat Avenell-Pankhurst, of Notting Hill Genesis, said: 'We're happy with the result of the project at Goat Wharf. The improvement to the network has meant the system is now much more reliable and we'll be able to offer more affordable tariffs to our residents.'

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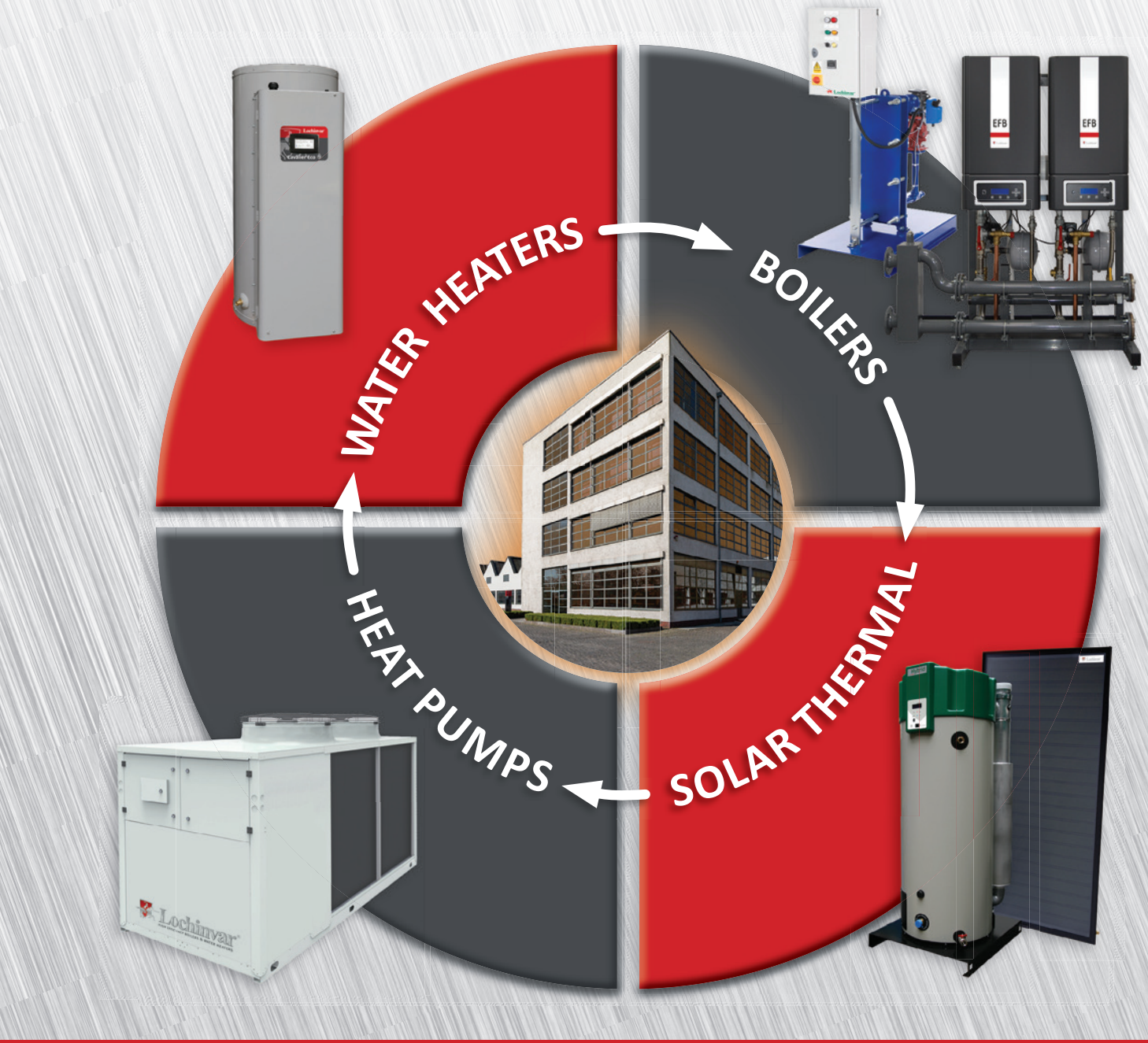

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The retrofit of the Electricity Supply Board's offices in Dublin was a test bed for innovative heating and ventilation systems. BDP's **Chris Croly** describes the building's transition from gas to electric

ELECTRIC AVENUE

The Electricity Supply Board (ESB) is majority owned by the Irish government, providing generation and distribution of electricity in Ireland and internationally. It has a target of being carbon neutral by 2040, and is investing heavily in renewable generation and associated technology, such as energy storage.

The redevelopment of its Dublin headquarters was an opportunity to contribute to the advancement of sustainable office development. To reflect this, a passive design approach has been taken, working with the local climate to minimise heating and cooling loads. Unsurprisingly, the ESB has moved away from gas to embrace heat pumps with heat recovery, while ventilation is a combination of natural and hybrid solutions.

The project contains two office buildings within one city block. The first is ESB's headquarters, which will also serve as a research tool; it is hoped that it will provide a source of intelligence on new techniques and technologies that will influence the next generation of offices. The second building includes many of the same techniques, but is optimised for the commercial market.

Almost all large commercial offices are sealed, air conditioned buildings with traditional services, so it was important to create a sustainable alternative that could stand as a precedent. Dublin's commercial market approved of the approach, placing a value on the building that covers the full cost of the development of both offices.

The design follows first principles and focuses on minimising energy demand. The use of fully glazed facades was explicitly banned in the design competition brief because they can lead to excessive heat losses and heat gains which increase energy usage. Glazing areas were adjusted by location, with smaller areas on the more exposed upper floors. South- and west-facing glazing is provided with solar control, while solar gains are encouraged from the north and east. South-facing façades have vertical external shading, optimal for blocking solar gains in the afternoon.

A 1.5m soffit strip of 1.5m of exposed mass is used at the perimeter in the form, raising the glazing level and projecting daylight deeper into the plan. The thermal mass absorbs heat and releases it at night. This is particularly important at the perimeter because the glazing produces some radiant heating, and the cooling effect from the concrete soffit helps to provide balance. Deeper plan areas are mainly reserved for tea stations and have open, timber grid ceilings.

A 70% ground granulated blast-furnace slag (GGBS) content was used in the foundations, and 50% for the structure, resulting in a reduction of 160 kg CO_2/m^2 of gross floor area.

Hybrid ventilation

Modern offices have a net cooling requirement throughout the year. External temperatures in Ireland are almost always lower than required internal temperatures, so sealing offices and actively cooling them may not make the best use of free cooling. The insulation and low infiltration levels of sealed buildings is likely to have a negative effect on cooling.

The hybrid ventilation solution used at ESB combines the best of natural and mechanical ventilation, and active cooling. In combination, better air quality is produced, with lower energy usage, than by each individual solution.

"In cellular spaces, an innovative technique was used that links the inlets to the fan coils directly to the open-plan space, so that large volumes of air exchange occur"

The Electricity Supply Board's headquarters front onto Fitzwilliam Street in Dublin

To date, zero active cooling energy has been required in the open-plan office building

The concept of opening windows in an air conditioned building is commonly frowned upon because of concerns that cooled air will be lost. However, such losses can be avoided through the careful control of room setpoints.

The human response to temperature is complex and adaption occurs naturally in warm weather. After several days of warm weather, tolerance to higher temperatures increases, so maintaining lower internal temperatures can create an environment that is perceived as uncomfortably cold.

An office upper temperature setpoint has been determined using a new control routine, relating the internal temperature to the weighted running mean of the external temperature. Inspiration was drawn from the thermal adaptation discussion within CIBSE TM52. As the resulting internal temperature is almost never below external temperatures, staff are free to operate windows, which work in conjunction with automated high-level openings and windows.

Early monitoring results have demonstrated the effectiveness of the strategy. To date, there has been almost zero active cooling energy required in the open-plan offices, even in external temperatures above 20°C.

Mechanical ventilation

Office air has traditionally been supplied with a constant air volume system, which operates at full volume irrespective of the number of people in the building, often using excessive volumes to take account of meeting rooms and canteens. This simplified approach is taken because of the number of variable air volume (VAV) dampers that would otherwise be required to provide control of internal meeting rooms and other cellular spaces.

The approach at ESB was to use breakout spaces that allow open air exchange with the open-plan areas. In cellular spaces, an innovative technique was used that links the inlets to fan coils directly to the open-plan spaces, so that large volumes of air exchange occur, avoiding the need for individual fresh air supplies. This means VAV was only necessary at the main risers on each floor, reducing costs dramatically, and natural ventilation is drawn into internal spaces.

The same technique is used within patch rooms (held at 25°C), which not only provides free cooling, but also recovers heat naturally to the office spaces. The VAV system employs a variable pressure control strategy that reduces fan energy use significantly compared with constant pressure VAV solutions (see online version of this article for more on the strategy).

In many traditional systems office ventilation air is supplied at a constant temperature, leading to unnecessary heating and cooling and the loss of free cooling. Several innovative control strategies to supply air temperature are being tested in the offices. A self-learning strategy has been implemented that adjusts the level of free cooling provided in proportion to the net building loads (heating minus cooling loads).

A total thermal recovery wheel is also used to provide recovery of moisture during winter. Two air handling »

» units are run in parallel to minimise fan power at times of low ventilation need. Initial monitoring shows: 85% less fan energy than would be consumed in a typical office building; almost no active cooling required, even with external temperatures above 20°C; excellent air quality.

Heating and cooling

The offices are a zero local pollution building, with no fossil fuel connections, even for cooking. The operational carbon impact of the building will approach zero as the national grid decarbonises.

Initial monitoring shows that almost zero heating was required (monitored data indicates a figure less than 7 $kWh{\cdot}m^{-2}$) and that heat was almost entirely recovered from cooling loads such as computer rooms.

While multipurpose air source heat pumps (ASHPs) allow heat recovery, there are limitations and the coordination of loads by integrated controls results in unexpected losses. So, a dedicated water-to-water shunt heat pump has been included. Heat recovery is guaranteed, without the risk of the air source system cutting in unintentionally. Similarly, the hot water heat pump is connected directly to the chilled water circuit, ensuring 100% of the load is derived from recovered heat. The conventional arrangement of coupling the hot water heat pump to the hot side can cause the ASHP to kick in unnecessarily (see article on web for further explanation).

Timber grid ceilings are used in tea rooms and deeper plan areas (left), allowing concrete to be thermally visible

Cooling is provided using a priority cascade as follows: recovery of cooling from domestic hot water heat pumps; free cooling provided by a 4.8km closed-loop ground collector; cooling recovered from any heating demands in the building; a phase change store to transfer any remaining heat rejected from heat pumps that are providing cooling. The phase change material (PCM), which is under test in this building, changes state at 10°C. .In winter, the PCM stores cooling associated with morning pre-heat for use later in the day.

The fan coils use a single coil with a six-port changeover valve, reducing capital costs, fan energy and embodied energy. A glycol-free system lowers chemical use while improving the heat-transfer properties of the water used.

Monitoring and reporting

The ESB offices are fitted with an extensive metering package, and BDP is undertaking tuning and monitoring of the building as part of a research project. Full details of the methods used in the building, along with data and the resulting insights, will be published.

If monitoring shows big savings in energy and costs, others may be encouraged to go electric by switching from gas to sustainable alternatives. ESB's Dublin office stands as proof that heating and ventilation needs can be met while heading towards net zero. **CJ**

CHRIS CROLY is the building services engineering director at BDP

WINDOW ARRANGEMENT

The building is set around a series of planted courtyards, with all office areas having access to external spaces, natural light and ventilation. Setting courtyards back from the street allows for natural ventilation, with less traffic noise and improved air quality.

Lower-level manual openings are provided for staff, with motorised openings at high level, reducing draughts and maximising airflow. The automated windows adjust appropriately to weather, cracking open when cold, opening fully when warm, and providing night cooling, They can, however, be manually overridden by staff.

Cracking the windows open whenever there is a net cooling load allows for an airtight building in cold weather without compromising free cooling in warmer weather.

An often ignored constraint of opening windows is that, in warm weather, blinds are pulled over the openings to prevent glare, blocking the free flow of air. To prevent this, solid window sections were used, and openings are protected by external shading in the form of vertical fins that do not restrict airflow.

The ESB HQ is also one big research tool for sustainable offices

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CUTTING BILLS WITH ENERGY-POSITIVE HOMES

Energy-positive homes in Wales have the potential to not only reduce energy bills, but also to make money for social housing tenants. Hoare Lea's **Eimear Moloney** Sero's **John Lloyd** and Wales & West Housing's **Mark Davies** describe

With average energy bills expected to rise to more than £3,200 this October, the prospect of living in an energy-positive home has never been more attractive.

This has become a reality for residents of 14 new low-cost social homes at Stormy Downs, in Bridgend, who are experiencing zero, or even negative, annual bills.

The housing project was kick-started by the Welsh School of Architecture at Cardiff University, which had the goal to design and build an electric-powered home that put more energy back into the Grid than it took away. In 2017, a design team was instructed on using the School's Smart Operation for a Low Carbon Energy Region (Solcer) concept, which was employed for the Stormy Downs homes.

Rhiw Cefn Gwlad is one of 10 projects in Wales sharing £43m in the second phase of the Welsh Government's Innovative Housing Programme. The grant of £940,000 brought government investment in the scheme to £2.4m, with a further £1.4m from Wales & West Housing.

The target was to accelerate industry learning on the development of sustainable social housing for the future with the aim of building 1,000 affordable homes with innovative elements, and monitoring them once occupied to understand how they performed.

At Rhiw Cefn Gwlad, homes including one-bed apartments to two- or four-bedroom houses – were constructed, and first occupied in January 2021. The key technologies proposed for them included photovoltaics (PVs), air source heat pumps (ASHPs) and PV solar systems (see panel, 'Key technologies', and Figure 1).

While architecturally similar to many other housing developments, the design has additional technologies not normally seen in social housing. Each house type was designed to be energy and carbon positive over a year, putting more energy back into the Grid than it takes out.

KEY TECHNOLOGIES

- 3.7-7.4kW PV solar systems
- 13.5kW AC-coupled lithium-ion batteries to store electricity
- Pichler PKOM4 exhaust ASHPs for heating and hot water
- Heating delivered through a mechanical ventilation with heat recovery (MVHR) system
- Energy-efficient double-glazed windows and doors
- No gas heaters, radiators or cooling

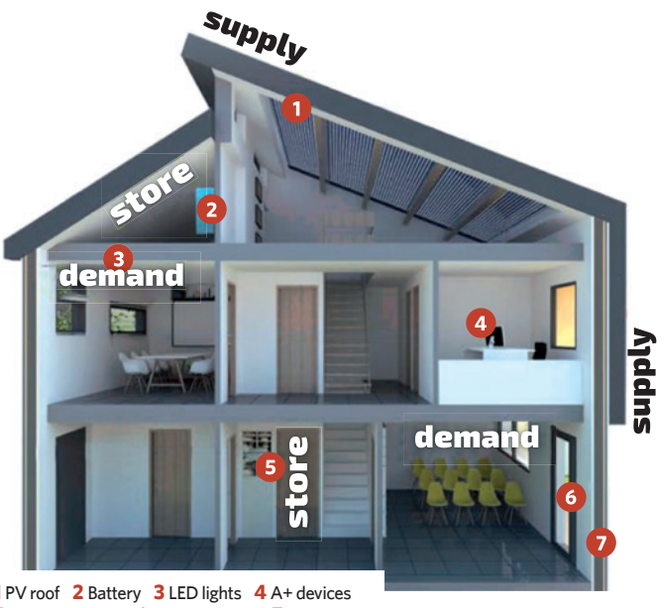
Energy predictions

In the design stage, a detailed 3D IES model was used to estimate the energy consumption and thermal performance of the homes. However, these models are not good at modelling the complex interactions between hot-water storage and varying system efficiencies, so a separate thermal-storage model was created to understand the hot-water heat pump profiles.

Finally, an electrical-storage model was developed, to consider battery storage performance and optimise the battery-control strategy for the houses.

Calculations were performed at half-hourly resolution over 12 months, and the models were combined to create a single model to optimise design, and create setpoint, control and energy strategies.

The homes at Rhiw Cefn Gwlad include photovoltaics, PV solar systems and heat pumps



1 PV roof 2 Battery 3 LED lights 4 A+ devices
5 Heating system 6 Double glazing 7 Sips panels

Figure 1: Integrated technology built into the homes

To ensure performance was measured, all the homes were designed with in-house monitoring meters and sensors to collect data on imported energy, renewable energy generated, electricity sub-metering, hot-water demand, internal air temperatures, and humidity levels. Figure 2 shows the combined model of estimated energy usage over a 12-month period.

Costs

The construction guidance cost of typical Building Regulations-compliant Welsh social housing is £1,800/m² and the average build cost of Rhiw Cefn Gwlad was £2,467/m² – a 35% increase.

The additional costs were attributed to an improvement in building fabric, and an exhaust ASHP, integrated solar panels, heat pumps, and battery storage. The scale cost difference is expected to decrease as new technologies become more common in the UK, but increases in construction costs are offset by energy cost savings to the residents.

While the Rhiw Cefn Gwlad development is at the bleeding-edge of net zero carbon social housing, it is anticipated that we will see a further reduction in development costs as more low carbon technologies become mainstream.

Performance

Once occupied, Hoare Lea monitored the in-use performance of the homes, and advised on any issues with the interaction of batteries, modern heating systems, and energy generation.

Performance reports were produced for all 14 homes at three-monthly intervals, to identify electricity demand, generation, import and export, thermal comfort, ASHP and battery performance, and tenant behaviour.

The first round of reports showed interesting results. Significant differences in heating setpoints across the 14 »

Construction costs

£1,800 Welsh Government guidance

£2,436 Bryn Bragl average cost

Construction costs typical Welsh social housing £/m² and Rhiw Cefn Gwlad

Import cost (including standing charge)	Export payment	Annual bill
£190	£249	£-59

Average annual energy bill for 2-bed homes with recommended tariff

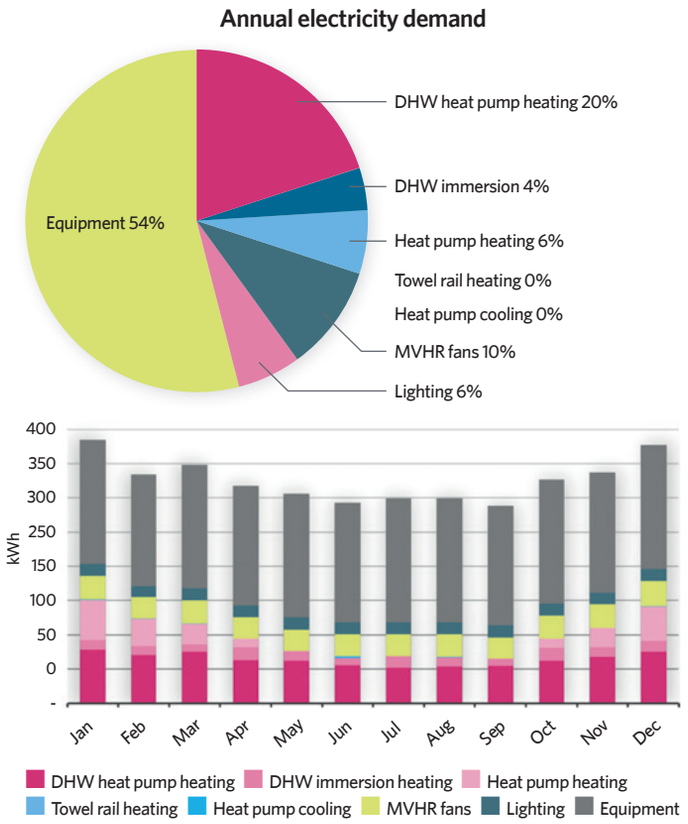


Figure 2: Combined model of estimated energy usage over a 12-month period

» homes were identified, ranging from 19°C to 24°C. Some tenants struggled with the heating controls, contributing electricity demands 60% higher than the design model.

Positive and negative initial lessons were learned; the houses had no problem reaching demand temperatures, rates of hot-water heating were fine, with the immersion heaters only kicking in occasionally for hygiene cycles and in homes with very high hot-water usage.

User control guides, and videos for operating the heating systems for residents who were less confident, were successful. Feedback from residents also indicated confidence in using the systems. The 13.5kWh storage batteries were proving effective at collecting excess solar energy and strategically deploying it to reduce grid demand at times when the grid has highest carbon intensity and cost.

Some of the initial challenges were 'top-up' duct heaters being used too frequently, to which controls optimisation was implemented at the start of March 2021. Compared with the design-stage models, space-heating demand was underestimated, but was balanced out by hot-water heating being overestimated.

Initially, 400W electric towel rails were a problem, causing high electrical usage because residents had difficulty understanding the controls. This was rectified by implementing a simpler two-hour timer, a more energy-efficient solution and one preferred by the residents, who finally understood how to control the towel rails.

One home had unexpectedly high electrical socket loads, which was due to medical equipment required by the resident which was not anticipated at design phase.

Benchmarking was performed on the properties after 12 months occupancy, to analyse the energy efficiency of the homes. The houses have been benchmarked against the National Energy Efficiency Data-Framework database, from the Department for Business, Energy and Industrial Strategy, which details the average energy consumption of UK homes, both new and existing.

To understand the underlying demand of the homes, PV generation has been removed from the comparison for the two-bed homes. To protect the identity of the homes, naming conventions used in this article do not correspond to addresses.

Figures 3 and 4, show all homes performing better than the benchmark for typical two-bed and semi-detached homes showing that even without the renewable energy generation, the homes are considerably more energy efficient than equivalents from the UK's existing housing stock.

Figure 5 (page 50) shows the average monthly energy imported from, and exported to, the Grid for the two-bed homes. This shows them using energy from the Grid during the six colder months, but net exporting for the warmer six months. Notably, the homes used practically no Grid electricity between April and the end of September. The purple line shows the running energy balance of these homes, which ended the 12-month period in negative territory, at around -1,000kWh. The ambitious design-stage target of 'energy positive' performance had been achieved. This was repeated for the average performance of the one-bed and four-bed homes.

When investigating the performance of individual properties, two did not achieve the energy-positive target. One was the aforementioned»

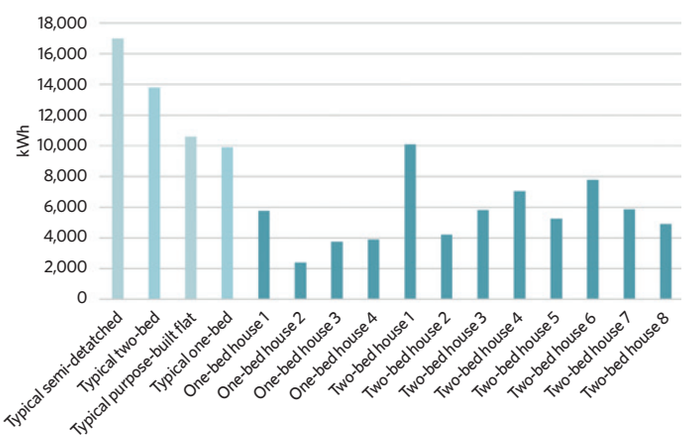


Figure 3: One- and two-bed home energy benchmarking

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» home with specialst medical equiptment, the other was one of the four-bed homes. Detailed analysis of the sub-meter data showed that the residents of this home were very high energy users with far higher than expected plug-socket loads, cooking, lighting, and towel rail usage. They also used considerably more hot water than anyone else on the site, averaging more than 400 litres/day. While this home did not achieve the energy-positive target, it was still exceptionally energy efficient, ending the year with a net energy demand from the grid of less than 1,900kWh.

Energy costs

In addition to energy and carbon targets, the residents' energy costs were at the forefront of the project team's minds. These homes had to be affordable to run and part of the solution to fuel poverty, not just environmental issues. While the social landlord has no control over the energy supplier or tariff chosen by residents, it did provide recommendations on tariffs that will work with the systems within the homes, to produce the lowest bills.

One such tariff was created by a partnership between

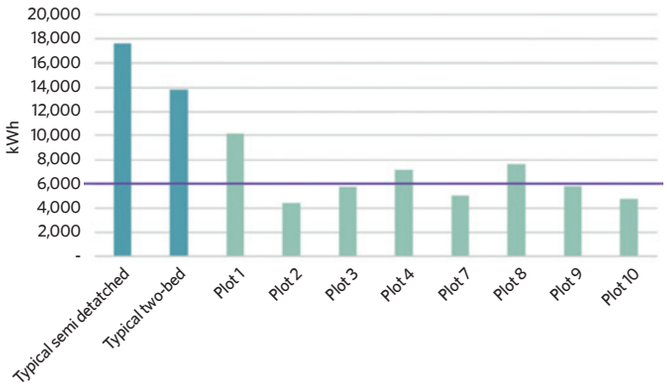

Figure 4: Two-bed home energy benchmarking

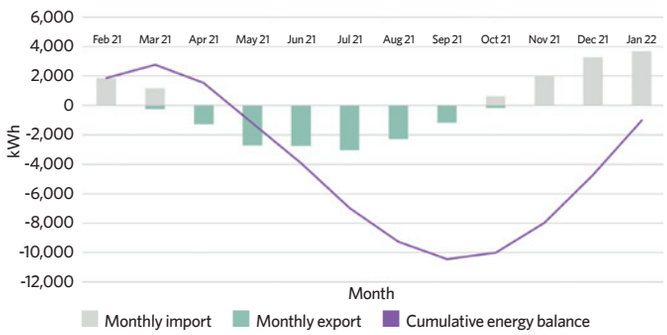

Figure 5: Average energy imported from, and exported to, the Grid for two-bed homes

one energy supplier and the battery supplier; if the residents used this tariff, they would have achieved exceptionally low bills over the monitoring period, with a negative bill over the 12 months – their home energy systems earning money, rather than costing money!

Given the current energy crisis and spiralling costs, the residents of these homes may be among the few people in the UK who need not worry about their energy bills this coming winter.

After the 12-month monitoring period, from February 2021 to January 2022, the conclusion was exceptionally positive, with the whole design and construction team delighted with performance. The residents were also very pleased with their homes, noting that they were comfortable, warm, and had extremely low energy bills. CJ

EIMEAR MOLONEY is a director at Hoare Lea
JOHN LLOYD is a at technical lead at Sero
MARK DAVIES is a developement project manager at Wales & West Housing

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RESTORED TO HEALTH

Building services materials from Nightingale hospitals have been reused in a Dorset diagnostic centre, as part of the NHS's drive to cut embodied carbon. **Molly Tooher-Rudd** looks at BDP's reuse strategy

As part of its net zero carbon strategy, the NHS is striving to minimise the embodied energy in its building programme and reuse materials wherever possible.

The strategy has been applied to a new one-stop NHS diagnostic centre in Poole, which has been built in Beales department store.

Design consultancy BDP, and construction and facilities management partner CFES, worked with University Hospitals Dorset NHS Foundation Trust to build the new centre for breast screening and diagnostics on what was the top floor of the shop.

It is the first of 40 community NHS diagnostic centres opening in England that will provide earlier diagnostics, and more convenient and accessible treatment, in local communities.

To minimise waste and embodied carbon, the project team reused as much of the shop's materials and plant as possible, and specified recycled equipment from other projects – notably, the decommissioned Nightingale hospitals, delivered at the height of the Covid-19 pandemic.

Elements recycled from the Nightingale hospitals included mixer taps, around 200 light fittings, and bed head and dado trunking in the consulting rooms. In addition, they also reused 1,000m of plumbing pipework, plus cable containment, 12,000m of cables, data and socket outlets, and light switches.

Plasterboard, doors, and ironmongery were among the other elements salvaged and stored, helping to reduce the project cost and speed up the programme delivery period. During construction on site, the project team carefully reviewed the installation to ensure it was up to standard and compliant.

'This project is the first of its kind in the country,' says Paul Johnson, architect director at BDP. 'Not only does it support a circular economy by reusing materials from the emergency Covid-19 hospitals in an existing building, but it is also built on the same collaborative and sustainable methods of design and construction.'

To ensure minimal disruption to the existing Beales store on the ground floor, the project team avoided drilling through the slab and work was done out of hours. Similar concerns over drilling resulted in the use of efficiently placed, mechanically pumped drainage for the wash hand basins.

Compliance with Health Technical Memoranda (HTM) was also essential. The design team had to highlight derogations from HTMs/Health Building Notes to the Trust and agree on the design methodology before it was developed and finalised. For example, point-of-use water heaters were used on the wash hand basins in clinical areas to ensure standards were met.

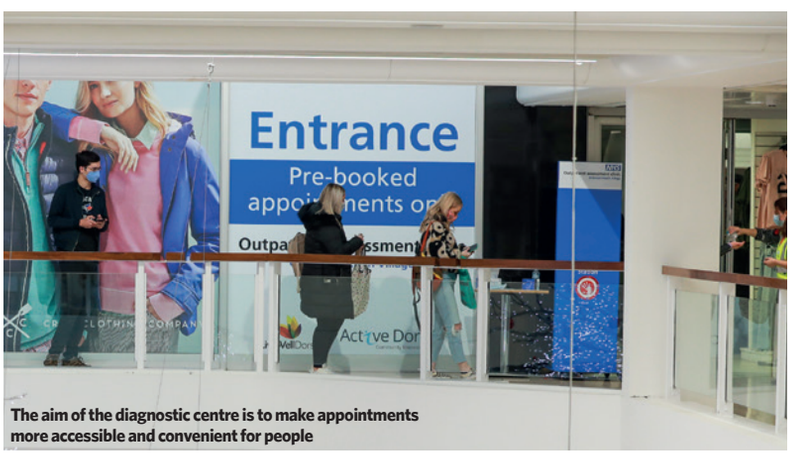
The existing boilers and air handling units were unsuitable for the proposed layout of the Health Village, so it was proposed to cut into the existing ductwork in the riser and cap it off within the floor. New ductwork was then introduced under the ceiling, which – because of concerns about asbestos – mitigated the need to disturb the existing ceiling. The project team carefully proposed the installation of duct-mounted diffusers along these ductwork runs, to disperse the air into consulting rooms that had no ceilings.

The existing extract system – consisting of two large extract grilles either end of the floor plate – was reused, and the existing smoke extract was kept in place.

For clinical reasons, the breast-screening and ophthalmology rooms required ceilings, so were unable to be cooled from the modified ventilation system. Instead,

Items from decommissioned Nightingale hospitals were used to build the centre

"To ensure minimal disruption, the team avoided drilling through the slab and work was done out of hours"



The aim of the diagnostic centre is to make appointments more accessible and convenient for people

small variable refrigerant volume systems were installed to provide cooling to the spaces through wall-mounted indoor cassettes.

As the specific luminaires from the Nightingale Hospitals were being used, the project team faced the challenge of providing the correct illumination levels for general and task lighting in rooms without ceilings.

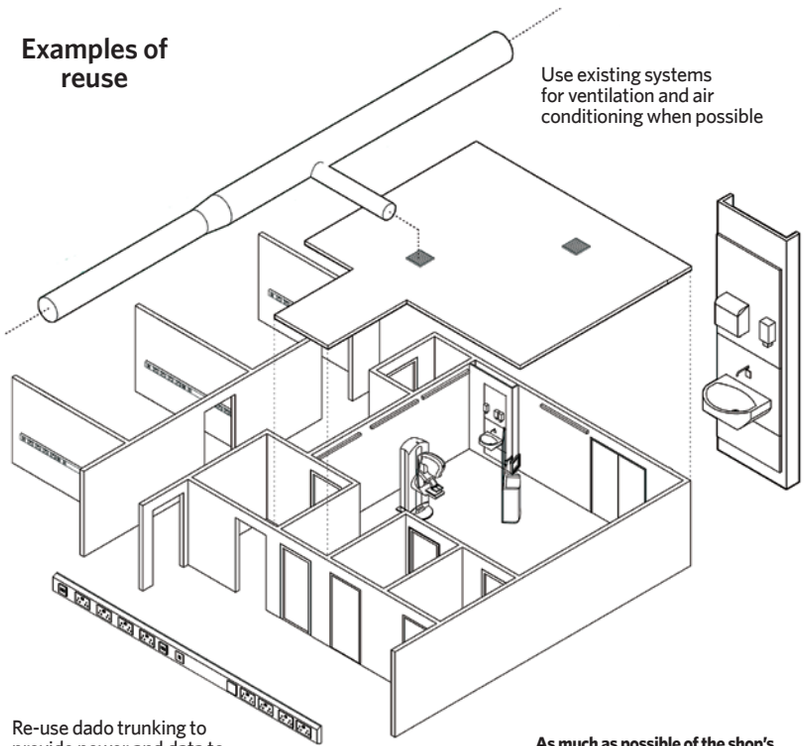
The design team overcame this by carefully modelling the rooms and locating luminaires along the walls, to use the reflected, indirect illumination from white surfaces. This achieved the required illumination levels in the various spaces while ensuring a uniform distribution throughout.

The existing electrical infrastructure was found to be unfit for purpose, so was isolated and made safe. A new busbar chamber in a local riser was introduced, using the existing low-voltage sub main cables, and split to provide a dedicated supply for the Dorset Health Village.

Walls were designed to accommodate the reuse of bedhead trunking, without the need for alteration, resulting in a simple, modular-type installation on site.

While the emergency Nightingale hospitals were, thankfully, never fully occupied, their legacy is helping the NHS pursue a leaner construction strategy centred on reusing the wealth of materials it has across its vast estate. CJ

Examples of reuse



As much as possible of the shop's materials and plant were reused, while equipment from other projects was recycled

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Evolving Building Regulations towards a net zero future

This module explores some of the changes in the recently updated Approved Documents that affect the provision of heating, cooling and ventilation for non-domestic buildings

The recent updates to the Building Regulations for England, together with the associated Approved Documents (ADs), are referred to as 'interim', and intended to raise standards in the design and construction of buildings in preparation for the Future Buildings Standard and Future Homes Standard, which are due in 2025 and will set higher targets. As outlined in last month's CPD, there is concurrent activity across the four nations of the UK to develop the Building Regulations (and supporting documentation), aiming towards a net zero future.

This CPD article will focus on some of the changes in the recently updated ADs that particularly affect the provision of heating, cooling, and ventilation for non-domestic buildings.

Overall, the intent in updating the Building Regulations is to drive the construction and property sectors towards delivering lower-carbon, energy-efficient buildings that employ 'decarbonised' energy sources. Applied since 15 June 2022, the amended ADs are AD L *Conservation of energy* and AD F *Ventilation*, which are both spilt into volume 1: *Dwellings*, and volume 2: *Buildings other than dwellings*. A new addition is AD O *Overheating*, which covers the overheating mitigation requirements in new residential buildings.

The previous ADs made use of complementary 'compliance guides' to provide detail of the provisions to meet requirements – the revised ADs include that level of detail without reference to a supplementary guide.

The new ADs also include a clearer indication of the specific regulation that is being addressed by the guidance, with bold notation providing the relevant regulation reference at the top of each page.

ADL2 *Buildings other than dwellings* sets out measures that will satisfy the energy performance as required by Part 6 of Building Regulations 2010. As with the previous edition, this is evidenced by meeting a target performance created from a notional building that is the same size and shape as the actual building, as specified by the UK's National Calculation Method for Non Domestic Buildings.[1]

The energy performance of the notional building establishes two targets. To comply, a proposed building must meet both annual targets – the target emission rate (TER) in kg $CO_2 \cdot m^{-2}$ per annum that, overall, is 27% lower than the previous requirement, and the newly introduced target primary energy rate (TPER) in $kWh_{PE} \cdot m^{-2}$ per annum (as discussed in last month's CPD). ADL 2021 requires that buildings must be nearly zero-energy, which would be evidenced by the calculated building emission rate (BER) being no greater than the TER.

Software such as Simplified Building Energy Model[2] (SBEM) is used to compare the performance of the actual building against the targets set by the notional building, with calculations undertaken for both the design and as-built stages.

The regulations include an uplift in requirements for fabric performance including lower U-values for fabric elements and reduced air permeability, both of which must be addressed at the design stage. Minimum performance standards for the »

» main fabric elements – including walls, roof elements, floors and windows, as shown in Table 1 – have been reduced by around a quarter compared with the previous requirements. The targets set by the notional building for a project will depend on the size and use of the building, and the systems installed, which will combine to deliver the TER for a building that has improved energy performance.

The fabric minimum standards are intended as a 'back stop', and the TER and TPER will be met by a combination of:

- Fabric energy efficiency
- Efficient building services
- Low- and zero-carbon technologies.

Before construction commences on a new building, an analysis is required of the technical, environmental and economic feasibility of using 'high-efficiency alternative systems'. Example systems are noted as:

- Decentralised energy supply systems based on energy from renewable sources
- Cogeneration
- District or block heating or cooling, particularly where it is based entirely or partially on energy from renewable sources
- Heat pumps.

The building specification can change during construction, but the completed building must still meet the targets. When construction is complete, the calculations for primary energy and emission rate must include any changes made during construction, as well as using the measured building air permeability.

ADL2 requires that controls for comfort cooling and air conditioning systems should meet BS EN 15232[3] *Energy performance of buildings – impact of building automation, controls and building management* class C or above. Class C is a 'standard building automation and control system (BACS)' and is essentially environmental zone control for temperature and ventilation. For space heating or air conditioning systems with an effective rated output greater than 180kW, the control system is required to:

- Fully comply with BS EN ISO 16484[4] *Building automation and control systems*
- Continuously monitor, log, analyse and allow for adjusting energy use
- Benchmark the building's energy efficiency and inform the person responsible for the facilities or building management about opportunities for energy-efficiency improvement
- Allow communication with connected fixed building services and other appliances in the building, and be 'interoperable with fixed building services across different types of proprietary technologies, devices and manufacturers'.

Element type	Limiting U-value $W \cdot m^{-2} K^{-1}$ or air permeability	
	Previously	ADL2 2021
Roof (flat roof)	0.25	0.18
Roof (pitched roof)	0.25	0.16
Wall	0.35	0.26
Floor	0.25	0.18
Swimming pool basin	0.25	0.25
Windows in buildings similar to dwellings	2.2	1.6
All other windows, roof windows, curtain walling	2.2	1.6
Rooflights	2.2	2.2
Pedestrian doors (including glazed doors)	2.2	1.6
Vehicle access and similar large doors	1.5	1.3
High-usage entrance doors	3.5	3
Roof ventilators (including smoke vents)	3.5	3
Air permeability (for new buildings) @ 50Pa	10 $m^3 \cdot h^{-1} \cdot m^{-2}$	8 $m^3 \cdot h^{-1} \cdot m^{-2}$

Table 1: Minimum performance standards for fabric elements (Source: ADL2A 2013 and ADL2 2021)

Type	EER	SEER
	NDBSCG 2013	ADL2 2021
Packaged air conditioners – single-duct type	2.6	3.0
Packaged air conditioners – other types	2.6	3.0
Split and multi-split air conditioners >12kW	2.6	5.0
Split and multi-split air conditioners ≤12kW	SCOP 'D' rating	5.0
Variable refrigerant flow/variable refrigerant volume (VRF/VRV) systems, including room unit	2.6*	5.0
Water-to-water chillers <400kW	3.9	5.0
Water-to-water chillers 400–1,500kW	4.7**	6.0
Water-to-water chillers ≥1,500kW	4.7	6.5
Vapour compression cycle chillers, air-cooled <400kW	2.55	4.0
Vapour compression cycle chillers, air-cooled ≥400kW	2.65**	4.5
Absorption cycle chillers	0.7	EER 0.7
Gas-engine-driven variable refrigerant flow	1	1.6

* not including room unit ** >750kW

Table 2: Minimum efficiency standards for comfort cooling (Source: Non-Domestic Building Services Compliance Guide: 2013 Edition and ADL2 2021)

ADL2 notes that a BS EN 15232 Class A-rated-type system would meet these requirements.

For existing buildings, 'consequential improvements' are required, in a similar way to earlier regulations, for buildings with a floor area greater than 1,000m² when a space is extended or a new/extended building service system is installed. This would require coincident energy efficiency improvements to the building where they are technically, functionally and economically feasible. ADL2 section 12 on consequential improvements is rather easier to follow than the appendix in the previous ADL2B. ADL2 Table D1 highlights the acceptable energy-efficiency measures that should 'usually' be installed when consequential improvements are required. This includes broadly similar requirements to the previous AD, including upgrading heating systems, cooling systems or air handling systems that are more than 15 years old, by providing new plant or improved controls.

ADL2 also includes some important changes to requirements for building services equipment – specifically, how energy efficiencies are measured and demonstrated. The requirements for comfort cooling equipment must now

explicitly meet minimum seasonal energy efficiency ratio (SEER) requirements – the previous requirement was in terms of the minimum full-load energy-efficiency ratio (EER), as shown in Table 2. The SEER was previously only employed in the determination of the building emission rate (in SBEM or similar).

BS EN 14825[5] is the referenced testing standard for determining SEER and SCOP (seasonal coefficient of performance). However, the requirements of ADL2 for variable refrigerant volume/variable refrigerant flow (VRF/VRV) systems require that the SEER should include the full system, which includes indoor units. Such calculations must include indoor and outdoor conditions, the power for controls, and the power used by the indoor units – this is not covered explicitly by BS EN 14825. This requirement produces a value that is akin to the SSEER (seasonal system energy-efficiency ratio) as employed by the National Calculation Method.[1] A potential value of a SEER to check compliance with ADL2 for such systems could be evaluated by employing detailed manufacturer's data – including appropriate power consumption for internal components – in the SEER equation from ADL2

$SEER = a(EER_{100\%}) + b(EER_{75\%}) + c(EER_{50\%}) + d(EER_{25\%})$

Where EER_X is the EER measured at the load conditions of 100%, 75%, 50% and 25% at the operating conditions detailed for that particular part-load energy-efficiency ratio, and a, b, c and d are cooling load factors (as provided in ADL2 for office accommodation). (The notional building in the NCM applies a cooling SSEER of 4.4.)

For new buildings with a floor area over 1,000m², there is now a requirement that the building owner should be handed a forecast of the actual energy use of the building that includes all metered energy uses (integrating unregulated loads such as appliances), in kWh per year, broken down by fuel type. ADL2 suggests several methods that may be used to produce these forecasts, including the recently published CIBSE TM54 *Evaluating operational energy use at the design stage*. In a useful reminder, it is noted that the output of SBEM and other compliance tools is not suitable for direct use to provide energy forecasting estimates. For new buildings with a BACS, information about the energy performance of the building automation and control systems should be included in the handover manual.

In existing buildings, when a new or replacement system is installed – such as a heating system, including heating appliance, pipework and emitters – or work on an system fundamentally alters the energy performance or system CO_2 emissions, the energy performance of the resulting system should be assessed and, together with appropriate guidance, the assessment output should be handed to the owner.

The emphasis in the updated ADF *Ventilation* is to deliver high standards for indoor air quality to support occupant health and wellbeing. There has been a complete overhaul of the tables, which provide a useful quick reference to relevant regulations and guidance that will assist in the determination of appropriate methods of ventilation. The guidance in ADF2 mainly concentrates on offices, where the general outdoor air supply rate remains at $10L{\cdot}s^{-1}$ per person or $1L{\cdot}s^{-1}$ per m² floor area – whichever is higher. The focus on air quality has meant that the section on minimising ingress of external pollution has moved from an appendix in the previous ADF to a whole section in the new ADF2 2021. This includes a new table of external pollutant limit values, including carbon monoxide (CO_l), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), benzene (C_6H_6), lead (Pb) and particulate matter (PM), that, if any are exceeded, indicates that there may be a need for the ventilation system to be specifically designed so as to minimise the intake of external air pollutants.

Figure 1: Example of commercially available air source heat pump designed for commercial domestic hot water application, where gas boilers, combined heat and power systems (CHP) or electric water heating have been traditionally utilised. At outdoor 7°CDB/6°CWB, inlet water temperature 9°C, the unit produces 40kW of water at 65°C with a COP of 3.65 (1,220mm x 760mm x 1,837mm high)

Indoor air quality (IAQ) monitoring is required by ADF2, by measuring the CO_2 level as a proxy for the IAQ, which is informed by a new appendix that provides basic information on CO_2 monitoring. This advises against 'snapshot' readings, as these can be misleading, and advises that continuous monitoring be used. It is suggested that to determine if a space is poorly ventilated, records should be maintained of CO_2 levels, number of occupants, and type of ventilation in use at the time and the date of the reading. ADF2 notes that an average CO_2 concentration of 1,500ppm over the occupied period is an indicator of poor ventilation, and action should be taken to improve the situation if readings are consistently high.

ADF2 notes that ventilation intakes should always be away from direct impact of the sources of location, and that where buildings are next to busy roads 'mechanical ventilation may be the most practical way of achieving this requirement'.

In existing buildings, any work carried out must not result in any degradation of the ventilation standards in the building. However, when that building work includes the ventilation system, it must meet the relevant parts of ADF2. It is noted that if work is carried out that increases the energy efficiency of a building, airtightness may be increased and so any useful ventilation that was lost should be replaced in order to maintain a healthy indoor environment.

Decarbonising the built environment will lead to major changes in the choice of equipment for all buildings. Heat pump technology has advanced significantly in the past five years, resulting in systems that are able to meet the heating, cooling and hot water demands of non-dwellings, as in the example shown in Figure 1. Heat pump technology is also being applied within or alongside other building services systems to enhance energy efficiency. For example, heat pump VRF/VRV systems can provide energy-efficient cooling and heating for commercial buildings that use renewable sources, and district energy networks that, increasingly, employ ambient loops operating at low temperatures. Many of the new requirements can be met with technology available today. However, such applications require holistic thinking about design and operation, not only from designers, but also from building managers and the building occupants. This provides an opportunity to adapt to new and better ways of heating, cooling and managing buildings to prepare for a net zero future.

Turn to page 58 for references. »

Module 200

August 2022

1. What month do the new ADs take effect?

- ☐ A December 2021
- ☐ B June 2022
- ☐ C December 2022
- ☐ D June 2023
- ☐ E June 2025

2. Overall, what approximate reduction in TER is there likely to be, compared with the previous regulations?

- ☐ A 0%
- ☐ B 7%
- ☐ C 17%
- ☐ D 27%
- ☐ E 37%

3. For systems rated greater than 180kW, what would indicate that a control system is fully adequate to meet the regulations?

- ☐ A One that complies with BS EN 14825
- ☐ B One that complies with BS EN 15232 Class A
- ☐ C One that complies with BS EN ISO 16484
- ☐ D One that complies with CIBSE TM54
- ☐ E One that complies with the new AD O

4. Why might a VRV/VRF system be more challenging when determining the SEER?

- ☐ A Manufacturers keep SEER data commercially confidential
- ☐ B The external units have a very high SEER that dominates the calculation
- ☐ C The National Calculation Methodology confusingly relates to SSEER
- ☐ D There is no standardised method as to how to account for the indoor units
- ☐ E They employ refrigerants that fall under F-Gas rules and methods

5. What is the COP of the 40kW output heat pump illustrated in Figure 1 when producing water at 65°C with outdoor 7°CDB/6°CWB and inlet water temperature 9°C?

- ☐ A 1.65
- ☐ B 2.15
- ☐ C 3.65
- ☐ D 4.15
- ☐ E 4.65

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References:

1 UK's National Calculation Method for Non Domestic Buildings, **www.uk-ncm.org**.uk – accessed 1 July 2022.
2 **www.uk-ncm.org.uk/download.jsp** – accessed 1 July 2022.
3 BS EN 15232 *Energy performance of buildings. Impact of building automation, controls and building management*, BSI 2017.
4 BS EN ISO 16484 *Building automation and control systems* (BACS), BSI 2017 + A1: 2020.
5 BS EN 14825:2018 *Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling. Testing and rating at part-load conditions and calculation of seasonal performance*, BSI 2018.

ELCO installs hybrid heating system in Derbyshire academy

A secondary academy school in Derbyshire has worked with ELCO Heating Solutions to install a hybrid heating system.

The academy's coal-fired boilers have been replaced by two 48kW Aerotop M commercial heat pumps and two 120kW Thision L ECO wall-mounted condensing gas boilers.

The sustainable heat pumps will provide the majority of heating, while the gas boilers act as a low-emission backup if the outside temperature falls below a certain level.

After connecting the building to the gas mains, West Midlands-based BSN Group worked with ELCO to integrate the new equipment. The hybrid heating system, combined with the restoration of the roof, funded by the Public Sector Decarbonisation Scheme, will save 134 tonnes of carbon per year for the academy.

The new Aerotop M reversible heat pumps are available in outputs from 24kW to 48kW. All models are supplied with flow and return manifolds for arrangements of up to four heat pumps, while 16 units can be managed by a cascade controller.

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Aquatech Pressmain offers new pressurisation unit with degassing options

The Aquapack AP pressurisation unit with degassing options maintains pressure in heating and chilled water in domestic and commercial systems. The unit can be placed on the floor or wall-mounted, and contain up to 50,000 litres, for temperatures from 3°C to 90°C and fill pressures 0.8bar to 14.0bar.

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Jung Pumpen offers new products and training

Pump Technology, the largest UK supplier for Jung Pumpen, has introduced new product innovation to the pumping sector. The additions are the DrainMinor S Shower Waste Pump and DrainMinor C Combi Oven Pump, which incorporate Jung U3KSL submersible pumps.

A training course on wastewater and sewage pumping will also take place at the Jung Pumpen centre in Germany from the 30 November to 2 December. The event is jointly sponsored by Pump Technology and Jung Pumpen.

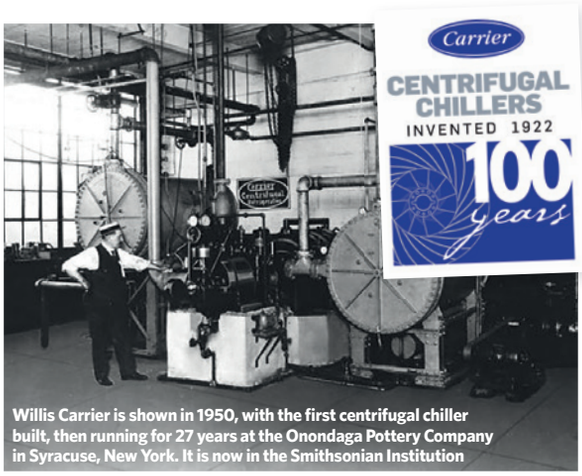
Contact David Johnson on 07984 520515 or email davidj@pumptechnology.co.uk

Carrier introduces heat-recovery and free-cooling options

HVAC leader Carrier has introduced energy-saving heat-recovery and free-cooling options to its AquaSnap 30RBP scroll chiller range.

The free-cooling system activates when air temperature drops 1°C below the chiller's return water temperature, reducing the need for mechanical cooling. A partial free-cooling option is available for computer suites and healthcare with a constant residual cooling need, while total free cooling can be used for industrial processes with a cooling need throughout the year. The heat-recovery system enables chillers to produce hot water up to 80°C and provide cooling for use in hotels and hospitals.

Visit www.carrier.com or follow @Carrier on Twitter



Willis Carrier is shown in 1950, with the first centrifugal chiller built, then running for 27 years at the Onondaga Pottery Company in Syracuse, New York. It is now in the Smithsonian Institution

Carrier celebrates 100th anniversary of centrifugal chiller

The first centrifugal chilling machine was unveiled in a sheet-metal shop in New Jersey, USA, 100 years ago. Created by Willis Haviland Carrier, the chiller was a precursor to the large-scale air conditioning of theatres, offices and hospitals.

Carrier's chiller assembled a centrifugal refrigeration compressor, with a shell, a condenser and a chiller in one frame. The units were installed in a Philadelphia chocolate factory and, eventually, a Detroit department store in 1924.

This technology is now used in more than 200 industries. Air regulation has made food production safer and hospitals more sanitary. It has enabled digital advancements in semiconductor chips, data centres and robotics.

Today, Carrier continues to develop its original chillers. The AquaEdge 19DV water-cooled chiller has efficient free-cooling and heat-recovery options, and the AquaEdge 19MV chiller combines multiple operations in a compact machine. Both feature the energy-saving EquiDrive two-stage, back-to-back compressor technology.

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Building control surveyors will have to be registered under the new regime

Lorna Stimpson

Under control

The Building Safety Act is introducing the biggest reforms the sector has seen. Lorna Stimpson, chief executive of the Local Authority Building Control, discusses its implications for the profession

The new Building Safety Act brings fundamental changes to the way building control operates, including: new duties and accountabilities for those responsible for the safety of high-rise and complex buildings; a Building Safety Regulator (BSR); and a new building safety framework, with a 'gateway' stop/go approval process at each stage of design and construction. The BSR will be responsible for overseeing the safety and standards of all buildings.

A new competency framework will also be introduced, with a register for building control professionals, opening in October 2023. From 1 April 2023, the full rollout of the framework will result in the new gateway approval regime taking effect for new higher-risk buildings, while existing higher-risk buildings will need to be registered between April and October 2023.

Lorna Stimpson is chief executive of Local Authority Building Control (LABC), the body representing the public sector building control profession. Here, she answers questions on what the new regime means for her organisation.

What are the implications for building control under the new regime?

There are enormous implications for public service building control. The biggest change is the registration of the profession and new competence requirements. The other is that public service building control will have a duty to support the BSR in its work on new and existing higher-risk buildings. In buildings of seven storeys or more, or above 18 metres where there are two or more residential units, in refurbishment or new build, the BSR will be the building control authority, but will draw upon building control to be part of its multidisciplinary team. Local authority surveyors will form part of the regulator's multidisciplinary team, alongside Health and Safety Executive (HSE) inspectors and fire service officers. These teams will regulate new in-scope buildings and those going through refurbishment, and will have a significant role in assessing and certifying existing high-rise buildings in England that will also be required under the new legislation.

Will building control look at anything differently?

Yes, certainly in occupied buildings. Around 12,500 existing high-risk buildings will come under scrutiny. The skills of building control are going to be used under section 13, which looks at the fire and structural safety of these buildings, to provide them with certification to be able to continue to be occupied under a safety case review.

Will this change the role of building control?

Building control is building control, regardless of who undertakes that role. There will be a need for local authority building control to work in a different way as part of the multidisciplinary team, but the biggest impact on the profession is the registration of building control surveyors.

Within public service building control, we have around 3,500 surveyors and technical support. If they want to continue to practise, everyone who works in the profession, whether public or private sector, will be required to join the new building inspector and building control approver registers. This will require proof of competence at various levels of building control surveying.

HSE/BSR is currently working on that with LABC and private sector building control. Proof of competence is likely to be competence validation, either through the Engineering Council or an ISO 17024 standard, which LABC has established through the creation of the Building Safety Competence Foundation (BSCF).

What is the BSCF?

It was formed last year as a not-for-profit community interest company, to deliver competence validation industry wide, and is the body under which LABC has developed its ISO/IEC 17024 certification of persons scheme. The foundation is measuring and proving competence of surveyors in the public and private sectors, and LABC expects it to achieve UKAS accreditation this summer. This will enable it to provide the proof of competence assessments required to meet the new building control regime's registration criteria.

Is LABC ready for the changes?

I sit on the joint regulator's group and the interim industry competence committee, and, post-Grenfell, we've been working with experts who are formulating policy. We've tried to interpret this emerging policy so that we can prepare for the new regime. I feel LABC is as prepared as it possibly could be.

EVENTS

NATIONAL EVENTS AND CONFERENCES

The Building Safety Act: The consultation period and the golden thread
14 September, London
CIBSE and the Society of Digital Engineering have launched a new event focusing on the new Building Safety Act and the golden thread – the information that allows you to understand a building and the steps needed to keep it and people safe. This event will convey and debate how the right people have the right information at the right time, to ensure buildings are safe and building safety risks are managed throughout the building cycle.
www.cibse.org/goldenthread

Young Engineers Awards
11 October
Encompassing Apprentice, Graduate, and Employer of the Year, the awards recognise the best new talent entering the building services industry, as well as those businesses that go the extra mile to support and nurture them.
The 2022 awards will be held at the new location of RIBA, London. Enter now at:
www.cibse.org/yea

Build2Perform Live
29-30 November
The flagship event returns to being a face-to-face occasion for 2022, at London Excel. The two days will feature a carefully curated CPD programme with more than 160 speakers and more than 70 exhibitors. To be kept up to date with the latest news, register your interest at
www.build2perform.co.uk

CIBSE REGIONS AND GROUP EVENTS

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

Intelligent Building Group: What is artificial intelligence when it comes to architecture?
14 September
Webinar looking at the ways artificial intelligence (AI) is creeping into, or acting as the architecture of, our cities, towns, districts and homes.

CIBSE YEN Gala and Careers Networking Day
13 October
A day for up to 450 student, apprentice and graduate engineers to meet employers. It will be followed by the YEN Gala, bringing young engineers together to celebrate their hard work and make lasting connections in the industry

CIBSE JOURNAL WEBINARS

The next *CIBSE Journal* webinar will take place on 23 August. This webinar, sponsored by Lutron, is titled: *Lighting the path to easily comply with the new Building Regulations.*
Register to watch this, or any previous *Journal* webinars, at **www.cibsejournal.com/cpd/webinars**

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. Upcoming courses:

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2-4 August

Building services explained
6-8 September

Energy strategy reports
7 September

Design of heating and chilled water pipe systems
8 September

Energy surveys
13 September

Electrical services explained
13-15 September

Below-ground building drainage
14 September

The importance of energy efficient buildings
20 September

Introduction to the Building Safety Act
20 September

Introduction to the Building Safety Act
22 September

Energy Savings Opportunity Scheme
27 September

Design of ductwork systems
4 October

Fundamentals of drainage
6 October

Low and zero carbon energy technologies
11 October

Heat Networks Code of Practice (CP1)
12 October

Mechanical services explained
18 October

Electrical services overview
18 October

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Upcoming webinars:
- 16 and 23 August
- 11 and 18 October

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

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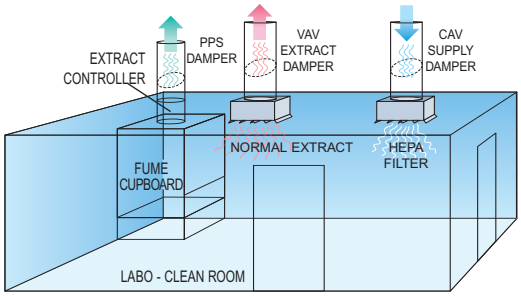

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