

# Beyond Net Zero

May 2026

  
CEPTION

MAX FORDHAM



# Max Fordham: Beyond Net Zero

## Our statement of intent



This year, we celebrate our 60th anniversary, and as we reflect on our history and our progress, we continue to believe that it is our shared responsibility to look after each other, to care for our communities, and to create a sustainable world.

For nearly 60 years, we have pioneered the highest standards of both comfort and sustainability in the built environment, from our earliest housing projects in the 1960s and 1970s to the ultra-low-energy offices, museums and sports centres of the 2020s. Our long-standing design philosophy, inspired by Max, endures today. 'Beautiful Engineering for a sustainable planet' encapsulates our belief in elegant, sustainable outcomes that are good for humanity and good for the planet.

We have been committed to net zero carbon since 2020, published the Net Zero Carbon Guide and committed to design without fossil fuels as the default on all our projects. We have supported the development of the UK Net Zero Carbon Building Standard through four working groups, and this year marks the release of V1 of the Standard.

The standard is voluntary but has been embraced across the industry in an exploratory testing approach. The standards are too tough for many projects still following a business-as-usual approach, but it serves as an important benchmark and clarified approach for all projects to measure themselves against. We've

supported the standard by enrolling four of our projects as pilot projects, providing data and feedback to inform V1 of the standard. It is not a coincidence that each of these are retrofit projects.

Our knowledge of low embodied carbon design, particularly in MEP, and embodied carbon modelling continues to be a growing area of expertise, and we have used this experience to provide peer review to the Westminster City Council evidence base and other strategic support to housing associations. Likewise, the need to close the energy performance gap, reduce bills and improve understanding of energy in use at a portfolio level has seen an increase in our post-occupancy work with housing associations, schools, and leisure centres.

Last year, we challenged ourselves to consider what 'biodiversity positive' could mean on our projects. Just this week, Waterwise and The Rivers Trust highlighted the connection between our water use and the health of the ecosystems that often supply their water. This isn't yet a defined aim, and right now we want to focus on the outcomes rather than the measurements. It's about reducing on-site water consumption, increasing our expertise and successes in MEP reuse as much as seeking opportunity for on-site biodiversity. We joined the Engineers Reuse Collective to continue researching ways to minimise the upstream and downstream ecological impacts of construction and want to share and learn alongside the industry.

Our second Beyond Net Zero Whitepaper is part of our ongoing commitment to knowledge sharing challenges and successes in the recognition that communication is a powerful tool for influencing the whole system we are in.

In this year's series of short insight articles and project case studies, we strive to illustrate how our projects are committed to better environmental performance in both operation and carbon, how those successes are realised and in recognising the importance (and beauty) of retrofitting historic buildings, both as models of reusing existing structures but also in how they uplift communities.

We continue to publish this paper as an encapsulation of what we believe as a practice, a summary of what we see as the state of the net zero nation, and a statement of our intent.

## Hero Bennett

**Sustainability Director, Max Fordham**

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# Our values



## Our values

We are Max Fordham. A partnership of engineers, designers and consultants, working with the built environment, to deliver a sustainable future and a thriving planet.

**Partnership:** we believe in building open, honest, collaborative relationships based on mutual trust and respect, whether with one another or our clients and colleagues in the industry.

**Authenticity:** we are passionate about everything we do and are driven by a genuine desire to make a positive difference.

**Openness:** we believe in sharing information, knowledge, and insight to stimulate the development of great ideas and to foster strong relationships with each other and our external collaborators.

**Considered thinking:** we are not swayed by ill-conceived fads, but endeavour to find the most appropriate solution in any given situation, thereby ensuring high quality results every time.

**Pioneering approach:** we strive to build on our heritage as innovators and leaders in truly sustainable building design.

**Sustainable outcomes:** we believe in delivering the most sustainable outcomes, both for our projects and in the way we run our business.

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# Making change



# Involvement with Westminster Retrofit First policy



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## Embodied carbon evidence base

We were appointed as independent third-party verifiers for the embodied carbon evidence base underpinning Westminster City Council's Retrofit First policy. That has since undergone review and been formally adopted by the council. Our role went well beyond a technical sense check. By rigorously interrogating assumptions, baselines and optioneering logic from both conceptual and technical perspectives, we helped ensure that the embodied carbon targets underpinning Westminster's Retrofit First policy are robust, defensible and practically achievable. We also worked closely with council stakeholders and the original authors to bridge the gap between what is defined in policy and what is realistic in the industry and in actual design practice.

We reframed the conversation towards the fundamental drivers of embodied carbon: geometry, structural logic, façade proportion and overall material intensity. This enabled the evidence base to focus on measures that deliver genuine, system-level carbon reductions rather than through specification of materials from scarce resources or optimistic procurement assumptions (e.g. low-carbon cement using ground granulated blast furnace slag (GGBS), higher recycled content aluminium).

The guiding principles we developed emphasise early design decisions and using less materials. This approach is more resilient to market uncertainty and more likely to result in real construction carbon reductions.

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## Embedding insights across our projects

The consideration of embodied carbon has been a core part of our practice for a long time, supported by a dedicated embodied carbon modelling team that works across the full range of our projects. Reviewing the third-party evidence in setting upfront carbon limits for the Retrofit First policy provided an opportunity to test, refine and strengthen the ideas that already sit at the heart of our work. It sharpened how these principles are communicated internally and externally, giving teams a clearer shared framework for assessing what constitutes meaningful, real-world carbon reduction.

One Hanover Square with Piercy & Co



We are now applying the same analysis consistently across our projects, testing whether proposed reductions are scalable, whether they rely on genuinely available resources, and whether they risk masking inefficient designs. This has strengthened our internal quality assurance around carbon modelling and optioneering, and improved the clarity and credibility of the advice we provide to clients and planning authorities, helping clients and collaborators move away from short-term optimisation and towards lean, adaptable buildings that are fundamentally lower carbon by design.

Supporting the Westminster Council through our peer review reinforced the importance of translating policy ambition into clear, practical design principles that can be adopted industry-wide.

# Masterplans: The blind spot in embodied carbon



**Hero Bennett**  
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Embodied carbon is now well established as a design consideration at building level, but some of the most important large-scale embodied carbon choices are made in the masterplanning stage, where the embodied carbon impact is not yet fully understood.

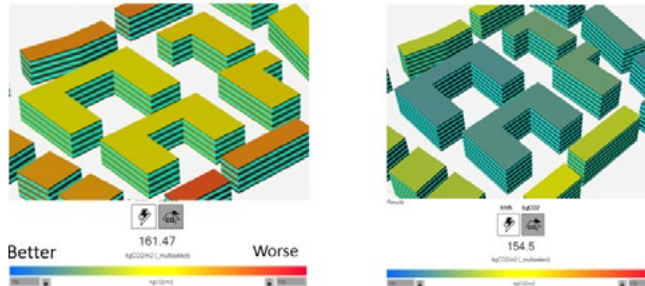
At this stage, decisions about density, massing, infrastructure and land use fundamentally shape whole life carbon outcomes, long before materials or specifications are selected. Road hierarchies, servicing strategies, earthworks and utility corridors quietly embed carbon that will persist for generations. The embodied carbon opportunities available to individual buildings are therefore constrained, or enabled, by decisions made at the outset.

## Considering carbon during design development

On the future phases of the Eddington masterplan in Cambridge, whole life carbon was treated as a fundamental consideration through the masterplan's design development. It was explored alongside layout and massing decisions to understand how spatial choices would influence both the embodied carbon potential of buildings and the scale of infrastructure required across the neighbourhood. This work helped reveal where carbon would be locked in by early strategic decisions, often well before individual buildings are defined.

Density optimisation, often a key decision maker in masterplanning, is actually more complicated than it would seem when carbon is considered.

Compact urban form performs well in whole place carbon terms, supporting walkability and shared infrastructure. Embodied carbon is a more nuanced picture.



Optimising building heights: Increasing heights from 3-6 storeys can lead to 4% improvement in embodied carbon (UMI modelling)

Lower rise development can enable timber and materially efficient structures, helping projects to meet the demanding targets set by the UK Net Zero Carbon Building Standard. Mid-rise schemes — typically five to six storeys — often strike a pragmatic balance between foundation efficiency, roof use and structural intensity, but are more likely to steer projects towards concrete solutions. Even taller buildings introduce a step change in structural, safety and servicing requirements that play out in embodied carbon, while low density expansion risks disproportionate infrastructure carbon, particularly on strategic sites where car dependency becomes a key challenge.

## Infrastructure – an underestimated carbon contributor

While building elements typically dominate a site's total embodied carbon, infrastructure still represents a significant and often underestimated contribution. Industry research has demonstrated how early masterplanning decisions can materially alter the

embodied carbon of enabling works. Our own testing has shown that while distributed infrastructure can defer emissions and allow adoption of future technologies, it may lead to higher whole life carbon once replacement and duplication are considered.

## Embodied carbon understanding must shape masterplanning decisions

The industry has begun to respond by setting embodied carbon benchmarks for buildings, increasingly incorporated into developer briefs and plot level requirements. This is necessary and welcome, but limited.

Established frameworks already exist to support a more holistic approach. BREEAM Infrastructure, promotes whole life carbon management aligned with PAS 2080. When its carbon credits are embraced, it can add strategic value to work already required through Environmental Impact Assessments, focusing attention early on where carbon reduction is most material rather than simply most measurable.

In practice, embodied carbon advice must become an active part of masterplanning. At Eddington, we used [Urban Modelling Interface \(UMI\)](#) to test different massing arrangements. While helpful, it also revealed a key insight: at this scale, form factor, building height and overall compactness are often reliable proxies for embodied carbon performance, and align closely with cost and heat loss optimisation. Modelling is helpful but it does not always add proportional insight early on. What matters more is carbon literacy shaping strategic decisions from the outset, setting parameters that keep low-carbon options open rather than relying on later optimisation to undo patterns that are already locked in.

# The science of design for health and wellbeing



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## How should we design our cities, towns and neighbourhoods for community, health and happiness?

With the UK government targeted to deliver 1.5 million new homes over the next 5 years, how do we ensure new developments are connected, integrated spaces that enable people to live happy and healthy lives?

Following our Nourishing Neighbourhoods research with Hawkins Brown and the Behaviour and Building Performance Group at the University of Cambridge, this article outlines key urban design interventions that can demonstrate measurable improvements in health and wellbeing outcomes, and crucially, why they work.



[Read more about Nourishing Neighbourhoods on the Hawkins / Brown website](#)

## Concentrate the nature dose

Green space is associated with improved mental health, reduced stress and increased physical activity, but proximity, usability and design quality are critical. People in towns and cities have greater exposure to nature when it is part of the streetscape. Tree coverage creates a buffer to both heat and wind, and shaded streets provide thermal comfort and enable people to walk further and for longer, increasing physical activity.

The practice of forest bathing in Japan has illuminated health benefits associated with inhaling natural volatile organic compounds (NVOCs) expressed by pine trees, lowering blood pressure and heart rate, activating the parasympathetic nervous system, and significantly improving immune function. Translating these effects into our cities, the introduction of specific species of trees could reduce airborne particulate matter and provide beneficial air quality that actively improves pedestrian health.

## Make walking, more interesting (and more challenging)

The benefits of physical exercise are widely known, but encouraging people to participate in exercise can be challenging. However, research has shown that people opt for shorter routes with elements of nature and signage, even if the routes were more physically challenging. Active and interesting walkways, combined with intuitive wayfinding, enable efficient navigation and greater use of pedestrianised routes.

Copenhagen's Trampoline sidewalk or Bourges Bubble sidewalk become attractions for people to walk through and engage with, while providing an opportunity for increased activity. When designing new developments, we can therefore encourage physical

activity by optimising the shortest route from A to B for physical and psychological health, integrating nature, elements of play, such as stepping stones, and interest to enrich and improve the everyday experience.

## Balancing connection and enclosure

Perceived safety heavily influences whether or not external spaces are used and engaged with for exercise (Perez-Tejera et al, 2022). Neighbourhoods should support healthy daily routines, compact mixed-use environments with access to amenities, with employment and public transport to enable active travel and reduce inequalities. Developments should opt for tall, narrow streets rather than wide streetscapes to increase perceived safety, with active frontages to enliven the streetscape and create environments people want to stop and spend time in.

Successfully incorporating simple techniques to support a flourishing neighbourhood means applying a scientific approach to design and test it rigorously. The built environment offers a powerful opportunity to move beyond simply avoiding harm, and instead creating places that gently encourage healthier, more connected and more fulfilling ways of living.

[Read the full article in the RIBA Journal.](#)

**Retrofitting first, and with boldness**



**Citizens Theatre Glasgow**

# Bold design for heritage



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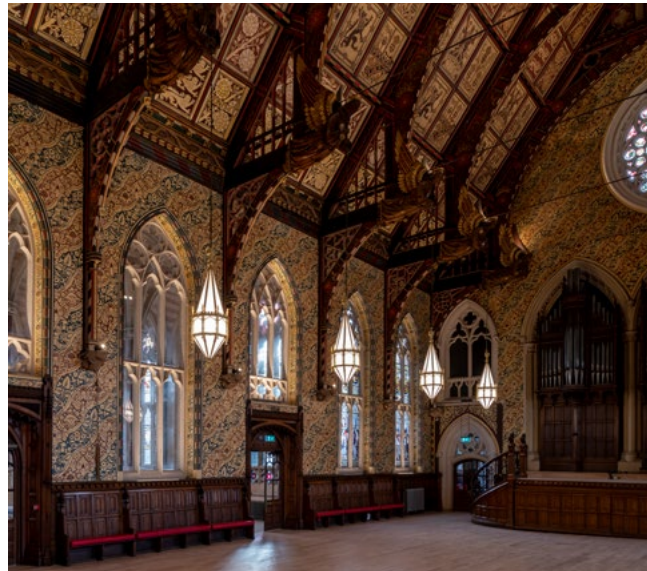
## “Fortune favours the brave when it comes to making historic buildings low-carbon and energy-efficient.”

Having worked on some of Greater Manchester’s most significant historic buildings, I’ve learned that perceptions about listed buildings can stifle ambitions. However, when we’re bold and creative with our low-energy aspirations for historic retrofits, we can absolutely deliver on low-carbon goals.

When retrofitting historic buildings, being bold is having the confidence to do less rather than more. A sensitive and creative restoration will breathe new life into an historic building, retaining elements of the original design that work well (i.e. natural ventilation and thermal mass) and supporting them with appropriate low-carbon technologies that bring the building up to modern standards of comfort.

At the Grade I-listed Rochdale Town Hall, we worked alongside architect Donald Insall Associates to double-glaze significant portions of the building. The roofs were insulated, with each roof structure requiring a carefully detailed solution developed through extensive investigative work.

The Town Hall had recently installed new gas boilers, so we designed a hybrid heating system which



The MEP systems were embedded inconspicuously behind and within architectural features to preserve the integrity of the Gothic details.

coupled them with more efficient air-source heat pumps. We turned the gas boilers down to 55°C to test if the hybrid system worked through the winter, and it did! Previously, the gas boiler had run for 10 hours a day in winter, so it was hot during the day and cold at night, stressing the delicate plaster, paint, and joinery with the constant changes in relative humidity. Our new strategy warmed the building in autumn and kept it there. The exposed stonework helps to regulate the temperature, which is now far more stable, and the heat pump does most of the work. The building is far more comfortable than it has ever been.

Historic buildings make fantastic design projects because you can see how they perform and get feedback on what isn’t working. It also means you can test and investigate options, such as different heating systems or lighting designs, and demonstrate

proposals to conservation officers before submitting for listed building consent. A digital twin or 3D model are no substitute for getting on your hands and knees and exploring how a building was put together, and how it can be made better in the real-world.

People are understandably nervous about listed buildings, but adventurous clients stand to benefit from being bold. The key to success is to employ a team that understands historic buildings and knows how to engage with clients, conservation officers, and other stakeholders. This role is no longer limited to the architect; an MEP engineer has a big role to play in communicating concepts and options. The right experience will reduce operating costs and protect your building from over-engineering, or inappropriate additions that could do more harm than good.



Air source heat pumps can be successfully integrated into historic settings when thoughtfully sited and detailed, without compromising the character of the building.

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# Rochdale Town Hall

CLIENT  
**Rochdale  
Development Agency**

ARCHITECT  
**Donald Insall  
Associates**

COMPLETION  
**2024**

SECTOR  
**Cultural, Heritage**

CONSTRUCTION VALUE  
**Confidential**

OUR SERVICES  
**• MEP Engineering**  
**• Acoustics**  
**• Architectural lighting**

AWARDS  
**• Europa Nostra Award  
2026**  
**• Civic Trust AABC  
Conservation Award  
2026**  
**• Civic Trust Michael  
Middleton Special  
Award 2026**  
**• RICS Heritage North  
West Award 2026**



Rochdale Town Hall, designed by William H Crossland and opened in 1871, stands as one of the most historically significant buildings in the country – described by Historic England as being ‘rivalled in importance only by those contained within the Palace of Westminster’. But by early in the 21st century, the building fabric had become highly compromised and deemed unfit for the changing needs of Rochdale Borough Council.

In addition to extensive repair and restoration work undertaken to the most historically significant areas such as The Great Hall and the Mayor’s suite of rooms, previously unseen spaces are now accessible to the public for the first time.

Over the past century, heating, ventilation and electrical installations have been unthoughtfully applied resulting in an uncared for institutional appearance to the interior. Full new mechanical and electrical installations throughout have meant that all services distribution routes are now concealed, restoring the interior to its original appearance, and bringing modern levels of comfort and efficiency. Better zoning of heating and lighting means better control and lower energy consumption, working with the new roof insulation and double-glazed windows. We restored and reused existing historic radiators so that the building

## Performance data and sustainability outcomes

ANNUAL GAS USAGE: 207 kWh/m<sup>2</sup>/y

OPERATIONAL ENERGY: 380 kWh/m<sup>2</sup>/y

UPFRONT CARBON (A1–A5): 131 kgCO<sub>2</sub>e/m<sup>2</sup>

EMBODIED CARBON (A1–C4): 297 kgCO<sub>2</sub>e/m<sup>2</sup>

is more efficient and comfortable than it ever has been - and more flexible. A Salix Grant funded an air source heat pump and new power supply to electrify the heating system and kitchens and reduce the dependence on gas. We estimate these interventions in combination will see a 55% reduction in carbon emissions, with the infrastructure now in place to deliver a net zero carbon, fully electrified building in the future.

## Lighting design

Lighting was a key part of this restoration project with a large proportion of the fittings recovered from the building. The beautiful Great Hall pendants were fully restored and rehung from the hands of the angels (the original location of the first gas lamps). The fittings in the newly glazed porte-cochère and clock tower entrance were sourced from an architectural salvage organisation and restored.

We converted the pendant lights to dimmable LED, with the same warm colour temperature to suit a building of this age and reflect the restored stained glass more effectively.

The lighting system now has more control. A switch at the door allows all fittings to be switched off by the last person out, so no lights are left on. Side corridors, bathrooms and offices are provided with occupancy detection so they automatically switch off when not in use. The Great Hall, Bright Hall and the Exchange all have special lighting control with scene-setting for the variety of events that will take place in these areas.

## Rochdale Town Hall

**“The level of collaboration between architect, engineers, client and contractors was the closest I have ever experienced and key to the success, the level of care and attention to detail have delivered a building that is probably closer to the original brief than it ever has been in its 150 year life. ”**

Iain Shaw, Director MEP Engineering



# Sustainable office retrofits



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## How can we see retrofit-first as the value creating opportunity that it is?

We know the planet cannot support endless new buildings, and as an industry we're grappling with how to embrace the retrofit-first shift we are seeing in the policy landscape. In December, we hosted a roundtable at New London Architecture (NLA) to explore the practical realities of adopting a retrofit-first approach in the built environment. We brought together voices across architecture, engineering, development and policy to examine how increasingly tough carbon-led legislation is reshaping retrofit delivery, and what the industry can do to embrace this an opportunity, not a constraint.

London boroughs are accelerating retrofit-first thinking through policies such as Westminster's Policy 43, signalling a decisive shift towards lower-carbon and more circular models of construction. While this direction is broadly welcomed, participants agreed that retrofit remains substantially more complex than new build delivery, with programmes, procurement models and risk frameworks often ill-suited to existing buildings.

One of the challenges is policy inconsistency at borough level. Differences in interpretation, measurement conventions, thresholds and evidence requirements create uncertainty, increase cost and slow decision-making. Case-by-case approaches are necessary given diverse building stock, but greater alignment would support more efficient and confident delivery.

A recurring theme was how to better understand, and de-risk retrofit projects. Decisions are frequently made early, based on incomplete or unreliable information, particularly where tenants remain in situ and intrusive investigations are constrained. Participants advocated for a defined investigative phase at project outset, allowing surveys, opening-up works and carbon optioneering to inform more realistic programmes. This requires recalibrating traditional RIBA Stages 1 and 2 to accommodate deeper design development and risk reduction.

We also agreed that early and genuine collaboration is critical. Bringing the full project team together, including involvement from facilities managers at the earliest stages improves understanding of existing systems and can result in significantly reducing operational carbon and running costs. We shared lessons from Soft Landings, and projects with long-term asset owners such as universities, demonstrating the value this approach can have on running costs.

Circularity and reuse are gaining traction, with pre-deconstruction audits and material salvage becoming more common, and sometimes helping to reduce costs. However, practical barriers remain around certification, re-warranty and logistics, particularly for MEP components, which represents both a major cost and a significant source of embodied carbon. Setting explicit reuse targets alongside embodied carbon goals is helping to prioritise meaningful outcomes, often through simple, low-cost interventions.

It's safe to say, we support retrofitting first because it reduces embodied carbon, supports reuse and historic preservation, and can significantly lower operational costs. It is mostly true that the greenest building is the one already built. Convincing investors is another story. While evidence shows that sustainable retrofit schemes can be approved more quickly and are more likely to attract high-quality tenants and long-term investment, unknowns, programme overruns and unforeseen costs make retrofitting risky.



# Helping historic buildings thrive with heat pumps



**Andrew McQuatt**

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## Decarbonising historic buildings is no longer a question of if, but how.

Heat pumps are now widely recognised as a critical technology for reducing reliance on fossil fuels across the built environment, yet their application in historic and listed buildings continues to attract scepticism. Concerns about performance, visual impact, noise, and compatibility with traditional building fabrics persist.

To help move the debate forward, Historic England commissioned a series of studies into the use of heat pumps in historic buildings. Working across domestic and non-domestic settings, we investigated air-source, ground-source, and water-source heat pump installations, drawing on site visits, system inspections, and interviews with building users. The outputs of this work were [four detailed guidance reports](#), each focused on a different heat source, but united by a common question: what determines success for these systems?

The clearest conclusion from the studies is that the heat pumps themselves are rarely the problem. Across all three technologies, systems were generally capable of reliably and efficiently delivering heat. Where outcomes fell short of expectations, the causes were almost always found elsewhere: in heating distribution design, control strategies, or a mismatch between the system and the building's use.

Historic buildings are often assumed to be ill-suited to low temperature heating. In practice, many



Air source heat pumps can be successfully integrated into historic settings when thoughtfully sited and detailed, without compromising the character of the building.

characteristics of older buildings can work in a heat pump's favour. High thermal mass, frequent occupation, and conservation-led heating strategies can align well with the steady, efficient operation of heat pumps. In many cases, existing pipework and emitters were retained, reducing disruption and embodied carbon while still achieving meaningful operational carbon savings.

The research also challenges some of the most common fears associated with heat pumps in heritage contexts. Visual impact and noise were rarely a concern for occupants or operators, and attempts to conceal equipment sometimes introduced new technical issues rather than resolving aesthetics. Similarly, cold air discharge from air source units was generally acknowledged but not considered problematic when equipment was appropriately sited.

One theme recurred throughout the studies: heat pumps must be treated as part of a whole system. Flow temperatures, emitter sizing, buffer volumes, and controls logic all have a profound influence on performance and running costs. The research has been influential in our own projects, with Rochdale Town Hall, Wolfson College Oxford and Poole Museum all successfully implementing heat pumps in heritage contexts.

Taken together, the Historic England heat pump studies point to a necessary shift in emphasis. The conversation needs to move beyond basic questions around the viability of heat pumps, and towards good design, careful integration, and long term optimisation. With the right engineering approach, heat pumps are not a compromise for historic buildings, they are a practical and essential part of their low-carbon future.



At Wolfson College Oxford, external air source heat pump installations were rarely found to cause problems with noise, appearance, or cold air discharge when sensibly located and properly detailed.

# Power Hall, Manchester Science and Industry Museum

CLIENT  
**Science and Industry  
Museum Manchester**

ARCHITECT  
**Carmody Groarke**

COMPLETION  
**2025**

SECTOR  
**Cultural  
Science and  
Technology**

CONSTRUCTION VALUE  
**£8.61M**

OUR SERVICES  
**• MEP Engineering  
• Decarbonisation**



## A major refurbishment celebrating engineering innovation

In 2021, we supported the Science and Industry Museum in a successful application for the government's Public Sector Decarbonisation Scheme (PSDS) capital works fund. The Museum secured £4.3M to support its goal of becoming net zero carbon by 2033.

We were also appointed to upgrade and decarbonise the working display of historic engines in the Power Hall: Andrew Law Gallery, and to rejuvenate the wider museum site to support the Science Museum Group's net zero carbon vision. Working alongside Carmody Groarke Architects, we have supported the sensitive restoration and upgrade of the Museum's historic buildings, creating an enhanced visitor experience, and celebrating innovation through low-carbon technologies.

Our strategy has been based on electrification of the site, taking advantage of the decarbonisation of the national grid, and making the new electric-based system as efficient as possible. A new electric steam boiler and distribution system has replaced the gas-

## Performance data and sustainability strategy

FOSSIL FUEL FREE: Yes

CARBON EMISSION REDUCTION: 515 tonnes of CO<sub>2</sub> per year (predicted)

HEAT EXTRACTION/REJECTION: two 80m deep extraction boreholes

fired system on a more limited usage policy, reflecting a more considered approach to energy consumption. Excess heat is recovered from the steam condensing process, and low-carbon heat is generated via water-source heat pumps, utilising the natural aquifer located beneath the site.

## A low energy, site-wide MEP strategy

Within the Power Hall, new heating, lighting, glazing and roof insulation have further reduced energy consumption and improved the visitor experience by removing and concealing clumsy modern interventions. A new control system allows the energy and carbon data to be accumulated and analysed, allowing us to identify opportunities to further reduce carbon emissions and running costs.

Overall, we expect to reduce the carbon emissions by around 515 tonnes of CO<sub>2</sub> per year.

The Power Hall tells the history of Manchester and its part in the industrial revolution, and our aim has been to tell the story of the 'green industrial revolution', illustrating the route to transition to a low-carbon future.

## Powering Victorian industrial machinery with clean energy

The SIM Power Hall first opened to the public in 1983, with a working display of 18th and 19th-century mill and factory machinery powered by a gas-fired steam boiler. Central to

# Power Hall, Manchester Science and Industry Museum

our design is a new 780kW electric steam boiler that provides steam to power seven of the historic engines, the earliest from 1864, via high-pressure and low-pressure circuits. With no available technical data for the 19th-century machinery, we had to estimate the steam consumption and condensate production of the engines during startup and steady running.

The steam condenses before it returns to the boiler, providing abundant heat to recover and reuse. In the past, this process was run by gas, and the heat went to waste, but now heat exchangers capture energy from the steam to heat the Power Hall and the 1830 Warehouse (via heaters on a separate loop, concealed under the historic railway platforms). When the historic machines aren't running and the steam system isn't in use, a water source heat pump warms the museum buildings.

The water source heat network is over 800m in length, and includes 401m of borehole pipework and an additional 407m of steam pipework in the Power Hall. In the Museum's upper yard, two 80m deep extraction boreholes are used for heat extraction and rejection from the steam condensing process. A borehole has also replaced the noisy and unsightly cooling towers.



The MEP plant room is proudly on display at Power Hall as part of explaining and showing and understanding how machines and systems operate.

**“There was a certain romance in decarbonising the historic working machines in the Power Hall. These machines, once driven by coal, have now been modernised as part of a ‘green industrial revolution’.**

**And where better to tell the story of decarbonisation than in the Power Hall - the home of the Industrial Revolution?”**

Iain Shaw Director MEP Engineering

# Temple Quarter Enterprise Campus (TQEC) Research Hub

CLIENT  
**University of Bristol**

ARCHITECT  
**Allford Hall Monaghan  
Morris**

COMPLETION  
**2025**

SECTOR  
**Education**

CONSTRUCTION VALUE  
**£18M**

OUR SERVICES  
• **MEP Engineering**  
• **Acoustics**  
• **Environmental  
design**

AWARDS  
• **RIBA - Regional  
Award - Shortlist**



The new Temple Quarter Enterprise Campus (TQEC) Research Hub, at the University of Bristol, provides research facilities for the Bristol Digital Futures Institute (BDFI) and a home for MyWorld, a hub focused on bringing together leaders in creative technology innovation.

Bristol University's new TQEC Research Hub repurposes two Victorian industrial buildings, restoring the historic building fabric as an outer skin to enclose new state-of-the-art media facilities, suitable for both academic and commercial use.

The facility comprises the Retort House (former home of the Bristol Gas Light Company), which dates from 1821; and the Coal Shed, which was built around 1850. Both buildings have significant historic character and interest, but before the project began, they were dilapidated and needed substantial restoration.

The project aimed to provide 45,000 ft<sup>2</sup> of space for cutting-edge specialist digital media facilities, including a commercial-standard television studio, an auditorium with a Dolby Atmos spatial audio system and audience monitoring technology, associated editing suites and control rooms, a 3D reality emulation suite, and workspaces and meeting rooms for 250 staff and researchers.

The facilities in the Coal Shed are housed in a new cross-laminated timber structure constructed inside the existing outer structure,

## Performance data and sustainability outcomes

FOSSIL FUEL FREE: Yes

OPERATIONAL ENERGY: 337 kWh/m<sup>2</sup>/y (predicted)

UPFRONT CARBON (A1-A5): 583 kgCO<sub>2</sub>e/m<sup>2</sup>

EMBODIED CARBON (A1-C4): 903 kgCO<sub>2</sub>e/m<sup>2</sup>

ON-SITE RENEWABLE ENERGY GENERATION: 9,928 kWh/y

which helps to acoustically isolate the technical spaces from outside noise. The combination of high-performance spaces, the swift pace and phasing of this project and 200-year-old existing structures posed many challenges, and required the whole design team to think creatively throughout the process.

## Developing an energy strategy

These high-tech facilities are inherently energy-intensive, so developing an energy strategy sympathetic to high peak loads and high cooling demands was key. New roof coverings, doors and glazing were installed to improve the thermal performance of the building fabric, which corresponded to approximately 43% of the building envelope.

The systems are designed to be acoustically quiet, especially in the television studio and associated control rooms. A combination of natural and mechanical ventilation was chosen to suit perimeter or landlocked spaces and the acoustic requirements. Very careful mechanical design was required to achieve the stringent noise criteria for the studio spaces and control rooms. The exposed thermal mass of the retained masonry walls allows a night-cooling strategy to be adopted in naturally ventilated spaces. Through a UK Research and Innovation net zero grant, an efficient reversible heat pump system was installed, which recovers waste heat from the site's large data centre and redistributes it around the site. A large battery array is combined with photovoltaic (PV) panels and a

# Temple Quarter Enterprise Campus (TQEC) Research Hub

micro-grid management and control system to allow efficient energy usage and research into the operation of micro-grids.

## Innovative acoustic and lighting design

The development offers a reality emulator for creating 3D digital twin modelling, a smart cinema for measuring technology's impact on humans, multi-camera live studios, and production facilities. The acoustic and lighting designs were highly specialised due to the facility's demands and were developed in collaboration with an external studio consultant.

The studio, associated control rooms and editing suite, and the instrumented auditorium within the Coal Shed are highly acoustically sensitive spaces, designed to meet the full television industry specifications. Delivering these levels of acoustic performance within an existing building was a challenge, and doing so within the cross-laminated timber (CLT) structure, specified because of its low embodied carbon, even more so. The acoustic separation and ventilation designs were carefully detailed to achieve the low noise levels required for this facility to operate effectively. Independent isolated structures were built within the primary building structure, using "box-in-box" principles designed to isolate the acoustically sensitive studios from the rest of the building and exterior noise.

The auditorium includes a full Dolby Atmos system, with an array of over 30 full-range speakers to produce 3D spatial audio at commercial cinema levels. This required careful design to provide acoustics within the room that support the immersive audio system, and also to protect adjacent areas from the high noise levels it produces.



The lighting was carefully designed to produce the highest-quality visual media. The general lighting within the studio spaces has been precisely selected to match daylight and be consistent throughout the spaces so that images are consistent across all spaces and on all screens.

Within the Retort Shed, careful acoustic design was required to separate the workshop, training, and computer rooms, forming the staff research accommodation adjacent to the immersive projection space of the reality emulator. Manually adjustable blinds allow for daylight control and multiple operating modes ensure that strict acoustic targets are met while also ventilating the space.

**“The project has restored these impressive Victorian buildings to their original splendour; previously lost amongst a sea of car showrooms, they will be a great addition to the city’s views as people arrive into the station by train. ”**

Henry Rock-Evans, Principal Engineer



Rochdale Town Hall

# UK Net Zero Carbon Building Standard and high performing buildings



Natural History Museum - Urban Nature Project

# The UK Net Zero Carbon Building Standard and points of debate



**Henry Pelly**  
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The UK Net Zero Carbon Buildings Standard (UK NZCBS) is widely regarded as one of the most significant recent initiatives in the UK built environment sector. It has been developed to bring long overdue clarity to a fundamental question: what it truly means for a building to be aligned with a net zero carbon world. In doing so, the standard addresses the longstanding problem of inconsistent and often unsubstantiated net zero claims, offering a clear, measurable and industry-wide framework.

## Focusing on real-world performance

Building on the UK Green Building Council's earlier Net Zero Carbon framework, the UK NZCBS is more comprehensive and prescriptive. It provides a consistent approach for assessing net zero carbon alignment by setting definitive limits for both operational and embodied carbon. These limits are measurable, time bound and designed to become more stringent over time, in line with the UK's carbon budgets. Importantly, the standard prioritises real world performance: offsetting is not required, and net zero claims can only be made once buildings are completed and operational. This focus on delivery rather than design intent significantly strengthens the credibility of the standard.

The UK NZCBS is also notable for the way it has been developed. Led by major industry bodies including RIBA, LETI, CIBSE, RICS and UKGBC, and informed by hundreds of professionals through task and sector groups, it represents a strong example of industry



The University of Portsmouth's Ravelin Sports Centre completed in 2022, has an actual energy use that would meet the limits right up until 2050.

collaboration. The pilot phase involved testing the standard against real projects, followed by the recent publication of Version 1 in March 2026.

The pilot sets clear requirements, including a ban on fossil fuel use, limits on energy use intensity (EUI) and upfront embodied carbon tailored by building type and project scope, minimum photovoltaic generation, and caps on refrigerant global warming potential. Projects must also report on peak energy demand and whole life carbon (WLC). Together, these measures address the key areas where design teams can meaningfully influence carbon outcomes.

## Points of debate

However, the standard has also attracted criticism. One concern is the differing upfront carbon limits for retrofit and new build projects. While retrofit

limits are lower in absolute terms, evidence shows they are generally more achievable, reflecting the significant carbon savings associated with retaining existing structures. The framework also ensures that substantial extensions or rebuilds within retrofit projects are assessed against new build limits, rewarding genuine retrofit rather than superficial retention.

Another point of debate is the absence of an absolute WLC limit. While such a limit may appear desirable, WLC assessments rely on uncertain assumptions about future energy decarbonisation, material lifespans and end of life scenarios. By contrast, upfront embodied carbon and operational energy use are measurable and verifiable today. The requirement to report WLC, alongside the intention to introduce limits in future, reflects a pragmatic balance between ambition and feasibility.

The update to Version 1 from the pilot version has been informed by industry feedback. It has increased the upfront carbon limit for offices and schools (by 10%). The EUI targets for offices, retail, storage and distribution and residential buildings and schools, were increased from 5-25%, which makes them more achievable, if still challenging in practice, even for Passivhaus schemes.

Despite these challenges, the UK NZCBS represents a major step forward. It sets a clear direction, establishes credible benchmarks and provides the industry with a robust framework to measure progress. While refinement is still needed, the standard already offers a powerful tool for driving genuinely net zero aligned buildings and accelerating climate action across the sector.

# Testing the UK Net Zero Carbon Building Standard



**Chris Price**

**Senior Sustainability Consultant**

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## Key findings from UK NZCBS Demonstrator study

At the start of this year we examined how the UK NZCBS can be applied to a typical mid-rise residential development, as part of a demonstrator study [undertaken by Buttress, Price & Myers and Max Fordham](#). The study examined how the UK Net Zero Carbon Buildings Standard (UK NZCBS) can be applied to a typical mid-rise residential development. Its central aim has been to test whether the Standard's upfront embodied carbon limits are achievable using current construction practices, materials and datasets, and to identify practical implications for future delivery.

The study has demonstrated that compliance with the UK NZCBS upfront carbon targets are technically achievable for low and mid-rise residential buildings. The case study, a six-storey residential scheme under 18m in height, achieves a total upfront embodied carbon figure of  $442\text{kgCO}_2\text{e/m}^2$  (A1-A5). This figure meets the NZCBS 2028 limit for new build flats, set at  $450\text{kgCO}_2\text{e/m}^2$ , effectively outperforming the current 2025 requirement by around three years, and provides strong evidence that the early milestones set by the Standard are grounded in real-world construction performance.

## Reliance on scarce resources

As with all studies, it comes with significant caveats. Firstly, the case study site is flat, simple and has



Agar Grove 1C

reasonable ground conditions, in other words it's a site that doesn't suffer from many constraints. Secondly, and more pertinently, the structural carbon is mitigated by over-specifying constrained resources, namely high-recycled content steel and cement substitution using ground-granulated blast furnace slag (GGBS). The elephant in the room is that new-builds often rely upon scarce resources such as GGBS to achieve ambitious net zero carbon limits. These resources tend to have minimal real-world carbon reductions, but there's a tangible benefit because they help to drive demand for lower carbon alternatives

that can slowly shift the whole market carbon performance. But, can you build a low-carbon building that achieves its aims in the real world, as well as on paper?

Another key finding is that regardless of the materials specified, embodied carbon reductions are achieved cumulatively rather than through a single design move. **Lean structural design and compact form are paramount**, and building services strategies need to have carefully balanced whole-life impacts. Early interdisciplinary collaboration through optioneering is vital to securing practical, buildable and integrated low-carbon buildings.

The study highlights some significant challenges down the road. Beyond 2028, further reductions will become increasingly difficult without deeper change. Structural systems and building services are stubborn sources of carbon that cannot be eliminated through specification alone. In addition, there is a growing tension between embodied carbon targets and other regulatory requirements, particularly fire safety under Approved Document B. Buildings over 18m, which require additional stair cores and structure, are currently unlikely to meet UK NZCBS limits without regulatory reform or major material innovation.

Overall, the demonstrator study confirms that the UK NZCBS is both ambitious and achievable in the near term, but susceptible to relying heavily on materials specifications that overstate carbon savings. It shows that while compliance is possible using today's tools, meeting future limits will require coordinated progress across design practice, material manufacturing, grid decarbonisation and regulation.

# Spencer Building, Corpus Christi College, University of Oxford

## CLIENT

**Corpus Christi College, University of Oxford**

## ARCHITECT

**Wright & Wright Architects**

## COMPLETION

**2025**

## SECTOR

**Education**

## CONSTRUCTION VALUE

**£9.8M**

## OUR SERVICES

- **MEP Engineering**
- **Passivhaus**
- **Acoustics**

## AWARDS

- **RIBA Regional Shortlist 2026**

## ACCREDITATIONS

- **Passivhaus**



The Spencer Building is a new 480m<sup>2</sup> Passivhaus-certified, purpose-built library and special collections centre at Corpus Christi College. It houses the college's highly valued special collection of manuscripts and early printed books, including works by Erasmus, the Venerable Bede and Galileo.

The new Spencer Building retains the existing, listed façade of the original structure, preserving the past and seamlessly extending the 16th-century Old Library building, providing an ultra-low-energy, permanent home for the library and the archive. On the side facing Oriel Square, a new façade has been created, matching the limestone of the surrounding buildings.

The new library is situated within a highly constrained parcel of land, and interfaces with historic fabric on three sides – the Old Library, a section of the medieval City Wall and the adjacent Old Lodging Building.

Both the footprint of the new library and its relationship with the surrounding listed structures posed challenges to the building services design, as well as to achieving a high-performance, low-energy environmental strategy.

## Performance data and sustainability outcomes

PRIMARY ENERGY RENEWABLE (PER) DEMAND: 65 kWh/m<sup>2</sup>/y area-weighted average (bespoke PER limit)

FOSSIL FUEL FREE: Yes

PEAK HEATING LOAD: 11 W/m<sup>2</sup> (predicted)

ANNUAL SPACE HEATING: ≤ 15 kWh/m<sup>2</sup>/y (predicted)

RENEWABLE ENERGY GENERATION: 13 kWh/m<sup>2</sup><sub>tp</sub>/y against building footprint

AIRTIGHTNESS : 0.56 @50 Pa (main building) 0.5 (archive)

## The design

Heating and cooling for the library and archive are provided by ground-source heat pumps via four boreholes in the car park. The library and the archive, though housed in the same building, have different environmental requirements.

The library uses a hybrid ventilation strategy, with mechanical ventilation with heat recovery (MVHR) providing reliable low-energy ventilation in winter, combined with natural ventilation with openable windows and automatically controlled rooflights during the summer.

The archive requires very specific conditions, which are largely passively maintained. Additional mechanical cooling and humidity control are utilised when needed during the hotter summer months. Mechanical ventilation is run briefly at night to refresh the air, maintaining a tightly controlled climate suitable for the preservation of the archive and the special collection.

The Passivhaus standard was chosen to minimise energy use, provide a stable temperature throughout the building, and control temperature and relative humidity within the archive. Alongside qualitative advice, the Passivhaus energy model, Passivhaus

# Spencer Building, Corpus Christi College, University of Oxford

Planning Package (PHPP), was used from the early stages to develop the design in coordination with the architect and the rest of the design team. We then provided support to the team through detailed design development, and worked closely with them and the main contractor through construction.

An airtight concrete structure was designed against the City Wall, with the wall's thermal mass moderating the temperature naturally, along with extensive insulation and high-performance triple-glazed windows.

The acoustic design for the library delivered appropriate sound insulation to enclosed rooms, ensuring privacy where required. In addition, the controlled reverberation character of the spaces and robust noise control of mechanical services, which meet all Passivhaus noise criteria, ensure a comfortable acoustic environment for the users.

## Performance

The passive approach and low-energy MEP design, using ground-source heat pumps for heating and cooling, mechanical ventilation with efficient heat recovery, and roof-mounted photovoltaic panels, means that the all-electric building requires minimal space heating.



# Bluebird Project, Southend-on-Sea

CLIENT  
**HARP**

ARCHITECT  
**SKArchitects Ltd**

COMPLETION  
**2022**

SECTOR  
**Residential**

CONSTRUCTION VALUE  
**£1.6M**

OUR SERVICES  
• **MEP Engineering**

AWARDS  
• **CIBSE Building Performance Award 2026**  
• **RIBA East Sustainability Award 2024**  
• **AJ Architecture Awards 2023**

ACCREDITATIONS  
• **Passivhaus**



The Bluebird Project is a multi award-winning, Passivhaus-certified supportive housing development in Southend-on-Sea that provides high-quality accommodation for people experiencing homelessness. Delivered for the Southend-based homelessness charity Homeless Action Resource Project (HARP) and designed by SKArchitects, the project demonstrates how ambitious environmental performance and strong social value can be achieved within tight budgets and operational constraints.

Environmental performance is central to the project's ethos. The new-build mews homes are fully Passivhaus certified and entirely fossil-fuel free, with heating and hot water provided by air-source heat pumps. A rigorous approach to building form, glazing, airtightness and services integration enabled the scheme to achieve excellent energy efficiency, significantly reducing operational costs for the charity. Systems were intentionally designed to be simple, intuitive and dependable, ensuring ease of use for occupants and maintainability for a non-residential landlord with no permanent on-site staff.

## Performance data and sustainability outcomes

FOSSIL FUEL FREE: Yes

OPERATIONAL ENERGY (EUI): 76 kWh/m<sup>2</sup>/y

UPFRONT CARBON (A1-A5): 375 kgCO<sub>2</sub>e/m<sup>2</sup>

EMBODIED CARBON (A1-C4): 593 kgCO<sub>2</sub>e/m<sup>2</sup>

AIRTIGHTNESS: 0.6 ACH@50Pa

To achieve Passivhaus certification the project adopted a rigorous approach to the overall form, orientation, quantities of glazing, solar shading and services throughout the design development. HARP sought to make sustainable choices wherever possible, resulting in a gas-free approach to the new build with six air source heat pumps that serve the heating and hot water requirements. Flow restrictors or low usage fixtures and appliances reduce water consumption, and rainwater collection is utilised by residents to water the gardens. Passivhaus-certified Mechanical Ventilation with Heat Recovery (MVHR) units were also installed to provide high indoor air quality whilst minimising heat loss.

Beyond measured performance, Bluebird exemplifies the role of thoughtful engineering and design in delivering social impact. HARP's strong commitment to sustainability shaped decisions throughout the project, embedding long-term environmental responsibility alongside improved quality of life for residents. The result is a calm, comfortable and aspirational environment that challenges stereotypes of homelessness accommodation and demonstrates that excellent performance and social purpose can go hand in hand. Bluebird stands as a replicable model for sustainable, supportive housing across the UK.

# Dulwich College Junior and Lower School Library

CLIENT  
**Dulwich College**

ARCHITECT  
**alma nac Ltd**

COMPLETION  
**2024**

SECTOR  
**Education**

CONSTRUCTION VALUE  
**£6M**

OUR SERVICES  
• **MEP Engineering**  
• **Sustainability Consultancy**  
• **Net zero carbon specialist**  
• **Acoustics**

AWARDS  
• **Education Property Awards, School Project of the Year 2026**  
• **Education Estates Awards, Independent School Project of the Year 2026**

ACCREDITATIONS  
**BREEAM Excellent**



For buildings to be genuinely sustainable it's important that they meet net zero carbon (NZC) standards for energy use and embodied carbon, but that they are also comfortable, healthy places to spend time in.

Dulwich College Lower School Library (LSL) achieves this. It has met the NZC standards defined by LETI and RIBA, along with a host of health and wellbeing characteristics. This has been demonstrated through post-occupancy evaluation (POE) through as-measured data, wherever possible.

The building is an 860m<sup>2</sup> new-build block connected to an existing 1960s building on the Dulwich College campus. It includes a 50-person library, specialist ICT classrooms, offices, WCs and circulation spaces.

The building was completed and occupied in summer 2024, and feedback from the Library Staff has noted a marked increase in student reading.

## The design

The energy strategy incorporates a "nearly-Passivhaus" approach, striking a balance between performance and cost. The design

## Performance data and sustainability outcomes

FOSSIL FUEL FREE: Yes

OPERATIONAL ENERGY: 63 kWh/m<sup>2</sup>/y

UPFRONT EMBODIED CARBON (A1-A5): 570 kgCO<sub>2</sub>e/m<sup>2</sup>

OPERATIONAL WATER USE: 1.7 m<sup>3</sup>/pupil/year

PEAK ELECTRICITY DEMAND: 35 W/m<sup>2</sup>

DAYLIGHT: All occupied rooms meet the (UDI and SDA) BREEAM standard

SUMMER COMFORT: Less than 3% of occupied hrs exceed 25°C

INTERNAL AIR QUALITY: Daily average CO<sub>2</sub> < 1000ppm for 99.5% of occupied hours

includes an efficient shape, optimised glazed areas, 300mm insulation, triple glazing, excellent draught-proofing, mechanical ventilation with heat recovery (MVHR), heating and cooling with air-source heat pumps (ASHPs), a mixture of passive and active cooling, highly efficient lighting, and sophisticated system controls.

The embodied carbon strategy also benefits from the simple, efficient building shape alongside features such as keeping structural spans low, a recycled arc furnace steel superstructure frame (partly produced using hydropower), high proportions of low-carbon cement replacement, mineral wool insulation, and lightweight hollow GRC cladding.

**"This project marks a pivotal moment in our ongoing masterplan to create sustainable, future-facing educational environments."**

Dulwich College

# Dulwich College Junior and Lower School Library

## Net zero carbon headlines

The NZC strategies have been successful, and upfront embodied carbon is 5% lower than the LETI specified target for NZC compatible buildings, and 3% lower than the UK Net Zero Carbon Building Standard (UK NZCBS) limit for projects commencing construction in 2025. The as-measured energy consumption is 3% lower than the corresponding LETI NZC target and just 3% higher than the UK NZCBS limit for projects commencing construction in 2025.

## Health and wellbeing metrics

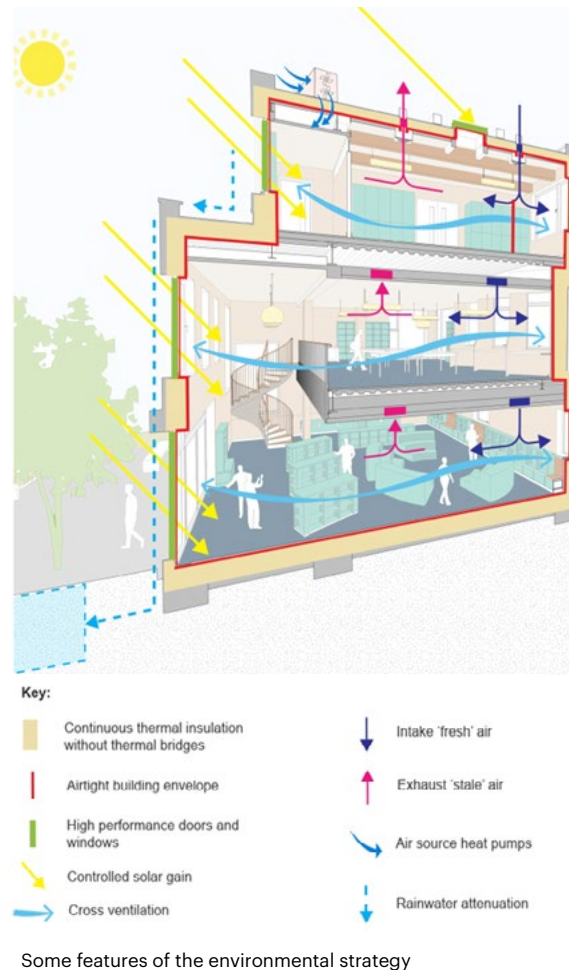
The following health and wellbeing metrics include those specified in the RIBA 2030 Climate Challenge.

**Daylight is good:** Climate based modelling of the as-built design shows all the spaces achieved the challenging BREEAM HEA O1 standard.

**Summertime overheating is avoided:** Room temperature data logs show all the occupied rooms met the RIBA target of less than 1% of occupied hours exceeding 28°C and less than 3% exceeding 25°C.

**CO<sub>2</sub> air quality is good:** The CIBSE recommend target for room CO<sub>2</sub> level is a daily average concentration < 1000ppm. Room CO<sub>2</sub> data logs show the occupied rooms meet this for 99.5% of the relevant period.

**Levels of airborne contaminants formaldehyde and VOC are good:** The average formaldehyde and total VOC air concentrations were measured near practical completion at 28 g/m<sup>3</sup> and 252 g/m<sup>3</sup>, both below the corresponding RIBA targets of 100 g/m<sup>3</sup> and 300 g/m<sup>3</sup>.

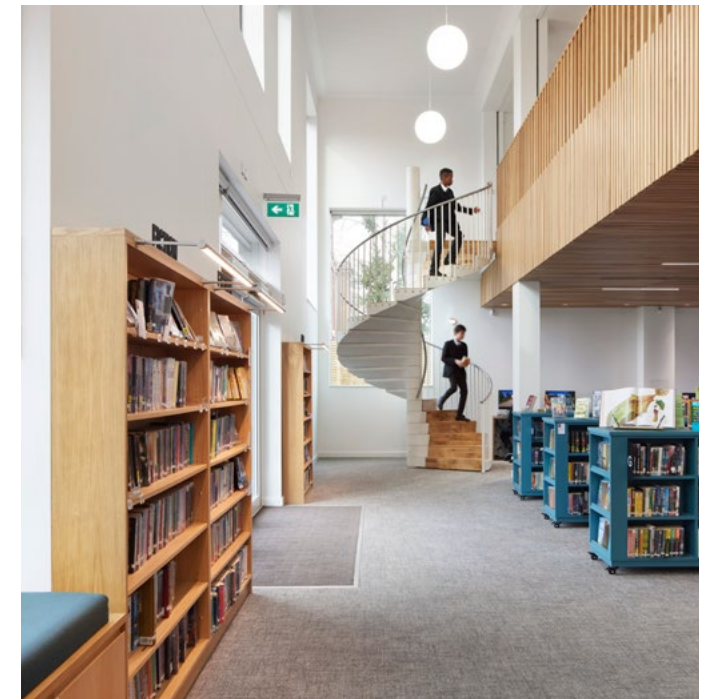


## Insight for future projects

A similar design, with some modifications, would be likely to meet the UK NZCBS, meeting their 2030 standard for operational energy. We'd propose a certified Passivhaus approach, improved draught lobbies and more efficient IT equipment.

Embodied carbon is more challenging; requiring considerations such as; CLT superstructure, reducing foundation mass, unfired bricks and simplifying the shape.

Water conservation is becoming a major issue; to meet the RIBA 2030 target rainwater harvesting would be required.



# Sevenoaks School New House

CLIENT  
**Sevenoaks School  
Foundation**

ARCHITECT  
**Tim Ronalds  
Architects**

COMPLETION  
**2024**

SECTOR  
**Education, Residential**

CONSTRUCTION VALUE  
**£9.3M**

OUR SERVICES  
• **Acoustics**  
• **Environmental  
design strategies**  
• **MEP engineering**



Sevenoaks School New House is a purpose-built boarding house provides fully electric accommodation for 60 female students, and is designed to Passivhaus principles for a low-carbon future. Designed by Tim Ronalds Architects, the project follows the success of the school's award-winning Aisher House and continues a shared commitment to comfort, wellbeing and environmental responsibility. We provided MEP engineering, acoustic design and sustainability consultancy, bringing continuity of expertise while refining design strategies developed on the earlier scheme.

Sustainability is central to the project's approach, with the building designed in line with Passivhaus principles to support a low-carbon future. The building is fossil-fuel free and constructed using cross-laminated timber (CLT), selected for its low embodied carbon. Energy demand is minimised through a high-performance building envelope, while ventilation is delivered via mechanical ventilation with heat recovery (MVHR) systems. Heating and hot water are provided by air-source heat pumps, and the building benefits from natural ventilation during summer months.

Together, these strategies create a highly efficient, comfortable living environment with reduced operational carbon.

## Performance data and sustainability outcomes

FOSSIL FUEL FREE: Yes

OPERATIONAL ENERGY: 20 kWh/m<sup>2</sup>/y (predicted)

UPFRONT CARBON (A1-A5): 514 kgCO<sub>2</sub>e/m<sup>2</sup>

EMBODIED CARBON (A1-C4): 994 kgCO<sub>2</sub>e/m<sup>2</sup>

POTABLE WATER: 53 litres per person/day (predicted)

Internally, New House is organised around naturally lit, spacious bedrooms and communal areas that foster a homely and sociable atmosphere. Generous shared spaces, including common rooms and circulation areas with window seating, provide places for students to relax and socialise. Careful consideration has been given to daylighting, with skylights drawing natural light into the core of the building, enhancing wellbeing and reducing reliance on artificial lighting.

Acoustic performance was a key design focus, particularly given the CLT structure and the close proximity of bedrooms to social spaces. The acoustic strategy builds on lessons learned from extensive post-occupancy testing at Aisher House, allowing wall and floor build-ups to be optimised for both performance and material efficiency. This approach achieved sound insulation levels significantly above regulatory requirements while reducing spatial demand, cost and embodied carbon.

Acoustic plaster and slatted timber finishes have been used within communal areas to limit sound build-up, while carefully specified doors and partitions ensure strong separation between social and private spaces. The result is a quieter environment that supports rest, concentration and overall wellbeing.

By combining a fabric-first approach, low-carbon construction and carefully considered acoustic and environmental strategies, Sevenoaks School New House delivers high-quality accommodation tailored to the needs of teenage residents.

# Sevenoaks School New House

The project demonstrates how environmentally responsible design can be seamlessly integrated with comfort, durability and architectural expression, contributing positively to both student experience and the school's broader sustainability ambitions.



# Schwarzman Centre for the Humanities, University of Oxford

CLIENT  
**University of Oxford**

ARCHITECT  
**Hopkins Architects**

COMPLETION  
**2025**

SECTOR  
**Education**

CONSTRUCTION VALUE  
**£185M**

## OUR SERVICES

- **MEP engineering**
- **Acoustics**
- **Passivhaus**
- **Architectural lighting design**
- **Environmental design strategies**

## ACCREDITATIONS

- **Passivhaus**



The Schwarzman Centre, designed by Hopkins Architects with us as the M&E engineers, acoustic and lighting designers, and contractor-side Passivhaus advisors for Laing O'Rourke, is a major new cultural campus in the heart of Oxford's Radcliffe Observatory Quarter, and the largest single building project ever undertaken by the University of Oxford. The Radcliffe Infirmary Quarter is a 10-acre site that has been under development since 2009. The centre has been developed by the University of Oxford with the support of a gift of £185 million from philanthropist and businessman Stephen A. Schwarzman.

The Schwarzman Centre provides a unique mix of academic teaching facilities for Oxford students and staff with world-class research and performance spaces, bringing leading figures from different disciplines together to demonstrate the power of the humanities to tackle the major challenges facing society today.

## Bringing the humanities together

The state-of-the-art spaces co-locate Oxford University's Humanities faculties for the first time and will also house the Institute for Ethics in AI, the Oxford Internet Institute and the new Bodleian Humanities Library. Public performance spaces include

## Performance data and sustainability outcomes

FOSSIL FUEL FREE: Yes

PER ENERGY DEMAND: 71 kWh/m<sup>2</sup>/y (PHPP predicted)

ENERGY USE INTENSITY: 63 kWh/m<sup>2</sup>/y (TM54 predicted)

PEAK HEATING LOAD: 6 W/m<sup>2</sup> (PHPP predicted)

ANNUAL SPACE HEATING DEMAND: 7 kWh/m<sup>2</sup>/yr (PHPP predicted)

ON-SITE RENEWABLE ENERGY GENERATION: 32,000 kWh/y (TM54 predicted)

% OF EUI SUPPLIED FROM RENEWABLES: 2.1

AIRTIGHTNESS: 0.66 m<sup>3</sup>/m<sup>2</sup>/h @50Pa (0.16ACH@50Pa)

the 500-seat Sohmen Concert Hall, a 250-seat theatre to host drama and dance, a black box immersive performance space, a cinema, an exhibition space, a museum for the display of the renowned Bate Collection of historic musical instruments, and a café and a bar, all set in extensive gardens. The development comprises over 25,300 square metres of space and nearly 1,000 rooms.

## A sustainable design

Sustainability was a key design principle for the project, and the building is now the largest Passivhaus scheme in England and the only Passivhaus concert hall in the world.

We worked closely with the design team to bring together servicing solutions for the huge variety of functions, from the concert hall right down to individual academics' studies. The services strategy, designed to Passivhaus standards, ensured ultra-low energy use and resilience to climate change through demand-controlled ventilation with heat recovery and all-electric heat pump-based heating and cooling.

# Schwarzman Centre for the Humanities, University of Oxford

Key features of the sustainable design include solar power generation installed on the roof, zero fossil fuel consumption within the building, and very high levels of insulation and airtightness to reduce the heating demand. Materials and equipment were chosen for longevity and performance, helping the building meet targets set by the university, and Passivhaus standards, for space heating demands and operational carbon emissions.

## Acoustic and lighting design

For the high-performance acoustic design, we employed a box-in-box strategy and isolated floors to provide superior sound insulation for key rooms, including the theatre, cinema, music studios, music ensemble and practice rooms, and ultra-quiet linguistics and phonetics research facilities. We also provided 3D acoustic simulations of critical spaces, including the Great Hall atrium.

Our approach for lighting design was to identify the key spaces, such as the Main Entrance, Great Hall and Concert Venue, where we were able to integrate lighting into the architecture to enhance its impact, whilst elsewhere we employed a simple palette of high efficiency fittings, controlled in real time across the site, to deliver appropriate light levels with minimal energy consumption.



**“We’re delighted the Schwarzman Centre set its sustainability ambitions to meet the rigorous Passivhaus standard, it’s a great demonstration that Passivhaus can be successfully applied to many building typologies, including performance spaces, and using modern methods of construction.”**

Gwilym Still, Director of Passivhaus

# Transparency, commitments, and making change

# Closing the performance loop: learning from post-occupancy evaluation



**Tom McNeil**  
**Principal Building Performance Consultant**  
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Delivering low energy buildings and seeing them demonstrate clients' ambitions is incredibly satisfying. Successfully achieving this means returning to buildings when they are occupied, helping to review and optimise their performance, reflecting honestly on what hasn't gone quite to plan, and making sure to celebrate the successes. These projects are recent examples of our post-occupancy evaluation work (POE).

## Agar Grove 1C

The third phase of the Agar Grove estate redevelopment comprises 125 new dwellings across two residential blocks. The heating and hot water is delivered through an all-electric system via an air source heat pump ambient loop with local water



Agar Grove 1C



Greenhaus, Salford

source heat pumps in the dwellings. As well as providing MEP design and Passivhaus consultancy, we produced the Home User Guide and carried out POE during the project's first year.

Measured energy consumption is extremely low, aligning closely with the Passivhaus modelling, and internal sensors installed in a sample of homes have demonstrated excellent air quality and comfortable temperatures. Specific findings will be published later in 2026 once feedback from the occupancy survey has been processed.

## Greenhaus, Salford

An all-electric, nine-storey residential block in Manchester, Greenhaus comprises 96 Passivhaus certified flats. We were the Passivhaus consultant and undertook POE during the first year of occupation, including energy sub metering, occupant surveys, and the installation of internal temperature and air quality sensors.

The sub-meter data showed that heating demand was in-line with the Passivhaus modelling, despite some challenges around heating controls. Small power consumption was found to be higher than anticipated, increasing overall consumption and resulting in a measured energy use intensity (EUI) of 64kWh/m<sup>2</sup>/yr (whole building GIA).

## Hinsley Lane, St John's College Cambridge

Hinsley Lane student accommodation townhouses were delivered to Passivhaus standard for St John's College, Cambridge. We were the Passivhaus consultants, and undertook an occupant survey and POE for the first phase of completed townhouses, reviewing their energy consumption, heat pump performance.

The overall energy consumption was very low, with a measured EUI of 54kWh/m<sup>2</sup>/yr. Some challenges around the heat pump design and installation meant some lessons learnt and opportunities for improved performance.



Hinsley Lane student accommodation, St John's College Cambridge

# Update on our climate commitments



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## Our climate commitments and GHG report

Max Fordham LLP has a long-standing commitment to sustainability, both within our projects and as a practice. We are guided by our sustainability policy and ISO 14001-certified environmental policy, as well as our commitments under the [Science Based Targets initiative \(SBTi\)](#) to reduce our operational emissions.

We committed as a practice in April 2022 to the SBTi to achieving the Net Zero green house gas (GHG) emissions targets against our CY2019 baseline year. Specifically, these commitments are to:

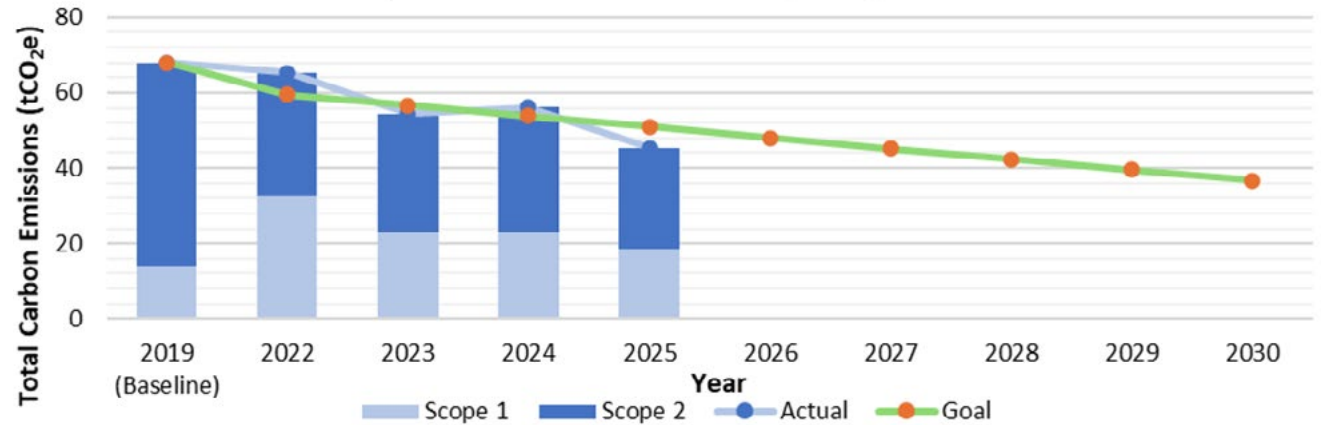
- Reduce scope 1 and 2 GHG emissions by 46% by CY2030
- Measure and reduce scope 3 emissions

## Progress against our Science Based Targets commitments

We are in the process of transitioning all our offices away from gas. Our Cambridge and Bristol offices are already all-electric, and our Manchester office relocated to a larger all-electric office at the end of May in 2025. This means we now have only two offices with dependency on gas. We are looking to decarbonise the heating systems in our Edinburgh and London offices by switching from gas boilers to heat pumps. This is currently underway in our London office with the aim for the new heating system to be operative in the 2nd quarter this year.

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Scope 1 & 2 Carbon Emissions Progress against SBT



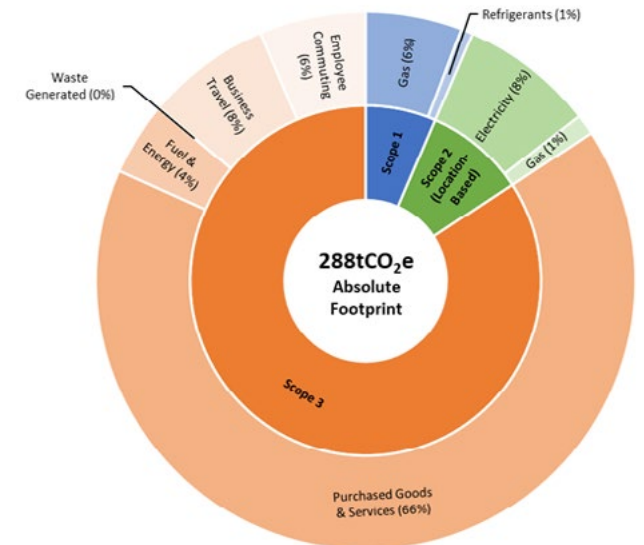
This graph shows an overall reduction in our total carbon emissions, with an overall target of reducing scope 1 and 2 emissions by 2030.

In our Manchester and London offices we use a 100% renewables tariff via 100Green which meets the UK GBC guidance on procuring renewable energy. Our other offices' energy is defined by landlords. To manage this, each office has an energy champion responsible for monitoring and optimising their office's energy consumption, led by our Building Performance Lead.

## Further reading

For further details on our Science Based Targets reporting refer to our [Annual Greenhouse Gas Emission Report \(2025\)](#).

We are continuing to look at where we can make improvement through our environmental working group and through improving our organisational integration of environmental management. This year we will be releasing our up-to-date Climate Transition Action Plan.



This pie chart shows the breakdown of scope 1, 2 and 3 emissions

# Factoring AI into scope 3 emissions reporting



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## The current context

The steadily increasing demand for cloud computing and digital services over the past decade has focused the need for energy optimisation, and for data centres to adopt energy-efficient equipment. However, the sudden increase in the use of AI, powered by data centres, is significantly outpacing efficiency gains. AI is rapidly transforming how some businesses operate, but this brings with it a significant and often overlooked environmental cost.

According to research conducted by Goldman Sachs<sup>1</sup>, a single ChatGPT request consumes nearly 10 times as much electricity as a standard Google search query, leading to a substantial cumulative effect from millions of daily users. Data centres already account for 1-2% of global electricity consumption, and that figure will climb sharply as generative AI workloads multiply. The generated greenhouse gas (GHG) emissions are due to the energy demand of powering queries in real time, but also due to the full lifecycle of server infrastructure from manufacture to operation, and eventual disposal.

As AI adoption expands, the environmental impact of server infrastructure will escalate, which creates the urgency for proactive management strategies now. We need to be conscious of adapting our behaviour around the use of AI to minimise its negative environmental impacts.

## Where we are now

As we continue to use cloud-based computing and move towards the adoption of AI in our consultancy work, we want to be able to use these tools as efficiently and sustainably as possible. We're actively exploring methodologies to calculate the greenhouse gas emissions generated from our use of AI tools, although we recognise that current limitations in data availability mean our assessments are based on purchase-driven calculations. But this is a rapidly evolving field, and we will continue to monitor developments as more accurate data becomes available.

Looking ahead, we are committed to implementing targeted policies and strategies that promote the efficient and sustainable use of AI and cloud-based computing within our practice and will continue to engage with our suppliers to ensure transparency and accountability regarding their environmental footprint.

[1 https://www.goldmansachs.com/insights/articles/AI-poised-to-drive-160-increase-in-power-demand](https://www.goldmansachs.com/insights/articles/AI-poised-to-drive-160-increase-in-power-demand)

[Additional resources](#)

Target	Max Fordham strategy and next steps
<b>Use AI only where it adds value</b>	We have a Copilot Champions Team where people in the practice can provide feedback on ways in which they find Copilot to be useful, as well as examples of how Copilot has not been beneficial.  The purpose of this team is to set up a feedback loop on how we as a practice can best use Copilot to our advantage. The discussion generated from this forum can feed into our IT policy around the use of Copilot.
<b>Write clear, concise prompts and batch queries</b>	Everyone in the practice has had high-level Copilot training, which included training on how to structure writing prompts.
<b>Choose efficient workflows</b>	Copilot has been integrated into our work systems to ensure efficient use. We advise that AI image generation is avoided.
<b>Use lighter AI models where possible and optimise workflows</b>	We will explore setting the default AI model to 'light' and develop guidance on which model is appropriate for which prompt. Batch processing should be used wherever possible.
<b>Train teams on carbon-efficient use</b>	Develop an internal training course on the emissions, energy demand and water use related to AI operations, and how we can best use Copilot to minimise impacts. This will be based on a year of Copilot being rolled out across the practice.
<b>Track and calculate AI-related GHG emissions</b>	We are currently able to track how many prompts people generate. We aim to stay up to date with the latest information on how to calculate associated GHG emissions linked to our AI use.



1

- First Floor
- Health Improvement
- Social Networks
- Enterprise Skills
- Business, Computing & Technology
- Academics

Ground Floor

- Enterprise Skills
- Health Improvement
- Business, Computing & Technology

# Further reading

## Resources from Max Fordham

- [Our website](#)
- [Beyond net zero website journals](#)
- [Our services](#)
- [Our projects](#)
- [Net zero carbon resources](#)
- [The Net Zero Carbon Guide](#)

## Technical guides and resources

- [UK Net Zero Carbon Building Standard \(UK NZCBS\)](#)
- [RIBA 2030 Climate Challenge](#)
- [BSRIA Soft Landings Framework](#)
- [Part Z](#)
- [Science Based Targets Initiative](#)

## Tools

- [FCBSCarbon](#)
- [Price & Myers Embodied Carbon Database](#)

## Industry organisations and groups

- [Building Performance Network](#)
- [Passivhaus Trust](#)
- [UK Green Building Council](#)
- [World Green Building Council](#)
- [Architects Climate Action Network \(ACAN\)](#)
- [UK Architect's Declare](#)
- [Building Services Engineers Declare](#)

## Interesting reading

- [Nature Positive](#)
- [OnePlanet](#)
- [Regenerative Architecture Index](#)

## CIBSE guides and Technical Memorandums

- [Guide L, Sustainability](#)
- [TM40, Health and wellbeing](#)
- [TM65 Embodied carbon in building services](#)

## Passivhaus learning hub

- [Learning hub overview](#)
- [Bespoke Primary Energy Renewable \(authored by our Gwilym Still\)](#)
- [Air-to-water heat pumps \(co-authored by our Gwilym Still\)](#)

## Podcasts

- [Architects' Journal: Climate Champions](#)
- [BBC Radio 4: Rare Earth](#)
- [BetaTalk: The Renewable Energy and Low Carbon Heating Podcast](#)
- [Thrive in Construction with Darren Evans](#)
- [Dezeen: Climate salon](#)
- [Zero ambitions](#)

## Conferences and events

- [AJ Retrofit & Reuse Live](#)
- [Footprint+](#)
- [FutureBuild](#)
- [UK + Ireland Passivhaus Conference](#)

## AI emissions

- [How AI use impacts the environment](#)
- [Navigating your company's AI carbon footprint](#)
- [Carbon footprint of AI](#)
- [Carbon and water footprint of data centres](#)
- [Understanding the carbon footprint of AI](#)
- [How servers and digitization accelerate climate change](#)
- [Progress on the road to 2030](#)
- [Using AI ethically and sustainably](#)

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