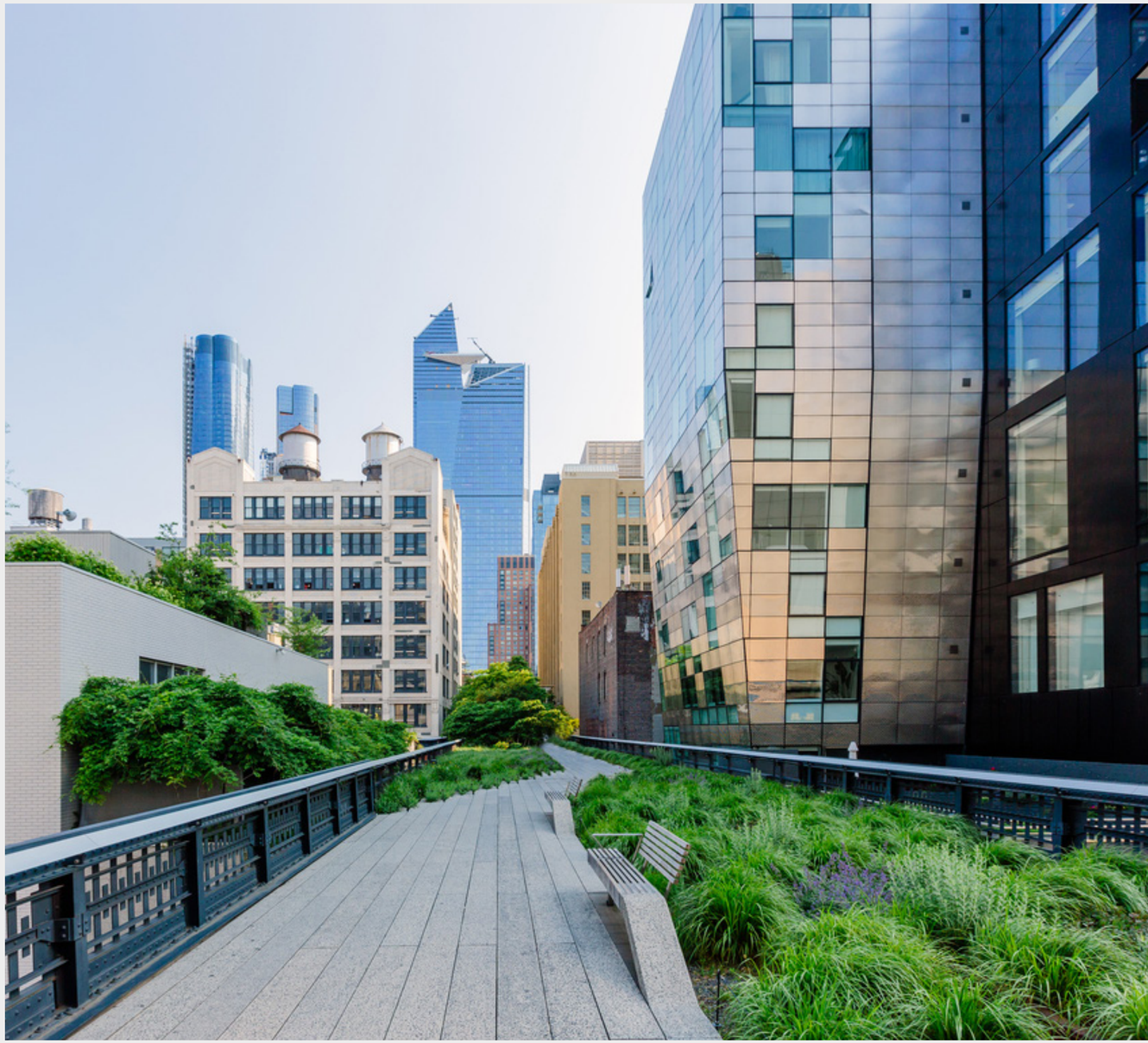
How to embed carbon management excellence throughout the built environment value chain



Introduction

Unlocking a more sustainable, connected future for the built environment

Reducing greenhouse gas emissions is one of the most urgent challenges facing society today. There are significant, interconnected obstacles for the built environment. On top of its sustainability aspirations, the industry faces rising material costs, rapid population growth, skills shortages, aging infrastructure as well as increasingly limited access to finance.

But there is much to be optimistic about. Fast-moving innovations, including low-carbon materials, smart building technology and generative design platforms are helping to accelerate progress towards a more sustainable world. To reach our goals even faster, enhanced collaboration will be crucial to implementing effective solutions across the sector.

Embracing the collaboration necessary to achieve our targets will require new skills and capabilities. Designing processes that optimize collective effort and embracing innovation and development of knowledge across all roles and domains will help the sector to accelerate this journey. Utilizing experts at the right juncture can be made simpler by embracing an informed supply chain and better collaborative efforts.

And because no single agency is directly responsible or accountable for reducing the industry's carbon emissions, a framework for collaboration and a rigorous global standard that ensures quality, consistency and clarity across the value chain will be crucial to meeting the industry's climate targets.

PAS 2080 sets out provisions around clear data that give changemakers like you the ability to track and report whole-life carbon emissions on major infrastructure and building projects.

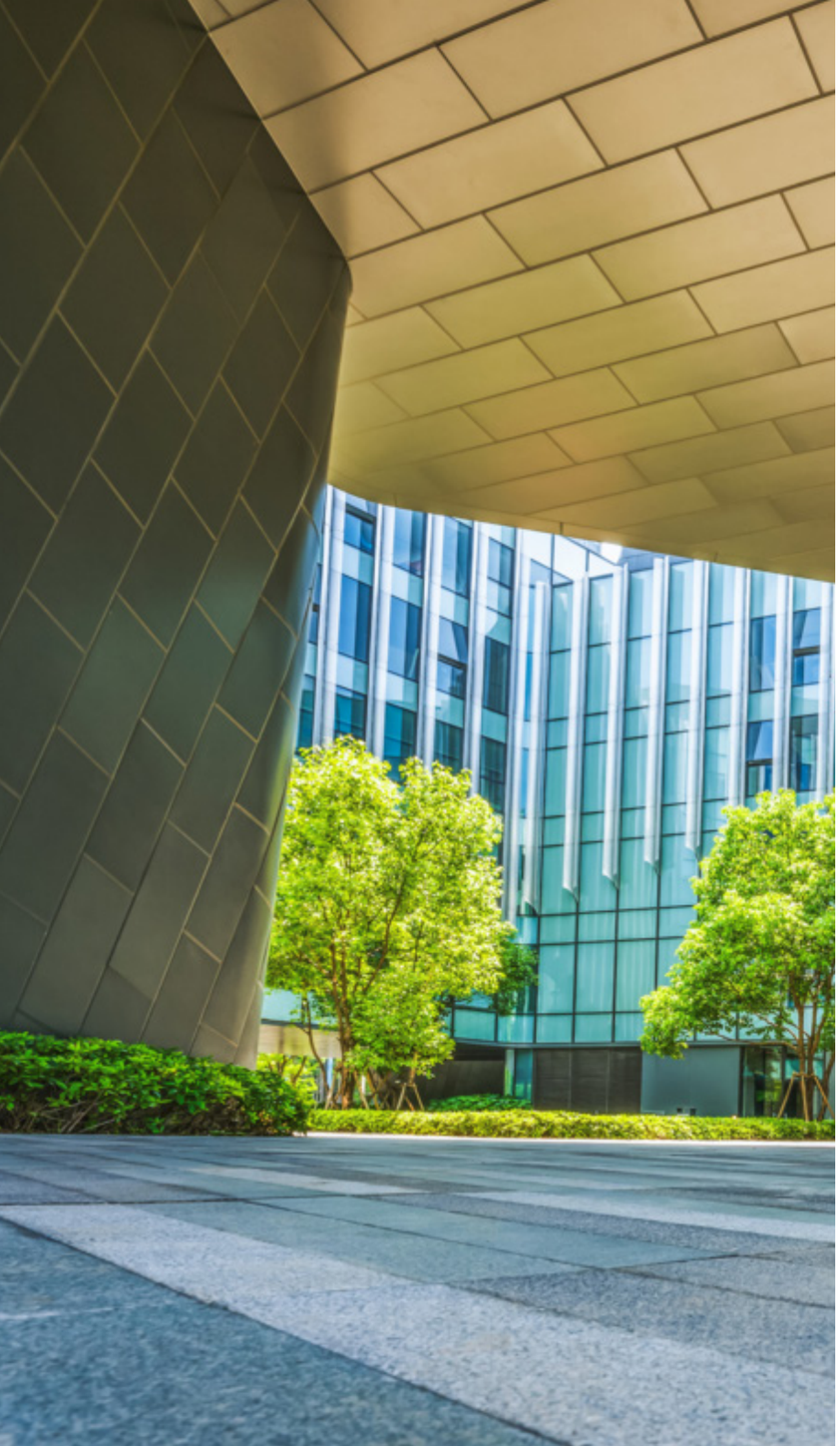
What is Carbon Management in Infrastructure (PAS 2080) verification?

PAS 2080 is the leading standard for managing carbon in buildings and infrastructure development. Verification supports industry by assessing your delivery of projects to PAS 2080 requirements, your measurement and monitoring of carbon against project delivery, and the management of your supply chain, and your role within it.

In this guide, we'll explore how organizations can embed carbon management excellence into their value chain, using PAS 2080 as the framework that will unlock the ability to harness breakthrough technologies, methods and materials to accelerate our mission to net zero.

Within this report, you'll discover:

- How innovations and technologies are breaking new ground in carbon reduction
- How independent verification and digital solutions are uniting the whole value chain
- Real-life examples of how PAS 2080 has benefitted organizations (from emission reduction and enhanced collaboration to cost savings)



Contents

The innovations and trends shaping the future of the built environment

"The buildings sector represents 40% of Europe's energy demand, 80% of it from fossil fuels. This makes the sector an area for immediate action, investment, and policies to promote short and long-term energy security.[1]"

– UN Environment Programme

As an individual with influence, you will be part of the collective that shapes the future of the built environment, driving meaningful progress towards net-zero.

The global perspective

The sixth great extinction
Alarming declines in biodiversity around the world[2] have raised fears that the natural ecosystems we rely upon to survive could collapse – a challenge intensified by the built environment's processes and use of materials.

New leaders, new values
A new generation of citizens are entering the workforce and expect sustainability to be a top priority[3]. This could have implications for organizational transparency, legitimacy and structure, and the distribution of wealth and opportunity across society.

Influencing change
Pressure is rising for governments to introduce and enforce decarbonization measures through regulation, grants and incentives[4], in addition to enabling conditions for private finance solutions.

"By 2050, an estimated 68% of the world's population will live in urban areas[5], yet 80% of the expected building stock is already in place[6]."

The built environment perspective

Smart cities and buildings
Rapid urbanization, population growth, greener lifestyles and limited access to financing all have the potential to push the built environment to adopt new business models, technologies and infrastructures[7].

Redefining collaboration
In response to skills shortages and recognition that governments alone cannot solve the climate crisis, responsibility for net-zero could be shared more widely among researchers, R&D institutions, NGOs and corporations[8].

"The Ellen MacArthur Foundation estimates that a circular economy could reduce global CO2 emissions from building materials by 38% in 2050[9]."

Clash of the titans
Organizations seeking lucrative contracts are under increased pressure to demonstrate digital innovation, process excellence and world-leading sustainability strategies[10].

Circular economy
The construction industry is expected to shift from the "take-make-waste" model[11] towards renovating existing assets with innovative, low-impact materials[12].

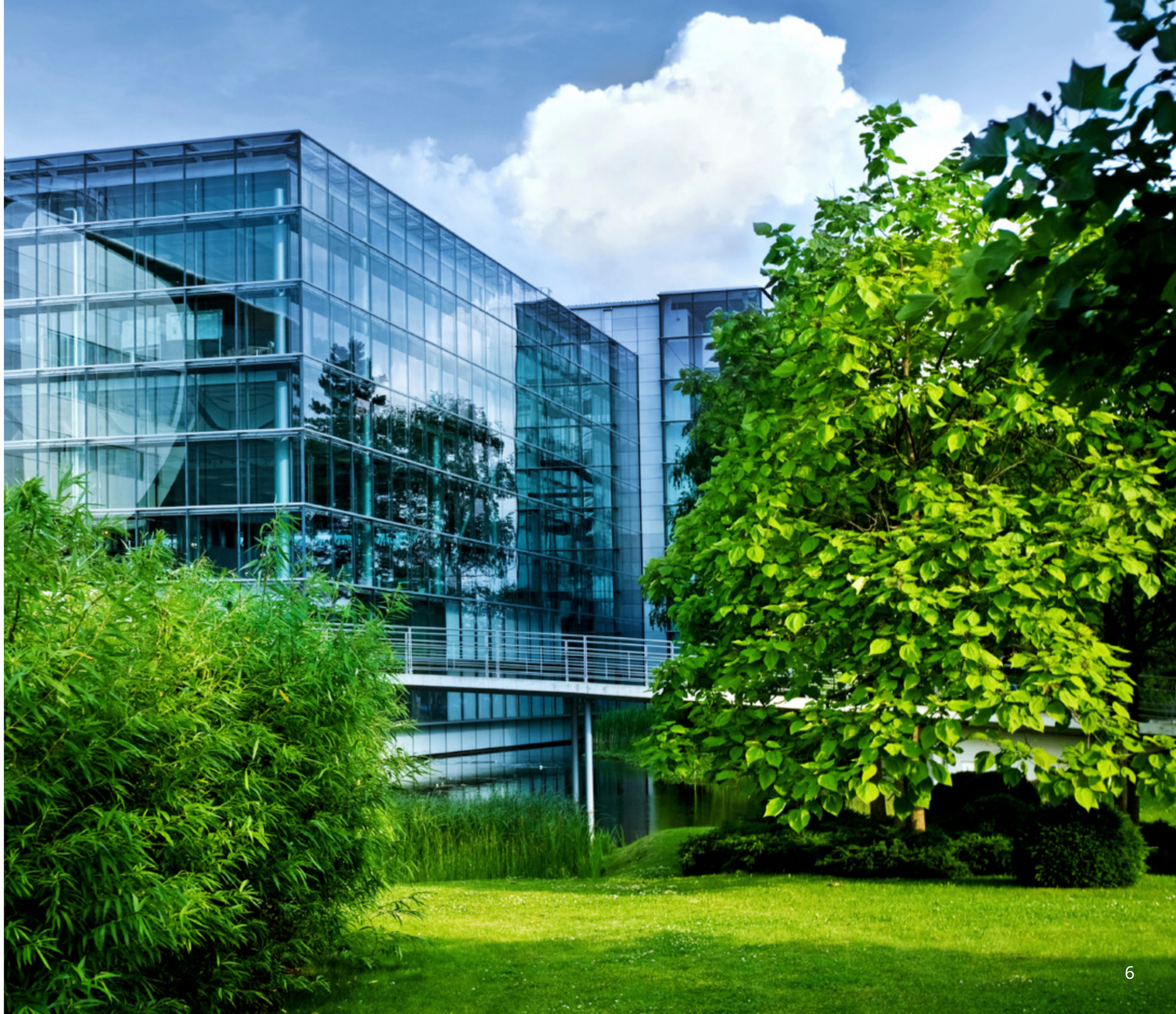
Supply chain transparency
Without access to high quality and reliable data, organizations across the built environment may not be able to report effectively on carbon emissions or view the entire value chain[13].

How closer collaboration can drive the next phase of sustainability

Construction and demolition in the UK alone produced 68 million tonnes of waste in 2018 – 92% of which was recovered [14] (CPA)

The challenge that the industry faces is how to best unite disparate stakeholders on buildings and infrastructure projects. When unwanted consequences of a fragmented supply chain occur, it can discourage communication, allowing inertia to set in - since no one entity is responsible for carbon management.

This is where PAS 2080, the world's first standard for managing carbon in buildings and infrastructure, can bring tangible value.



The power of Carbon Management in Infrastructure (PAS 2080)

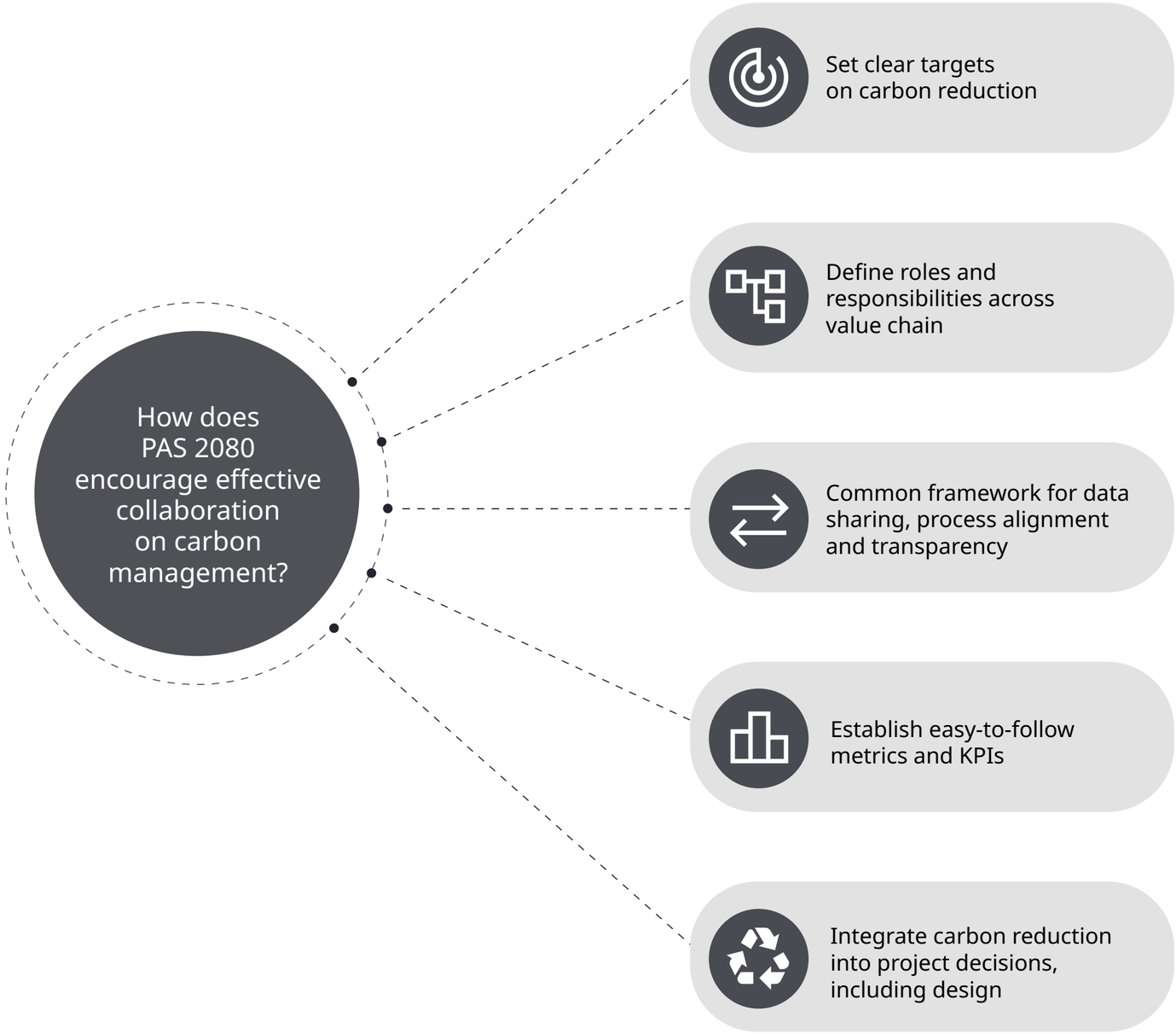
How does PAS 2080 work?

The standard applies to new projects or programmes of work, as well as the management or retrofit of existing assets and networks. This means that those working on any new buildings or infrastructure projects can consider the carbon footprint throughout their entire lifecycle, from design and construction to operation and end-of-life decommissioning.

By giving every stakeholder clarity from the outset around carbon targets and how best to achieve them, PAS 2080's provisions for transparency and clear communication allow built environment professionals to proceed with confidence when:

- **Planning for the present** as you devise and enact low carbon solutions
- **Preparing for the future** by proposing ambitious goals with innovative ideas

Standards and independent verification can help organizations seeking to adopt net-zero principles because they embed sustainability into the fabric of the business at every stage. Professionals utilizing standards such as PAS 2080 may benefit from a more comprehensive view of how to excel when proposing low-carbon solutions, and can be better equipped to share best practice as sustainability leaders.



How reducing carbon can help the built environment lower costs

Limiting expenditure is likely to be a significant ongoing consideration for the majority of stakeholders across the built environment.

Carbon-reduction initiatives can often result in cost savings throughout the project's lifecycle. Examples of efficiencies achieved through focusing on carbon reduction include:

Heysham to M6 road project, Lancashire (Costain and Tarmac)

25% reduction in aggregate tonnage and readymix concrete, and 21% CO2e savings

Close collaboration two years before the start of works enabled a deeper understanding of the companies' respective operations and how to integrate them effectively. Strategic decisions made prior to construction, from quarrying to vehicle routes, helped optimize processes and minimize waste.

M5 Junction 27-28 resurfacing scheme, Willand (Skanska)

Original projected cost of £4.5 million halved and carbon footprint reduced by 23%

Skanska found cost and carbon reductions by optimizing their resources. They planned truck movements to allow for continuous asphalt production. A 'hot-box' technique kept the equipment at an optimal temperature when batching asphalt. They lay the asphalt in the summer to take advantage of the heat. Equipment and vehicles were also stored close to the site.

Thameslink signal structures project (Balfour Beatty Rail)

60% reduction in carbon footprint and projected costs from original proposal

By reevaluating and modifying the design of new cantilever structures and utilizing existing gantry structures as part of that design, Balfour Beatty Rail found considerable reductions in waste, cost and material usage. There was no excavated soil to be removed from the site, and thanks to the modified proposal, a parapet wall no longer needed to be demolished.

The initiatives accelerating the built environment’s low-carbon future

As the built environment looks to move away from the “take-make-waste” model, a range of forward-thinking initiatives are already accelerating the industry’s vision for being a low-carbon leader.

These initiatives illustrate why embracing a contextual model – one in which project benefits are integrated with positive outcomes for local communities and wildlife habitats – will be crucial to our progress towards a more sustainable future.

Harnessing the full range of sustainable design principles[15]

- **Net zero**
  A low-build future in which heat pumps, solar panels and insulation are routinely installed in new and retrofitted buildings
- **Circular economy principles**
  Optimizing existing resources by reducing, reusing or omitting materials, aided by supply chain partners
- **Digitalization**
  Innovations such as AI, machine learning, BIM (building information modelling) and digital twins that drastically reduce lead times and optimize construction
- **Biophilic design and green infrastructure**
  Projects integrate, preserve and highlight surrounding natural habitats and features, enhancing wellbeing and promoting biodiversity
- **Climate resilience**
  Retrofit solutions for rooves and facades, as well as smart building systems and landscape features, able to withstand extreme weather events such as flooding and heatwaves
- **Social equity**
  Buildings, infrastructure and initiatives (e.g. green participatory budget) that foreground inclusive, community-minded living

Establishing trust in new innovations

Carbon management is a fragile process. Like a game of dominoes, it can take just one stakeholder in the value chain to renege on carbon targets for the whole project to miss its net zero ambitions. That’s why it’s up to changemakers like you to encourage your network to take the leap and drive towards net zero.

From legislative leaders to corporate influencers, we as an industry have the opportunity to encourage professionals to switch from defaulting on established methods to adopting cutting-edge technology.

A key part of the solution will be for the built environment and its regulatory bodies to embrace a trusted framework that enables the built environment to evaluate and optimize its sustainability efforts.

Four areas of innovation that are transforming carbon management

Effective innovation is the process of drawing from experience to enter the unknown. In this section, we want to equip you with real-life examples of innovation in action. Using this insight into emerging solutions, organizations can proceed with confidence to shift boundaries and propel the industry forward.

We've collated built environment breakthroughs in four areas that showcase the industry leaders integrating clever design and low-carbon innovations into their business practices, limiting material usage, and driving down emissions across the whole value chain.

1. Next-generation design and digitization

Organizations are optimizing material usage and design efficiency throughout the construction lifecycle with these digital solutions

- Generative design software
- Standardized kits of parts for construction or platform design
- Platform design for manufacture and assembly (e.g. Project Etopia)
- Energy-producing homes (e.g. "The Risby")

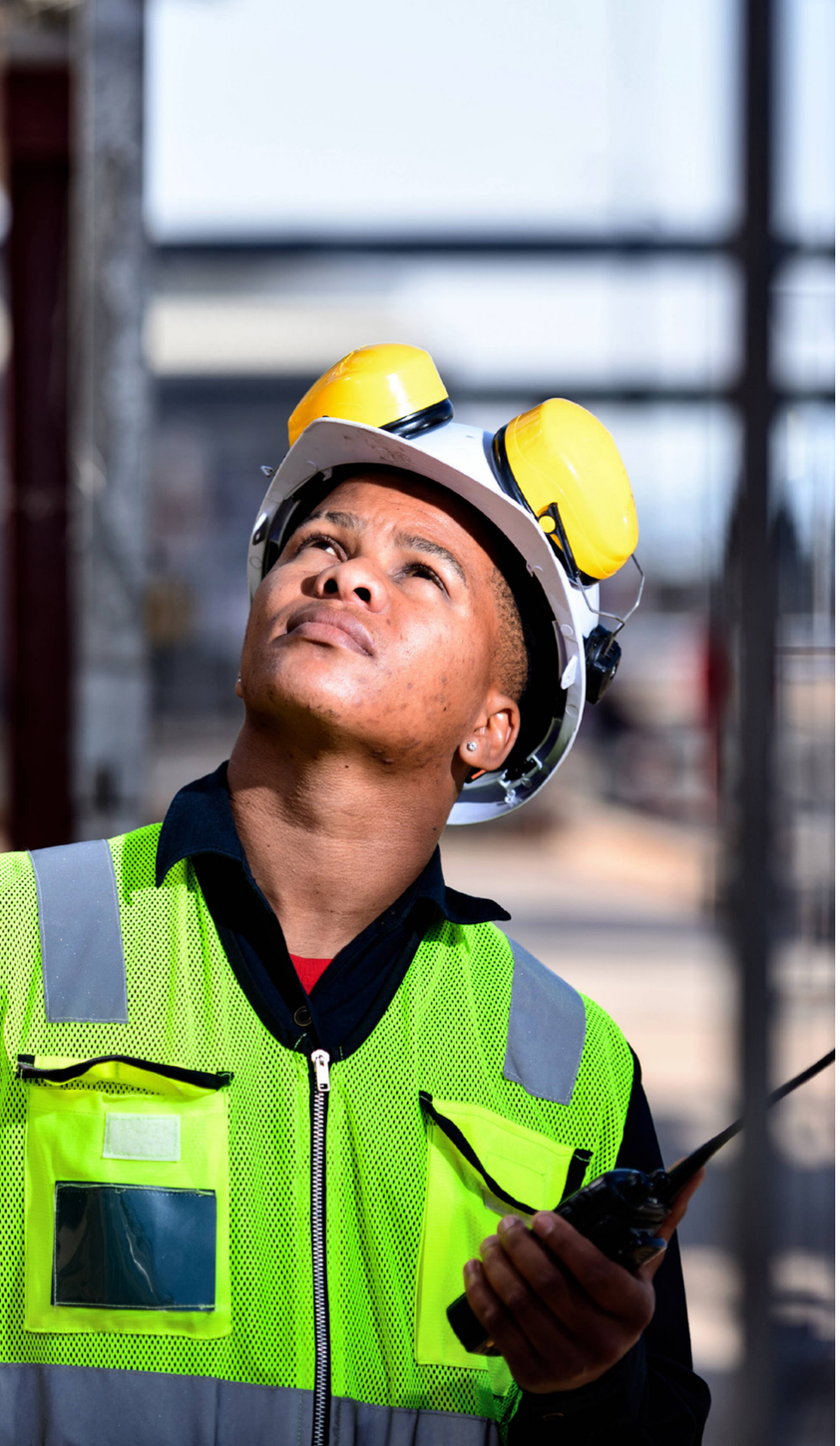
Innovation in action: Genzero

A platform solution for manufacture and assembly, made using a standard kit of parts that was designed digitally and to be rolled out at scale. GenZero was the UK's first ultra-low carbon standard for schools[16], using UK-sourced timber as the primary material and reducing typical timber use for similar buildings by 35%

2. Retrofitting

These solutions are helping to decarbonize existing buildings blocks and reduce our reliance on new constructions

- Heat-loss reducing smart air bricks
- Ground-, air- or water-source heat pumps
- Mechanical ventilation with heat recovery systems (MVHR)
- AI-powered retrofit assessments (e.g. Tallarna)



Innovation in action: SHREWSBURY FLAXMILL MALTINGS

Bringing together architects, surveyors, brick specialists, builders, carpenters, ecologists, engineers, ironworkers, roofers and scaffolders, the multi-year restoration's features include a ground-source heat pump (estimated to reduce space heating emissions by 46%) and an integrated bat roost[17].

3. Smart buildings

These AI-powered platforms can help to continuously track performance and drive carbon reductions

- Consumption-monitoring proptech (e.g. arbnco)
- Data-driven property management software
- Electricity-conserving systems
- Occupancy-responsive HVAC
- Predictive digital twins technology (e.g. Microsoft and Ansys)

Read the Digital Twin Blog

Innovation in action: HAMMERBROOKLYN

Using sensor technology and Internet of Things (IoT) interfaces, the Hammerbrooklyn Pavilion in Hamburg collects data on temperature, oxygen and occupancy to optimize energy use. It was built from upcycled materials, including boardwalk planks salvaged from Hurricane Sandy in 2012 and a steel frame repurposed from the US Pavilion at 2015's Expo Milan.

Discover independent IoT product certification

4. Low-carbon materials

These innovative natural or recycled alternatives have the potential to reduce industry costs and dependence on virgin raw materials

- Carbon-negative lightweight aggregate (e.g. OSTO)
- Cementless concrete (from Earth Friendly Concrete)
- Panel boards made from waste materials or hard-to-recycle plastic
- Biomaterials (e.g. hemp, mycelium, timber)

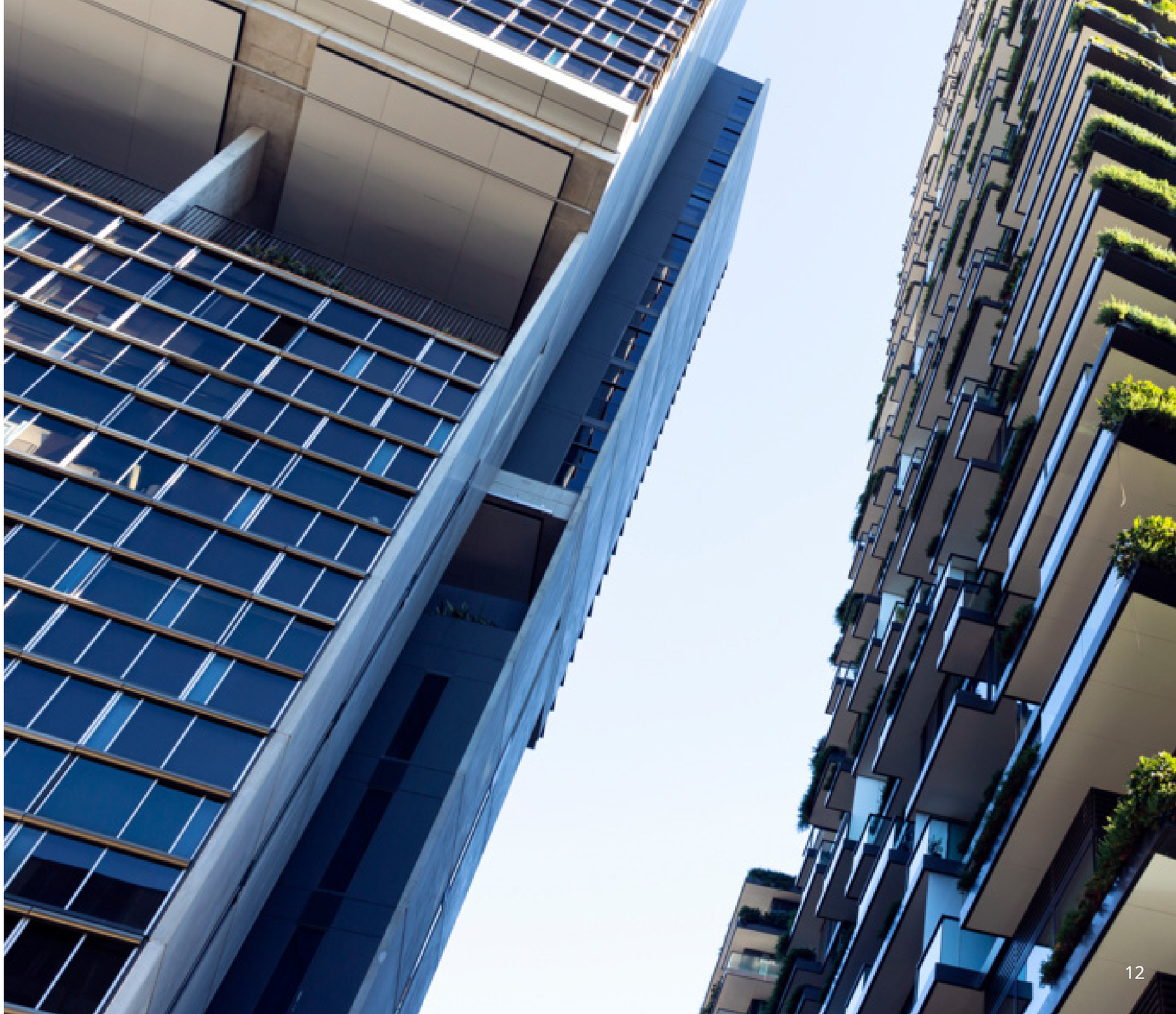
Innovation in action: hyperion robotics™

A concrete construction solution that uses low-carbon concrete – made from mining tailings, ashes and slags – to 3D print structures such as foundations, water tanks, trenches and buildings. A recent pilot project for Iberdrola and Peikko building pillars for electric substations resulted in a 75% reduction in material use and a 60% drop in eCO_2[18].

Building the right foundations

To drive innovation while securing trust in the built environment, it's important for industry professionals to consider holistic strategies – ones that emphasize process excellence and collaboration with the right partners as much as procuring the latest tech and low-carbon materials.

Far from requiring a radical process overhaul from built environment professionals, PAS 2080 is meant to help you strengthen your existing compliance strategies. It aligns with the priorities outlined in the UK government's Construction Playbook, which also addresses some of the built environment's most urgent issues.



Harnessing ingenuity, harmonizing the value chain: the benefits of PAS 2080

Without an assurance framework that gives you the confidence to adopt sustainable methods at speed and scale, organizations may find it difficult to stray from the tried and tested - even where the new methods have proven benefits.

This challenge is especially pressing for government agencies that consult with built environment leaders to shape guidance on safe construction methods and materials. Adopting an innovation-first approach can help us to construct more sustainable built environment, and is even more effective when supported by a harmonizing standard that breeds trust across the value chain.

PAS 2080 gives built environment professionals a platform in which innovation thrives, because the governance structure empowers leadership teams to challenge existing standards and specifications whenever an opportunity arises to meet carbon targets.

National Grid provide a great example, using Carbon Management in Infrastructure (PAS 2080) as guidance to embed supply chain.

How National Grid challenges its supply chain to drive sustainability

In line with its strategic priorities of driving value through resilience and sustainability, National Grid's commercial and technical teams challenge suppliers to reduce whole-life carbon and costs, earning a place on Carbon Disclosure Project's Supplier Engagement Rating Leaderboard.

"We will continue to collaborate with our supply chain and reduce emissions as much as it is feasibly possible. We will only offset residual emissions, in line with the internationally recognized industry standard PAS 2080 Carbon Management in Infrastructure."[19]

nationalgrid

Other National Grid sustainability initiatives include:

- Replacing SF6 in high-voltage electrical equipment - a world first
- EconiQ retrofill that uses eco-efficient fluoronitrile gas mixture
- Charity partnerships to upskill in STEM and carbon responsibility
- Connecting underserved communities with employment opportunities
- Developing a Supply Chain Sustainability Charter[20]

Enabling transparency and consistency across the supply chain

The ability to track and assess carbon output on construction projects is a key enabler of effective target setting that can help to unite key stakeholders behind a common goal.

Unreliable data sets can make effective supply chain collaboration challenging, especially when it comes to attributing embodied and operational carbon to buildings and infrastructure with confidence.

Innovation in action: Mott Macdonald

The global engineering, management and development consultancy has recently achieved PAS 2080:2023 verification. One of the solutions that supported this achievement was **Moata Carbon Portal**, a tool which gives anyone across the business and supply chain the ability to track, record and reduce carbon.

The PAS 2080 advantage
The standard offers a holistic carbon management structure with clear guidance on:

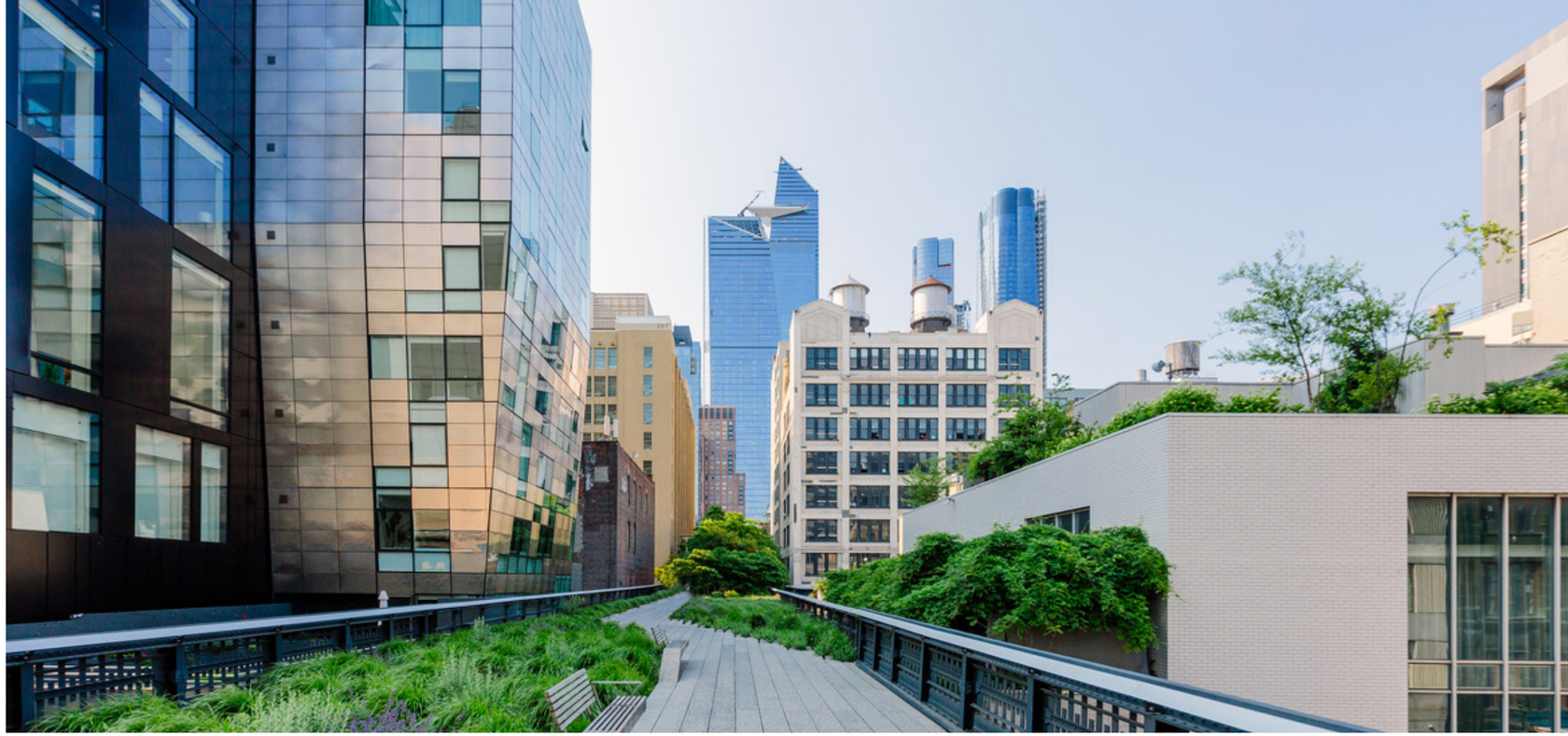
- Target setting
- Baselines
- Monitoring
- Reporting
- Continuous improvement

The value of the PAS 2080 framework lies in giving stakeholders across the value chain the ability to agree on metrics, KPIs and incentives, minimizing ambiguity.

When considering the broader industry environment, a more framework-friendly context is emerging. The EU is currently revising its Construction Products Regulation (CPR) to better encourage sustainability and innovation.

The **EU's** report on that process shows that the market appetite for a better built environment is not only gathering momentum, but will widen the global industry's scope for activity with European partners.

The global leadership opportunity of PAS 2080



PAS 2080 helps professionals like you realize reductions in material, energy and labor costs, while reducing whole-life carbon emissions by providing clarity and transparency around:

- Carbon reduction targets
- Roles and responsibilities
- Data sharing
- Process alignment
- Decision-making and procurement

The standard's requirements around data clarity can also give senior industry leaders the ability to monitor progress on driving down carbon emissions on major infrastructure projects.

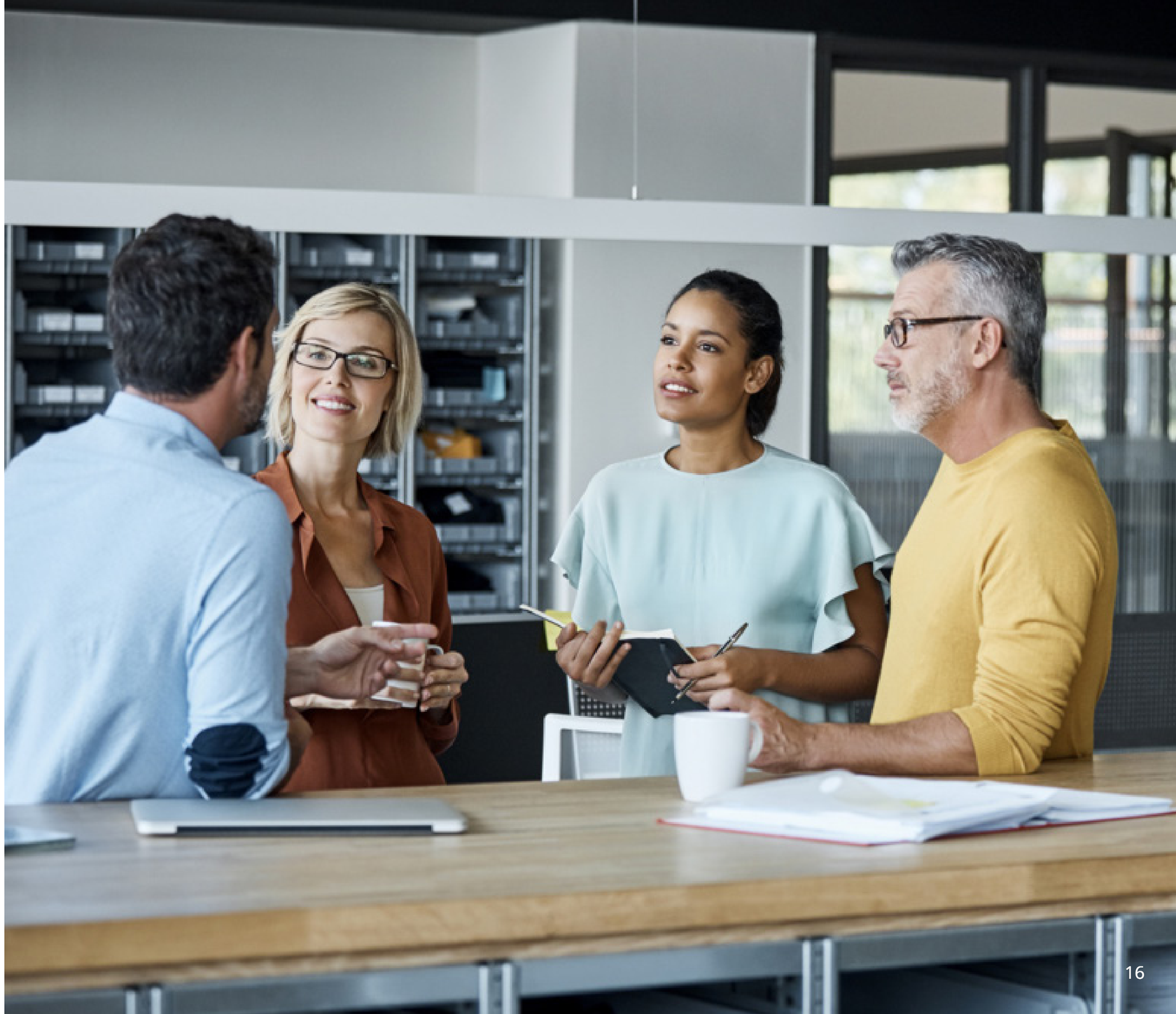
As built environment organizations face soaring costs[21], it's equally important to plan for long-term resilience as the industry moves towards more sustainable practices.

In the case studies summarized on the following pages, you'll see that industry leaders are already making path-breaking, future-proofing progress on monitoring and reducing carbon emissions using PAS 2080.

PAS 2080 in action: Three examples of low-carbon leadership

Major infrastructure projects are already taking advantage of the standard, using digitally-driven collaboration to significantly reduce whole-life carbon.

Using these success stories, PAS 2080 can pave the way for the built environment to excel as a carbon-conscious industry.



HS2[22]

One of the world’s first PAS 2080-verified infrastructure projects, whose target is to achieve carbon neutrality by 2035

- Sets clear targets for designers, contractors and suppliers to follow
- Diesel-free construction sites
- Designing earthwork and tunnels to reduce material excavation and transport
- Sharing materials with adjacent projects
- Regenerative design geared towards biodiversity net gains

Costain

A leading sustainable infrastructure solution firm helping to decarbonize the delivery of HS2

- Strategic maximizing, reuse and recycling of demolition materials
- Holistic carbon modeling of entire project with integrated digital system
- Systemic identification of opportunities to reduce carbon emissions
- Shareable carbon data accessible across the value chain
- 70,000 tCO2e projected savings using vegetable oil-based diesel alternative
- 2,000 tCO2e saved by removing 35,000 lorry movements from local roads

Skanska[23]

One of the world’s first contractors to successfully acquire (and contribute to) PAS 2080 accreditation, with a target of being net-zero by 2045

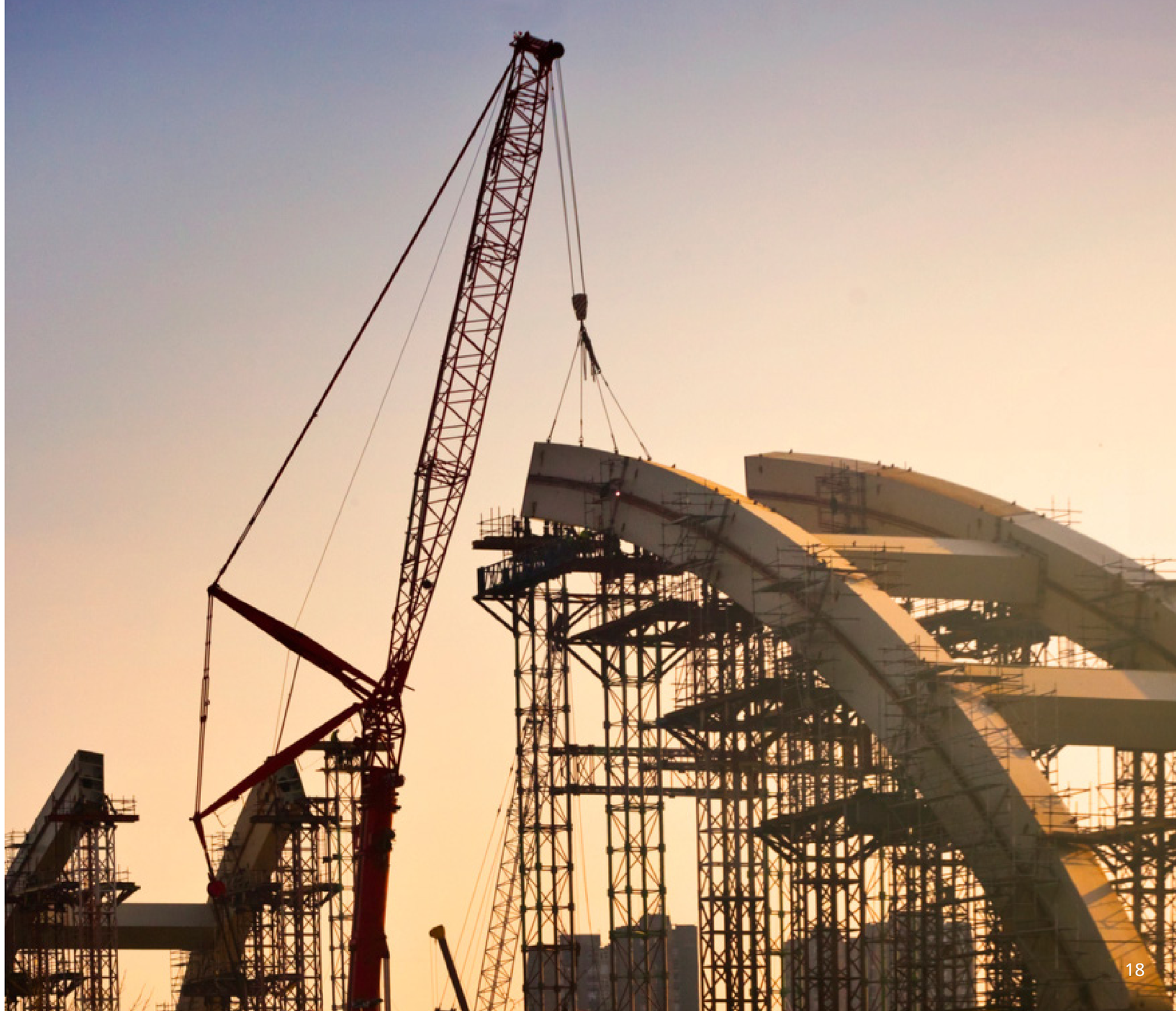
- Bringing estimating, planning, design and operational teams closer
- Improving processes across pre-construction and project delivery phase
- 11% emissions reduction by redesigning concrete platforms on tunnel project
- Using BIM to identify carbon savings and sharing data across portfolios
- Using only biofuel across all Skanska projects

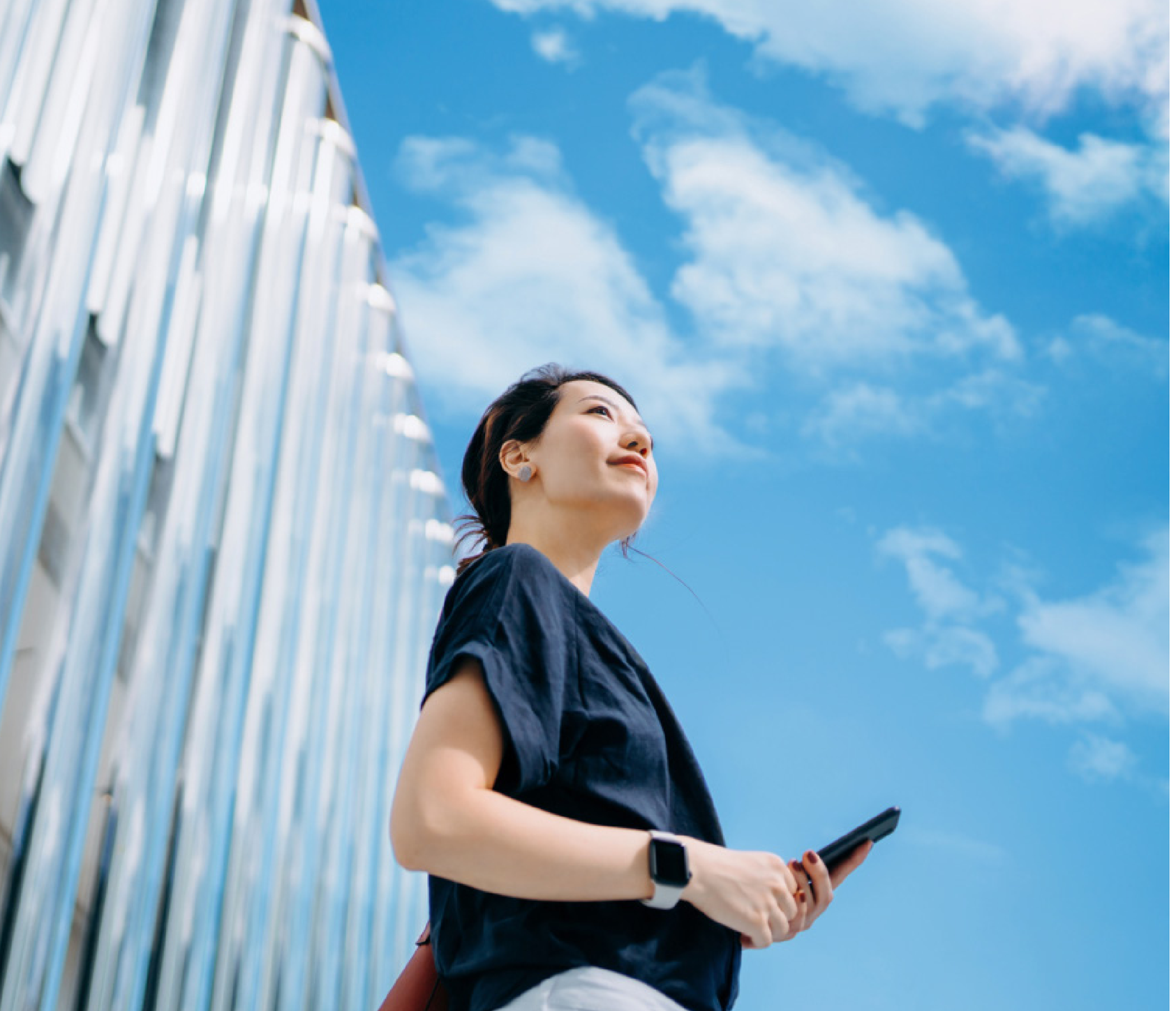
Continual improvement

The standard was revised, with PAS 2080:2023 to incorporate a wider scope of activities that affect carbon management:

- Expanded scope beyond infrastructure to include all of the built environment (e.g. bridges and tunnels)
- Includes requirements specific to procurement stage and decision-making stage
- Scope of value chain members includes financiers and government entities
- Emphasis on leadership, collaboration and governance structure across value chain
- Integrates consideration of wider factors such as climate adaptation and biodiversity
- Brings consistency across built environment industry to manage whole-life carbon

You can find out more about these changes at **bsigroup.com/pas-2080-uk**





About BSI

BSI is committed to accelerating progress towards a better society and shaping a more sustainable world.

We achieve our purpose by helping our clients achieve their objectives. Their progress builds trust and confidence for their customers. It's a positive cycle. Whether we're tackling the drivers of climate change, building trust in our digital lives or helping end exploitation, we're accelerating innovation.

We partner with built environment organizations to accelerate their progress towards a more sustainable world. This commitment is at the heart of PAS 2080, the world's first standard for collaboratively managing carbon in buildings and infrastructure.

Updated in collaboration with the Institution of Civil Engineers (ICE), the Green Construction Board (GCB) and the Construction Leadership Council (CLC), PAS 2080 addresses specific built environment challenges, fostering clarity and consistency across the whole value chain with innovation and collaboration at its core.

Working with more than 84,000 clients across 193 countries, BSI is a truly international business with skills and experience across multiple sectors.

To learn more, visit bsigroup.com

Accelerate your net-zero journey with PAS 2080 verification

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Visit bsigroup.com or for more information on the standard, visit our PAS 2080 landing page.

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