



CARBON CRUNCH

Aotearoa 2024

Output from the Aotearoa Carbon Crunch hosted by LGNZ, Infrastructure Sustainability Council, Institute of Directors Chapter Zero and Mott MacDonald, on 12 September 2024



INTRODUCTION

Climate change is having a devastating impact on communities around the world. Raging wildfires, intense rainfall and unprecedented flooding are increasingly dominating the news.

Preserving our climate is the responsibility of both the individual and collective, requiring every one of us to act with intention and unity. In the infrastructure sector, we have a huge potential to make a difference, and our Carbon Crunch events serve as a platform to keep the climate conversation front of mind. In order to decarbonise the infrastructure supply chain, we must work together to transform our infrastructure systems, innovate and build resilience for future generations.

For our second annual Aotearoa Carbon Crunch event, we chose to take a holistic approach to decarbonising infrastructure by connecting the supply chain for important discussion on meaningful action. To do so we partnered with Local Government New Zealand, Infrastructure Sustainability Council (ISC) and the Institute of Directors, Chapter Zero to share industry leader's knowledge.

Our presenters shared their experience across the whole industry, from the conversations happening in the boardroom, to what is now expected during design and construction. Practical examples of decarbonisation efforts in concrete, steel and construction were shared to inspire the industry to keep moving towards net zero and consider nature-based solutions as a catalyst for transformation.

Throughout these pages you will find details of the key points made during the event. I hope this content empowers you to integrate decarbonisation and climate resilience into your organisation. It will not be easy, but it is possible.

We all play a part, and I urge you to read, watch and act on the messages from this report. Let us continue making strides towards a more sustainable future, together.

Mott MacDonald



Amanda Bryan
Environment and society lead - New Zealand,
Mott MacDonald

Governance and decision making



Abby Foote
Steering committee
member, Chapter Zero

LEADING THE CHARGE ON CLIMATE ACTION

As we approach the 10-year anniversary of the Paris Agreement, the urgency to limit global warming to 1.5°C has never been more critical. Global emissions need to fall by 9% annually until 2030 to keep that goal alive, yet in 2023 they rose by 1%¹. In New Zealand, the government's latest emission plan shows we are not on track to meet our 2050 climate targets.

A 2050 scenario recently released by the transport sector in New Zealand paints a grim picture of a possible future. Extreme weather events will overwhelm local networks, insurers will retreat from parts of the roading network, crime including fuel theft will hamper transport choices and international tourism will decline due to concerns about climate stranding. A further scenario out to 2100 describes a world that few of us would recognise.

These scenarios reflect a policy approach based on adaptation and economic growth imperatives. It reveals the impact of an approach where NZ doesn't feel it can take the risk to decarbonise ahead of major markets. Where the persistent cost of living pressures temper the social, and political will to pay the higher price of transitioning away from fossil fuels. Effectively, these scenarios are a continuation of our current path.

In this context, climate is a key issue for leaders. Climate change and the transition to a low-emissions, climate-resilient economy is already

having significant and disruptive implications for business competitiveness, viability, and shareholder value. Leaders, whether directors, boards, executives, or politicians, have both the responsibility and the opportunity to drive action and change.

Key reasons why climate has become a leadership issue include risk management in the face of significant physical and transition related risks, compliance with stricter regulations both locally and in export markets, strategic opportunities for gain from leading the transition, and increasing stakeholder expectations.

Integrating climate into organisational strategy and structures is now critical. And yet, climate governance is probably the most significant challenge that boards and other governance groups have ever faced. The long-term nature, complexity and pace of change can be overwhelming but that can't become an excuse for inaction.

To achieve the goal of long-term resilience and climate competitiveness of our economy leaders need to make commitments, sending clear messages to our organisations that emissions reduction is important. We must embed low-carbon thinking into our organisations and across our supply chains, empowering collaboration to find ways around the challenges. The key to this is leadership.

¹[United Nations Secretary General special address on climate action, June 2024](#)



Pioneering sustainability in urban infrastructure requires a clear vision, ambitious targets, and a collective effort from all stakeholders.

PIONEERING SUSTAINABILITY IN URBAN INFRASTRUCTURE

Auckland's City Rail Link (CRL) is one of New Zealand's largest and most ambitious infrastructure projects aimed at significantly enhancing the city's public transport network.

The CRL project, an underground railway project in central Auckland, aims to break through the dead end at Britomart Station and connect back into Maungawhau Mount Eden with two new stations in between. This line will double the capacity of the city's metropolitan railway. At peak travel times up to 24,000 people will come and go from the new CRL stations per hour, with this number increasing to 54,000 over time - a significant step forward for Auckland's future.

However, an underground railway has a substantial footprint and involves the extensive use of steel, concrete, and workforce.

The project's sustainability journey began back in 2016, driven by a clear vision and commitment from CRL Ltd.'s leadership. Targets were set to reduce resource

consumption and carbon emissions, aiming for zero waste to landfill and better social outcomes for Māori, Pasifika, and youth.

The carbon reduction targets included a 15% reduction in materials carbon and a 25% operational energy carbon saving across construction and operation over the 100-year asset life. While these targets were ambitious, they reflected the standards of the time. Today, some projects overseas are targeting a 50% reduction, highlighting the evolving nature of sustainability goals.

Achieving these targets requires significant commitment and innovation. It is not just the responsibility of the sustainability team but of everyone involved in the project.

One of the key achievements has been replacing cement with a less carbon intensive material, such as fly ash - a by-product of coal combustion. The project has reached a 12.5% replacement in shotcrete and 30% in most other concrete. This has helped shift the needle on acceptance of such replacements in New Zealand, although we still have room to improve compared to our Australian counterparts.

The CRL project has also achieved a 95% construction and demolition waste diversion rate, a testament to the ambitious zero waste goals set by the leadership from the outset. This success is largely due to the strong culture of sustainability on site and in the boardroom, supported by over 12,000 people who have worked on the project.

Procurement processes have been integral to the sustainability efforts, with bidders required to meet carbon and waste targets and demonstrate their track record and ambition around innovation. This has ensured that sustainability is embedded in every aspect of the project.

The CRL project exemplifies how pioneering sustainability in urban infrastructure requires a clear vision, ambitious targets, and a collective effort from all stakeholders. By setting high standards and pushing the boundaries of innovation, we can create a more sustainable future for our cities and communities.



Carolyn Cox
Sustainability manager, Kaiwhakahaere rauora,
City Rail Link

Innovation in design and construction

INNOVATING THE DESIGN OF INFRASTRUCTURE TO REDUCE CARBON

As we aim to reduce carbon emissions in infrastructure, setting ambitious goals is essential, but action from all stakeholders is crucial to achieve meaningful change. This concept is vividly illustrated by the value chain members diagram from PAS 2080 on the next page, which highlights the necessary push and pull from all parties involved in infrastructure delivery.

Regulators must set stringent goals and requirements, while asset owners need to provide leadership and set clear targets. Designers play a pivotal role by specifying outcomes and solutions that minimise whole-life carbon. Meanwhile, constructors must consider their impacts and demand low-carbon products, and the supply chain must respond by investing in innovative technologies.

While operational carbon emissions are important, New Zealand's renewable energy supply, while not perfect, increases the importance for us to focus on embodied carbon in construction. In some baselined programmes of work, the contribution of embodied carbon equates to 50% of emissions.

Designers must challenge traditional approaches and consider alternatives that avoid unnecessary construction. For example, instead of building a new stormwater pipeline, we could explore options like daylighting streams or reusing existing assets.

It's also crucial to work closely with the supply chain to understand and implement the latest low-carbon technologies. Continuing to specify products that were business as usual on the last project is not enough; new low carbon solutions must continue to permeate through projects.

The push and pull dynamic is evident throughout the process; from setting goals to implementing solutions, every link in the chain must be engaged and proactive. This also extends to asset owners, which may be required to take bold steps when adopting new technologies and materials.

Overseas experience and local New Zealand capital carbon baselines using the Carbon Portal have identified concrete and steel as key emission hotspots in delivering infrastructure. Addressing these areas is a vital first step for reducing overall emissions.

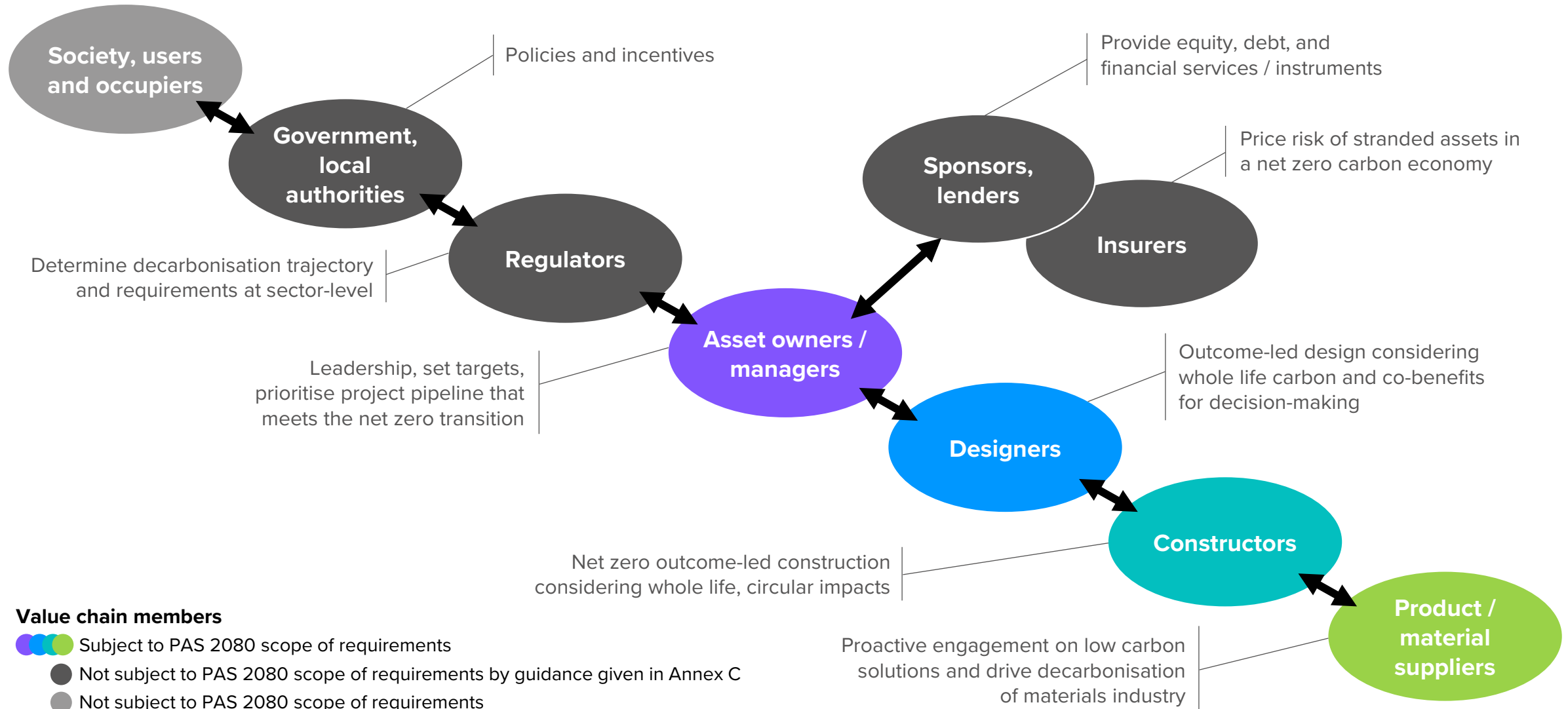
As we continue to innovate and collaborate, we must encourage each other to challenge the status quo. By doing so, we can collectively drive down emissions and create a more sustainable future for our infrastructure.



Nick Dempsey

Upper North Island water manager,
Mott MacDonald

PAS 2080: value chain members in the built environment and their roles in carbon management





DECARBONISING CONCRETE: NEW ZEALAND'S CHALLENGE AND OPPORTUNITY

In the quest for infrastructure decarbonisation, concrete plays a pivotal role. As a fundamental material for building a modern society - supporting our transport infrastructure, hospitals, schools, and more - concrete remains indispensable. However, the challenge lies in decarbonising this essential material.

Concrete NZ is a member-based association that includes all the cement and ready-mix concrete suppliers across the country, as well as concrete precasters, masonry producers and steel reinforcement processors. One of its focusses is on improving the sustainability credentials of the industry. This includes reducing the carbon footprint of concrete, a material composed of natural ingredients like coarse aggregate, sand, water, and cement. Despite its simple composition, cement accounts for over 80% of concrete's global warming potential in large parts due to the CO₂ released during its production from limestone.

Key strategies for decarbonisation include:

- **Fuel replacement:** The production of clinker, a key component of cement, requires significant heat. While much of this heat is already generated from waste materials, further replacing fossil fuels with renewable energy sources can reduce emissions.
- **Supplementary cementitious materials (SCMs):** SCMs, such as slag and fly ash, can partially replace cement in concrete mixes, reducing the overall carbon footprint. Although New Zealand has been slow to adopt SCMs due to a lack of domestic industrial by-products, recent investments have increased their availability. Additionally, natural SCMs like pozzolans from volcanic ash offer further potential.
- **Design and construction:** While New Zealand's seismic activity limits some design flexibility, improving the efficiency of concrete use remains crucial. Globally, concrete accounts for 6-7% of man-made carbon emissions, but in New Zealand, it is only 2%, indicating relatively efficient use.
- **Production efficiency:** Enhancing the efficiency of concrete mixes, production and delivery can also contribute to decarbonisation. This includes using electric or hybrid trucks and centralising mixing operations to reduce diesel use.
- **Carbon uptake:** Concrete naturally absorbs CO₂ from the atmosphere over time, incorporating it into its structure. Recognising and accounting for this process can help offset emissions, although it is a slow process and not a short-term solution.

Even today, low-carbon concrete mixes are available, capable of reducing embodied carbon emissions by 30-40% at little to no additional cost. To perpetuate these gains, it is essential to specify performance-based CO₂ reduction targets rather than prescriptive material requirements when engaging suppliers. This allows suppliers to optimise mixes based on available materials and project conditions.

Decarbonising concrete is a multifaceted challenge that requires innovation, collaboration, and commitment across the industry. By leveraging new technologies, improving efficiency, and adopting sustainable practices, we can significantly reduce the carbon footprint of concrete and contribute to a more sustainable future.

**Tim Kleier**

Sustainability and policy director,
Concrete NZ



FORGING A GREENER FUTURE

The steel industry faces a significant challenge in its quest for decarbonisation, akin to the hurdles seen in concrete production. As a hard-to-abate sector, steelmaking is responsible for a substantial portion of global carbon emissions. However, innovative solutions are emerging that promise to transform the landscape of steel production.

At the heart of traditional steelmaking is the blast furnace, where metallurgical coal is converted into coke, and iron ore is transformed into liquid iron. This process, while effective, is also carbon-intensive, primarily due to the chemical reactions that release CO₂ as a byproduct. In New Zealand, the unique iron-making process utilizes iron sand, coal, and limestone, producing liquid iron through a slightly different method than the conventional blast furnace.

Despite steel being 100% recyclable, there remains a critical challenge: the global demand for steel far exceeds the available scrap material. Projections indicate that by 2050, only about 45-50% of the world's steel demand could be met through recycled scrap. This reality underscores the need for alternative methods to reduce emissions in the primary steelmaking phase.

One promising avenue is hydrogen-based steelmaking. By replacing coal with hydrogen, we can significantly lower emissions. However, this transition is not without its challenges. The production of green hydrogen requires substantial energy, potentially consuming a quarter of the world's electricity demand if implemented at scale. This necessitates a robust increase in renewable energy sources to support the shift.

In New Zealand, the introduction of an electric arc furnace (EAF) marks a pivotal step in decarbonisation efforts. Set to commence operations in late 2025, this project aims to reduce CO₂ emissions by up to one million tonnes annually - equivalent to removing over 375,000 cars from the road, and utilising local post-consumer scrap. This shift not only represents a significant reduction in local emissions but also sets a precedent for other steelmakers globally.

Moreover, ongoing research partnerships, such as those with Victoria University, are exploring innovative methods to decarbonise iron sand using hydrogen. This research is crucial for addressing the local emissions from the remaining coal-based iron production.

As the industry moves forward, collaboration among stakeholders is vital. Engaging with suppliers and understanding their decarbonisation strategies will be essential for achieving net-zero goals. Additionally, initiatives like the roadmap for net-zero emissions in the steel sector, with partners including Metals New Zealand, will provide a framework for collective action.

While the path to decarbonisation in steel is fraught with challenges, the innovations underway offer a hopeful outlook. By embracing new technologies and fostering collaboration, the steel industry can significantly reduce its carbon footprint and contribute to a more sustainable future. The journey is complex, but with concerted effort and innovation, a greener steel industry is within reach.



Israel MacDonald
Sustainability and market development director,
New Zealand Steel



TAILWINDS AND CROSSWINDS IN INNOVATING CONSTRUCTION PRACTICES



Rachel Blake
Environmental manager,
Brian Perry Civil

In the ever-evolving landscape of construction, innovation is not just a buzzword; it's a necessity. The industry is committed to ambitious carbon reduction targets, aiming to cut emissions significantly by 2030. This commitment and the ambition to meet client carbon reduction targets drives innovative approaches and solutions in the field.

Tailwinds: Momentum in sustainability

One significant stride has been in reducing Scope 1 and 2 emissions, primarily from diesel. Substantial progress has been made in converting light vehicle fleets, with nearly 50% now comprising more practical and efficient vehicles and even some electric vehicles (EVs). However, the challenge remains with heavy plant and machinery, where options like hydrogen or electric alternatives are not yet widely supported. To address this, the focus is on maintaining a modern, efficient fleet and exploring biodiesel blends for certain projects.

Another area of momentum is in material specifications. Clients are increasingly open to innovative materials, such as recycled crushed concrete, now approved for use in road manufacturing. This shift not only promotes sustainability but also aligns with a broader focus on circularity, exemplified by the acquisition of companies specialising in crushing and reusing materials.

Crosswinds: Challenges and opportunities

Despite these advancements, challenges persist, particularly in data management and investment. Accurate carbon baselines for projects are often lacking, making it difficult to motivate construction teams. Innovative use of estimating software helps build carbon estimates from first principles, but discrepancies remain between estimated and actual measurements.

Investment in new technologies also poses challenges. For instance, a promising zero-emissions project was deferred multiple times, resulting in lost funding and missed learning opportunities. Such setbacks highlight the need for stable project timelines and reliable funding to drive innovation.



Celebrating success and learning from failures

Innovation in construction is a continuous journey. Celebrating successes and sharing learnings, both good and bad, are crucial. Collaboration and clear communication of sustainability goals can unlock further innovations and drive the industry forward.

The future of sustainable construction is exciting. By embracing innovation and overcoming challenges, the industry is paving the way for a more sustainable and efficient infrastructure landscape.

The path **forward**

THE PATH FORWARD



Dr Kerry Griffiths

IS technical director,
Infrastructure Sustainability Council (ISC)

In the past two decades, New Zealand has witnessed a remarkable evolution in its approach to infrastructure development, particularly concerning sustainability and decarbonisation. It's clear that our understanding of sustainability has matured significantly. 20 years ago, there were only a few voices advocating for sustainability, but now, it's heartening to see a collective commitment across the industry.

Infrastructure is not merely about concrete and steel; it forms the backbone of our society. It provides essential services and supports community well-being. As we strive for a decarbonised future, the role of infrastructure becomes even more critical. This sentiment resonates deeply as we engage with various stakeholders - from decision-makers to suppliers - who are increasingly aware of their impact on the environment.

The journey towards decarbonisation is not just about compliance; it's about collaboration and innovation. Today, we see a shift from siloed approaches to integrated solutions. The conversations happening in our sector reflect a growing recognition that we must work together to tackle the challenges ahead. This collaborative spirit is essential for driving meaningful change.

Moreover, the establishment and use of frameworks like the IS ratings is pivotal in raising industry standards. These frameworks encourage organisations to not only measure their carbon footprints but also to set and achieve ambitious targets for reduction – through smart planning and design, innovation and the use of net zero products and services. As we celebrate milestones, such as the introduction of decarbonisation and sustainability awards at industry conferences, we acknowledge the progress made and the work still to be done.



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Building capability within our workforce is equally crucial. We must invest in training and education to equip the next generation of engineers and sustainability professionals with the skills needed to navigate this complex landscape. Initiatives like ISC's iSupply directory facilitate connections between suppliers and projects, fostering collaboration and innovation.

As we look to the future, it's vital to maintain momentum. The next five to ten years will be critical in accelerating our decarbonisation efforts. By engaging communities and valuing the role of infrastructure in achieving sustainability goals, we can create a resilient and thriving society.

The path to decarbonising infrastructure in New Zealand is paved with opportunities for leadership, collaboration, and innovation. Together, we can build a sustainable future that not only meets the needs of today but also safeguards the environment for generations to come. Let's continue this journey with enthusiasm and commitment, celebrating our achievements while taking urgent action to address the challenges ahead.

CARBON CRUNCH:

Then, now and into the future

Mott MacDonald has been hosting the annual Carbon Crunch event in the UK since 2013 to help catalyse change and hasten the decarbonisation of our built environment.

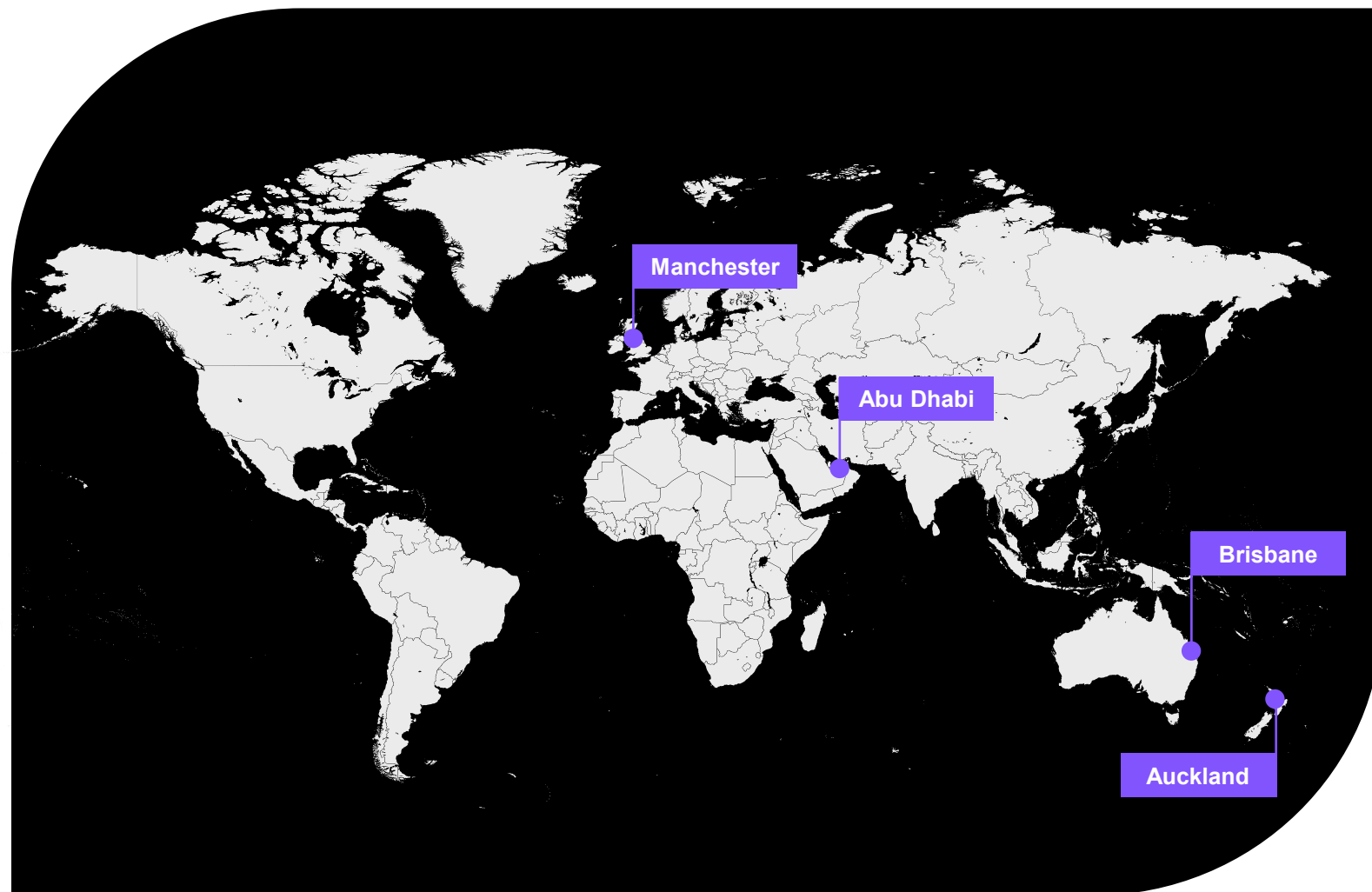
Over the past decade, the key message that has been echoed time and again is the power of collaboration. Bringing together infrastructure owners, government, regulators, academics, consultants, contractors and suppliers to exchange ideas, share experiences and devise solutions has emerged as a cornerstone for driving progress. You can read last year's UK Carbon Crunch report on our [website](#).

This year, Carbon Crunch events were hosted in multiple locations across the globe:

- Auckland, New Zealand – 12 September 2024
- Manchester, United Kingdom – 2 October 2024
- Brisbane, Australia – 30 October 2024
- Abu Dhabi, Middle East – 5 November 2024

We'll be sharing reflections from across all these events on our website and are aiming to establish more Carbon Crunch events in other locations next year.

[Follow us on LinkedIn and stay tuned for further insights.](#)



Tackling the causes and effects of climate change. **Together.**

Carbon management

Climate resilience

Sustainability

Net zero

ESG

Nature-based solutions

Climate risk

Renewable energy

**Want to know more?
Contact us.**

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