MOTT MACDONALD

Decarbonising infrastructure:

accelerating our transition to a net-zero world

Output report from Carbon Crunch 2021: the pre-COP26 edition, hosted by Mott MacDonald, 4 to 7 October 2021



COP26 is crunch time for net-zero infrastructure



Mark Crouch
Carbon management discipline lead, Mott MacDonald

Contents

COP26 and infrastructure: accelerating change

Energy: navigating complexity at the decarbonisation nexus

Transport: responding to rapidly changing technologies, behaviours and energy needs

A net-zero built environment: tackling heat, retrofit and embodied carbon



Whatever agreements are made at COP26, infrastructure owners and operators must act now to help secure global net-zero by 2050.

The success of carbon management is dependent on industry-wide collaboration and knowledge sharing.

With this goal, for nine years now, we have been running our annual infrastructure carbon management summit, Carbon Crunch.

This year's event, the pre-COP26 edition and the second to be held online, focused on practical steps and best practice to drive change in decarbonising infrastructure.

Using examples from the COP26 host city of Glasgow and beyond, the event explored the roles and responsibilities of national policy-makers, regulators and local decision-makers, as well as asset owners and operators, in enabling and accelerating the climate transition.

It's great to see such a wide range of stakeholders engaged in this work. And it shows that whatever our role in the infrastructure value chain, we all have a part to play in achieving net-zero.

Working together we can achieve net-zero





Denise Bower
Executive director, external engagement, Mott MacDonald

Climate change is one of humanity's most urgent challenges. It poses immense risks but also enormous opportunities to create a better world.

To succeed, we must transform our social and economic infrastructure, our built and natural environments, and the systems that underpin society, to cut emissions as far and as fast as possible.

It will be vital to employ innovative new digital solutions, adopt circular business models which place a greater emphasis on reuse and the elimination of waste, and build resilience to the impacts of a changing climate.

And we need to work together. Through collaboration between governments, businesses, cities and communities, we can take action now to help secure global net-zero by 2050. In developed countries, this requires a transformation of society and the economy. In low- and middle-income countries, it calls for climate-conscious development.

There are a host of compelling reasons to cut emissions and align with the transition to a net-zero world. Whether commercial and competitive, as radical emissions reductions require innovation in all areas of business, or to comply with financial, fiduciary and legal obligations, net-zero is a global goal with which everybody needs to align – governments and businesses alike.

The COP26 summit will be key in developing an effective routemap for responding to climate change in the years ahead. With time to act running out, it is vital that long-term emission reduction commitments are translated into short-term actions.

For the infrastructure industry, this will mean identifying where we can build upon existing progress, learning from best practice in other sectors, and recognising key areas where innovation and further development are required.

All of which was the focus of Carbon Crunch: the pre-COP26 edition. This summary of the presentations delivered by leading industry figures and our own experts will help guide you on your decarbonisation journey.

COP26 and infrastructure:

accelerating change

Overcoming the challenges of the climate transition

The decarbonisation of cities and the acceleration to net-zero will likely bring significant benefits to the infrastructure sector in terms of growth and opportunity.



But a number of challenges are emerging:

Stranded assets

The climate transition, if very quick, could mean that companies will own assets that are no longer viable.

There is also increased risk of companies shelving or abandoning projects, which has implications for those involved in helping to deliver them.

Skills

There will be a major skills challenge if cities around the world get serious about retrofit. Most of the workforce needed to deliver a net-zero economy are already in employment.

If we have a significant labour shortage, we are going to have to retrain, retool and reskill, and the skills system is not set up for that.

There is not yet the pipeline of projects and scale of investment needed to give employers and infrastructure providers the assurance to invest in recruiting and training people. And a ‘knee-jerk’ shift in demand will create delivery problems.

Climate impacts

Increasing global warming represents financial, reputational and delivery risks, and we have got to factor those into our planning.

Re-evaluation of roles and governance

What’s the role of an infrastructure company in this space in the 21st century? Is it the same as it was 10 or even five years ago? I would say no.

For the Apollo programme, NASA instigated completely different ways of working with private sector companies.

It’s time to think about that again. How can business models evolve – through partnerships, for example – as part of deeper systemic changes to bridge knowledge and skills gaps?

Glasgow City Council are committed to overcoming these challenges. But we need to work together.

It will mean radical change and the infrastructure sector must be active participants in bringing about this change because they have the crucial knowledge and insight to make it happen.

Kit England
Green economy manager,
Glasgow City Council



Delivering resiliency and decarbonisation in Scotland

The Institution of Civil Engineers Scotland supports and represents more than 8000 members who design, build and maintain Scotland's transport, water supply and treatment, flood management, and energy infrastructure.

Hannah Smith
Director, ICE Scotland

The expertise we can call upon is unparalleled and not surprisingly one of our key priorities is to channel that into informing, and leading, the debates around the decarbonisation of infrastructure.

We are currently focusing this knowledge base on three main areas:

- Resiliency
- Enabling
- Delivery

Resiliency

The increasing impact of extreme weather – flooding, heat, drought – is already putting much of Scotland's infrastructure under great strain and future challenges will only exacerbate that.

That is why improving resiliency is paramount – in a way that maximises the opportunity to deliver wider outcomes, both socially and economically, as well as making assets more sustainable. The scale of this is immense, particularly on knowing where to prioritise resources to deliver maximum impact.

To help answer this, we are advising the Scottish Government to conduct a resiliency audit across the entire infrastructure sector and we are hopeful this will be started in the coming months.

Enabling

Our sector is as aware as any of the need to decarbonise our infrastructure, and fast – but how best to achieve that?

From a policy-maker's perspective, there is a huge amount of information to wade through in the carbon space before you can ascertain what action you can take that will have a meaningful impact and add value.

We are working with Mott MacDonald to identify the key policy, regulatory and financial measures needed to enable the decarbonisation of Scotland's infrastructure. For this study we've been working on a very robust programme of stakeholder engagement to capture data and knowledge about projects that are already successfully decarbonising assets. We will then do the analysis and hard thinking so we can present policy-makers with policy and regulatory quick wins – actions we know, through learnings from the projects we've looked at, that could be impactful across the board, and help us reduce the carbon impact of our infrastructure faster.

The findings will be published later this year and will be a blueprint for future activity in this area.

Delivery

As we have seen, underpinning successful delivery of resiliency and decarbonisation will be the mechanisms used.

It's important we get the right processes and frameworks in place quickly, so we bring forward the right projects and not the wrong ones.

We need to think more holistically about the wider value of assets to society, the economy and the environment, and the positive impacts they can have.

This is how we should view infrastructure: as a means to an outcome rather than an end in itself. So, we need to ensure delivery mechanisms lock in the good outcomes we want to see from our infrastructure.

There is a risk that we 'do things the way we've always done it' – including on the processes that determine the value and validity of infrastructure projects. Old thinking may not be sufficient to tackle new challenges; it's right that we consider how we're delivering infrastructure – from blueprint to build-out.

8000

members represented and supported by the Institution of Civil Engineers Scotland





Accelerating change towards net-zero

70%
reduction in capital carbon by 2030



Anglian Water has been measuring, managing and reducing carbon for more than 15 years.

We understand why this is so important in our region: we are at risk to the impacts of climate change because the topography is flat, increasing vulnerability to flooding, and we are already under water stress due to having two-thirds of the average annual rainfall.

By 2030, we aim to achieve net-zero carbon emissions and a 70% reduction in capital carbon compared to the 2010 baseline.

Having credible targets with clarity is a really important first step towards decarbonisation. There also needs to be good collaboration – with the government, regulators, stakeholders and across the supply chain.

On top of that you must have validation from external auditors who can come in to ensure what you say you are doing has been externally verified. We do that through ISO 14064, Achilles Carbon Reduce (formally CEMARS), and PAS 2080.

To accelerate decarbonisation, you need to know where the carbon hotspots are in your organisation and where you need to focus efforts.

Our biggest source of emissions is the energy we use. But the biggest challenge going forward will be to reduce process emissions, that's the nitrous oxide and methane emitted during wastewater treatment. There's no technology available yet to fully eliminate those emissions. In 2020 the water companies in the UK came together to launch a routemap to net-zero by 2030. Working closely with Mott MacDonald, we have also developed our own data-driven pathways to net-zero.

Our target pathway highlights three key areas of activity and intervention:

- First, to reduce emissions within our control. How do we reduce energy usage? How do we become more water efficient and reduce leakage?
- Second, how do we maximise the opportunities from renewables, including solar, wind and biogas to grid? This will require us to develop ways to store green energy.
- The third area of focus, which is something new for Anglian Water, is offsets. As we don't have answers to eliminating process emissions, we will still have residual emissions in 2030 that will require offsetting. Rather than go out and buy the cheapest offsets available, we are working with stakeholders in the East of England, to develop a market and opportunities around offsetting that will bring environmental and social prosperity to the region we serve.

Lastly, sustainable finance. We've raised over £1bn in green bonds since 2017. This year we issued the world's first sustainability linked bond tied to operational and capital carbon targets. If we meet these targets, we will raise cheaper finance.

Aligning the sustainability agenda with finance and how we invest in our infrastructure is now a critical part of our net-zero strategy.

David Riley
Head of carbon neutrality, Anglian Water

Energy: navigating complexity at the decarbonisation nexus

The energy sector is integral to the decarbonisation of the economy as the sector itself undergoes a clean transition.

Heating and transport, for example, will become more intrinsically linked with the power system in the future with increased electrification required in all credible net-zero scenarios.

Delivering this to meet the UK's 2050 net-zero target will clearly require more systemic thinking than we've seen to date. With the transition will come a series of challenges and opportunities as organisations adopt new business models and technologies.

Caroline Pye
Account leader – energy sector,
Mott MacDonald

Harnessing the synergy between energy and transport

Five years ago, the energy sector was the sector with the highest emissions, but with the closure of coal power stations and the growth of renewables, it has been on a decarbonisation journey.

Dr Russell Fowler
Senior project manager – decarbonisation of transport, National Grid

National Grid has been at the heart of this, supporting the uptake of renewables, greater flexibility in the system and more interconnectors so that energy can move around the system more efficiently.

Today, transport is the sector that emits the most carbon – it accounts for 27% of our national emissions. We now want to support transport on its own decarbonisation journey.

It's important to note that the decarbonisation of transport is not all about batteries. Among heavier vehicles, hydrogen may be the likelier solution, and we are technology agnostic. Whether energy is needed to plug into a battery or to create green hydrogen, we are there to support that.

There is certainly an opportunity for the UK to become a leader in electric vehicle (EV) infrastructure. Making this happen will require collaboration across industries; the wider energy industry and the transport sector will need to work together.



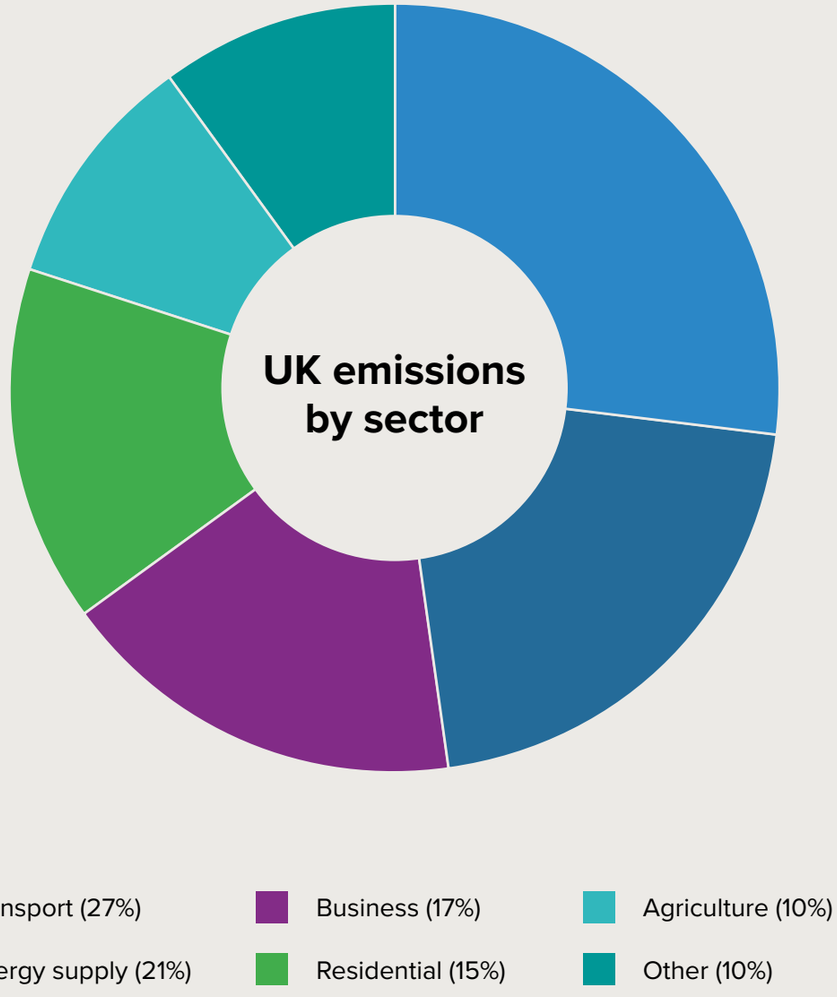
It's obvious that EVs need clean power. At National Grid, we're looking to connect 40GW of offshore wind by 2030 – that's a quadrupling from the 10GW we have now in just nine years.

But the other side of the coin, and something that's maybe not so obvious, is that the variability of renewable generation means that we need the flexibility provided by EVs.

Smart charging – where your vehicle is charging overnight or when it's windy or sunny – enables renewable power by helping manage that system in a more efficient way. It gives you flexible demand that can be matched with your more variable supply, so there's a nice synergy.

One way in which we are looking to play a more direct role in transport decarbonisation is supporting Project Rapid, a government initiative from the Office for Zero Emission Vehicles to ensure there are ultra-rapid, open access charging points at every motorway service station in England. These will charge your vehicle in about 15 minutes – so they are quite energy intensive – and there needs to be enough of them to facilitate the full uptake of EVs, so they will require a lot of power and a substantial network connection.

Funding of £950M has been allocated to this. By 2035, when all new cars will be EVs, we are expecting there will be 6000 of these chargers across 110 sites on England's strategic road network.



Source: BEIS, 2019 UK Greenhouse Gas Emissions, Final Figures

Trading energy flexibility will aid decarbonisation

Local balancing is an important part of the decentralised, digital future of the energy system.



Piclo is an independent marketplace for trading energy flexibility online. Like any other market, we have buyers and sellers. Transmission and distribution networks come to us when they have constraints on their network, and parties who can provide flexibility – such as virtual power plants, aggregators and electric vehicle (EV) charging providers – are able to meet that request. We aren't replacing the traditional reinforcement that substations need, but we do help them to minimise cost and avoid compromising the local grid.

System operation is becoming more complex and decentralised. The old system was centralised and analogue, but we're moving to one that is more decentralised and digital. Traditionally, the systems operator's role has been to ensure that there is enough security in the whole system and that it is balanced.

90GW

UK's future peak energy demand

This is still the case, but now with high renewable penetration and EVs on the grid, there is also the risk of congestion at the distribution level, and there is the need for local balancing, which is where Piclo comes into the picture. It's a more complex system, but at the same time, quite exciting.

Currently, energy demand in the UK peaks at around 60GW, but in the future demand is going to be more variable during the day, and peak at around 90GW. Flexibility by the distribution network operators can help balance it and avoid us having to deploy carbon-intense solutions like coal power stations. Flexibility could halve the amount of network reinforcement needed, saving £2.7bn per year.

When we started in 2013, the market was only 38MW in size; so far this year it has reached 350MW. Energy retailers, aggregators, EV charging providers, project developers and large energy users are all participating and enjoying an extra revenue stream, as well as making the energy system greener and more resilient.

Stefanos Anagnostopoulos
Commercial manager, Piclo

The power of partnerships

Overcapacity is a feature, and not a bug, in a decarbonised energy system. This is especially true on the island of Ireland, where we have been endowed with a phenomenal wind resource, both offshore and onshore.

Installed wind power capacity is forecast to eclipse median peak demand by 2027. Overcapacity presents a great opportunity for us to extend the value of electricity and change how we think about energy systems; this is where we believe that hydrogen has an important role.

Hydrogen is a key link between a renewable power system and a wider net-zero energy system. Overcapacity means that the wind will blow more than we need it to, and dispatching electrolysers to turn this potentially wasted power into hydrogen ensures that every green unit of electricity is put to work.

Hydrogen also provides an opportunity for energy storage for those times when the wind doesn't blow, and it drives our ability to take decarbonisation to areas where electricity is not best suited, such as the maritime and heavy transport sectors.

Dr Joe Devlin
Senior analyst, Power NI



But who is going to build electrolyser capacity and invest in the production of green hydrogen when there's no demand? And if you are a potential green hydrogen customer, why would you change your processes and engage in significant capital investment if you are worried about not actually being able to source this fabled green hydrogen?

This is where partnerships, systems thinking and funding come to the rescue. The only way to solve a two-sided market problem is to tackle both supply and demand at the same time. That's why we've partnered with Translink, Interreg, the Office for Zero Emission Vehicles and Department for Infrastructure on a pioneering project that will directly reduce emissions in Northern Ireland. Translink's new hydrogen double-decker buses, built by Wrightbus, will be fuelled with renewable hydrogen produced by one of Power NI's windfarms.

And completing the supply chain for this project is the installation of the first hydrogen fuelling system on the island of Ireland. This project on a technical level is great for proving concepts and business models and kick-starting the hydrogen economy. It's also a blueprint for how to collaborate across sectors to achieve our net-zero goals.

In a similar spirit of partnership, we are transferring our learnings to the maritime space via our membership of the Belfast Maritime Consortium, a 13-partner syndicate of businesses, academia and local government which has received £33M of UK Research and Innovation Funding to deliver a net-zero ferries project. Building on this, the NI Green Seas Project, led by Power NI and containing partners including Mott MacDonald, will leverage our experience to identify and investigate zero-emissions solutions for port and vessel operations.

By unleashing the power of partnerships, we can take sustainability as far as possible and compound our impact on climate change.

£33M

of UK Research and Innovation Funding received to deliver a net-zero ferries project



Transport: responding to rapidly changing technologies, behaviours and energy needs

In a world where transport is so important, it is vital that we find low-carbon ways of moving people and goods to their destinations.

The transport landscape is rapidly changing with new technologies emerging at a rapid pace, and the demand for travel continually evolving.

In this context, we must set clear roadmaps for the future of our transport systems which integrate existing solutions with innovative emerging technologies, and provide incentives for the decarbonisation of transport around the world.

Kim Yates
Sustainability and climate change lead – UK and Europe, Mott MacDonald



Systems thinking needed to decarbonise transport

Leon Daniels OBE
Vice-president of the Chartered Institute of Logistics and Transport, and member of Department for Transport's Net Zero Transport Board

The UK's Decarbonising Transport Plan (DTP) outlines the government's commitments and the actions needed to decarbonise the entire transport system in the UK.

The DTP sets out a roadmap for increasing cycling and walking, introducing zero-emission road vehicles and a net-zero rail network, and accelerating the decarbonisation of aviation and maritime vessels. Importantly, the plan takes a whole-system approach.

The pace of change set out in the DTP is fast, and the deadlines tough. All new non-zero emission road vehicles, from motorbikes to HGVs, will be phased out by 2040, and by 2050 every place in the UK will have its own net-zero transport network.

The DTP raises some important challenges for policy-makers and transport planners, and these potential bumps in the road will need smoothing through innovative solutions and policies.

Air quality and respiratory health will vastly improve in our towns and cities if EVs replace internal combustion engine vehicles, for example, but will do nothing to ease congestion unless people change their behaviour and use alternative modes of transport.

Replacing the £2.8bn raised by fuel duty each year is another conundrum for government, with road pricing – the simplest way to plug the shortfall in tax revenue – politically difficult to introduce in a country where drivers are not used to paying per mile.

Rail contributes just 0.6% of UK greenhouse gas emissions, yet accounts for more than 10% of all distance travelled across the country. The COVID-19 pandemic has significantly reduced rail travel, but to meet our net-zero target we need the train to again take the strain rather than use a car.

Confidence in the safety of trains and stations will return in time but encouraging more people to use rail in the future will come down to reducing the cost of tickets and making it easier for passengers to get to and from a station. Better integration of rail with other modes of transport, including active travel, and taking a whole-system approach to transport will help drive change.

Incentivising the rail sector to decarbonise

76%

less carbon produced by rail compared to road freight



The UK government's Decarbonising Transport Plan and Rail Environment Policy Statement both put rail at the heart of the nation's future sustainable transport system. To realise this ambition, we need tangible strategies backed up with the right investment and resources.

The independent Rail Safety and Standards Board has been leading an industry-level decarbonisation research programme for more than three years. One of the key projects is intended in part to provide advice and guidance to the Department for Transport (DfT) on how best to incentivise decarbonisation in the rail industry.

One focus has been on where we should electrify and where hydrogen and battery trains will be more cost-effective options. We need to understand how best to support high-speed rail for long-distance travel, and how to move more freight on the railways. It's a decarbonisation strategy for the next 30 years and beyond.

Our 'decarb programme' to date comprises 17 projects, including traction options for both passenger and freight trains, indicative routes into service for hydrogen and battery trains, and decarbonisation of the rail supply chain. We are updating the programme each year through an extensive consultation process with the industry so we know we are addressing the most important issues at an industry level. To deliver a significant modal shift to rail, we've also had to look at what is happening in other parts of the economy and consider the impact of COVID-19 on the industry – not just at peak commuting times.

Incentives around demand are really challenging. There are knock-on effects on taxation and on other sectors from switching people and freight onto the railways, while removing diesel-powered engines from the network by the DfT's 2040 target date has enormous financial implications for the industry. We also need to achieve decarbonisation without negatively impacting efficient and safe services for passengers and freight.

Rail is hugely important to delivering a net-zero UK. Rail produces 76% less carbon than road freight, with one freight train able to keep up to 76 HGVs off the road, providing benefits not just through decarbonisation but across a much wider range of economic, environmental and social measures. But moving more freight by rail will add complexity to the rail system and have consequences for ports and logistics chains and companies, including getting goods the last mile to shops and consumers.

Every one of us must change how we live, work and play to deliver a future zero-carbon economy. Identifying the most effective mechanisms to deliver the necessary change requires collaboration and engagement beyond the rail industry so we maximise efficiencies, social value and resilience.

Andrew Kluth
Lead carbon specialist,
Rail Safety and Standards Board



Embedding net-zero in Scotland's transport appraisal process

Scotland's target for reaching net-zero emissions is 2045 – five years earlier than the UK's goal of 2050. A further target requires a 75% reduction in emissions from 1990 levels by 2030.

Stephen Cragg
Head of modelling and appraisal, Transport Scotland

Mairi Joyce
Project principal, Mott MacDonald

Transport has a clear responsibility in the climate transition and we're now updating the appraisal guidance for transport planners and decision-makers working on Scottish-based transport projects.

First published in 2003, and last updated in 2008, the **Scottish Transport Appraisal Guidance** or STAG consists of two parts: overall guidance on transport appraisal and reporting structure; and a detailed technical guide on best practice assessment methodologies for completing an appraisal.

The primary drivers for change are the amendments to strategy and policy since 2008, including the second National Transport Strategy. Climate change specific policy drivers include the Climate Change Scotland Act 2019, last year's updated Climate Change Plan and the Infrastructure Investment Plan published in February. We've also gathered feedback from STAG users through workshops and a survey.

We have focused on the following key questions:

- What role does appraisal play in achieving climate change targets?
- What do the updated climate change priorities for Scotland mean for decision-makers?
- What information do decision-makers need?
- How do we best measure impacts against targets?

The revised appraisal guidance includes:

- The creation of a new STAG criterion which requires assessment of options against their contribution to net-zero targets, resilience, and ability to adapt to climate change.
- Identifying options based on Scotland's sustainable investment hierarchy. This includes, for example, making better use of existing assets before considering building new ones.
- Amendments to the Policy Assessment Framework Tool to incorporate climate change specific policy.

The updated guidance is currently out for consultation. Besides amending in line with feedback, next steps include updating the accompanying investment decision-making guidance and technical database as new government guidance on assessing carbon emissions emerges. Rolling out improved training for users is also on the horizon.

A net-zero built environment: tackling heat, retrofit and embodied carbon

There are three imperatives that everyone in the built environment sector should be working towards:

First, a clean energy revolution, transforming the energy system in both supply – which is how we produce and distribute low-carbon energy, and demand – which is how we use it.

Second, we need to curb energy demand. This transformation isn't financially or technically feasible without radically transforming our approach to energy conservation, in both construction and operation. We have to get better at using the energy we do have more wisely.

Finally, for those carbon emissions that we just can't eliminate, they must be captured and stored – for ever.

The built environment is an integral part of this. We've been managing carbon emissions associated with buildings for decades – since energy conservation was first featured in the Building Regulations.

But only recently have we seen a recognition that the built environment is part of a wider integrated system. How buildings interact with other forms of infrastructure such as transport is critical in driving wider behaviour and social change, and in generating more fundamental shifts to lower-carbon ways of living.

Clare Wildfire
Global practice leader for cities,
Mott MacDonald



Working towards net-zero at a local level

Over the next 10 years the Isle of Dogs in London will see more than 30,000 new homes built and the creation of 110,000 new jobs.

In developing a Local Area Energy Plan for this booming part of the capital, our strategy moves away from traditional approaches which focus on growth, and towards wider goals such as resilience and decarbonisation. This had to be aligned with UK government policy, the Mayor of London's plans for the city – including his decision to bring net-zero targets forward to 2030, and local plans at area or borough level.

Our plan aims to:

- **Show** how we can decarbonise the energy system while supporting economic growth. This includes reducing overall energy needs, increasing efficiency, and meeting the demand for low-carbon warmth and hot water in existing buildings as well as new ones.
- **Understand** the likely uptake of new technologies such as heat pumps and electric vehicles, and the effect on electricity use.
- **Explore** a range of decarbonisation strategies including high heat, electrification and decarbonised gas against factors such as cost and disruption, and how new technologies apply to the local context.
- **Engage** local people through consultations and citizen juries which will examine and feed into decarbonisation strategies.

The outcome of our work will be the development of a preferred decarbonisation pathway and a system transformation roadmap that pinpoints low-regret investments, key decision points for more substantial investments, and areas where planning policy must be tightened.

Core challenges so far include:

- **Engagement:** The local authority has limited capacity to engage, and energy system planning is a non-traditional space for them to be involved in. We must take people on the journey with us.
- **Data quality:** We need to ensure data – on the building fabric, energy use and uptake of low-carbon technologies – is up to date.
- **Resources:** It is important that sufficient time and investment are committed to this activity, especially when it comes to tracking progress and considering residual emissions and offsets.
- **Scope:** There is no single agreed process for exploring different decarbonisation scenarios and options that are accepted by the wider industry. While using Ofgem's sponsored methodology has been helpful, we need to define the limits of our work.
- **Local policy alignment:** Our plan must dovetail with the local authority's existing plans and responsibilities, with any interventions backed up with clear evidence and the support of the community.

There is a huge opportunity to develop a joined-up strategy that everybody can contribute to from the outset, with everybody aligned around a common vision. Having all stakeholders on board will be crucial in setting this busy and vibrant pocket of east London on the road to net-zero.

Andrew McMunnigall
Planning lead, infrastructure co-ordination service, Greater London Authority



Making buildings more energy efficient

The Scottish Futures Trust's aim is to ensure world-class infrastructure for the people of Scotland – a mission that must deliver on our net-zero commitments.

To this end, we worked with our partners – including the Scottish Government, Zero Waste Scotland, Health Facilities Scotland, local authorities and construction firms – to co-create the Net-Zero Public Sector Building Standard.

This new standard provides energy efficiency guidance for all new builds as well as major refurbishment projects. It is voluntary, and public sector organisations can shape the targets and remit of the standard to reflect their own policies.

Ross Ramsay
Associate director, Scottish Futures Trust

The standard is divided into three key sections:

Place

Applies the three key principles of Scotland's Infrastructure Investment Plan: driving inclusive economic growth, creating resilient and sustainable places, and the transition to net-zero. Identifies the need, and whether existing assets or services can be used to meet it. If a major refurbishment or new building is required, then the standard drives the client to engage with other parts of the public sector to maximise value from this new investment.

Carbon

This covers three areas: embodied carbon during construction, operational energy from day-to-day use, and other whole-life energy use such as replacement of equipment or maintenance. For the first two, we set targets early in the process, driving users to maximise energy performance from the outset.

Environment

This area is divided into two objectives: indoor environment, where post-occupancy evaluations can report on how efficiently energy is being used; and environmental aspects, covering all other environmental implications of the project.

To refine the standard, we applied it to 10 'pathfinder' projects of different types and different stages of construction. One was the refurbishment of St Sophia's Primary School in Galston, East Ayrshire. The project aims to become one of the first schools in the UK to achieve EnerPHit (the energy efficiency standard for retrofits equivalent to Passive House).

The application of 'Place' principles early in the project identified the importance of the existing building to the community and, because of this, a deep refurbishment was chosen as opposed to new build. East Ayrshire Council also sought to demonstrate that excellent energy and internal environmental performance was possible in refurbishment. The decision to enhance the existing building minimised the overall construction embodied carbon of the project. Once complete, St Sophia's should provide an exemplar for public sector buildings in Scotland.

The standard will be available soon and we hope as many public sector organisations make use of it as possible. The standard will be refined and enhanced over time and as it becomes more widely applied. It will evolve as the best becomes better, as industry responds to net-zero and as our understanding of what is possible improves, ensuring it continues to provide best-in-class guidance.



Retrofitting is crucial part of climate transition

While we understand the need to cut embodied and operational carbon emissions in new buildings, many overlook the crucial work that must be done to retrofit existing buildings, too.

In the UK, 80% of the buildings that we will have in 2050 already exist today,[1] so renovating existing buildings must form a key part of our net-zero journey. Globally, renovation rates need to increase by 3% a year from 2017 if we are to have any hope of achieving net-zero in the building sector by 2050.[2]

Many barriers, however, limit the number of refurbishment projects delivered each year:

Risk: Uncertain building conditions combined with a stricter planning and regulatory environment bring additional risk to any renovation project.

Additional cost: Existing buildings may require additional surveys or greater design costs.

Planning regime: There are often restrictions to what can be done to existing buildings, with added hurdles during the planning process.

Barriers to creativity: Working with existing structures curtails what possible outcomes can be achieved.

Construction challenges: There may be operational challenges to construction, especially if the existing building remains in use during site work.

Materials: While there is no VAT on construction products, there are few incentives to use salvaged materials.



Eszter Gulacsy
Technical director, Mott MacDonald

1. Property Week
2. World Green Building Council

Just three materials – concrete, steel and aluminium – are responsible for 23% of global emissions.[3] While there are already initiatives to bring down the embodied carbon emissions of these products, other low-hanging fruit include better specification of rebar, insulation, glazing and finish materials, all of which will significantly reduce embodied carbon emissions while coming at a minimal or no cost premium.

Bringing materials suppliers into the process early on can help to optimise the final design. But cutting embodied carbon emissions is just the start of the journey. We also need to look at what happens to buildings at the end of their lifecycles, and the possibilities for reuse, recycling and salvage and bringing materials back to the beginning of the lifecycle of buildings.

Integrating these specialisms into the design process will help to embed circular economy principles into the project, maximising efficiency and cutting waste and associated emissions.

3. Architecture 2030

Reducing embodied carbon in buildings

Concrete

14-33%

Optimise concrete mix
None to low-cost premium

Finish materials

5%

Select low- or zero-embodied carbon finish materials
None to low-cost premium

Insulation

16%

Select low- or zero-embodied carbon insulation products
No cost premium

Glazing

3%

Select low-embodied carbon glazing products
10% cost premium

Rebar

4-10%

Use high recycled content rebar
None to low-cost premium

Source: Rocky Mountain Institute, Reducing Embodied Carbon in Buildings, 2021

Helping you on your decarbonisation journey



Wherever you are on your net-zero journey, Mott MacDonald has the expertise, tools and know-how to support you along the way. Here are some resources that can help.

Thought leadership

'COP26 – the last best chance for our climate' – Only immediate and sustained action across every sector of the global economy will bring rising temperatures under control and help us avoid the worst impacts of climate change, says Sam Friggens, our global practice leader for climate change.

'Net-zero: winning strategy or false sense of security?' – Net-zero is powerful as a rallying message but we must be more aware of who gets to make use of the 'net', writes Clare Wildfire, our global practice leader for cities.

'How to develop a net-zero plan: lessons from the Water UK routemap' – Infrastructure owners need routemaps that will guide them to net-zero carbon – and their journeys need to start now, writes Priyesh Depala, Mott MacDonald's investment planning advisor.

'Transporting you to a low-carbon future' – Transport is the largest source of carbon dioxide emissions in the UK. The sector needs to lead the way in moving the UK, and the rest of the world, to a greener future. By Katie Chesworth, our principal transport planner and transportation unit sustainability lead.

'The transport-energy nexus' – Keeping global warming to 1.5°C will require the transport and energy sectors to work together, explain Mott MacDonald's Paul Hammond and Craig Lucas.

'Hydrogen: the key to a zero-carbon energy system' – Hydrogen is an essential counterpart to renewable generation, providing a means of storing energy to overcome intermittency and balance supply with demand. By Chris de Beer, our global hydrogen leader.

Online resources

Combating the causes and effects of climate change. Together. – Our new climate change web pages.

Reducing emissions to net-zero – Learn more about how we can support you during the climate transition.

'Less is more' – Our carbon management brochure.

Moata Carbon Portal – Our carbon monitoring solution for the built environment, enabling a net-zero future.

'A place-based approach to net-zero' – How local insight, capability and connectivity can help the UK towards a better, faster, cheaper net-zero. (Produced by the Net-Zero Infrastructure Industry Coalition.)

A leader in carbon management

Nobody knows carbon management like we do. We have been working with our clients to cut carbon for nearly a quarter of a century, helping them to reduce their environmental impact, drive efficiency and become more sustainable.

In 2015, we co-authored PAS 2080, the international standard for managing infrastructure carbon, and are accredited to PS 2080 globally. In 2020, we became the first company of our kind to be **certified** as carbon neutral and we have pledged to become a **net-zero organisation** by 2040 or earlier.

We have joined the UN **Race To Zero** campaign, are a partner to the Coalition for Climate Resilient Investment (leading the development of a methodology for assessing physical climate risk), and support the **Powering Past Coal Alliance** to advance the transition to clean energy.



Nine years of crunching carbon

The reports from all our previous Carbon Crunch events can be found on our website:

- **2013** – New strategies for cutting the cost of infrastructure: introducing the Infrastructure Carbon Review
- **2014** – Shining a searchlight on leadership, innovation and procurement
- **2015** – How to manage infrastructure carbon and cost: introducing PAS 2080, the international standard for managing infrastructure carbon
- **2016** – The road to zero carbon: why the highest level of ambition opens opportunity for innovation and reward
- **2017** – Who needs reduction targets? Strategies for accelerating carbon and cost savings
- **2018** – Achieving net-zero: the investor angle
- **2019** – Delivering net-zero infrastructure: practical steps
- **2020** – Delivering net-zero infrastructure: practical steps in a changing world



Opening opportunities with connected thinking.

Talk to us:
carbonmanagement@mottmac.com

mottmac.com