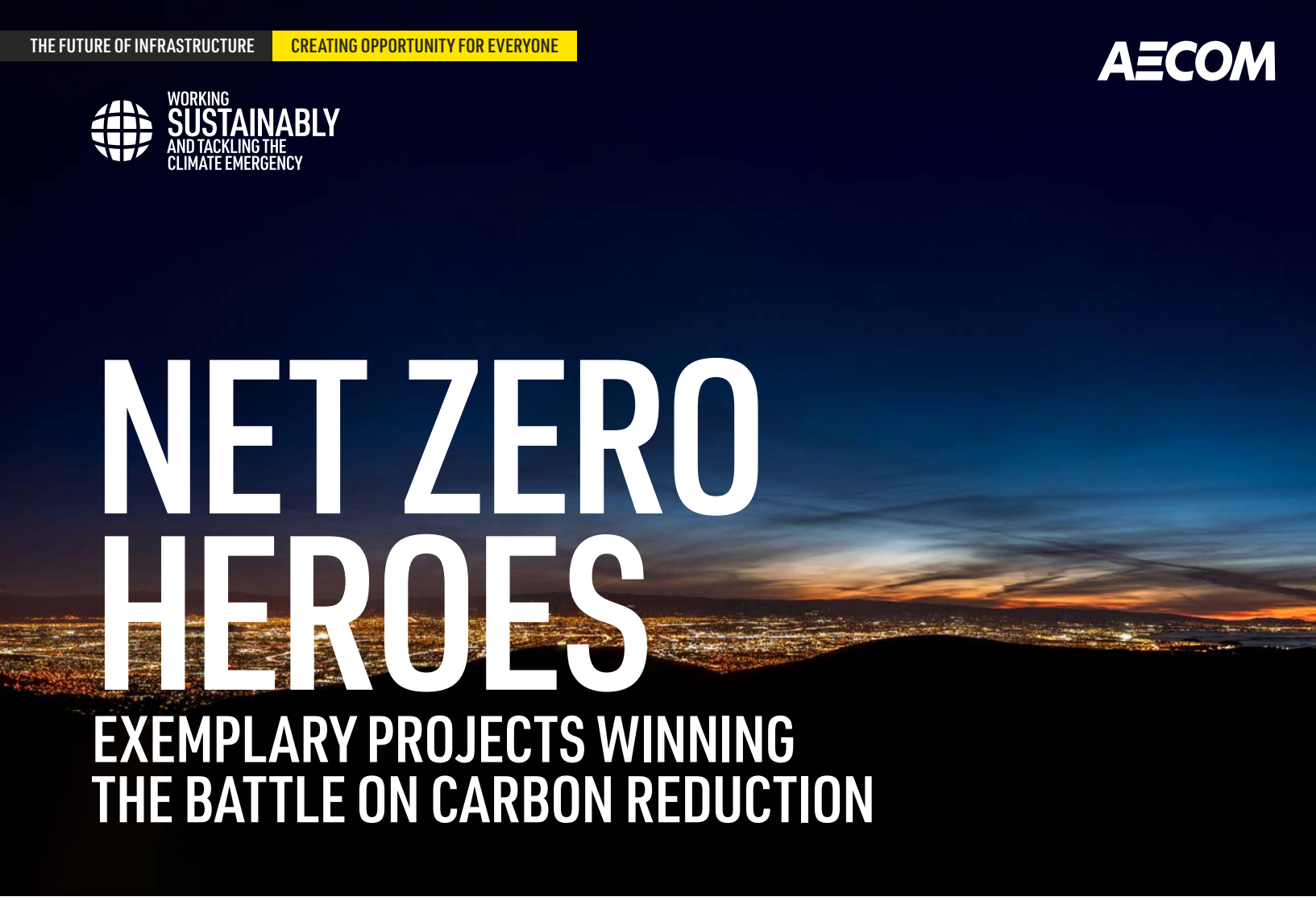
AECOM

WORKING SUSTAINABLY AND TACKLING THE CLIMATE EMERGENCY



NET ZERO HEROES

EXEMPLARY PROJECTS WINNING THE BATTLE ON CARBON REDUCTION

From the city of Palo Alto in California, to the Environment Agency in England, and the city of Christchurch, New Zealand, ever more organisations are committing to reduce their carbon emissions. Taking inspiration from the new technologies and fresh thinking making these goals achievable, AECOM's **Robert Spencer** and **Claire Bonham-Carter** examine projects that could have a huge impact on the health of our planet — if implemented more widely.

The Paris Agreement on climate change commits signatories to limiting global warming. To meet their goal, the Intergovernmental Panel on Climate Change (IPCC) estimates that carbon emissions need to be reduced to zero by 2050. A growing list of countries, cities and corporations are signing up to this target, or promising to do more: Microsoft, [1] for example, plans to become carbon negative in 2030.

To put the brakes on the climate crisis, ten years is a very short timeframe. But thanks to advances in technology, which are bringing down the price of renewables and increasing energy efficiency, we believe a sustainable energy future is in reach. Getting there is no easy task, however: it will require incentives, targets, roadmaps, and creative thinking.

For his recent documentary film 2040, award-winning director Damon Gameau travelled the world looking for working solutions that could help improve the health of our planet. Similarly, we looked across our business for examples of projects at the vanguard of creating a carbon neutral and liveable world.

We have identified five areas where reducing infrastructure-related emissions could have a huge impact. Naturally, this includes energy, buildings and transport, which in the US together account for around 70 percent of carbon emissions. [2] Also fundamental to the challenge are so-called nature-based solutions that protect and restore natural ecosystems that absorb carbon emissions and enhance resilience by, for example, reducing rainfall runoff and the impact of flooding. Finally, there's a need to cross boundaries — looking for solutions outside the boxes that constrain our spatial imaginations.

MOMENTUM FOR CHANGING THE WAY WE PRODUCE, CONSUME AND STORE ENERGY IS INTENSIFYING.

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ENERGY

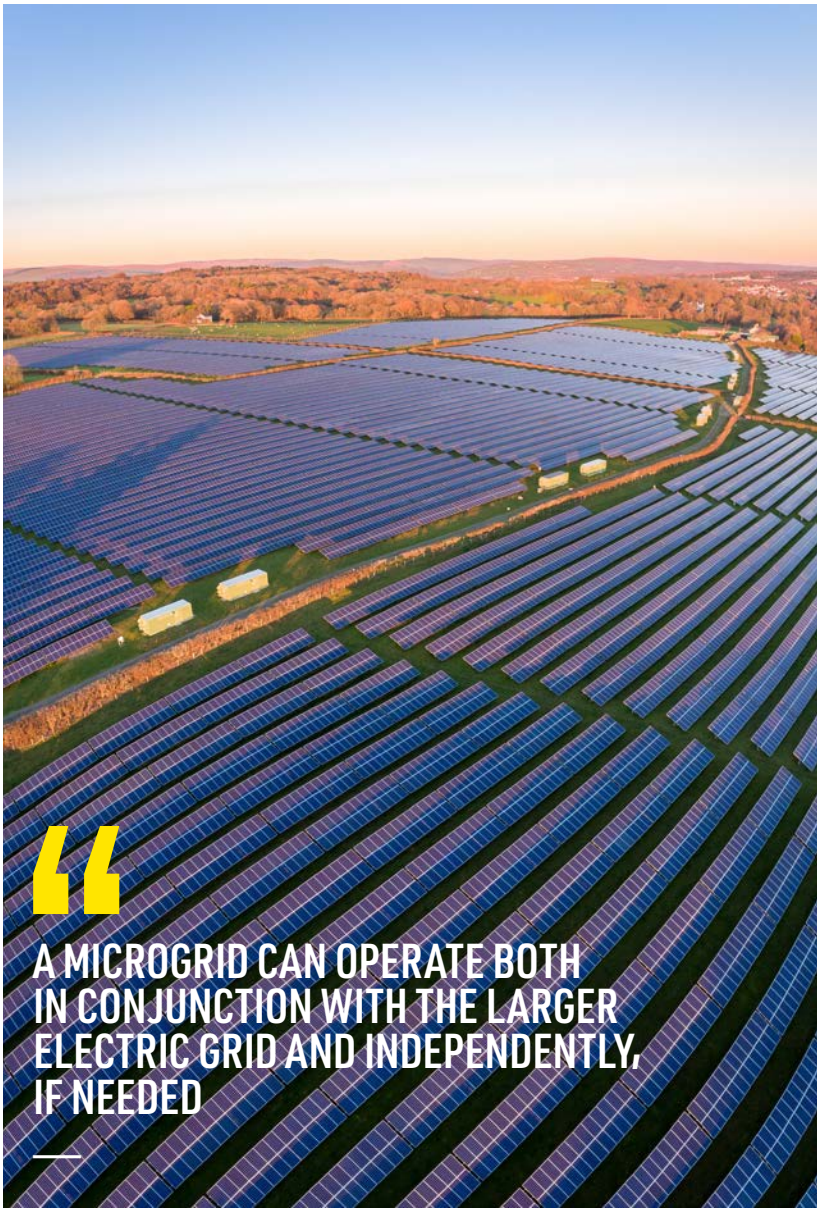
Momentum for changing the way we produce, consume and store energy is intensifying. In northern Illinois, local electric utility ComEd is working with customers to identify ways that resilient energy infrastructure can benefit communities, combat the effects of climate change, and improve daily life.

In Bronzeville, a neighborhood just south of the Chicago Business District, ComEd is constructing the first utility operated microgrid cluster. A microgrid can operate both in conjunction with the larger electric grid and independently, if needed, due to the distributed energy resources like solar PV and energy storage that power it.

Designed to harness on-site renewable resources, the microgrid will serve an area that includes critical city facilities, such as Chicago's public safety headquarters, schools, and libraries. It is also designed to enable the study of how microgrids support the integration of clean energy onto the grid and increase grid security to keep power flowing even during extreme weather or a catastrophic event.

The microgrid is a key component of ComEd's Community of the Future Initiative, focused on resilience, decarbonization, inclusive economic growth, and STEM education. Several STEM education programs are underway, aimed at helping high school students develop crucial skills, cultivate an energy-saving mindset, and receive career guidance and opportunities.

ComEd is testing solutions that connect infrastructure with daily life in the community. This includes new technologies that make the grid more sustainable and resilient, and new business models that give residents and businesses more control over their energy use.



A MICROGRID CAN OPERATE BOTH IN CONJUNCTION WITH THE LARGER ELECTRIC GRID AND INDEPENDENTLY, IF NEEDED

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64.6
KWH/SQM/YR

80 Ann St., Brisbane, Australia, energy intensity

130
KWH/SQM/YR

Average minimum compliance office building in the same geography

BUILDINGS

When it comes to tall buildings, the first principle of physics prohibits their ability to achieve completely carbon neutral outcomes within the site boundary — but they can still try. With real estate group Mirvac, we're planning a 35-level office building in sunny, subtropical Brisbane, Australia, that is fully electrified with an energy intensity of 64.5 kWh/sqm/yr (in comparison, an average minimum compliance office building in this geography might consume over 130 kWh/sqm/yr). The electrified approach to the 80 Ann St project gives Mirvac the ability to source renewable energy via commercial arrangements such as energy supply agreements (ESAs).

Not only that but for 25 percent of the year, multiple floors of the building will maintain comfortable working conditions using mechanically assisted natural ventilation — no small feat in this subtropical climate. To limit the need for heating and cooling, the building's façade limits the transfer of solar radiation and automatically opens panels under the right conditions. Light-filled spaces with Australian native plant species also offer users and visitors a breathable space to interact with nature, encouraging health and wellbeing benefits. Greenery continues up the rise of the tower through planting along vertical spines.

In its design, AECOM targeted carbon neutrality, 6 Star Green Star rating (World Excellence), 5.5 Star NABERS Energy rating, 4.5 Star NABERS Water rating, and WELL Platinum.

TRANSPORT

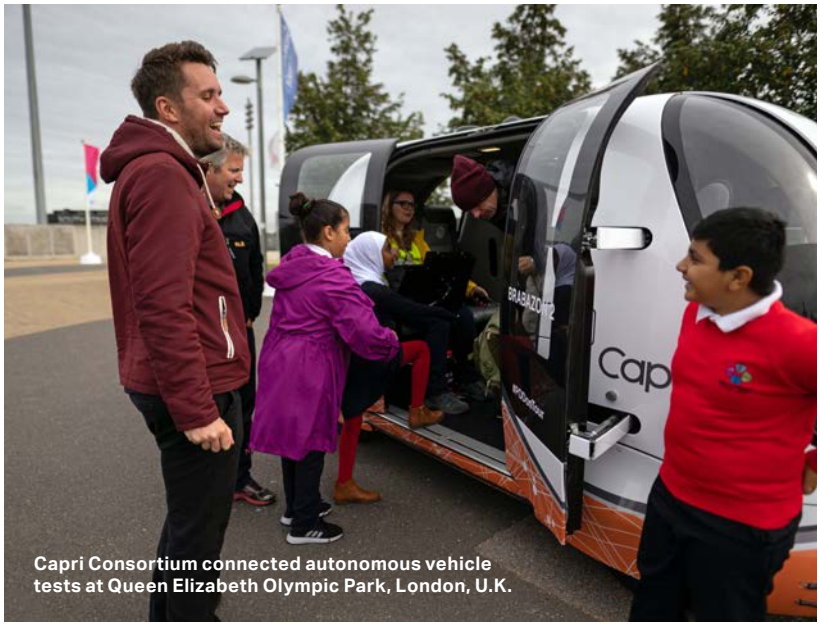
The idea of driverless cars has been around since at least the 1960s, when a sensitive self-driving Volkswagen Beetle called Herbie won cinemagoers hearts in the Disney classic The Love Bug. As connected digital technology makes this futuristic concept a reality, however, it's becoming clear that the potential is much more than a hands-free driving experience. The real potential of autonomous vehicles is about moving towards a collective and more efficient transport experience that would reduce the number of vehicles on roads and curbsides. When coupled with the electrification of vehicles and the greening of electric grids, the potential to reduce carbon emissions is enormous.

The future of mobility is ACES (Automated, Connected, Electric, Shared). Each of these elements will impact in different ways, and getting the combination right will ultimately determine the carbon credentials of the system. In other words, it's the management of the technology that's important, not the technology alone.

Transport systems across the world are already using artificial intelligence and digital sensors to help analyse the millions of pieces of data being generated relating to demand, delays and constraint issues across their networks. Soon they'll be able to respond in real time with increased capacity, timetable changes and updates to passengers. The process could be so seamless that there would be little need for an individual car. Those needing to travel will summon the most appropriate means of electric, connected and autonomous transport from a Mobility-as-a-Service (MaaS) provider summoned by app — from an individual pod to a shared vehicle accessed at a mobility hub. If the system works efficiently, it could mean the days of individually-owned private vehicles — with the cost and maintenance they require — are numbered, liberating garages, curbsides and parking lots.

In London this March, AECOM invited members of the public to the Queen Elizabeth Olympic Park to test out the first 'on-demand' connected and autonomous vehicle (CAV) using a mobile app in the UK, led by the Capri Consortium. The app allowed users to insert their start and end point from a preselected dropdown list, as well as the number of seats required and whether they needed special assistance services such as wheelchair access for the electric, driverless, connected vehicle they were summoning. The Capri trial is an excellent example of an ACES mobility system in action, and the small steps that are required now to inform policy that will make a big difference in the future.

In the context of the pandemic and social distancing personal safety needs, it is likely that demand for CAVs — which eliminate the need for personal contact and could incorporate automatic washing and disinfection functions — will increase.



Capri Consortium connected autonomous vehicle tests at Queen Elizabeth Olympic Park, London, U.K.

100 YEARS

Reforestation has the potential to erase as much as 100 years of carbon emissions.

NATURE-BASED SOLUTIONS

Nature-Based Solutions (NBS) are actions designed to work with and enhance natural habitats in order to take advantage of the ability of healthy natural and managed ecosystems to sequester carbon. In contrast with many engineered solutions, NBS have the potential to tackle both climate mitigation and adaptation challenges at relatively low-cost while delivering multiple additional benefits for people and nature.

Well-designed policies and measures to protect and enhance forest resources, in particular, have a tree-mendous role to play in reaching the Paris carbon reduction goal. A recent scientific report [3] named reforestation as one of the most effective carbon drawdown solutions to date, with the potential to erase as much as 100 years of carbon emissions. However, despite growing recognition of the potential of NBS, there is relatively little finance made available for their implementation. Efforts to restore, protect and enhance natural carbon 'sinks' are also often in competition with more lucrative sources of income from agricultural production and extraction and harvesting of natural resources.

To address these challenges, payments for ecosystem services (PES) have emerged as a possible means of financing investments in NBS. The basic idea behind PES is that those who benefit from the goods and services that nature provides (ecosystem services), reward those who adopt land management practices that support delivery of those services. PES may operate at a variety of scales.

In Ethiopia, AECOM explored the potential for setting up PES schemes in the highland forests in order to tackle issues of food and water security under a changing climate. Ethiopia wants to become a climate resilient middle-income country by 2025, with no net increase in greenhouse gas emissions. At the same time, the changing climate is putting pressure on Ethiopia's already fragile economy, impacting agriculture and creating issues of food security and desertification. Significant fluctuations in rainfall cause disruption to electricity distribution, 95 percent of which is generated by hydropower, as well as water supplies.

> DEVELOPERS ARE UNDERSTANDABLY RELUCTANT TO LOOK BEYOND THEIR SITE AS THIS HAS THE POTENTIAL TO ADD COSTS, RISKS, DELAYS AND/OR CONTRACTUAL ISSUES TO THE PROJECT.

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Through mapping and modelling the supply of and demand for ecosystem services, we identified the river basin areas and services that would be suited to the development of PES. First, we calculated the benefits the forest brings in terms of carbon storage and sequestration, shading for crops such as coffee, flood alleviation and prevention of sedimentation and siltation of major dams downstream. Then we looked at who might pay for these services, such as dam operators, coffee growers, and international climate markets to finance the interventions or land management actions required to protect the forest.

On the basis of the analysis, two sites were selected. Both would allow for carbon sequestration, qualifying for carbon credits in international carbon markets, whilst encouraging water quality regulation and the protection of the last remaining populations of wild-growing Coffea arabica, the leading commercial coffee species accounting for around 70 percent of global production.

CROSSING BOUNDARIES

Developers are understandably reluctant to look beyond their site as this has the potential to add costs, risks, delays and/or contractual issues to the project. When it comes to energy consumption, however, physical and contractual boundaries are hampering our ability to deliver low energy, low carbon developments. Those willing to cross the red line boundary around the site stand to reap huge benefits in terms of sourcing 'secondary heat', such as heat recovery from sewerage systems, canals, rivers, and district heating schemes.

In Denver, the National Western Center is a legendary Colorado entertainment complex in the process of being re-imagined. The project has a long-term goal of becoming a net-zero energy campus and AECOM and partners Saunders and Enwave were tasked with finding a solution, including long-term operation and maintenance.

A key part of the district renewable energy strategy is tapping heat from the Delgany sewer main to feed into an ambient campus wide piping distribution loop. The system will heat and cool six facilities, including the Stockyard Event Center, Livestock Center, and Equestrian Center by coupling the loop with high efficiency heat pumps. The sewer has twice the amount of energy needed to supply the entire campus and meets over 90 percent of the heating load. Such are the benefits that the sewer — which needs to offload some of the thermal heat it carries for its own environmental compliance — is being re-routed through the site. By using this centralized district energy network, the energy use of the campus is reduced to the extent where the remaining demand could be generated with solar photo-voltaic (PV) panels on the building rooftops.

National Western Center, Denver, Colorado, U.S.

PRIORITIZING ACTIONS

2020 kickstarts a decade of environmental change, and cities and organisations are looking across the world for inspiration from projects such as those identified here. By 2030, it could be possible to eliminate carbon emissions — but only if we learn from the best the world has to offer.

Take Palo Alto, for example. This Silicon Valley city is a leader in renewable electricity and gas and has set itself a target of achieving 80 percent greenhouse gas reductions by 2030, relative to 1990 levels — not an easy feat given its significant commuter traffic and congestion challenges. AECOM was recently selected to assist in an update of the City's Sustainability and Climate Action Plan that includes updating the city-wide emissions inventory with special attention on calculating the transport-related emissions and the benefits of emissions reductions, as well as engaging residents and businesses. Their support and participation will be crucial for the success of the plan.

The next step is making decisions, selecting projects such as those outlined here that will make our world a more liveable place. But where to start?

Bill Abolt, George Lunt, Petrina Rowcroft, Kenny Teeter, Calum Thompson, and Adriaan Window contributed to this article.

> The climate action selection and prioritization (ASAP) tool is a key component within C40's Climate Action Planning programme, as it supports cities to deliver on their ambitious GHG emission reduction targets. The tool enables cities to prioritise their mitigation and adaptation actions and develop ambitious and equitable climate action plans in line with the objectives of the Paris Agreement. The C40 Climate Action Planning Programme provides a wide range of support such as. training, workshops, peer-to-peer collaboration to C40 cities, a network composed of the world's megacities committed to addressing climate change.
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> **Michael Doust, Programme Director, Measurement and Planning, C40**

To help guide the decision-making process, we've devised a tool for the C40 Cities Climate Leadership Group, which is leading 96 cities around the world through a climate action planning program designed to reach net zero by 2050. The C40 Climate Action Selection and Prioritisation Tool helps city staff and other users prioritise carbon reduction and climate adaptation actions to reduce emissions and increase resilience to climate hazards. Reflecting both best practices in climate action planning and the unique context and priorities of their city, there is no other climate action prioritization tool like this available.

Supported by over 1,500 lines of custom code and designed to be flexible to the needs, contexts and priorities of each city, the tool guides cities through each step in the action prioritization process. First, they enter data on the sources of emissions by sector, as well as the likelihood and impacts of various climate-related hazards. Then they load in all the actions they are considering from programs to policies, physical projects and so on, rating their performance based on potential emissions reduction, vulnerability reduction, feasibility, and social, environmental and economic benefits. The results are displayed visually in a series of dashboards that guide decision-making. The tool is also designed to encourage stakeholder engagement.

In an ideal world, cities would be able to begin pursuing all actions necessary to achieve carbon neutrality and climate resilience simultaneously, but the reality is that all have limited resources and competing priorities. An action prioritisation process that reflects the priorities of the city is more likely to be successful and therefore help meet our net zero goals. This project is especially exciting because it will be used on five continents representing one twelfth of the world's population. WL