

Voices on Infrastructure

# Meeting the sustainable infrastructure challenge

September 2021



# Table of contents

02	Introduction
04	News from the Global Infrastructure Initiative
05	Delivering sustainable infrastructure: Insights from industry leaders
10	Action needed: Help us measure project sustainability
13	Accelerating sustainable infrastructure: An investor's perspective
17	Ensuring adaptation and resilience to climate change



# Introduction



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Welcome to the September 2021 issue of *Voices on Infrastructure*, a collection of insights on how infrastructure can help address the climate-change challenge.

Many of the obstacles and uncertainties experienced over the course of the COVID-19 pandemic have had unprecedented effects on the \$11.6 trillion global infrastructure industry. While the disruptions have been significant, COVID-19 also accelerated a number of trends that were already occurring, including a renewed focus on sustainability and resilience, decarbonization, the energy transition, social equity, and digital-technology and talent strategy.

Infrastructure investment continues to be a critical driver for outcomes such as these, and bold commitments and strong collaboration across the public and private sectors are likely to prove essential to addressing climate change.

We hope the following topics in this issue of *Voices* help inspire leaders globally to reimagine creating paths to meeting the climate-change challenge—one of the most important themes for sustainable infrastructure:

- Climate change will spur **a wave of changes to how we design, build, and operate infrastructure**. Unprecedented and increasing levels of natural hazards call for innovative and increasingly efficient technologies—and for the industry to develop new skills and capabilities, from carbon accounting to green finance. This secular shift presents opportunities not only for engineering and construction firms, but also for owners.
- Investing in sustainable infrastructure to bolster adaptation and mitigation will require **a new approach to public–private collaboration**. Capital requirements for a net-zero world are enormous, resulting in potential stranded assets and rising production costs. However, the

costs of a disorderly transition are likely to be higher still. New regulatory frameworks, metrics, and institutions could encourage private capital to invest in sustainability for the long term while ensuring equitable access for vulnerable communities.

- **Capital sustainability will play a critical role in achieving sustainable development goals** in the years to come. Yet today there is wide fragmentation of evaluating instruments and sustainability metrics as well as a lack of agreed-upon definitions and benchmarks. One of our goals as practitioners is to create clarity on the right sustainability metrics and instruments for companies to focus on, and thus guide capital-sustainability investments.
- **Adapting our cities to climate risk.** According to a recently published joint report from McKinsey and the C40 Cities Climate Leadership, there are 15 high-potential actions cities can take to address climate change, including pursuing nature-based solutions, investing in actions that increase resilience systemically, and improving equity in climate-risk adaptation. Developing a fit-for-purpose agenda based on each city's unique economic, demographic, and climate profile will be a critical task for urban leaders.

The existential threat of climate change prompts a rethink on the part of all infrastructure participants. Only by taking a fresh look at our technologies, business models, and agendas can the industry meet the challenge—and in a sustainable, equitable way. Every challenge, though, brings with it opportunities for leaders to have a lasting impact in the fight against climate change.

# News from the Global Infrastructure Initiative



**Tony Hansen**

Director of the Global Infrastructure Initiative,  
McKinsey & Company

Welcome to the September edition of *Voices on Infrastructure*, which is focused on meeting infrastructure's climate challenge.

At the 2021 GII Summit in April, it was evident that sustainability—decarbonization, the energy transition, social equity, and resilience—has moved to the top of the CEO agenda. To solve these challenging issues, bold commitments and strong collaboration across sectors, geographies, and the full value chain will be essential. As highlighted by global leaders in this [short video](#), those organizations that step up their game now will be better prepared to confront future challenges and contribute to building a more sustainable, resilient, and inclusive world. This edition of *Voices* shares perspectives on how to get started.

Consistent with this month's theme, we have scheduled our first two roundtables for Q3 and Q4. On September 15, we hosted a virtual roundtable on charting net-zero emissions in transport. On October 19, we will host a roundtable on future-proofing transport infrastructure. We will also be co-hosting two sessions on sustainable cities and decarbonizing the construction value chain as part of our [virtual event series at the COP26 Climate Change Conference in Glasgow](#). Over the coming months, we will confirm more roundtables, and you can find details on our [roundtable page](#).

We are also excited to announce that our [eighth GII Summit will take place in Tokyo](#) on October 19–21, 2022. Further details can be found on our website, and invitations will be sent out in November.

We hope you enjoy this issue, and we welcome your thoughts on how GII can continue to be a catalyst for driving change toward sustainable infrastructure. If you have comments or would like to subscribe a colleague to *Voices*, please contact us at [info@giiconnect.com](mailto:info@giiconnect.com).



Rendering courtesy of AECOM

# Delivering sustainable infrastructure: Insights from industry leaders

Sustainable infrastructure is critical in reducing carbon emissions. More efficient design approaches, new technologies, and better benchmarking can help.



**Lara Poloni**  
President of AECOM



**Nick Smallwood**  
CEO of IPA  
Head of the UK government's  
Project Delivery Function

**Climate change is here.** Evolving regulations and the increased frequency of natural disasters are changing how the construction industry designs, builds, and operates critical infrastructure, from transport and energy infrastructure to real estate. The industry's role in delivering sustainable infrastructure requires not one initiative but a portfolio of them, including decarbonizing the construction process and materials, designing and building projects that create net-zero emissions throughout their life cycle, and future-proofing infrastructure against both man-made and natural disasters, from cybersecurity threats to hurricanes. We spoke with Lara Poloni, president of AECOM, to get a sense of what's required during the engineering and construction phase, and Nick Smallwood, CEO of IPA and head of the UK government's Project Delivery Function, for an owner's perspective.

**McKinsey:** What are the three biggest obstacles to delivering sustainable infrastructure today?

**Nick Smallwood:** First, driving significant cultural and behavioral change to put carbon, the environment, and sustainable infrastructure and delivery at the forefront of our thinking. I think we are on a similar journey to that witnessed in the late 1980s and '90s and the message of "safety first."

This will not just be new skills and processes in terms of assessing how we measure our impact, but a cultural shift toward a sustainable "future first" approach. We won't have a successful project unless a focus on the future impact is at the heart of all our decisions.

The IPA's Transforming Infrastructure Performance (TIP) program supports this by transforming how government and industry intervene in the built environment to drive a step change in performance.

Second, too often we don't engage with the market on the basis of outcomes. This must be a focus, as set out in TIP and the government's Construction Playbook, and this is also linked to the continuing dependence on carbon-intensive materials in construction.<sup>1</sup> We need to establish the models that will incentivize industry to bring their innovation to bear to drive lower carbon solutions.

And third, using data to better understand the interconnected system and inform comprehensive decision making, supported by more consistent tracking and reporting, such as our construction metrics and benchmarking work.

**Lara Poloni:** Sustainability and resilience are often not considered early enough in the infrastructure life cycle. We need to make long-term considerations the default option when looking at the initial business case for infrastructure. And we need to better leverage data, not only to inform the type of asset that might be required but also to better identify the opportunities to maximize sustainability and resilience.

This requires a mindset shift to embrace "whole of life" infrastructure thinking, as well as a corresponding increase in client understanding that sustainable infrastructure does in fact provide a return on investment. Such an acceptance can ease the tension between capital expenditures and ongoing operations and maintenance budgets, providing a long-term view that stacks up.

In addition, long-term, effective policy with consistent bipartisan support is essential to promoting investment and supporting the market transition to net-zero emissions. Climate change and natural disasters are now at the top of many government policy agendas. New mandates and regulations are coming through that prioritize decarbonization. These

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<sup>1</sup>For more, see *The Construction Playbook*, December 2020, gov.uk.

will require focused solutions—cocreated by governments and the private sector—that reduce hurdles and offer incentives while demonstrating positive climate impact and social value.

Finally, if we can make infrastructure more socially acceptable—prioritizing more nature-based solutions over gray alternatives, as well as demonstrating the long-term benefits related to public amenities, green space, and air quality—then we stand to receive more community support, which can lead to more efficient and lower-cost delivery.

**McKinsey:** Which specific decarbonization measures should the construction industry prioritize now, and why?

**Nick Smallwood:** The construction industry must work with the government to support the move to platform approaches to construction, bring manufacturing principles into the sector, and act as an enabler for low-carbon materials and more carbon-efficient processes.

Whole-life carbon measurement and reporting must also be a priority. The focus to date has been on operational carbon, yet this doesn't take into account the big picture and won't take us to net-zero emissions. By focusing on whole-life carbon measurement and reporting, we can accurately determine our carbon impact and therefore make better decisions and drive efficiencies.

Finally, there needs to be a focus on scaling up industry's capability and capacity to retrofit existing social infrastructure and housing to improve energy efficiency as well as the resilience of our building stock.

**Lara Poloni:** The continued focus on reducing embodied and operational carbon should accelerate, whether that's through using fewer and lower-carbon materials or prioritizing Design for Manufacture and Assembly

(DFMA) approaches that increase off-site manufacturing and on-site, modular assembly.

I also believe we should challenge the notion of continuously building new infrastructure assets and explore options to get more use out of the infrastructure we already have. What is the best solution? Is a new building needed? Or is retrofitting an existing building the better, more sustainable option?

Clients need to come on this journey with us and help identify and cocreate the appropriate lowest-carbon, most resilient infrastructure solution. In this way, those solutions can solve the identified issues and support community health and well-being.

**McKinsey:** What roles can new technologies and materials play in increasing resiliency, accelerating delivery, and enabling more sustainable infrastructure?

**Nick Smallwood:** There are many positive roles technology can play. For example, there are a number of first-rate technologies available now, and we will need all those to be brought to bear, from AI to new materials, to help solve the challenges.

On the cautionary side, these areas do come with their own challenges. While new advanced materials will undoubtedly bring about some amazing capabilities, in the shorter term we will need to find ways to innovate within the existing system.

**Lara Poloni:** Both play important, interconnected roles. Technology provides the opportunity to better collect, organize, and analyze carbon and climate data. This in turn enables us to design low-carbon and resilient-asset options that may use sustainable materials or fewer materials in general. These options not only provide more accurate cost-benefit projections for the asset owner but

can also aid community engagement efforts, helping demonstrate social value, secure buy-in, and ultimately accelerate delivery.

On the materials front, we know materials such as concrete and steel are enormously carbon intensive, but there are nature-based or hybrid alternatives to standard gray-materials solutions—some of which may even absorb carbon emissions. There’s already been a lot of investment in decarbonizing steel and in the development of lower-carbon concrete, and although there may be risks attached to these new materials, the sharing of that risk between the contractor, designer, and asset owner is key to accelerating their adoption. Investing in trials of new materials, sharing the trial results, and updating design standards will also go a long way to facilitate the introduction of low-carbon materials.

**McKinsey:** How can we establish a benchmark and measure sustainability impact across the project life cycle?

**Lara Poloni:** There are already many benchmarks—for example, rating and certification frameworks LEED and CEEQUAL.<sup>2</sup> The Envision rating system is also widely used to embed sustainability into infrastructure projects. That said, we need to understand why these systems, and others, aren’t used more often.

There is also considerable fragmentation across the current benchmarks and standards. The International Coalition for Sustainable Infrastructure seeks to provide a more coordinated, consistent approach by cataloging the various guidance, tools, and standards currently used in the design and delivery of sustainable infrastructure. Meanwhile, Infrastructure Australia’s new Assessment Framework includes societal impact—with sustainability and resilience as supporting themes—as part of its assessment criteria for new projects.

That’s where there’s an enormous opportunity to improve how we share and analyze the massive amount of data generated through those various standards and benchmarks across asset types, and to drive sustainability and resilience advances. We’ll have better benchmarks when we have better carbon and sustainability data, and that data can come via the development of a library of asset types, such as bridges, roads, and tall buildings, that align with corresponding benchmarks and can act as a point of incremental improvement.

**Nick Smallwood:** The IPA is currently working on setting out construction metrics. Establishing a carbon baseline is critical—we will not be able to move forward without it. However, this is only part of the picture. Colleagues across government are working with us to establish the appropriate measurement methods for this on a whole-life basis, and we need industry to support us in this by providing the data and by coming forward with strong ideas.

Recently, the IPA updated its benchmarking guidance document to include a new annex that provides guidance on how to bring whole-life carbon into the heart of the benchmarking process. This will help to ensure carbon is captured and considered alongside cost, time, and benefits as part of the project investment and decision process.

**McKinsey:** What new skills and capabilities are required to realize the sustainable-infrastructure goal?

**Lara Poloni:** Ongoing skills development across the engineering profession is critical. Ultimately, we need to shift our thinking. We need to approach every project through the lens of sustainability, resilience, and long-term community benefit. And that will happen only through developing a high level of carbon literacy and competency around how materials—and design and construction

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<sup>2</sup> LEED refers to Leadership in Energy and Environmental Design, and CEEQUAL, a sustainability assessment rating scheme.

approaches—impact the carbon load of an asset's design and operation.

If we are designing a sustainable, resilient bridge, then we need to consider how it can be constructed from fewer, less carbon-intensive materials at the business-case stage. In this regard, as we develop and leverage our own technical and visual design skills to improve decision making, we also have the opportunity to show communities how these decisions will protect them from future climate impacts.

**Nick Smallwood:** People deliver projects, so it is crucial to success that we attract new skills to the sector and build up a technologically smart workforce for the 21st century. Most important, this means building multidisciplinary teams that are made up of both innovators who can come up with creative solutions as well as those with strong contract-management skills to drive the change we need. It is crucial we recruit people who can think across silos and bring together conflicting demands to drive better overall outcomes.

**Lara Poloni** is the president of AECOM. **Nick Smallwood** is the CEO of IPA and head of the UK government's Project Delivery Function.

*Voices highlights a range of perspectives by infrastructure and capital project leaders from across geographies and value chains. McKinsey & Company does not endorse the organizations that contribute to Voices or their views.*

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# Action needed: Help us measure project sustainability

Quickly delivering capital projects will be key in fighting climate change. Doing so requires capital-sustainability metrics that apply across industries and sectors.



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**One of the key highlights** from McKinsey's seventh Global Infrastructure Initiative Summit in April was that sustainability performance has moved to the top of the CEO agenda. Several reasons help explain why this is the case—namely, the need for industry leaders to adapt to more frequent extreme weather events as a result of climate change, the acceleration of greenhouse-gas (GHG) emissions targets, and increasingly stringent government regulations.

On these points, a number of initiatives and measures offer high-level guidance for navigating the years ahead. Most prominently, the Paris Agreement aims to limit global warming to 1.5 degrees Celsius,<sup>1</sup> and the United Nations' Race to Zero campaign aims to build momentum before COP26, the next UN conference on climate change.<sup>2</sup> Yet players across the infrastructure value chain—including investors; developers; owners; and architecture, engineering, and construction players—are looking for more consistent ways to assess the sustainability projects at both the board level (for investment decisions) and the executive level (to better manage and direct project development).

This should not be surprising: capital sustainability will play a critical role in achieving long-term sustainable development goals. In addition, consumers are increasingly aware of and demand more sustainability, investors are considering its impacts across the value chain, and projects that employ sustainable practices are more likely to be supported and receive funding.

As sustainability continues to shift to the forefront of the minds of investors and the public, infrastructure players are looking for markers that demonstrate their commitment toward sustainable practices, such as leveraging alternative building products,

retrofitting existing assets with carbon-capture technology, and employing digital practices to reduce waste.

## Shifting to the project of the future

There are two driving forces behind improving capital sustainability. First, construction is directly or indirectly responsible for approximately 25 percent of GHG emissions,<sup>3</sup> and the industry creates up to 20.4 million tons of waste in a single year from building and demolition.<sup>4</sup> Second, capital sustainability can improve ROIC and reduce risk—lowering financing costs—as many private and pension investors offer more and cheaper capital for sustainable players and shun carbon-related assets.

In response, financiers, developers, and owners are looking not only to build more sustainable assets but also to build them more sustainably.

On the first point, there are several ways to approach the sustainability of assets. Those currently being employed can reduce their carbon footprints by being retrofitted for carbon-capture, utilization, and storage technology. In other instances, different types of asset classes can be pursued, such as renewable (solar and wind) and emerging (hydrogen). In addition, as the world moves toward increased electrification, upgrading utility grids to withstand extreme weather events because of climate change will be as important as increasing capacity to meet demand for electric vehicles (EVs) and other technologies.

Regarding building more sustainably, companies can pursue practices at the outset of the construction process that improve how new assets are designed, engineered, and constructed. This can entail incorporating materials with smaller carbon footprints or employing digital practices

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<sup>1</sup>"The Paris Agreement," United Nations Climate Change, unfccc.int.

<sup>2</sup>"Race to zero campaign," United Nations Climate Change, unfccc.int.

<sup>3</sup>Jose Luis Blanco, Hauke Engel, Focko Imhorst, Maria João Ribeirinho, and Erik Sjödin, "Call for action: Seizing the decarbonization opportunity in construction," July 14, 2021, McKinsey.com.

<sup>4</sup>Salman Shooshtarian et al., "We create 20m tons of construction industry waste each year. Here's how to stop it going to landfill," July 18, 2019, theconversation.com.

such as digital twins to reduce sources of waste, and modular building to reduce unnecessary transportation.

### **Creating capital-sustainability metrics**

Quickly delivering capital projects will be key to fighting climate change. Doing so requires building more renewable power at a faster pace, and developing economies around the electric grid and hydrogen. The transport industry will need to be further decarbonized, which requires a number of new battery plants as well as a huge push for EV charging infrastructure. Other industries—such as cement, chemicals, and steel—will similarly require significant changes to both existing plants and those being built. The construction industry also needs to be decarbonized around new builds and revamping existing buildings. Finally, in terms of capital expenditures, sustainable businesses need to be grown.

Overcoming these challenges in the most sustainable way will require instruments and sustainability metrics that are incorporated across

industries, sectors, and regions. Senior leaders should have a good sense of what to measure while also being able to demonstrate that their changes are making progress toward their sustainability goals.

McKinsey is embarking on an effort to create clarity across key sustainability dimensions. In doing so, we hope to provide an actionable set of metrics to better define and enable the performance improvement of a “sustainable project.” Furthermore, we aim to assess the full asset life cycle—including location, development, supply-chain materials, construction methodologies, social or community engagement, and lifetime operating footprint—to allow owners, investors, and contractors to improve their projects, design and deliver them sustainably, and secure demonstrable sustainability over the asset’s complete life cycle.

*To better understand sustainability practices for major capital projects, as well as what we should measure, collaboration is required. Please help us by completing this [short survey](#).*

**Ruth Heuss** is a senior partner in McKinsey’s Berlin office, **Tip Huizenga** is a senior partner in the Sydney office, **Mark Kuvshnikov** is a partner in the Houston office, and **Prakash Parbhoo** is a partner in the Johannesburg office.

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# Accelerating sustainable infrastructure: An investor's perspective

Sadek Wahba, chairman and managing partner of I Squared Capital, explains how to overcome challenges for funding sustainable infrastructure and why equitable access is so important.



**Sadek Wahba**

Chairman and Managing  
Partner of I Squared Capital

**As climate change increases** the frequency and severity of extreme weather events, essential structures and systems such as buildings, power stations, and roads will need to adopt sustainable measures. In turn, sustainable infrastructure will play a key role on two fronts: first, helping to mitigate the effects of climate change, and second, future-proofing existing assets while building new ones. In this lightly edited interview conducted by Tony Hansen of the Global Infrastructure Initiative, Sadek Wahba explains how collaboration between governments and the private sector can address the sustainability of critical infrastructure, as well as how inclusive project development can help ensure no communities are left behind.

**McKinsey:** What is the investment case for sustainable infrastructure, and what are some of the most exciting growth opportunities?

**Sadek Wahba:** We believe sustainable infrastructure investment will be a fast-growing investment opportunity in the coming years. Nearly every major economy has committed to the Paris Agreement and the UN Sustainable Development Goals. Recent projections from the International Renewable Energy Agency show that achieving global Paris targets by 2050 requires investments of \$4.4 trillion per year into low-carbon energy alone.

Some of the most exciting potential growth opportunities can be found in solving for renewable-energy intermittency. Battery-powered renewable projects are starting to compete with fossil fuels to provide “on-demand” power. Because land and population density are an issue in many places—notably Asia—we are seeing promising growth opportunities in proven technologies such as floating solar and floating wind turbines, as well as offshore wind.

Finally, the transport sector shows promise as well, with the rapid adoption of renewable technologies and the replacement of diesel and gasoline vehicles with electric vehicles, hydrogen-based vehicles, and the related infrastructure. The ultimate goal is for sustainable infrastructure not to be seen as an investment opportunity in the future because all infrastructure will already be sustainable.

**McKinsey:** What challenges have you seen in funding these investments, and what will it take for investors to fully embrace the sustainable-infrastructure opportunity?

**Sadek Wahba:** Investment and technology innovations will inevitably come at a price. Sustainable infrastructure is more expensive than conventional infrastructure, at least until we reach sufficient scale. Building enough wind turbines to reach net-zero carbon emissions globally by 2050—the goal of the upcoming United Nations COP26—requires 1.7 billion tons of steel, which is enough to build the Golden Gate Bridge more than 22,000 times over. Wind farms require more steel for each unit of energy they produce than other energy sources, and steel production still relies on coal for its energy production. The question is—who will pay for this increased cost?

Until now, taxpayers shouldered the costs of wind and solar in the form of subsidies. This means user fees across multiple sectors need to be introduced or increased, and targeted mechanisms need to be developed to ensure an equitable distribution of costs. These issues also apply to emerging markets, where you have the added challenge of attracting global investors.

**McKinsey:** What steps can governments take to broaden their roles and help catalyze sustainable infrastructure projects?

**Sadek Wahba:** To begin, governments need sustainable regulations that are not subject to political changes every few years. This will allow investors to focus on the long term. Next, governments can work with the private sector to develop projects, initiatives, and structures that will “crowd in” private sector investment.

I have proposed the creation of a government-sponsored infrastructure bank in the United States that consolidates public and private funds and invests in public projects in the form of loans or direct-equity investments.

One of the bank’s goals could be to invest in sustainable infrastructure. And as part of the selection process, proceeds would be tied to delivering positive sustainability outcomes. The bank can also support the underserved by investing in inner cities or low-population-density towns. Finally, the bank can use profits to subsidize projects in less wealthy areas at lower returns or take a more active role in the R&D required for decarbonization pathways.

**McKinsey:** What do you see as the biggest challenges for asset management over the next ten years, and what strategies are you putting in place to deal with these challenges?

**Sadek Wahba:** The greatest challenge will be successfully navigating an increasingly complex maze of physical and transition risks, including regulatory changes. By physical risk, I mean the effects of climate change that are impacting our environment with increasingly volatile weather patterns. These events have a direct impact on infrastructure assets.

A good asset manager will invest with flexibility built into their operations. They will also look to diversify their investments across regions and sectors using well-defined risk models that internalize environmental, social, and governance (ESG) criteria, rather than treating

ESG as an appendix. It is also important to develop long-term sustainability road maps with portfolio companies to ensure maximum sustainability value can be extracted and to leave a long-term and credible sustainability legacy at exit.

**McKinsey:** How can we deal with critical infrastructure that cannot adapt to climate change, and how do we finance all that needs to be done?

**Sadek Wahba:** We should recognize that costs of an orderly transition are almost always going to be lower than the costs of a disorderly transition, and we should identify the sectors that are most vulnerable to climate change, as well as the regions that will be most impacted.

Over time, it is expected that few critical infrastructure systems will be left untouched by climate change. Using quantifiable data, we can model and rank which critical infrastructure systems and what locations are most susceptible to climate change. Public-private partnerships are often a good way to deal with those sectors and regions, rather than having the government shoulder the funding and execution burden.

**McKinsey:** The COVID-19 pandemic has highlighted the challenge of equitable access to infrastructure. How do we better address this with both existing and new infrastructure?

**Sadek Wahba:** We need to change how we make the case for infrastructure investment by looking at true costs and weighing them against the social benefits—job creation, social equity, and accessibility—and environmental and economic criteria.

The recent discussion around the US infrastructure bill included debate on whether

to increase user fees. One group felt these fees were highly regressive, while another group supported user fees instead of funding through increased government deficits. On this point, the federal gasoline tax, which helps maintain the US highway system, has remained unchanged since 1993. This means it has dropped by more than 70 percent in real terms. With electric vehicles, the revenues from the

federal gasoline tax will further erode. Yet there has been little serious research on the degree to which user fees are regressive.

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**Sadek Wahba** is chairman and managing partner of I Squared Capital.

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# Ensuring adaptation and resilience to climate change

It is necessary to implement a prioritized approach to protect urban residents, and the infrastructure that supports them, from climate risk.



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**A friendly green oasis** in the bustle of central Singapore, Bishan-Ang Mo Kio Park was long defined by a three-kilometer concrete canal that ran along its southern border. The canal often overflowed, flooding nearby roads.

In 2009, Singapore began stripping away the concrete, converting the canal into a meandering river. The result not only is more beautiful but also provides better drainage and water quality.<sup>1</sup> Even the local wildlife approves. The new waterway has brought more biodiversity to the park, including otters and a wide variety of birds.

This effort is an example of a growing trend in cities around the world: the use of natural features to manage the movement of water and reduce the risk of flooding. More broadly, it is an example of how cities are adapting to the realities of a rapidly changing climate.

Situated on the front lines of climate change, cities are already home to most of the world's people—and they're still growing. Moreover, they are often sited on coastlines and the floodplains of major rivers. That makes them vulnerable to rising seas and flooding.

At the same time, urban buildings and roads absorb and reflect the sun's heat, making cities considerably hotter than surrounding areas. Historic decisions to pave over streams and green spaces have reduced the protection offered by trees, plants, and natural drainage. As the most recent Intergovernmental Panel on Climate Change report noted, "ongoing urbanization together with more frequent, longer and warmer heat waves will make cities more exposed to global warming."<sup>2</sup>

The impacts of climate change are not felt equally by all residents. Poorer communities, the sick, and the elderly are more at risk. For example, rapid urbanization is leading to bigger, more crowded informal settlements,<sup>3</sup> which often lack the

resources to withstand the cyclones or flooding that climate change could bring. The challenge of ensuring that those who contributed least to climate change don't suffer the most is both global and local.

In just the past few months, we have seen the immediate threats posed by climate change. Extreme heat and wildfires have claimed hundreds of lives in Western Canada and the United States. Hundreds have died, and there has been major property damage due to unprecedented floods in Belgium and Germany. There is no question that protecting urban residents and the infrastructure that supports them requires urgent action.

Ensuring successful adaptation requires going beyond simply executing new projects; there is also a need to incorporate resilience into existing projects, develop innovative financing structures to unlock adaptation investment, and plan the built environment for improved adaptation. While infrastructure players are beginning to invest in building resilience, many are looking for guidance on where to begin. With this in mind, C40 Cities—a network of 97 global cities dedicated to addressing climate change—and McKinsey Sustainability set out to identify a starting set of 15 high-potential actions for cities to consider.<sup>4</sup>

Some of these actions build "systemic resilience," meaning they improve a city's ability to withstand and recover from a range of hazards (exhibit). Almost all cities should develop a basic understanding of climate risks and their impact, incorporate these risks into planning, develop early-warning systems, and ensure financial backstops for damages.

Other actions are specific to certain hazards, meaning they reduce the impact of a particular threat, such as heat or floods, or enhance a city's ability to recover from it. Examples include installing cool roofs, restoring wetlands, planting street trees, and managing river catchment.

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<sup>1</sup> Nathalie Badaoui et al., *Integrating climate adaptation: A toolkit for urban planners and adaptation practitioners*, C40 Cities, October 2020, [c40knowledgehub.org](https://www.c40knowledgehub.org).

<sup>2</sup> For the full report, see "AR6 climate change 2021: The physical science basis," IPCC, August 2021, [ipcc.ch](https://www.ipcc.ch).

<sup>3</sup> "AR5 climate change 2014: Impacts, adaptation, and vulnerability," IPCC, 2014, [ipcc.ch](https://www.ipcc.ch).

<sup>4</sup> For the full list of 15 actions, see Brodie Boland, Elizabeth Charchenko, Stefan Knupfer, and Shivika Sahdev, "How cities can adapt to climate change," July 2021, [McKinsey.com](https://www.mckinsey.com).

## The focused-adaptation report aims to help leaders embark on adaptation journeys.

**Focused adaptation aims to reduce the complexity of adaptation for city leaders by identifying a short list of adaptation actions leaders could evaluate for their city. The report did the following:**

- 1 Compiled more than 100 of the most common adaptation actions that build resilience to 5 physical climate risks
- 2 Assessed and scored the risk-reduction potential of all actions relative to each other based on quantitative case studies, peer-reviewed impact research, and expert perspective
- 3 Assessed and scored the relative complexity of implementation for all actions in terms of financial cost, infrastructure difficulty, and stakeholder complexity
- 4 Identified the actions with the highest potential that cities could consider adopting, using a benefit-by-feasibility matrix
- 5 Grouped cities into “typologies” based on economic, built-environment, and governance variables to assess whether the highest-potential actions differed based on these variables; concluded that roughly the same actions rose to the top for all typologies



### Four high-potential systemic-resilience actions



Risk assessment: hazard maps, impact assessment, and spatial analysis



Incorporating climate risk into urban planning



Early-warning systems and protocols



Climate insurance provision and alignment

### High-potential actions for each of 5 hazard types

● Nature-based solution

Extreme heat	Inland flooding	Coastal flooding and storm surges	Drought	Wildfires
<ul style="list-style-type: none"> <li>● Street trees</li> <li>Cool surfaces</li> </ul>	<ul style="list-style-type: none"> <li>● River-catchment management</li> <li>● Nature-based sustainable urban drainage solutions (SUDS)</li> </ul>	<ul style="list-style-type: none"> <li>● Coastal nature-based barriers</li> <li>Coastal artificial barriers</li> <li>Flood- and storm-resilient buildings</li> </ul>	<ul style="list-style-type: none"> <li>Water-conservation behavior programs</li> <li>Water-system efficiency</li> </ul>	<ul style="list-style-type: none"> <li>Development planning</li> <li>Preventive forestry management</li> </ul>

For each action, C40 and McKinsey offer real-life examples of how they can work. Many not only build resilience but also provide additional benefits, such as cutting greenhouse-gas emissions or air pollution:

- When Madrid’s Mercamadrid fish market installed a roof painted white to reflect the sun, temperatures inside the building fell by 5 degrees Celsius.
- Planting street trees brings shade and reduces temperatures while making cities more beautiful; Medellín’s Green Corridors project serves as an excellent example.
- Retrofitting public infrastructure can be expensive up front but can ultimately pay for itself. According to the US National Institute of Building Sciences, building retrofits to make structures more resistant to hurricanes can create \$6 in value for every \$1 spent.<sup>5</sup>

- Improving drainage reduces the risk of flooding and is also good for the creatures who live in and along riverbanks, as the otters in Bishan-Ang Mo Kio Park in Singapore display.

Effectively delivering on these 15 adaptation actions will require collaboration across the public and private sectors, including mobilization of both public and private capital. Some of these actions, such as building barriers to protect coastal areas, are expensive. Others, such as planting street trees and initiating behavioral-change programs, are relatively cheaper. Every city, regardless of wealth, can do something (see sidebar, “Five elements necessary for cities to implement climate actions”).

During the 2017–18 water crisis, Cape Town, South Africa, introduced a creative campaign to encourage residents to curb water use.<sup>6</sup> The campaign sponsored activities, such as school competitions, and used a series of nudges, such as promoting

## Five elements necessary for cities to implement climate actions

1. *Governance structures* to build accountability that adaptation plans are integrated into a city’s climate strategy
2. *Strategic planning* to ensure that climate adaptation is a core part of city growth and is updated regularly
3. *Monitoring and reporting* processes to illustrate adaptation progress and assess impact
4. *Capacity building and stakeholder management* to increase society’s climate awareness, as well as the capabilities of government employees, citizens, and even firms
5. *Finance planning* to establish collaborations with different institutions and long-term, continuous funding

<sup>5</sup>“Natural hazard mitigation saves: 2019 report,” National Institute of Building Sciences, December 1, 2019, nibs.org.

<sup>6</sup>Ammaarah Martinus and Faisal Naru, “How Cape Town used behavioral science to beat its water crisis,” *Behavioral Scientist*, October 19, 2020, behavioralscientist.org.

two-minute songs to sing to limit time spent in the shower, to lower water use. It worked: Cape Town managed to cut water use by more than half.

The global climate crisis is under way. Lives, livelihoods, and infrastructure are already at risk. Cutting emissions is critical, but it is also a long-term effort. In the meantime, cities can act now to protect their people and create a more resilient and hopeful future.

Download *Focused adaptation: A strategic approach to climate adaptation in cities*, the full report on which this article is based, on [McKinsey.com](https://www.mckinsey.com).

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