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INFRASTRUCTURE
INITIATIVE

By McKinsey & Company

Voices on Infrastructure

Improving project development and delivery

December 2021

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Introduction

As 2021 draws to a close, we are excited to bring together another slate of diverse voices to weigh in on the pressing, foundational questions facing infrastructure today. How do we pay for new and retrofit projects? How do we build, maintain, and operate better? How do we ensure the decisions we make today set us on a path for net-zero emissions by 2050?



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The climate-change solutions needed are of particular concern. At the 2021 UN Climate Change Conference (COP26), world leaders announced a new level of detail to their plans for how to meet the European Union's goal of reducing greenhouse gas emissions by 55 percent by 2030. In this issue of *Voices on Infrastructure*, we attempt to tackle the questions surrounding what asset owners, investors, and contractors need to do to realize the opportunities and manage the risks of improving project development and delivery in the age of decarbonization.

Los Angeles Metro CEO Stephanie Wiggins and A.P. Moller Capital Managing Partner and CEO Kim Fejfer weigh in on what industry players can help accomplish in the next generation—from spurring development in emerging markets to building equitable, reliable mobility options in our global cities. Rob McIntosh, route managing director for Network Rail, and Roger Bayliss, capital works director of MTR Corporation Limited (MTRCL), offer their insights into how the rail industry can meet changing environmental, social, and governance expectations. And a global set of our McKinsey colleagues explore how to use investment to spur infrastructure transformation and meet decarbonization goals.

The answers we're seeking are complex and nuanced, and we're grateful for the participation of these experts on infrastructure and their thoughtful approach to how we should move forward.

News from the Global Infrastructure



Tony Hansen

Managing Director of the
Global Infrastructure Initiative,
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Welcome to the December edition of *Voices on Infrastructure*, tackling how we improve project development and delivery at this critical juncture.

Extraordinary infrastructure stimulus accompanied by net-zero climate targets have presented both significant opportunities and challenges in regard to how we develop and deliver major projects. Although the funds may have been allocated, the systems to deliver these projects may struggle even to handle the anticipated increase in capacity and pace—let alone the new sustainability and resilience criteria. This edition of *Voices* will share perspectives on what it will take to redefine project success: developing new funding models, streamlining the approval process, incorporating new sustainability and equity criteria, and building the internal capabilities to deliver.

At the recent 2021 UN Climate Change Conference (COP26) meetings in Glasgow, McKinsey hosted a [full agenda of sessions](#) on driving the difference. The Global Infrastructure Initiative (GII) supported a number of sessions on transport, the built environment, and sustainable cities. At these sessions, participants identified the key themes and initiatives on which leaders could collaborate to drive progress. You can read insights from previous events and see our forthcoming roundtables [here](#).

We are excited to announce the first of our GII partners for our [eighth GII Summit](#), which will take place in Tokyo from October 19 to 21, 2022. We warmly welcome our pillar partners, Ashurst, Caisse de dépôt et placement du Québec (CDPQ), Spencer Stuart, and Trimble, as well as our institutional partner, the Global Infrastructure Investor Association. We are excited to work with these organizations to help shape the global infrastructure agenda over the next year. For more details on our summit, roundtables, site visits, and *Voices* publications, please visit our [GII website](#).

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.



Perspectives on optimizing project performance in rail

Rail-industry leaders from Hong Kong and the United Kingdom offer insights on optimizing project development and delivery to meet changing environmental, social, and governance expectations.



Rob McIntosh

Route managing director,
Network Rail



Roger Bayliss

Capital works director,
MTR Corporation Limited (MTRCL)

As sectors across the construction ecosystem adopt new digital technologies and aim to reduce their carbon footprints, the rail industry faces unique challenges. The industry is heavily regulated—safety and reliability are critical—and companies must make difficult decisions to improve performance and manage risk without causing inconvenience. Improving project performance and delivery from design to construction is key to providing sustainable infrastructure, attracting new talent, and keeping up with evolving government policies and regulations.

To learn more about how the industry can stay on course, McKinsey spoke with Rob McIntosh, route managing director for Network Rail, and Roger Bayliss, capital works director of MTR Corporation Limited (MTRCL).

McKinsey: What are the top three factors that would improve project performance and productivity in your current portfolio of infrastructure projects?

Rob McIntosh: The most important thing is to make the uncomfortable decisions early in the project. If you apply the same energy and rigor in the first third of a project that's traditionally applied in the last third, when everyone's a bit panicked and the deadline is near, your last two-thirds will be much easier. Focus the energy into getting the big scope and integrations decisions sorted and get a good view of how to manage your risks.

Next is leadership. Driving that energy early on requires the willingness to face up to difficult decisions. In those early stages, this can seem difficult because lots of stakeholders are advocating their positions. But it will be far more painful in the last third if you're not making the right decision early.

Third, using digital technology and data in the design process to manage risk and cost. This can help give everyone information

about the decisions. You're able to use data to model what the outcome is going to be and demonstrate to someone that it's either practical or unreasonable to implement whatever it is that you're being pushed toward.

Roger Bayliss: First, I would say technology and innovation. On technology, MTRCL is committed to using building information management on all future railway-extension projects, from design to construction, and ultimately delivering a digital twin to operations. And on innovation, there is no doubt that industrial techniques—such as design for manufacture and assembly, offsite fabrication, and modular—will become increasingly important.

Second, new ways of working. The focus should be on collaboration to deliver project objectives and reduce the inherent waste in the construction process. We should recognize our respective responsibilities and hold ourselves and each other accountable.

And third, a reliable supply chain. Consultants and contractors need sufficiently high-quality resources, just as we need strong project-management and -delivery capabilities.

McKinsey: How can digital and new technologies help with project delivery?

Rob McIntosh: One of the opportunities is to use tools to model the solution. Too often we default to just building more infrastructure rather than using digital twins to model what the system needs and what the outcomes will be. We're working on modeling train performance—the industry doesn't yet have a standard model for that. It has tools that help me form a view, but it does not have a model that says how reliable the train service is going to be.

Roger Bayliss: The world is going digital, and Hong Kong and MTRCL are no exception. We are embracing digital technologies to strengthen our capital-asset delivery and management.

For example, our Capital Works business unit is transitioning to a smart organization that plans, designs, manages, and constructs our projects to enable digital operation of the railway.

Our aspiration is for future construction sites to be smart, informed, and connected by digital technology, adopting ways of working that empower our skilled people to enhance safety, strengthen quality, and drive improved project outcomes. As an example, connecting construction sites to cloud-based solutions allows for seamless information flow and for data to be structured to enable real-time decision making.

McKinsey: What actions are you taking to improve collaboration across the value chain?

Rob McIntosh: In my region, which covers about a third of the national network, we've gone live with a new capital-delivery organization. We structured out one-third of our head count in capital delivery, and we have a new model based on the client taking an assurance role (rather than a management role) for the supply chain.

Suppliers will not be able to rely on the client the way they used to. They'll be held to account more by the client, and there will be risk and reward associated with that. It's important to have your goals and targets aligned with the organizations you collaborate with. That doesn't mean incentives have to be the same. The best route to achieving aligned targets is for everyone to have some upside in the outcomes and for the risk related to achieving those outcomes to be clearly left with the party best placed to manage and mitigate it.

Roger Bayliss: To strengthen our commitment to collaboration, we're looking to adopt contract forms tailored to the specific needs, risks, and challenges presented by a given contract, and we are committed to a program of internal and external training for our Capital Works staff to ensure they have the required skills and competencies.

We incorporate incentives around safety and environmental performance into our contract provisions and will extend this approach to quality. This means adopting two-stage early contractor involvement for our technically complex and high-risk contracts, with an emphasis on building the team and preparing for delivery.

Finally, we are reinvigorating project partnering, with a focus on working collaboratively to drive out waste and improve performance.

McKinsey: How is your organization responding to the imperative for delivering sustainable infrastructure? Where do you see challenges, and what are the opportunities?

Roger Bayliss: MTRCL has recently established a new corporate strategy with ESG [environmental, social, and governance] as one of the key pillars. To this end, we are aligned with Hong Kong's aim for carbon neutrality by 2050. First, we aim to achieve Building Environmental Assessment Method (BEAM) Plus Gold or above certification for new railway stations, to establish a high level of sustainable design and construction through a recognized and structured sustainability-assessment framework. Second, we aspire to deliver our first carbon-neutral station, built using the digital tools and techniques mentioned earlier, with a focus on industrialized methods.

Rob McIntosh: Sustainable rail infrastructure and operations need to have—and will have—a profound effect, because reducing our emissions has to be much more prevalent in our decisions. The industry needs to respond not only with the solutions it tables but also in the way it builds those solutions and in the materials used.

We might be heading toward a period in which there needs to be more consideration of wider societal impacts and benefits: employment, skills, education, healthcare, air quality. I hope this is a wake-up call to be more focused on

societal benefits—and sustainability would be a massive part of that.

We need to be clear and consistent about the outcomes. You can't keep everyone happy in the context of rail. Being able to model and make decisions about what you do with the whole system is important. It's also important to understand how infrastructure can ensure that every pound you spend is genuinely needed and spent in the right place.

McKinsey: What steps are you taking to attract, train, and retain the required talent for your organization?

Roger Bayliss: In anticipation of the future, we restructured our projects and engineering divisions to form Capital Works. In doing so, we have revamped our competency management and learning-and-development approach to ensure we have the right competencies in the right place at the right time.

A strong culture is an essential part of a successful organization. In Capital Works, colleagues can get exposure to a multidisciplinary environment and gain experience in various phases through the whole project life cycle. We also encourage colleagues to broaden their skill sets through job rotation or enrichment, such as exchange of engineering and maintenance design and construction colleagues.

Rob McIntosh: That's been a challenge for a while. When I speak with colleagues outside of rail, they talk about data-analysis capabilities being one of the most finite and sought-after resources around the world. I think we need to retrain people and rethink our organizations. If you bring data analysts into an environment that's less constrained and safer, you start to

see some real breakthroughs, but if you bring them into a heavily regulated environment that starts with, "It doesn't work that way around here," you run the risk of them leaving for a more progressive environment.

McKinsey: How can government policy and regulation best support project development and delivery?

Roger Bayliss: As the ultimate decision maker on railway development, governments could introduce future projects as a measured pipeline and help avoid "boom and bust" scenarios, which characterize public works in some places. Governments can also take the lead to drive digital. The acceptance of digital submissions in the statutory process and the greater use of digital communication tools, including online-meeting tools, would be a real benefit as the industry itself embraces a digital agenda.

With Hong Kong pledged to become carbon neutral by 2050¹, the government can take a leading role in shaping ESG initiatives with the infrastructure, property, and construction industries, among others. This may involve changes to the current approach to project performance measurement and evaluation.

Rob McIntosh: One of the best clients I ever worked for when I was in the private sector was the Singapore Land Transport Authority. The scale of a transport system like Singapore's is helpful because you can get your arms around it and therefore more easily take a full-system perspective. The authority is also very well informed and benefited from leadership who were able to set a consistent direction.

On a larger scale, there's a question of integrating projects with policy, so in the UK that would be led by devolved government

¹ Hong Kong's Climate Action Plan 2050, September 2021, [climateready.gov.hk](https://www.climate.gov.hk/).

or other subnational bodies. Of course, the complication that we have is that the regions are all interconnected via road, rail, and air systems. As a result, there will always be a need for some

kind of blend of national and local perspectives in policy making, but there is no reason that should not be achievable.

Rob McIntosh is the route managing director for Network Rail. **Roger Bayliss** is the capital works director of MTR Corporation Limited.

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Creating capacity to deliver: Using investment to spur transformation

The IIJA and the EU Green Deal present opportunities to reimagine the built environment for years to come. Infrastructure organizations will need to radically change how they deliver projects.



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Infrastructure investment is increasing

to unprecedented levels in several large markets. In the United States, the recently passed Infrastructure and Investment Jobs Act (IIJA) represents the most significant federal investment in decades, raising infrastructure spending to around 0.4 percent of GDP. Meanwhile, the United Kingdom's government has announced plans to invest in key infrastructure policy areas, including expanding broadband, supporting increased uptake of electric vehicles, and achieving net-zero emissions targets.¹ The EU Green Deal also aims to expand alternative fuels infrastructure to support zero- and low-emissions vehicles.²

While exciting, the increase in spending puts pressure on today's infrastructure organizations to deliver, with new expectations around resilience, sustainability, and equity goals. Meeting these expectations will require organizations to consider radically changing how they do three things in particular:

1. Prioritize against a broader, harder-to-optimize set of criteria in capital programs
2. Develop innovative and politically durable funding and financing approaches that match the portfolio or project's timeline rather than election cycles
3. Deliver projects, given the current and growing talent shortage across the project-delivery value chain

If the right actions are taken today, the IIJA could result in project funding going further and faster. In fact, our research shows that when project delivery for infrastructure agencies is in line with best-in-class projects, net-present value of project outcomes can be improved by as much as 10 to 15 percent.

Broadening capital portfolio optimization criteria and approaches

Capital strategy and resource allocation not only define what gets built but also where it gets built, often with generational impacts on economic development, access to economic centers, environmental outcomes, and future spending commitments. The IIJA and the EU Green Deal present opportunities to reimagine the built environment for the next fifty years. However, this will require thoughtful project development and deployment.

Today, capital planning and portfolio optimization need to reflect the complexities that decision-making leaders are faced with. Processes and tools should not only consider the technical performance of assets in "traditional" situations and classic cost-benefit measurements but also objectively consider the impact of increasingly frequent and severe weather events. Armed with this knowledge, leaders can include ways to experiment and innovate with new sustainability approaches, such as testing the reliability of green concrete, as well as better outline the anticipated equity impacts of different investment and development scenarios. As an example, improving access to public transport and infrastructure services may require estimating and then monitoring the specific GHG reductions, congestion, and ability of different demographics to access employment and education centers against clear key performance indicators that are reviewed and evaluated in the same manner as cost and schedule expectations.

Developing innovative and politically durable funding and financing approaches

This level of infrastructure funding provides an opportunity for public entities to put in place funding structures that can endure volatile

¹ Ben Goodwin, "Long awaited National Infrastructure Strategy finally published – was it worth the wait?," Institution of Civil Engineers, November 25, 2020, <https://www.ice.org.uk>.

² Delivering the European Green Deal, European Union, July 2021, ec.europa.eu.

political cycles and enable the sustainable delivery of infrastructure services. To do this government agencies may:

- *Reprioritize and expand capital plans* to better attract and sustain funding
- *Build robust and innovative business plans* for priority projects as well as bolster development and business-planning capabilities
- *Structure and procure projects* to catalyze private funding and utilize risk mitigation and blended financing instruments

Reprioritize and expand capital plans

Government agencies responsible for managing roads, airports, ports, transit, and power and water systems are due to receive increased levels of funding. A majority of this funding will be competitive, likely requiring government entities to demonstrate that projects are “shovel ready and shovel worthy” as well as financially, environmentally, and socially sustainable. Of the approximately \$273 billion in total funding that will flow through the Department of Transportation over five years for newly authorized federal programs, about \$97 billion will be competitive. In realigning and reprioritizing capital plans in line with federal funding objectives, asset owners can consider making savvy investments in metrics, analytics, and tools that evaluate and track impacts, such as carbon emissions.

Build robust and innovative business plans

The COVID-19 pandemic has put significant pressure on already-fragile infrastructure business models. Reduced ridership on public transit, deferred maintenance on water systems due to rate caps, and a future of dwindling revenues from traditional infrastructure funding sources, such as gasoline taxes,³ all contribute to the urgency to prioritize robust business planning and resilient funding models. Long-term business plans for projects can help

accurately account for capital and operations and maintenance costs, build in funding and risk mitigation tools to manage climate risk, allocate cost overrun and revenue risk to the private sector when appropriate, and secure multiple funding sources. Furthermore, organizations can look into infrastructure project business models enabled by alternative technologies that, under the right conditions, can be at least partly self-fund, such as upgrading curbside services to enable smart parking.

Structure and procure projects to catalyze private funding

Private capital allocated to infrastructure is at an all-time high. This capital is available to fund greenfield infrastructure expansion and technologies that can improve efficiencies in infrastructure delivery and reduce carbon impact, such as solar photovoltaics, electric vehicles, and green cement and steel. As governments perform project prioritization and business-plan development, they may ask whether including private funding, government guarantees, or bringing in innovative insurance products could allow provide more flexibility in meeting budgetary and sustainability goals. As an example, they can build their developer and finance capabilities as well as follow the lead of successful global examples and establish project preparation facilities to build the next generation of tech-enabled green infrastructure.

Radically transforming how projects are delivered, given talent shortage

Prior to COVID-19, the construction industry already faced labor shortages, namely a decline in the labor workforce that hadn't yet recovered from the 2008 financial crisis and an aging workforce that's been retiring at an increasing pace (23 percent of industry employees are older than 55). In addition, low labor productivity has not generated enough growth through process innovation and technological adoption to offset these losses.

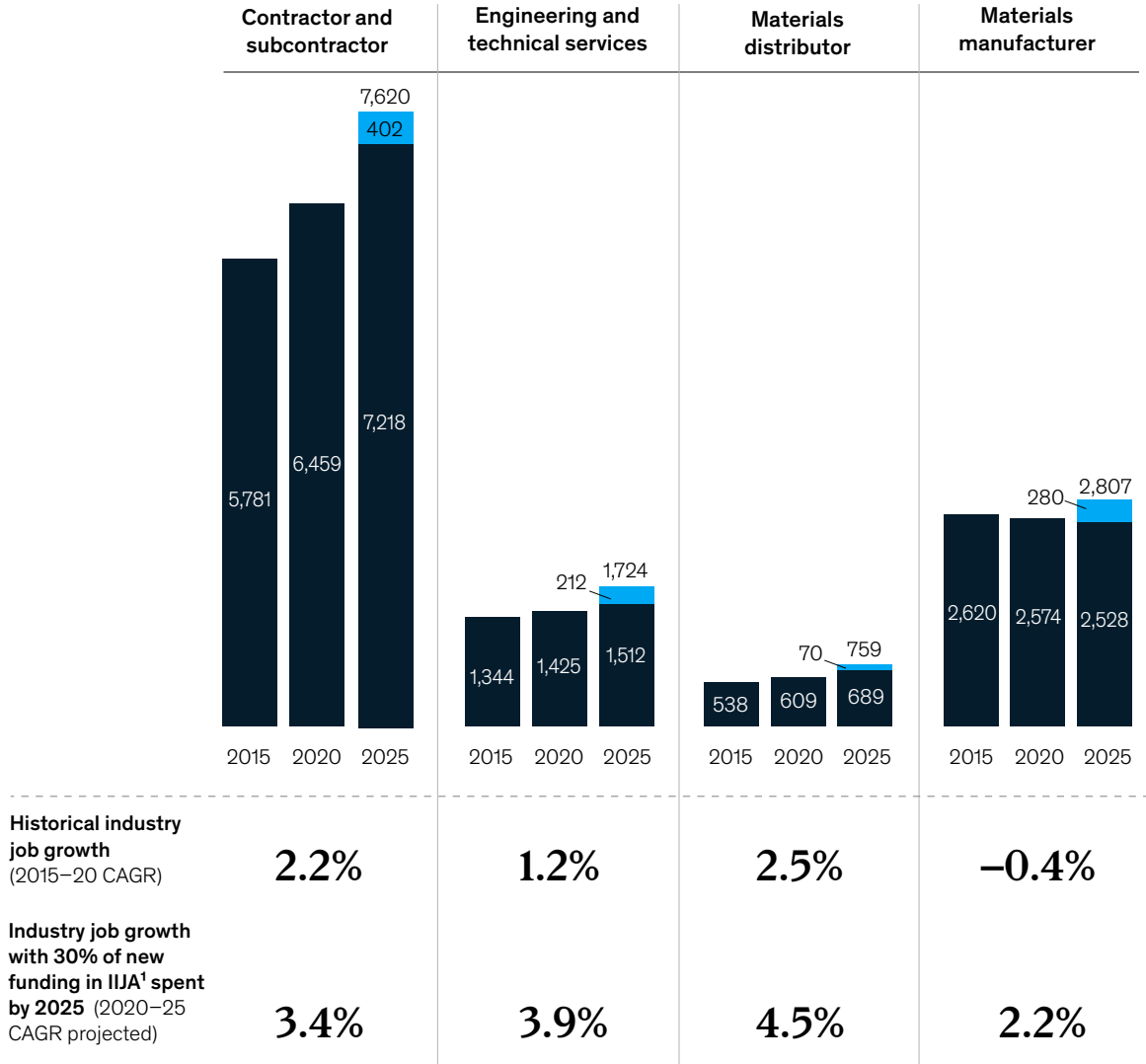
³ Joseph Kile, “Addressing the long-term solvency of the Highway Trust Fund,” testimony before the Congressional Budget Office, April 14, 2021, [cbo.gov](https://www.cbo.gov).

Exhibit

Infrastructure legislation could substantially increase demand for labor.

US jobs in industries within construction value chain, thousands

■ Incremental jobs added by incremental \$550 billion in IIJA¹ if it were 30% spent by 2025



Note: Figures may not sum to 100%, because of rounding.

¹Infrastructure Investment and Jobs Act.

Source: Bureau of Labor Statistics (BLS); Emsi; Infrastructure Investment and Jobs Act (IIJA) Draft, August 2021

The US construction industry relies on a value chain of approximately 11 million workers, including contractors, engineers, material manufacturers, and distributors. In the United State, this workforce will need to increase in some fields by around 4.5 percent annually to keep pace with IJJA investment (exhibit).

If the demand for infrastructure investment outstrips the growth in jobs along the value chain needed to deliver that infrastructure, projects will likely slow while costs inflate. Thus, projects can emphasize recruiting and retaining highly skilled people throughout the organization as well as investing in ways to reduce the overall workforce hours needed to deliver. The following points can help:

- **Identify key personnel**, such as senior leaders, project directors, project managers, junior engineers, foremen, and superintendents, and ensure they are assigned to projects for which they can leverage maximum impact. Also, develop specific apprenticeship and development programs for key people to increase their effectiveness, which can have the added benefit of boosting retention.
- **Expand the regional workforce** by adopting remote ways of working, improving mobility for experienced workers and skilled trades who live in areas of lower demand, or retraining and improving mobility for workers with adjacent experience in economically depressed industries.
- **Change mind-sets** during the design phase to focus on reducing construction-phase timelines. This requires key performance indicators during the design phase that track engineering and construction hours as well as material and equipment costs. Solutions should push for greater adoption of simplified design and detailed constructability reviews as well as increased use of prefabrication and modularization to shift labor hours off site to manufacturing centers.
- **Focus on the supply chain** during project execution by collaborating with all project contract parties, adopting new on-site processes to improve productivity of construction field labor, and investing in productivity and automation within materials manufacturing operations.

Unprecedented levels of investment mean there are unprecedented opportunities to spur transformation and prepare the built world for the 21st century. Creating the capacity to deliver in the years to come could make the difference between leading the way and falling behind.

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Investing in the next generation of transportation infrastructure

Two CEOs—one leading a global investment fund and the other heading one of the world’s largest transit agencies—discuss the once-in-a-generation opportunity to invest in the infrastructure industry.



Kim Fejfer

Managing partner and CEO
A.P. Moller Capital



Stephanie Wiggins

CEO
Los Angeles Metro

In the United States, the Infrastructure Investment and Jobs Act presents an unprecedented opportunity to invest in the country's transportation systems, while in emerging markets, such as Africa, strong demand for new transportation infrastructure continues to drive investment. At the same time, evolving net-zero climate targets and other sustainability criteria require industry leaders to account for a number of factors when making decisions. Navigating the path toward positive growth and social impact will likely mean expanding organizational capacity and staying abreast of new financing and delivery models.

To learn more about investing in the future of infrastructure, McKinsey's Tony Hansen spoke with Kim Fejfer, managing partner and CEO of A.P. Moller Capital, and Stephanie Wiggins, CEO of Los Angeles Metro.

McKinsey: What excites you most about what the infrastructure industry can accomplish over the next generation with this global infrastructure-investment scale-up?

Stephanie Wiggins: As the leader of a transportation agency with a core mission of providing equitable mobility options to the residents of Los Angeles County, what excites me most is the opportunity to make real improvements in the mobility options we provide our customers. LA Metro has one of the most ambitious infrastructure-improvement programs in the nation.

This is made possible through tax measures approved by the voters that allocate two cents of every dollar spent in Los Angeles County to transportation projects in our region. Despite what some might see as a tax-revenue windfall, our existing funding streams are still not enough to tackle the root mobility and equity challenges in Los Angeles. We look at the US infrastructure stimulus as a way for the federal

government to assist in augmenting our existing funding streams. This is necessary so we can complete these needed mobility projects and provide a world-class transportation system to the residents of Los Angeles County.

Kim Fejfer: In emerging markets in general, and in Africa in particular, the demand for new infrastructure has been and remains strong. The key there is less the supply of capital and more the way government and private players structure the projects. What I find exciting is the overall and seemingly unstoppable growth in volumes. From power demand to goods transported, the volume of infrastructure development in Africa is growing exponentially. COVID-19 has created a bump in the road, but African economies have been, in general, relatively little affected—meaning infrastructure development is going strong.

This growth means different, but positive, things for investors, governments, and customers alike. For the investor, it makes infrastructure projects more economical. Growth also allows for a cushion against inherent volatility in emerging markets. While financial and credit metrics can look tight in the early years of an investment, they tend to improve significantly over time with the growth in volume. This gives comfort to equity investors. For the government and the customers, the growth in supply volumes typically translates to more affordable services in the long run.

The affordability of infrastructure services also tends to improve over time for another reason. In the power sector, when investing in a new, more efficient power plant, you can supplement or even replace the existing, typically less efficient power plants. Doing so tends to drive power prices lower or at least limit the inflation of fossil-fuel prices.

In emerging markets in particular, new infrastructure can make a huge impact with

important ripple effects. A new power plant reduces the risk of power outages. Refurbishing a port reduces the transportation time for shipping lines and their clients. Infrastructure supports businesses, making it cheaper and easier to carry out their manufacturing and trading activities. By doing so, you also create jobs, both directly and indirectly. You can do good while doing well.

McKinsey: How can infrastructure leaders best integrate the net-zero climate targets—and other sustainability criteria—into the infrastructure project pipelines?

Stephanie Wiggins: I believe owners should look at the typical life cycle of infrastructure development and incorporate sustainability at the beginning of the planning process. Integrating net-zero targets requires both careful planning during design and construction, and ensuring continued achievement of the benefits of those strategies during the operations and maintenance of the infrastructure throughout its life.

They should also think about the liabilities associated with the consequences of doing nothing about climate mitigation, especially in vulnerable communities.

Another consideration is that many of these net-zero solutions are planned with only local impacts in mind. For example, a zero-emissions bus program may significantly reduce [greenhouse-gas] emissions and criteria air pollutants in one community, but if the sources of the electricity are coal-powered plants, is the net benefit to society really net-zero emissions?

We must also continually facilitate a pipeline of professionals who will think about, advocate for, and execute on net-zero emissions. This can start by integrating the principles of sustainability in what our children learn in school and in what colleges and universities

are teaching to prepare the new generation of professionals. Climate-change responses are not the exclusive purview of STEM professionals; they also involve economists, social scientists, and others who do not traditionally engage in the climate conversation.

Kim Fejfer: We have to rethink up front which projects will be able to deliver this net-zero climate target, particularly for power projects. Some projects simply have to be taken off our pipeline.

In the power-generation sector, when you consider building a power plant that will provide baseload power (with a reliable output), there can be a dilemma between the social impact and the environmental impact. Wind farms and solar panels have an intermittent production pattern by nature. Power-plant options to generate baseload power can be rather limited, and they usually generate carbon emissions.

This dilemma is particularly acute in Africa. According to the World Bank, the total electricity generation capacity in Africa, with a total population of nearly one billion, is less than 100 gigawatts.¹ This is smaller than the total generation capacity in Spain, with its population of 46 million.

To offset our carbon footprint, we typically consider reforestation in deforested areas. Carbon-capture technologies are also available, and we hope they will become more cost-effective over time.

McKinsey: What steps do owners, investors, and contractors need to take now to develop the organizational capacity to deliver on the anticipated projects coming out of the stimulus?

Stephanie Wiggins: The single biggest challenge, or opportunity, I see in the transportation infrastructure space is the availability of the types of technical and

¹ Access to electricity (% of population) - Sub-Saharan Africa, The World Bank, November 15, 2021, data.worldbank.org.

management personnel needed to deliver these complex projects on the owner, designer, and contractor sides. Our annual construction budget is around \$3 billion, and it will go up to around \$5 billion by 2026. Meanwhile, some economists are forecasting qualified-personnel shortages. This is not a sustainable situation for my agency or any of our delivery partners, and we must continue to focus on growing our workforce to accommodate the increased spending.

Here at LA Metro, we are focused on education, internships, entry-level programs, job training, small businesses, mentor and protégé programs, succession planning—you name it and we have a program for it. But we also must address the engineering and construction trades part of the business. We need all kinds of skilled trades—train-control engineers, geologists, tunnel miners, track workers—to deliver on transportation infrastructure. As an industry, we all must focus on developing skilled talent.

Kim Fejfer: In emerging markets, delivering a project requires getting involved with the stakeholders at the development stage. That's because capital is often plentiful, but there are not many existing assets and it is hard to generate bankable projects. To achieve this, you need to be on the ground and to work with stakeholders at a relatively early stage. You also need a strong network of stakeholders. These individuals often combine strong sector experience and deep knowledge about certain transportation markets in certain geographies—the best transport corridors, the best opportunities to invest in, and so forth.

McKinsey: What new financing and delivery models can be applied to access funding and quickly put it to work on priority projects?

Kim Fejfer: A well-structured greenfield project will likely get financing, either from international institutions or from local lenders. Projects that are well balanced from an economic and risk-sharing standpoint can

wield their compliance with standards—such as the UN Global Compact (UNGC), the PRI (UN Principles for Responsible Investment), and the IFC Environmental and Social Performance Standards to help to secure financing. By addressing these issues at an early stage of the project, the process with the lenders is easier and faster.

Stephanie Wiggins: At LA Metro, we are pursuing numerous delivery models to supplement our funding streams and move projects quicker into and out of the pipeline. For example, we are using a P3 (public–private partnership) model with project development agreements on our Sepulveda Transit Corridor project, using a traditional P3 approach on our West Santa Ana Branch project, and exploring federal TIFIA (Transportation Infrastructure Finance and Innovation Act) loans for our ExpressLanes program. We are also pursuing alternative project delivery to improve our partnerships with contractors and build the capacity required to build these critical projects.

McKinsey: How can the public and private sectors collaborate better to streamline and speed up the permitting process?

Kim Fejfer: First, both the public and private stakeholders would benefit from realistic assumptions up front in terms of costs, returns, social impact, timing, and risk sharing. The existence of a [P3] framework also helps, as well as the experience of all stakeholders in implementing such a framework. An early review of the project by developers or investors helps to address their concerns, and change the design if necessary.

In certain emerging markets, the land acquisition process can also be quite difficult and lengthy. In these areas, the process is streamlined when the land where the infrastructure would get built is already owned by the state.

The interest of private investors can also be piqued when states or international institutions, such as development banks, finance the

feasibility studies and early-stage development costs, because this shortens the period between investors getting involved and the project's financial close.

Last but not least, it is important to have strong relationships with governments and local partners, which are true relationships of trust. If governments know that their partners can deliver a new port, rail, or road because they have already delivered a project in that country, it will for sure help the relationship's dynamics.

Stephanie Wiggins: Projects of this complexity and magnitude take much more than a willing owner and skilled contractors. It takes partnership with numerous stakeholders and third parties, such as water and power companies, city engineering departments, and state and federal regulatory agencies.

First, we need to strengthen our partnerships with all our third parties and regulatory agencies to speed up the permitting process. This starts with reviewing our culture internally to

ensure that we are structured in a way to optimize relationships with third parties. To this end, we recently stood up a new delivery unit at Metro focused on alternative delivery methods. Alternative delivery methods and qualifications-based contractor selections will allow us to truly partner with private industry and develop projects and pricing using the best teams, shared-risk strategies, and transparent partnership with shared goals.

We also need to plan these projects from an early stage using an equity lens and make sure our expectations and goals for the projects are in line with the desired results for the affected communities the projects are in. The permitting process for transportation projects is always more efficient when they are planned correctly and enjoy the strong support of the communities we serve. True partnership and shared vision with the cities we serve and work within are absolutely critical to delivering on our current program—not to mention making the best use of the future infrastructure funding on the horizon.

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Infrastructure investing to build a net-zero-carbon world

Infrastructure investors face the opportunity—and the challenge—of helping Europe meet its decarbonization goals. Their focus is to protect past investments, future-proof current ones, and find the next great project.



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Recent analyses suggest that meeting the European Union's net-zero emissions targets by 2030 and 2050 is possible—but daunting. Progress in some areas, particularly in replacing fossil fuels with renewable-energy technologies, has laid an important foundation. From here, private investors have a significant opportunity to help shape the progress made in the sectors critical to decarbonization.

For their part, asset managers are increasingly being challenged by their limited partners (LPs) to generate environmentally friendly investment opportunities and divest polluting investments—all without compromising returns.

As investors prepare to take part in a pool of opportunities that reaches into the tens of trillions of dollars, they need to carefully explore large-scale investment opportunities for both new and familiar technologies, often in new constellations and structures. At the same time, they need to take stock of, and reconfigure, their existing portfolios to make sure they manage technology and regulatory risks while continuing to be part of building a net-zero world.

McKinsey analysis suggests that achieving net-zero emissions in Europe will require approximately \$28 trillion in investment—50 percent of which is directly relevant for infrastructure investors.¹ Upgrading existing assets and allocating capital to the right infrastructure projects—past, present, and future—has never been more important. Those who get it right have the opportunity not only to profit, but also to play a critical role in helping mitigate and adapt to climate change.

Investment opportunities

Generating the infrastructure needed for decarbonization of key industries will require massive capital reallocation; more sustainable materials and production methods; and significantly expanded green technologies, including, crucially, renewables. The required investment will likely

exceed public funding capacity, opening the door for private capital—which would give investors a critical role to play in helping to shape the future of sustainable infrastructure.

There will be challenges. The successful expansion of renewables, which is the current mainstay of sustainable-infrastructure investing, could lead to a reduction of feed-in tariffs and a reassessment of offtake arrangements. And pressure on returns, already palpable, may intensify as war chests grow faster than investable projects. According to McKinsey analysis, average return spreads in mature markets have already decreased to approximately 1 percent.² In Germany, with more than 49 gigawatts of solar already installed, we believe wholesale prices may decrease by approximately 40 percent by 2030, heavily influenced by intense competition for tendered volumes.

We estimate that about half the required investments do not have stand-alone investment cases today (exhibit).³ On the one hand, rapidly evolving regulatory frameworks may well introduce policies that bolster these investment cases. On the other, regulatory decisions may have a negative impact on infrastructure operators' portfolios, with return and risk of specific assets susceptible to changes in carbon pricing, tariff preferences, and other factors.

Maximizing investment opportunities

Infrastructure investors can start by building an in-depth understanding of the core technologies for a net-zero world, including hydrogen, biofuels, heat pumps, and carbon-capture technology. Investors will want to carefully consider where to play on the risk–return scale, bearing in mind how the options might resonate with LPs: demand for riskier sustainable portfolios may not always align with LPs' risk appetite, requiring careful design of investment products and funds. Investment strategies should also consider how technology deployment is expected to evolve over time.

¹This estimate is based on a set of assumptions, including a societal discount rate (reflecting value to society rather than individual corporate weighted-average costs of capital) and rational total-cost-of-ownership calculations. These assumptions may differ from real-world decisions, which often prioritize up-front purchase prices over total lifetime costs.

²Defined as ROIC minus the weighted average cost of capital.

³Defined as being net-present-value positive.

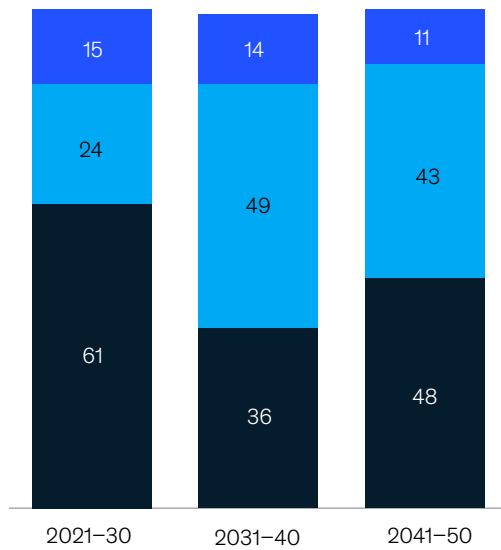
Exhibit

About half the investments required to meet emissions targets do not have positive stand-alone investment cases for their stakeholders.

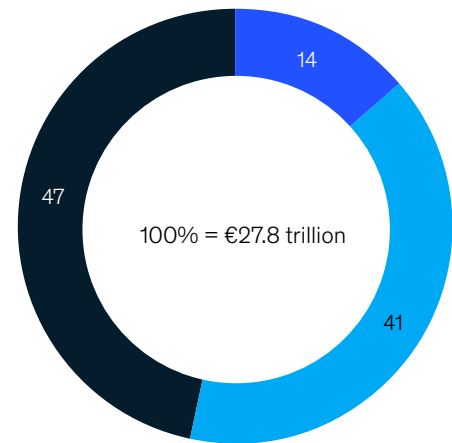
Emissions-reduction investments by type of investment case for individual stakeholders

● No stand-alone business case² ● Stand-alone business case² ● Infrastructure³

Total capex¹ in EU-27 within time bracket, %



Total capex by sector, 2020-50, %



Note: Figures may not sum to 100%, because of rounding.

¹Capital expenditures.

²Investment cases that are net-present-value positive. For assumptions (including weighted average cost of capital and lifetime expectancy), see technical appendix.

³As an enabling public service, infrastructure will be required to undergird projects even when they have achieved a stand-alone business case.

Investors will want to define how to engage with these technologies, with three common approaches in mind: buying a portfolio of existing assets, adding individual projects to an existing portfolio, or building a portfolio from scratch—that is, greenfield building of the physical asset, not the investment vehicle.

As markets mature, the pricing of existing sustainable options is set to escalate, potentially making the economics of bolt-on acquisitions challenging. For example, McKinsey analysis finds that renewable-energy valuations increased from a multiple of about 10 in 2019 to a multiple of about

15 in 2021, growing faster and achieving higher multiples than comparable assets in the same time frame.

However, as currently seen in renewable energy assets, a more gradual approach of expanding on an existing portfolio of similar assets may face cost challenges as asset classes appreciate rapidly, and limited market opportunities may not be conducive to the transition speeds LPs are looking for. Opening up greenfield opportunities can be exciting and is increasingly being pursued by leading infrastructure investors, but building

something from scratch is also resource-intensive and risky—which not all LPs are looking for.

Finally, investors can broadly engage with a variety of stakeholders to fully understand the scope of possibilities:

- *Policy makers:* Ongoing engagement will be key in understanding and monitoring policy developments critical for managing risk and identifying new opportunities.
- *Sustainable LPs:* It's crucial for investors to understand the expectations of these LPs regarding sustainability targets, risk appetites, and implications for returns.
- *State-owned enterprises and industrials:* Projects that are still in pilot phases can offer investors firsthand understanding of emerging technologies and markets while allowing them to position themselves as partners of choice as these technologies mature.

Existing portfolios

Many of today's infrastructure-investment portfolios include high-emissions legacy assets. However, portfolio-wide decarbonization targets are increasingly common, with more than \$43 trillion in assets already managed under the net-zero asset managers initiative. Some leading LPs have gone a step further and locked out certain subsectors, such as coal. Others go so far as to exclude high-environmental-impact energy sources such as oil sands and arctic exploration.

McKinsey estimates that the value of assets stranded as a result of the transition to net-zero emissions could total €215 billion.⁴ To transition smoothly, investors will need to devise strategies for smart and timely disposition of outdated assets, as well as innovative options for repurposing or

generating other forms of value from assets such as land value. For example, Europe has already reduced more than 120 metric megatons per year of refining capacity. While about 80 percent of that reduced capacity has been repurposed, these efforts have focused on conversion to terminals—an outcome that does not move the needle in achieving net-zero ambitions.

However, executing repurposing plans is not always straightforward. While some asset managers have been creative in repurposing assets, potential is limited. Retrofitting is not always cost-effective, particularly in especially old or outdated assets. And some solutions that have proven popular, such as converting refineries to biofuel plants and storage terminals, have patchy demand and thus can be undertaken profitably only a limited number of times. The business case for everything from refurbishment to land restoration, as well as the effects of decisions on the local workforce and community, will play into how investors unwind unsustainable legacy assets.

Protecting and advancing existing portfolios

Investors can start by conducting careful portfolio diagnostics to assess transition risk, understanding that risk on an asset-by-asset basis, and identifying potential for sustainable improvements through process efficiencies, alternative feedstocks and power sources, and redesigned products. Investors that closely monitor greentech penetration will be best poised to determine optimal holding and exit timelines for legacy assets.

Leading investors may also explore innovative business models by aggregating subscale assets into portfolios large enough to generate cost-effective sustainability upgrades. In this way, savings on an individual home level—for example, environmental and cost savings from installing heat pumps—can be bundled into an investable option at the right scale.

⁴ Paolo D'Aprile, Hauke Engel, Godart van Gendt, Stefan Helmcke, Solveigh Hieronimus, Tomas Nauclér, Dickon Pinner, Daan Walter, and Maaikje Witteveen, "Net-zero Europe," November 2020, McKinsey.com

Finally, investors can play an important role by working with public sector and other stakeholders to draw up socially balanced transition and wind-down plans for fossil assets. The private sector's involvement in the energy transition can help maintain energy security by supporting smooth transitions, and collaboration with private investors will be key to fully understanding the cost of certain regulatory measures and to developing the ability to finance new, sustainable development at reasonable costs. At the same time, certain investments that are critical to decarbonization, such as power transmission and EV-charging networks, will require close collaboration between the two sectors.

Investors in infrastructure investments are, by nature, in it for the long haul. That's a challenge at a time when the world is rapidly changing,

entire technologies are being introduced and retired within a decade, and emissions targets make certain innovations a must. Infrastructure investors must plan ahead for anticipated challenges to infrastructure investment opportunities, such as by developing a deep understanding of emerging technologies, both so they know where to find their next investment opportunities and so they can seek ways to future-proof existing assets. They can also carefully manage current assets to support modernization where possible and cost-effective wind-down of legacy assets where not.

The fundamental reconfiguration of energy and transportation systems that is currently under way has created an urgency for change. Question marks around the long-term sustainability of certain technologies combine to create an uncertain but exciting future—one in which investors can play a crucial role.

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The authors wish to thank Marcel Brinkman and Alex Ugryumov for their contributions to this article.

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