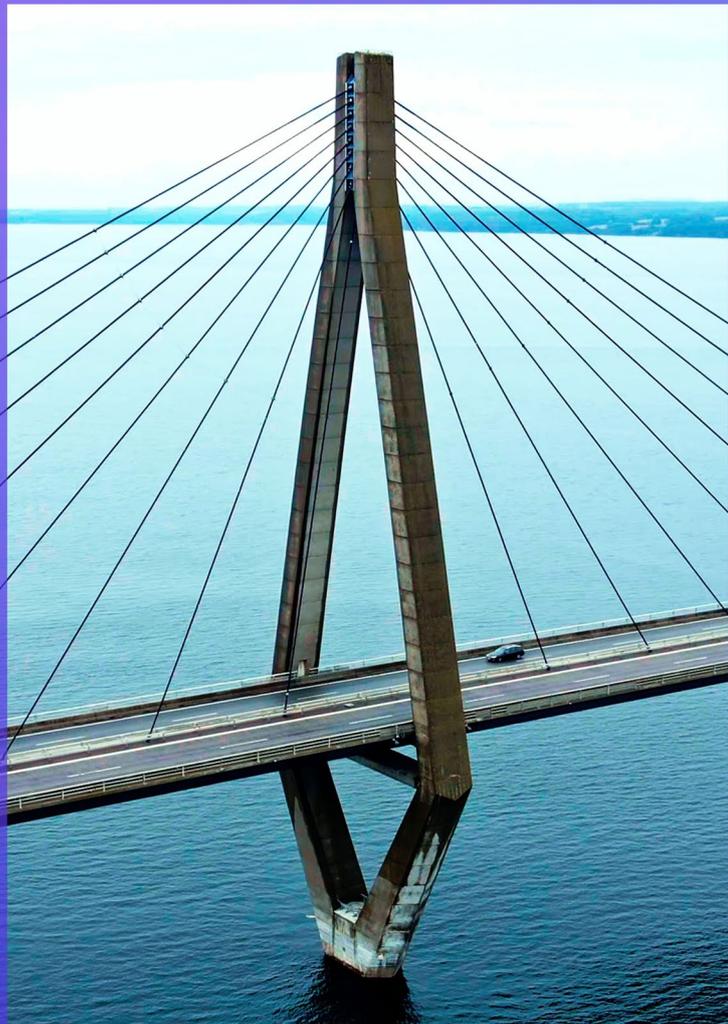




Construction in 2030

Insights about the future to help guide your actions today



KPMG International

[kpmg.com](https://www.kpmg.com)

Foreword

What could the world of construction look like in 2030?

Even for an industry that has experienced its fair share of volatility, the past few years have been dramatic for engineering and construction (E&C).

COVID-19, massive supply chain disruption, continued material shortages, raging inflation, war in the Ukraine, and major talent gaps.

And these phenomena come on top of longstanding challenges of a variable performance record, poor productivity, inability to attract graduates and school leavers, boom-and-bust economic cycles, low contractor margins, and continued lack of cost certainty for owners.

With some exceptions, the E&C sector remains a technology laggard and is struggling to get to grips with data and analytics — despite swimming in data. Major technology players are already eyeing up the sector, seeking to use their data mastery and fast innovation to steal market share.

Environmental, social, and governance (ESG) goals are also having a huge impact. On the one hand, E&C companies aim to be at the frontline of delivering sustainable infrastructure, energy production, factories, offices, schools, hospitals and homes, as well as carbon capture, biodiversity and other sustainability projects. On the other hand, the industry is a massive emitter of carbon, with concrete alone responsible for approximately eight percent of global CO₂ annually.¹

If all this paints a rather grim picture — it also presents incredibly exciting opportunities. Which is why the October 2022 Engineering & Construction Risk Institute Risk Management Conference, in the stunning setting of Athens, Greece, provided a timely opportunity to discuss the way forward for the industry.

One of the sessions was joined by some of the world's leading E&C minds, people with extensive experience dealing with the pressing issues facing the sector — and in many cases already coming up with interesting answers.

This paper aims to look at the world of construction from the year 2030, casting eyes back to today and then reflecting on the progress made. Future gazing is always an intriguing exercise, but also one that can provide pointers — and inspiration — to help take the necessary steps to drive the sector forward and fulfil its potential.

KPMG International have a longstanding relationship with the Engineering & Construction Risk Institute, and would like to thank them for the opportunity to hold this debate — and look forward to similar conversations in the coming years.



Geno Armstrong
Sector Leader —
Engineering & Construction,
KPMG International



Clay Gilge
Lead, Major
Projects Advisory,
KPMG in the US



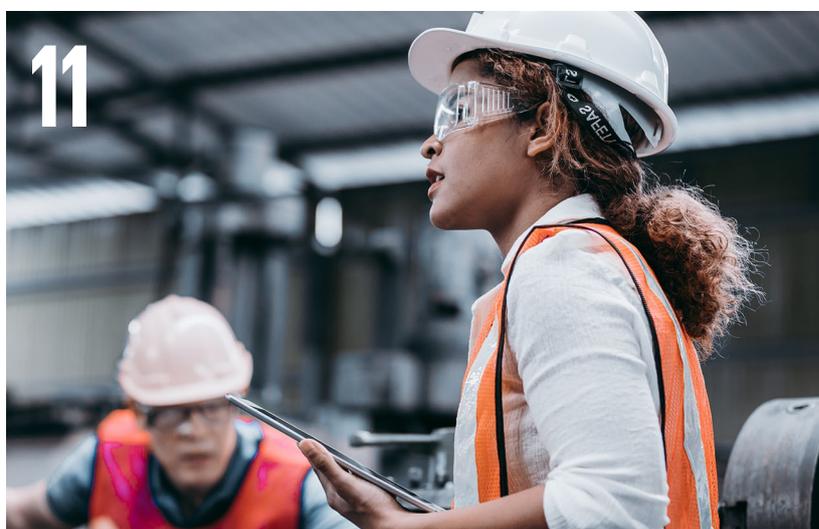
Roni Michael
Global Head of Innovation,
KPMG International



Lisa Kelvey
Global Infrastructure
Sustainability Lead,
KPMG International

¹ Ellis, L.D., Badel, A.F., Chiang, M.L., Park, R.J.-Y. & Chiang, Y.-M. *Proc. Natl Acad. Sci. USA* **117**, 12584–12591 (2020).

Contents



Looking back to 2023 **05**

The E&C industry in 2030 **08**

Conclusion **11**

Acknowledgements **13**



“

The past is a foreign
country; they do things
differently there. ”

L.P. Hartley, 'The Go-Between'

Looking back to 2023



In 2023, one can see an industry that was grappling with age-old, sector-specific challenges whilst adapting to a post COVID world of fractured supply chains and inflation, resource and talent shortages, rising ESG pressures and huge technological disruption.

Project performance under the spotlight

Despite heavy investment in project management tools to help improve processes through technology, the industry continued to experience projects going over budget and over schedule — occasionally spectacularly so — with a mixed record of predictability over performance.

Project owners, meanwhile, often failed to achieve the cost certainty they desired, clouding their investment decisions and causing considerable frustration. Part of the problem was the historically thin margins that contractors had become accustomed to, due to the competitive nature of bids, which at times resembled a race to the bottom that benefited neither owners nor E&C companies.

The industry was also plagued by fragmentation, both within projects and across the wider supply chain. With a multitude of players, lack of data sharing and interoperability, and a siloed value chain, visibility across individual and multiple projects was often lacking — again hindering predictability.

Construction productivity lagged behind other sectors, actually falling by seven percent between 1997–2021 — in contrast with the manufacturing sector, whose average productivity rose by 126 percent over the same period. And, with limited transparency, project managers were often unable to identify and address poor performing projects, sites or individuals.

As the University of Oxford's Bent Flyvberg commented in the 2021 KPMG Global Construction Survey, "With a lack of competition on a global scale, the sector has struggled to innovate leaving a productivity gap compared with other industries."

At a low point on the innovation curve

Although adoption of technologies like automation, AI/ML, robotics and drones had gathered pace by 2023, overall the construction sector lagged behind many others in innovation, with outmoded production

and construction methods and lack of investment in technology. The shift to a manufacturing-led mentality had been slow to catch on.

The often paper-thin margins earned by contractors hardly helped, reducing the capital available for funding new technologies. And in a conservative industry, the concept of 'failing fast' — associated with startups and other disruptive businesses — had not really taken hold.

Another factor that held back innovation was the fragmented structure of construction, where each player tended to have its own agenda. This was contrary to the trends towards cross-sector ecosystems built around customers, which encouraged both individual companies and groups of participants to collaborate in pursuit of mutual benefits.

The need to innovate was exacerbated by the growing threat of disruption from technology companies eyeing opportunities to gain market share. As traditional boots-on-the-ground construction became superseded by automated design, prefab manufacturing, 3D printing and robots, E&C companies risked being relegated to commodity providers or even faced extinction.

What these disruptors bring, above all, is excellence in making data work for them, to gain insights, drive decision-making and create value. Becoming data leaders, rather than laggards, is one of the single biggest innovation challenge facing the E&C industry.

Questions over risk management

By the early 2020s, the increasing scale of mega-projects had placed enormous strain on E&C companies. One major project failure at best had the potential to wipe out a year of strong performance, and at worst could bring down the entire company. A lack of robust enterprise risk management — and insufficient linkage between project risk management and enterprise risk management — prevented contractors from accurately aggregating all their risks to fully understand their corporate risk profile.

Stressed supply chains and resource management

Geopolitical forces, climate change, the COVID-19 pandemic and conflict in Ukraine had pushed up energy and material costs and severely disrupted supply chains in the early years of the decade. With no obvious sign of when these trends were likely to flatten out, E&C companies had to maintain margins while winning competitive bids. Extreme volatility in supply chains — especially long-distance chains — impacted the ability to schedule accurately and left teams onsite without essential materials, pushing up costs.

With suppliers often held at arm's length via strict contracts, there was a distinct lack of collaboration, which heightened the possibility of disputes, and contributed to poor transparency across the supply chain, as suppliers had less incentive to invest in technology such as internet of things (IoT) and data and analytics (D&A).

Talent shortfalls threatened progress

A limited talent pipeline was one of the most serious challenges to the E&C industry, especially in technology and data skills. The overall tight labor market — with high job vacancy rates and an ageing workforce — made talent a long-term, strategic imperative. With actual and future employees seeking flexibility both in working hours and locations, companies had to adapt to remote working — something which flew in the face of established ways of working.

The industry's reputation as a male-dominated, hard-hat, long-hours, culture, with unpleasant working conditions, deterred potential recruits — and held back efforts to make workforces more diverse. Diversity offered an opportunity to attract a wider pool of people

and bring in essential new skills and thinking, but by 2023 the sector was only making limited progress in this respect.

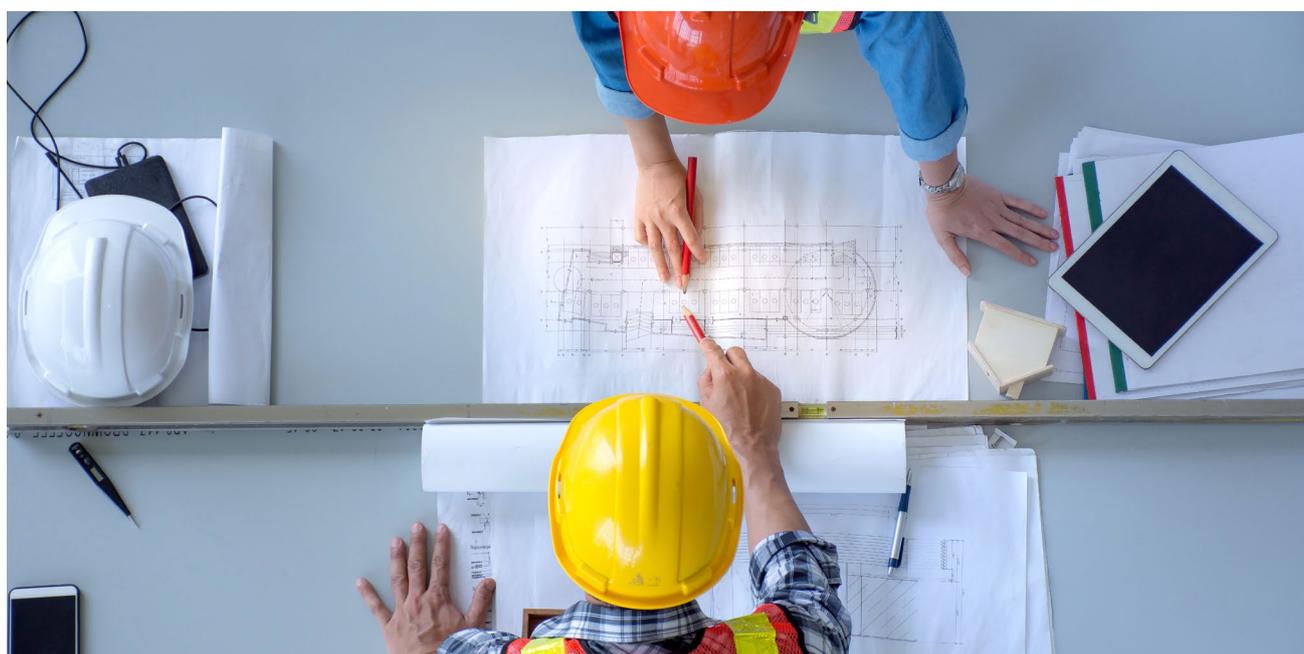
Across the E&C industry, insufficient attention was paid to developing a talent pipeline, from craft worker to professional level, with other industries perceived as more exciting, with better pay and prospects, placing them ahead in the race to attract new recruits.

Slow shift to ESG

Despite some progress, in 2023 the construction industry was still often regarded as being high-carbon footprint, high-waste and high-polluting, with a lack of appreciation of biodiversity, high use of scarce resources like water and minerals, and a lack of engagement with local communities. Usage of renewable energy was moderate, while diversity was limited. There were shining exceptions to this, with projects in remote sites training local workers, and growing attention to sustainability and biodiversity, but overall the sector had some way to go.

At the same time, regulatory demands for sustainable construction were growing, demanding circular, low-carbon projects and energy- and resource-efficient, low-waste buildings and infrastructure. Paradoxically, the E&C sector was also on the forefront of delivering ESG, but has yet to translate these concepts fully into their own businesses.

All of which was starting to impact access to capital from investors shunning fossil-fuel, energy-intensive, projects and seeking sustainability and strong human rights records. Any E&C businesses that were not addressing ESG concerns faced higher costs of capital — or even barriers to capital entirely.



The E&C industry in 2030



Construction in 2030

It's now 2030 and the sector has made huge strides, working together to modernize, innovate and consolidate, learning lessons from other global industries and harnessing technologies and new ways of working. E&C companies are in much better financial shape, with healthy margins and the ability — and courage — to say “no” to high-risk or high-carbon projects. The threat from technology disruptors has not gone away, but the sector is adapting well to new competitors and welcoming them into the construction ecosystem. And the structure of E&C is less fragmented, with greater collaboration.

A step change in project performance

Productivity has improved dramatically, with a much higher record of on-time, on-budget, high-quality projects. The widespread use of data sharing, common data standards, and interoperability creates wide-ranging transparency across the value chain, enabling project managers to identify and address issues swiftly, to help minimize delays and cost overruns. Whether it's a measurement error, a leaking pipe or damage to vital substructure, the early resolution means that projects can resume with limited negative impact.

Decision-making has been greatly enhanced through use of IoT, AI, ML, automation, and analytics, with sensors able to detect problems that would previously have been unseen. The E&C industry's productivity has improved immeasurably, thanks to up-to-the minute benchmarking on why certain teams are not performing.

And the growing application of D&A has unlocked the potential of predictive forecasting and maintenance, enabling project managers to keep clients well-informed of progress, tackle potential problems before they arise and keep equipment operational to help minimize shutdowns.

Construction ecosystems have fostered a new spirit of collaboration, fueled by knowledge management that lets data and insights flow between contractors, suppliers and owners. This spreads best practice learned from other projects, helping different players meet their performance objectives through improved understanding of project delivery.

Asset owners' customer experience has become central to contractors' operations, which has required a significant change in mindset. Rather than simply getting a project over the line, E&C companies are now focused on high quality delivery at all stages, with clear communications to clients and awareness of issues like ESG and customer satisfaction. For instance: a road building project considers how to keep lane closure to a minimum to avoid major traffic delays. Or a building construction aims to reduce noise and pollution.

Above all, there is strong focus on giving project owners greater certainty over cost, through realistic pricing and effective cost and schedule management that also protects contractors' margins.

Today's balanced scorecards don't just cover cost and time; they also take into account safety, quality, sustainability and impact on the wider public, as well as improving whole-of-life costs for the asset. In today's customer-centric world, a seamless, personalized client experience is front of mind for contractors.

Pushing the innovation envelope

In a few short years, E&C has embraced innovation with open arms. Companies have adopted startup mentalities, through innovation labs or hubs separate from the main business, where employees are encouraged to take risks to accelerate and improve performance. Many have also acquired startups from within and beyond the sector and worked in partnership with other leading-edge players in the construction ecosystem. And the sector has gained mastery over data, with E&C companies frequently considered to be “data companies that build things”. These advances have been helped by an influx of talent from non-traditional sources like data science, AI, and other technology companies, as well as mainstream business candidates attracted by the innovation in the sector.

Modularization and standardization have gone mainstream, with a major emphasis on better, often automated design for manufacture and assembly, with far less work performed on site, remote working and design, and routine use of 3D printing. With designs transferred direct to manufacturing, complete stages are removed, with the time taken to progress from design to construction cut substantially. Also significantly reduced are the carbon footprint and the levels of waste and pollution, with material choices based upon sustainability and circularity, using fewer scarce resources. Safety has also been a big winner, with a lot of dangerous jobs carried out by robots and remote operating equipment.

Risk management from a higher altitude

In 2030, risk management has reached the same levels of maturity that health and safety had achieved by 2023. Thanks to the ability to aggregate risk at an enterprise level, contractors and owners now have a clearer view of portfolio risk. This helps avoid bids that could push the business beyond its accepted risk limit, as well as spotting potentially damaging risks earlier and taking decisive action to prevent project failure.

Increasing use of D&A has led to a better understanding of risk interdependence, both within and across projects. For example, E&C companies can now gain a more accurate view of the impact of disruption to supply chains, or worker availability, or material cost inflation, on both projects and the wider portfolio.

Reliable and resilient supply chains

In 2030, suppliers are treated as partners in strategic innovation, as the industry has shifted from contractual, transactional relationships to longer-term partnerships, where Tier 2 and 3 suppliers are involved much earlier in project planning and conversations, and risk and profit is shared across the supply chain. Consequently, supply chains are far more transparent, making it easier to spot problems and carry out ESG reporting.

The sector has also experienced a growth in innovative, localized sourcing, which cuts transportation costs, lowers carbon footprint and hedges against the risk of disruption from geopolitical events, resource shortages and climate change. 3D printing has helped this transition. Higher use of renewables reduces emissions and protects supply chains against energy price increases or shortages.

These developments have had a tremendous impact upon supply chain reliability and resilience, with the sector far more adaptable to risks from climate change.

A sector in demand

In a major turnaround, construction has become an industry of choice for graduates and school leavers, offering exciting careers involving technology, design and engineering, working on the cutting edge of innovation. Many of the jobs traditionally carried out onsite have moved to factories and design offices, while flexible, remote working (where appropriate) has become more common, with an emphasis upon work-life balance.

The diversity barrier has been overcome, with a huge influx of women, and talent from around the world joining the sector, from a variety of educational backgrounds and disciplines. Which has brought exciting new approaches to problem-solving and transformed the image from “hard-hat, manual labor” to “slick creators of technologically advanced, beautiful and sustainable buildings and infrastructure”. Potential recruits are increasingly attracted to E&C companies by the strong sense of purpose as the industry has embraced ESG and moved away from high-carbon projects.

Learning and development has also come a long way since 2023, with compelling and flexible career paths, strong affiliations with colleges and universities, and an increased proportion of workers joining on apprenticeships. E&C talent hubs have emerged around the world, offering a rich source of talent.

ESG adoption drives investment

Throughout the 2020s the construction industry was responsible for building the next generation of sustainable infrastructure, including renewable energy facilities, and energy-efficient buildings with low lifetime carbon footprints and low water usage. And the construction value chain has become equally sustainable, with circular design, sensitivity to biodiversity, and strong support of local communities. Consultations with those impacted by projects being at an early stage and continue throughout the project lifecycle and beyond.

The buildings and infrastructure that the sector creates have also become far more resilient to the effects of climate change, such as rising sea levels, floods, droughts, heatwaves, wildfires and other extreme weather events. E&C companies and consultants have been heavily involved with owners to help them improve capital planning, with detailed operational planning that incorporates net zero targets, circularity and diversity, while balancing short-term shareholder expectations.

E&C businesses are now predominantly value-based, with an ethical stance on the types of projects they take on, and high standards of ESG reporting. All of which makes the sector appealing to investors, with low-cost capital flowing into projects.

Conclusion



Like any industry, E&C thrives when its customers have an outstanding experience, which means sustainable, circular and fast delivery of high-quality assets that are themselves sustainable throughout their lifetimes. 'Customers' doesn't just mean the owners, but a wide group of stakeholders including those individuals that use the infrastructure and buildings, as well as anyone impacted by them in their community.

E&C companies are literally changing the world, and if the sector can reach the heady heights of this paper's 2030 vision, then a sustainable future is within reach.

How KPMG professionals can help

When engineering and construction leaders turn to KPMG firms for advice, they do so because KPMG professionals understand the industry at a local, national and global level. For decades, we have provided services tailored specifically to meet the needs of the industry. KPMG firms have certified public accountants, professional engineers, architects, project managers, owner representatives, contract and procurement specialists, finance and tax professionals, business valuation specialists, cost estimators and specialists, certified fraud examiners and forensic technology specialists to assist you.

KPMG professionals can provide strategic insights and relevant guidance where clients operate. Services are delivered through the global organization of KPMG firms operating in 143 countries and territories with more than 265,000 partners and employees working around the world. KPMG professionals help clients

identify and mitigate project risks throughout the project life cycle. Their methodology encompasses both 'doing the right project' and 'doing the project right'. KPMG professionals can assist with construction program evaluations, project risk and controls assessments, contract compliance analyses and cost investigations, as well as project support on complex and troubled projects.

They can provide industry knowledge, multidisciplinary teams, and substantive experience in assisting with both the financial and technical aspects of major capital projects and programs. KPMG firms' advisory practice consists of professionals from diverse formal backgrounds. By combining valuable global insight with hands-on local experience, they can help you address challenges at various stages of the life cycle of infrastructure assets or programs — from planning, strategy and construction through to operations and hand-back.



Acknowledgements

Thank you to all of the participants in this report and for sharing your insights and perspectives.



Jon Nield
Chief Executive Officer,
Engineering &
Construction Risk
Institute (ECRI)



Greg Amparano
Chief Operating Officer,
Engineering &
Construction Risk
Institute (ECRI)



Xanthe Larsen
Attorney,
Engineering &
Construction Risk
Institute (ECRI)



John Kouchoukos
Vice President,
AECOM



Mayank Agarwal
Manager,
Projects and Project Controls,
Air Liquide



Damien Jeannolle
Risk Manager,
Air Liquide



Zahi Ghantous
Vice President,
Construction Support and
Quality Management
Department, Consolidated
Contractors Group (CCC)



Mustafa Abusalah
Manager,
Learning & Innovation,
Consolidated Contractors
Group (CCC)



Greg Ramsay
Global Director,
Risk and Consulting,
Hatch



Kris Reid

Senior Project
Risk Manager,
Worley



Borys Yarosh

Vice President,
Risk Management —
Corporate/Global
Projects Support,
SNC Lavalin



Pietro Profeta

Head of Business
Risk Management,
SBM Offshore



Alex Budzier

Fellow in Management
Practice,
Saïd Business School,
University of Oxford



Moe Roghabadi

Risk Manager
Hatch



Isidora Kosta

Lead,
Infrastructure Industries,
World Economic Forum

In addition to all the participants interviewed, this report was a team effort around the world. A special thank you to Athanasia Kiritsi, Blenda Runebjork, Camelia Bucur, Charlotte Buchholdt, Chris Harris, Dimitrios Papakanellou, Dimitra, Caravelis, Jamie Anderson, Jamie MacDonald, Jennifer Laffitte, Jonathan Sedger, Lily Ainapure, Maria Mallinos, Michelle Carter, Nikolaos Dimakos, Penny Vithoulka, Peter Valentin, Samantha Dann, Tim Bedingfield, and Vikram Ramakutty.

Contact us

Geno Armstrong

Sector Leader — Engineering & Construction
KPMG International
garmstrong@kpmg.com

Rob Fisher

KPMG IMPACT and ESG Leader, Partner
KPMG in the US
rpfisher@kpmg.com

Clay Gilge

Lead, Major Projects Advisory
KPMG in the US
cgilge@kpmg.com

Lisa Kelvey

Global Infrastructure Sustainability Lead
KPMG International
lisa.kelvey@kpmg.co.uk

Roni Michael

Global Head of Innovation
KPMG International
ronimichael@kpmg.com

Richard Threlfall

Global Head of Infrastructure,
Government and Healthcare (IGH)
KPMG International
richard.threlfall@kpmg.co.uk

Some or all of the services described herein may not be permissible for KPMG audit clients and their affiliates or related entities.

kpmg.com/socialmedia



The information contained herein is of a general nature and is not intended to address the circumstances of any particular individual or entity. Although we endeavor to provide accurate and timely information, there can be no guarantee that such information is accurate as of the date it is received or that it will continue to be accurate in the future. No one should act on such information without appropriate professional advice after a thorough examination of the particular situation.

© 2023 Copyright owned by one or more of the KPMG International entities. KPMG International entities provide no services to clients. All rights reserved.

KPMG refers to the global organization or to one or more of the member firms of KPMG International Limited ("KPMG International"), each of which is a separate legal entity. KPMG International Limited is a private English company limited by guarantee and does not provide services to clients. For more detail about our structure please visit kpmg.com/governance.

The KPMG name and logo are trademarks used under license by the independent member firms of the KPMG global organization.

Designed by Evalueserve.

Publication name: Construction in 2030

Publication number: 138561-G

Publication date: February 2023