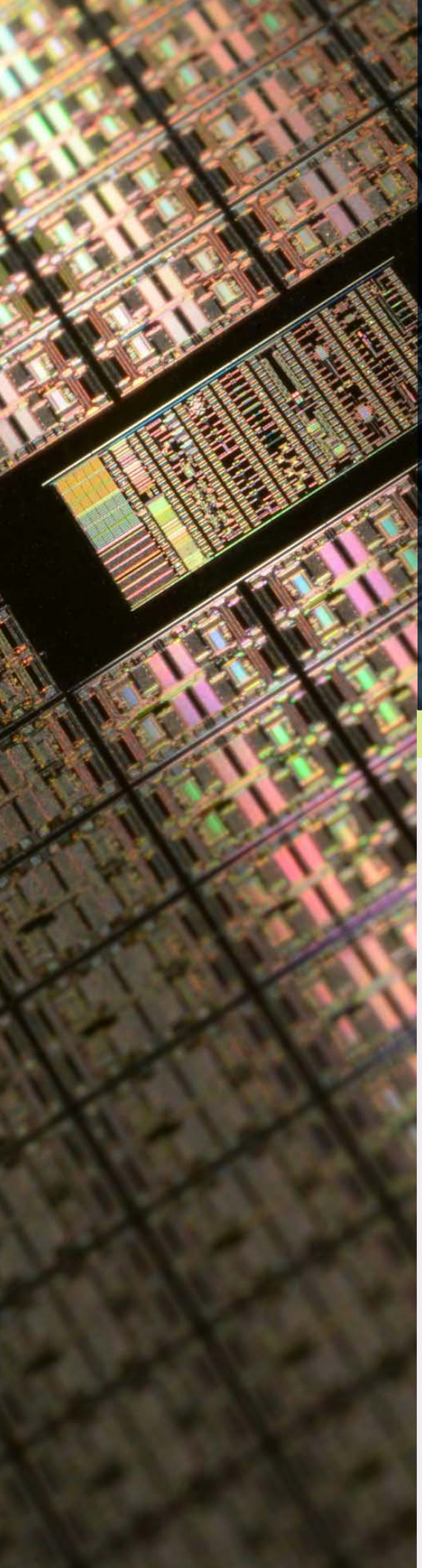

STEPSTONE

STAYING ON THE LEADING EDGE

Infratech

Infrastructure | SEPTEMBER 2024

In every industry, technology is a potentially disruptive or return-enhancing force, and infrastructure is no different.

From revolutionizing how infrastructure assets are designed and constructed to improving how they're operated and maintained, technology will transform the asset class. To stay apace and optimize portfolio construction, investors must anticipate how technology can affect the assets in their portfolios.

Historically, infrastructure companies have operated in a relatively stable and predictable technology environment. However, recent technological advancements have shifted this reality, affecting how and where infrastructure is used, and which assets stand to lose or gain value. Artificial intelligence is likely to accelerate these changes.

Technological innovation also makes asset life cycles less predictable. Investors may now need to better understand technology and consider that it could make some assets obsolete—if they are not effectively managed. Alternatively, what is considered value-add today may one day be considered core.

Many infrastructure investors have already broadened their target investments beyond traditional core infrastructure—notably, value-add infrastructure that is increasingly revolved around technology-enabled assets or "infratech." To capitalize on these opportunities and create more sustainable business plans, we believe investors should consider working with partners that can help them step outside their comfort zones to underwrite technology's effect on infrastructure assets.

Over the years, we've partnered with some of the infrastructure investors at the forefront of this change, deploying capital in a variety of sectors that are being redefined by technology. This paper distills these experiences and the forces at work to demonstrate that as an asset class, infrastructure can be on the leading edge. In each instance we explore the technological catalysts and the change they are bringing about.

Technology is changing infrastructure development

Much of the opportunity set today in infrastructure entails either deploying capital toward new greenfield projects or modernizing existing brownfield infrastructure. In either case, technology is fundamentally changing each phase of project development and disrupting the way that infrastructure ecosystems have traditionally functioned.

	"Business as usual"	Innovation-forward approach
Procurement	**Cost as primary competitive advantage:** Developers compete in response to request for proposal (RFP) on cost of capital in delivering similar projects.	**Innovative solutions:** Outcome-based procurement rewards differentiated solutions and enables "sole sourcing."
Development risks	**Idiosyncratic binary risks:** e.g., permitting, interconnection, offtake agreements.	**Early-stage contracts:** New contractual relationships (e.g., bespoke interconnections) enabled by technology accelerate project development.
Business models	**Margin compression:** Spread between project costs and contracted revenue under constant pressure.	**Operational enhancement:** Technology drives excess returns from improved operations and new revenue models.
Data	**Added feature:** An afterthought for operational improvement.	**Data and AI integration:** Incorporate the benefits of leveraging data and AI across the asset life cycle into the underwriting of asset investments.
Asset design	**Traditional design:** Legacy form factors limit the impact of technology on CapEx and operations.	**Technology enabler:** Physical form factors that are designed to leverage technology are cheaper and more effective.

Source: StepStone Group analysis.

Disruption and opportunities by sector

In this section, we explore the sectors that are ripe for technological disruption along with the technologies that are catalyzing these changes. Though some of these opportunities might seem far-fetched, we are already deploying capital in them.

TRANSPORT AND SUPPLY CHAINS

	Drivers of disruption	Infratech applications
Transportation	**Autonomous solutions** require a rethink of traditional transportation demand risk models. **Decarbonizing transportation** includes electric vehicles (EVs) for passenger, light and medium-duty vehicles; green hydrogen (H_2) or EVs for heavy-duty trucking; H_2, ammonia, methanol or other fuels for ocean shipping; and sustainable aviation fuels (SAF) for commercial air travel.	**Smart roads** that optimize traffic based on real-time data analysis using AI. **Autonomous driving** expanding commercially viable use cases, machine learning improving productivity, robotics improving warehouse automation, and drones finding niche use cases. **Logistics platforms** that incorporate next-generation fuel capabilities.
Supply chain	**E-commerce expansion** is taking market share from traditional retail. **Convenience factor** with delivery timelines that are reduced, deliveries include constant tracking and returns have flexible policies. **Geopolitical tensions** are opening alternative routes for commerce. Seaports along the US East Coast and the Gulf of Mexico are growing faster than those on the West Coast.	**Airports, seaports and logistics platforms** that incorporate real-time tracing, digitalization and AI to improve customer outcomes and decrease bottlenecking. **Low-cost internet of things (IoT)** connecting and enabling real-time tracking down to the item level; new use cases for sensors and remote monitoring.

Source: StepStone Group analysis.

ENERGY TRANSITION AND ELECTRIFICATION

	Drivers of disruption	Infratech applications
Power generation	**Increasing renewables penetration:** To stay on track for the 1.5°C pathway, by 2050 91% of the 90 petawatt-hours of electricity generated needs to come from renewables.[1] **Inefficient peaker plants** are no longer sufficient to sustain uninterrupted power during key peak demand events. Development and operations are CapEx inefficient.	**Peak grid congestion alleviated by demand management.** Homes and electric vehicle-to-grid applications become distributed virtual power plants (VPPs), with a two-way relationship with the grid. Increasing demand response provides a solution to grid instability at a lower cost and with a lower carbon footprint. **Distributed and decentralized generation:** Community and residential solar and batteries providing more direct contracting with customers.
Electrification, storage and grid reliability	**Volatility on the electrical grid is increasing**, driven by the electrification of transportation, buildings and industries as well as explosive growth in AI-driven data center demand. An estimated US$35 trillion of cumulative additional investment is needed in the sector to stay in the 1.5°C pathway.[2] **Energy security** amid surge in demand and geopolitical disputes.	**Improving battery tech for utility-scale storage and electrification of everything;** other technologies continue to drive down costs and improve duration of storage. **AI and machine learning for smart grids,** optimizing energy efficiency and electric mobility.
Green fuels	**Government incentives** worldwide like those provided in the Inflation Reduction Act are offering economic support for new technologies, lowering the cost of development and implementation.	**H_2 and other alternative fuel sources (renewable natural gas, SAF):** Tech improvements expected to result in manufacturing economies of scale, lowering costs of production, transport and storage—resulting in new use cases for H_2 and sequestered CO_2.

Source: StepStone Group analysis.

[1] International Renewable Energy Agency: "Investment Needs of USD 35 trillion by 2030 for Successful Energy Transition," March 2023.
[2] Ibid.

TELECOM AND DATA

	Drivers of disruption	Infratech applications
Wireless	**5G access structurally requires dense network** of small cells typically rolled out by each network operator, which deploys its own hardware, sometimes on shared infrastructure. Historically, third-party operators have leased tower space to carriers in 3G and 4G rollouts. Constraining CapEx costs for single-carrier rollouts contribute to slow 5G deployments.	**Physical assets are virtualized and shared in the cloud.** **Potential tech-enabled sharing** of network on a single radio provided by third-party operators enables densification at lower cost in 5G and 6G rollouts relative to single mobile network operator roll out alternatives.
Data centers	**Power grid constraints limit new interconnection with** insufficient power density and workload variability of proliferating AI compute capacity. Third-party developers with legacy access to land and power build commoditized data centers for hyperscalers, which are unable to meet hyperscalers' climate goals.	**Advanced energy management solutions** enable AI across constrained grids. **Flexible data centers** can optimize for the different uptimes required by traditional data centers and AI computing (e.g., tensor processing units). **100% renewable power** and large-scale batteries enable same reliability at lower cost and carbon impact while feeding power back to the grid as needed.

Source: StepStone Group analysis.

Conclusion

As technology transforms how infrastructure fulfills its role, it has altered the economics of traditional assets. As a result, technology-enabled and technology-ready assets are rapidly evolving across infrastructure sectors and subsectors. Portfolio optimization will increasingly be reliant on investors obtaining exposure to future-proofed assets that can enhance returns and mitigate risk.

When combined with traditional infrastructure assets, new and emerging technologies are increasingly providing solutions that enhance the user experience and integrate what were historically disparate pieces of the infrastructure puzzle. Investors should seek investment opportunities that, while at the frontier today, might inform the investment decisions of tomorrow.

We believe technology is revolutionizing every aspect of infrastructure and may become the answer to current infrastructure challenges—improving operational transparency and efficiency; facilitating the transition to climate-resilient assets; unlocking more sustainable business models; and transforming traditional monolithic assets into future-ready, distributed and system-integrated assets that are better able to meet the needs of tomorrow.

By working with a global partner that possesses a large sourcing engine and established partnerships with players across the value chain, LPs can access more technology opportunities that may generate attractive returns over the long run. In the next several years, we expect to see this increased focus on innovation in infrastructure bear fruit. Though the market is nascent and yet to be shaped, those who act sooner may have more opportunities available to them.

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