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Investing in Infrastructure

Investors are increasingly seeking out infrastructure opportunities offering portfolio diversification and relatively stable cash flows generated from real assets. They are finding huge demand for their capital: As of March 2022, the G20's Global Infrastructure Outlook initiative estimates that current investment will leave the world with a \$15 trillion infrastructure funding gap by 2040.¹ As critical global infrastructure assets age, they need to be overhauled to allow global, national and local societies and economies to continue to function. Population growth, technological advances and changes in trade patterns are creating further demand for new infrastructure investment.

In this paper, we assess the key attributes of infrastructure investments and the major investment themes being identified by governments and capital allocators alike.

¹ Source: Global Infrastructure Outlook, "Forecasting infrastructure investment needs and gaps," <https://outlook.gihub.org/>.

Executive Summary

- The G20's Global Infrastructure Outlook initiative estimates that current investment will leave the world with a \$15 trillion infrastructure funding gap by 2040.
- Governments cannot afford to make all of these investments, so projects are increasingly turning to private markets for capital, and private investors are exhibiting a growing appetite for the asset class.
- Investors are generally attracted by the key attributes of the asset class:
 - They are essential long-life assets with high barriers to entry
 - They offer inflation protection to portfolios
 - They typically offer relatively stable cash flows and current income
 - Average credit quality is high and correlation with traditional asset classes has historically been low
- Along with many other investors and government bodies, we identify four major infrastructure investment themes that we believe are particularly attractive:
 - Digitalization: The proliferation of connected devices and the transition to 5G networks
 - Energy Transition: Decarbonization and the race to net-zero emissions
 - Urbanization: Migration from rural areas and large cities to medium-sized centers
 - Supply Chain and Logistics: Enhancements to meet the demands of e-commerce, the changes in global trade patterns, and the shift from “just-in-time” to “just-in-case” inventory models

Infrastructure assets—from bridges, roads, tunnels and power grids to hospitals, schools, 5G networks and ports—are critical to making society and the economy work and grow sustainably.

For investors, that can potentially make infrastructure an attractive option from an environmental, social and governance (ESG) perspective. Improvements to transportation infrastructure can increase mobility and access to community and local resources. Improvements to communications and digital infrastructure can increase access to information and commerce opportunities for previously isolated populations. Improvements to power, renewables and utilities infrastructure can potentially have a positive environmental impact, and alternative energy can also increase reliability and energy security.

For similar reasons, governments, legislators and regulators often look favorably on infrastructure investments, as they offer material bang for the taxpayer's buck. Estimates for the multiplier effect of infrastructure spending—the increase in GDP for every dollar increase in infrastructure investments—often compare favorably to those for other types of government spending. In 2012, Sylvain Leduc and Daniel Wilson of the Federal Reserve Bank of San Francisco, in their paper, *Roads to Prosperity or Bridges to Nowhere?*, estimated an average multiplier over a 10-year horizon of almost two times.² Investments in infrastructure also have the potential for significant jobs creation, particularly at a local or municipal level. In November 2021, Moody's estimated that the \$1.2 trillion U.S. Infrastructure Investment and Jobs Act would create more than 800,000 jobs at its peak impact in the middle of the decade, for example.³

Despite these public benefits, government revenues are currently so stretched that programmatic re-investment in maintaining and developing new transport, utility and logistics systems is often neglected or is not prioritized. Even with programs such as the U.S. Infrastructure Investment and Jobs Act and the European Union's NextGenerationEU plan, as of March 2022, the G20's Global Infrastructure Outlook initiative estimates that current investment will leave the world with a \$15 trillion infrastructure funding gap by 2040.⁴

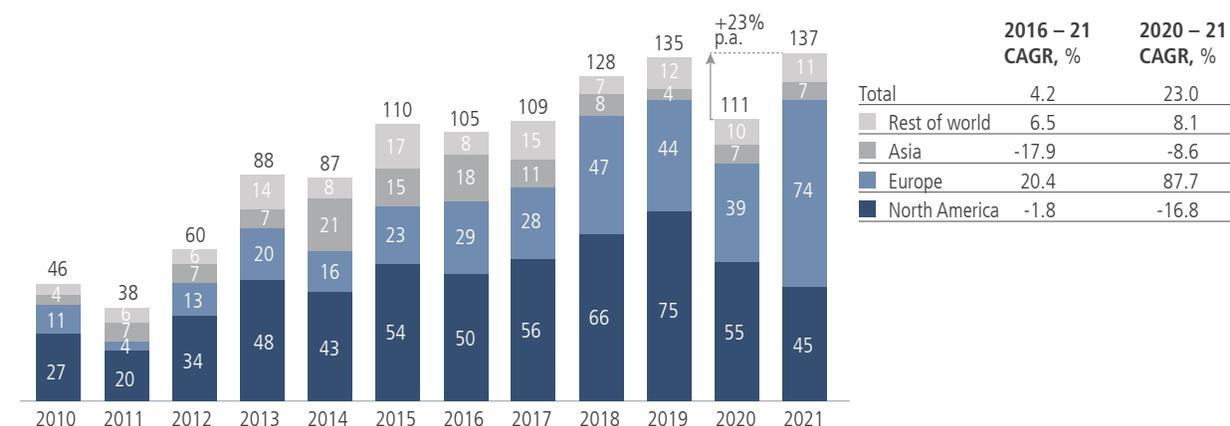
² Source: Federal Reserve Bank of San Francisco, *Roads to Prosperity or Bridges to Nowhere?*, <https://www.frbsf.org/economic-research/publications/working-papers/2012/04/>.

³ Source: Moody's Analytics, *Macroeconomic Consequences of the Infrastructure Investment and Jobs Act & Build Back Better Framework*.

⁴ Source: Infrastructure Outlook, *Forecasting Infrastructure Investment Needs and Gaps*, <https://outlook.gihub.org/>.

Private investment in infrastructure can help fill this gap, and, as Figure 1 shows, an increasing amount of capital is being raised in this sector.

FIGURE 1: GROWING INVESTOR APPETITE FOR INFRASTRUCTURE
Global Infrastructure and Natural Resources Fundraising by Region (\$ in Billions)



Source: Preqin, McKinsey & Company, *McKinsey Global Private Markets Review 2022*. Excludes secondaries, funds of funds, and co-investment vehicles to avoid double counting. For illustrative and discussion purposes only.

Going forward, global private infrastructure AUM is estimated by Preqin to likely double over the next five years, reaching \$1.9 trillion and overtaking real estate as the largest real asset class.

Key Attributes of Infrastructure Investments

While definitions of what constitutes infrastructure may vary, we see core infrastructure assets offering the following key attributes:

- 1) **Essential long-life assets:** Core infrastructure assets are expected to remain in service for decades before a substantial overhaul or replacement is required.
- 2) **High barriers to entry:** Long lead times for new projects and tight regulation of essential assets and services subject them to limited competition.
- 3) **Inflation protection:** Revenues are typically linked directly to inflation, through either the pricing formulas established by the asset’s regulator or through a contractual arrangement that adjusts for inflation.
- 4) **Stable cash generation:** Services provided by infrastructure assets are often regulated or determined under long-term contracts, providing good visibility into future cash flows. Usage of such critical and essential assets remains relatively consistent regardless of variations in pricing and user incomes; this typically results in relatively stable current income, which can be made available for distributions to investors or used for capital expenditure.

These attributes are common factors in virtually all “core” and “core-plus” infrastructure investments. Where one or more are absent, as with “value-add” or “opportunistic” investments, which may be greenfield, less monopolistic, more growth-oriented, more exposed to commodity price fluctuations or located in emerging markets, investors can be compensated with meaningfully higher return potential.

As a source of relatively stable, indexed cash flows, core and core-plus infrastructure can potentially act as both an income asset and an inflation hedge—qualities that are especially attractive in the current low-yield, high-inflation environment, which we anticipate likely being a persistent characteristic of coming economic cycles. Infrastructure assets can also be resilient during economic downturns: Transportation, communications and digital, power and renewables, utilities, midstream and energy, water and waste, and social housing assets often come with particularly defensive characteristics that have made this asset class durable in most all conditions.

Diligent portfolio construction is required to achieve investor goals, as private infrastructure assets span the risk/return spectrum and assets are not homogeneous. That said, in general terms, as Figure 2 suggests, infrastructure bonds have exhibited lower default rates and credit losses compared to their corporate peers, while a range of models of the performance of infrastructure equity have exhibited relatively low volatility and modest correlation with the broad equity market and Treasuries.

FIGURE 2: A HIGH-QUALITY AND DIVERSIFYING ASSET CLASS

Volatility and Return (Duration 9 – 10 Years)		
Annual Volatility	A/above	BBB
Corporates	7.0%	12.7%
Infrastructure Corporates	6.5%	8.2%
Historical Total Return	A/above	BBB
Corporates	4.5%	6.7%
Infrastructure Corporates	4.5%	5.5%

Source: Bloomberg Barclays. Volatilities and historical total returns are estimated from monthly historical return series from Jan. 2015 to Dec. 2021. Historical total returns are estimated from monthly historical return series from Jan. 2015 to Dec. 2021.

For illustrative and discussion purposes only. **Past performance is not indicative of future returns.** The benchmark performance is presented for illustrative purposes only to show general trends in the market for the relevant periods shown. The investment objectives and strategies of the benchmark may be different from the investment objectives and strategies of infrastructure private funds and may have different risk and reward profiles. A variety of factors may cause this comparison to be an inaccurate benchmark for any particular private fund and the benchmarks do not necessarily represent the actual investment strategy of a fund. It should not be assumed that any correlations to the benchmark based on historical returns would persist in the future.

Volatility and Correlation Characteristics of Various Models of Infrastructure Return						
Correlation Matrix	Global Fixed Income	U.S. Equity	Global Equity	Private Real Estate	Global Private Equity	Private Infrastructure Equity
Global Fixed Income	1.00	0.00	0.10	0.01	0.12	0.24
U.S. Equity	0.00	1.00	0.95	0.39	0.75	0.54
Global Equity	0.10	0.95	1.00	0.39	0.79	0.60
Private Real Estate	0.01	0.39	0.39	1.00	0.71	0.62
Global Private Equity	0.12	0.75	0.79	0.71	1.00	0.70
Private Infrastructure Equity	0.24	0.54	0.60	0.62	0.70	1.00
Annualized Volatility	5.8%	16.5%	18.0%	9.4%	11.2%	9.1%

Source: Bloomberg, Cambridge Associates. Correlations and volatilities are estimated from quarterly historical return series from Q1 2000 to Q3 2021. NB uses Bloomberg Global-Aggregate Total Return Index to represent global fixed income, and uses S&P 500 Index for U.S. equity, and uses MSCI ACWI Index for global equity. The data source of private real estate, private equity and private infrastructure equity is Cambridge Associates.

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Major Infrastructure Investment Themes

At Neuberger Berman, we identify four infrastructure investment themes as particularly attractive:

1. Digitalization
2. Energy transition
3. Urbanization
4. Supply chains and logistics

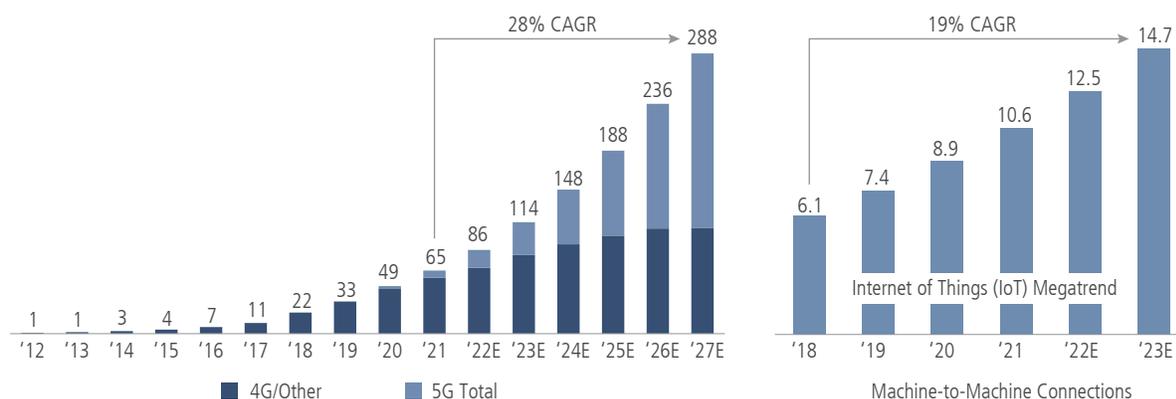
1. Digitalization

Declining device and connection costs are empowering more individuals and institutions around the globe to access the internet and “go digital.” This increased access, paired with population growth and the rise of the Internet of Things, is significantly increasing internet usage and demand for sophisticated telecommunication and 5G infrastructure. The shift to remote-working during the COVID-19 pandemic has accelerated similar trends even in regions where internet access was already widespread. In turn, higher usage is creating more and more data, spurring a focus on gathering and analyzing “big data.”

Together, these trends are accelerating global demand for decreased latency and more cloud computing power, increased bandwidth, more and bigger datacenters, more fiber connectivity, and more wireless solutions—generating significant investment opportunities in telecommunication infrastructure across the world in the coming years.

FIGURE 3: GROWTH PROJECTION FOR 5G MOBILE DEVICE USAGE

Global Mobile Data Traffic (Exabytes of Data per Month)



Source: Ericsson, Mobility Visualizer, accessed February 2022. For illustrative and discussion purposes only. There is no guarantee that estimates will be achieved.

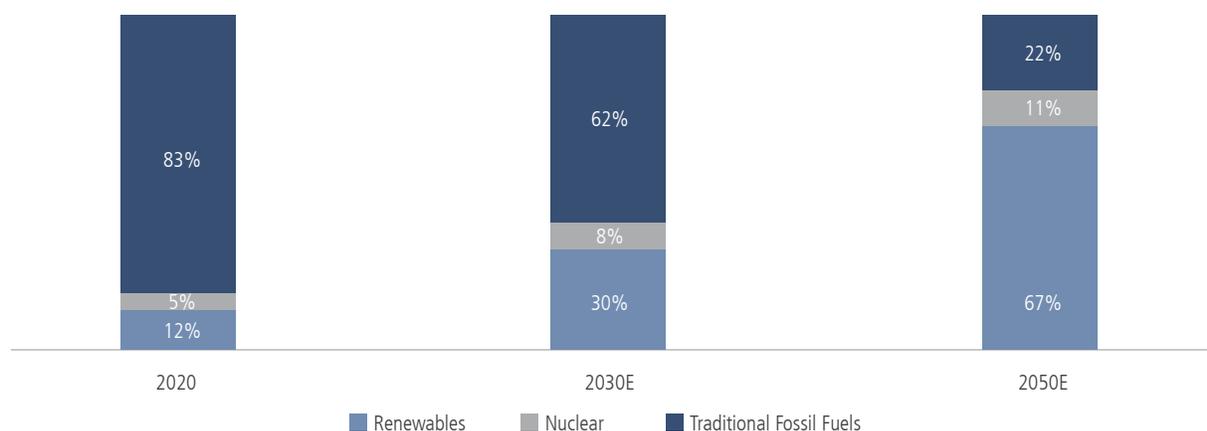
2. Energy Transition

The past decade has seen a global push toward decarbonization, given the environmental effects of fossil fuels and the potential cost advantages of alternative energy. The adoption of natural gas and renewables has accelerated, with coal-fired power plants the primary energy source being replaced. In its *Annual Energy Outlook 2021*, the Energy Information Administration (EIA) modeled projections for U.S. energy production and use; in its Reference case, renewables as a total percentage of U.S. electricity generation are expected to double from 21% in 2020 to 42% in 2050.⁵ The European Commission has a 32% target set for 2030, with a potential 60%+ share by 2050 implied by its net-zero emissions scenario, according to its strategic plan set out in 2018, *A Clean Planet for All*.⁶

The push for decarbonization coincides with rising demand for electricity, particularly in emerging markets, where access to reliable energy is still an important determinant of improving quality of life. In developed countries, by contrast, much aging power infrastructure is either tired or not designed for current demands and technologies, and needs to be repaired or replaced.

FIGURE 4: THREE DECADES OF RENEWABLE POWER INVESTMENT AHEAD

Global Energy Supply Projection to Achieve Net-Zero Emissions



Source: International Energy Agency, *Net Zero by 2050, A Roadmap for the Global Energy Sector*, May 2021. For illustrative and discussion purposes only. There is no guarantee that estimates will be achieved.

3. Urbanization

Urbanizing populations are straining highway systems and public transit, while years of underinvestment have left U.S. infrastructure, in particular, in a state of disrepair—even as the population of the U.S. grows faster than that of most other developed countries.

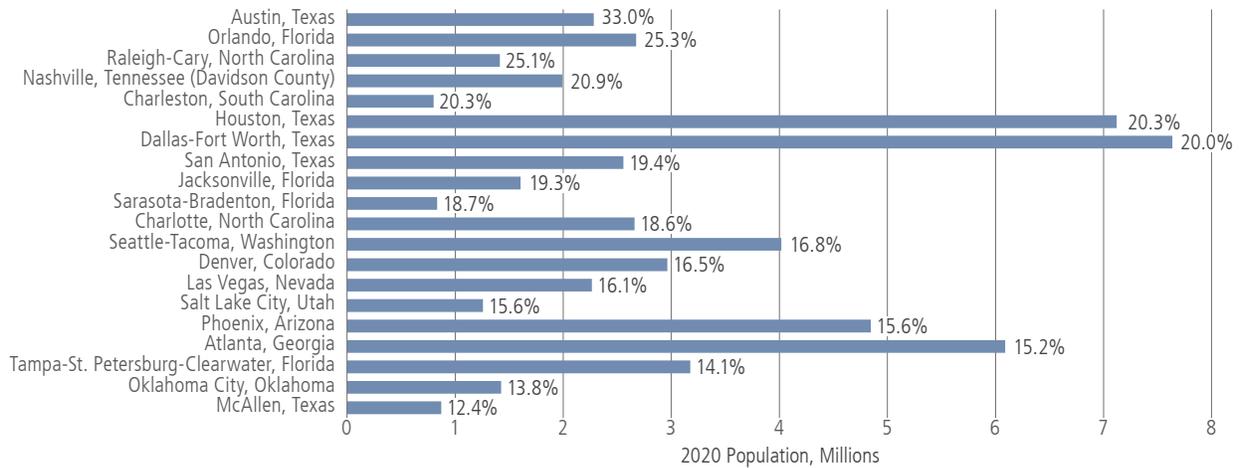
Moreover, current urbanization trends do not necessarily build on those of the past. Surging home prices, together with greater remote-working flexibility following the pandemic, are pushing people to move from larger, dense cities to more affordable suburbs, exurbs or even small towns. Recent U.S. census data show that San Francisco, New York and Los Angeles led top metropolitan cities in population losses over the past year, while medium-sized cities are experiencing explosive growth. These mid-tier areas are often unprepared for this population influx, adding to already strained infrastructure systems, and both state and local governments have limited budgets, forcing policymakers to look to private investment to build and repair critical infrastructure.

⁵ Source: U.S. Energy Information Administration, *Annual Energy Outlook 2022* (AEO2022).

⁶ Source: European Commission, *A Clean Planet for All*.

FIGURE 5: IN THE U.S., SMALL AND MEDIUM-SIZED CITIES ARE GROWING FASTEST

Percentage Change in Population, 2010 – 2020



Source: Exploding Topics, U.S. Census Bureau. For illustrative and discussion purposes only.

4. Supply Chain and Logistics

Globalization, increasingly complex supply chains and the rise of e-commerce have tested and changed logistics systems over the past three decades and increased demand for more robust transportation infrastructure. More recently, the pandemic has delivered a shock to global logistics systems, significantly increasing supply chain costs for companies and revealing widespread vulnerabilities. For example, according to Freightos Data, the cost of shipping a 40-foot container from China or Eastern Asia to the West Coast of North America increased almost fourfold between October 2020 and March 2022—from approximately \$3,800 to approximately \$15,900 per container.⁷ We believe that investments in technology improvements and capacity are vital to make supply chains more efficient and cost effective.

U.S. ports are a great example of a key bottleneck in need of improvement. There are over 300 coastal and inland ports in the U.S., supporting 30.8 million jobs in 2018 (up from 23.1 million in 2014), with goods worth 26% of total GDP passing through them every year.⁸ According to the American Society of Civil Engineers' *2021 Report Card for America's Infrastructure*,⁹ ports and port tenants planned to spend \$163 billion between 2021 and 2025, with investments focused on capacity and efficiency enhancements.

FIGURE 6: COVID-19 REVEALED WEAKNESSES IN THE GLOBAL SUPPLY CHAIN

40-Foot Shipping Container Freight Rate



Source: Freightos data, Bloomberg. Accessed April 2022. For illustrative and discussion purposes only.

⁷ Source: Freightos container index—China/East Asia to North America West Coast, <https://fbx.freightos.com/>.

⁸ Source: American Society of Civil Engineers, *A Comprehensive Assessment of America's Infrastructure*.

⁹ Source: American Society of Civil Engineers, *2021 Report Card for America's Infrastructure*.

Conclusion: Infrastructure Can Potentially Be a Vast and Diverse Opportunity

With current infrastructure aging and needing repair, logistic systems reeling from the impact of the COVID-19 pandemic, and an urgent race to net-zero carbon emissions getting underway, municipal, state, national and supranational authorities are increasingly focused on closing their \$15 trillion financing gap. But while governments can cover some of that financing, they cannot afford to cover it all. As such, projects across a wide range of infrastructure sectors are increasingly likely to turn to private markets for capital. We think digitalization, the energy transition, urbanization and supply chain enhancements are set to provide some of the most attractive investment opportunities over the coming generation.

In our view, diligent portfolio construction is required to navigate the diverse risks associated with these heterogeneous, often complex and usually highly regulated assets. We believe it is prudent to partner with experienced asset managers and operators, with well-established track records in the asset class.

Given the current macroeconomic outlook, the huge demand for private capital, the diversity of the opportunity set, and the asset class's long history of relatively stable, uncorrelated returns and consistent cash flows, we anticipate that infrastructure is likely to become an ever more important part of private markets programs.

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The **S&P 500 Index** is a float-adjusted market capitalization weighted index comprised of 500 stocks chosen for market size, liquidity, and industry group representation. The S&P 500 Index is constructed to represent a broad range of industry segments in the U.S. economy. The S&P 500 Index focuses on the large-cap segment of the market with approximately 80% coverage of U.S. equities. Criteria for inclusion include financial stability (minimize turnover in the index), screening of common shares to eliminate closely held companies, and trading activity indicative of ample liquidity and efficient share pricing. Companies in merger, acquisition, leveraged buyouts, bankruptcy (Chapter 11 filing or any shareholder approval of recapitalization which changes a company's debt-to-equity ratio), restructuring, or lack of representation in their representative industry groups are eliminated from the index.

The **MSCI ACWI Index**, MSCI's flagship global equity index, is designed to represent performance of the full opportunity set of large- and mid-cap stocks across 23 developed and 24 emerging markets. As of June 2021, it covers more than 2,900 constituents across 11 sectors and approximately 85% of the free float-adjusted market capitalization in each market. The index is built using MSCI's Global Investable Market Index (GIMI) methodology, which is designed to take into account variations reflecting conditions across regions, market cap sizes, sectors, style segments and combinations.

The **Bloomberg Global Aggregate Index** provides a broad-based measure of the global investment-grade fixed income markets. The three major components of this index are the U.S. Aggregate, the Pan-European Aggregate, and the Asian-Pacific Aggregate Indices. The index also includes Eurodollar and Euro-Yen corporate bonds, Canadian government, agency and corporate securities, and USD investment grade 144A securities.

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