Note: The following is a redacted version of the original report published May 2, 2025

US Infrastructure Investment

A Bigger Role for Private Funding

Economics

Funding Infrastructure
Andrew Hollenhorst

Equity Strategy

Equity Strategy Perspective
Scott Chronert

Fundamental Equity Research

Multi-Industrial, Engineering & Construction
Andrew Kaplowitz

Transportation
Ariel Rosa

Construction Materials
Anthony Pettinari

Alternative & Renewable Energy
Vikram Bagri

Energy Infrastructure
Ryan Levine

Technology & Communications
Michael Rollins

May 2025

Executive Summary

Infrastructure projects involve large up-front capital commitments and difficult-to-quantify returns that may be spread over multiple generations. Traditional funding strategies rely heavily on state and local borrowing and direct federal funding. But already-large budget deficits and evolving infrastructure needs suggest a larger role for the private sector. A new US sovereign wealth fund may also be a vehicle for funding domestic infrastructure.

The private sector and potentially a new US sovereign wealth fund (SWF) are likely to take on an increasingly important role in funding US infrastructure. Historically, governments were uniquely able to shoulder the non-standard risk profile and sometimes multi-generational time horizon associated with large-scale infrastructure projects. But two dynamics are leading to less government funding and consequently more funding from alternative sources:

Yawning budget deficits and infrastructure needs for supporting new technologies call for less dependency on the government for funding.

1. Already large US budget deficits limit the capacity for direct government funding.

2. Rapidly changing technology means evolving infrastructure needs that in many cases can be better met by the private sector, either alone or in partnership with government.

Direct government funding of infrastructure in the US has been declining for 50 years. The ability of the US government to spend more on infrastructure is constrained by already-large deficits driven in part by "nondiscretionary" spending on Social Security, Medicare and interest expense. Simply maintaining the quality of *existing* infrastructure has been a challenge in the US. The American Society of Civil Engineers grade for US infrastructure has improved, but only from a D+ in 2017 to a C in 2025 — barely a passing grade.

We see three funding models, explored further in this report, as potentially driving more capital into infrastructure investment:

1. *Private-public partnerships* involve private actors sharing some risk of an infrastructure project. This model has worked well in certain cases (e.g., private toll roads) but has been difficult to scale up.

2. A new *sovereign wealth fund* might use private sector funds to leverage existing assets of the US government to increase its ability to invest in domestic infrastructure.

3. *Direct private investment* in infrastructure to support new technologies (e.g., data centers).

Citi's equity analysts expect infrastructure-related sectors to benefit:

- **Multi-Industrial and Engineering & Construction** — Analyst Andrew Kaplowitz believes most, if not all companies in these sectors should benefit from incremental funding with existing legislation already providing a tailwind. Multi-industrials should benefit in general, but which firms will benefit most depends on the specific objectives of the new infrastructure spending.

- **Transportation** — Analyst Ariel Rosa notes that a sovereign wealth fund looking for long-lived assets would see investments in highways, railroads, bridges, ports and power generation as attractive.
- **Construction Materials** — Analyst Anthony Pettinari views the construction materials space as a key potential beneficiary of increased infrastructure investment from alternative sources — including potential investment from a new US SWF. Construction aggregates are the key ingredients in asphalt and concrete used in almost all infrastructure projects.
- **Alternative & Renewable Energy** — Analyst Vikram Bagri and team estimate that renewable capacity additions may total ~$303 billion in a base-case scenario through 2030, though they note there is considerable variation dependent on the pace of capacity additions and capital costs. Nuclear could fit well strategically with the stated policy and purpose of the US SWF, not least given bipartisan support.
- **Energy Infrastructure** — Analyst Ryan Levine notes that a US SWF may have the opportunity to own critical energy infrastructure assets such as regulated utilities, electric and gas transmission, power plants, exploration and production development projects, and longer-dated innovation projects by leveraging the resources of the US government while advancing the economic interest of the country.
- **Technology & Communications** — Michael Rollins and the global Tech & Comms Super-Sector team now forecast overall global data center IT load to grow at a compound annual growth rate (CAGR) of 14% to 110 gigawatts (GW) by 2030.

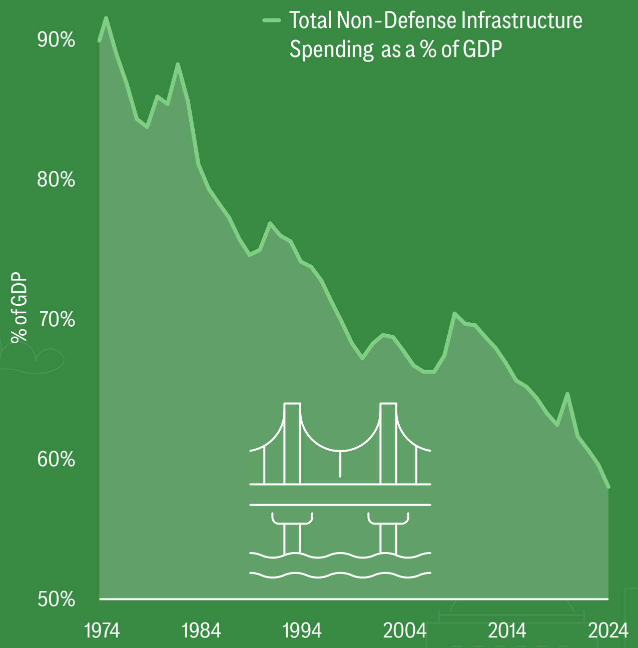
We hope you find this report helpful for understanding the various funding models in US infrastructure investment.

Andrew Hollenhorst
Chief US Economist

The Future of Infrastructure

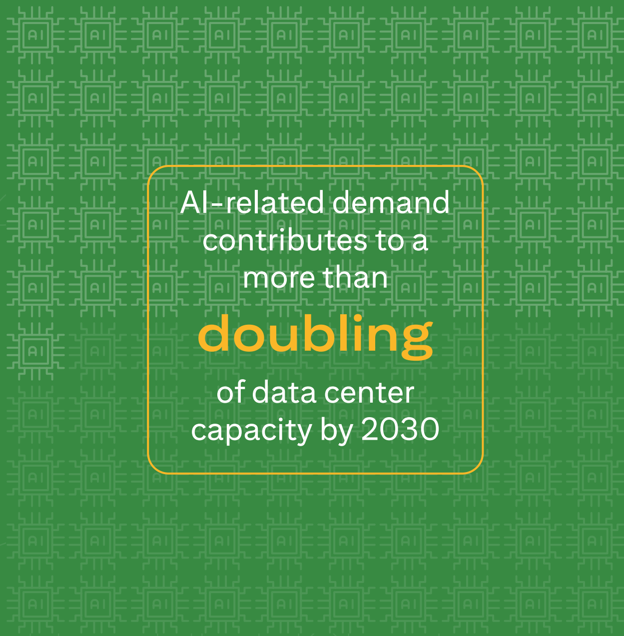
Government Funding is in Decline

Projects often involve large up-front capital, and it's difficult to quantify returns that may be spread over multiple generations.



New Technologies = New Funding Types

Constrained government spending and the rapid need for new kinds of infrastructure call for a larger role for private funding.



Recent Infrastructure Acts

Congress has recently enacted several funding programs in the wake of major economic downturns or in response to geopolitical tensions.

1 — 2008

American Recovery and Reinvestment Act

$105 Billion allocated for infrastructure

$48 Billion of that for transportation

2 — 2021

Infrastructure Investment and Jobs Act (IIJA)

$550 Billion split between transportation...

...and other core infrastructure

3 — 2022

Inflation Reduction Act

$391 Billion for energy production and electric vehicles

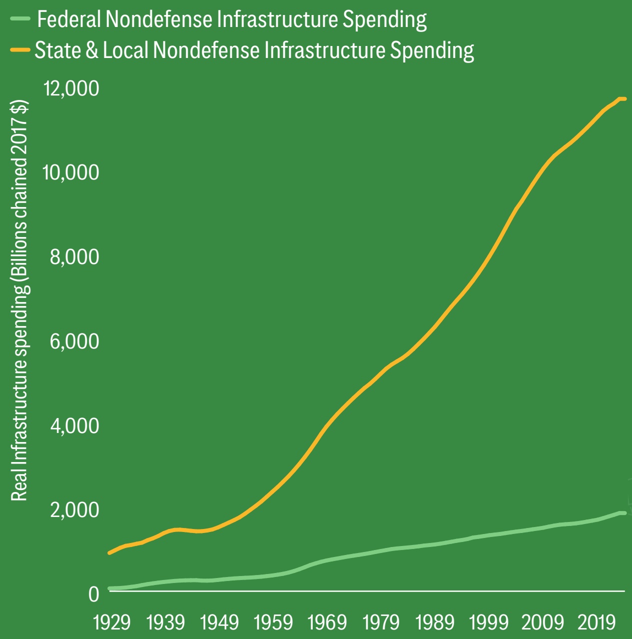
4 — 2022

CHIPS Act

$59 Billion for semiconductor investment

Government Infrastructure Investment

Since the 16th Amendment was ratified in 1913, the lion's share of infrastructure investment has been done at the state and local level.



Public vs Private

Already-large budget deficits and evolving infrastructure needs suggest a larger role for the private sector.

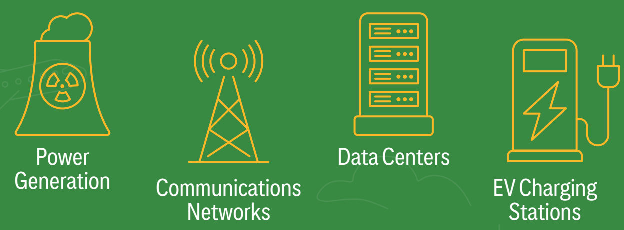
Public-Private Partnerships

Since the early 1990s

Only 1%–3%

of water and transportation infrastructure investment has been in the form of a public-private partnership.

Privately Owned Infrastructure



Infrastructure Features

Large-scale infrastructure means financing is complex and more difficult for the private sector without government involvement.

Often long-lived structures

New York subway system, Suez Canal, Fossdyke and Arkadiko Bridge

Large up-front outlays of capital & ongoing maintenance

A new airport can cost over $1 billion and require millions in upkeep every year

"Natural monopolies" lend themselves to government-supplied infrastructure

One connected system means more efficient railroad network effects and right-of-way

Government policy affects investment ROI

All infrastructure investments are ultimately subject to potential changes in taxes and regulation

Safety and environmental concerns

Government entities facilitate public planning decisions (e.g. diverting waterways, roads and airports)

Security and geopolitical concerns

US policymakers are focused on domestic infrastructure that's secure from foreign attack

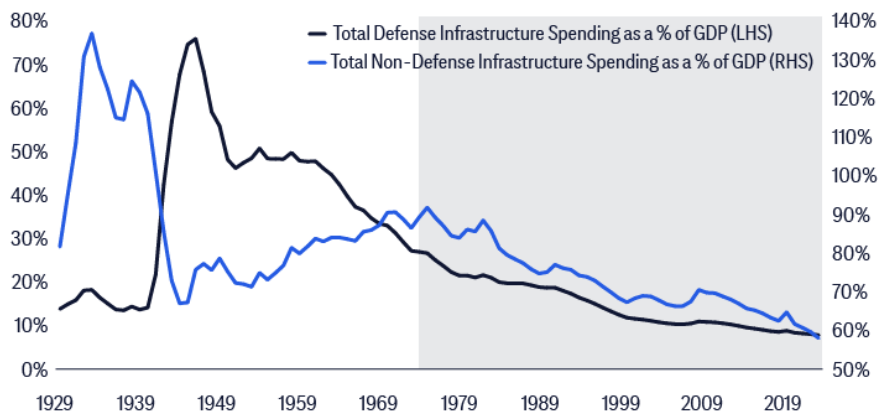
A Bigger Role for Private Funding

Andrew Hollenhorst
U.S. Economics

Funding Infrastructure

Over the last 50 years the share of US government spending on non-defense infrastructure has steadily declined from nearly 90% of GDP to about 60% of GDP (Figure 1).

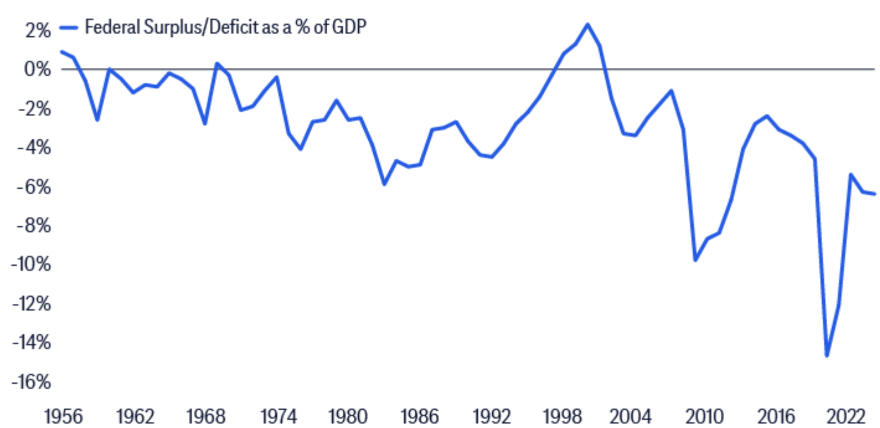
Figure 1. Government spending on infrastructure has been declining for over 50 years



Source: Citi Research, Ray C. Fair

Scope for further direct funding from the government is limited. The federal government deficit stands at an elevated 6.4% of GDP (Figure 2).

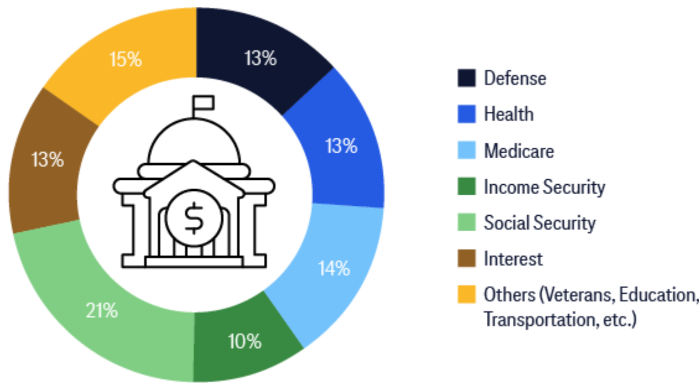
Figure 2. Government deficits are historically large...



Source: Citi Research, CBO

Cutting other government spending is challenging given that the majority of the budget goes to defense, interest expense and popular government programs like Social Security and Medicaid (Figure 3).

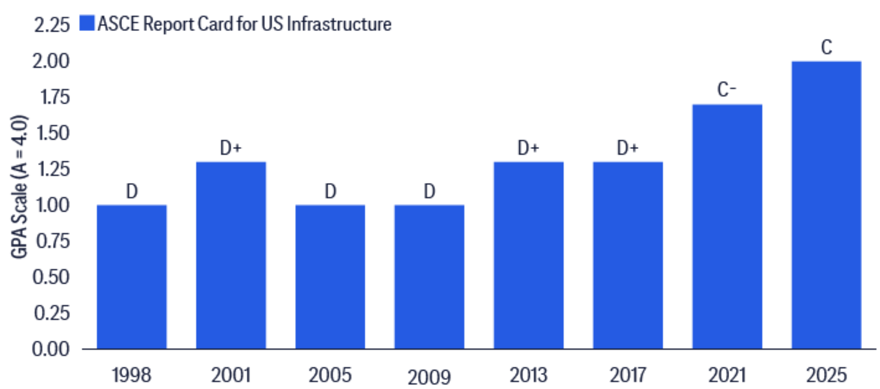
Figure 3. …and most spending is on difficult-to-cut defense, Social Security, Medicare & Medicaid, and interest expense



Source: Citi Research, Department of Treasury

Government spending on new infrastructure investment is also constrained by the need to maintain existing infrastructure. The American Society of Civil Engineers have upgraded the state of infrastructure from a D+ to a C in recent years, but that involved historically large — and likely not soon to be repeated — post-COVID infrastructure investment programs (Figure 4).

Figure 4. US infrastructure "report card" has improved in recent years



Source: Citi Research, ASCE

New technologies will require new kinds of infrastructure that may be more efficiently and more rapidly funded by the private sector. Citi now estimates that demand related to artificial intelligence (AI) and other new technologies will contribute to a more than doubling of data center capacity by 2030 (see the detailed discussion in the Technology & Communications section on page 21).

Constrained government spending and the need to quickly build new kinds of infrastructure mean the private sector is likely to continue playing an expanding role in funding infrastructure. This can be done either directly, through private-public partnerships, or with the private sector leveraging capital provided by the soon-to-be created US sovereign wealth fund, discussed in further detail on page 9.

Infrastructure is a Unique Investment Requiring Unique Funding Strategies

- **Infrastructure projects are often long-lived,** with benefits accruing to both current and future generations. In 2024 over one billion trips[1] were taken on the New York subway system (first opened in 1904), and on some days more than 100 ships pass through the Suez canal (built in 1858). Records attest that the Fossdyke connecting the rivers Trent and Lincoln in England was refurbished in 1121 AD and may have begun life as a Roman engineering project in 120 AD. Hikers in the Greek Peloponnese can still take advantage of the same 22 meter long Arkadiko bridge in continuous use since the Bronze Age (~1300 BC).

- **Infrastructure requires large up-front outlays of capital, followed by a commitment to ongoing maintenance and other operating expenses.** Building a new airport can cost over $1 billion, and require millions in upkeep every year to keep it functioning.

- **"Natural monopolies" make it most efficient for governments to supply some infrastructure either directly or in partnership with the private sector.** An obvious example is the power grid or railroads where network effects and limited right-of-way make it efficient to have one connected system rather than disjointed competing systems.

- **Government policy affects the return on infrastructure investment.** Of course, all investments are ultimately subject to potential changes in taxes and regulation. But the fees charged (or not) to access public infrastructure such as roads, airports and utilities are often either directly or indirectly determined by government policy.

- **Safety and environmental concerns.** Making decisions like diverting waterways or deciding where to locate roads and airports necessarily involves some level of public planning facilitated by government entities.

- **Security and geopolitical concerns.** Particularly given rising geopolitical tensions, US policymakers are increasingly focused on building domestic infrastructure that is secure from foreign attack.

These defining features of large-scale infrastructure make financing complex and historically more difficult for the private sector to manage without government involvement.

State and Local Government Dominate US Infrastructure Investment

The 16th Amendment to the Constitution was ratified in 1913, providing the authority for Congress to establish a federal income tax through the Revenue Act of 1913. Importantly for the future funding of infrastructure, the act made interest on state and local debt deductible — meaning it would now be more tax-efficient for local governments to fund infrastructure. As the data in Figure 5 show, the lion's share of

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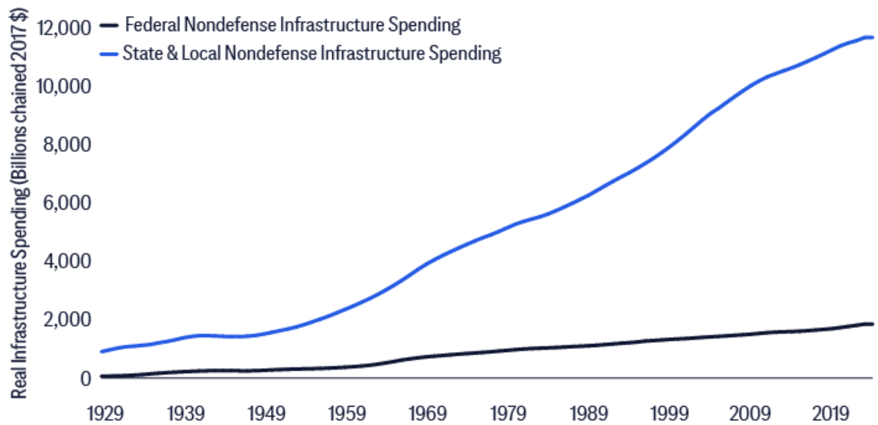
[1] November 4, 2024 NYC Press Release: ICYMI: Governor Hochul Announces One Billionth New York Subway Rider of 2024

infrastructure investment has been done at the state and local level ever since.

Figure 5. State and local infrastructure spending has grown substantially in the past decade



Source: Citi Research, BEA

Following the 2008 financial crisis, and again after the 2020 pandemic, Congress enacted major infrastructure programs — which often worked by pushing federal money to the state and local level.

- The 2008 **American Recovery and Reinvestment Act** allocated $105 billion to infrastructure, with $48 billion of that amount spent on transportation.
- In 2021 Congress passed the five-year **Infrastructure Investment and Jobs Act (IIJA)** with some level of bipartisan support (69–30 in the Senate and 228–206 in the House). The bill appropriated $550 billion in new spending split evenly between transportation (including roads, rails and airports) and other core infrastructure (including broadband, power and water).
- This was followed up by the 2022 **Inflation Reduction Act (IRA),** passed by Democrats through party-line reconciliation and earmarking $391 billion (largely through tax credits) over ten years for energy production and electric vehicles. Also in 2022, the CHIPS Act provided $59 billion in semiconductor investment.

Stable funding for infrastructure requires models more flexible than the big packages Congress passed following extraordinary events in recent years.

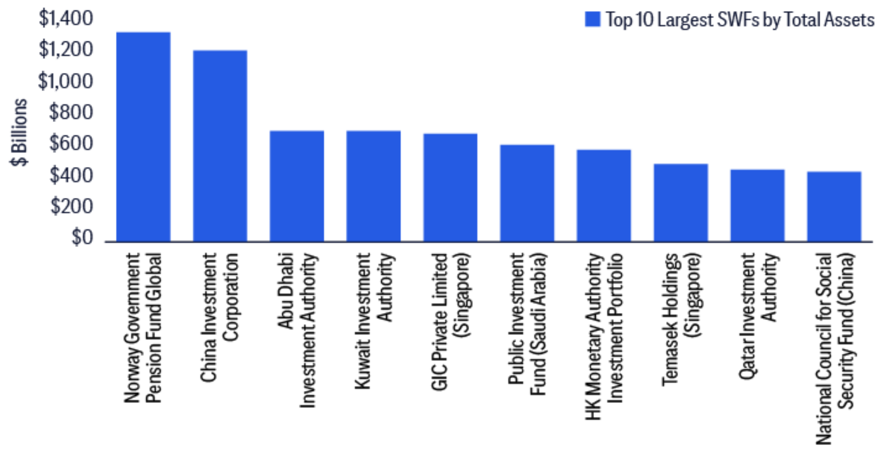
These are large numbers, but it is telling that these packages were only passed in the wake of major economic downturns or in response to evident geopolitical tensions that drove bipartisan cooperation. Stable funding for infrastructure requires more flexible funding models, as discussed below.

US Sovereign Wealth Fund

Sovereign wealth funds (SWFs) are distinguished by a broad mandate to obtain a return on a sovereign's invested capital. SWFs differ from public pension funds where the primary objective is to satisfy long-term obligations, implying investments skewed toward long-duration, low-risk fixed-income instruments. SWFs are also distinct from direct holdings of central bank reserves that are typically kept in short-maturity local and foreign currency instruments to manage liquidity and currency risk.

SWFs are relatively new structures. Some of the oldest, and currently some of the largest, SWFs were set up by Persian Gulf countries to manage the revenue generated by their oil resources. Chinese SWFs are funded by foreign reserves that built up due to persistent large trade surpluses (Figure 6).

Figure 6. Sovereign wealth funds control trillions in investable assets



Source: Citi Research, SWFI

But while SWFs have usually been associated with countries that run fiscal or trade surpluses, there is nothing preventing a country like the US (that currently runs fiscal and trade deficits) from setting up a similar structure. There is some bipartisan support for this type of structure with both the prior Biden administration and current Trump administration indicating a desire to establish such a fund.

On February 3rd President Trump announced his plan to establish a US SWF, stating:

It is in the interest of the American people that the Federal Government establish a sovereign wealth fund to promote fiscal sustainability, lessen the burden of taxes on American families and small businesses, establish economic security for future generations, and promote United States economic and strategic leadership internationally. [2]

President Trump has tasked the secretaries of the Treasury and Commerce with formulating, by May 4th, plans for a US Sovereign Wealth Fund.

He instructed the Secretary of the Treasury and the Secretary of Commerce to develop a governance model and plans for funding and investment by May 4th.

Treasury Secretary Bessent has indicated that the plan is to put "assets to work." The US Treasury holds $5.7 trillion in assets. About $3 trillion of that is made up of loans and cash and other monetary assets that could potentially be contributed to the stand-up of a new SWF (Figure 7). This new SWF would be as large or larger than existing SWFs.

[2] https://www.whitehouse.gov/presidential-actions/2025/02/a-plan-for-establishing-a-united-states-sovereign-wealth-fund/ (February 3, 2025)

Figure 7. US Treasury asset breakdown

US Treasury Assets	2024 ($Bil.)	2023 ($Bil.)
Cash and other monetary assets	1,177.70	922.2
Accounts receivable, net	278.7	319.9
Loans receivable, net	1,751.00	1,695.10
Loan guarantees	27.9	4.6
Inventory and related property, net	447.3	423
Property, plant and equipment, net	1,313.00	1,235.00
Investments in government-sponsored enterprises	305.8	240.4
Investment	132.4	130.8
Advances and prepayments	146.4	252.7
Other assets	81.9	195.4
Total Assets	**5,662.10**	**5,419.10**

Source: Citi Research, Bureau of the Fiscal Service

The SWF would not need to sell these assets to make investments. Instead, it could borrow against them by issuing debt. The European Investment Bank is levered about 10-to-1, meaning a US SWF could control $30 trillion in firepower (close to 100% of US GDP) by adopting a similar leverage ratio.

Even if the SWF primarily invests in foreign-based assets, there would still be capacity to robustly support domestic infrastructure. The desire to promote "leadership internationally" may also indicate that the SWF could be involved in funding international infrastructure projects that are of US interest, such as shipping ports and canals used by US vessels.

Public-Private Partnerships

In a public-private partnership, the private sector takes some portion of the risk in an infrastructure project. The private investor receives compensation from tolls or other revenue produced by the project. This model has been effectively used in certain situations and likely has capacity to grow in coming years, but has made up a relatively small share of total infrastructure investment. In 2017 the Congressional Budget Office (CBO) concluded that since the early 1990s only 1%–3% of water and transportation infrastructure investment has been in the form of a public-private partnership.[3]

Privately-Owned Infrastructure

The word "infrastructure" is often used as short-hand for "public infrastructure." Public goods such as roads and defense assets are usually most efficiently provided by the government directly.

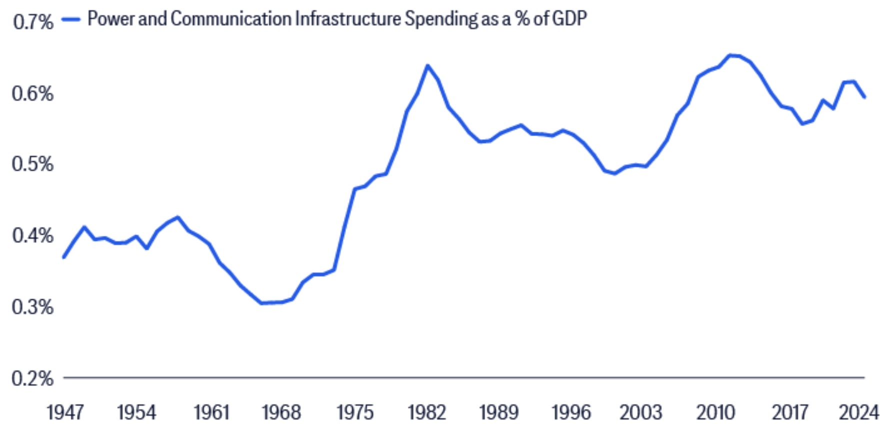
There is no agreed upon definition of "private infrastructure", but we might include fixed assets that require a large up-front investment and provide a general economic service needed by other parts of the economy. This could include privately owned power generation, communications networks, data centers and electric vehicle (EV) charging stations.

With government debt levels already high, government spending on infrastructure declining and new technologies evolving swiftly, direct

[3]January 2020 CBO report Public-Private Partnerships for Transportation and Water Infrastructure

private funding of infrastructure is likely to continue to increase in coming years (Figure 8).

Figure 8. Private spending on infrastructure has room to increase in coming years



Source: Citi Research, BEA

Equity Strategy Perspective

Scott Chronert
US Equity Strategy

The infrastructure topic has been an ongoing one over the years. We see it as a multifaceted one with numerous macro and micro considerations. Ultimately, the question for us is the degree to which it translates into US equity fundamentals. One clear path is whereby governmental spending on "social good" projects (e.g., transportation infrastructure) translates into a fundamental tailwind for suppliers to those programs. Here, taxation and governmental borrowing are de facto sources of capital. Another path is where the definition of "infrastructure" is broadened out to include products and services funded by more direct revenue generation (e.g., utilities, garbage collection). And, more recently, the spending surge on data center capacity to support technology advancement (including AI) provides yet another angle on the infrastructure discussion.

Over the past two years we have written on several related topics. For example, we see opportunity for the cyclical part of the US equity indices to regain lost weight as technological advancements trigger an industrial rebirth. On a related note, we have increasingly focused on the "tech users" construct as a means of justifying lesser earnings volatility and higher through-cycle valuations for industrials companies.

More directly, the capital spending circumstance for US equities is an obvious starting point for assessing future growth initiatives alongside traditional fundamental trajectories. The current set up is that the S&P 500 is expected to spend approximately $1.2 trillion on capex in 2025. This is a 14% increase from 2024's expenditure and comes on the heels of a 14% spending increase in 2024 over 2023's levels.

The important context is that the capex spending contribution within the S&P 500 has shifted quite notably over the past decade. Essentially, the trend has been away from the Energy/Industrials sectors and toward the Information Technology, Communication Services, Consumer Discretionary and Utilities sectors.

Currently, we expect that tariff and policy related uncertainty will lead to a push-out or delay of some spending and may cause other initiatives to be redirected. But the inexorable trend, in our view, is down a path which ultimately supports increased "productivity" in its various manifestations.

We do not yet have sufficient insight to weigh in on the potential influence of a SWF angle. However, we have noted over the past 18 months our growing concern over the sustainability of the post-pandemic fiscal spending surge. Intuitively, a SWF influence would align with a more traditional, longer-term investment approach. At the same time, given the deficit realities described by our economist colleagues, we question how much incremental growth in infrastructure spending can unfold. In turn, state and local government funding is likely to remain front and center. Ultimately, an evolving public and private partnership would seem to be a critical part of the infrastructure spending equation.

Fundamental Equity Research Perspectives

In this section, our fundamental equity analysts weigh in on the sectors that could benefit from expected infrastructure investment in the United States, both public and private.

Multi-Industrials and Engineering & Construction

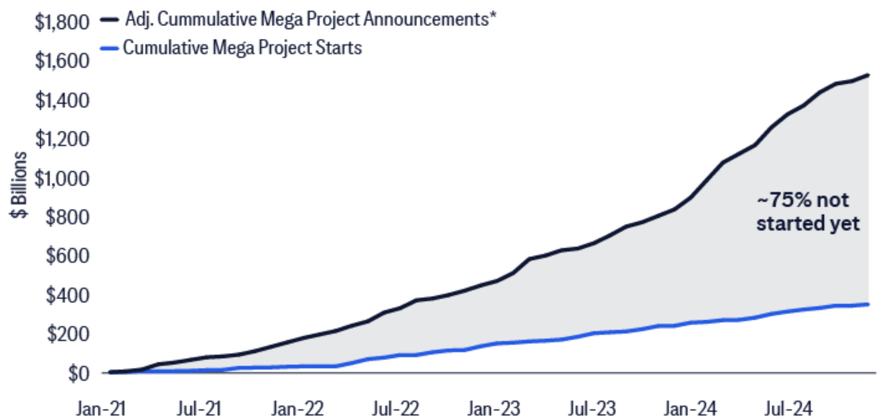
Andy Kaplowitz
US Multi-Industrials and Engineering & Construction

We think an SWF could be well positioned to direct some portion of its capital toward infrastructure-related investments.

Our expectation is that incremental funding for domestic infrastructure — including via a potential newly established SWF — would likely be supportive of continued healthy demand trends in the Engineering & Construction (E&C) sector and could also be generally beneficial for industrial demand more broadly. We've previously highlighted legislation mentioned elsewhere in this note such as the IIJA, the IRA, and the CHIPS Act, and while funding associated with these legislative acts has been relatively slow to materialize in some cases, we do think that government support for infrastructure investment remains a key long-term funding source. As such, we think an SWF (that we surmise would be focused on generating long-term returns) could be well positioned to direct some portion of its capital toward infrastructure-related investments.

Notably, despite increased near-term uncertainty, the past several years have seen a relatively significant uptick in "megaproject" announcements that we think already represent a relatively durable tailwind for infrastructure-related end markets and the companies that serve them (Figure 9). With ~75% of announced megaprojects still yet to start (Figure 10), we see domestic infrastructure markets as having potentially durable underpinnings, particularly as efforts such as an increased focus on domestic manufacturing capabilities and AI-related/data center capex we think could continue to emerge as key competitive imperatives.

Figure 9. Megaproject Adj. Cumulative Project Announcements (as of Dec. '24)



Source: Citi Research, Company Reports, ConstructConnect

Figure 10. Megaproject Starts 2021–2024

Mega Projects Started in 2024		
Total # of Mega Projects		46
Total Mega Project $'s (mn)		$109,960
Projects by Category	**#**	**$/mn**
Civil/Engineering	4	$11,575
Commercial	9	$15,400
Industrial	12	$32,100
Institutional	7	$15,400
Residential	3	$4,000
Heavy	11	$31,485

Mega Projects Started in 2023		
Total # of Mega Projects		41
Total Mega Project $'s (mn)		$104,850
Projects by Category	**#**	**$/mn**
Civil/Engineering	7	$15,100
Commercial	10	$15,150
Industrial	18	$65,600
Institutional	4	$7,000
Residential	2	$2,000

Mega Projects Started in 2022		
Total # of Mega Projects		31
Total Mega Project $'s (mn)		$105,261
Projects by Category	**#**	**$/mn**
Civil/Engineering	6	$13,060
Commercial	1	$1,500
Industrial	15	$75,670
Institutional	7	$10,931
Residential	2	$4,100

Mega Projects Started in 2021		
Total # of Mega Projects		16
Total Mega Project $'s (mn)		$32,380
Projects by Category	**#**	**$/mn**
Civil/Engineering	4	$6,400
Commercial	9	$6,990
Industrial	12	$12,600
Institutional	7	$3,790
Residential	3	$2,600

Mega Projects Started in 2021-2024		
Total # of Mega Projects		134
Total Mega Project $'s (mn)		$352,451
Projects by Category	**#**	**$/mn**
Civil/Engineering	20	$46,135
Commercial	24	$39,040
Industrial	49	$185,970
Institutional	21	$37,121
Residential	9	$12,700
Heavy	11	$31,485

Source: Citi Research, ConstructConnect

Looking beyond what we view as an already relatively favorable demand outlook for domestic infrastructure, we do think that, as mentioned above, a potential US SWF could represent a potential source of incremental funding support for infrastructure. That said, incremental long-duration infrastructure funding, if it were to materialize, we think could lead to an even more favorable demand environment over time supporting "higher for longer" growth potential.

With respect to Multis, we view infrastructure-related investment as broadly positive for industrial activity that, depending on the specific objectives or focus areas, could positively impact markets such as HVAC, data centers and/or electrical components, factory/process automation, and water.

Transportation

Ariel Rosa
US Transportation

Transportation and infrastructure assets are often popular investment targets for SWFs, as they are long-lived, visible, and generate public benefits beyond just investment returns. North American freight railroad infrastructure is already among the best in the world, leading us to believe that transportation-related infrastructure investments would likely be directed toward highways, bridges, and ports, as well as EV infrastructure and various adjacent projects including power generation — particularly targeting coal as well as oil and gas under the Trump Administration. We expect an increase in domestic manufacturing projects would stimulate demand for freight transportation.

Power generation is an oft-cited area in which a sovereign wealth fund may invest. We anticipate a potential increase in funding toward US power generation projects, with the Trump Administration specifically citing increased domestic coal production as an area where it would like to focus. This could have positive implications for rail volumes over time. Specifically, the increase in power consumption from data centers and greater domestic energy production aligns with Trump administration objectives. In early April, the Trump Administration signed executive orders (White House, 4/8/2025)[4] to expand US coal production to meet the rising power demand from an expected resurgence in domestic manufacturing as well as construction of AI data centers in the United States. Boosting coal-fired power is now seen as a top priority for the Trump administration, which could reverse the structural decline in coal production while also supporting American coal exports. For reference, coal-burning plants generate less than 20% of US electricity, which has been on a steady decline from ~50% in the early 2000s.

The potential shift away from renewable energy sources implies pushing out the scheduled retirements of coal plants and therefore supports domestic coal production over time. We also expect more domestic oil and gas production would boost demand for freight transportation, with a wide range of inputs used for energy extraction (frac sand, metals and minerals), as well as outputs (crude oil and refined petroleum products). Coal volume declines and falling yields have been headwinds to rail given the rise of natural gas. Accordingly, we look at the increased spending on infrastructures as favorable not only to offset structural declines in coal volumes, but also supportive of coal pricing that would be likely to support rail earnings.

Transportation infrastructure is another oft-cited area in which an SWF might look to invest. To the extent that investment in the maintenance and construction of roads, highways and bridges in the United States could be part of a US SWF's outlays, we anticipate trucking carriers to benefit, as they operate on the US's public road system. We expect limited benefits to the railroads as they invest in their own rail network infrastructure.

More broadly, we think railroads and less-than-truckload carriers could benefit from a potential resurgence in domestic manufacturing and increased infrastructure spending given their mix of business (levered to industrial activity), their relatively high incremental margins, and their current levels of available capacity.

Construction Materials

Anthony Pettinari
US Construction Materials

We view the construction materials space as a key potential beneficiary of increased infrastructure investment from alternative sources — including potential investment from a new US SWF. Construction aggregates (sand, gravel, crushed stone) are the key ingredients in asphalt and concrete used in almost all infrastructure projects.

While public demand for aggregates is generated by various types of infrastructure investment, among infrastructure projects highway construction generates the greatest demand for aggregates (an estimated 40,000–80,000 tons per 1 mile of a 4-lane highway, vs just 120–400 tons per housing start). Construction aggregates are primarily used to create a stable base to lay a foundation, and highway projects by nature have a significantly higher ratio of foundation surface area to overall project size (though aggregates still remain a relatively small part of overall highway construction costs, perhaps ~5% of total spend). The need for highway

[4] https://www.whitehouse.gov/presidential-actions/2025/04/reinvigorating-americas-beautiful-clean-coal-industry-and-amending-executive-order-14241/

infrastructure remains significant; while The American Society of Civil Engineers has upgraded the state of infrastructure from a D+ to a C in recent years, the grade for roads remains a D+.

The state of infrastructure overall has improved from a D+ to a C but the grade for roads remains a D+, underscoring still-significant highway infrastructure needs.

Federal highway budget legislation, which occurs roughly every 4–7 years, sets and generally raises the federal budget for highway spending outlays (the most recent example being the $1.2 trillion that the IIJA passed in 2021). Now more than halfway through the IIJA's 5-year effective period, we estimate that only ~1/3 of total IIJA highway/bridge funding through fiscal 2026 ($350 billion allocated through the IIJA) has been spent**.** There is a meaningful lag between federal infrastructure legislation and revenue recognition for Construction Materials producers, as the federal government distributes funding to the states, and the states award contracts. There can further be a ~6–18 month lag between contract awards and the start of sales for Heavy Construction Materials producers. Roughly, we see the IIJA supporting steady incremental year-over-year growth in 2025–2026 (potentially in the low single digits per annum), rather than driving a sharp single-year increase.

With the IIJA set to expire in 2026, investor focus has shifted to the potential size and timing of IIJA highway reauthorization. We expect a Republican-led congress to support a replacement that may be smaller than the IIJA (i.e., less than $1.2 trillion), but may have a roads & bridges component that meets or exceeds the IIJA ($110 billion of incremental highway spending).

Highway spending is funded at both the federal level (through the Highway Trust Fund) as well as the state/local level, which actually provides the lion's share of funding (~74% of US highway outlays are funded at the state/local level). While federal funding makes up a smaller portion of highway spending, the availability of federal funds sends an important signal to state legislators and gives states confidence to begin major projects when a steady stream of federal funding is secure. As a result, transportation construction put-in-place generally lags federal highway outlays by roughly 18 months or more. While an SWF may not have the same impact as federal infrastructure spending legislation on "unlocking" state spending, we see potential positive knock-on effects to state project pipelines.

Alternative & Renewable Energy

Vikram Bagri
US Alternative & Renewable Energy

Estimating upfront investment required

While much has been said about renewable capacity addition growth, less has been said about how much targeted growth may cost, especially for nuclear, which has only recently gained traction as a solution to AI power needs.

In the following section, we forecast total estimated upfront capital costs annually for each renewable energy addition type including nuclear and the enriched uranium supply chain as well as for solar and storage.

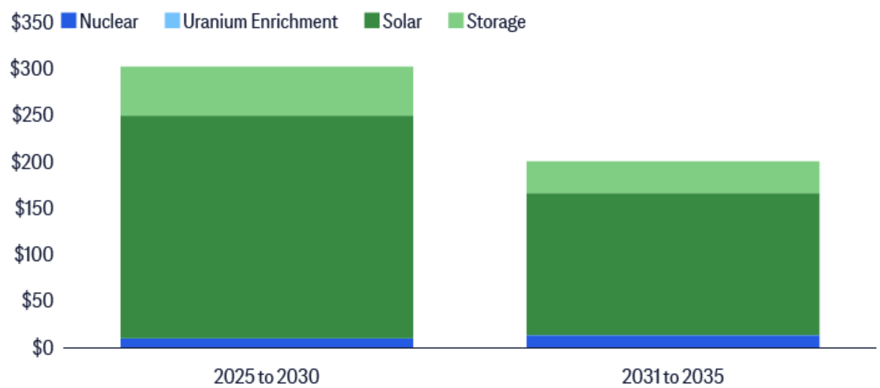
We use overnight capital costs as forecasted by the Energy Information Administration (EIA) in its latest *Annual Energy Outlook*, released in April 2025. These costs represent the cost of building the plant for a developer including civil, material, and equipment costs, excluding financing costs. Cost estimates are before available tax credits are applied.

We also use Wood Mackenzie forecasts for utility scale solar capacity additions and assume a 55% battery storage attach rate to estimate storage installations. In nuclear, we apply estimated capacity per Idaho

National Lab estimates. For instance, ~9GW of new nuclear capacity is expected by 2040.

In brief, we estimate that renewable capacity additions may total ~$303 billion in a base-case scenario through 2030 (Figure 11). However, there is considerable variation dependent on the pace of capacity additions and capital costs.

Figure 11. Estimated Cost of Energy Deployment ($ billion, in 2024 dollars)

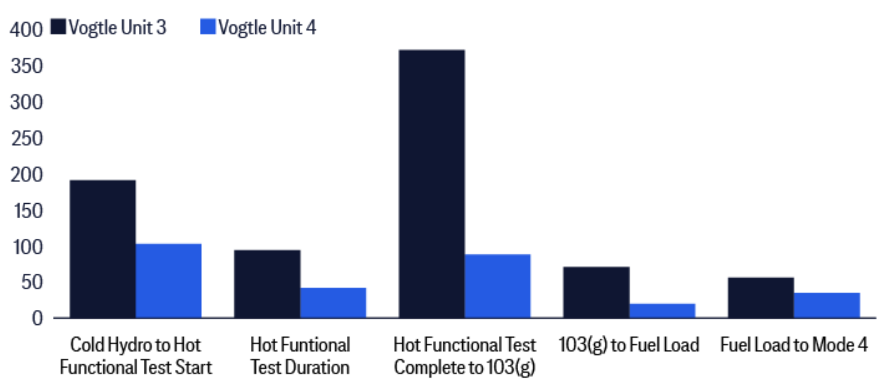


Source: Citi Research, EIA, Wood Mackenzie, Idaho National Laboratory

Moving the Cost Needle

Ultimately, total cost will be a function of both construction cost per kW and the amount of energy being deployed. Construction costs should decline with the number of units deployed. For instance, the price of solar modules has historically declined by ~20% with every doubling of installed production capacity. Savings occur even from the second deployment. Vogtle, the most recent nuclear deployment in the US, cost ~$32 billion, sharply above original projections. However, major milestones for Vogtle Unit 4 took significantly less time than for Unit 3 (Figure 12).

Figure 12. Days Between Major Milestones for Vogtle Units 3 and 4

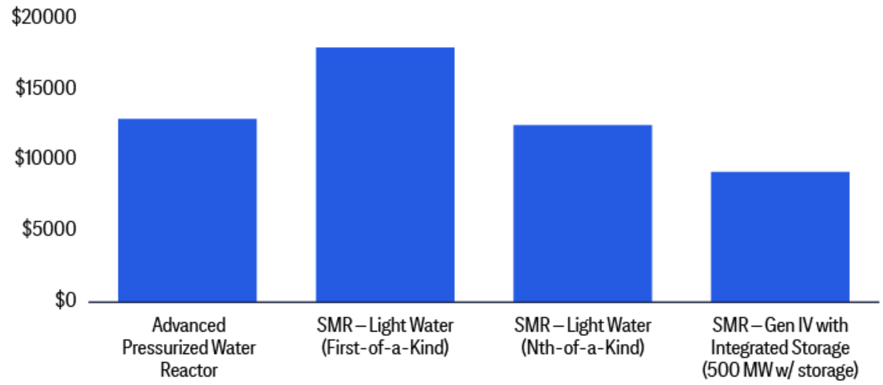


Source: Citi Research, Department of Energy

Although small modular reactors (SMRs) are expected to have lower upfront total cost than traditional light water reactors along with faster deployment, upfront capital construction costs will be high initially for first-of-a-kind (FOAK) reactors.

The Tennessee Valley Authority is among the first utility companies to put forward SMR deployment plans in the US. It published its construction cost estimates by energy technology type in its draft resource plan, displayed below in Figure 13. We note the FOAK costs for an SMR could lead to substantial outlays, depending on number of units being deployed.

Figure 13. Comparison of Overnight Capital Costs by Reactor Type and Status (2024 $/kW before tax credits)

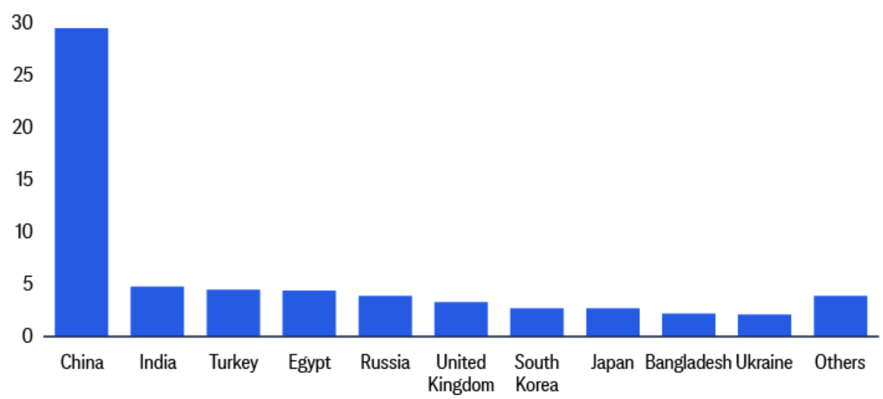


Source: Citi Research, Tennessee Valley Authority

Strategic Importance

The US operates the largest nuclear fleet globally but has only constructed three new commercial scale reactors since 1996. China is constructing the majority of new reactors (Figure 14).

Figure 14. Nuclear Reactors Under Construction by Country (in GW)



Source: Citi Research, IAEA

Nuclear power could fit well strategically with the stated policy and purpose of the US SWF, not least given bipartisan support}

Nuclear could fit well strategically with the stated policy and purpose of the US SWF, not least given bipartisan support. Currently, imports make up more than 70% of annual domestic commercial fuel requirements. This includes Russia imports, for which waivers must be obtained by both countries following the Prohibiting Russian Uranium Imports Act.

In the advanced deployment scenario, we estimate that domestic separate work unit (SWU) demand would increase to 45–50 million by 2050, as shown below. We note that our capital cost requirement assumes only the incremental SWU demand is met through domestic enrichment, which means the capital cost through 2050 to build enrichment capacity is roughly ~$22 billion in the advanced case.

If the US were to install enough enrichment capacity to meet its annual commercial demand domestically, the total capital cost would be $12–$14 billion.

In April 2025, the Department of Energy identified 16 federal sites which could be used for rapid data center construction, which could fast-track permitting for new energy generation, such as nuclear.

In addition, the Advance Act should speed things up for novel nuclear technologies. As a reminder, the Advance Act supports the nuclear industry by lowering licensing fees, reducing timelines, and advancing nuclear reactor awards smoothly. It was signed into law in 2024 but contains amendments which become effective in October 2025.

Currently, there are roughly two dozen companies that are engaging with the Nuclear Regulatory Commission (NRC) in different ways regarding advanced nuclear reactors. Three companies are moving forward with active licenses, and the others are expected to file their applications 12–18 months after the Advance Act takes effect.

Beyond that, President Trump's 2021 executive order ensuring fuel supply to SMR companies combined with micro reactors at defense sites that could side-step the NRC process should also support nuclear adoption.

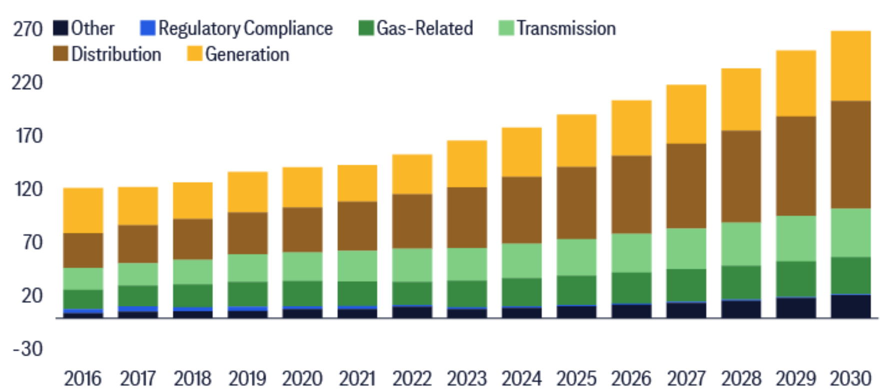
Energy Infrastructure

Ryan Levine
US Utilities and Power

Spending on utility-related energy infrastructure is expected to meaningfully increase.

A US SWF may have the opportunity to own critical energy infrastructure assets such as regulated utilities, electric and gas transmission, power plants, exploration and production development projects, and longer-dated innovation projects by leveraging the resources of the US government while advancing the economic interest of the country. The US is currently spending over $175 billion per year on utility-related energy infrastructure and that figure is expected to meaningfully increase — driven by modernizing the grid, replacing aging infrastructure, enhancing safety and reliability, and supporting economic growth in industries critical to the US such as AI, advanced manufacturing and EVs (Figure 15). The amount of capital the industry spends is largely a function of state regulators and political processes to support the needs of the communities that the companies service.

Figure 15. US Utility Capex Historical Mix & Growth Outlook



Source: Citi Research, EEI

The US government already owns regulated utility assets such as the Tennessee Valley Authority at the federal level and many local utilities at the municipal levels of governments. Given the government ownership and longer-term strategic priorities, these businesses have been leaders in developing newer power plant technologies such as nuclear technologies where publicly owned utilities have been reluctant to take the same levels of risks.

A US SWF would be well positioned to capture investment opportunities for advancing the societal goals of a regulated utility, given a longer-term time horizon and preferences for advancing US strategic interests}

Over the last several decades, there have been several times when regulated utilities entered financial distress, filed bankruptcy, faced natural disasters (wildfires, hurricanes, mudslides, storms, etc.), or encountered other challenges, and there were no logical longer term-oriented buyers of the utility that could advance the societal goals of a regulated utility — keeping the lights on while supporting economic development for the community — given perceived political and regulatory uncertainty for investors. A US SWF would be well positioned to capture these investment opportunities given a longer-term time horizon and preferences for advancing US strategic interests. More recent potential situations where the SWF may be well positioned include wildfire-impacted utilities in California, Hawaii, and Oregon, as well as hurricane-impacted utilities in Texas and Louisiana that needed risk capital to rebuild critical infrastructure (Figure 16).

Figure 16. Effects from Natural Disasters on Regulated Utilities

Ticker	Year	Event	Description
ETR	2005	Hurricane Katrina	Hurricane Katrina resulted in ~$500M+ in damages
ED	2012	Superstorm Sandy	Superstorm Sandy resulted in ~1B recovery costs via storm hardening and riders
PEG	2012	Superstorm Sandy	Superstorm Sandy resulted in ~1.7B in storm and issued securitization bonds
DUK	2018	Hurricane	Hurricanes resulted in ~$760M recovery across Carolinas
NI	2018	Gas Explosions	Gas Explosions resulted in ~$1.1B Columbia Gas settlement and exit of Massachusetts gas business
PCG	2019	Chapter 11 Bankruptcy	Chapter 11 bankruptcy from ~$30B in wildfire liabilities from 2017-2018
CNP	2021	Winter Storm Uri	Winter Storm Uri resulted in ~$2.5B securitized via Texas storm bonds
ETR	2021	Hurricane Ida	Hurricane Ida resulted in ~$2B in storm restoration costs
EVRG	2021	Winter Storm Uri	Winter Storm Uri resulted in ~$600M in damages and received recovery via regulatory deferrals
ATO	2021	Winter Storm Uri	Storm resulted in ~$2B in damages from gas exposure

Source: Citi Research, company filings

Large US electric and gas transmission lines have been difficult to build in the US for a variety of reasons including permitting (federal, state, and local), cost allocation issues between parties, Federal Energy Regulatory Commission (FERC) regulatory processes (FERC Order No. 1000, etc.), and NIMBY ("not in my backyard") issues. A US SWF may be able to help advance these projects to achieve US policy objectives around power reliability, carbon emissions reduction, and economic development.

Similarly, the US has struggled to attract capital to build new merchant gas and other power plants in Texas (ERCOT), the mid-Atlantic region (PJM), and elsewhere given policy uncertainty over the longer term. Local regulators and politicians have attempted to spur this investment with subsidized debt and other financial incentives, but these efforts are largely viewed to be insufficient to advance the power plant projects that are critical for US industry and US strategic priorities. A longer-term oriented SWF may prove critical in helping to fund power development growth.

For oil & gas development, some countries around the world have utilized SWFs and government entities to develop reserves in partnership with private industry, albeit with mixed financial success. In the US, the logical opportunities that could be considered are federal lands in Alaska, the Permian Basin (on the New Mexico side) and in the Rockies (namely the Powder River Basin), as well as in federal waters offshore in the Gulf. That said, there is also an argument for the government to simply open up land for development and accelerate offshore lease rounds, and then have the associated royalties flow into the SWF to then be reinvested.

Technology & Communications

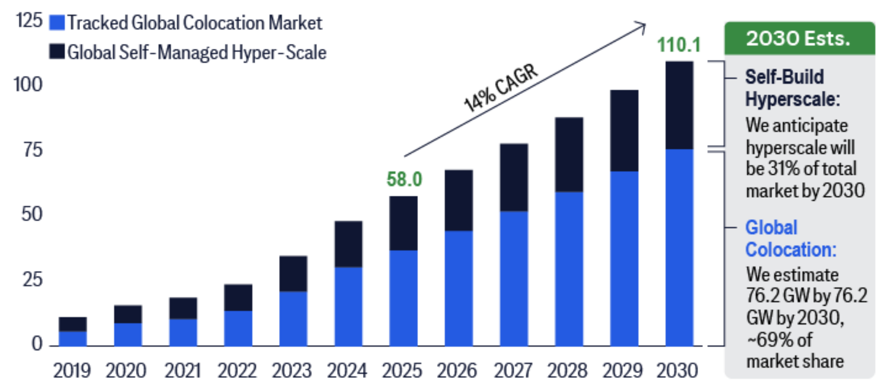
Increasing Demand for Data Centers

Michael Rollins
US Communications Infrastructure

The Technology & Communications Super-Sector team recently published an update to our expectations for data center demand based on a top-down regional market view supported by bottom-up AI chip estimates. Citi now forecasts overall global data center IT load to grow (within the markets tracked) at a compound annual growth rate (CAGR) of 14% to 110 gigawatts (GW) by 2030 (Figure 17).

Figure 17. Tracked Global Demand: Colo vs. Self-Managed Hyperscale (GW)

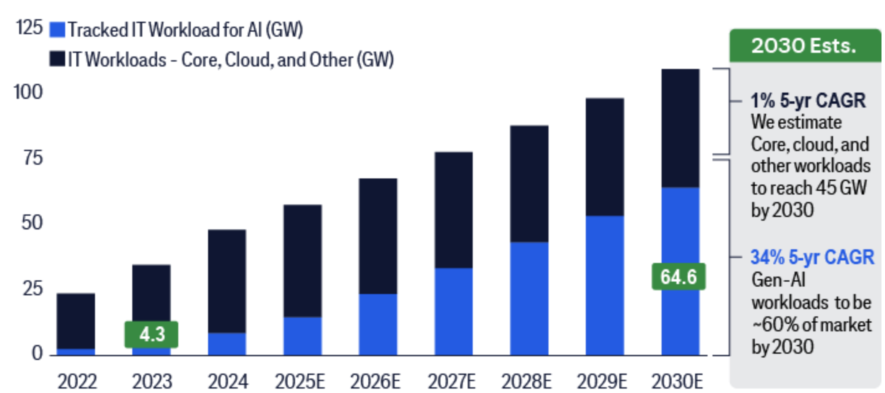
We forecast overall global data center growth (within our tracked markets) at a CAGR of 14% to 110 GW by 2030.



Note: A portion of incremental capacity comes from newly added tracked markets.
Source: Citi Research, datacenterHawk (DCH), FactSet, Data Center Knowledge

We expect generative AI (Gen-AI) workloads are likely to be almost 60% of the demand for data center power by 2030, representing a CAGR of 34% from 2025 (Figure 18).

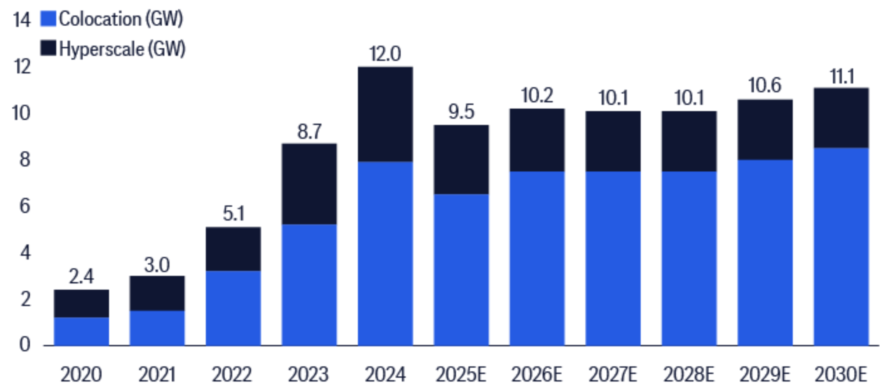
Figure 18. Globally Tracked Data Center Demand – Annual



Note: A portion of incremental capacity comes from newly added tracked markets.
Source: Citi Research, datacenterHawk (DCH), FactSet, tomshardware.com, Schneider

Forecasts of absorption, which represents the net growth in data center IT load demand, in the global markets tracked are in excess of 10 GW per year through 2030, with roughly 74% coming from the colocation market and an average of 26% from self-build hyperscalers (Figure 19). For 2025, we previously expected some digestion of extremely strong absorption in 2024 to hold back demand this year relative to the outperformance in 2024. We believe a combination of factors, including macro uncertainty, is likely to moderate absorption even further during 2025 to 9.5 GW from our prior forecast of ~10 GW and ~12 GW in 2024. We expect demand to reaccelerate in 2026 to at least 10 GW.

Figure 19. Absorption for Globally Tracked Colo/Hyperscale



Source: Citi Research, datacenterHawk (DCH), FactSet

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