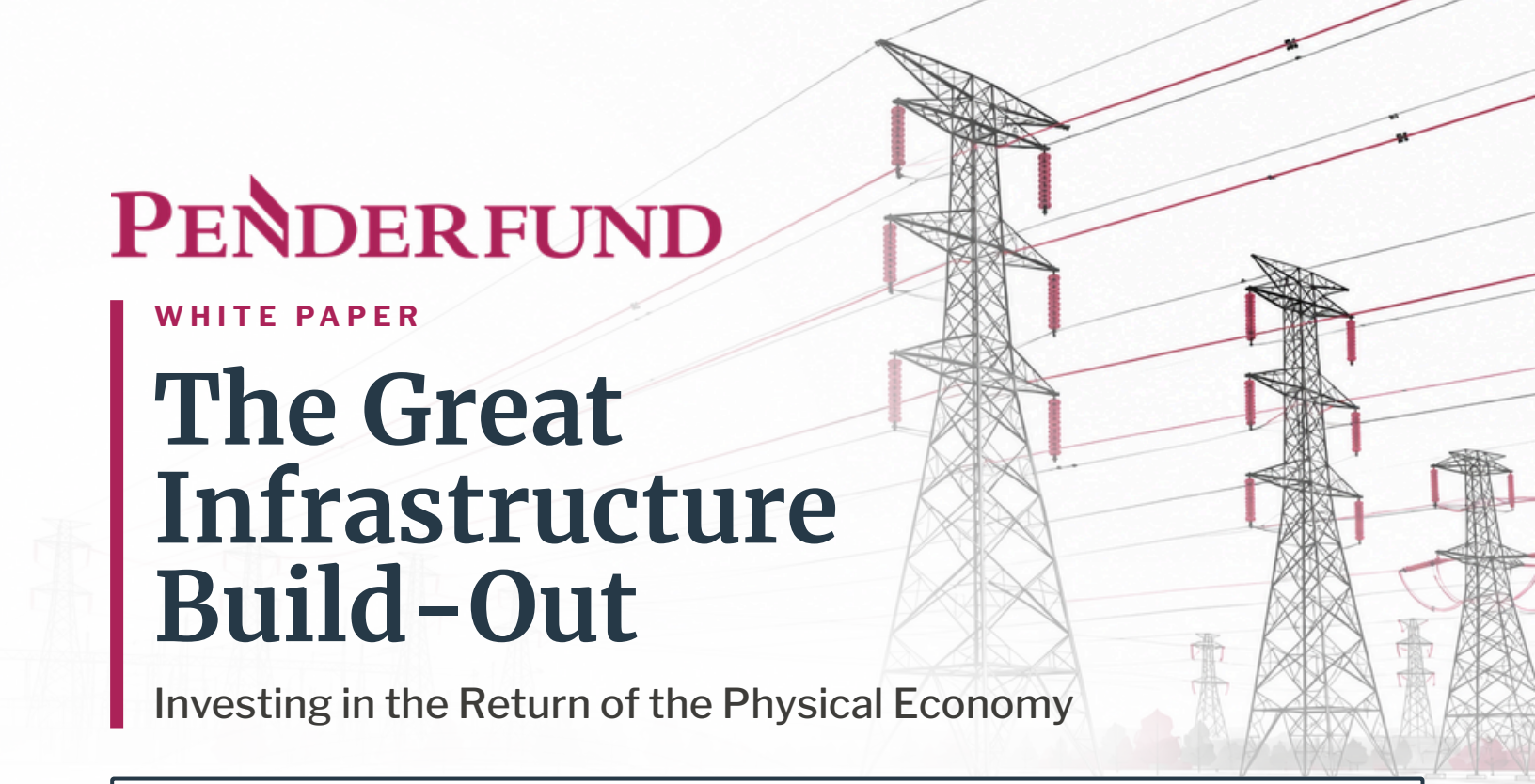
PENDERFUND

WHITE PAPER

The Great Infrastructure Build-Out

Investing in the Return of the Physical Economy



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01 - INTRODUCTION

The End of Capital-Light

For fifteen years, investors paid a premium for capital-light business models, businesses that scaled on code and near-zero marginal cost. Anyone who poured concrete, strung wire or pulled resources out of the ground got a very different message: cut capex and hand the cash back to shareholders.

In our view, that era is ending. AI, electrification, reshoring, defence, energy security and a decade and a half of deferred spending are all pushing capital back into the physical economy at once and, importantly, into a system with very little spare capacity. We believe the result is a multi-year build-out the market may still be underestimating.

But big spending isn't the same as good returns. A build this size creates backlogs and pricing power. It also inflates costs and, historically, leaves many investors holding assets that never earned their cost of capital. The question today is who will capture the economics of this capital supercycle and what will separate the winners and losers.

What's at stake

$732.5B

2026 capex guidance across the four largest hyperscalers (Kindig, 2026)

$3.7T

projected gap between planned and needed US infrastructure investment (ASCE, 2025)

~2x

growth in North American data centre electricity use, 2025 to 2030 (Reuters, 2026)

The Cost of Underinvestment

North America has spent roughly the last 15 years underinvesting in physical capacity. For most of that time, investors had it easy. Globalization kept costs low, central banks suppressed interest rates and capital flowed freely across borders. The biggest winners were asset-light businesses that could grow enormously without consuming much labour, energy, commodities or infrastructure. In hindsight this sounds reckless, but at the time it was a rational response to flat demand, cheap money and markets that rewarded capital lightness. But the bill has come due, all at once, to an industrial base sized for a world that no longer exists.

Taking the grid as an example, for years electricity demand barely grew, so utilities had little reason to add capacity. They focused on maintenance rather than expansion. The same pattern played out across the other gaps. Energy producers returned cash instead of building, pipelines stalled, and manufacturers expanded overseas rather than at home. Each decision made sense on its own. Together, they left the system with almost no slack, which raises the question as to why an entire economy chose to stand still.

Part of the answer lies in the capital markets. In a zero-rate world, the highest multiples went to businesses with high ROIC, minimal reinvestment and recurring revenue. Heavy industry and energy were pushed toward returning capital through buybacks and dividends instead of building new capacity. Across markets, the cost of capital for long-lived physical assets rose in relative terms, even as absolute rates fell.

A hollowed-out supply chain

Layer flat demand and capital discipline on top of decades of offshoring, and the industrial supply chain hollowed out. Fewer manufacturers of transformers and other heavy electrical equipment remained, and those that did had no reason to expand. Then demand turned, and there was no spare capacity to absorb it. Today, large gas turbines are now largely sold out through 2030.[1] We believe supplier scarcity today has become a direct product of supplier rationalization in the past.

Where the gaps are

The underinvestment wasn't evenly spread. It has become clearly apparent in the same four areas now at the centre of the build:

- **The power grid -** Transmission and distribution were maintained, not expanded.
- **Generation -** Little new firm capacity was added while demand flatlined, leaving less margin for error once load returned.
- **Energy production and pipelines -** After the 2014 oil crash, producers traded growth for shareholder returns, and major pipeline projects stalled or were cancelled.
- **The industrial base -** Offshoring left North America short of domestic capacity in everything from transformers to semiconductors.

To make things worse, North America's regulatory backdrop added friction. Transmission, pipelines and large generation projects have faced long, uncertain approval processes. Where projects could avoid multi-jurisdictional approvals, they got built. Elsewhere, they mostly didn't. In Canada, the problem was even more pronounced. In 2014, Canada invested about 87 cents per worker for every dollar invested in the United States; by 2024, that had fallen to 54 cents. Over the same decade, Canadian business investment per worker fell 18.8% while US investment per worker rose 31.3%.[2]

Add the 2014 oil price collapse and the cancellation of Northern Gateway, Energy East and Keystone XL, and a perception took hold that large Canadian infrastructure couldn't get built. That's why Alberta's current data centre and gas-to-power push matters: it's a test of whether that perception is finally changing.

[1] Source: https://vistergy.com/p/gas-turbines-are-sold-out-to-2030
[2] Source: https://www.fraserinstitute.org/studies/comparing-business-investment-per-worker-canada-and-united-states-2007-2024

Canada has fallen behind on business investment

Business investment per worker, Canada vs. United States



Dashed line marks US parity ($1.00).

Bars measured from zero (vertical rule).

Source: Fraser Institute, 2025.

The bill comes due

To put some numbers behind this trend, ASCE's 2025 Report Card graded US energy infrastructure a D+, down from C– in 2021, and projects a $3.7 trillion gap between planned and needed infrastructure investment, up from $2.59 trillion four years earlier.[3]

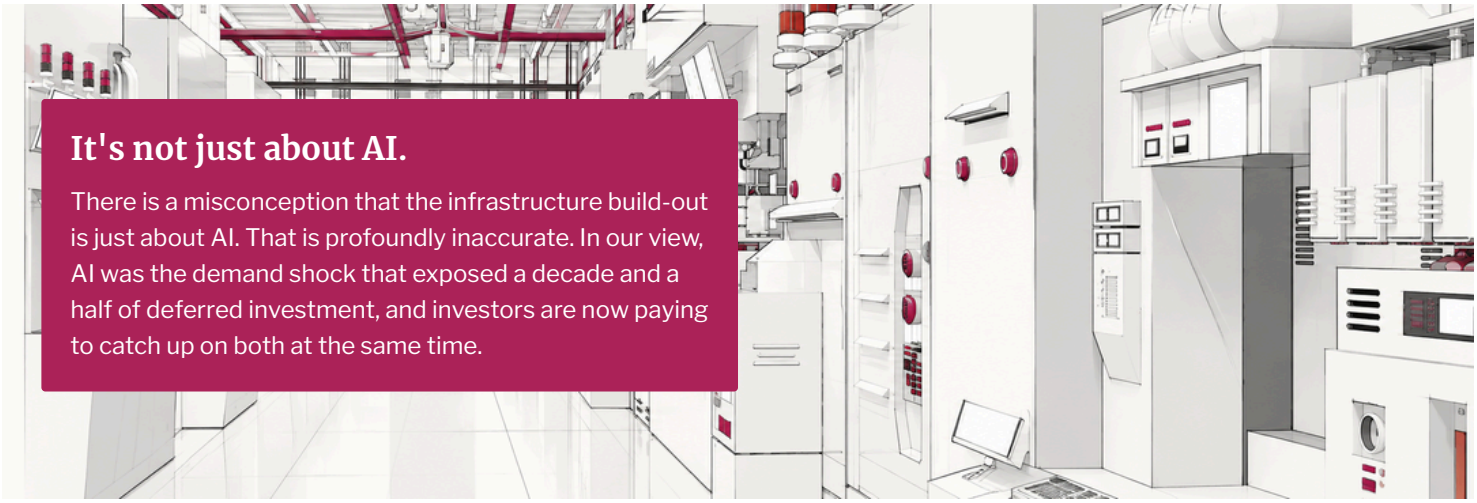
D+
ASCE grade for US energy infrastructure, 2025

C-
the same grade in 2021

$3.7T
projected gap, planned vs. needed US investment

$2.59T
the projected gap four years earlier

Underinvestment flattered returns for 15 years. Low reinvestment boosted free cash flow, buybacks and margins across utilities, energy and industrials, while capital-light sectors captured the valuation premium. But today we are starting to see a reversal. Capital intensity is rising across the economy, scarce physical capacity continues to push upward, and returns are likely shifting toward whoever owns the bottlenecks. Not to mention, this cycle carries an inflationary element the last didn't. Rebuilding physical capacity competes for labour, materials and equipment in a way software never did, one reason the capital-light era's mix of low rates and high multiples may not return quickly.



It's not just about AI.

There is a misconception that the infrastructure build-out is just about AI. That is profoundly inaccurate. In our view, AI was the demand shock that exposed a decade and a half of deferred investment, and investors are now paying to catch up on both at the same time.

[3] Source: ASCE EWRI Government Relations Update | ASCE

AI Is Becoming a Resource Story

Investors still tend to view AI as a software story. It is rapidly becoming a resource story.

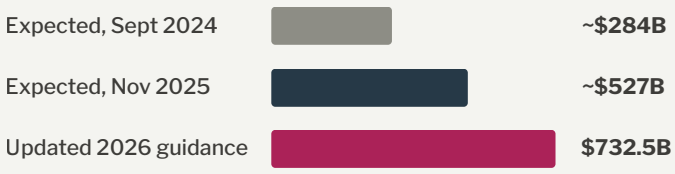
What separates this cycle from the digitalization that came before is its collision with physical reality: the binding constraint has shifted from code to power. The infrastructure behind AI demands staggering amounts of electricity, copper, steel, cement, natural gas and critical minerals. Data centres are becoming some of the largest power consumers anywhere, forcing utilities to rethink grids built for a very different world. And financing it all requires a massive amount of capital.

The hyperscaler spending surge

If AI is the demand shock, the hyperscalers are the most obvious starting point. Microsoft, Meta, Amazon and Alphabet (the largest cloud and AI platforms) are anchor customers for this build. Their data centre orders set demand for chips, power, electrical equipment and construction all the way down the supply chain. In addition, their business models personify the shift we have been describing. For most of the last fifteen years, these companies have been the capital-light market winners. Today, they're writing some of the largest capex cheques in corporate history.

2026 hyperscaler capex: Expectations vs. guidance

Combined full-year capex, Microsoft, Meta, Amazon and Alphabet (US$ billions)



Dashed line marks US parity ($1.00).

Earlier expectations implied from guidance being 158% and 39% above them.
Source: FactSet.

$301B
combined hyperscaler capex, first half of 2026

$732.5B
updated full-year 2026 guidance

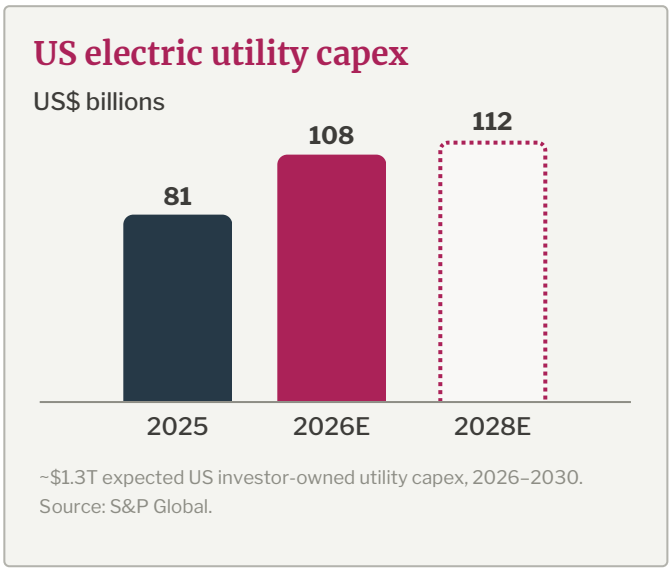
~50%
capex as a share of revenue for several hyperscalers

≈ $0
FY26 free cash flow expected for all but two

Their combined capex reached $301 billion in the first half of 2026 alone, with updated guidance pointing to $732.5 billion for the full year, 39% above analyst expectations from November 2025 and 158% above expectations from September 2024.[4]

As a result of this spending, the financial profiles of these companies are changing significantly. Capex now runs at roughly half of revenue for several hyperscalers,[5] which is even higher than the mid-teens to 20s typical of mature telecoms and utilities. In addition, analyst estimates are calling for FY26 free cash flow could to approach zero or turn negative for all but Alphabet and Microsoft.[6] In order to fund this amount of spending, Meta, Alphabet and Amazon have each raised tens of billions in bonds since late 2025, and that isn't expected to stop.

[4] Source: AI Capex to Hit $1 Trillion – And Estimates Are Still Too Low - I/O Fund
[5] Source: fitchsolutions.com/creditsights/articles/technology/tech-raising-hyperscaler-capex-2026-estimates-09-02-2026/
[6] Source: Hyperscalers Tap External Financing as AI Capex Outruns Cash Flow



~$1.3T expected US investor-owned utility capex, 2026–2030.
Source: S&P Global.

Downstream: utilities and power

Importantly, this build doesn't stop at the data centre. It has downstream effects on utilities, power generators, equipment makers and commodity producers alike. S&P Global expects US investor-owned utility capex near $1.3 trillion over 2026–2030, with the electric utility group's spending rising from about $81 billion in 2025 to $108 billion in 2026 and $112 billion by 2028.[8] The appetite for spending is there but now investors are faced with the question as to whether the physical system can absorb that much spending and build what it's paying for.

[8] Source: https://www.spglobal.com/market-intelligence/en/news-insights/research/2026/04/surging-energy-demand-puts-us-utility-capex-forecast-near-1-3t-in-2026-30

04 - CONSTRAINTS

The Bottlenecks Are Physical

Right now, it can't, at least not at the pace being planned. The first constraint is equipment: as noted earlier, large gas turbines are sold out for years, and transformers face similar backlogs. The second is execution. In early 2026, approximately 60% of planned solar projects and 50% of battery storage projects experienced delays.[7]

Then there's the question of who pays. In West Virginia, a FirstEnergy subsidiary plans to spread the cost of $2.7 billion in new generation, built largely for one data centre customer, across its broader customer base. But asking ratepayers to suddenly fund expensive capital build-outs is a hard sell, and we believe affordability, maybe even more than demand, is becoming the binding constraint.

[7] Source: https://adi-analytics.com/2026/07/02/record-utility-spending-meets-project-reality/

~60%
of planned solar projects experienced delays in early 2026

~50%
of battery storage projects experienced delays

$2.7B
new generation, largely for one data centre, spread across a utility's customer base

05 - CONVERGING DEMAND

Four Forces, One System

If AI were the only source of demand, those constraints would be manageable, and perhaps the system would simply build a little slower. But AI isn't standing alone. Four forces are converging on the same physical system at once, and all four are drawing on the same constrained pool of equipment, labour and power.

AI and data centres

100+ kW

per AI rack, vs. 5–10 kW in a traditional data centre

Unprecedented compute investment, at unprecedented power density. Single AI racks now draw over 100 kW, versus 5–10 kW in a traditional data centre. North American data centre electricity consumption is projected to nearly double, from over 386 TWh in 2025 to about 755 TWh by 2030.[9]

Electrification

$15.8T

potential global T&D investment need, 2025–2050

Growing load from transportation, industry, buildings and digital infrastructure makes the grid the single largest capital requirement in the build. Global transmission and distribution networks may need $15.8 trillion of cumulative investment between 2025 and 2050. In the US, peak demand is forecast to rise 18% over the next decade.[10]

Reshoring, energy security and reindustrialization

$82B → $244B

US manufacturing construction spending, 2021 to 2024

The push for resilient domestic supply chains is redrawing the production map. US manufacturing construction spending roughly tripled from $82 billion in 2021 to $244 billion in 2024.[11] About $1.42 trillion of new US manufacturing investment was announced between January 2025 and mid-March 2026, concentrated in semiconductors, pharmaceuticals and clean energy.

Every new plant also needs reliable power, which is why generation, fuel supply, pipelines and domestic production are back on the policy agenda. In Canada, it's already showing up in Alberta. Pembina's $4.6 billion, 932 MW Greenlight Electricity Centre is intended to serve a data centre, turning price-challenged gas into contracted, long-duration power revenue.

Aging infrastructure and deferred investment

Replacement and modernization that can no longer be postponed. Much of North America's energy system is nearing the end of its service life, and the investment gap is widening, not closing. Any one of these would support a healthy capex cycle. Together, they compete for the same transformers, electricians, turbines and interconnection queues.

[9] https://www.reuters.com/business/energy/ai-double-data-centre-power-water-consumption-by-2030-un-researchers-say-2026-06-03/
[10] https://about.bnef.com/insights/clean-energy/electric-vehicles-remain-key-driver-for-grid-investment-despite-data-center-boom/
[11] U.S. Census Bureau, Total Construction Spending: Manufacturing in the United States [TLMFGCONS], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/TLMFGCONS, November 18, 2026.



More Than a Normal Construction Cycle

A normal construction cycle is rate-sensitive, spread across many small buyers, and mean-reverts within a few years as supply catches up. We believe this build is different: it represents a transition of the digital economy toward an industrial model, where physical assets are the competitive moat. Four features set this cycle apart:

A normal cycle		This build
Rate-sensitive, many small buyers, mean-reverts within a few years	→	A shift to an industrial model where physical assets are the moat

The buyers are rewriting their business models

In a typical cycle, developers, homebuilders or industrial firms add capacity at the margin and pull back when conditions change. Here the demand comes from the world's largest companies, and they aren't adding capacity to an existing model. They're changing what kind of company they are. When a handful of megacaps move from asset-light to capex approaching half of revenue, it resets how that part of the market is valued.

It breaks a multi-decade demand trend

Construction cycles usually oscillate around a stable trend. Electricity demand growing at 4% a year after 15 flat years isn't an oscillation, it's a new trend line. A shift that size forces utilities to rebuild their long-range planning from scratch, and their capex step-up shows they already are.

Every layer is being built at once

A housing or office boom mostly stresses one supply chain. This build needs chips, data centres, generation, transmission, gas supply, cooling and skilled labour simultaneously, and each layer can constrain the others. With turbines scarce, developers are turning to on-site gas engines while utilities extend coal plants and pursue batteries and transmission upgrades. When the bottleneck is physical rather than financial, cheaper credit alone may not speed things up. That keeps pricing power with suppliers for longer than a normal cycle would.

The motive is strategic, not rate-driven

Normal cycles turn when rates rise or margins compress. This one is propelled by a competitive race among hyperscalers, plus national-security and industrial-policy goals like reshoring and energy security. Hyperscalers have kept raising guidance even as free cash flow approaches zero and they turn to bond markets. Spending that continues while cash generation deteriorates is the opposite of normal cyclical behaviour, where falling cash flow triggers cuts.

07 - HISTORICAL LENS

Is This Another 1999?

It's the question on many investors' minds, and the answer is more complicated than yes or no. Our short answer: partly.

Where it differs

The late-1990s fibre build was funded largely by leveraged, often unprofitable carriers. Today's biggest spenders are among the most profitable companies in history. And much of the physical layer is backed by replacement need that exists with or without AI.

Where it is alike

The spenders' cash cushion is thinning. Free cash flow is expected to approach zero or turn negative this year for some of the large hyperscalers, and funding has shifted to bond markets and off-balance-sheet vehicles. Servers with five-to-six-year lives financed with long-dated debt is a duration mismatch the telecom era would recognize. And depreciation hasn't caught up to the spend yet.

> ***The fibre of 1999 got built, lit and eventually used.***
> ***The equity that funded it mostly didn't earn its return.***
>
> The lesson isn't to avoid the build, it's to be deliberate about which part of it you own.

08 - CONCLUSION

Follow the Bottlenecks

When everything needs building at once, we believe value accrues to whatever is scarce. Today that's heavy electrical equipment, skilled labour and specialty contractors, permitted and powered land, grid interconnection and firm power.

Heavy electrical equipment

Large gas turbines largely sold out through 2030; transformers face similar backlogs

Skilled labour and specialty contractors

Every layer of the build draws on the same pool of electricians and trades

Permitted and powered land

Sites that have cleared approvals and secured power are in short supply

Grid interconnection

All four forces compete for the same interconnection queues

Firm power

Little new firm capacity was added during 15 years of flat demand



Own what is scarce

Returns are shifting toward whoever owns the bottlenecks

The capital-light era rewarded owning nothing.
*The next one may reward **owning the thing everyone else is waiting for.***

09 - SUMMARY

Key Takeaways

We believe the winners will be those who own what is scarce.

Fifteen years of underinvestment left North America's grid, generation, energy supply and industrial base with almost no spare capacity. Now AI, electrification, reshoring and aging infrastructure are drawing on that same constrained pool of equipment, labour and power at once. Hyperscalers are guiding to $732.5 billion of capex in 2026 alone and utilities are stepping up to match, but the bottlenecks are physical, and cheaper credit can't speed them up. Big spending isn't the same as good returns, and 1999 is a reminder that the equity funding a build-out doesn't always earn its cost of capital. We believe the winners will be those who own what is scarce: heavy electrical equipment, skilled labour, permitted and powered land, grid interconnection and firm power.

$732.5B
2026 hyperscaler capex guidance

$1.3T
US investor-owned utility capex, 2026–2030

~755 TWh
North American data centre power use by 2030

$3.7T
US infrastructure investment gap (ASCE)



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