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AI Infrastructure: Physical Barriers to a Digital World

INSIGHTS

In this paper, we explore the physical barriers that could have important implications for inflation, corporate margins and infrastructure completion.

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The debate around AI rages on. Who will be able to monetize AI mass adoption? Are hyperscaler and semiconductor company valuations justified? While these are crucial questions, we believe another concern is just as pressing, yet often overlooked: can the infrastructure required to support mass AI adoption be delivered on time and in a cost-effective manner?

Power Infrastructure: A Significant Component of AI Economics

The popular narrative around artificial intelligence (AI) is that it will require vast amounts of electricity, possibly outpacing energy production. While that remains a possibility, a more pressing question is whether the electric grid can deliver energy to where data centers are being built. In our view, the primary bottleneck is more likely to be transmission infrastructure, or the grid, than electricity generation itself.

Transmission projects typically require seven to ten years to permit and construct, whereas modern hyperscale data centers can be completed in as little as 18 to 24 months. As a result, AI infrastructure is being deployed roughly five times faster than the electricity network needed to support it.[1]

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This mismatch is emerging as one of the defining constraints on AI expansion.

U.S. interconnection queues now exceed 2,600 GW, more than twice the country's total installed generating capacity.[2] Meanwhile, the average wait time for grid connections has risen from less than two years in 2010 to roughly five years today, while some regions, like California, face delays approaching a decade.[3]

If developers cannot secure grid access quickly, they will increasingly seek alternatives. The most practical solution is so-called "behind-the-meter" (BTM) generation, which involves building dedicated gas power plants adjacent to data centers rather than relying on the public grid.

1. Source: Belfer Center, Harvard Kennedy School. As of 2026.
2. Source: Berkeley National Lab. As of 2026.
3. Sources: Lawrence Berkeley National Laboratory, Queued Up. As of 2024. Enverus Interconnection Queue Outlook. As of 2025. Carbon Direct. As of 2026.

More than 100 GW of dedicated on-site generation capacity has already been announced, and Meta alone plans to build ten BTM gas-powered plants to support its Hyperion facility in Louisiana. For context, this project alone would increase Louisiana's entire power generation capacity by more than 30%.[4]

While BTM generation solves the access problem, it introduces a new one: cost. Electricity generated on-site is generally more expensive than energy sourced from the grid. Data center operators must finance and maintain their own power generation assets, secure fuel supply and absorb ongoing operating costs. As a result, higher electricity costs could prove to be one of the most important consequences of the AI infrastructure boom.

This matters because AI economics are highly sensitive to power costs. According to a recent Dallas Fed assessment, in a high-demand scenario, wholesale electricity prices could rise by 50%. This could increase a representative hyperscale data center's total operating costs by 20% to 30%.[5] If these higher costs prove pervasive, marginal projects may be delayed, relocated or cancelled altogether. For investors, the relevant question is how higher power costs could affect project-level returns, financing needs and operating margins.

Water & Cooling: Important Project Considerations

Water requirements can also have a meaningful impact on project economics. Large volumes of water are needed to produce microchips, generate electricity and cool data centers, making water availability an increasingly important factor in assessing the economics and viability of data center development.

Data center water consumption can vary enormously across time, with hyperscale facilities drawing much larger volumes of water during periods of hot weather. Peak daily demand can be six to ten times higher than average usage. As a result, water utilities, most of which are local government entities, must build treatment plants, storage reservoirs, pump stations and transmission pipelines, capable of handling those peak loads, even if much of that capacity is rarely used. In other words, the operating costs of this infrastructure can potentially exceed what would otherwise be optimal for steady-state usage.

In addition, nearly two-thirds of planned data centers in the U.S. are in locations that have experienced drought conditions over the past year according to data from Cleanview and the U.S. government. Rising water consumption could therefore be concentrated in areas that are already water-stressed.[6]

The cost of building the required water infrastructure across the U.S. is estimated at $10 billion to $58 billion. The question, however, is who will pay?

4. Sources: Carbon Direct, AI Scale and Climate Commitments. As of 2026. Source: American Action Forum. As of 2026.
5. Sources: Dallas Fed; Alpha-matica. As of 2025.
6. Source: The Guardian. As of June 8, 2026.

Historically, new infrastructure has been financed by municipalities through higher utility rates. But in a world where elevated inflation remains a politically sensitive issue, public infrastructure investments tied directly to the needs of data centers could increase project execution risk. Just as Ireland, the Netherlands, Denmark and China have restricted, or in some cases banned, new hyperscale data center development when electricity costs became politically contentious, a similar dynamic could emerge if water costs also surge significantly.[7]

The key point is that investors should carefully consider the costs and risks associated with hyperscalers potentially having to fund and secure their own water supply. On the positive side, innovation is flourishing and cooling technologies are rapidly evolving. Even so, higher project costs remain a meaningful near-term risk.

Investment Implications

CREDIT: A NEW SOURCE OF EXECUTION RISK

Credit spreads often assume that announced data center projects will proceed as planned and be monetized successfully. The physical and commodity-related barriers discussed above, however, suggest that this assumption may prove optimistic. A hyperscale data center cannot generate revenue until adequate power and water resources are secured, making grid access, permitting and utility infrastructure increasingly important determinants of project viability.

While much of the focus has been on demand risk—whether mass AI adoption will occur at scale and can be monetized—we believe attention may increasingly shift toward execution risk: whether projects can be delivered on time. This is particularly relevant for investors with exposure to the AI infrastructure buildout through utilities, power developers, construction firms, data center operators and related supply chains.

The risk of delays between project announcement and deployment is growing. If interconnection delays extend, water constraints intensify or local opposition grows, projects may be postponed, downsized or abandoned altogether. As a result, credit investors may need to underwrite not only demand forecasts, but also infrastructure-access risk.

EQUITIES: HIGHER INFRASTRUCTURE COSTS MEAN GREATER MARGIN UNCERTAINTY

Rising semiconductor prices are often cited as potential pressure points for hyperscaler margins. However, uncertainty around future operating costs also deserves attention, and we believe equity investors may be underestimating this risk. If operators are increasingly forced to rely on behind-the-meter generation, fund their own water infrastructure or pay significantly higher utility prices, operating margins may prove less favorable than current expectations imply, even if demand continues to grow and monetization strategies prove reliable.

7. Source: UC Riverside, CalTech. As of 2026.

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This does not necessarily imply lower AI adoption or weaker revenue growth. Rather, it suggests that the path from AI demand to profits could be volatile. Markets today reward firms for compute deployment and capacity expansion. The next phase of investor scrutiny, however, may focus increasingly on energy procurement strategies, exposure to local resource constraints, infrastructure efficiency and growing political constraints.

Companies with privileged access to power, efficient cooling technologies or the ability to deploy workloads flexibly across regions may enjoy a growing competitive advantage.

MACRO: AI COULD BE INFLATIONARY FIRST, DISINFLATIONARY LATER

At the macro level, one of the most important implications may be that the AI buildout becomes a sustained near-term source of inflation. The immense demand for semiconductors, electricity generation, transmission networks, substations, turbines, transformers, construction labor, water infrastructure and specialized industrial equipment is already putting upward pressure on prices across these categories.

As noted earlier, the estimated investment needed to support both energy and water infrastructure is immense. Given the urgency surrounding the AI race, executing this infrastructure at scale and within a condensed timeframe raises the prospect of cost overruns that spill over into other industries. To the extent that utilities, municipalities or hyperscalers are required to finance new water and power networks, these costs could potentially be passed through, directly or indirectly, to consumers.

The most likely near-term outcome is sustained upward pressure on a narrow set of prices linked to energy and infrastructure. Over time, however, rising costs for these essential inputs, which underpin most production processes and household expenditures, could begin to propagate through the rest of the inflation basket.

Longer term, AI has the potential to become a transformative, productivity-enhancing technology at a time when many economies are facing long-term demographic challenges. While these AI-led productivity gains can potentially lead to longer-term disinflation, the historic surge in demand for constrained resources may well underpin sticky inflation in the years immediately ahead.

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