POWERING THE AI AND CLOUD REVOLUTION

SCALING DIGITAL INFRASTRUCTURE IN AN ERA OF UNPRECEDENTED DEMAND

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EXECUTIVE SUMMARY

1 CLOUD COMPUTING AND GENERATIVE AI ARE SUPERCHARGING DEMAND

The boom in cloud services and the surge of Generative AI have set data centers on an upward trajectory. In 2024, U.S. data center absorption is on pace for over 7,300 MW, a 29% increase in total U.S. inventory.

2 SUPPLY STRUGGLES AGAINST POWER BOTTLENECKS

The race to meet this demand is not simple. Power infrastructure is lagging, land that fits data center requirements is scarce, and the supply chain is strained, illustrated by record-low national vacancy rates of just 1.7% in Q3 2024.

3 GOVERNMENT AND PRIVATE SECTOR TACKLING ENERGY GAPS

While Washington and local utilities roll out grid modernization plans, the tech giants are getting creative, with moves towards nuclear energy investments signaling a bold shift in tackling energy constraints.

4 ADAPTABILITY AND ALIGNMENT

Strategic collaboration with hyperscalers through tailored designs and powered shells has emerged as a key approach to addressing the growing supply-demand imbalance in the cloud and AI landscape. This adaptability strengthens tenant relationships and positions facilities to be future-ready for evolving technologies.

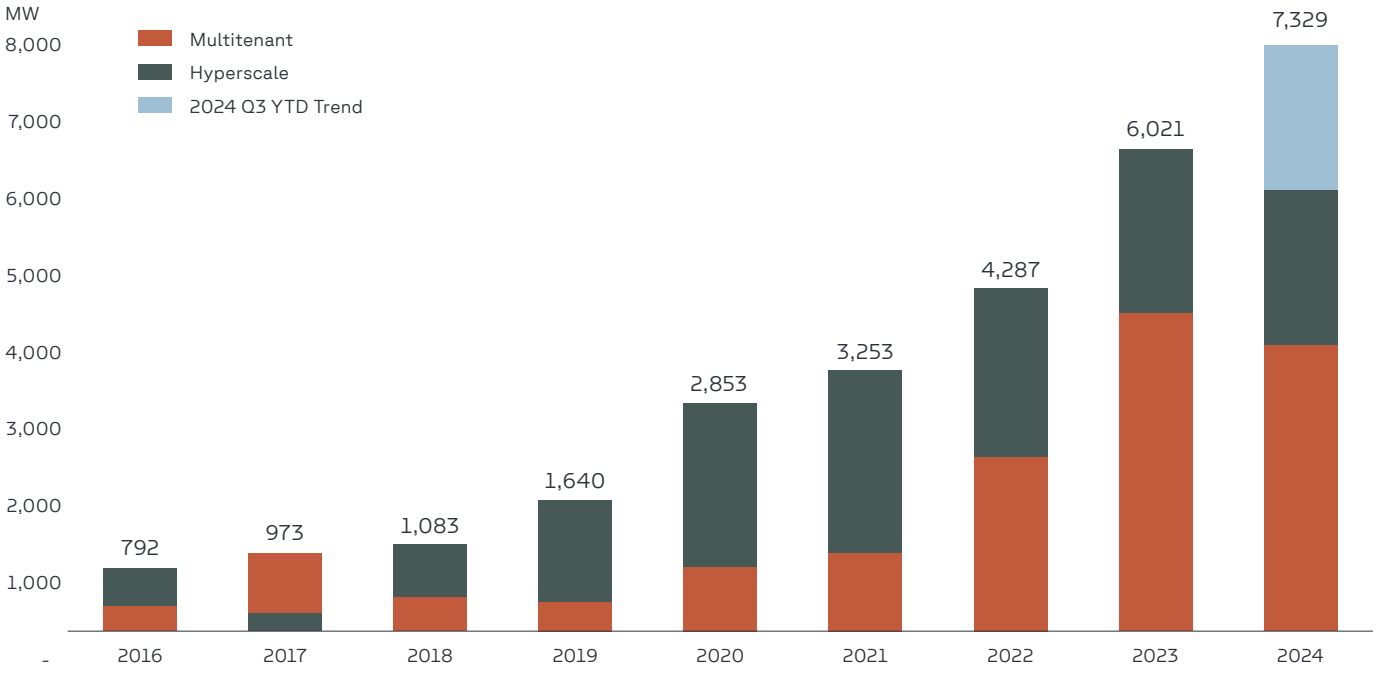
DEMAND DRIVERS

Data centers are no longer just the backbones of tech — they are the silent powerhouses of the U.S. economy's digital evolution. The proliferation of cloud computing services and the advancement of generative AI technologies are propelling the need for more robust, scalable, and energy-efficient data centers.

- **CLOUD COMPUTING:** The adoption of cloud services by companies and consumers increases the need for flexible and scalable storage solutions. This shift means data centers must support extensive compute loads and network bandwidth to allow cloud providers to expand their storage capabilities rapidly.
- **GENERATIVE AI:** Training and deploying generative AI models, such as large language models and image generators, require vast amounts of data and computational power. For example, a ChatGPT query will utilize approximately 10x the power of a Google search.[1] The processing demands of these models push for high-performance data centers capable of handling intensive workloads and parallel processing.

Cloud computing requirements were already driving rapid acceleration in absorption since 2020, and generative AI served as an accelerant. As shown in **Exhibit 1**, absorption across the U.S. was over 6,000 MW in 2023, and the pace through Q3 suggests 2024 will break that high-water mark by a substantial margin. **The last two years reflect nearly 70% increase in the total size of the U.S. data center market.**

EXHIBIT 1: U.S. DATA CENTER ABSORPTION BY YEAR



Source: datacenterHawk, Affinius Capital Research

The largest U.S. tech companies are driving leasing activity, and with cloud computing growth remaining strong and intense competition to create best-in-class AI applications, **rising investment in digital infrastructure from the largest tech companies demonstrates no signs of abating:**

- Cloud revenue growth for the three market leaders (AMZN, MSFT, GOOGL) was up 22% YoY as of Q3 2024, and has an annual compounded growth rate of 27% since 2016.

> AWS quarterly cloud revenues crossed $25 billion in Q1 2024 — marking the first time Amazon achieved an annual run rate of over $100 billion in annual revenue solely from its AWS business. Microsoft recently passed this threshold as well for their cloud revenues.

1. Note that power consumption of AI applications compared to general cloud computing can vary significantly depending on the specific workloads and hardware used, and advancements in efficiency look to narrow this gap in the future.

- The leading hyperscaler firms listed previously, plus Meta, have collectively budgeted over $180 billion in capital expenditures for 2024, reflecting a 25% year-over-year increase and a more than 50% rise from 2020 levels. The following comments from Q3 2024 earnings calls suggest investments in their digital infrastructure will remain robust:

> **MICROSOFT:** "Our AI business is on track to surpass an annual revenue run rate of $10 billion next quarter, the fastest business in our history to reach this milestone .... Q3 cap ex was $20 billion .... roughly half of our cloud and AI related spend continues to be for long lived assets that will support monetization over the next 15 years and beyond .... we have run into lots of external constraints because data center demand showed up so fast .... in the long run, we do need power, we do need data centers."
>
> **META:** "CapEx were $9.2 billion driven by investments in servers, data centers, and network infrastructure .... we're growing infrastructure investments significantly this year and expect significant growth again in 2025."
>
> **ALPHABET:** "Our reported CapEx in the third quarter was $13 billion .... our expansion of data center capacity is expected to bring economic benefits to countries where we are investing .... in Q3 alone, we made announcements of over $7 billion in planned data center investments."
>
> **AMAZON:** "We expect to spend approximately $75 billion in capex in 2024 .... majority of the spend is to support the growing need for technology infrastructure...primarily relates to AWS as we invest to support demand for our AI services .... we'll spend more than that in 2025."

These public cloud providers are at the forefront of generative AI, which demands high computational power, quality data for training, and technical expertise — all areas where they excel. The growing cloud revenues further strengthen the case for increasing infrastructure investments.

SUPPLY CONSTRAINTS

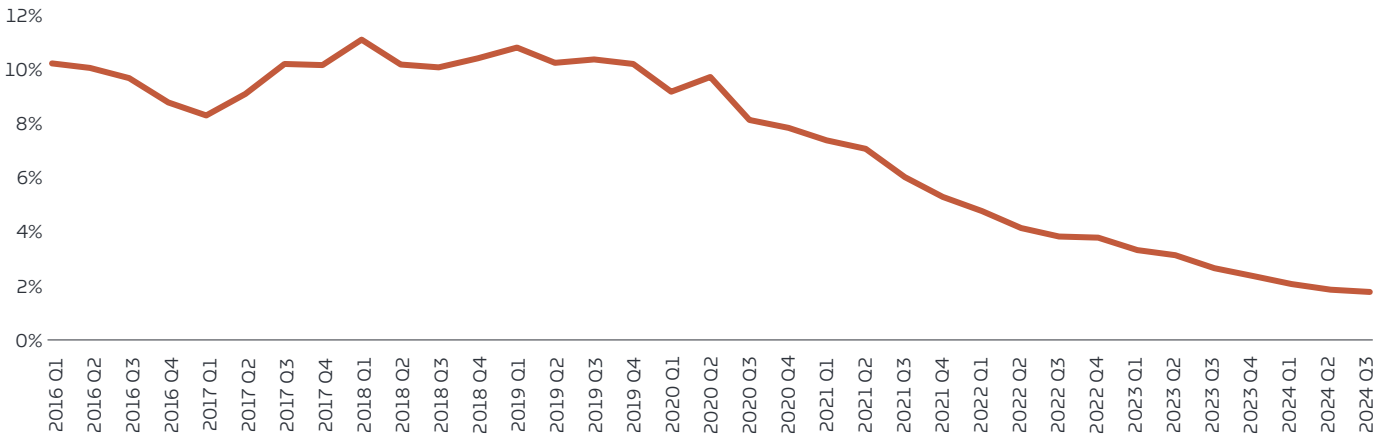
Unprecedented and rapid demand growth for data centers has exceeded the ability of the physical real estate to meet this demand. Key constraints on new developments include:

- **LIMITED SUITABLE LOCATIONS** not every plot of land will do. Proximity to key markets, reliable power grids, and accessible cooling water sources are necessities. Developers must also increasingly be aware of local NIMBYism — community pushback that can sideline projects indefinitely.
- **SUPPLY CHAIN DISRUPTIONS** the global supply chain for essential data center components, such as high-performance processors, cooling systems, and networking equipment, has periodically experienced disruptions due to geopolitical tensions, trade restrictions, and pandemic-related production delays.
- **POWER SUPPLY ISSUES** **this is the real bottleneck; data centers consume significant amounts of power, and many grids are not equipped to handle the surge.** This can result in delays or restrictions on data center development until power infrastructure is upgraded.
- **TRANSMISSION CAPACITY CONSTRAINTS** AI workloads require high-speed and high-capacity network connections, and AI data centers frequently operate in clusters or across multiple sites, demanding robust interconnects. Having insufficient transmission equipment and capacity can slow processes and reduce overall efficiency, in addition to greater cooling demands which require additional power.

The supply/demand mismatch is evident when analyzing sector fundamentals.

- Vacancy rates continue to decline, hitting an all-time low of 1.7% nationally in Q3 2024 (see **Exhibit 2**). This compares with the 2016-19 period, when the U.S. averaged double-digit vacancy rates.
- Rent growth for hyperscale facilities has remained robust. For example, in Northern Virginia, hyperscale rents are up 13% YTD in 2024, and have averaged 16% growth annually since 2021.[2]

EXHIBIT 2: U.S. DATA CENTER VACANCY RATE



Source: datacenterHawk, Affinius Capital Research

The power challenge is the most difficult to solve; it is estimated that an incremental power generation capacity of 47 GW is needed to support U.S. data center power demand growth through 2030, whereas the current size of the market sits at approximately 31 GW.[3] Utilities are scrambling to meet the increased electrification needs of the U.S. economy, and both hyperscalers and governments are looking to address the gap:

- The U.S. government has launched several initiatives to modernize the power grid and support the growing energy demands of data centers, including:

  GRID RESILIENCE AND INNOVATION PARTNERSHIPS (GRIP) PROGRAM: launched in October 2024, run through the Department of Energy, includes nearly $2 billion for 38 projects across 42 states to upgrade transmission infrastructure and enable over 7.5 GW of grid capacity.

  FEDERAL-STATE MODERN GRID DEPLOYMENT INITIATIVE: announced in May 2024, brings together federal entities and 21 states to prioritize modern grid solutions, expanding capacity and capabilities to meet increasing energy demands, including those from data centers.

  FEDERAL ENERGY REGULATORY COMMISSION (FERC) INITIATIVES: FERC approved new rules to streamline the approval process for large regional power transmission projects in May 2024, aiming to expand the grid and integrate more renewable energy sources.

- Large tenants are also searching for alternatives as traditional grid-based solutions are taking longer to procure; this includes nuclear power and renewable energy:

  Google announced in October that it will purchase power from a fleet of SMRs[4] made by Kairos Power – suggesting it sends an "important demand signal to the market" while making a long-term investment to accelerate commercialization.[5]

  Microsoft inked a deal for Constellation Energy to restart Three Mile Island, buying up the reactor's output.

  Amazon reached an interconnection agreement with Talen at the Susquehanna nuclear power plant, though the FERC has rejected amended portions of the agreement.[6]

2. datacenterHawk, as of Q3 2024.
3. Generational Growth: AI, Data Centers, and the Coming U.S. Power Demand Surge. Goldman Sachs Equity Research, April 2024.
4. SMRs are small modular reactors, and the hope is that they are a more cost-effective way to produce nuclear power at scale.
5. https://www.cnbc.com/2024/10/14/google-inks-deal-with-nuclear-company-as-data-center-power-demand-surges.html
6. https://www.power-eng.com/policy-regulation/ferc-rejects-amended-interconnection-agreement-for-amazon-data-center-at-susquehanna-nuclear-plant/

FLEXIBLE ARCHITECTURE AND DESIGN

The rapid adoption and evolution of Generative AI solutions is fueling demand for data centers with unique requirements. Generative AI data centers differ from traditional data centers in several key aspects due to the specifications of AI workloads, including massive data processing, training complex models, and ensuring real-time inference. Implications in site selection and design for data centers supporting Generative AI Training include:

- Power availability is the primary location consideration, and secondary markets are more accepted given latency requirements are less stringent for AI processing. Significantly higher rack power densities are required for AI facilities (26-80kW currently vs. 6-12kW in typical data centers).
- Specialized hardware like high-powered GPU-based (Graphics Processing Units) servers, or custom AI accelerators optimized for parallel computation are required as high-performance storage and memory is needed to handle large datasets used in model training and inference.
- Advanced cooling solutions, such as liquid or immersion cooling, may be used to manage heat from high-powered GPUs.

The explosion of AI applications and the relentless growth of the cloud are driving an extraordinary mismatch between supply and demand, creating both challenges and opportunities. In this context, the importance of strategic partnerships with hyperscalers cannot be overstated. Developers must deliver tailored solutions — whether through proprietary designs or powered shells built to precise tenant specifications. This adaptability can strengthen relationships with hyperscalers and lead to a broader pipeline of opportunities, as the sector evolves. Examples include:

- **ADAPTABLE POWER AND COOLING:** The data center's architecture is built for flexibility, catering seamlessly to both AI and traditional cloud workloads. What is particularly powerful is the ability to redistribute power and cooling post-deployment — a game-changer for hyperscalers needing agility in an ever-evolving tech landscape.
- **HIGH-DENSITY, HIGH-VOLTAGE READY:** AI workloads demand serious horsepower, and these data centers deliver with support for high-density racks and direct high-voltage systems at the rack level. It is a capability most competing buildings currently cannot provide.
- **UNIFIED WORKLOAD OPERATIONS:** By integrating AI and cloud workloads under one roof, these data centers eliminate the inefficiencies of siloed infrastructures. This single-building strategy not only simplifies operations but also provides a competitive edge in scaling diverse technologies efficiently.
- **FUTURE-PROOF BY DESIGN:** With a blueprint that anticipates tomorrow's tech — like quantum computing — these data centers aren't just built for today; they are strategically positioned to lead the next wave of innovation.

CONCLUSION

The race to meet data center demand is not just a story about rising power usage; it is about tech strategy, regulatory pivots, and energy reinvention. Cloud computing and AI are not just transformative tech — they are reshaping the blueprint for the U.S. economy's infrastructure. And as supply strains under this relentless push, the lines between tech, data centers, and energy are becoming indistinguishably linked.

CARRINGTON BROWN

Senior Managing Director, Development
Affinius Capital
carrington.brown
@affiniuscapital.com

MARK FITZGERALD, CFA, CAIA

Executive Director, Head of North American Research
Affinius Capital
mark.fitzgerald
@affiniuscapital.com

BAHRAM MOTAMEDIAN

Senior Managing Director,
Portfolio Management
bahram.motamedian
@affiniuscapital.com

NIC BUSTAMANTE

Chief Technology Officer
Corscale Data Centers
ncb@corscale.com

Important Disclosures

AFFINIUS CAPITAL

9830 Colonnade Blvd., Suite 600
San Antonio, Texas 78230
affiniuscapital.com

CORSCALE DATA CENTERS

1980 Post Oak Blvd, Suite 1900
Houston, TX 77056
corscale.com