EQUIPMENT LEASING & FINANCE
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Your Eye on the Future

2025 Vertical Market Outlook Series:

Data Centers

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Introduction

The U.S. data center market represents a key component of the nation's technology infrastructure, providing the physical foundation that enables the storage, processing, and transmission of vast amounts of digital information. Serving clients from small firms to multinational corporations to government, the sector includes everything from traditional in-house centers to advanced facilities managed by specialized providers.

The importance of this vertical is illustrated by recent Equipment Leasing & Finance Foundation (ELFF) research that touched on the impact of data centers on the U.S. economy. In regard to their tracking of several equipment verticals, ELFF noted:

> Equipment and software investment surged during the first half of 2025. While six of seven tracked equipment verticals posted gains, the main driving force behind this expansion was technology equipment and software spending tied to the AI boom. Massive outlays by a handful of tech giants to build data centers and other AI infrastructure drove most of the growth — indeed, AI-related commodities accounted for roughly one-third of real GDP growth over the first half of 2025.[1]

The Foundation also found that demand for new data centers helped drive construction spending to an "all-time high" in early summer 2025.[2]

This paper will provide an overview of the U.S. data center vertical and will address such topics as macroeconomic factors, market dynamics, and equipment/technology trends that will have an impact on the sector and its needs going forward.

(Note: This report was researched and written September-November 2025)

Executive Summary

The following are some key insights that will be discussed in more detail in this report.

- Data centers originated in the 1940s and were initially located on-site at a company or organization.
- Remote options have developed that can be utilized by multiple customers. Currently, there are several types of data centers used by companies and organizations. These include enterprise data centers, cloud-based data centers, and hyperscale data centers.
- Key components of a data center include servers, storage systems, and networking equipment.
- As of March 2025, there were a reported 5,426 data centers in the U.S., more than in any other country. Statista projects that the U.S. data center market in terms of revenue will reach $171.90 billion in 2025. Revenue is expected to show an annual growth rate (CAGR 2025-2030) of 7.38%.

- Construction of data centers in the U.S. is at record levels
- The key driver of data center demand will be the "emergence of generative AI (gen AI)."
- By the end of the decade, hyperscalers such as Amazon Web Services, Google Cloud, Microsoft Azure, and Baidu will "host the lion's share of data center workloads."
- U.S. federal governmental policies, such as executive orders, tariffs, and tax incentives, can have a large impact on the data center vertical.
- Growth in data centers is expected to continue, leading to increased labor needs. However, there are several challenges that may hinder employment growth.
- Data centers have a sizable impact on the environment – they are huge consumers of energy and water, and they generate large levels of electronic waste. Additionally, "construction and expansion of data centers can lead to land use changes, potentially impacting local ecosystems and biodiversity."
- Data center equipment trends and innovations include rapid connectivity improvements, scaling for AI, and the adoption of new connectivity solutions. Developments in cooling, power, and security are also underway.
- McKinsey estimates that global data center investments for computing hardware such as servers will reach over $4 trillion by 2030, with more than 40% of this spending to occur in the U.S.
- Keeping data center equipment functional and up to date will require considerable investment going forward.
- CBRE expects the data center real estate market to struggle to keep pace with demand. This will lead to higher utilization rates in existing facilities and tighter vacancy rates. It is expected that there will be increased competition for land and resources to build new data centers.
- Data centers are extremely capital-intensive, with costs ranging from $200 million for smaller facilities to well over $1 billion. It has been reported that data center financings in the U.S. were $30 billion in 2024 and could reach $60 billion in 2025.
- There are a variety of options for data center equipment financing, including traditional loans (through financial institutions or hardware manufacturers), leasing, and subscription models.
- A variety of stakeholders can play a role in equipment purchasing and financing decisions in data centers. These include executive leadership (CEO/CIO, CFO), accounting teams, legal teams, technical teams (IT infrastructure/operations), facilities/engineering teams (power, cooling), and procurement/sourcing teams.
- Looking at equipment opportunities, AI is a key driver increasing the need for "data centers with enhanced energy efficiency and high-capacity processing capabilities." This will create opportunities for equipment leasing and financing companies.

The Data Center Ecosystem

Definition and composition

A data center is an "enterprise that houses and maintains back-end IT systems and data stores — its mainframes, servers and databases." Gartner provides some further context:

> In the days of large, centralized IT operations, this department and all the systems resided in one physical place, hence the name data center.
>
> With today's more distributed computing methods, single data center sites are still common, but are becoming less so. The term continues to be used to refer to the department that has responsibility for these systems, no matter how dispersed they are.
>
> Market and industry trends are changing the way enterprises approach their data center strategies. Several factors are driving enterprises to look beyond traditional technology infrastructure silos and transform the way they view their data center environment and business processes. These include aging data center infrastructures that are at risk for not meeting future business requirements, an ongoing cost-consciousness, and the need to be more energy-efficient.[3]

History of data centers

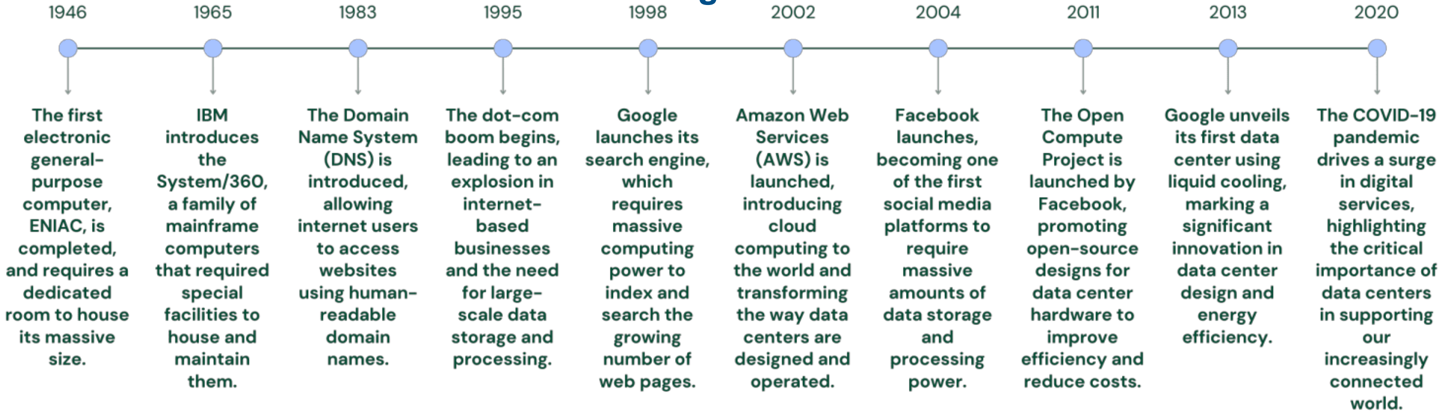
Data centers originated in the 1940s. As computers became more "size-efficient," they required less space. In the 1990s, with the advent of microcomputers, even less space was required. "These microcomputers that began filling old mainframe computer rooms became known as servers, and the rooms became known as data centers." Cloud computing entered the picture in the early 2000s further disrupting the data center environment.[4]

According to TechTarget,

> In the past, data centers were highly controlled physical environments. However, modern infrastructures have shifted away from physical servers to virtualized environments, facilitating the deployment of applications and workloads across diverse multi-cloud environments.
>
> Modern data centers can support a variety of workloads, from traditional enterprise apps to modern cloud-native services. These enterprise data centers increasingly incorporate facilities for securing and protecting cloud computing and in-house, on-site resources. They're designed to meet the growing demands of businesses for computing resources, while optimizing energy efficiency and reducing operational costs.
>
> As enterprises turn to cloud computing and multi-cloud environments, conventional data centers are evolving, blurring the lines between the data centers of cloud providers and those of enterprises.[5]

Nlyte Software created a timeline of significant data center milestones. (See Figure 1)[6]

Figure 1



Types of data centers

Initially, data centers were located on-site at a company or organization. Remote options have developed that can be utilized by multiple customers. Currently, there are several types of data centers used by companies and organizations. These include:

Enterprise (on-premises) data centers. “These proprietary data centers are built and owned by organizations for their internal end users. They support the IT operations and critical applications of a single organization and can be located both on premises and off-site.”[7]

Cloud-based data centers. “These off-site distributed data centers are managed by third-party or public cloud providers…Based on an infrastructure-as-a-service model, the leased infrastructure enables customers to provision a virtual data center within minutes.”[8] The three largest cloud providers globally are Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP).[9]

Hyperscale data centers. “Synonymous with large-scale providers, such as Amazon, Meta, and Google, these hyperscale computing infrastructures maximize hardware density, while minimizing the cost of cooling and administrative overhead.”[10] These contain at least 5,000 servers and miles of connection equipment and can be as large as 60,000 square feet.[11]

Edge data centers are smaller facilities that solve the latency problem by being geographically closer to the edge of the network and data sources, according to TechTarget. They can “enhance application performance and customer experience, particularly for real-time, data-intensive tasks, such as big data analytics, artificial intelligence, and content delivery.”[12]

Further, edge data centers can be “located close to end-users and connected devices, often in remote or rural areas. They are designed to provide low-latency access to data and computing resources, which is critical for applications such as streaming video, gaming, and Internet of Things (IoT) devices.”[13] (Note: In the context of data centers, latency refers to the time delay between when data is sent and when it is received or processed.)

Colocation data centers. “These rental spaces inside colocation facilities are owned by third parties. The renting organization provides the hardware, and the data center provides and manages the infrastructure, including physical space, bandwidth, cooling, and security systems. Colocation is appealing to organizations that want to avoid the large capital expenditures associated with building and maintaining their own data centers.”[14]

Intermediate Distribution Frame (IDF) is a “small-scale data center that is typically used to support the network infrastructure needs of a building or campus. It serves as a distribution point for network cabling and can include equipment such as switches, routers, and firewalls. They are generally smaller than enterprise data centers and are designed to be located closer to end-users to minimize network latency.”[15]

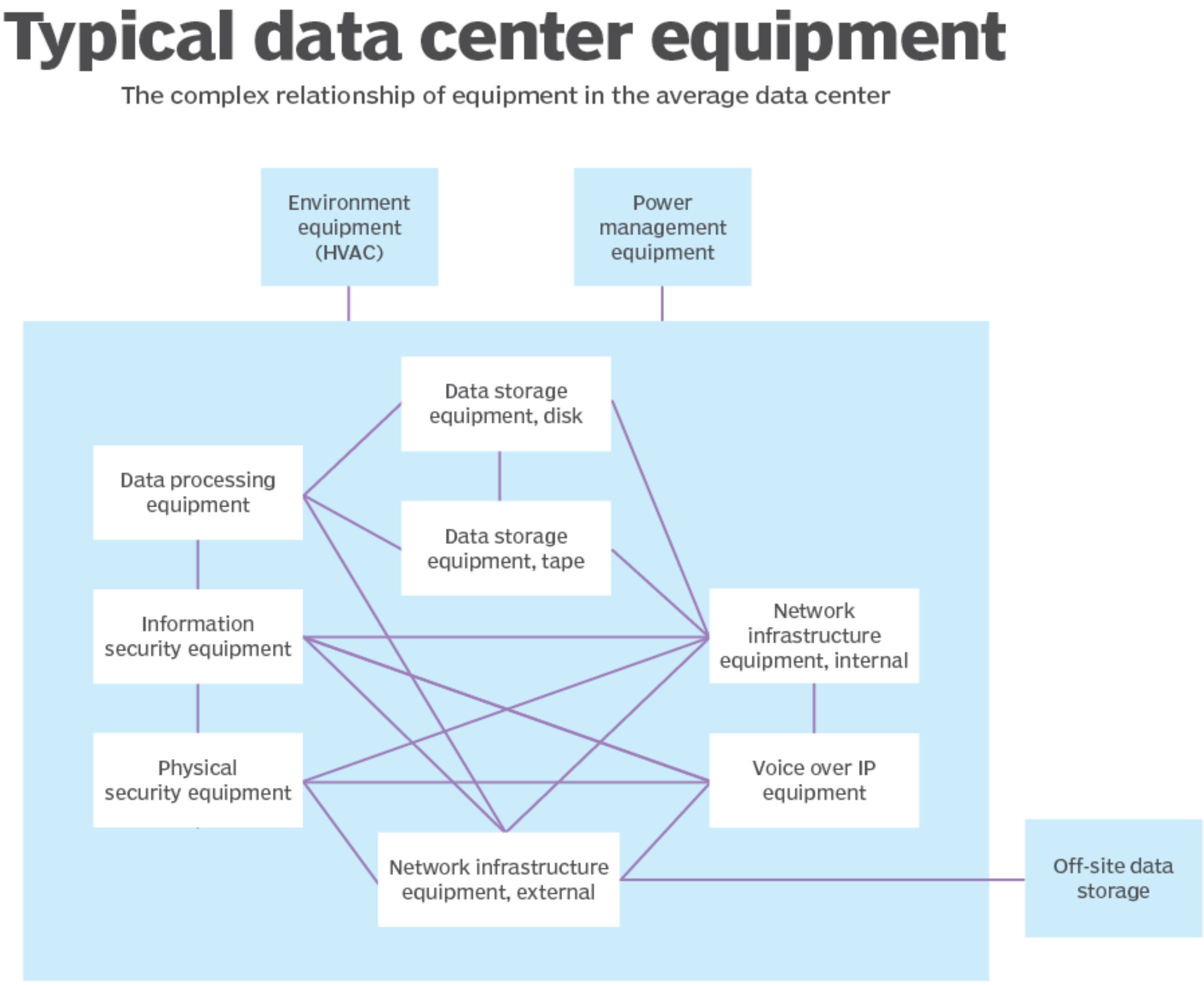
Modular data centers are "prefabricated units that can be assembled on-site or shipped to a location for rapid deployment. They are designed to be highly scalable and can be customized to meet specific requirements, making them an ideal solution for temporary or remote IT infrastructure needs."[16]

Neoclouds. "Neoclouds are a new breed of cloud provider, built from the ground up to support artificial intelligence (AI) and high-performance computing (HPC). Unlike household names like Amazon Web Services, Microsoft Azure, or Google Cloud (often referred to as hyperscalers), Neoclouds are purpose-built to do one thing exceptionally well: deliver raw, scalable computing power, especially using graphics processing units (GPUs) for the most demanding workloads."[17]

Components of a Data Center

The infrastructure of a data center is complex and made up of a variety of components. TechTarget provides an illustration of a typical data center and its equipment in Figure 2.[18]

Figure 2



Source: TechTarget

Key components of a data center include servers, storage systems and networking equipment.

Servers are the computers that "deliver applications, services, and data to end-user devices."[19] Servers come in a variety of sizes and shapes:

> Rack-mount servers are wide, flat, stand-alone servers the size of a small pizza box. They are stacked on top of each other in a rack to save space (versus a tower or desktop server). Each rack-mount server has its own power supply, cooling fans, network switches and ports, along with the usual processor, memory, and storage.
>
> Blade servers are designed to save even more space. Each blade contains processors, network controllers, memory, and sometimes storage. They're made to fit into a chassis that holds multiple blades and includes the power supply, network management, and other resources for all the blades in the chassis.
>
> Mainframes are high-performance computers with multiple processors that can do the work of an entire room of rack-mount or blade servers. The first virtualizable computers, mainframes, can process billions of calculations and transactions in real time.[20]

Server choice is determined by such factors as space, the workloads that need to be run, available power, and cost.

Racks, typically constructed of metal, are the frames that hold the servers in a data center. They can be designed to accommodate a variety of server sizes and configurations. Racks are designed to maximize airflow and cooling, while also providing easy access to servers for maintenance and upgrades."[21]

Nlyte Software identified the three common types of data storage systems used in data centers:

> Direct-attached storage (DAS) is a simple storage solution that connects directly to a server, providing fast access to data. However, DAS is not ideal for large-scale data storage, as it lacks the scalability and redundancy of other storage solutions.
>
> Network-attached storage (NAS) is a specialized storage device that connects to a network, providing a centralized storage solution that is easily accessible to multiple servers and users. NAS devices are typically less expensive than other storage solutions, making them an attractive option for small to medium-sized businesses.
>
> Storage area network (SAN) is a high-performance storage solution that provides block-level access to data over a dedicated network. SANs are designed for large-scale data storage and can be scaled up to meet the needs of enterprise-level organizations.[22]

Networking equipment provides connectivity. "This equipment supports the storage and processing of applications and data by handling tasks such as switching, routing, load balancing, and analytics."[23]

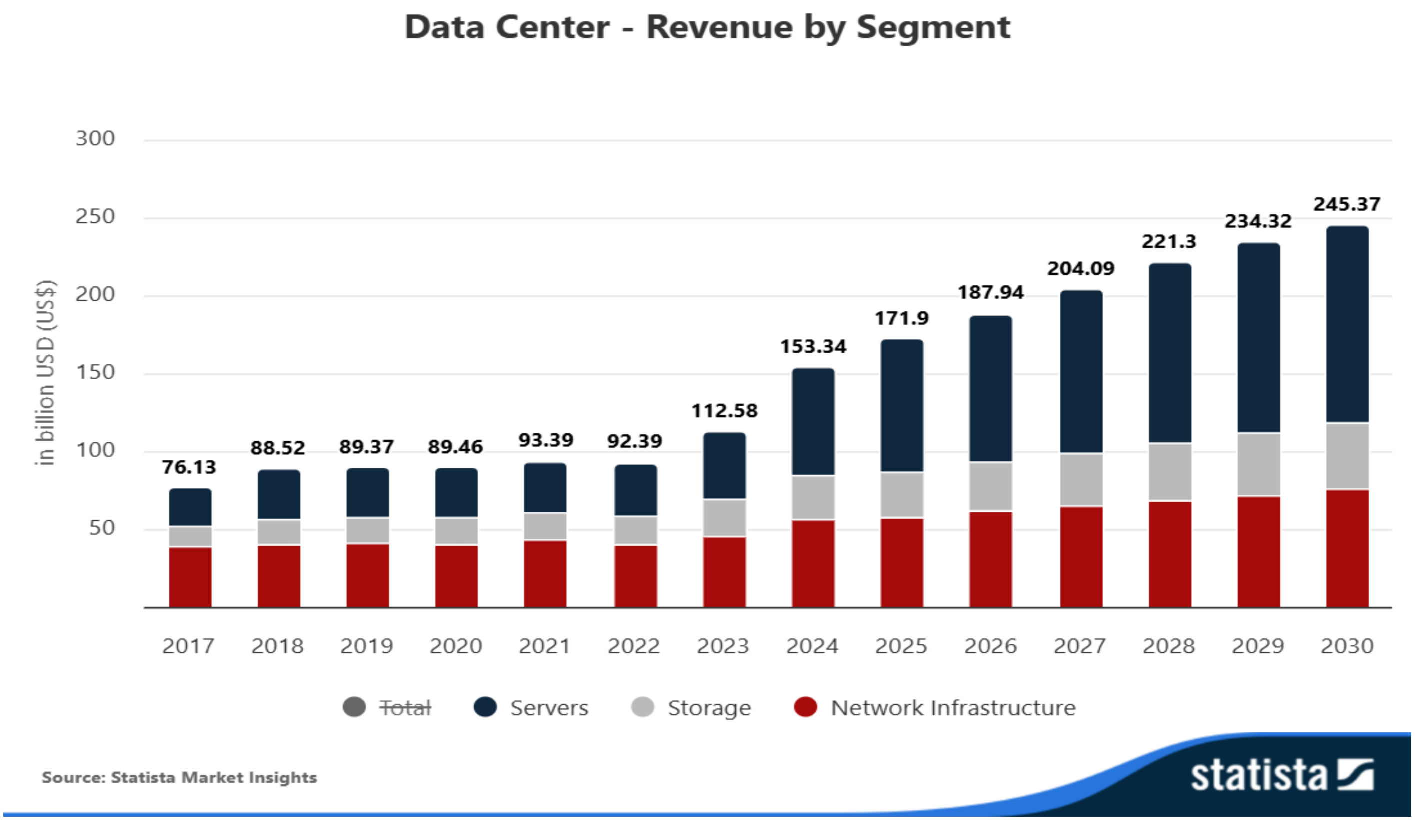
Power supply is crucial to data center operation. According to IBM, data centers "need to be always-on at every level. Most servers feature dual power supplies. Battery-powered uninterruptible power supplies (UPS) protect against power surges and brief power outages. Powerful generators can take effect if a more severe power outage occurs."[24]

Cooling systems are another critical component because data center environments generate heat, and the correct temperature needs to be maintained to prevent equipment failure. Data center cooling systems include computer room air conditioning and chiller plants.[25]

Market size and future growth

As of March 2025, there were a reported 5,426 data centers in the U.S., more than in any other country.[26] Statista projects that the U.S. data center market in terms of revenue will reach $171.90 billion in 2025. Revenue is expected to show an annual growth rate (CAGR 2025-2030) of 7.38%. Servers are the largest segment of this market. See Figure 3 for details.

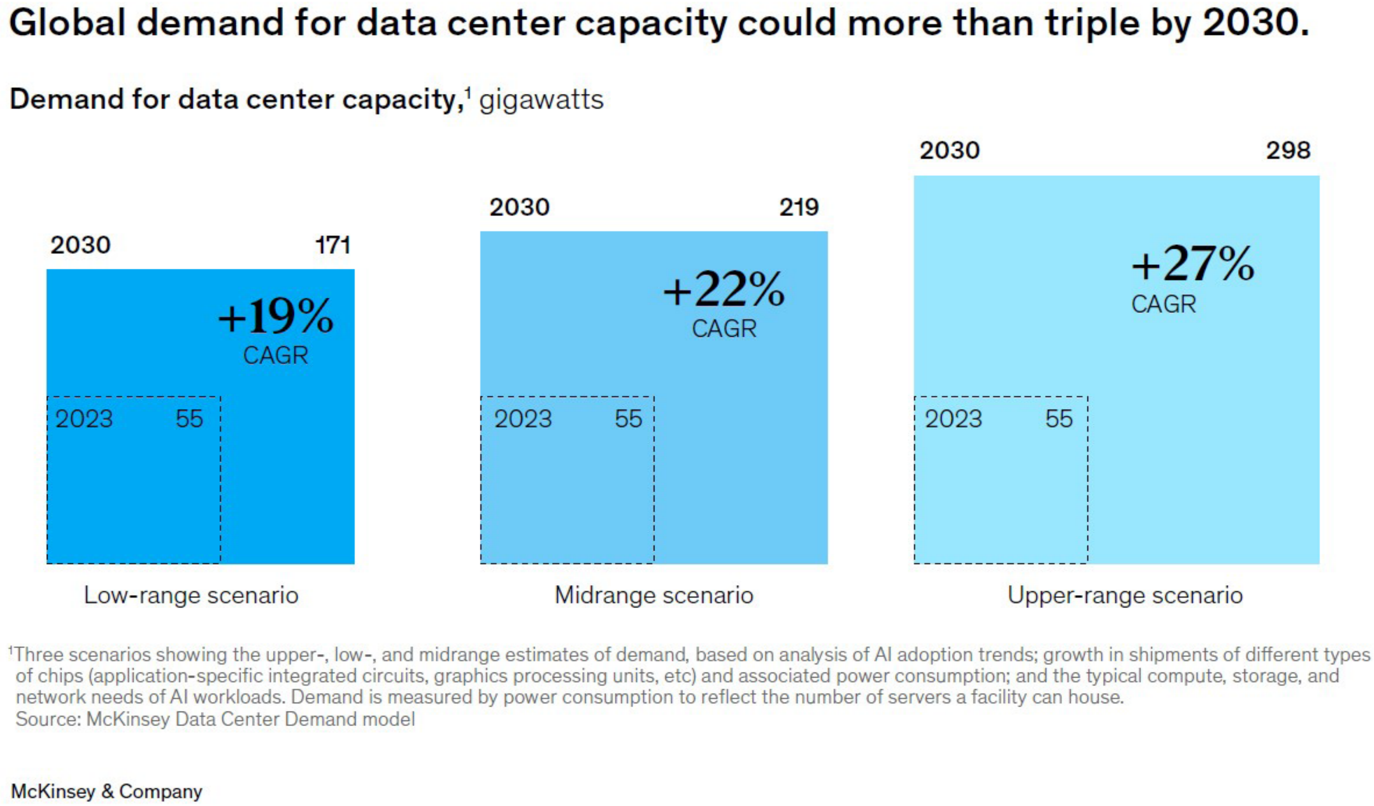
Figure 3



Future demand for data center capacity will depend on factors that are still hard to accurately determine, according to McKinsey. These factors include the adoption of advanced AI use cases, mix of different types of chips deployed, their associated power consumption, the balance between cloud and edge computing for AI workloads, and the typical compute, storage, and network needs of AI workloads. The consulting firm created three scenarios for capacity demand through 2030 stating that their analysis of current trends:

> …suggests that global demand for data center capacity could rise at an annual rate of between 19 percent and 22 percent from 2023 to 2030 to reach an annual demand of 171 to 219 gigawatts (GW). A less likely yet still possible scenario sees demand rising by 27 percent to reach 298 GW (Exhibit 1).2 This contrasts with the current demand of 60 GW, raising the potential for a significant supply deficit. To avoid a deficit, at least twice the data center capacity built since 2000 would have to be built in less than a quarter of the time.[27] (See Figure 4.)

Figure 4



Construction of data centers

It is reported that the construction of data centers in the U.S. is at record levels:

> In 2024, the U.S. added about 5,000 new leased data centers, and total supply in key markets grew by over 30%. Northern Virginia leads with over 11,000 megawatts of power supply. Other fast-growing hubs include Phoenix, Dallas-Fort Worth, and Las Vegas/Reno, each adding significant capacity.[28]

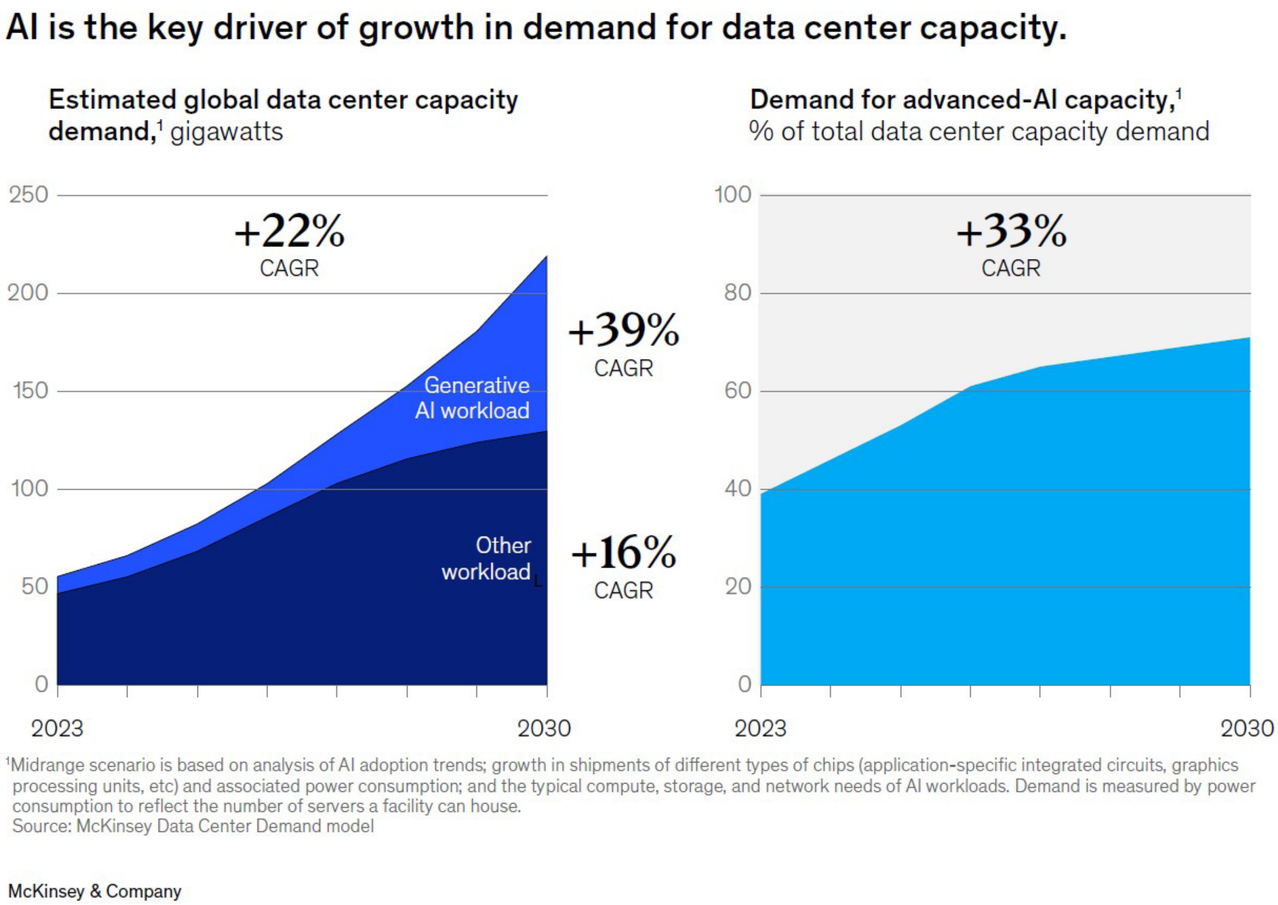
According to CC Tech Group, investors view data centers as valuable assets because of strong demand from the tech, finance, and healthcare industries.[29] "Capital spending on procurement and installation of mechanical and electrical systems for data centers is likely to exceed $250 billion by 2030, according to McKinsey estimates."[30]

AI advancements driving demand

As Figure 5 shows, the key driver of data center demand will be the "emergence of generative AI (gen AI)":

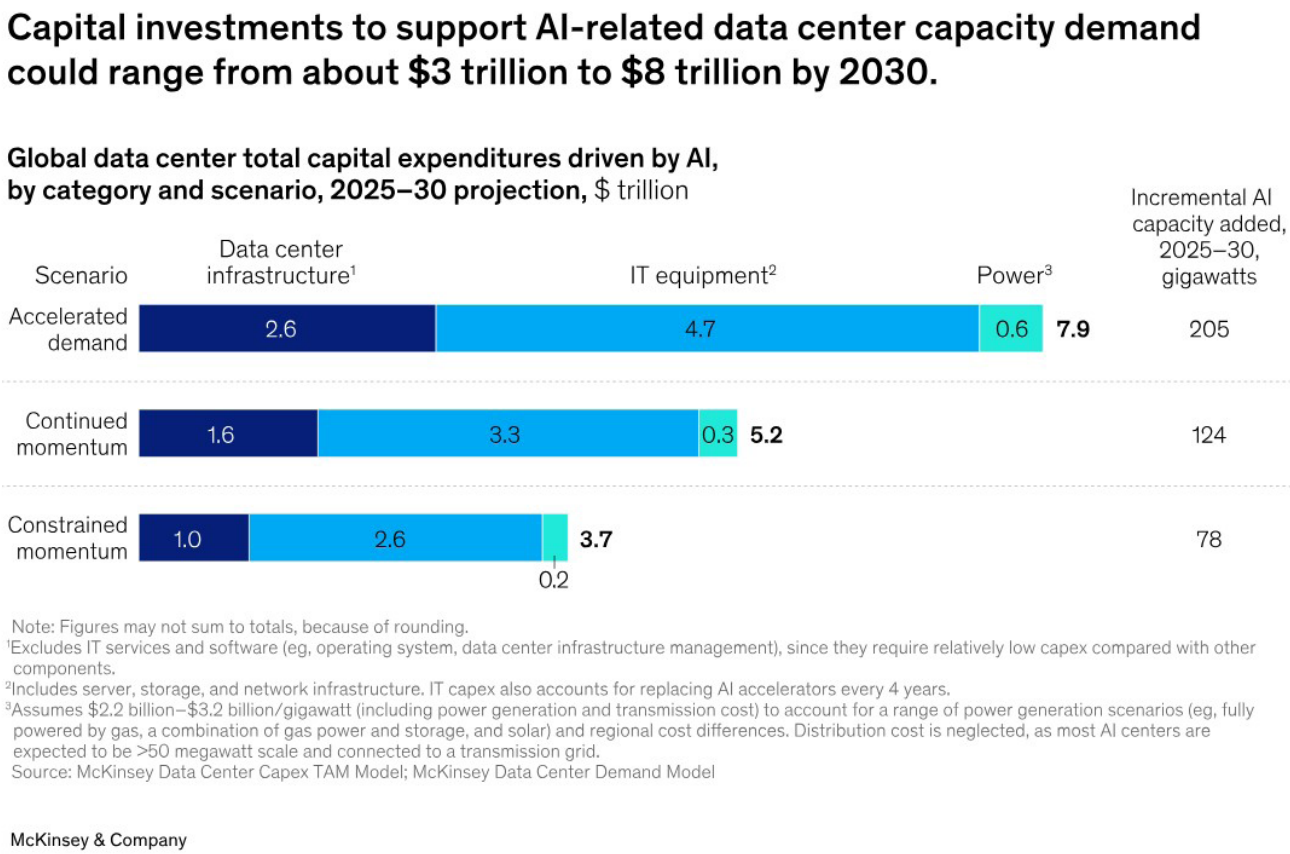
> A big chunk of growing demand—about 70 percent at the midpoint of McKinsey's range of possible scenarios—is for data centers equipped to host advanced-AI workloads. And the nature of those workloads is rapidly transforming where and how data centers are being designed and operated.[31]

Figure 5



McKinsey calculated that companies across the compute power value chain will need to invest $5.2 trillion into data centers by 2030 to meet worldwide demand for AI alone (their middle range estimate). They created some different scenarios based on future demand. Refer to Figure 6.[32]

Figure 6

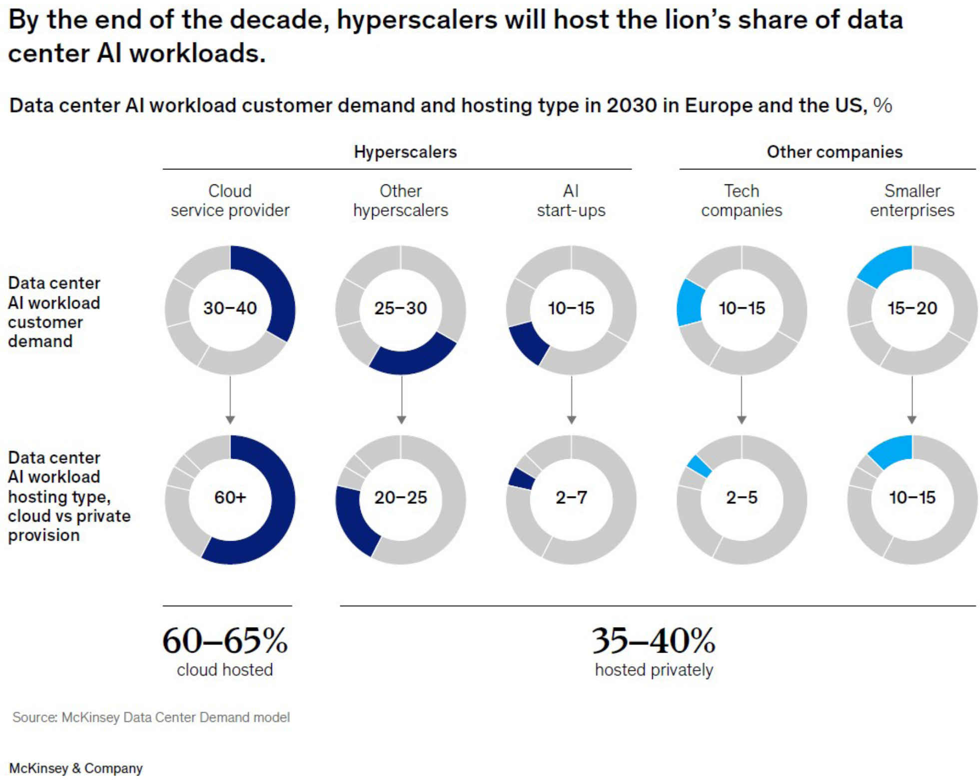


McKinsey provided an estimate of where this investment will be going:

- Approximately 15% ($0.8 trillion) of investment will flow to builders for land, materials, and site development
- Another 25% ($1.3 trillion) will be allocated to energizers for power generation and transmission, cooling, and electrical equipment.
- The largest share of investment, 60% ($3.1 trillion), will go to technology developers and designers, who produce chips and computing hardware for data centers.
- McKinsey notes that two investor archetypes, operators (such as hyperscalers and colocation providers) and AI architects, also invest in compute power, but their spending is difficult to estimate because of the overlap with their R&D activities.[33]

Hyperscalers such as Amazon Web Services, Google Cloud, Microsoft Azure, and Baidu will dominate capacity and supply according to McKinsey.[34] (See Figure 7.)

Figure 7



Although it is generally felt that the data center vertical will continue to grow, there will be challenges. Deloitte's 2025 AI infrastructure survey of executives from U.S.-based data center and power companies identified some of the key challenges.[35] (See Figure 8.)

Figure 8

Top challenges among respondents for data center infrastructure development

Question: What does your organization believe are the greatest challenges to data center infrastructure build-out?

	Data centers	Power companies
1	Power and grid capacity constraints in meeting load growth	
2	Data center and grid build-out timeline mismatches	Supply chain disruptions affecting equipment and materials
3	Cyber and/or physical security concerns	
4	Supply chain disruptions affecting equipment and materials	Difficulty in securing permits
5	Difficulty in securing permits	Data center and grid build-out timeline mismatches
6	Workforce constraints	Gas (un)deliverability
7	Gas (un)deliverability	Workforce constraints

Note: Ranking is based on the number of respondents who selected "very" or "extremely" challenging.

Source: Deloitte 2025 AI Infrastructure Survey.

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Macroeconomic Environment

U.S. government regulations and legislation

U.S. federal governmental policies can have a large impact on the data center vertical. A few current examples are discussed in this section.

Accelerating Federal Permitting of Data Center Infrastructure

In July 2025, President Trump signed an executive order to "facilitate the rapid and efficient buildout of data center infrastructure."

This order:

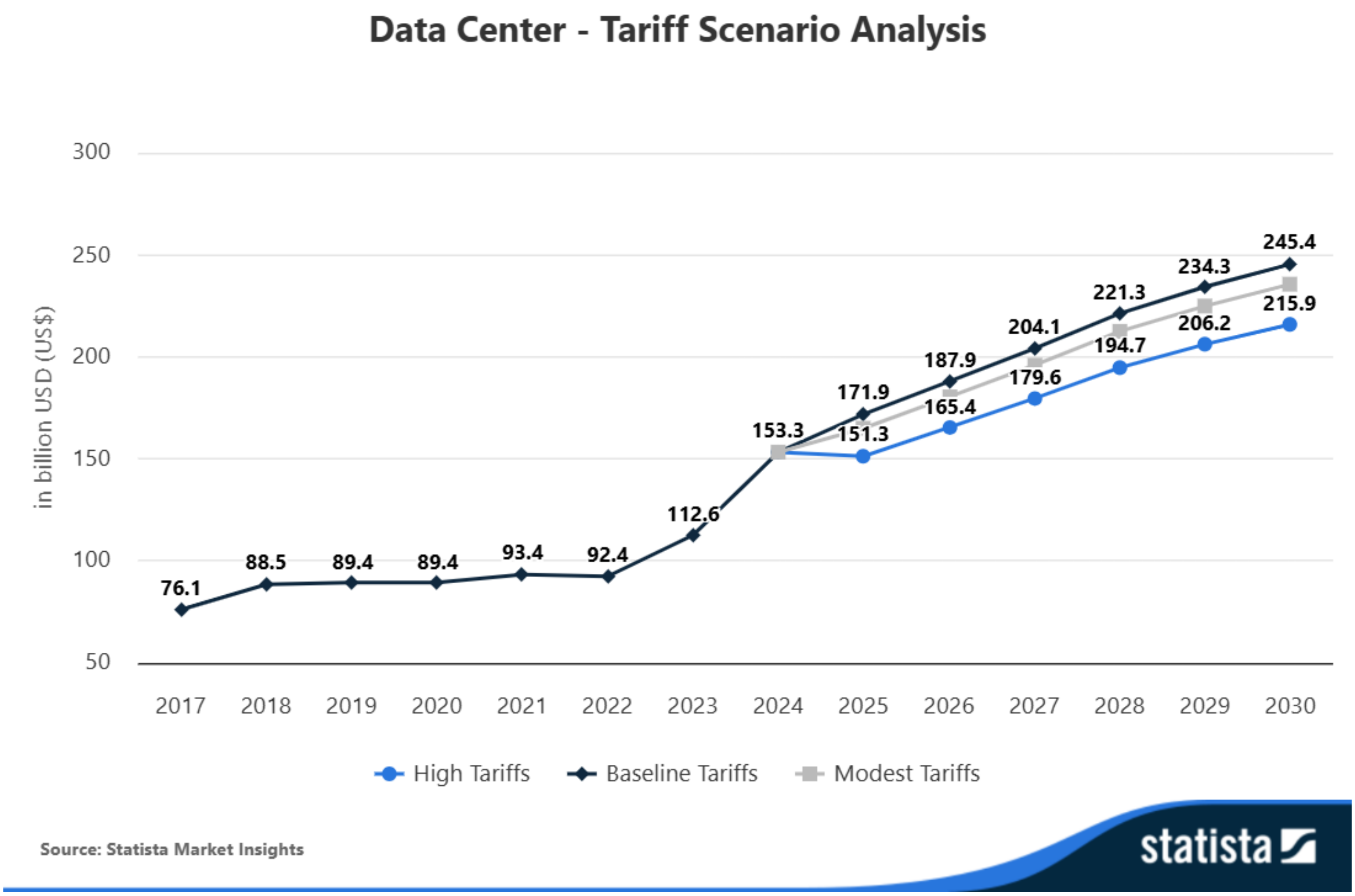
- directs the Secretary of Commerce to launch an initiative to provide financial support, such as loans, grants, and tax incentives, for Qualifying Projects. These Qualifying Projects include data centers that require greater than 100 megawatts of new load, infrastructure projects related to data center energy needs, semiconductor facilities, networking equipment, or other data center or related infrastructure projects selected by the Secretary of Defense, Secretary of the Interior, Secretary of Commerce, or Secretary of Energy.
- instructs the relevant agencies to streamline environmental reviews and permitting for data centers and related infrastructure.
- promotes the use of Brownfield and Superfund sites for data center development, repurposing these lands for productive use.
- directs the Department of the Interior, the Department of Energy and the Department of Defense to authorize data center construction on appropriate federal lands."[36]
- revoked Executive Order 14141 of January 14, 2025 (Advancing United States Leadership in Artificial Intelligence Infrastructure).[37]

These initiatives can help expedite the growth of new data centers; however, local level environmental, energy, and privacy regulations will need to be taken into account.

Tariffs

Some of the current administration's proposed and implemented tariff policies could affect data center economics. An analysis by Statista shows the impact of three different tariff scenarios on the U.S. data center market. (See Figure 9.)

Figure 9



Tariffs can impact this vertical by creating cost increases for equipment. CSIS noted that "Trump proposed a 100 percent tariff on semiconductors that could raise the cost of AI servers by as much as 75 percent, disrupting data center economics and pricing smaller firms out of frontier AI development."[38] Acquiring transformers could also be a problem because it is reported that the U.S. is facing a "critical transformer shortage" and "U.S. transformer manufacturers account for only 20 percent of U.S. demand, with imports primarily from Mexico and China filling the remainder."[39]

Tax Incentives

The accounting and advisory firm, AbitOs summarized federal tax incentives for building and operating data centers in a July 2025 article.

> **100% bonus depreciation:** The "Big, Beautiful Bill" reinstates 100% bonus depreciation on qualified capital equipment and property placed in service before January 1, 2030. That means that instead of depreciating equipment over several years under MACRS rules, data centers can now deduct the full cost of qualifying equipment in the year it's placed in service. This provides a powerful cash flow boost and makes it possible for data center operators to recover their costs much sooner.
>
> **Opportunity Zones:** While not data-center specific, there are also federal tax benefits for locating centers in Opportunity Zones. The OBBBA renews and expands the Opportunity Zone programs under IRC 1400Z-1 and 1400Z-2. The Act also provides a new type of Qualified Rural Opportunity Fund. These new funds provide for a 30% basis increase for investments held for at least five years…

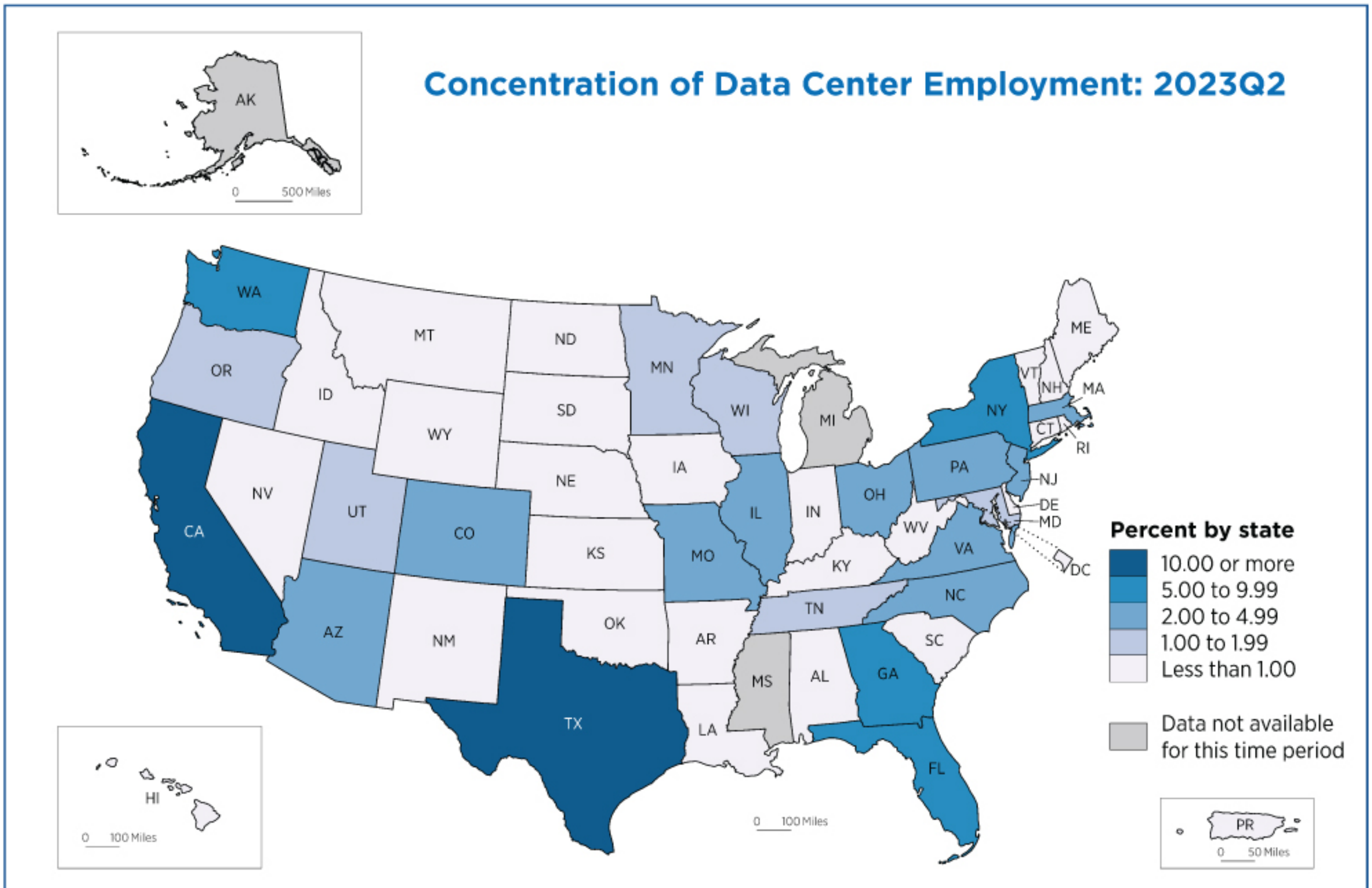
a marked improvement compared to the 10% allowed under the pre-existing Qualified Opportunity Funds. However, data center developers need to balance these considerations with other factors such as access to talent, access to reliable power and water supplies, and latency concerns.[40]

Additionally, AbitOs reported that at least 41 states are offering tax incentives to encourage data center development. These incentives include sales tax exemptions, property tax abatements and income tax credits.[41]

Labor

Employment in U.S. data centers increased more than 60% from 2016 to 2023, according to the U.S. Census Bureau's Quarterly Workforce Indicators (QWI). "The number of people working in data centers grew from 306,000 to 501,000 between 2016 and 2023, according to the Bureau of Labor Statistics." Over 40% of this employment is concentrated in five states. Figure 10 provides the details.[42]

Figure 10



Source: U.S. Census Bureau, Quarterly Workforce Indicators R2024Q3, beginning of quarter employment (not seasonally adjusted).

Growth in data centers is expected to continue, leading to increased labor needs. However, there are several challenges that may hinder employment growth. The Uptime Institute's 2025 Annual Global Data Center Survey of more than 800 data center owners and operators found that staffing challenges persist in 2025. "Nearly two-thirds of operators report difficulty retaining staff, finding qualified candidates, or both." Difficulties in finding senior people were called out by Andy Lawrence, Executive Director of Research, Uptime Institute:

"This is a time where senior-level experience is critical. But for the first time, more operators are finding it harder to recruit and retain senior people than people at an earlier stage of their career. There is a management shortage, with many experienced leaders retiring just as another phase of dramatic growth gets underway."[43]

It is also reported that there is a shortage of skilled manufacturing, construction and electrical workers to build and operate data centers. Many experienced workers are retiring, and there aren't enough young professionals entering these trades.[44]

Sustainability

Data centers have a significant impact on the environment in numerous ways. According to one source (GBC Engineers), in 2025, data centers consume nearly 3% of the world's electricity and contribute around 2% of global greenhouse gas emissions—a figure rivaling the airline industry."[45]

Data centers are also huge consumers of water:

> A study by the International Energy Agency estimates that a 100 MW U.S. data center may consume roughly the same amount of water as 2,600 households, accounting only for direct water consumption and averaged across the various cooling strategies. One study estimated that data centers use roughly seven cubic meters of water per megawatt-hour (MWh) of energy.[46]

EY, in a January 2025 article, listed some of the environmental impacts of data centers:

- The construction and expansion of data centers can lead to land use changes, potentially impacting local ecosystems and biodiversity
- Data centers require significant amounts of electricity and water to power and cool high-velocity computing equipment
- Data centers generate sizable levels of electronic waste
- Data centers face a variety of social concerns for nearby communities. During construction, data centers have community and work impacts due to rapid construction. …Noise is another concern…[47]

Some examples of initiatives being undertaken to address this are provided by GBC:

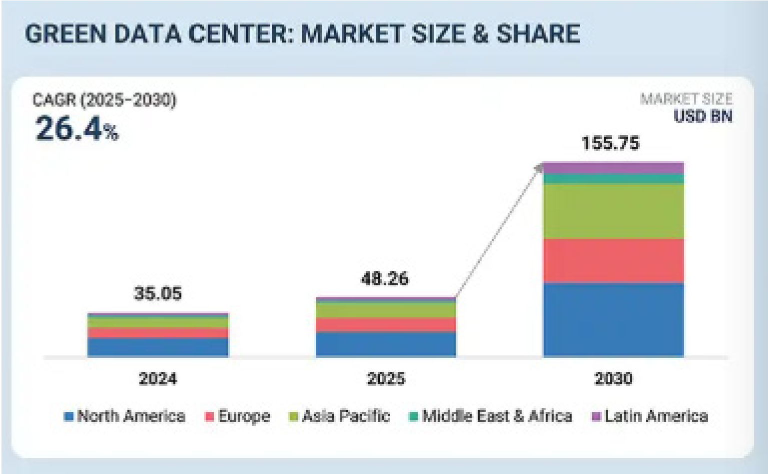
> **Google:** Committed to operating entirely on carbon-free energy 24/7 by 2030, Google uses AI to manage data center energy use and partners with renewable providers globally.
>
> **Microsoft:** Innovating with underwater data centers and pledging to be carbon negative by 2030. It also uses AI to optimize data center cooling and power efficiency.
>
> **Amazon Web Services (AWS):** Investing in solar and wind projects to power its global infrastructure. AWS has also introduced the Sustainability Pillar in its Well-Architected Framework.[48]

Green Data Centers

A green data center, or sustainable data center, is a type of data center that is designed to minimize its environmental footprint by utilizing energy-efficient technologies and sustainable practices. Bloom Energy, a California-based sustainable energy company, identified the ways green data centers are using to improve their environmental footprint. These initiatives include reusing waste heat, utilizing liquid cooling, incorporating hot aisle/cold aisle containment for rack arrangement, leveraging renewable energy sources, virtualization, which enables a single physical server to do the job of several, recycling water, employing onsite power and committing to environmental programs.[50]

The green data center market is expected to grow, supporting sustainability efforts going forward. A September 2025 MarketsandMarkets report projects the global green data center market to reach $155.75 billion by 2030, up from $48.26 billion in 2025. (see Figure 11.)[51]

Figure 11



Source: MarketsandMarkets

Sustainability – looking ahead

Data center operators, along with the broader tech industry, utilities and regulators can pursue several objectives to "achieve balance between sustainability and expedited time to market, while keeping data centers' rising energy demands under control and finding more sustainable ways to power AI" according to Deloitte. The firm offers the following examples of efforts that could help meet gen AI demand sustainably:

- Make gen AI chips more energy-efficient
- Optimize gen AI uses and shift processing to edge devices
- Implement changes in gen AI algorithms and rightsize AI workloads
- Collaborate with other stakeholders and sectors to make an overall positive environmental impact.[52]

EY also calls out the need for partnerships, noting that data center development requires a "partnership mindset," because the environmental and regulatory demands and risks can't be managed alone. Further, "some data center developers are taking a "bolt-on" approach to sustainability rather than intentionally integrating it into the initial design and operating strategy." The firm suggests that data center developers/operators should consider partnering with private equity/venture capital firms to invest in clean-tech solutions, driving more sustainable outcomes.[53]

Market Dynamics and Equipment Trends

Equipment technology

The "exponential growth of AI and machine learning (ML) applications,"[54] along with the market dynamics discussed above, is driving technology innovations. Data center equipment trends and innovations include rapid connectivity improvements, scaling for AI, and the adoption of new connectivity solutions. (Note: technology and innovations in cooling, power and security are discussed in their own sections.)

AI-driven data traffic in data centers is projected to grow by over 30% annually, according to a LINK-PP blog. Key requirements to support this include:

> **High Bandwidth:** AI models rely on rapid data exchange between servers, storage, and GPUs.
>
> **Low Latency:** Real-time applications, such as autonomous vehicles or fraud detection, need near-instantaneous responses.
>
> **Scalability:** As models grow, infrastructure must support expanding data volumes without compromising speed.[55]

Some current examples of equipment trends and shifts include:

- The development of specialized infrastructure within data centers for serving users and customers - To support AI integration needs, it is reported that hyperscalers are investing heavily in AI chip design as a way to optimize cloud offerings. Hyperscalers are also building specialized AI infrastructure for machine learning workloads. Note that Data Center Frontier reports that most colocation providers have been seen adopting AI more cautiously, focusing on operational efficiency and tenant support.[56]
- Larger GPU clusters - The need for increasingly capable AI systems is creating demand for larger GPU clusters and more sophisticated, higher-capacity interconnected solutions. A GPU cluster is a collection of computers (called nodes) that are connected together, with each computer equipped with one or more GPUs, according to Northflank. "When you connect multiple GPUs across several machines, you gain massive parallel processing power, which is ideal for AI workloads."[58]

The Link-PP blog identified some connectivity-related innovations:

- Data center connectivity has evolved from copper-based Ethernet to fiber-optic dominance, driven by the need for higher bandwidth and energy efficiency.
- Specialized high-bandwidth connectors are the unsung heroes in AI-ready data centers. They facilitate the physical layer connectivity between servers, switches, and storage systems…for example, using high-bandwidth fiber optic transceivers ensures that data-intensive AI tasks, such as image recognition or natural language processing, run without interruptions.
- Optical modules, or transceivers, are critical components that convert electrical signals to optical ones for transmission over fiber cables. In AI-driven data centers, they enable high-speed, long-distance data transfers with minimal latency.[59]

It has been noted that "integrating high-speed data center connectivity and AI infrastructure optimization has become a top priority for organizations aiming to stay competitive."[60]

McKinsey estimates that global data center investments for computing hardware such as servers will reach over $4 trillion by 2030, with more than 40% of this spending to occur in the U.S.[61]

Equipment lifecycle/replacement

Keeping data center equipment functional and up-to-date will require considerable investment going forward. Below is presented a brief case study on the replacement decision process using servers as an example.

Replacing a server is expensive, with cost varying widely depending on such factors as performance needs, storage, and scalability requirements:

- "The cost of a server for a large business can vary widely depending on performance needs, storage, and scalability requirements, but on average, a dedicated enterprise-grade server can range from $5,000 to $20,000 upfront, while high-performance data center servers may exceed $50,000. In addition to hardware, businesses must also factor in expenses for licensing, maintenance, IT staff, and potential cloud hosting alternatives, which can shift costs from large upfront investments to monthly subscriptions."[62]
- Servers optimized for AI/data-centers (with GPUs, etc.) cost considerably more. The cost of a single AI server with eight GPUs typically exceeds $500,000 according to a 2025 Cisco white paper.[63]

Data center servers are procured and refreshed every four to six years on average in large-scale environments according to a variety of sources. Clearfuze notes that proper maintenance can safely extend this to six to eight years.[64] "Chief information officers (CIOs) and IT leaders must select the optimal time to replace all or part of their existing server infrastructure." According to IDC, there is a mindset that pushing out server-refresh initiatives is prudent when business priorities change, or cash needs to be preserved:

> Most IT leaders acknowledge that infrastructure consisting of older servers requires more care and attention, but they believe that they can:
>
> - Delay server replacements to reduce cost.
> - Rely on server virtualization technologies and oversubscribe existing server infrastructure for tackling short- and medium-term requirements for existing applications.
> - Shift on-premises spending to public cloud infrastructure as a service for provisioning new applications, without examining the long-term implications of inter-application dependencies.[65]

However, IDC believes that while on the surface these approaches appear to be sound strategies, they are expensive and risky in the long run. The firm's analysis showed that the longer a server stays in the infrastructure, the more expensive it is to operate. "IDC recommends that CIOs and IT leaders prioritize the upkeep of on-premises server infrastructure, specifically by adopting more frequent replacement cadences that will help optimize their server performance."[66]

Cooling Systems

Cooling to prevent equipment such as servers from overheating is vital. The traditional cooling systems in data centers require a large amount of energy. An August 2025 U.S. Congressional brief describes the typical cooling scenarios in data centers:

> The operation of the IT equipment raises the temperature of the ambient room air, necessitating a cooling strategy. Centralized cooling resources are of two types: (1) those moving chilled air through large ductwork, or (2) those moving chilled water in a piped cooling loop that exchanges heat with the environment. An alternative to these centralized systems is room-scale air conditioners. One type, called computer room air conditioners (CRACs), is common in smaller data centers. Exchanging the heat with the environment can happen faster with methods that directly consume water. The source of the water can be the local water utility and can also be on-site reservoirs or other collocated water resources.[67]

Innovations in cooling are focusing on improving airflow and using more efficient equipment to reduce energy usage:

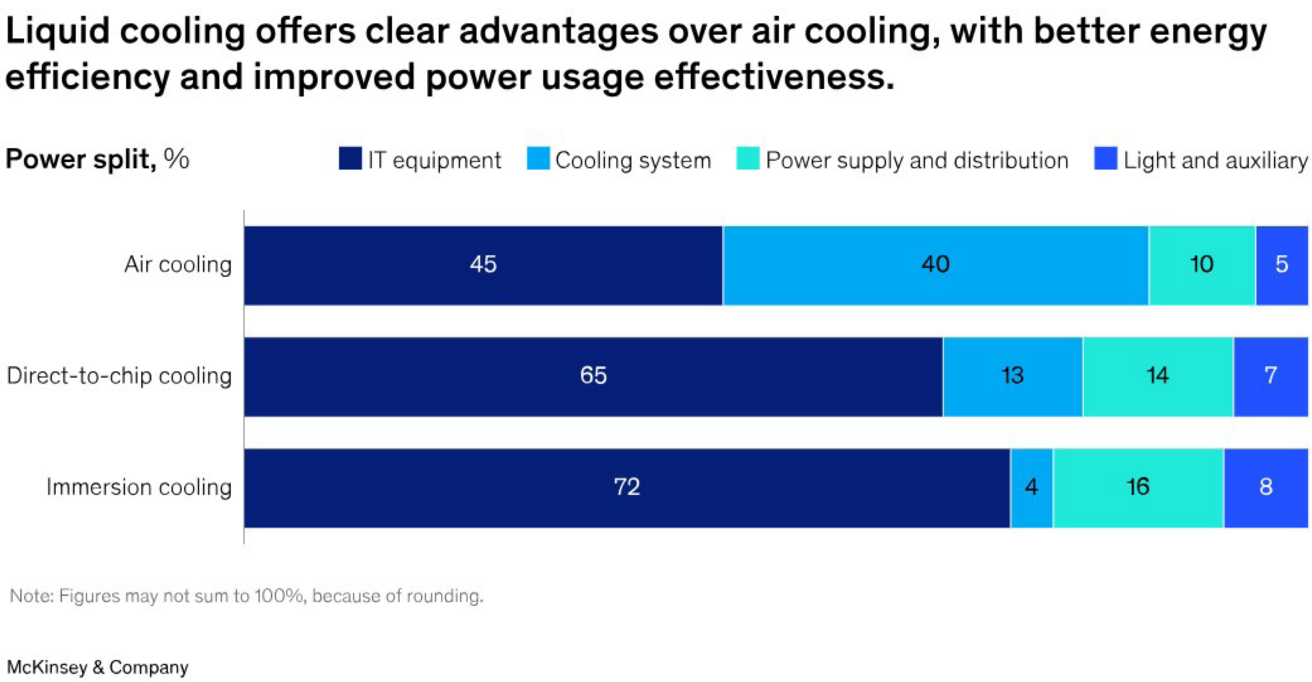
> Some facilities use *liquid cooling* instead of air, which removes heat more directly from servers and uses less power, especially in high-density computing environments. Others use *free cooling*—using outside air—when conditions allow. Operators are also using advanced monitoring and artificial intelligence to control cooling more precisely. Improvements in cooling technology help lower costs and reduce the environmental impact of data centers.[68]

McKinsey feels that liquid cooling is more efficient and environmentally friendly than established air-cooling methods, noting that there are currently three prominent liquid cooling methods:

- rear door heat exchangers (RDHx): A specialized door to the rear of the server rack chills hot air expelled by the servers while coolant transports the absorbed heat to a secondary cooling system.
- direct-to-chip (D2C) systems: The system circulates a cold liquid over integrated circuits, with the absorbed heat carried to a secondary cooling system.
- immersion cooling: The server is submerged in a liquid that absorbs heat directly from components, with the heat transferred to a secondary cooling loop.[69]

They project (see Figure 12) that the global data center cooling market will reach $40 billion to $45 billion by 2030, with liquid cooling accounting for $15 billion to $20 billion of that.[70]

Figure 12

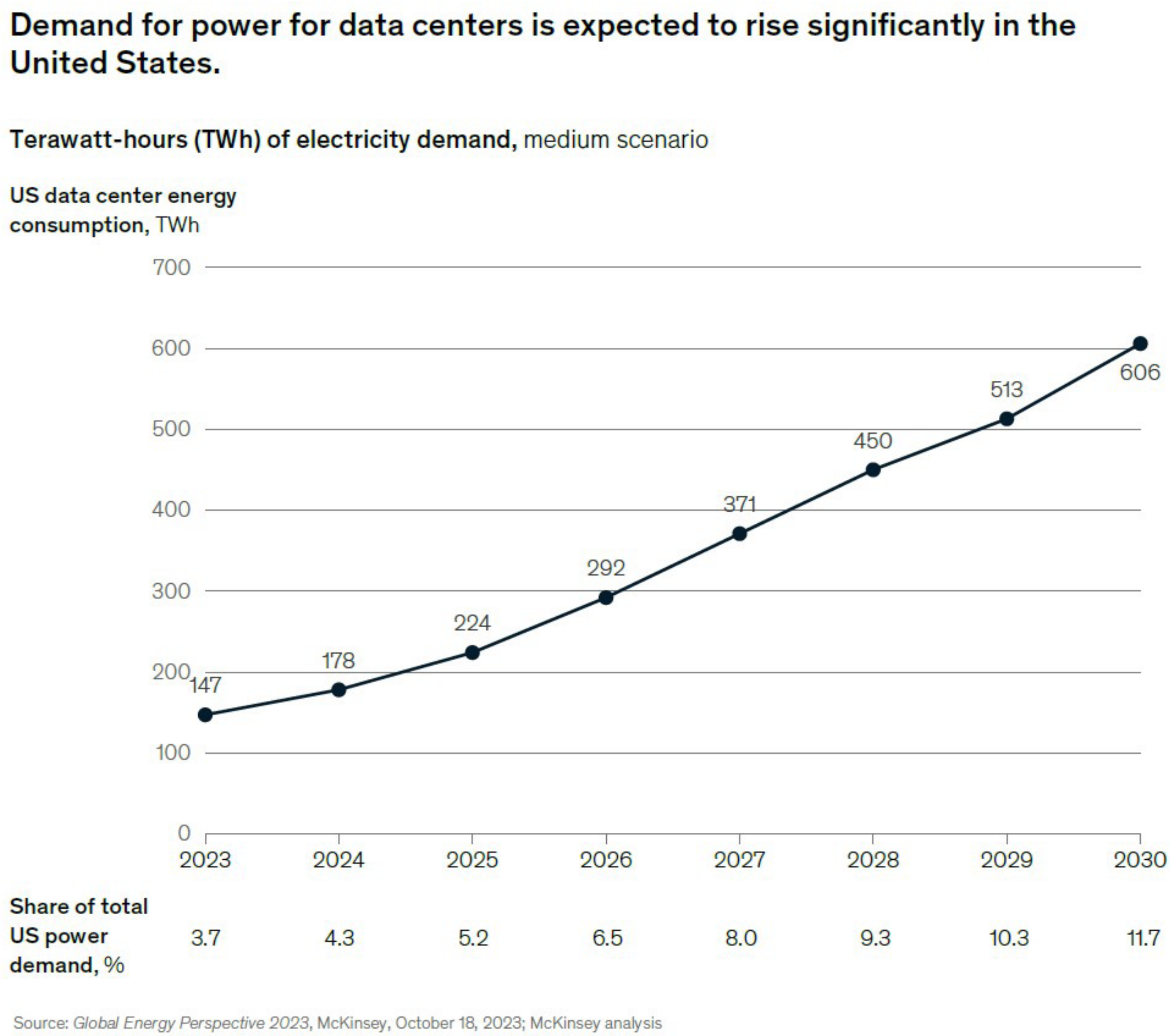


Companies are also looking at technologies to reduce water usage in cooling. “Microsoft, Evolution Data Centers, Vertiv and Bridge Data Centers are moving towards zero-water cooling. Using closed-loop systems, engineered fluids, and hybrid designs, these operators are replacing evaporative methods with alternatives that conserve resources without compromising performance.”[71]

Energy usage, storage and management

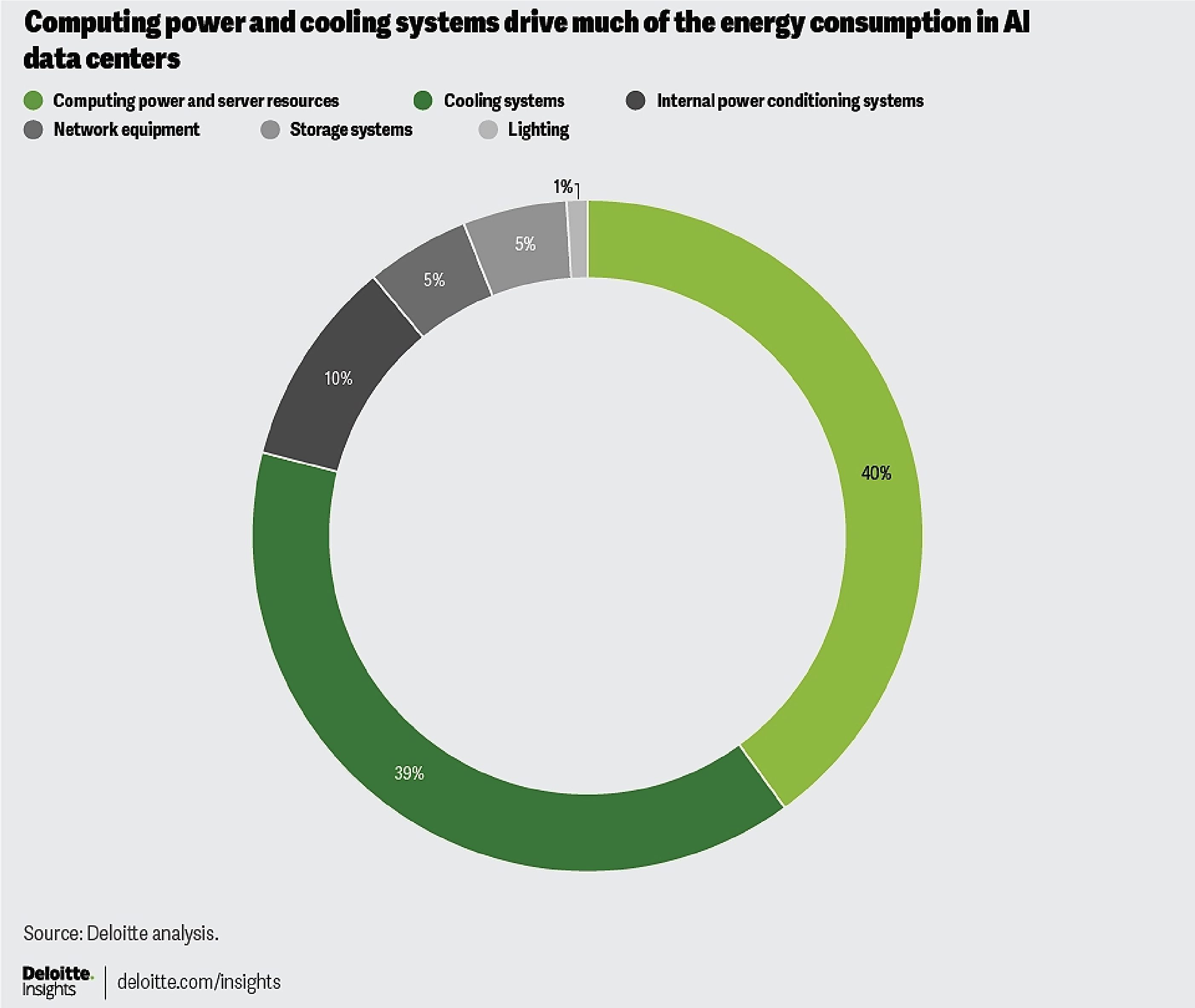
Data centers are among the most energy-intensive buildings, using as much as 10 to 50 times more power per square foot than a typical office, according to CCTech Group. AI (including model training) and cloud computing increase the need for energy each year.[72] In 2023, data centers used about 4.4% of all electricity in the U.S. and the Department of Energy expects them to consume 6.7% to 12% of total U.S. electricity by 2028.[73] The following graphic from McKinsey (Figure 13) presents a forecasted demand for power.[74]

Figure 13



Approximately 50% (or more) of the electric power demand of data centers is from the operation of electronic IT equipment; most of the rest is for cooling.[75] Deloitte provided a breakdown showing the areas driving energy consumption in AI data centers specifically. (See Figure 14.)[76]

Figure 14



As more data centers are built, and the amount of power needed increases, the existing power supply is being challenged. Many utilities that support areas with clusters of centers, such as Northern Virginia and Santa Clara, "haven't been able to build out transmission infrastructure quickly enough, and there is concern that at some stage they may be unable to generate sufficient power."[77]

In addition to the growing number of centers, the increase in their size and AI applications has expanded the need for energy. McKinsey reported that data centers have exploded in size in terms of power consumption. "Ten years ago, a 30-megawatt (MW) center was considered large. Today, a 200-MW facility is considered normal." Further, the computing power needed by AI-ready data centers increases their energy needs:

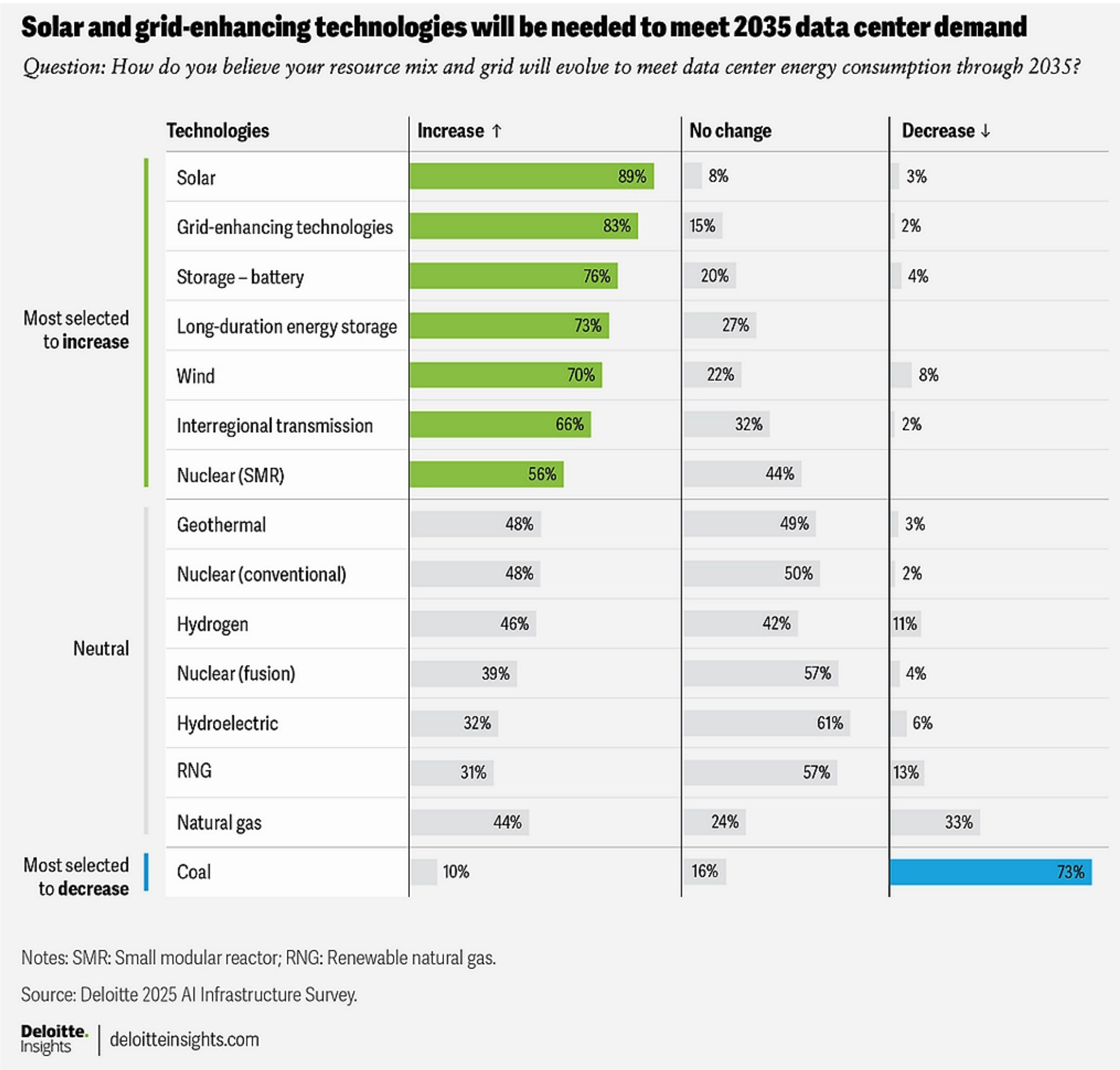
> All data centers consume significant amounts of energy, but AI-ready ones are especially demanding because of their high average power densities—the energy consumption of servers in the racks. Average power densities have more than doubled in just two years, to 17 kilowatts (kW) per rack, from eight kW, and are expected to rise to as high as 30 kW by 2027 as AI workloads increase. Training models like ChatGPT can consume more than 80 kW per rack, while Nvidia's latest chip, the GB200, combined with its servers, may require rack densities of up to 120 kW.[78]

Alternative Energy Sources

There is potential for using alternative sources of energy to power data centers going forward. Goldman Sachs interviews with renewable developers indicated "that wind and solar could serve roughly 80% of a data center's power demand if paired with storage, but some sort of baseload generation is needed to meet the 24/7 demand." It was further noted that nuclear is the preferred option for baseload power, but the difficulty of building new nuclear plants means that natural gas and renewables are more realistic short-term solutions.

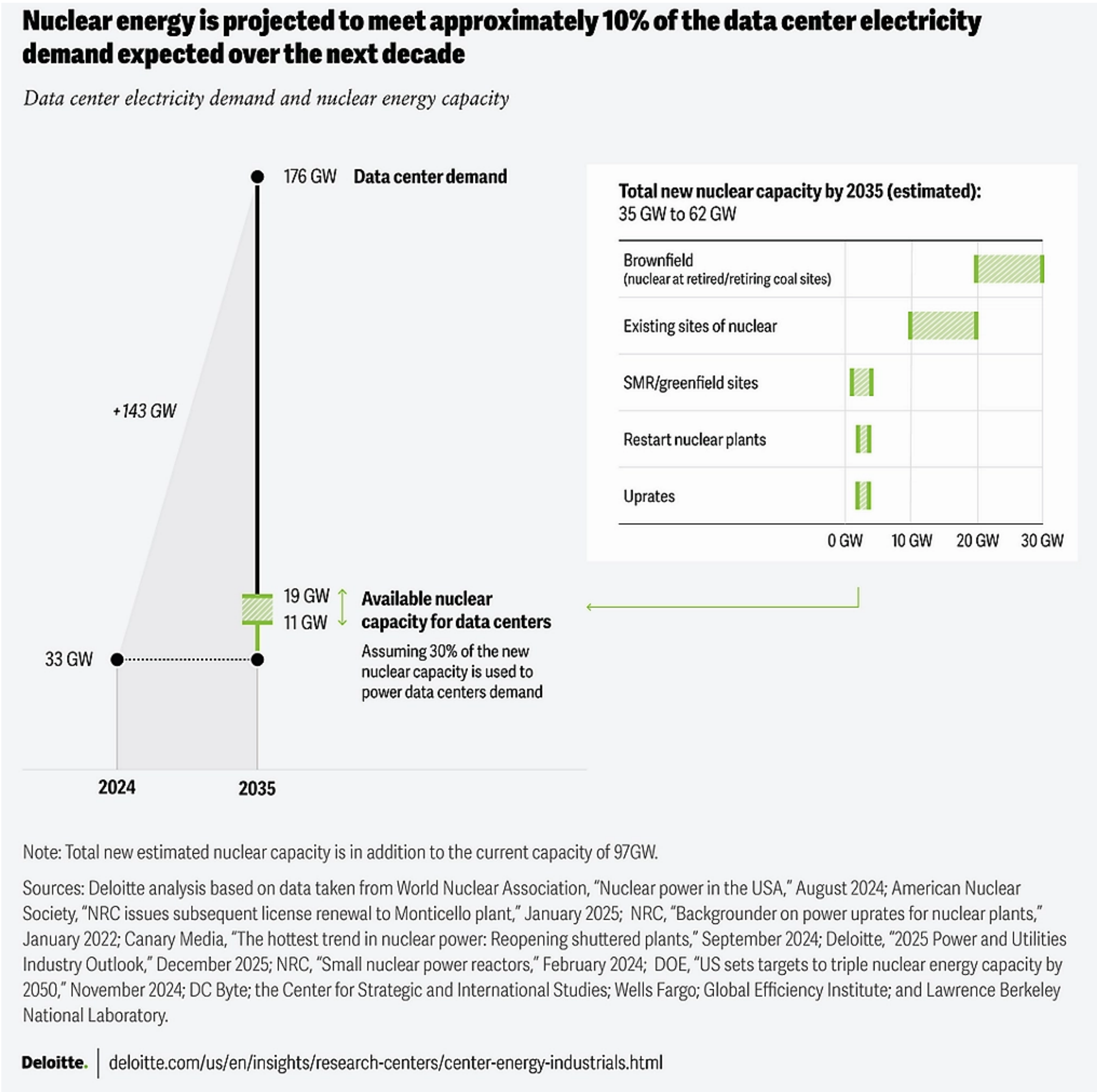
Deloitte, in their 2025 AI Infrastructure Survey, asked about grid-enhancing technologies that will be needed going forward. Figure 15 presents the results:[79]

Figure 15



In an April 2025 analysis, Deloitte presented a scenario projecting that nuclear energy is projected to meet approximately 10% of the data center electricity demand expected over the next decade. (See Figure 16.)[80]

Figure 16



Both nuclear facilities and renewables/green energy sources are receiving investment from AI providers. "In the U.S. alone, big tech companies have signed new contracts for more than 10 GW of possible new nuclear capacity in the last year, and Goldman Sachs Research sees potential for three plants to be brought online by 2030." The firm expects that by the 2030s, new nuclear energy facilities and developments in AI could start to bring down the overall carbon footprint of AI data centers. Goldman Sachs also forecasted that 40% of the new capacity built to support increased power demand from data centers will be renewables.[81]

IDC summarized the importance of energy efficiency:

> Prioritizing energy efficiency in data centers is no longer just a matter of environmental responsibility—it's essential for sound data center financial management. As the demand for digital services, AI, and cloud computing continues to soar, the pressure on organizations to minimize their carbon footprint while managing rising electricity costs will only intensify. By taking action now—investing in more energy-efficient technologies and optimizing operations—organizations can reduce their environmental impact and significantly cut operating expenses, their top two priorities.[82]

Virtual Power Plants

Virtual power plants (VPPs) "leverage digital connectivity, software, and AI to aggregate and manage distributed energy resources (DERs), such as solar, wind, energy storage, and more. This integration enables DERs to function as a unified, flexible power plant, addressing key challenges in the modern energy system via the integration into energy markets." According to Energy Central, "data centers are very good VPP candidates and can significantly enhance their energy strategy and contribute to a more sustainable grid by participating in VPPs."[83]

> Here's how:
>
> - **Optimized Energy Use:** VPPs enable data centers to leverage real-time market fluctuations. By shifting energy use to off-peak hours when electricity is cheaper, they can significantly reduce their energy bills.
> - **Grid Stability and Renewables Integration:** VPPs aggregate distributed energy resources like renewables. Data centers, with their significant and flexible energy demand, can help stabilize the grid by integrating more renewable energy sources.
> - **New Revenue Streams:** VPPs can unlock new revenue streams for data centers by facilitating participation in energy markets. This can involve providing ancillary services for frequency regulation and voltage support, or actively trading electricity in wholesale markets (spot/day-ahead).
> - **Sustainability Boost:** Data centers participating in VPPs can significantly increase their reliance on renewable energy sources, reducing their carbon footprint and promoting a more sustainable energy future.[84]

Energy Storage

Growth in data center workload "has contributed to varying load demands, in turn, increasing the power consumption. The increased power consumption has created a necessity for the deployment of Energy Storage Devices (ESDs)."[85]

Energy storage in data centers refers to systems that store electrical or thermal energy on-site to ensure reliable power delivery, improve efficiency, lower costs, and enable greater use of renewable energy. Common forms of energy storage include battery energy storage systems (BESS) and thermal energy storage (TES). Data centers may also utilize other technologies such as flywheels.

Delfos Energy provides a description of BESS:

> A Battery Energy Storage System (BESS) in a data center is essentially a large battery backup system that stores electricity and provides power when needed. It usually consists of many battery modules (often lithium-ion), inverter/charger units, and control software. In data centers, BESS are used as a fast-responding power source to keep servers running during any grid outages or disturbances – like a giant UPS. They can also be used for energy management (charging when power is cheap, discharging to support the load at expensive times). Unlike a traditional diesel generator, a BESS provides instant, seamless power without fuel and can operate quietly with no on-site emissions.[86]

Thermal energy storage systems are involved in both cooling and energy storage:

> Thermal energy storage systems for cooling remove heat from the storage material, lowering its temperature or changing its phase, during off-peak periods (often when electricity is cheaper or greener) and hold it to assist in cooling during peak demand times. TES can take several forms: chilled water tanks, ice storage systems, phase-change materials (PCMs), and even ground-coupled. Instead of running chillers or compressors at full capacity during hot afternoons — the most expensive and grid-stressed periods — a data center equipped with TES can shift some or all its cooling load to periods of lower demand. This “load shifting” capability helps balance energy supply and demand, reducing operational costs, enhancing grid stability, and potentially decreasing carbon footprint.[87]

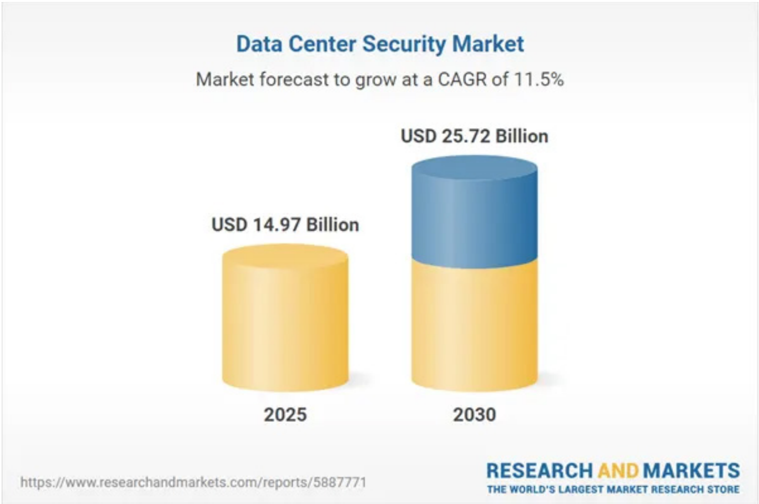
Flywheels can provide energy storage for data centers, supporting uninterruptible power supplies (UPS) and grid stabilization. According to EE Power, a flywheel system stores energy mechanically in the form of kinetic energy by spinning a mass at high speed. “Electrical inputs spin the flywheel rotor and keep it spinning until called upon to release the stored energy. The amount of energy available and its duration is controlled by the mass and speed of the flywheel.”[88]

The global data center energy storage market size is estimated to reach $2.67 bilion by 2030, registering a CAGR of 9.5% from 2025 to 2030, according to a June 2025 report by Grand View Research.[89]

Security

Security and protection of data is a key area of focus and concern in this vertical. According to one estimate, the global data center security market grew from $13.41 billion in 2024 to $14.97 billion in 2025 and is expected to continue growing at a CAGR of 11.46%. (See Figure 17.)[90]

Figure 17



Deloitte summarizes some of the threats faced by data centers:

> As AI capabilities grow, data centers should be secured against hackers who could subvert an AI model by gaining access to its weights, which govern model training and output. AI data centers can be especially vulnerable to supply chain attacks. Points of entry for cyber infringement can include servers, storage systems, cooling equipment, network gear, and other digital equipment that are shipped from multiple countries. Security of power supply is another concern for data center operators, as back-up generators have limited capacity.[91]

These challenges are compounded by the fact that companies and organizations are increasingly storing data off-site at non-company facilities. EY makes the point that while physical security is typically handled by a dedicated data center facility function, using sophisticated modern surveillance and authentication technology to prevent unauthorized entrance, securing the data logically is a different story.[92]

Data centers invest heavily to protect against external threats. “State-of-the-art firewalls, AI-powered tools that provide real-time insights into dangerous network traffic, built-in resiliency and redundancy, and other technologies give data center operators unprecedented control over malicious attacks, yet companies are still losing data.”[93] Examples of these security technologies include intelligent video surveillance, biometrics, AI-powered analytics, and predictive monitoring systems.[94]

However, data theft can originate internally as well. EY recommends that to better protect their data, data centers “should consider a zero-trust strategy, including strict access controls, network segmentation and analytics to identify threats. Beyond tech and strategies, ongoing collaboration between cybersecurity and IT teams is crucial for effective data protection.”[95]

Real Estate

CBRE expects the data center real estate market to struggle to keep pace with demand. This will lead to higher utilization rates in existing facilities and tighter vacancy rates. It is expected that there will be increased competition for land and resources to build new data centers.[96]

Wall Street is taking an interest in this area. According to a datacenters.com piece from September 2025, a surprising new asset class is dominating institutional portfolios: data center real estate:

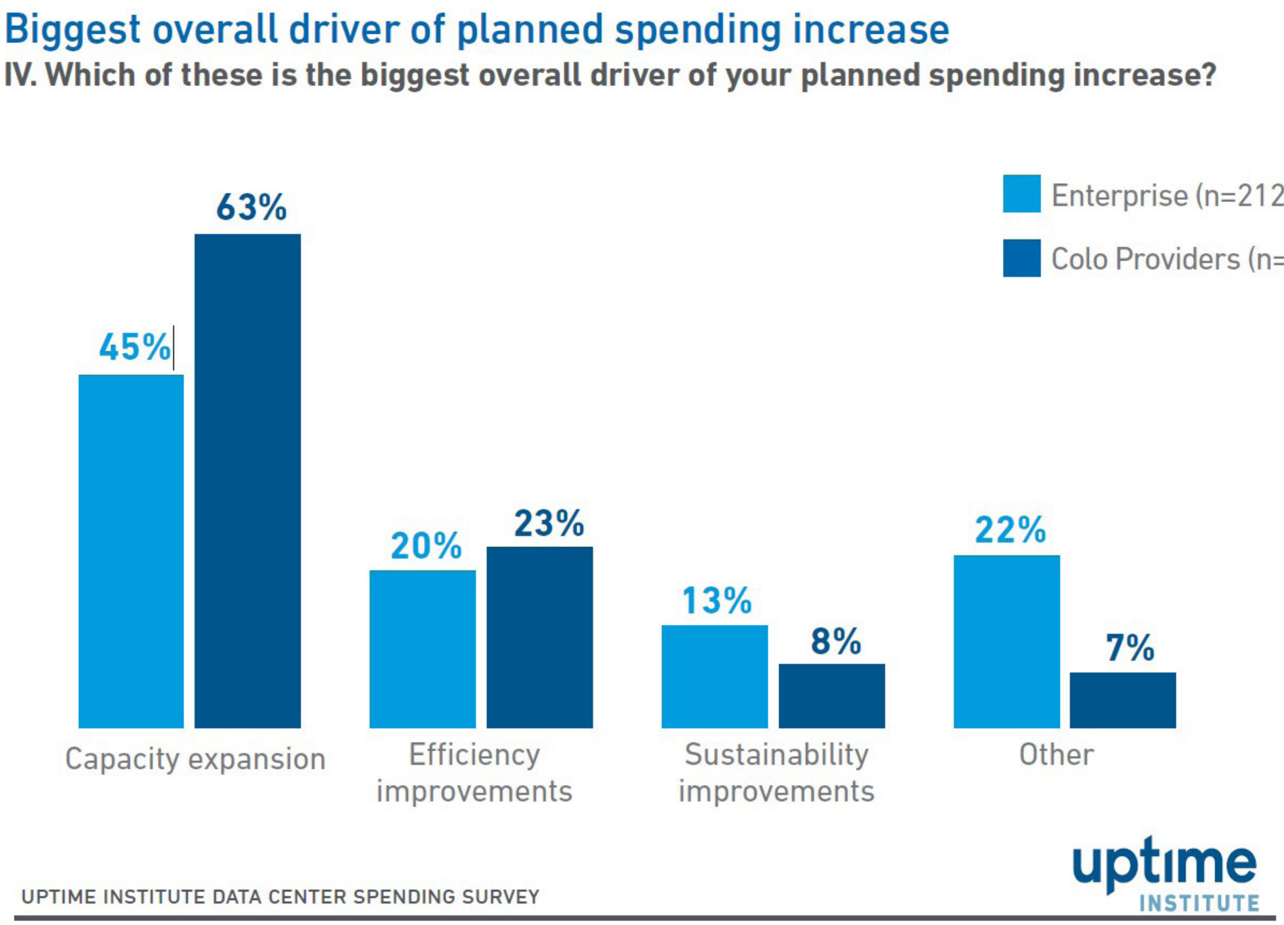
> Once considered a niche investment for specialized REITs and infrastructure funds, data centers are now attracting mainstream attention from private equity giants, sovereign wealth funds, and even pension managers…Prime data center real estate is hard to come by. Power availability, fiber density, zoning, and environmental clearance all restrict new developments. That scarcity creates defensible moats—precisely what investors seek.[97]

Predictable cash flows are a factor making data centers attractive to investors. “Leases in the data center industry are typically long-term (10–15 years) with annual escalators. This provides stable, predictable income—a key requirement for institutions managing risk-averse capital from pension and sovereign wealth funds. In addition, the credit quality of tenants—hyperscalers like AWS, Microsoft, and Google—is often AAA-rated, reducing vacancy and default risk.”[98]

Planned Data Center Spending

The Uptime Institute conducted a survey between October 9, 2024, and November 14, 2024, regarding planned budget allocations. There were 453 data center owner/operator respondents (globally). The graphic in Figures 18 depict findings regarding spending plans.[99]

Figure 18


Biggest overall driver of planned spending increase
IV. Which of these is the biggest overall driver of your planned spending increase?
Enterprise (n=212)
Colo Providers (n=64)
45%
63%
20%
23%
13%
8%
22%
7%
Capacity expansion
Efficiency improvements
Sustainability improvements
Other
UPTIME INSTITUTE DATA CENTER SPENDING SURVEY
uptime INSTITUTE

Trends Impacting Equipment Finance

Data centers are extremely capital intensive with costs ranging from $200 million for smaller facilities to well over $1 billion.[100] It has been reported that data center financings in the U.S. were $30 billion in 2024 and could reach $60 billion in 2025.[101]

How data centers are financed

There are a variety of options identified by EY for financing construction and new data centers:

- YieldCo/DevCo - which recycles capital through the sale of stabilized (leased) assets — build one, sell one and repeat
- Public funding/IPO
- Private funding
- Joint ventures[102]

According to EY, even the largest players are seeking alternative financing strategies. EY believes that there is growing awareness that public markets will need to be involved in funding future development.[103]

Traditional data center financing can take a bundled approach, combining "property acquisition and construction costs with equipment purchasing or leasing into a single loan." However, as TD Commercial Banking explained in a blog, "the cost of IT equipment—from the racks of servers to the sophisticated networking systems—far exceeds the price of land and construction. For that reason, it can be advantageous to separate the two":

> "It really does make sense to carve out the equipment financing side of the data center from the real estate side," said Carl Boccuti, Senior Vice President for TD Equipment Finance. "Handling them individually can give you significant savings."
>
> Commercial banks can often offer much lower interest rates for equipment financing versus real estate financing. With millions of dollars in financing involved, even a small reduction in the interest rate can lead to substantial savings over the life of the equipment lease or loan.
>
> "Whether the company is using a third party to develop the data center or doing it themselves, they can get better interest rates by segregating the equipment and real estate," Boccuti said. "If you're still doing turnkey data center financing, you're probably paying more than you need to be."[104]

Equipment Financing

There are a variety of options for data center equipment financing including traditional loans (through financial institutions or hardware manufacturers), leasing, and subscription models.

Subscription financing options for data center equipment can be offered through hardware-as-a-service (HaaS) models, which allow operators to lease or subscribe to physical IT hardware rather than purchasing it outright. "Under this model, businesses pay a fixed, recurring fee, shifting costs from Capital Expenditure (CapEx) to Operating Expenditure (OpEx). The hardware remains the property of the service provider, who is responsible for its installation, performance, and disposal. This eliminates the need for significant upfront investments while ensuring businesses always have reliable and up-to-date technology."[105] There are some challenges with this model:

> Despite its benefits, the HaaS model presents a few challenges that businesses need to consider. Organizations relying on service providers for hardware uptime, maintenance, and updates may face operational disruptions if vendors fail to deliver. Additionally, long-term contracts can include restrictive terms, making it challenging for companies to exit or adjust agreements to fit evolving needs. Data security is another critical concern.[106]

The rise of artificial intelligence (AI) and machine learning (ML) is creating considerable opportunities for equipment finance companies. A Monitor Daily article makes the point that equipment finance companies that offer leasing and flexible payment options can help support the growing data center infrastructure:

> As AI adoption accelerates, businesses require flexible, cost-effective financing solutions to deploy and scale their AI infrastructure. Equipment finance companies that embrace AI-focused leasing strategies can capitalize on this trend, providing businesses with the necessary tools to drive innovation.
>
> By offering customized payment options, financing for AI data centers and subscription-based AI hardware and software models, equipment finance firms can position themselves as key enablers of AI-driven transformation. The demand for AI infrastructure will continue to grow, and those financing companies that adapt to this rapidly evolving market will stand to benefit the most.[107]

Financing decision makers

A variety of stakeholders can play a role in equipment purchasing and financing decisions in data centers. These include executive leadership (CEO/CIO,CFO), accounting teams, legal teams, technical teams (IT infrastructure/operations), facilities/engineering teams (power, cooling), and procurement/sourcing teams.

The stakeholders involved in data center financing decisions are changing. According to S&P real estate funds and other property investors have been entering the data center sector and expanding their presence.[108]

CBRE's surveyed 92 major investors* worldwide (84% based in the U.S.) to gain insight into their data center investor intentions, finding that investors were showing greater risk tolerance for data centers. Some insights from this early 2025 research[109]:

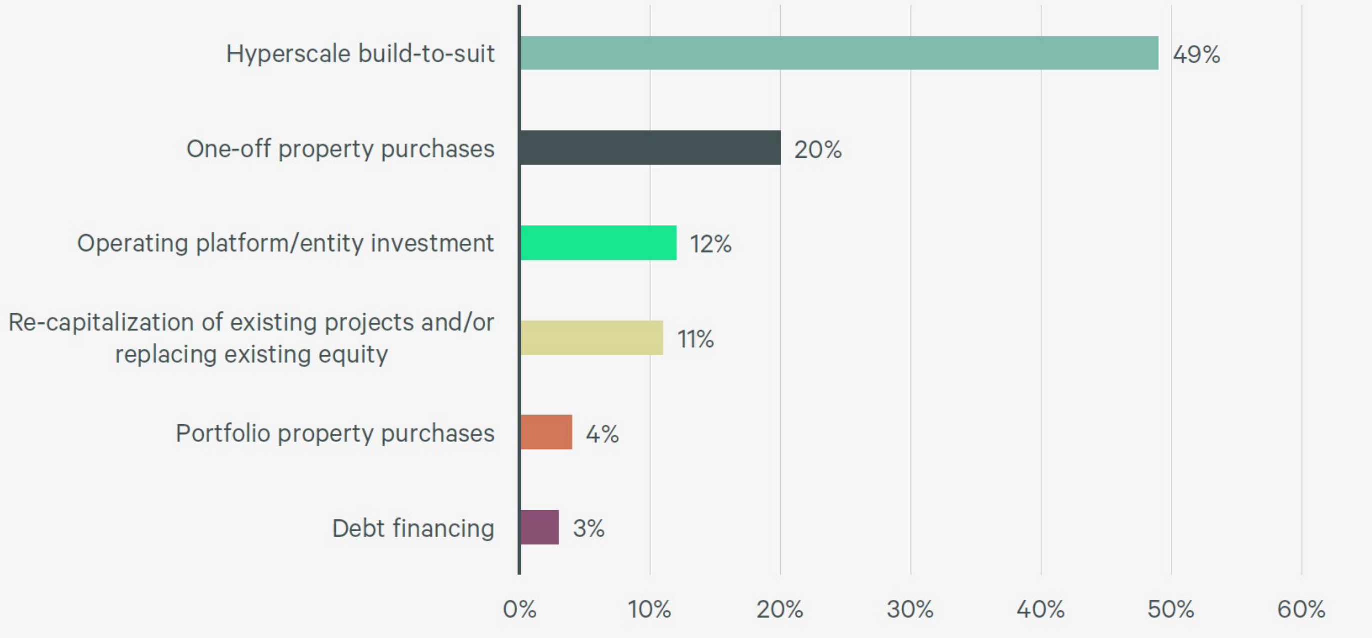
- 95% of survey respondents plan to increase their data center investments this year.
- 2024's top investor concern was the cost and availability of debt, cited by 59% of survey respondents.
- In 2025, debt availability was cited as the top concern by just 10% respondents, eclipsed by 39% citing regulations and power availability.
- Investors expressed confidence in the sector's pricing resilience despite broader market volatility.

Financing opportunities

The CBRE survey asked about investment opportunities and found that hyperscale build-to-suits were seen as offering the greatest opportunity for data center investment. (Figure 19.)

Figure 19

Where do you see the greatest opportunity for data center investment over the next 12 to 24 months?



Source: 2025 Global Data Center Investor Intentions Survey.

*Professionals within the digital infrastructure industry were surveyed. These included investors, developers, investment managers and operators, with over one out of four (27%) respondents directly involved in operating, developing, or owning a colocation facility.

Looking at equipment opportunities, AI is a key driver increasing the need for "data centers with enhanced energy efficiency and high-capacity processing capabilities." This will create opportunities for equipment leasing companies, according to a Monitor Daily article:

As data centers evolve to serve the needs of more power-intensive AI computing equipment, and as limited power supply and sustainability concerns weigh on the race to meet sharply rising demand, equipment finance leaders should consider additional areas of opportunity the data center boom presents.[110]

The article goes on to list areas of opportunity:

Power Infrastructure and Energy Efficiency Solutions

- Financing for AI-specific power solutions, including liquid cooling systems and energy-efficient data center infrastructure
- Lease-to-own agreements for backup power systems, such as uninterruptible power supplies (UPS) and AI-driven energy management software
- Green energy financing for AI data centers adopting renewable energy sources, including solar and battery storage solutions

Scalable Storage and Networking Equipment

- Leasing agreements for high-capacity storage systems, including all-flash arrays and distributed cloud storage
- Financing for AI-driven networking hardware, such as high-bandwidth switches, optical interconnects and AI-optimized data pipelines

- Payment structures that align with data-center expansion and technology refresh cycles

AI-Specific Data Center Construction and Expansion

- Equipment financing for modular and prefabricated data centers designed for rapid deployment
- Capital investment in hyperscale data centers focused on AI processing and ML model training
- Partnerships with AI-focused cloud providers and enterprises to offer custom financing solutions for dedicated AI computing environments.[111]

Conclusion

It is widely believed that "the United States is in the midst of an unprecedented AI infrastructure buildout." This is supported by reported spending data. The Center for Strategic & International Studies noted that Google, Amazon, Meta, and Microsoft collectively plan to spend over $350 billion on AI-related data centers in 2025 alone. Morgan Stanley projected the total AI buildout could cost up to $3 trillion over the next three years.[112]

Along with this growth will come many decisions to be made. The vertical will need to navigate both opportunities and challenges. including rapidly evolving technology, governmental policies, and environmental factors.

The risk-reward of building a data center will need to be weighed against the cost of ongoing operations. In other words, the strategy for those involved in data centers (and those supporting them) will need to balance large, upfront capital expenditures (CapEx) for building and equipping facilities with ongoing operational expenditures (OpEx) for running them. There will be an increasing need for equipment-related investments in such areas as cooling, energy storage and sustainability initiatives.

For financial stakeholders specifically, it will be critical to assess how long-term revenue aligns with escalating infrastructure costs. They will need to be attentive to regulatory shifts, especially those related to energy usage, emissions, and land use, all of which could have an impact on project feasibility and valuation. Investors should also understand the refresh cycles and potential innovations for equipment such as servers and network hardware.

In the face of these challenges, the data center market remains fiercely competitive for prospective investors. However, a profound understanding of the underlying costs is imperative for anyone venturing into this realm, and to optimize returns on data center management investments, executives need to meticulously gauge both CapEx and OpEx expenditures.[113]

About Big Village

A Bright Mountain company, Big Village is a global advertising, technology, and insights company. Our global market research insights business uncovers not just the ‘what’ but the ‘why’ behind customer behavior and trends, unlocking better data and supporting clients’ insights needs with agile tools, branding, product innovation, data & analytics, and more. Big Village secondary research analysts integrate human insight, authoritative published content, and technology to deliver insightful business decision support. Our analysts leverage continuously improving sources that integrate text analytics, AI, and other technologies to deliver cost-effective insights into consumers, B2B customers, markets, competitors, and trends.

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