DATA CENTRES & THE POWER CHALLENGE

December 2025

Executive Summary

As global AI infrastructure investment accelerates, data centres are emerging beyond mere IT infrastructure to become core real assets that bridge the power industry and the real estate market simultaneously. With industries such as AI, cloud, streaming, gaming, and retail all relying on data processing and storage capabilities, data centres have become the office buildings of the digital era.

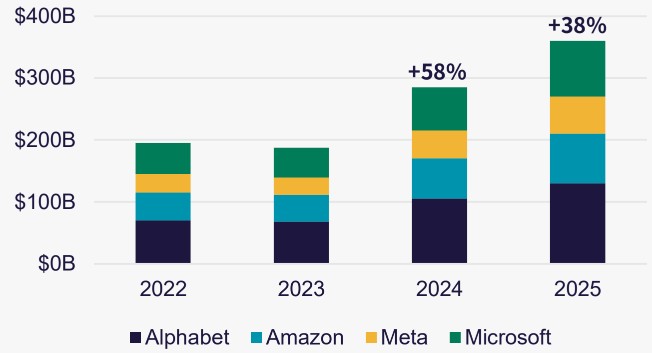
Rising demand for AI model training and inference has driven growth in large, high-performance data centres. Hyperscalers and cloud service providers aggressively ramped up capital expenditures, fueling rapid industry growth in 2024. Existing demand drivers such as cloud computing, data storage, and generation have also remained steady, serving as key drivers for digital infrastructure expansion. As a result, global data centre operational capacity reached approximately 49 GW in the first half of 2025.

As data centre demand has surged, development has shifted mainly from end-users, telecommunications company, and IT operators to global asset managers and infrastructure investors such as Blackstone, BlackRock, and Brookfield. As institutional investors take on a more active role in direct development, data centres are shifting in perception from traditional operational assets to investment-grade real estate. The share of institutional investors in Korea's data centre market, which was only 3% in 2015, is projected to increase to 13% in early 2025 and reach 27% in the future.

- **Blackstone** acquired Air Trunk, a hyperscale data centre operator in the APAC region, as part of its strategy to become a leading investor in digital infrastructure across the APAC region.
- **Brookfield AMC**'s infrastructure division owns DCI, which focuses on developing and operating hyperscale data centres across the APAC region.
- **EQT Infrastructure** acquired EdgeConneX, an operator of edge and hyperscale data centres, which currently operates over 80 data centres across more than 50 markets worldwide.

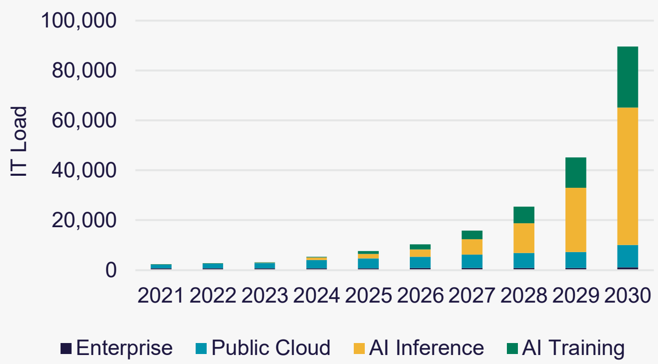
With the rapid expansion of data centres, global markets are facing structural constraints from power supply bottlenecks and the burden of electricity costs, as AI-related energy demand is concentrated in large cloud

Forecasted Hyperscale Spending



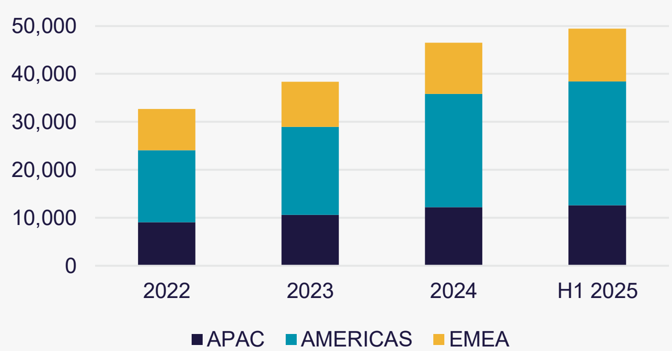
Source: Cushman & Wakefield Research, WSJ, Visible Alpha, company data

Global Colocation Demand : AI vs NON-AI (MW)



Source: Cushman & Wakefield Research, Structure Research

Global Data Center IT Load Evolution (MW)



Source: Cushman & Wakefield Research, DC Byte

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land hyperscale data centres. While conventional data centres typically require 10 to 25MW, AI data centres demand 200 to 400MW per site. High-density GPU clusters for AI workloads sharply increase cooling needs, with energy consumption per unit area over 50 times that of standard industrial facilities. Consequently, major markets, including Korea, face constraints on new supply due to grid limitations, transmission capacity saturation, and stricter permitting. Securing power has emerged as a key factor in data centre site selection.

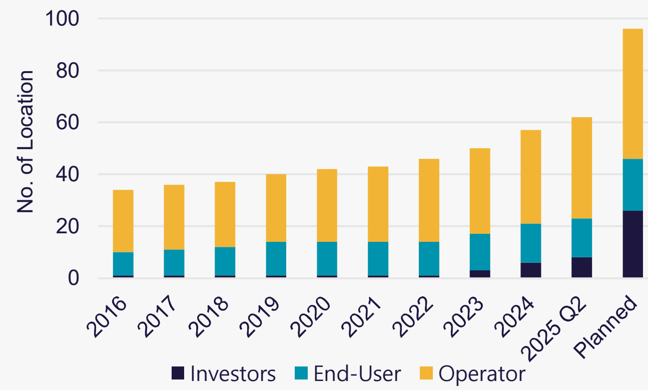
Global Market Overview

U.S. data centre electricity consumption, which accounts for the largest share of global data centre operational capacity, held around 60 TWh from 2014 to 2016, then surged to 76 TWh (1.9% of total U.S. electricity) in 2018 and 176 TWh (4.4% of total U.S. electricity) in 2023. It is projected to reach up to 580 TWh (12% total U.S. electricity) by 2028. Global trend in power usage is similar: data centres consumed 415 TWh in 2024 (1.5% of global electricity), with an average annual growth of 12% over the past five years. Consumption is expected to hit 945 TWh by 2030 and exceed 1,200 TWh by 2035.

In major data centre hub markets such as the U.S., Japan, and Singapore, surging power demand is causing power connection bottlenecks. As a result, operators are diversifying into areas with sufficient grid capacity, leading to a reorganization of data centre clusters that were previously concentrated in specific regions.

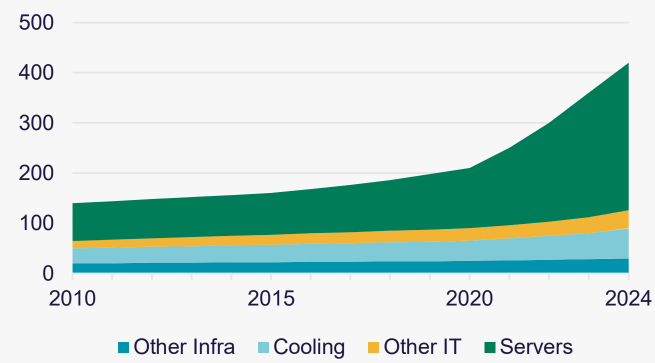
- Though Northern Virginia, including Ashburn, is the world's largest data centre hub, prolonged permitting delays and power supply bottlenecks since 2022 have led some new projects to relocate to other states such as Austin, Iowa, and Atlanta.
- From 2019 to 2022, Singapore imposed a moratorium on new data centre applications due to power and land resource constraints, along with sustainability concerns. This resulted in hyperscaler demand, which requires massive power and land, shifting to Johor (Malaysia).
- In Tokyo, Japan, the lead time for power grid interconnection (transmission network) has increased to over five years, and costs have risen, prompting major operators to consider alternative sites in outlying areas such as Nagano and Hokkaido.

Evolution of Data Centre Investor Composition



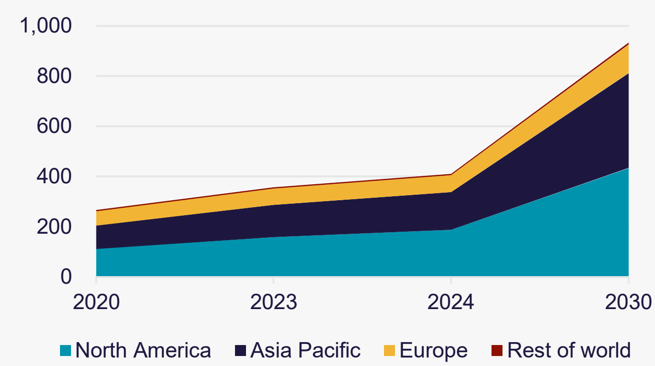
Source: Cushman & Wakefield Research, DC Byte

Total Data Centre Electricity Consumption by equipment (TWh)



Source: IEA, Energy & AI, 2025

Global Electricity consumption (TWh)



Source: IEA, Energy & AI, 2025

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Korea Market Context

Korea is classified as an "Emerging Data Centre Market" in the APAC region, with a current operational capacity of approximately 725MW. However, the market is highly regarded for its future growth potential, as the pipeline in the planning stage reaches 1.2GW.

While Korea's current operational capacity stands at around 70% of Singapore's, a key hub in the APAC region, the completion of planned projects is expected to expand Korea's data centre operating capacity beyond Singapore's.

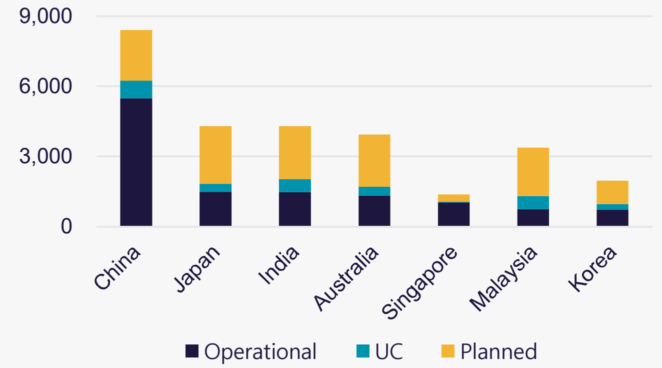
Despite strong growth, the Korean data centre market exhibits structural characteristics of location concentration and power infrastructure constraints, with around 75% of existing operating capacity and 68% of new projects concentrated in the Greater Seoul Area(Seoul, Gyeonggi, Incheon). However, the GSA’s power self-sufficiency rate stands at 66% (compared with the national average of 108%), indicating a strong dependence on external transmission networks. Seoul’s self-sufficiency rate is only 11.6%, the lowest in the country. This imbalance in power infrastructure is emerging as a key risk for future data centre development, likely impacting market structure due to limitations of available sites and the time required for power allocation.

According to the Ministry of Trade, Industry and Energy's 11th Basic Power Supply Plan, data centre power requests submitted to Korea Electric Power Corporation(KEPCO) increased from 906 MW in 2023 to 7,343 MW by 2027, approximately an eightfold increase. However, the available power supply is less than half of this demand. As data centre power consumption is expected to grow from 5.0 TWh in 2023 to 15.5 TWh by 2038, power shortages and resulting bottlenecks are likely to persist.

To mitigate the burden on the power grid caused by an excessive concentration of data centres in the GSA, the government enacted the *'Distributed Energy Activation Special Act*', encouraging relocation to regions with ample grid capacity. Under this law, facilities consuming over 10 MW must undergo a 'Power Grid Impact Assessment'. As a result, major data centre developers are increasingly considering regional sites with a stable power supply. Additionally, the requirement to submit a separate power supply plan when applying for power use has extended the average permitting period to over two to three years, further driving location diversification.

Top APAC Markets by Operational IT Load (MW)

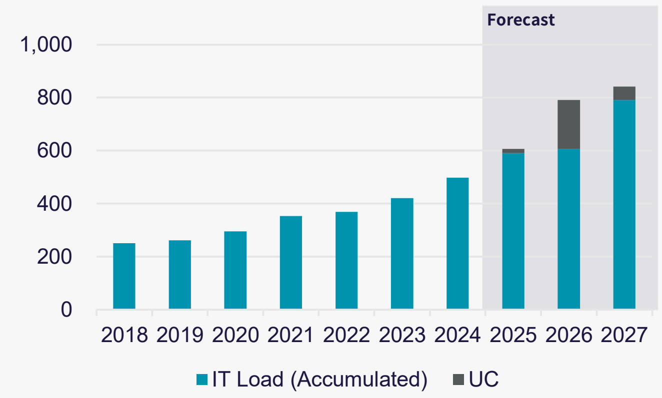
Comparison of the Top Seven Countries



Source: Cushman & Wakefield Research, DC Byte

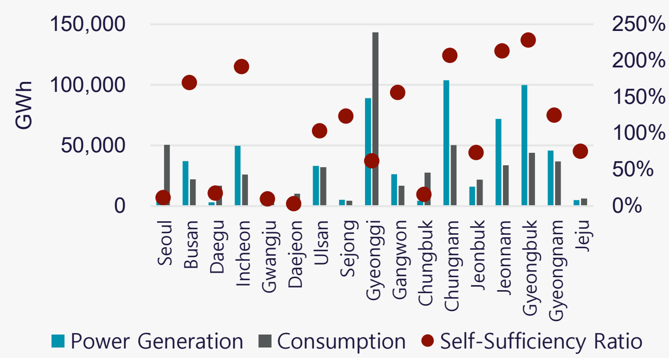
Data Centre IT Load Evolution in the GSA (MW)

Based on completed construction and commencement filings



Source: Cushman & Wakefield Research, DC Byte

Power Self-Sufficiency Ratio by Region



Source: KEPCO, The Monthly Report on Major Electric Power Statistics, 2024.12

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Non-GSA Data Centre Project Cases

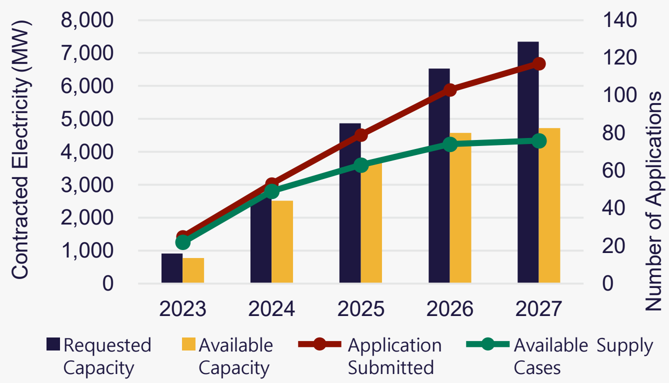
Project Name	Lead / Partners	Location	Scales and Key Specs	Site Characteristics / Remarks
Gyeongbuk Yecheon AI Cloud Data Centre	KT Cloud (Public-Private Partnership)	Gyeongbuk Yecheon	• An approximately KRW 110bn investment • Power Capacity 10MW, IT Load 6MW	• Korea's first Public-Private Partnership (PPP) Model • Compliance with the regional distributed data centre policy
Haenam SolaSeado AI Data Centre	Samsung SDS Consortium	Jeonnam Haenam (Planned)	• A scale over approximately KRW 2.5tn • Goal to secure 15,000 GPUs by 2028 → 50,000 GPUs by 2030	• Advantages of renewable energy infra + easy access to cooling water • expectation of the region becoming an AI hub
Ulsan AI Data Centre (SK-AWS)	SK Telecom + AWS	Ulsan Mipo National Industrial Park	• Multi-trillion KRW-scale investment • In a 100MW-class facility, about 60,000 GPUs are planned	• A manufacturing-based city + stable power grid + proximity to the industrial park • Review for future 1 GW-scale expansion
Jeonnam AI Data Centre (OpenAI-SK)	OpenAI + SK Group	Jeonnam Haenam (Planned)	• Projected investment over tens of trillions of KRW • In a 20MW-class facility, about 10,000 GPUs are planned	• Global AI company participation • Anticipation for local talent development and ecosystem building

Source: Cushman & Wakefield Research, media reports, and publicly available company disclosures

Moreover, the 'Notice on Direct Power Trading in Distributed Energy Special Zone,' implemented in June 2024, allows distributed energy business operators within distributed areas to supply electricity directly to power users without going through a power market intermediation. This allows power users to build supply infrastructure linked to their own power sources, mitigating some risks associated with existing transmission and distribution grid saturation issues. This, in turn, is expected to change future data centre location strategies and power procurement structures.

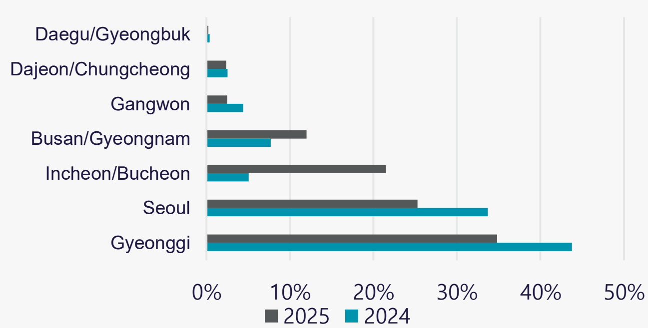
The colocation data centre pipeline is also expanding beyond major clusters into regional areas. While the Seoul and Gyeonggi region accounted for 77% of the total pipeline in 2024, this share is projected to decrease to 58% in 2025, with the share distributed across the Incheon·Bucheon and Busan·Gyeongnam regions. Although Incheon has relatively higher power independence compared to its neighbouring region, Seoul/Gyeonggi, it now faces supply constraints due to a recent surge in data centre permit applications. According to KEPCO, all 24 data centres that applied for large-scale power usage in Incheon since the power system impact assessment system was introduced in June last year have been ruled as unable to supply. Consequently, more projects are expected to explore regional areas with better power accessibility.

Data Centre Power Usage Application and Supply Plan Review Results



Source: MOTIR, KEPCO

Change in Regional Data Centre Pipeline Share



Source: Cushman & Wakefield Research, DC Byte

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Key Investment Consideration

1. **Power securing capability**: Power accessibility has emerged as a core competitive factor in the data centre industry. As power constraints intensify, sites with high power availability are becoming scarce, driving up land costs and asset value premiums.

   Data centre sites with permits in the GSA have been traded at prices ranging from 1.5 to as much as 5 times higher than comparable land in the same zoning. Over the past five years, while the general official land price in the GSA increased by only 3–5%, land for data centre development where power is secured recorded a steep land price increase averaging 30% annually. Incheon, a region recently concentrating data centre demand, showed an even higher appreciation rate of approximately 40%.

   Data centres with secured power supply had low vacancy risks and showed an upward trend in rents. In Virginia, the world's largest data centre hub, new supply has become difficult, and the pre-leasing rate* of the data centres scheduled for supply remains above 88.7%, reflecting strong demand. Between 2022 and 2025, colocation rents rose approximately 32% in Virginia, and the vacancy rate remained around 1%.

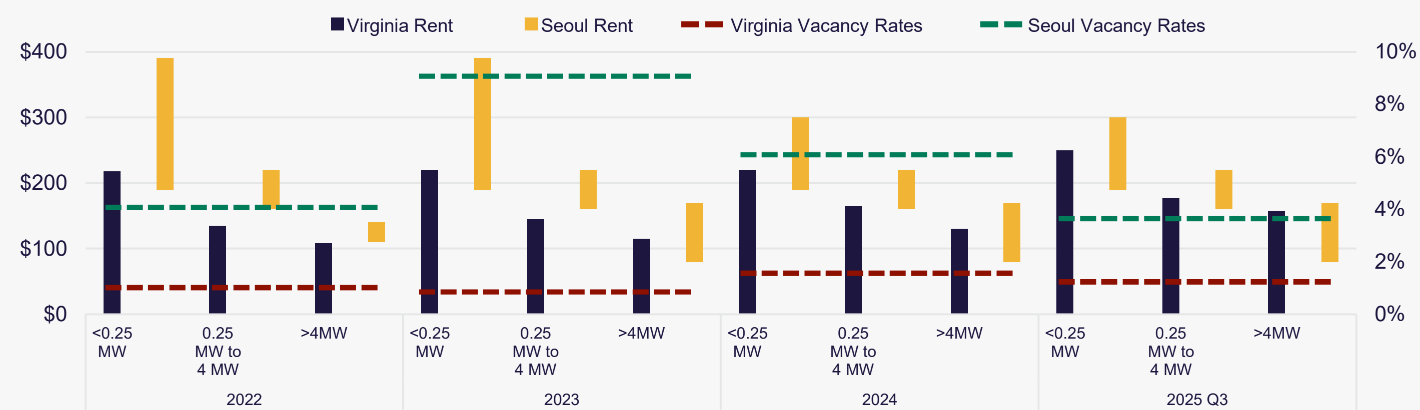
   As of Q3 2025, the GSA's data centre vacancy rate remained stable at about 3.9%. Rents, initially high due to early-stage supply shortages, have recently been adjusted to more market-realistic levels as large new capacities have been supplied. Due to this trend, while colocation rents have slightly declined (rents in the U.S. also showed a downward trend from 2013 to 2021), they are expected to recover gradually as supply shortages persist.

2. **Pre-empting alternative sites and expanding joint investment in infrastructure**: Bottlenecks in power supply are driving major changes in both data centre location strategies and investment structures. In key hubs where securing power is difficult, expansion toward areas near power plants, known as "Power-Adjacent" strategies, has emerged as a new location alternative. For example, as Virginia faces power supply constraints, Atlanta has rapidly emerged as a substitute market, with new data centre developments over 1.1 GW in scale underway. Atlanta's stable power grid and extensive fibre network enable low-latency and the development of high-bandwidth infrastructure, with a pre-leasing rate of 88.9% reflecting strong demand.

   This trend extends beyond site relocation into joint power infrastructure investments. While data centres complete in two to three years, power infrastructure requires several years of planning and construction, making grid access and load stability key factors for long-term returns. As a result, major operators are shifting to an "Infrastructure + Data Centre" project models that integrate the development of both facilities.

* Note: The average pre-leasing rate is 76% across the U.S.

Trends in Data Centre Rents and Vacancy Rates : Virginia VS Seoul



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- BlackRock, Global Infrastructure Partners, Microsoft, and MGX have launched a data centre and power infrastructure fund worth approximately USD 100bn.
- KKR and Energy Capital Partners have formed a USD 50bn integrated investment partnership to meet surging power and data centre demand driven by AI and cloud expansion. Based on an 8 GW data centre pipeline and 100 GW generation assets, the firms plan to accelerate the construction of AI training and inference infrastructure for hyperscalers.
- Brookfield is making large-scale investments across all power infrastructures, including renewables, hydro, nuclear power, and fuel cells, to meet the soaring electricity demand of the AI era. It has partnered with Microsoft to develop 10.5 GW of wind and solar power, signed an agreement with Google for the supply of 3 GW of hydro power, and secured a USD 80bn partnership with the U.S. government for a Small Modular Reactor construction project.

3. **Location differentiation for workload and energy efficiency**: As AI adoption accelerates, data centres are evolving from generic storage and compute hubs, entering a phase where workload characteristics differentiate location. Specifically, AI training and inference differ significantly in power requirements, cooling methods, and latency tolerances, which structurally differentiate the impacts on development location.

   AI training often requires over 200MW for ultra-high-density GPU clusters, positioning regional areas with ample grid capacity and scalability as prime development sites. In contrast, latency minimization is critical for AI inference, so demand for edge or mid-size data centres is rapidly expanding in areas with high user and business demand, such as the GSA. Specifically, dedicated inference infrastructure is deemed acceptable to a certain extent even within the GSA's power regulation environment due to lower power burden and higher space efficiency compared to training.

   Building on this trend, regional areas are expected to be reorganized into hyperscale learning-only campuses, and the GSA into a hub focused on inference, content, and cloud edge services.

Conclusion

The expansion of AI infrastructure has turned data centres into core real assets, combining the power industry and real estate. The influx of global capital has elevated data centres to investment-grade real estate, with value hinges on the ability to secure stable power. This suggests the future market will be reshaped around core players possessing both substantial capital and advanced energy solution capabilities.

Securing power is a core competitive edge for data centres, but it does not guarantee investment success. Risks persist from rising transmission grid expansion costs, permit and authorization delays, and grid instability, alongside high initial CAPEX and long payback periods. Particularly, project profitability can be directly affected by electricity rate volatility, policy changes like the Distributed Energy Activation Special Act, and variations in regional transmission capacity.

Due to power supply constraints and cost-efficiency issues, the future market is expected to be functionally differentiated by workload characteristics. Energy-intensive AI training infrastructure will cluster in regional bases with ample power reserves, while low-latency inference centres will be dualized to the GSA, where demand is highly concentrated. Ultimately, investment success lies not just in securing power but in the ability to propose flexible energy solutions (PPA, distributed energy linkage, liquid cooling, etc.) in line with changing policies and technology trends.

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