

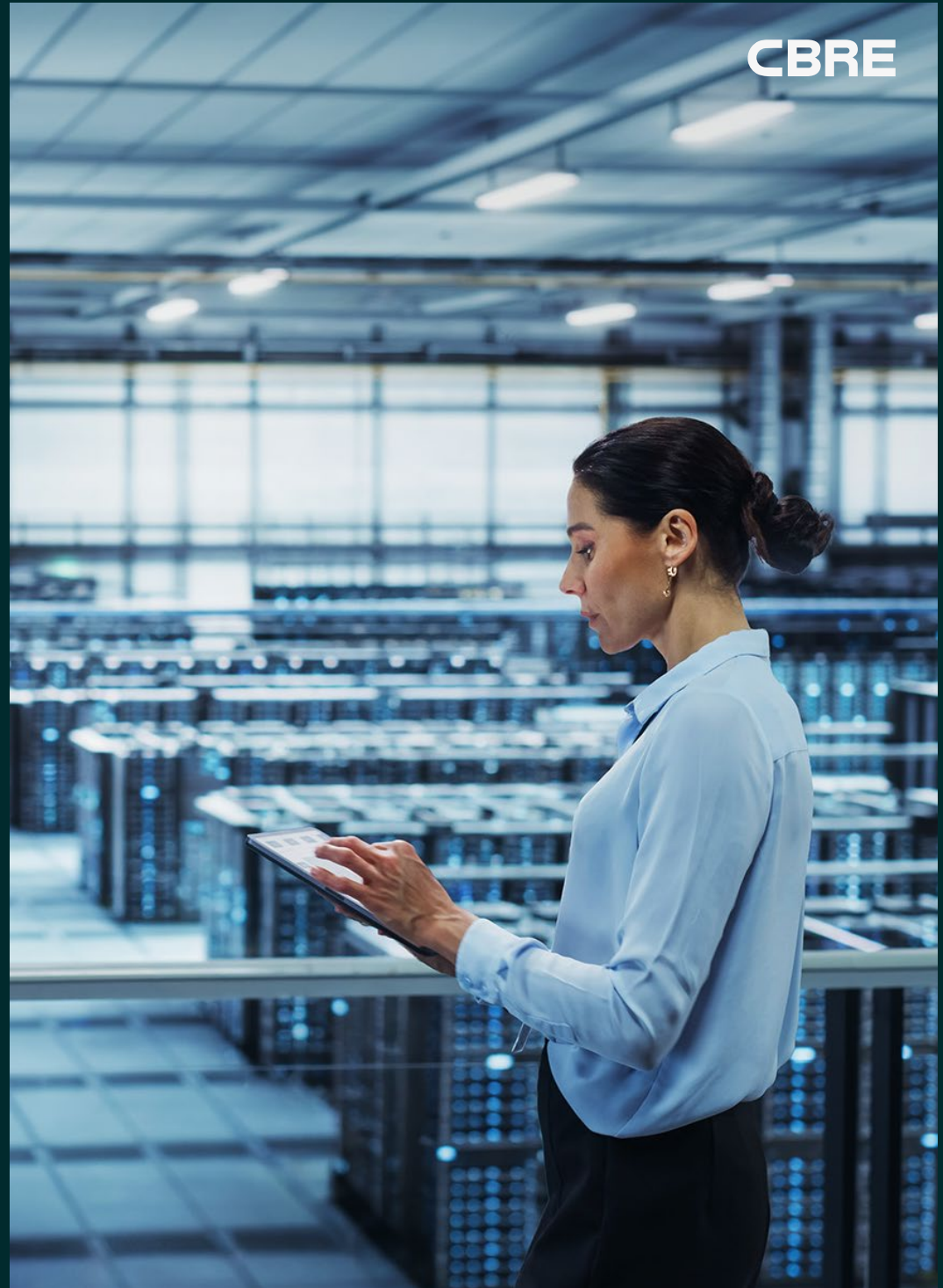
Creating Resilience

Smarter, Cleaner, Faster: The Case for Data Center Co-Generation Systems

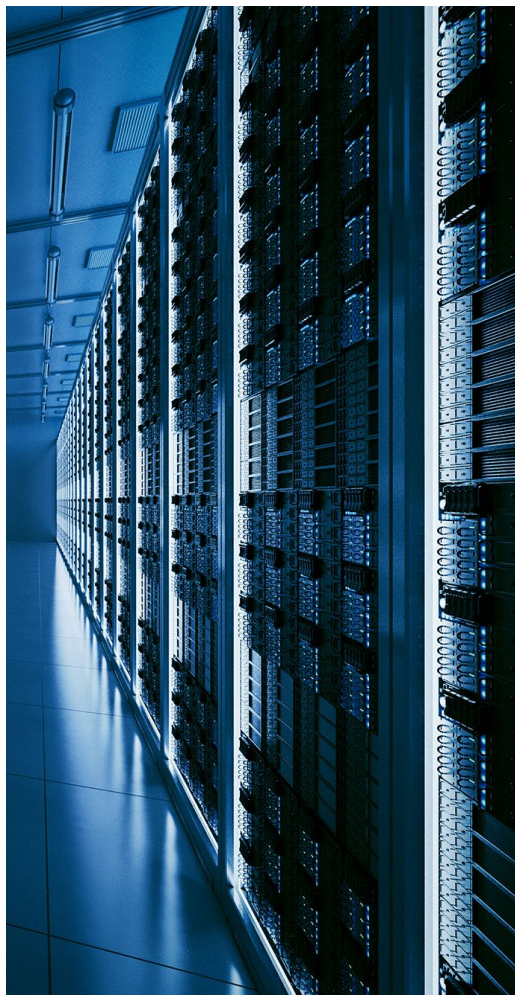
The introduction of co-generation systems to eliminate electricity wait times and improve investment efficiency

REPORT

CBRE RESEARCH
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Summary



1. The proliferation of generative AI and growing demand from cloud operators are tightening the data center supply-demand balance in Greater Tokyo. As of Q1 2026, data center occupancy stood at 94%, up 7 pp. from the 2024 figure of 87%. Numerous data center development projects are in the pipeline, with the Greater Tokyo market set to expand to 3.3x its current level.
2. As data center capacity increases, so will demand for electrical power. Maximum electricity demand from data centers in Japan is projected to reach approximately 10x its 2026 level by 2035, with the most significant surge in demand expected in Greater Tokyo.
3. Securing the super-high voltage power supply required for the establishment of a new data center takes a significant amount of time, with waits of over five years standard in Greater Tokyo, and some developments elsewhere forced to wait up to 10 years. This is due to concentrated demand in Greater Tokyo and the time required to install high-voltage power lines.
4. A solution for this issue is the implementation of Co-Generation Systems (CGS) into data center development. CGS data centers command advantages in several areas such as shorter wait times, reduced energy consumption, and lower CO₂ emissions. Challenges include additional initial costs incurred for the installation of electrical generators, and increased maintenance and management costs.
5. Self-powered data centers should offer higher project IRR levels than standard data centers connected to the power grid. CBRE expects this to act as an incentive to encourage greater investment in self-powered data centers in the coming years.

1. Data center supply-demand balance in Greater Tokyo remains extremely tight

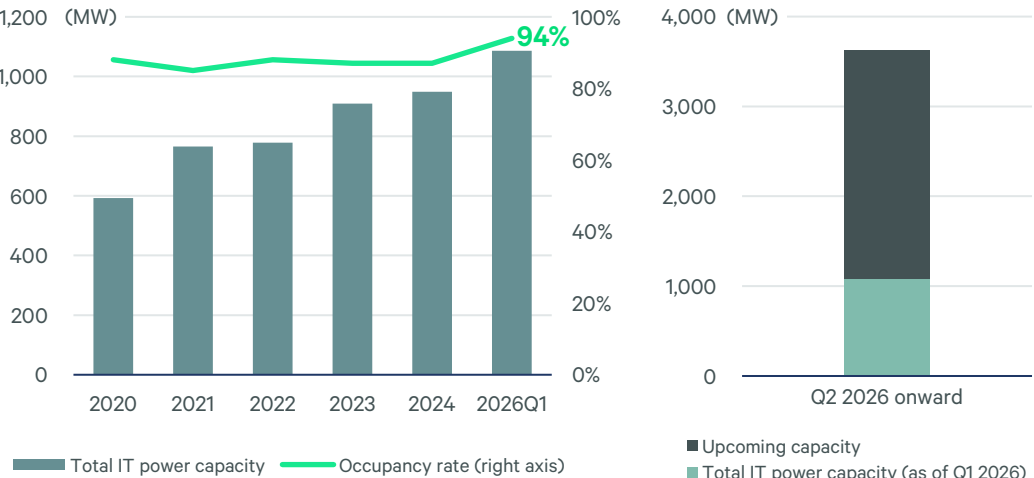
The spike in demand for servers that can handle cloud computing and generative AI has created an extremely tight data center supply-demand balance in Greater Tokyo. As of Q1 2026, total IT power capacity (essentially equivalent to data center market scale) occupancy stood at 94%, up 7 pp. from the 2024 figure of 87%. This is now above the 90% mark at which new users are no longer actively sought (Figure 1).

Most new data centers commencing operations in 2025 did so at high occupancy rates, driven by surging demand from both cloud operators and semiconductor designers, primarily in the manufacturing industry. This robust demand has spurred a wide array of new data center development projects, with Greater Tokyo capacity set to expand to 3.3x Q1 2026 levels, when calculated using total IT power capacity.

Greater Tokyo hosted just under 60% of all data centers in Japan by number as of 2025; a share projected to remain largely unchanged through 2030 (Figure 2). Demand remains strong for new data centers in major metropolitan areas as these locations offer convenience for most end-user companies and the general population along with minimal latency due to the advanced development of communication networks in such locations. While government aid programs and power availability issues should lead to a certain level of regional distribution in future data center development, they are likely to remain concentrated in major conurbations.

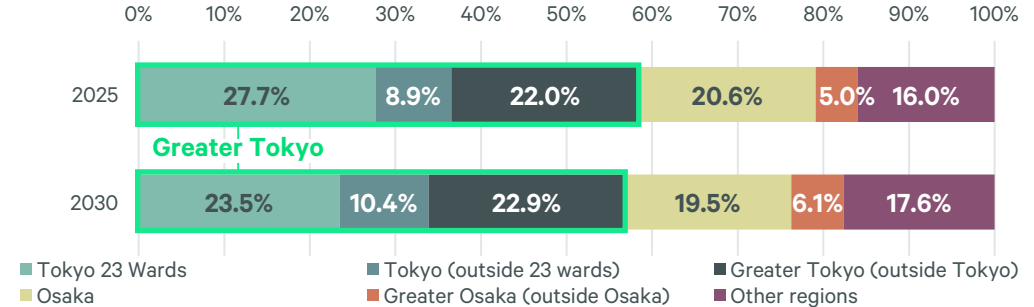
Figure 3 lists the major data center construction projects currently in development in the largest metropolitan areas of Greater Tokyo and Greater Osaka. While the average IT power receiving capacity per building is generally around 20 MW, there are several developments whose capacity far exceeds this figure. This trend is largely due to an increase in AI data centers, which can stably operate the GPU servers required to power generative AI.

Figure 1: Data Center Supply-Demand Balance in Greater Tokyo and Projected Future Supply*



* Carrier-neutral data centers, excluding private data centers. Upcoming capacity refers to all under construction and announced capacity.
Source: CBRE Research, Q1 2026.

Figure 2: Major Domestic Data Center Locations and Distribution by Region (nationwide; comparison of 2025 and 2030 by number of locations)



Source: CBRE Research, August 2026.

1. Data center supply-demand balance in Greater Tokyo remains extremely tight

Figure 3: Major Upcoming Data Center Developments in Greater Tokyo and Greater Osaka

Location	Company name	Facility name (project name)	Site area (m ²)	Total floor area (m ²)	Power supply at opening (MW)	Opening date
Fuchu City, Tokyo	DayOne Data Centers Japan	Fuchu Intelligent Park		66,360	80	2028
Tokyo	Empyrion Digital	JP1 Tokyo Data Centre	-	21,000	25	2028
Chiba	Ada Infrastructure	TOKYO EAST 2	-	-	190	2028
Tochigi City, Tochigi	NTT Data Group	Tochigi Data Center	-	-	100	2028
Osaka City, Osaka	SC Zeus Data Centers	Zeus OSA1 Phase 1	13,956	19,016	25	2028
Saitama City, Saitama	Princeton Digital Group	Aquila Project Phase 2 New Construction Project (Name TBD; TY1 Phase 2)	17,656	32,282	48	June 2028
Inzai City, Chiba	ST Telemedia Global Data Centres	STT Tokyo 2	-	-	70(38)	2027
Chiba	Ada Infrastructure	TOKYO EAST 1	-	-	67(20)	2027
Soraku-gun, Kyoto	STACK Infrastructure	KIX01	53,000	-	80	2027
Shiroi City, Chiba	NTT Data Group	Tokyo TKY11 Data Center	-	-	50(24)	April 2027
Sakai City, Osaka	SoftBank	Sharp Sakai Plant	App. 450,000	App. 840,000	250(150)	2026
Ibaraki City, Osaka	Vantage Data Centers	Osaka (KIX1) Data Center Campus	App. 45,000	-	68(28)	2026
Inzai City, Chiba	MC Digital Realty	NRT14 Data Center	-	22,867	25	April 2026
Seika Town, Kyoto	NTT Data Group	Keihanna OSK11 Data Center	-	App. 28,894	30	February 2026

Source: Compiled by CBRE based on publicly available materials, August 2026.

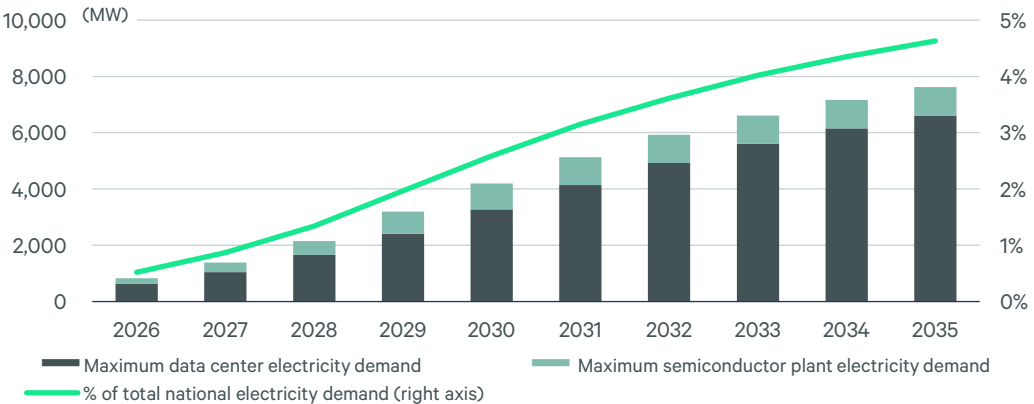
2. Data center electricity demand on the rise nationwide

As data center capacity increases, so does demand for electrical power. Nationwide data show maximum electricity demand for newly constructed data centers and semiconductor plants is expected to surge between 2026 and 2035. Power demand for new data centers, responsible for the majority of this data, is projected to multiply by 10x over this period.

Maximum electricity demand from data centers and semiconductor plants, as a share of total nationwide maximum electricity demand, is projected to increase sharply from approximately 0.5% today to nearly 5% by 2035 (Figure 4). Divided by region, maximum electricity demand is expected to rise most significantly in Greater Tokyo, where many new data centers are under development, leading to a further widening of the gap with regional areas (Figure 5).

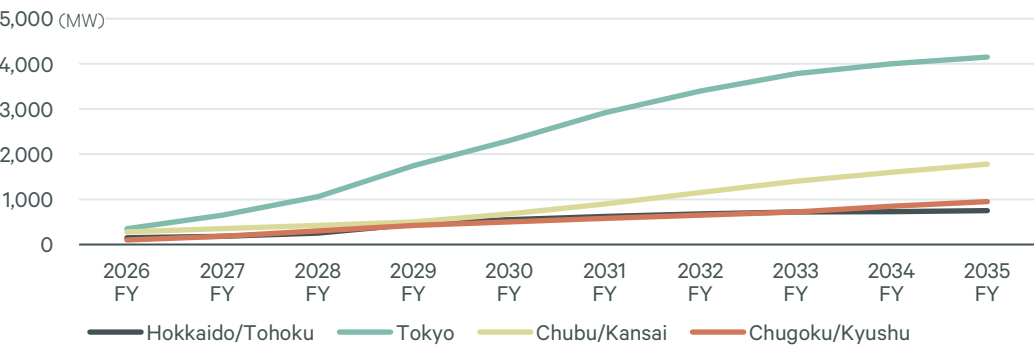


Figure 4: Projected Maximum Electricity Demand Attributable to Data Center and Semiconductor Facility Expansion, and Share of Total Electricity Consumption (nationwide to 2035)



Source: Compiled by CBRE based on “Estimated Nationwide and Supply District-Specific Demand (FY 2026)”, Organization for Cross-Regional Coordination of Transmission Operators, Japan (January 21, 2026)

Figure 5: Projected Maximum Electricity Demand Attributable to Data Center and Semiconductor Facility Expansion (by region)



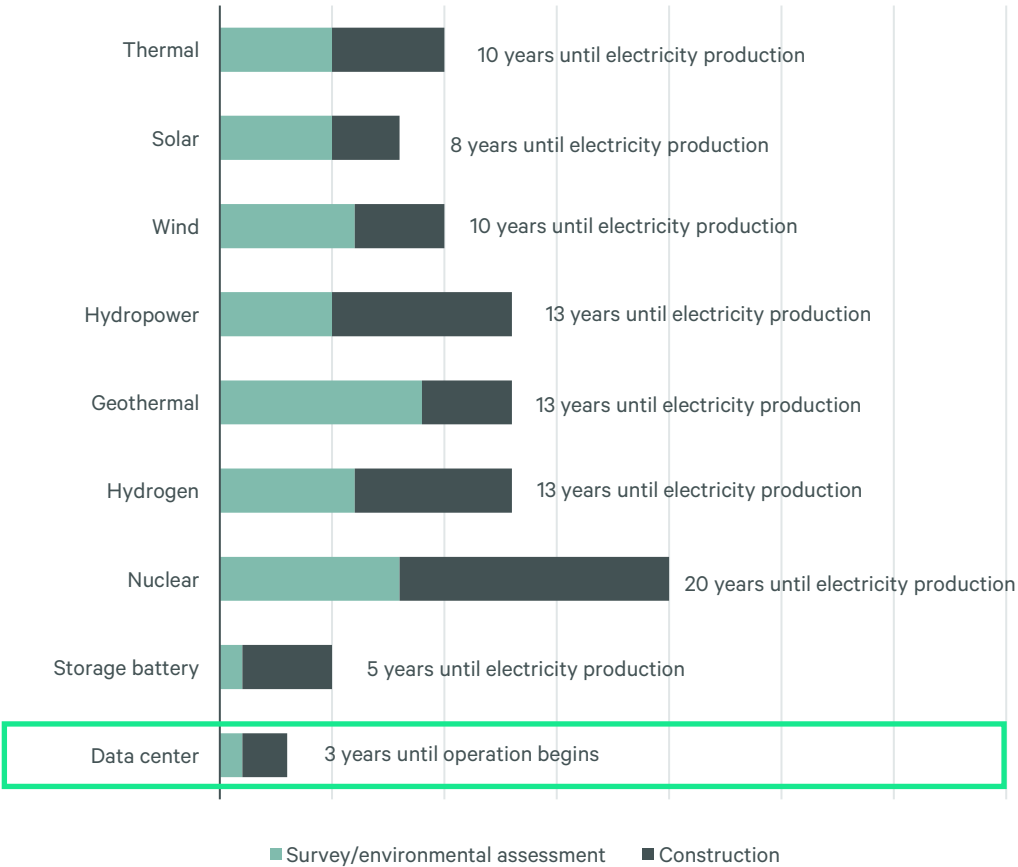
*Area calculations have been made so that individual demand cannot be determined.
Source: Compiled by CBRE based on “Estimated Nationwide and Supply District-Specific Demand (FY 2026)”, Organization for Cross-Regional Coordination of Transmission Operators, Japan (January 21, 2026)

3. Electrical power availability obstructing new data center development

While new data center development is proceeding rapidly, securing the super-high voltage power supply required for the establishment of new data centers remains a challenge. The average new data center development in Greater Tokyo is forced to wait at least five years, while waits of up to 10 years may be necessary. According to Ministry of Economy, Trade and Industry data, around 40 large-scale developments are currently awaiting access to high-voltage electricity supply in data center-intensive locations such as Inzai and Shiroy in Chiba Prefecture, with the combined power requirements of these projects estimated to total approximately 2,500 MW.*1 The following factors are contributing to this bottleneck.

- (1) **Concentrated demand:** With approximately 60% of the nation’s data centers concentrated in Greater Tokyo, and new demand significantly exceeding available power capacity, pressure on substations in the region has reached a critical level.
- (2) **Time taken to prepare power stations and power lines:** While constructing a new data center only takes around three years, power stations take considerably longer to be built, leading to a mismatch in construction scheduling (Figure 6). Power lines connecting power stations and data centers also require significant time and money to install.
- (3) **Advance securing of power:** An increasing number of data center developers are focusing on securing power supply at a very early stage, even before the project has been confirmed. This is contributing to lengthening wait times for later developments.
- (4) **Growing power requirements:** AI data centers configured to support generative AI platforms require massive amounts of electrical power. This has led to a significant growth in the size of the average power supply required by each data center.

Figure 6: Lead Times for Power Station and Data Center Development (standard norms)



Source: Compiled by CBRE based on Ministry of Economy, Trade and Industry “Materials from the 67th Subcommittee on Basic Policy for Electricity and Gas (Working Group on System Review), Document 5”, and the Organization for Cross-Regional Coordination of Transmission Operators’s website (<https://www.occto.or.jp/capacity-market/yoryoshijyo/background/>)

*1 “On the current state and key issues regarding localized, large-scale demand”, Agency for Natural Resources and Energy, March 2025.

4. Self-powered data centers using co-generation systems

An effective way to avoid these delays and reduce dependence on the standard power grid is to implement Co-Generation Systems (CGS) in data center development. CGS uses natural gas provided by city gas providers to fuel gas engines, gas turbines, and/or fuel cells that power data centers. This approach also recovers waste heat for use in air conditioning and water-heating systems.

Traditionally, data centers have used gas turbines or diesel engines powered by crude oil as emergency generation sources for use during power cuts. CGS, by contrast, lets data centers disconnect entirely from the grid and run their operations on electricity generated on-site.

As CGS exhaust fumes produce very few air pollutants, it is already being implemented in a wide range of other facilities, including in urban areas with strict environmental emission standards and in large buildings consuming significant energy resources, such as factories, hotels, hospitals, and retail facilities.

While no single case of CGS implementation has been reported in a Japanese data center as of August 2026, several developments in the U.S., the world leader in this field, are using CGS to power extremely high-capacity facilities (Figure 7).

Figure 7: U.S. Data Centers Using Co-Generation Systems (by power source)

Company/ project name	Location	Overview	Scale (power receiving capacity)	Power source/supplier	Announcement date
Nscale, Microsoft, NVIDIA “Monarch AI Campus”	West Virginia	On-site power generation for a 1.35 GW AI computing data center development for which Microsoft has signed a letter of intent (LOI) with NVIDIA.	1.35 GW	Gas engines (Caterpillar)	March 2026
Joule Capital Partners	Utah	Announcement of development plans for a new 4000-acre data center campus in central Utah.	4 GW	Gas engines (Caterpillar)	August 2025
Wärtsilä	Ohio	On-site power generation facilities for direct data center supply. Orders placed for 15 natural gas-powered engines.	282 MW	Gas engines (Wärtsilä)	July 2025
Chevron, Microsoft “Project Kilby”	South-west Texas	20-year contract for exclusive power provision (no grid connection). Power supply to begin in 2028.	App. 2.67 GW	Gas turbines (GE Vernova)	June 2026
Chevron, Engine No.1, GE Vernova “Power Foundries”	Multiple sites in the south-east, midwest, and west	Plans for the construction of multiple gas turbine power stations by the end of 2027.	Max 4 GW	Gas turbines (GE Vernova)	January 2025
Oracle, Bloom Energy	Multiple locations for US AI infrastructure	Fuel cell units procured for AI cloud and infrastructure projects. Half have already begun construction, with operation achieved in just 55 days.	Max 2.8 GW	Fuel cells (Bloom Energy)	April 2026
Equinix, Bloom Energy	19 locations in six states	Starting with a pilot project of 1 MW in Silicon Valley in 2015, the scheme has expanded to 19 locations in six states in 10 years. 75 MW operational, 30 MW under construction.	Over 100 MW	Fuel cells (Bloom Energy)	February 2025

Source: Compiled by CBRE based on corporate press releases, August 2026.

4. Self-powered data centers using co-generation systems

Compared to their grid-reliant counterparts, CGS data centers (self-powered data centers) enjoy advantages in several areas. The most significant such advantage is the fact that a power source can be secured in as little as two to three years from the time of order, dramatically reducing or even entirely eliminating the problem of waiting for electricity, which plagues grid-connected centers (Figure 8).

They can also be constructed anywhere on any city gas pipe network with sufficient gas supply. This essentially enables them to be built in any location, exponentially increasing the number of site options in comparison to grid-connected facilities. Due to the fact that power loss is also much lower in CGS data centers than in grid-connected ones, the excess heat produced at generation that goes to waste in the latter can be used in the former to power absorption chillers to produce chilled water for the cooling of servers. In comparison to grid-connected centers, therefore, CGS-powered data centers have much higher levels of total energy efficiency (which measures the usage efficiency of electricity and heat) and also make a higher contribution to reductions in energy use and CO₂ emissions.

Other advantages include their role in improving Business Continuity Processing (BCP) due to their ability to continue operating independently even when the power grid is down, and their eligibility for receiving a wide range of financial aid packages and tax breaks.

There exist several challenges in constructing CGS-powered data centers. In addition to the significant initial costs associated with the installation of power-generating systems, running costs are required to keep systems maintained. Furthermore, while the city gas pipeline network covers almost every urban area nationwide, there are some suburban or rural areas it cannot reach.

Other issues obstructing the implementation of CGS data centers include adherence to restrictions on gas emissions and sound and vibrations created by generating facilities, and the necessity to obtain permits in these areas. For data centers with particularly high levels of power receiving capacity, many local body governments require environmental assessments to be carried out, leading to the possibility of significant delays before approval can be obtained. One strategy for overcoming some of these issues is to launch a new project as a CGS-powered center with the bare minimum power receiving capacity, then switch to a hybrid model taking additional power from the grid once it is available. In addition to keeping initial costs down, this approach can also reduce the risks associated with securing planning permissions.

Figure 8: Summary of Benefits of CGS in Data Centers and Challenges to Implementation

Benefits	Elimination/significant reduction of electricity wait times	As little as two to three years (wait times for grid connection in Greater Tokyo are up to 10 years)
	Greater range of location options	Anywhere on the city gas pipeline network
	High total energy efficiency	Total energy efficiency* CGS: 70~80% (when using waste heat) Grid-connected: App. 40%
	Improved BCP measures	As independent operation is possible even when grid power is lost, the risk of operational failure during blackouts is mitigated
	Availability of financial aid and tax breaks	Programs offered by METI, Ministry of the Environment, and local body governments
Challenges	Increased initial investment	Additional initial costs related to installation of CGS facilities (for gas engines: JPY 200-300 million/MW)
	Increased running costs	Maintenance costs and necessity for specialist expertise in maintaining CGS facilities
	Restricted to areas served by city gas	Some suburban or rural areas are not served by the city gas pipeline network
	Permissions required for gas emissions and noise	Restrictions on and monitoring of NOx (nitrogen oxides) and noise produced as a by-product of CGS operation

* Japan Gas Association homepage: <https://www.gas.or.jp/gas-life/n-cogeneration/>
Source: Compiled by CBRE based on publicly available materials, August 2026.

5. Characteristics of three major co-generation systems

There are three main types of CGS systems: gas engine, gas turbine, and fuel cell. Each of these has its own unique features (Figure 9). Based on each data center’s location and size, developers must carefully consider which system to implement.

Of the three, the **gas engine** system is the most prevalent domestically. Providing greater flexibility in terms of project scale, it allows for gradual expansion as electricity receiving capacity increases. It also offers advantages in terms of built-in redundancy, as even when one engine stops, the others can replace its output in a multiple-engine system.

Used also in airliners, **gas turbines** generate more power than gas engines and are therefore more suited to larger-scale facilities in suburban areas. However, lower generation efficiency means that fuel costs can be expensive, and as each turbine generates so much power, the impact of a single turbine failing can be significant.

Fuel cells tend to be smaller-scale projects than the other methods, while initial costs are also the most expensive. Generating almost no noise or vibration and with limited CO2 emissions, they are most suited to urban and residential areas with severe restrictions on the installation environment. Their other advantage is the relative infrequency of mechanical failure.

Figure 9: Comparison of Three Major Types of Co-Generating Systems

System	Gas engine	Gas turbine	Fuel cell
Overview	Most popular method for industrial and commercial use in areas on the city gas network. A wide variety of sizes are available.	High output and high waste heat recovery capacity make this system suited to large-scale facilities and factories with high thermal loads. Lower power generation efficiency compared to gas engines makes fuel costs higher.	Generates almost no noise or vibration and has limited CO2 emissions. Most suited to urban and residential areas with severe restrictions on the installation environment.
Initial investment (per kWh)	Low	Low	High
Redundancy/ reliability	Easily expandable in stages; effect of a single engine failing is limited in a multi-engine system.	High output per turbine means the effect of a failure can be significant.	Few moving parts mean a low likelihood of mechanical failure.

Source: Compiled by CBRE based on publicly available materials, August 2026.

6. Self-powered data centers should enhance investment efficiency

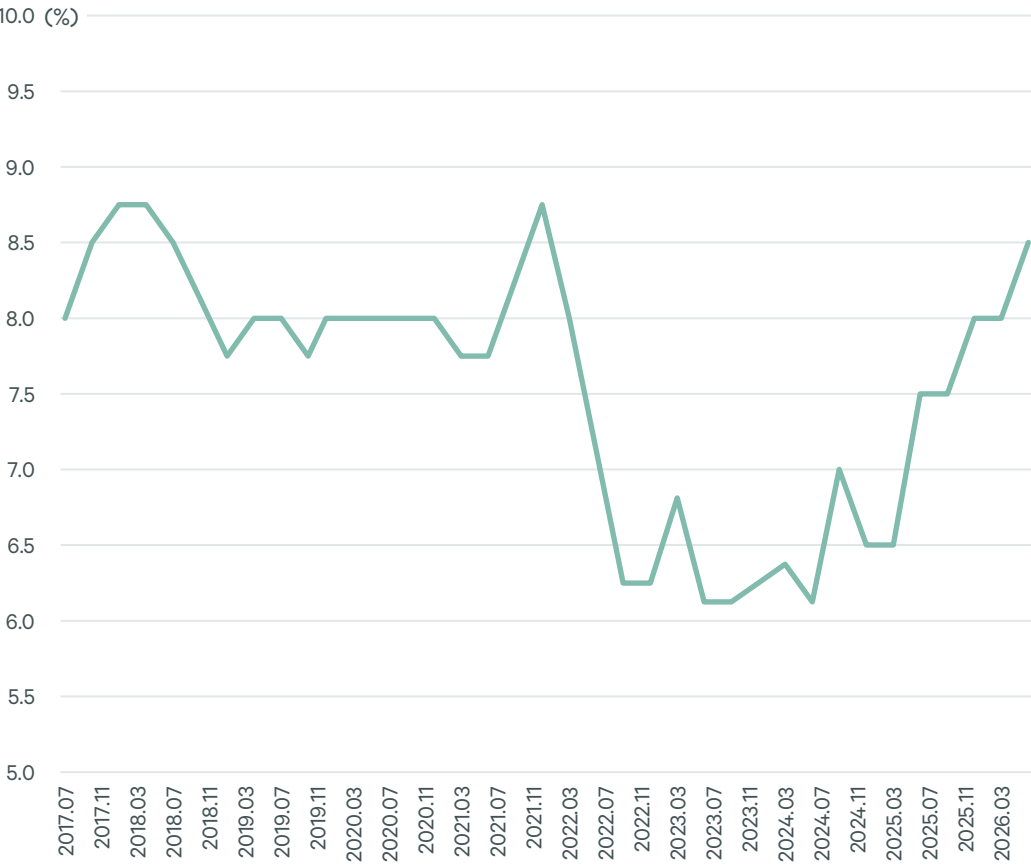
Self-powered data centers offer higher investment efficiency than standard data centers connected to the power grid. By eliminating wait times to be connected to the grid, they are able to significantly reduce development lead times. Their ability to turn a profit in the short term makes it possible to recoup investments, including those in CGS facilities, much more quickly.

Furthermore, cloud operators, the major tenant sector for data centers, tend to prioritize early operation as a selection factor. This gives owners of self-powered data centers an advantage over those of data centers with long electricity wait times in terms of negotiations, meaning that they can expect to command higher rents. This leads to a projection of higher internal rates of return on development (project IRR), for example, for self-powered data centers in comparison to their standard counterparts.

CBRE’s latest cap rate survey of domestic institutional investors show standard data centers in Tokyo and environs had required IRRs of between 7.0% and 10%, with an average figure of 8.5% (albeit in a limited sample size). These figures have been steadily increasing since 2025 on the back of rising costs and interest rates (Figure 10).

With expectations of further interest rate hikes and inflation, investors are demanding higher investment efficiency than ever before from the assets in which they invest. Such incentives may push a greater number of investors to consider investment in CGS-implemented self-powered data centers, which should in turn encourage further development.

Figure 10: Data Center IRR in Tokyo and Environs (averages)



*Survey of June 2026 (n=8)
Source: CBRE, Cap Rate Survey Q2, 2026.

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