Goldman Sachs Research

Equity Research

11 October 2026 | 3:44PM HKT

GS SUSTAIN & APAC DATA CENTERS

From Commitments to Capacity: Bottlenecks, Mitigation Pathways and Beneficiaries

The key debates around AI and data center infrastructure is shifting from capacity commitments to capacity conversion. Recent community pushback in the US demonstrates that demand alone is no longer sufficient to guarantee data center growth, with power affordability, water consumption, emissions, noise and permitting increasingly influencing project outcomes. As operators scale multi-gigawatt AI campuses globally, we see debates will increasingly emerge across APAC. **In this report, we apply a framework to assess data center capacity conversion — identifying bottlenecks, mitigation pathways and beneficiaries — as a guide for how quickly committed capacity in APAC can be brought online from the capacity supply perspective.** We use Ulanqab and Johor as case studies to illustrate how resource constraints can evolve from operational considerations into infrastructure-planning and permitting issues.

We identify 10 capacity conversion bottlenecks among three categories

- **Hard Infrastructure Bottlenecks** — Grid Connection & Reliability, Power Equipment Supply, Optical Networking, and Land Availability (risk elevated in Hong Kong, Singapore, Tokyo) — represent critical requirements that can physically delay or prevent committed capacity from becoming operational, with benefits typically accruing to a limited group of suppliers given scarce capacity and limited substitutes.
- **Emerging Constraints** — Ambient Environment, Water Demand, Skilled Labor, and Infrastructure-Ready Land (risk elevated in Indonesia, Thailand, Malaysia) — are yet to halt growth today but are becoming increasingly important as AI infrastructure scales, influencing project economics, cooling architecture selection, site readiness, deployment timelines and permitting outcomes.
- **Social License-to-Operate** — Noise Impacts, Localized Warming, and Air Pollution & Emissions — reflect areas of rising community and regulatory scrutiny that can increasingly shape permitting decisions, infrastructure planning and the long-term sustainability of data center expansion.

Xavier Zhang
+852-2978-6681 | xavier.zhang@gs.com
Goldman Sachs (Asia) L.L.C.

Brian Singer, CFA
+1(212)902-8259 | brian.singer@gs.com
Goldman Sachs & Co. LLC

Timothy Zhao
+852-2978-2673 | timothy.zhao@gs.com
Goldman Sachs (Asia) L.L.C.

Eunice Liu
+852-2978-7472 | eunice.liu@gs.com
Goldman Sachs (Asia) L.L.C.

Ronald Keung, CFA
+852-2978-0856 | ronald.keung@gs.com
Goldman Sachs (Asia) L.L.C.

Kelsey Santoso
+65-6889-2473 | kelsey.santoso@gs.com
Goldman Sachs (Singapore) Pte

Jacqueline Du
+852-2978-1783 | jacqueline.du@gs.com
Goldman Sachs (Asia) L.L.C.

Hao Chen
+86(21)2401-8812 | hao.z.chen@goldmansachs.cn
Goldman Sachs (China) Securities Company Limited

Mark Delaney, CFA
+1(212)357-0535 | mark.delaney@gs.com
Goldman Sachs & Co. LLC

Brendan Corbett
+1(415)249-7440 | brendan.corbett@gs.com
Goldman Sachs & Co. LLC

Evan Tylenda, CFA
+44(20)7774-1153 | evan.tylenda@gs.com
Goldman Sachs International

Grace Chen
+44(20)7774-5119 | grace.j.chen@gs.com
Goldman Sachs International

Goldman Sachs does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision. For Reg AC certification and other important disclosures, see the Disclosure Appendix, or go to www.gs.com/research/hedge.html. Analysts employed by non-US affiliates are not registered/qualified as research analysts with FINRA in the U.S.

Sector and Stock Implications

We believe suppliers of critical infrastructure components — **power equipment**, **behind-the-meter (BTM) solutions**, **optical networking components** — are best positioned to benefit. We also note a broader set of enablers should see tailwinds from growing adoption of mitigation solutions aimed at addressing emerging constraints and maintaining a social license-to-operate, including **advanced liquid cooling, adiabatic cooling systems, water technology, noise mitigation** and **waste heat recovery.** We highlight **53 Buy-rated stocks** globally exposed to these solutions. Among the list, **Shengyi**, **Weichai Power** and **Panasonic HD** are on our APAC Conviction List (Directors' Cut). We spotlight **Vertiv** and **Envicool** as key cooling enablers for APAC data centers.

For APAC data center operators, while power usage requirements are sometimes more stringent than water usage requirements in certain markets (e.g. China, Japan, Singapore), we see operators that can demonstrate credible water-management strategies, recycled-water usage and lower summer peak water demand should be better positioned to convert committed capacity into operating capacity. We also see increasing integration between data center operation, GPUaaS and liquid cooling on the company level e.g. Range Intelligent, Guangdong HEC, which may become one of the differentiating factors among data center operators.

Data Center Capacity Conversion Framework

Bottlenecks, Mitigation Pathways, Stocks

HARD BOTTLENECKS



Grid Connection & Reliability

- **BTM Power Solutions**
  - **Weichai Power** (2338.HK)
  - **Delta Electronics** (2308.TW)
  - **Panasonic HD** (6752.T)
  - **Murata** (6981.T)
  - **TDK** (6762.T)
  - **Minebea Mitsumi** (6479.T)
  - **LG Energy Solution** (373220.KS)
  - **Ceres Power** (CWR.L)
  - **Flex** (FLEX)



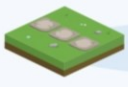
Power Equipment Supply

- **Power Equipment**
  - **MHI** (7011.T)
  - **Sieyuan** (002028.SZ)
  - **Yingliu** (603308.SS)
  - **Hitachi** (6501.T)
  - **Kstar** (002518.SZ)
  - **GE Vernova** (CEV)
  - **Siemens Energy** (ENR1n.DE)
  - **INNIO** (INIO)



Data Networking & Transmission

- **Optical Components**
  - **Innolight** (3308.HK)
  - **Eoptolink** (300502.SZ)
  - **TFC Optical** (300394.SZ)
  - **Shengyi** (600183.SS)
  - **Sumitomo Electric** (5802.T)
  - **Fujikura** (5803.T)
  - **Furukawa Electric** (5801.T)
  - **Prysmian** (PRY.MI)



Land Availability (HK&SG&JP)

- Land Developer
  - **Keppel DC REIT** (KEPE.SI)
  - **Keppel** (KPLM.SI)
  - **Mitsui Fudosan** (8801.T)
  - **Tokyo Tatemono** (8804.T)

EMERGING CONSTRAINTS



Ambient Environment

- **Advanced Cooling**
  - **Envicool** (002837.SZ)
  - **Delta Electronics** (2308.TW)
  - **AVC** (3017.TW)
  - **Auras** (3324.TWO)
  - **Vertiv** (VRT)
  - **nVENT** (NVT)
  - **Flex** (FLEX)
  - **Johnson Controls** (JCI)
  - **Carel Industries** (CRLI.MI)
  - **Carrier Global** (CARR)



Water Demand & Infrastructure

- **Water Technology**
  - **Organo** (6368.T)
  - **Nomura MS** (6254.T)
  - **Kurita Water** (6370.T)
  - **Toray Industries** (3402.T)
  - **WaterBridge** (WBI)
  - **Legence** (LGN)
  - **Xylem Inc.** (XYL)
  - **Veralto Corp.** (VLTO)
  - **Jacobs Solutions** (J)



Skilled Labour & Land Readiness (ASEAN)

- Upskilling, Training, Specialised Contractors

SOCIAL LICENSE-TO-OPERATE



Noise & Vibration Impact

- **Noise Reduction**
  - **Rockwool** (ROCKb.CO)
  - **Armstrong World Industries** (AWI)
  - **3M** (MMM)
  - *Kinetics Noise Control (private)*
  - *IAC Acoustics (private)*



Localised Warming & Urban Heat

- **Waste Heat Recycling/Insulation**
  - **Mitsubishi Electric** (6503.T)
  - **AECOM** (ACM)
  - **Legence** (LGN)
  - **Siemens Energy** (ENR1n.DE)
  - **Dover Corp.** (DOV)
  - **Rockwool** (ROCKb.CO)
  - **Carlisle** (CSL)



Air Pollution & Emissions

- **Pollutant Control**
  - *Johnson Matthey (JMAT.L)*
  - *AERINOX (private)*
  - *MIRATECH Corporation (private)*
  - *Nett Technologies (private)*

● *Denotes mitigation solutions* ● *Denotes supply beneficiaries* ● *We highlight property developer with exposure to data center projects*

APAC data center capacity conversion bottlenecks and solutions

Data center capacity conversion is becoming an increasingly important investment focus as operators move from securing committed capacity to bringing projects into live operation. While demand for AI infrastructure remains robust, the ability to convert planned capacity into operating capacity is increasingly influenced by a combination of **critical infrastructure supply, emerging resource constraints and community relations**. Beyond hard infrastructure bottlenecks such as power availability, grid connectivity and networking infrastructure, we are seeing growing regulatory scrutiny and community push-back expand beyond the US globally (i.e. South Korea), particularly around water consumption, noise, environmental impacts and resource allocation. These dynamics are already influencing permitting outcomes in markets like the US and Malaysia and are likely to become increasingly relevant across APAC as data center clusters continue to scale.

In this report, we identify 10 potential capacity conversion bottlenecks across the data center value chain globally and assess areas that are most relevant for APAC operators. We highlight a range of mitigation pathways that could see increasing adoption as operators navigate these constraints. From an investment perspective, we distinguish between companies benefiting from the scarce supply of critical infrastructure components and those exposed to growing demand for mitigation solutions, highlighting the stocks best positioned to benefit as the industry puts greater resources into ensuring that capacity can be permitted, built and operated sustainably. We group data center capacity conversion bottlenecks into three categories:

Hard Bottlenecks

Hard Bottlenecks reflect foundational challenges such as power availability, grid connectivity and critical component shortages that can physically delay or prevent committed capacity from becoming operational, with benefits typically accruing to a limited set of suppliers given the lack of practical substitutes.

- **Grid Connection & Reliability:** Securing sufficient grid power remains the primary capacity-conversion requirement for AI data centers, while maintaining system reliability is becoming increasingly important as power demand accelerates. Interconnection delays continue to be a major gating factor globally, creating growing incentives for hyperscalers to adopt behind-the-meter (BTM) generation, storage and backup capacity to accelerate time-to-market as well as accommodate potential future grid interruptibility. Beyond physical connectivity, power affordability is also emerging as a capacity-conversion consideration, as rising household electricity bills increase regulatory scrutiny and community pushback around large-load customers. Our US Utilities team expects average consumer bills to rise by 3.7% annually through 2029, while our EMEA Utilities team expects Europe average consumer bills to rise by 2%-4% annually through 2030.
- **Power Equipment Supply**: Global supply constraints of transformers, switchgear, generators and UPS systems have emerged as a key capacity conversion bottleneck. Unlike many resource constraints, shortages of critical power equipment offer limited mitigation pathways and can materially delay commissioning timelines. As

AI-related power demand scales, available manufacturing capacity, long lead times and supplier concentration are becoming increasingly important determinants of deployment speed, making qualified equipment suppliers disproportionately valuable.

- **Optical Networking**: Unlike traditional cloud infrastructure, next-generation AI systems require high-bandwidth, low-latency interconnections across both scale-up and scale-out architectures, making optical connectivity essential for unlocking computing performance rather than simply transmitting data. Analysis by our Global Tech team highlights that networking is becoming the next frontier of AI infrastructure, with networking content per computing unit expected to increase materially as GPU clusters scale and interconnect density rises. Similar to power equipment, optical networking constraints offer limited mitigation pathways once a cluster architecture is determined, with bottlenecks often emerging in optical modules, optical engines, lasers, fiber infrastructure and associated supply chains. As a result, scarce manufacturing capacity, technology leadership and the ability to support speed migration from 800G to 1.6T, 3.2T and beyond are increasingly valuable, while operators continue to invest in fiber buildouts, network upgrades and optical technologies to ensure computing capacity can be fully utilized once deployed.
- **Land Availability (within APAC, elevated risk in Tokyo, Hong Kong and Singapore)**: Our recent industry discussions suggest land constraints are most acute in **Singapore**, **Hong Kong** and **Tokyo**, where limited developable land and competing commercial uses continue to restrict large-scale campus development and increase costs. As a result, we view land as a primary constraint in select developed markets rather than a structural limitation for regional AI infrastructure growth, with beneficiaries more likely to be data center property developers, industrial park operators and integrated campus providers in land-constrained locations.

Emerging Constraints

Emerging Constraints, such as water availability, cooling efficiency, infrastructure-ready land and labour supply, are not yet limiting growth today but could increasingly influence project economics, site selection and permitting outcomes as AI infrastructure scales.

- **Ambient Environment**: Higher heat, humidity and drought risks limit cooling technology selection optionality for data centers and requires greater power demand in affected regions where minimizing direct water demand is a priority. Our analysis suggests that **89% of new APAC data centers are set to be built in areas with elevated physical risk to heat, humidity and/or drought**. We expect growing adoption of advanced liquid cooling and adiabatic solutions to mitigate the physical environment constraints of data center cooling efficiency. We highlighted data center cooling stock ecosystem in our July 2026 report.
- **Water Demand**: As AI workloads drive higher cooling intensity, freshwater availability is becoming more relevant to both permitting outcomes and long-term capacity expansion, particularly in water-stressed markets. Recent developments in

Malaysia and **Thailand** suggest regulators are moving beyond monitoring water use toward actively incorporating water management into project approvals and infrastructure planning. While advanced liquid cooling can help mitigate water constraints, regional regulatory priorities, particularly China's strong focus on power usage effectiveness (PUE) optimization and cost minimization, may incentivize operators to pursue a more water-intensive pathway. As such, we remain bullish on water technologies including recycling, wastewater reuse, reverse-osmosis treatment, alternative industrial water sourcing and water-efficient cooling architectures, which can support future capacity growth while reducing reliance on municipal freshwater supplies without compromising energy efficiency.

- **Skilled Labour Availability**: We continue to see risks that skilled labor availability constraints — particularly electricians — represents a key risk to execution globally. In Asia, talent is also emerging as an underappreciated capacity conversion constraint. Labour shortages are particularly acute in fast growing markets such as **Malaysia**, **Indonesia** and the **Philippines**, where data center capacity is expanding faster than the local pool of experienced engineers and operators, according to CBRE analysis. This is driving greater investment in training, automation and AI-enabled operations to improve workforce productivity and support long term growth.
- **Land Availability (Indonesia, Thailand, Malaysia)**: Infrastructure-ready land is increasingly becoming a growth constraint across emerging markets. Our ASEAN analysis suggests the key challenge is often not securing land, but obtaining timely access to sufficient power, water, transmission capacity and fiber connectivity. In **Thailand**, power deliverability into the Eastern Economic Corridor (EEC) has emerged as a key gating factor; while in **Indonesia**, utility readiness and the availability of industrial-scale infrastructure remain important considerations for future hyperscale deployment. As a result, the most valuable sites are increasingly not those with the lowest land cost, but those with pre-existing access to power substations, water infrastructure, fiber backbones and industrial-zoned development rights.

Social License-to-Operate

Social License-to-Operate considerations including air emissions, noise and environmental impacts reflect areas of rising community and regulatory scrutiny; while these debates are most visible in the US today, we see similar risks emerging across APAC based on projects delay examples witnessed in South Korea.

- **Noise Impacts**: Recent media reports suggest noise is becoming an increasingly important source of community pushback, particularly when larger AI-oriented data centers are built closer to residential areas. Unlike many industrial sources that see activity decline overnight, data centers operate continuously, generating low-frequency noise and vibration from cooling equipment, ventilation systems and backup generators. As a result, developers face a growing risk of permitting delays, legal challenges and additional mitigation costs, particularly in densely populated areas. We expect greater adoption of acoustic shielding, enhanced site buffers and liquid cooling technologies, which can materially reduce fan-related noise while also

improving thermal management efficiency.

- **Localized Warming**: Recent pushback to Utah's Stratos data center project — and subsequent project scope changes — highlights risks that large-scale data center developments could intensify local heat stress alongside water depletion. In this context, redirecting heat into productive use reduces thermal discharge to the environment and reframes data centers from heat sources into energy suppliers potentially — increasingly important as social license becomes a gating factor for new capacity. While waste heat capture at data centers is in earlier stages, we note it is being done in areas such as Finland and France and can serve as a solution where the economics warrant.
- **Pollution & Waste Management**: Community concerns in the US have increasingly focused on pollutants emissions from onsite power generation, with backup diesel generators attracting greater permitting scrutiny given their disproportionately high emissions of NOx and particulate matter (PM2.5) despite relatively limited operating hours. We believe this could also become increasingly relevant in parts of **emerging Asia**, where grid readiness remains a constraint and data center operators may rely more heavily on captive generation — particularly coal — to accelerate capacity deployment. This should support growing adoption of battery backup units, purification and selective catalytic reduction (SCR) technologies.

Please see below reports for more on data center power demand and AI infrastructure:

- GS SUSTAIN: AI/Data Centers: Power demand, cyclical progression and Sustainability implications
- GS SUSTAIN: Reliability: How heat, humidity and water use minimization could drive data center cooling, power demand and stocks
- GS SUSTAIN: AI/Data Center Power Demand: How rising hyperscaler reinvestment impacts the 6 Ps driving power growth/constraints
- Carbonomics: Behind-the-meter power solutions for data centers: gas turbines, fuel cells and reciprocating engines
- Framing the Battery Backup Unit Opportunity: $50bn by 2030 (CAGR +87%); Buy Panasonic HD
- Optical Networking: The next mega trend in AI infrastructure
- ASEAN DATA CENTER PRIMER: Mapping the ecosystem
- China Data Centers: Scaling the AI Infrastructure; Initiate Range Intelligent at Buy, Athub at Neutral

In Exhibit 1, we highlight 53 Buy-rated stocks levered to data center capacity conversion framework. Among the list, **Shengyi** (600183.SS, covered by Allen Chang), **Weichai Power** (2338.HK, covered by Nick Zheng, CFA) and **Panasonic HD** (6752.T, covered by Ryo Harada) are on our APAC Conviction List Directors' - Directors' Cut. We also highlight Kinetics Noise Control and IAC Acoustics among private companies in the data center noise-abatement space, as well as AERINOX, MIRATECH Corporation and Nett Technologies among private companies for providing captive-power emissions control, purification and SCR technologies.

Exhibit 1: We select Buy-rated stocks that could see tailwinds from data center capacity conversion bottlenecks

Ticker	Company Name	Price	Upside to TP	Markets	Hard Bottleneck Beneficiaries				Growing Constraint Mitigants		Social License-to-Operate Enablers	
					BTM Power Solutions	Power Equipment	Optical Networking	Data Center Land	Advanced Cooling	Water Technology	Noise Reduction	Waste Heat Recycling
3308.HK	**Innolight**	HK$999.5	227%	China			✓					
603308.SS	**Yingliu**	Rmb36.1	100%	China		✓						
2308.TW	**Delta Electronics**	NT$1965.0	110%	Taiwan	✓				✓			
600183.SS	**Shengyi Tech**	Rmb131.9	89%	China			✓					
2338.HK	**Weichai Power**	HK$28.4	94%	China	✓							
002518.SZ	**Shenzhen Kstar**	Rmb32.9	82%	China		✓						
002028.SZ	**Sieyuan Electric**	Rmb117.1	75%	China		✓						
300502.SZ	**Eoptolink**	Rmb378.5	69%	China			✓					
7011.T	**MHI**	¥3679.0	69%	Japan		✓						
6503.T	**Mitsubishi Electric**	¥5118.0	54%	Japan								✓
002837.SZ	**Shenzhen Envicool**	Rmb51.9	52%	China					✓			
6981.T	**Murata Mfg.**	¥8004.0	61%	Japan	✓							
6368.T	**Organo Corp.**	¥2776.5	44%	Japan						✓		
6254.T	**Nomura Micro Science**	¥3770.0	43%	Japan						✓		
5801.T	**Furukawa Electric**	¥4089.0	57%	Japan			✓					
8801.T	**Mitsui Fudosan**	¥1442.0	39%	Japan				✓				
6479.T	**MinebeaMitsumi**	¥3661.0	50%	Japan	✓							
8804.T	**Tokyo Tatemono**	¥3178.0	38%	Japan				✓				
KEPE.SI	**Keppel DC REIT**	S$2.2	36%	Singapore				✓				
6762.T	**TDK**	¥3290.0	49%	Japan	✓							
373220.KS	**LG Energy Solution**	W401000.0	30%	South Korea	✓							
6752.T	**Panasonic Holdings**	¥4449.0	42%	Japan	✓							
5802.T	**Sumitomo Electric**	¥2369.5	39%	Japan			✓					
5803.T	**Fujikura**	¥5435.0	40%	Japan			✓					
3402.T	**Toray Industries**	¥1232.5	29%	Japan						✓		
6370.T	**Kurita Water**	¥7768.0	29%	Japan						✓		
KPLM.SI	**Keppel Ltd.**	S$10.5	30%	Singapore				✓				
3017.TW	**AVC**	NT$3440.0	31%	Taiwan					✓			
300394.SZ	**TFC Optical**	Rmb235.1	32%	China			✓					
6501.T	**Hitachi**	¥5701.0	16%	Japan		✓						
3324.TWO	**Auras**	NT$1520.0	-11%	Taiwan					✓			
CWR.L	**Ceres Power**	£369.0	148%	UK	✓							
LGN	**Legence**	$51.6	84%	USA						✓		✓
INIO	**INNIO**	$19.2	82%	USA		✓						
XYL	**Xylem**	$102.0	57%	USA						✓		
ACM	**AECOM**	$59.5	53%	USA								✓
ENR1n.DE	**Siemens Energy**	€142.5	49%	Germany		✓						✓
CSL	**Carlisle**	$321.3	48%	USA								✓
WBI	**WaterBridge**	$29.8	38%	USA						✓		
PRY.MI	**Prysmian**	€122.3	42%	Italy			✓					
CARR	**Carrier Global**	$55.8	33%	USA					✓			
AWI	**AWI**	$163.1	33%	USA							✓	
FLEX	**Flex**	$114.7	34%	USA	✓				✓			
ROCKb.CO	**Rockwool**	Dkr179.0	34%	Denmark							✓	✓
CRLI.MI	**Carel Industries**	€26.8	35%	Italy					✓			
MMM	**3M**	$163.6	23%	USA							✓	
DOV	**Dover**	$189.0	24%	USA								✓
VLTO	**Veralto**	$96.5	22%	USA						✓		
J	**Jacobs Solutions**	$138.6	23%	USA						✓		
JCI	**Johnson Controls**	$154.0	24%	Switzerland					✓			
GEV	**GE Vernova**	$999.4	22%	USA		✓						
VRT	**Vertiv Holdings**	$243.7	23%	USA					✓			
NVT	**nVENT Electric**	$164.2	17%	USA					✓			

Stocks priced as of 10/08/2026

Source: Goldman Sachs Global Investment Research

Takeaways from New York Climate Week on Data Center Bottlenecks

Discussions during New York Climate Week reinforced that the key challenge for AI infrastructure is increasingly capacity conversion rather than demand creation. Industry participants consistently highlighted grid interconnection delays, shortages of critical power equipment, workforce constraints and growing community pushback as the most important hurdles to bringing committed capacity online. Industry participants also highlighted potential implications from midterm elections for the development queue as well, **as roughly 70% of planned data center load sits in front of commissions facing electoral change in upcoming elections**. Because of these bottlenecks, hyperscalers are underwriting clean firm technologies (e.g., SMR nuclear, advanced geothermal, long duration energy storage) with deployment horizons that might have previously been considered uninvestable, i.e., 2030-35.

Momentum for behind-the-meter development remains given interconnection delays. One estimate referenced during the week was that roughly half of the existing US data center pipeline plans to source its own power via hybrid or fully behind-the-meter (BTM) approaches. Comments throughout the week reiterated that BTM is not the optimal grid design — it is the cost of developing AI at speed. Interconnection delays are the clearest explanation for why hyperscalers are increasingly behaving like utilities, why developer consolidation is accelerating, and why powered land and queue positions have become acquirable assets. The preference for most BTM assets to be eventually grid-connected was also reiterated consistently throughout the week.

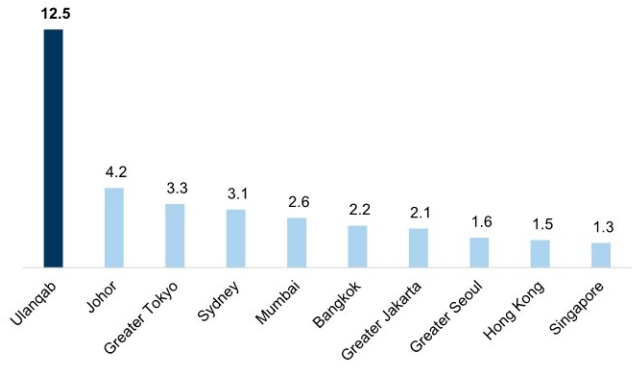
Community pushback has changed the stakes of engagement. Power affordability/reliability, water use, noise and heat pollution were all cited as common topics of data center scrutiny that have forced adjustments from developers and regulators. Large-load tariffs have proliferated to 37 states, with certain designs cited as cutting ratepayer exposure by over 85%. Collateral requirements, exit fees and large-load tariff design were cited as additional tools being deployed to abate cost externalization to ratepayers, particularly for transmission upgrades and incremental grid capacity. Hyperscaler willingness to accept curtailment and non-firm interconnection in exchange for speed has also changed materially over the past year. Demand response, workload scheduling and aggregated flexibility are seen as some of the most likely tools to be deployed to allow for this flexibility.

Ongoing need for increased community engagement. Beyond the physical operating impacts of data centers, general NIMBYism and broader distrust of AI's societal impact were cited as more intractable sources of pushback to development. Broader local engagement, workforce programs and direct community investment, e.g., home weatherization programs, jobs and ratepayers savings were all cited as a cost of doing business for DC developers/operators that will be increasingly necessary to shifting some of this public sentiment. Demonstrating clear value to local communities was referenced as a common social license to operate threshold for historically extractive or heavy industries with an emphasis that no two communities are alike and that frameworks oversimplify local concerns.

Case Study #1: Cooling tradeoff among China data centers

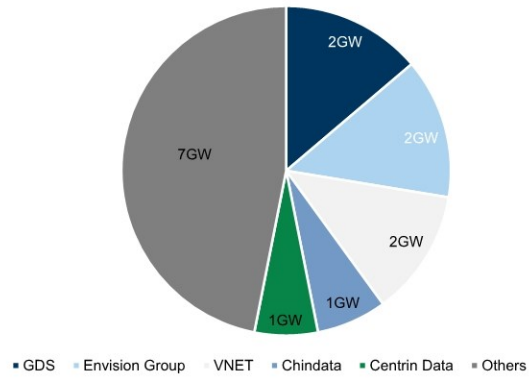
Following our July data center cooling report, investors have increasingly asked whether China's policy focus on maximizing energy efficiency and achieving industry-leading power usage effectiveness (PUE) could result in greater water consumption, and ultimately whether water could emerge as a constraint on data center capacity expansion. At the same time, Ulanqab located approximately 240 km from Beijing, has rapidly emerged as one of APAC's largest and fastest-growing AI computing clusters, with 12.5 GW of committed capacity. The region combines several competitive advantages, including low-cost renewable power, direct connectivity to Beijing (~4.2ms latency), electricity prices of Rmb0.33-Rmb0.36/kWh and a cool climate with annual average temperatures of ~4°C, enabling extensive use of free cooling and helping operators meet China's stringent PUE requirements. However, the scale of planned expansion has raised growing investor debate over whether such a large concentration of future capacity could create tension between data center water demand and local agricultural and residential consumption in a region already facing water stress challenges.

Exhibit 2: Total data center capacity (live, under construction and pipeline) in key APAC hubs (GW)



Source: Local government websites, Cushman & Wakefield, Data compiled by Goldman Sachs Global Investment Research

Exhibit 3: We see GDS, VNET and Envision group contributing to the pipeline capacity in Ulanqab
Pipeline capacity share by company



Source: Company data, Sina News, Data compiled by Goldman Sachs Global Investment Research

Water demand in Ulanqab has remained relatively stable over the past five years, with agriculture as the major driver of total consumption. **However, the full build-out of Ulanqab's 12.5GW committed data center capacity could add c.17-67mn m³ of annual water demand, equivalent to c.3%-14% of the city's average annual water consumption over 2020-24.** The key swing factor is not only the amount of data center capacity itself, but the cooling pathway ultimately adopted. At the low end, Ulanqab's cool climate enables extensive use of dry and free cooling for much of the year, while operators could aggressively deploy advanced liquid cooling and indirect evaporative cooling technologies to maximize both thermal and water efficiency as compute densities increase. At the high end, operators may instead prioritize lower initial capex and operating costs and stronger energy efficiency, relying more heavily on evaporative cooling to achieve China's stringent PUE requirements, resulting in materially higher water consumption. While the range remains wide, we believe China's policy emphasis on energy efficiency, combined with operators' incentives on cost advantages, suggests actual water usage is likely to trend toward the middle-to-upper end of the range rather

than the most water-efficient outcome.

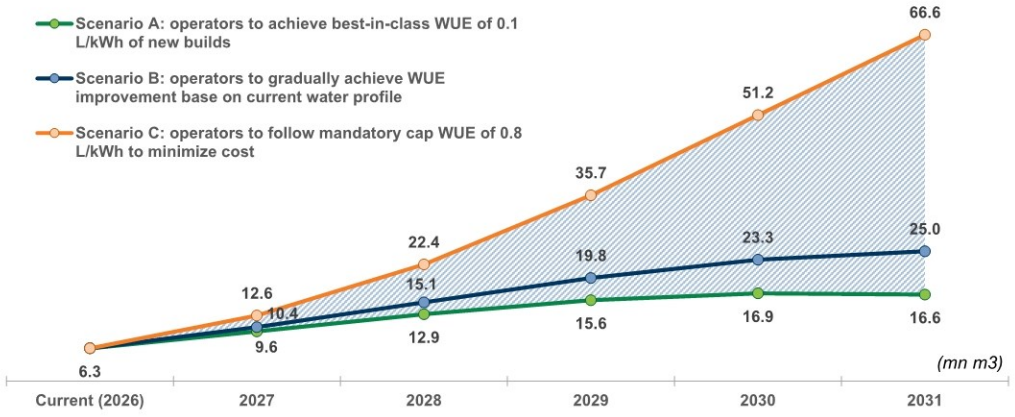
- **Scenario A: Water usage of c.17 mn m³ annually.** This represents a best-in-class deployment scenario where new facilities broadly adopt advanced liquid cooling, indirect evaporative cooling and extensive dry/free cooling for the majority of the year. Under this outcome, portfolio-wide water efficiency would gradually converge toward best-in-class levels, with water usage effectiveness (WUE) largely below **0.1 L/kWh for new builds**, requiring both aggressive advanced liquid cooling adoption and disciplined water management across the cluster.

- **Scenario B: Water usage of c.25 mn m³ annually.** This assumes WUE gradually declines from **0.8 L/kWh today toward 0.3 L/kWh by 2031**, reflecting increasing adoption of indirect evaporative cooling and seasonal wet-mode operation during summer peak periods, alongside a gradual shift away from traditional cooling towers. We note a green data center project in Ulanqab has disclosed **WUE of 0.6 L/kWh**, suggesting this scenario could potentially already assume continued improvement beyond currently disclosed performance, and therefore remains a relatively optimistic water-efficiency pathway.

- **Scenario C: Water usage of c.67 mn m³ annually.** We assume data centers operate at the current regulatory ceiling of **0.8 L/kWh WUE**, the maximum level permitted for new facilities in water-stressed regions. This scenario reflects our view that operators are likely to prioritize lower power consumption and compliance with China's stringent PUE requirements over maximizing water efficiency. As a result, we view this as a realistic upper-end scenario for assessing Ulanqab's potential long-term water footprint.

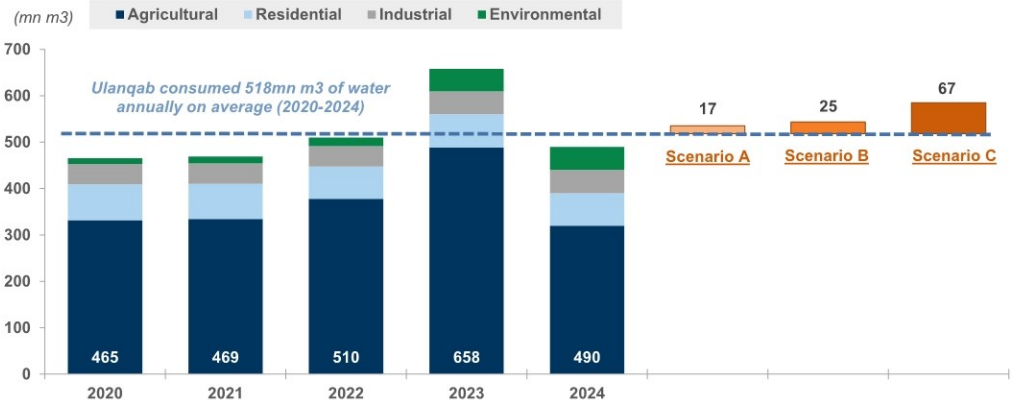
We also note that our analysis is based on annual water consumption, which may understate the severity of seasonal water stress. In practice, the most acute pressure on local water resources is likely to occur during the summer months, when data center cooling demand, agricultural irrigation and residential water consumption all peak simultaneously. This overlap is particularly relevant for Ulanqab given its role as a major potato producing region in China, where the key irrigation season broadly coincides with the June-August period when cooling systems are most likely to operate in wet mode. As a result, the challenge is not only the magnitude of annual water demand, but also the concentration of demand during a relatively short seasonal window. **Hence, in our view, managing peak summer water demand is likely to become a more important consideration than annual water consumption alone.** Operators that can reduce reliance on freshwater during summer peak periods may be better positioned to accommodate future capacity additions while reducing competition with agricultural and residential users for limited water resources.

Exhibit 4: 12.5 GW data center capacity in Ulanqab could drive additional 17-67 million m3 of water demand annually by 2031...
Potential data center water consumption for cooling under various scenarios, mn m3



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 5: ...which would be equivalent to c.3%-14% of the city's average annual water consumption over 2020-24
Ulanqab's water consumption by sector and potential incremental demand from new built data centers



Source: National Bureau of Statistics of China, Goldman Sachs Global Investment Research

On the supply side, Ulanqab's water resources appear considerably less flexible than its growing demand profile, given the city's heavy dependence on groundwater. Groundwater currently accounts for an estimated **70%-80% of total water supply**, supporting both residential consumption and agricultural activities, but local policies are increasingly focused on limiting extraction due to historical over-pumping and expanding groundwater depression cones. In 2024, the local government also formally banned data centers in Ji Ning district (Ulanqab) from using ground water for cooling. Surface water contributes another **15%-20%** of supply, although future expansion potential appears constrained by limited local runoff and dependence on larger cross-basin diversion projects. **By contrast, recycled water currently represents only 5%-10% of supply but offers the greatest potential for future growth,** particularly as wastewater treatment infrastructure expands and reclaimed water is increasingly directed toward industrial applications such as data center cooling. As a result, while overall water supply expansion opportunities appear

limited, recycled water is likely to be the most scalable source of incremental water supply to support Ulanqab's next phase of data center growth.

Exhibit 6: The supply of water in Ulanqab is less flexible and has limited potential to expand, given high reliance on groundwater source

Water Source Type	Estimated % Share of Supply	Primary Application	Potential to Increase Supply
Ground -water	70% - 80%	**- Residential:** urban & rural drinking water; **- Agricultural:** traditional crop irrigation and livestocks;	No Potential (Decreasing) Due to severe historical over-extraction and expanding depression cones, local policy mandates strict capping and reduction of groundwater pumping.
Surface Water	15% - 20%	**- Agricultural:** seasonal irrigation, **- Ecological:** river and lake restoration, partial urban backup	Moderate Potential Local natural runoff is highly constrained, meaning future volume increases rely heavily on national and provincial cross-basin water diversion projects.
Recycled Water	5% - 10%	**- Industrial:** data center cooling, manufacturing processing and urban greening	High Potential As the city expands its wastewater treatment infrastructure, reclaimed water could support booming data centers without depleting natural reserves.

Source: National Bureau of Statistics of China, Goldman Sachs Global Investment Research

China data center operators: a close look at their water-related disclosure

GDS (9698.HK) | Lead Analyst: Timothy Zhao | GS Rating: Buy

GDS (2GW capacity committed in Ulanqab) reported a 31% yoy increase in water consumption to 11 mn m^3 in 2025, from 8 mn m^3 in 2024, while WUE edged up to 1.69 L/kWh from 1.66 L/kWh. The broadly stable WUE suggests capacity growth, rather than a material deterioration in operating efficiency, was the primary driver of higher absolute water demand. GDS has not disclosed a portfolio-level WUE target, but continues to deploy dry or zero-water cooling in water-stressed regions and expand reclaimed-water, rainwater-harvesting and recycling systems, including reverse-osmosis technology capable of recovering approximately 70% of cooling-system wastewater.

VNET (VNET) | Lead Analyst: Timothy Zhao | GS Rating: Buy

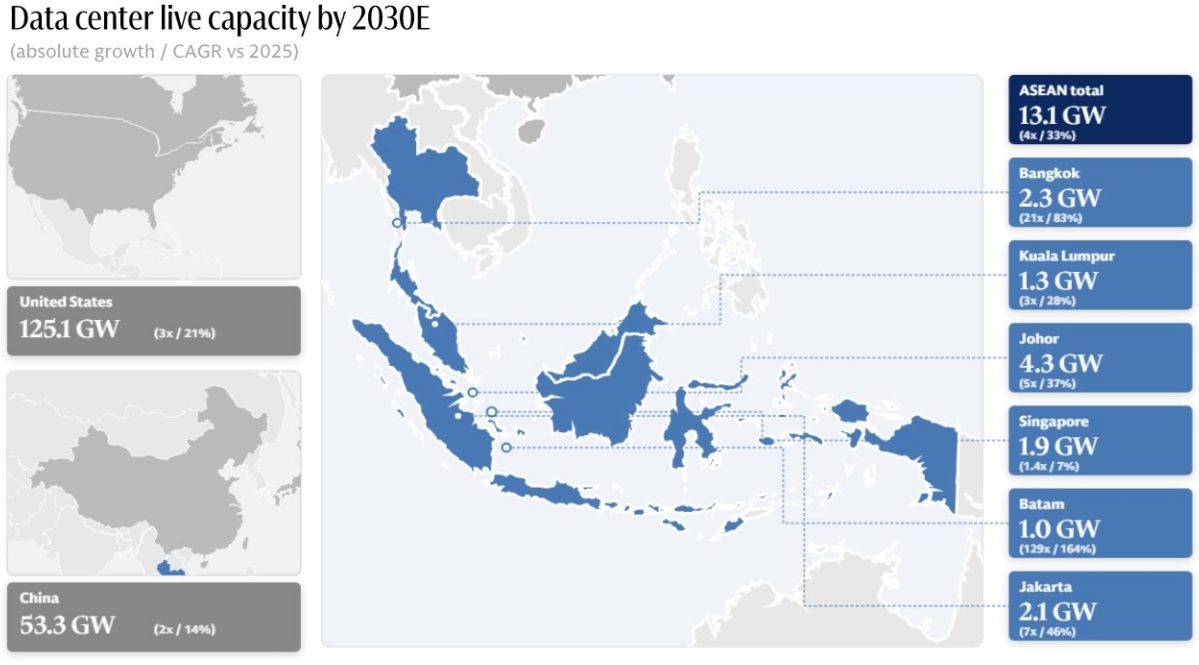
VNET's group level water consumption increased 40% yoy to 4.4 mn m^3 in 2025, from 3 mn m^3 in 2024, alongside continued expansion of its operating footprint. While VNET does not disclose portfolio-wide WUE or a formal group-level target, project-level progress is more encouraging: reclaimed water supplies over 50% of demand at one Langfang facility, contributing to a 9.2% YoY reduction in site WUE in 2025, while its air-liquid hybrid solution for water-constrained locations is designed to achieve WUE below 0.1 L/kWh and PUE below 1.2.

We note that Chindata (private) and Centerin (private) have not disclosed WUE for their data center facilities historically. Other China IDC players i.e. Range (300442.SZ, Buy), Sinnet (300383.SZ, Sell) and Athub (603881.SS, Neutral) do not have meaningful capacities exposed to Ulanqab area.

Case Study #2: Emerging water concerns for ASEAN data centers

Johor, Malaysia: An Asian example of water becoming a permitting constraint
Importantly, Ulanqab is not the only fast-growing APAC data center hub where water availability and usage are sources of local debates. Johor, Malaysia provides one of the recent examples in APAC of water evolving from an operational consideration into a **capacity-fulfillment and permitting constraint**. Benefiting from sub-5 millisecond latency to Singapore, lower power costs, abundant land availability and significant hyperscaler investment, Johor has become the primary destination for Singapore spillover demand and is expected to become ASEAN's largest data center market, with live capacity forecast (GSe) to grow from **897 MW in 2025 to 4.3 GW by 2030E**.

Exhibit 7: ASEAN within the global context

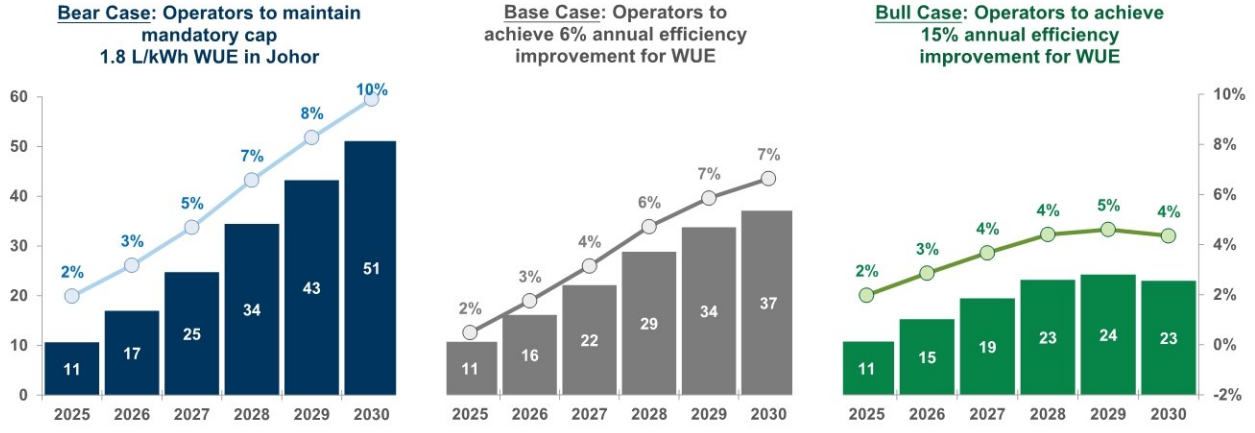


Source: Cushman & Wakefield, DC Byte, JLL, IMDA, Goldman Sachs Global Investment Research

Despite being one of the least power-constrained markets in ASEAN, Johor has increasingly encountered water-related bottlenecks. Since late 2025, Johor authorities have reportedly stopped approving data centers with high WUE and requested operators to defer water-cooled expansions by approximately 18 months, to around mid-2027. In other words, the limiting factor has not been demand, land availability or even power supply, but rather concerns around the sustainability of local water resources as data center development accelerates. As water became a more visible permitting issue, cooling architecture and water-resource management increasingly became prerequisites for project approval rather than simply operational design choices. **Our analysis of Johor's future data center water demand helps explain why water has moved to the center of the regulatory debate.** We estimate data center cooling water demand in Johor could increase from c.11 mn m^3 in 2025 to c.23-51 mn m^3 annually by 2030 (Exhibit 8), depending on the pace of efficiency

improvements. This would be equivalent to roughly 4%-10% of Johor's average municipal water consumption between 2018-22. While these levels do not imply an outright water shortage, they are sufficiently material to attract regulatory scrutiny, particularly given the rapid pace of capacity additions and competing residential and industrial demand. In our view, Johor provides an example that water could emerge as a permitting and infrastructure-planning issue well before it becomes a physical resource constraint.

Exhibit 8: For Johor, we estimate data center cooling water demand could reach 23-51 mn m³ by 2030, equivalent to 4%-10% of Johor's average municipal water consumption between 2018-22
Potential data center water consumption for cooling under various scenarios, mn m3 (LHS); data center water demand as % of Johor's municipal water consumption, 2018-2022 average (RHS)



We assume the average WUE level of Johor data centers to be 1.8 L/kWh in 2025, which has factored in the tropical inefficiency of evaporative cooling.

Source: Department of Statistics Malaysia, Goldman Sachs Global Investment Research

Johor's response to data center-related water constraints has increasingly shifted from resource management toward economic and regulatory intervention. Rather than relying solely on delaying expansion, authorities have begun using fiscal tools to discourage dependence on municipal freshwater supplies. A notable example is the introduction of a dedicated RM5.33/m³ treated-water tariff for data centers, above standard industrial water rates, designed both to discourage freshwater-intensive cooling and to generate funding for broader water infrastructure upgrades. **Alongside demand-side controls, Johor is pursuing an aggressive buildout of alternative water infrastructure to decouple future data center growth from municipal water supply.** The state is increasingly steering operators toward reclaimed and non-potable water sources, including wastewater recycling systems developed through cooperation between state utility providers and sanitation agencies. Major operators i.e. BDC and AirTrunk have responded by investing directly in water-treatment and distribution infrastructure, including large-scale reclamation facilities, reverse-osmosis systems, and dedicated recycled-water pipeline networks. At the same time, Johor is accelerating multi-billion-ringgit upgrades to regional water infrastructure, including the expansion of treatment plants and off-river storage facilities to improve system resilience before the next phase of data center growth. In our view, the Johor experience demonstrates that large-scale computing hubs do not necessarily need to rely on freshwater expansion alone; instead, water recycling, alternative supply networks and targeted infrastructure capex can become critical enablers of future capacity growth once water emerges as a permitting constraint.

Focus Stock: Vertiv Holdings (VRT, Buy-rated by Mark Delaney, CFA)

Thematic Relevance

Vertiv is well positioned to benefit from rising cooling intensity across APAC data center markets as operators increasingly balance power efficiency, water availability and higher AI compute densities. The company has already established relationships with major operators across the region, including supplying its water-free **Liebert DSE** natural-cooling system to Centrin Data's Ulanqab facility and maintaining a strategic cooling partnership with VNET. While Ulanqab provides a visible example of cooling demand linked to large-scale AI deployment, we see the broader opportunity extending across emerging AI hubs where operators are seeking to optimize capacity conversion amid infrastructure, resource and permitting considerations.

Vertiv's thermal management portfolio is particularly well aligned with the growing adoption of hybrid cooling architectures. Its solutions can operate in dry or free-cooling mode when ambient temperature and humidity permit, minimizing both power and water consumption, before switching to mechanical or wet cooling when required. This flexibility is increasingly valuable across APAC, where operators are balancing stricter efficiency requirements, higher rack densities and growing scrutiny around water use. Vertiv's portfolio spans dry coolers, trim coolers, free-cooling chillers and water-cooled chillers, allowing customers to tailor cooling architectures to local climatic and infrastructure conditions rather than relying on a single cooling approach year-round.

Beyond gray-space cooling, Vertiv remains a leader in coolant distribution units (CDUs), a critical component of direct-to-chip liquid cooling, while its integrated power, cooling, controls and services capabilities position it to capture a larger share of data center infrastructure spending. In our view, the combination of liquid cooling adoption inside the white space and intelligent hybrid cooling systems outside the data hall should support sustained demand for Vertiv's solutions as AI campuses scale from individual facilities toward multi-phase, gigawatt-scale deployments. Its ability to provide both equipment and lifecycle services further strengthens its positioning as capacity conversion becomes an increasingly important focus for operators globally.

Valuation/Risks

We are Buy rated on the stock. Our 12-month price target is $301, which is based on a 22X EV/EBITDA multiple applied to our updated Q5-Q8 EBITDA estimate.

Key downside risks to our view include: 1) Revenue growth — Vertiv has a portion of its datacenter revenue still tied to traditional on-premise datacenters, which is a part of the market that could be impacted by either enterprise spending weakness or by the shift to the cloud. In addition, Vertiv's ability to continue to improve its cloud/hyperscale revenue and grow in the channel will be important factors in how fast its revenue will increase. Also, market share will be a factor in revenue trends. 2) Margins — There are risks to our expectation for margin expansion. This could come from increased competitive pressure, mix, or execution, tariffs.

Focus Stock: Envicool (002837.SZ, Buy-rated by Jacqueline Du)

Thematic Relevance

We see Envicool as a key beneficiary of greater usage of advanced, water-efficient cooling in China. Envicool's full-chain liquid-cooling portfolio spans cold plates, quick connectors, manifolds, CDUs, coolant, piping and primary-side heat-rejection equipment, supporting both direct-to-chip and immersion architectures. Its air-liquid hybrid platform can accommodate rack densities of 20-200kW and multiple cooling sources, positioning the company to capture demand from both new AI facilities and the progressive conversion of existing air-cooled data centers.

In gray-space cooling, Envicool's offerings are particularly well aligned with key China hubs' seasonal climate and water constraints. Its **XFlex 5.0 indirect evaporative cooling system** uses AI controls to switch dynamically among dry, wet, hybrid, energy-saving, water-saving and fully water-free modes, enabling water-free operation at ambient temperatures of up to 30°C. A disclosed deployment of Tencent achieved annual **PUE of 1.16 and WUE below 0.5 L/kWh**. For liquid-cooled facilities, Envicool's **Coolinside dry coolers** use free cooling and variable-speed fans to deliver heat rejection with extremely low water consumption, with optional adiabatic assistance available during warmer periods.

Valuation/Risks

We are Buy-rated on Envicool. Our 12-month target price of Rmb79.0 is based on a 42x 2028E P/E discounted back to 2027E with a 10% cost of equity.

Key downside risks to our view include: 1) Slow R&D/business progress with key customers; 2) tougher liquid cooling competition and margin risks; 3) ESS demand growth hiccups; 4) geopolitical changes impacting the global server/data center and ESS supply chain.



Disclosure Appendix

Reg AC

We, Xavier Zhang, Brian Singer, CFA, Timothy Zhao, Eunice Liu, Ronald Keung, CFA, Kelsey Santoso, Jacqueline Du, Hao Chen, Mark Delaney, CFA, Brendan Corbett, Evan Tylenda, CFA and Grace Chen, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

Contributing Authors: Xavier Zhang Goldman Sachs (Asia) L.L.C., Brian Singer, CFA Goldman Sachs & Co. LLC, Timothy Zhao Goldman Sachs (Asia) L.L.C., Eunice Liu Goldman Sachs (Asia) L.L.C., Ronald Keung, CFA Goldman Sachs (Asia) L.L.C., Kelsey Santoso Goldman Sachs (Singapore) Pte, Jacqueline Du Goldman Sachs (Asia) L.L.C., Hao Chen Goldman Sachs (China) Securities Company Limited, Mark Delaney, CFA Goldman Sachs & Co. LLC, Brendan Corbett Goldman Sachs & Co. LLC, Evan Tylenda, CFA Goldman Sachs International, Grace Chen Goldman Sachs International.

Unless otherwise stated, the individuals listed in the Contributing Authors disclosure of this report are analysts in Goldman Sachs' Global Investment Research division.

GS Factor Profile

The Goldman Sachs Factor Profile provides investment context for a stock by comparing key attributes to the market (i.e. our universe of rated stocks) and its sector peers. The four key attributes depicted are: Growth, Financial Returns, Multiple (e.g. valuation) and Integrated (a composite of Growth, Financial Returns and Multiple). Growth, Financial Returns and Multiple are calculated by using normalized ranks for specific metrics for each stock. The normalized ranks for the metrics are then averaged and converted into percentiles for the relevant attribute. The precise calculation of each metric may vary depending on the fiscal year, industry and region, but the standard approach is as follows:

Growth is based on a stock's forward-looking sales growth, EBITDA growth and EPS growth (for financial stocks, only EPS and sales growth), with a higher percentile indicating a higher growth company. **Financial Returns** is based on a stock's forward-looking ROE, ROCE and CROCI (for financial stocks, only ROE), with a higher percentile indicating a company with higher financial returns. **Multiple** is based on a stock's forward-looking P/E, P/B, price/dividend (P/D), EV/EBITDA, EV/FCF and EV/Debt Adjusted Cash Flow (DACF) (for financial stocks, only P/E, P/B and P/D), with a higher percentile indicating a stock trading at a higher multiple. The **Integrated** percentile is calculated as the average of the Growth percentile, Financial Returns percentile and (100% - Multiple percentile).

Financial Returns and Multiple use the Goldman Sachs analyst forecasts at the fiscal year-end at least three quarters in the future. Growth uses inputs for the fiscal year at least seven quarters in the future compared with the year at least three quarters in the future (on a per-share basis for all metrics).

For a more detailed description of how we calculate the GS Factor Profile, please contact your GS representative.

M&A Rank

Across our global coverage, we examine stocks using an M&A framework, considering both qualitative factors and quantitative factors (which may vary across sectors and regions) to incorporate the potential that certain companies could be acquired. We then assign a M&A rank as a means of scoring companies under our rated coverage from 1 to 3, with 1 representing high (30%-50%) probability of the company becoming an acquisition target, 2 representing medium (15%-30%) probability and 3 representing low (0%-15%) probability. For companies ranked 1 or 2, in line with our standard departmental guidelines we incorporate an M&A component into our target price. M&A rank of 3 is considered immaterial and therefore does not factor into our price target, and may or may not be discussed in research.

Quantum

Quantum is Goldman Sachs' proprietary database providing access to detailed financial statement histories, forecasts and ratios. It can be used for in-depth analysis of a single company, or to make comparisons between companies in different sectors and markets.

Disclosures

The rating(s) for Vertiv Holdings is/are relative to the other companies in its/their coverage universe: Aeva Technologies Inc., Amphenol Corp., Aptiv Plc, Aurora Innovation Inc., Belden Inc., BorgWarner Inc., Cerence Inc., Flex, Ford Motor Co., General Motors Co., Gentex Corp., Innoviz Technologies, Jabil Circuit Inc., Keysight Technologies Inc., Lear Corp., Magna International Inc., Mobileye Global Inc., QuantumScape Corp., Rivian Automotive Inc., Sensata Technologies Holding, Symbotic Inc., TE Connectivity Plc, Tesla Inc., Versigent PLC, Vertiv Holdings, Visteon Corp.

The rating(s) for Shenzhen Envicool Technology is/are relative to the other companies in its/their coverage universe: Best, Bochu, CRRC Corp. (A), CRRC Corp. (H), Centre Testing Intl Group, Estun Automation Co.(A), Estun Automation Co.(H), Faratronic, Haitian International Holdings, Han's Laser Technology, Hongfa Technology, Huaming, Kehua Data Co., Lead Intelligent (A), Lead Intelligent (H), Leader Harmonious Drive Systems Co., Luster LightTech Co., Megmeet, Moons' Electric, NARI Technology, Nantong Jianghai Capacitor Co., OPT Machine Vision Tech Co., Sanhua Intelligent Controls (A), Sanhua Intelligent Controls (H), Shanghai Baosight Software, Shenzhen Envicool Technology, Shenzhen Inovance Technology Co., Shenzhen Kstar Science & Tech, Shuanghuan Driveline, Sieyuan Electric, Sungrow Power Supply Co., Techtronic Industries, Wuhan Raycus Fiber Laser Tech, Yiheda Automation, Yingliu, Zhejiang Supcon Technology Co., Zhuzhou CRRC Times Electric Co. (A), Zhuzhou CRRC Times Electric Co. (H)

Company-specific regulatory disclosures

The following disclosures relate to relationships between The Goldman Sachs Group, Inc. (with its affiliates, "Goldman Sachs") and companies covered by Goldman Sachs Global Investment Research and referred to in this research.

Goldman Sachs beneficially owned 1% or more of common equity (excluding positions managed by affiliates and business units not required to be aggregated under US securities law) as of the month end preceding this report: Shenzhen Envicool Technology (Rmb50.89)

Goldman Sachs has received compensation for investment banking services in the past 12 months: Vertiv Holdings ($242.78)

Goldman Sachs expects to receive or intends to seek compensation for investment banking services in the next 3 months: Shenzhen Envicool Technology (Rmb50.89) and Vertiv Holdings ($242.78)

Goldman Sachs had an investment banking services client relationship during the past 12 months with: Shenzhen Envicool Technology (Rmb50.89) and Vertiv Holdings ($242.78)

Goldman Sachs had a non-investment banking securities-related services client relationship during the past 12 months with: Vertiv Holdings ($242.78)

Goldman Sachs had a non-securities services client relationship during the past 12 months with: Vertiv Holdings ($242.78)

Goldman Sachs has managed or co-managed a public or Rule 144A offering in the past 12 months: Vertiv Holdings ($242.78)

Goldman Sachs is a registered market maker in the securities or derivatives thereof: Vertiv Holdings ($242.78)

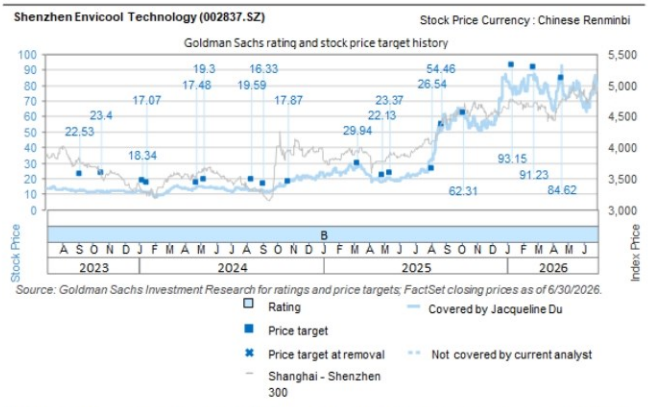
Distribution of ratings/investment banking relationships

Goldman Sachs Investment Research global Equity coverage universe

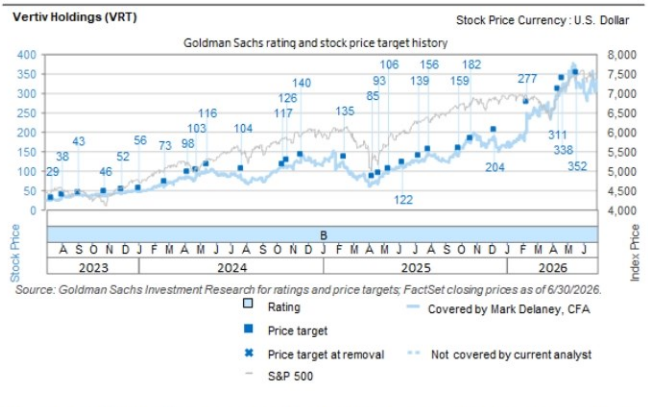
	Rating Distribution			Investment Banking Relationships		
	Buy	Hold	Sell	Buy	Hold	Sell
Global	50%	34%	16%	65%	59%	43%

As of July 1, 2026, Goldman Sachs Global Investment Research had investment ratings on 3,104 equity securities. Goldman Sachs assigns stocks as Buys and Sells on various regional Investment Lists; stocks not so assigned are deemed Neutral. Such assignments equate to Buy, Hold and Sell for the purposes of the above disclosure required by the FINRA Rules. See 'Ratings, Coverage universe and related definitions' below. The Investment Banking Relationships chart reflects the percentage of subject companies within each rating category for whom Goldman Sachs has provided investment banking services within the previous twelve months.

Price target and rating history chart(s)



The price targets shown should be considered in the context of all prior published Goldman Sachs research, which may or may not have included price targets, as well as developments relating to the company, its industry and financial markets.



The price targets shown should be considered in the context of all prior published Goldman Sachs research, which may or may not have included price targets, as well as developments relating to the company, its industry and financial markets.

Target price history table(s)

Shenzhen Envicool Technology (002837.SZ)

Date of report	Target price (Rmb)	Closing price (Rmb)
25-Aug-26	79.00	60.23
21-Apr-26	110.00	83.82
24-Feb-26	118.60	83.92
12-Jan-26	121.10	76.98
07-Oct-25	81.00	61.52
24-Aug-25	70.80	50.51
06-Aug-25	34.50	33.15
13-May-25	39.50	20.16
28-Apr-25	37.40	17.86
11-Mar-25	50.60	28.37
25-Oct-24	30.20	18.76
05-Sep-24	27.60	12.36
13-Aug-24	33.10	12.80
09-May-24	42.40	14.71
26-Apr-24	38.40	15.38
17-Jan-24	37.50	11.27
08-Jan-24	40.30	11.43
20-Oct-23	51.40	12.24

Vertiv Holdings (VRT)

Date of report	Target price ($)	Closing price ($)
30-Jul-26	301.00	227.50
21-May-26	352.00	323.40
23-Apr-26	338.00	321.75
13-Apr-26	311.00	299.96
12-Feb-26	277.00	236.51
09-Dec-25	204.00	178.38
22-Oct-25	182.00	171.59
29-Sep-25	159.00	143.31
30-Jul-25	156.00	144.17
11-Jul-25	139.00	123.30
09-Jun-25	122.00	112.00
12-May-25	106.00	101.05
24-Apr-25	93.00	83.88
10-Apr-25	85.00	67.73
13-Feb-25	135.00	109.28
19-Nov-24	140.00	140.94
23-Oct-24	126.00	108.36
14-Oct-24	117.00	112.41
25-Jul-24	104.00	76.48
16-May-24	116.00	97.29
25-Apr-24	103.00	90.35
09-Apr-24	98.00	81.80
22-Feb-24	73.00	62.90
03-Jan-24	56.00	45.57

Shenzhen Envicool Technology (002837.SZ)

Date of report	Target price (Rmb)	Closing price (Rmb)

Vertiv Holdings (VRT)

Date of report	Target price ($)	Closing price ($)
30-Nov-23	52.00	43.66
26-Oct-23	46.00	34.86

Price targets shown in table(s) are unadjusted for corporate actions.

Regulatory disclosures

Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; registered market maker. Goldman Sachs trades or may trade as a principal in debt securities (or in related derivatives) of issuers discussed in this report.

The following are additional required disclosures: **Ownership and material conflicts of interest:** Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst's area of coverage. **Analyst compensation:** Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. **Analyst as officer or director:** Goldman Sachs policy generally prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director or advisor of any company in the analyst's area of coverage. **Non-U.S. Analysts:** Non-U.S. analysts may not be associated persons of Goldman Sachs & Co. LLC and therefore may not be subject to FINRA Rule 2241 or FINRA Rule 2242 restrictions on communications with a subject company, public appearances and trading in securities covered by the analysts.

Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. **Australia:** Goldman Sachs Australia Pty Ltd and its affiliates are not authorised deposit-taking institutions (as that term is defined in the Banking Act 1959 (Cth)) in Australia and do not provide banking services, nor carry on a banking business, in Australia. This research, and any access to it, is intended only for "wholesale clients" within the meaning of the Australian Corporations Act, unless otherwise agreed by Goldman Sachs. In producing research reports, members of Global Investment Research of Goldman Sachs Australia may attend site visits and other meetings hosted by the companies and other entities which are the subject of its research reports. In some instances the costs of such site visits or meetings may be met in part or in whole by the issuers concerned if Goldman Sachs Australia considers it is appropriate and reasonable in the specific circumstances relating to the site visit or meeting. To the extent that the contents of this document contains any financial product advice, it is general advice only and has been prepared by Goldman Sachs without taking into account a client's objectives, financial situation or needs. A client should, before acting on any such advice, consider the appropriateness of the advice having regard to the client's own objectives, financial situation and needs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests and a copy of Goldman Sachs' Australian Sell-Side Research Independence Policy Statement are available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Brazil:** Disclosure information in relation to CVM Resolution n. 20 is available at https://www.gs.com/worldwide/brazil/area/gir/index.html. Where applicable, the Brazil-registered analyst primarily responsible for the content of this research report, as defined in Article 20 of CVM Resolution n. 20, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. **Canada:** This information is being provided to you for information purposes only and is not, and under no circumstances should be construed as, an advertisement, offering or solicitation by Goldman Sachs & Co. LLC for purchasers of securities in Canada to trade in any Canadian security. Goldman Sachs & Co. LLC is not registered as a dealer in any jurisdiction in Canada under applicable Canadian securities laws and generally is not permitted to trade in Canadian securities and may be prohibited from selling certain securities and products in certain jurisdictions in Canada. If you wish to trade in any Canadian securities or other products in Canada please contact Goldman Sachs Canada Inc., an affiliate of The Goldman Sachs Group Inc., or another registered Canadian dealer. **Hong Kong:** Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C. **India:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (India) Securities Private Limited, Research Analyst - SEBI Registration Number INH000001493, 10th Floor, Ascent-Worli, Sudam Kalu Ahire Marg, Worli, Mumbai-400 025, India, Corporate Identity Number U74140MH2006FTC160634, Phone +91 22 6616 9000, Fax +91 22 6616 9001. Goldman Sachs may beneficially own 1% or more of the securities (as such term is defined in clause 2 (h) the Indian Securities Contracts (Regulation) Act, 1956) of the subject company or companies referred to in this research report. Registration granted by SEBI and certification from NISM in no way guarantee performance of the intermediary or provide any assurance of returns to investors. Goldman Sachs (India) Securities Private Limited compliance officer and investor grievance contact details, a copy of the annual compliance audit report and other relevant information and disclosures can be found at this link: https://www.goldmansachs.com/worldwide/india/research-analyst. **Japan:** See below. **Korea:** This research, and any access to it, is intended only for "professional investors" within the meaning of the Financial Services and Capital Markets Act, unless otherwise agreed by Goldman Sachs. Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. **New Zealand:** Goldman Sachs New Zealand Limited and its affiliates are neither "registered banks" nor "deposit takers" (as defined in the Reserve Bank of New Zealand Act 1989) in New Zealand. This research, and any access to it, is intended for "wholesale clients" (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests is available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Russia:** Research reports distributed in the Russian Federation are not advertising as defined in the Russian legislation, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian legislation on appraisal activity. Research reports do not constitute a personalized investment recommendation as defined in Russian laws and regulations, are not addressed to a specific client, and are prepared without analyzing the financial circumstances, investment profiles or risk profiles of clients. Goldman Sachs assumes no responsibility for any investment decisions that may be taken by a client or any other person based on this research report. **Singapore:** Goldman Sachs (Singapore) Pte. (Company Number: 198602165W), which is regulated by the Monetary Authority of Singapore, accepts legal responsibility for this research, and should be contacted with respect to any matters arising from, or in connection with, this research. **Taiwan:** This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk. Investment results are the responsibility of the individual investor. **United Kingdom:** Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Conduct Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.

European Union and United Kingdom: Disclosure information in relation to Article 6 (2) of the European Commission Delegated Regulation (EU) (2016/958) supplementing Regulation (EU) No 596/2014 of the European Parliament and of the Council (including as that Delegated Regulation is implemented into United Kingdom domestic law and regulation following the United Kingdom's departure from the European Union and the European Economic Area) with regard to regulatory technical standards for the technical arrangements for objective presentation of investment recommendations or other information recommending or suggesting an investment strategy and for disclosure of particular interests or indications of conflicts of interest is available at https://www.gs.com/disclosures/europeanpolicy.html which states the European Policy for Managing Conflicts of

Interest in Connection with Investment Research.

Japan: Goldman Sachs Japan Co., Ltd. is a Financial Instrument Dealer registered with the Kanto Financial Bureau under registration number Kinsho 69, and a member of Japan Securities Dealers Association, Financial Futures Association of Japan Type II Financial Instruments Firms Association, and Investment Management Association of Japan. Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

Ratings, coverage universe and related definitions

Buy (B), Neutral (N), Sell (S) Analysts recommend stocks as Buys or Sells for inclusion on various regional Investment Lists. Being assigned a Buy or Sell on an Investment List is determined by a stock's total return potential relative to its coverage universe. Any stock not assigned as a Buy or a Sell on an Investment List with an active rating (i.e., a stock that is not Rating Suspended, Not Rated, Early-Stage Biotech, Coverage Suspended or Not Covered), is deemed Neutral. Each region manages Regional Conviction Lists, which are selected from Buy rated stocks on the respective region's Investment Lists and represent investment recommendations focused on the size of the total return potential and/or the likelihood of the realization of the return across their respective areas of coverage. The addition or removal of stocks from such Conviction Lists are managed by the Investment Review Committee or other designated committee in each respective region and do not represent a change in the analysts' investment rating for such stocks.

Total return potential represents the upside or downside differential between the current share price and the price target, including all paid or anticipated dividends, expected during the time horizon associated with the price target. Price targets are required for all covered stocks. The total return potential, price target and associated time horizon are stated in each report adding or reiterating an Investment List membership.

Coverage Universe: A list of all stocks in each coverage universe is available by primary analyst, stock and coverage universe at https://www.gs.com/research/hedge.html.

Not Rated (NR). The investment rating, target price and earnings estimates (where relevant) are removed pursuant to Goldman Sachs policy when Goldman Sachs is acting in an advisory capacity in a merger or in a strategic transaction involving this company, when there are legal, regulatory or policy constraints due to Goldman Sachs' involvement in a transaction, and in certain other circumstances. **Early-Stage Biotech (ES).** An investment rating and a target price are not assigned pursuant to Goldman Sachs policy when this company has neither a drug, treatment or medical device that has passed a Phase II clinical trial nor a license to distribute a post-Phase II drug, treatment or medical device. **Rating Suspended (RS).** Goldman Sachs Research has suspended the investment rating and price target for this stock, because there is not a sufficient fundamental basis for determining an investment rating or target price. The previous investment rating and target price, if any, are no longer in effect for this stock and should not be relied upon. **Coverage Suspended (CS).** Goldman Sachs has suspended coverage of this company. **Not Covered (NC).** Goldman Sachs does not cover this company.

Global product; distributing entities

Goldman Sachs Global Investment Research produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; Public Communication Channel Goldman Sachs Brazil: 0800 727 5764 and / or contatogoldmanbrasil@gs.com. Available Weekdays (except holidays), from 9am to 6pm. Canal de Comunicação com o Público Goldman Sachs Brasil: 0800 727 5764 e/ou contatogoldmanbrasil@gs.com. Horário de funcionamento: segunda-feira à sexta-feira (exceto feriados), das 9h às 18h; in Canada by Goldman Sachs & Co. LLC; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman Sachs & Co. LLC. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom.

Goldman Sachs International ("GSI"), authorised by the Prudential Regulation Authority ("PRA") and regulated by the Financial Conduct Authority ("FCA") and the PRA, has approved this research in connection with its distribution in the United Kingdom.

European Economic Area: Goldman Sachs Bank Europe SE ("GSBE") is a credit institution incorporated in Germany and, within the Single Supervisory Mechanism, subject to direct prudential supervision by the European Central Bank and in other respects supervised by German Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin) and Deutsche Bundesbank and disseminates research within the European Economic Area.

General disclosures

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. The information, opinions, estimates and forecasts contained herein are as of the date hereof and are subject to change without prior notification. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst's judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by Global Investment Research. Goldman Sachs & Co. LLC, the United States broker dealer, is a member of SIPC (https://www.sipc.org).

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and principal trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, principal trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.

The analysts named in this report may have from time to time discussed with our clients, including Goldman Sachs salespersons and traders, or may discuss in this report, trading strategies that reference catalysts or events that may have a near-term impact on the market price of the equity securities discussed in this report, which impact may be directionally counter to the analyst's published price target expectations for such stocks. Any such trading strategies are distinct from and do not affect the analyst's fundamental equity rating for such stocks, which rating reflects a stock's return potential relative to its coverage universe as described herein.

We and our affiliates, officers, directors, and employees will from time to time have long or short positions in, act as principal in, make a market or act as liquidity provider in, and buy or sell, any securities, derivatives, or other financial instruments referred to in this research (including any financial instruments issued by the companies referred to herein), unless otherwise prohibited by regulation or Goldman Sachs policy.

The views attributed to third party presenters at Goldman Sachs arranged conferences, including individuals from other parts of Goldman Sachs, do not necessarily reflect those of Global Investment Research and are not an official view of Goldman Sachs.

Any third party referenced herein, including any salespeople, traders and other professionals or members of their household, may have positions in the products mentioned that are inconsistent with the views expressed by analysts named in this report.

This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of investments referred to in this research and the income from them may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors. Investors should review current options and futures disclosure documents which are available from Goldman Sachs sales representatives or at https://www.theocc.com/about/publications/character-risks.jsp and https://www.goldmansachs.com/disclosures/cftc_fcm_disclosures. Transaction costs may be significant in option strategies calling for multiple purchase and sales of options such as spreads. Supporting documentation will be supplied upon request.

Differing Levels of Service provided by Global Investment Research: The level and types of services provided to you by Goldman Sachs Global Investment Research may vary as compared to that provided to internal and other external clients of GS, depending on various factors including your individual preferences as to the frequency and manner of receiving communication, your risk profile and investment focus and perspective (e.g., marketwide, sector specific, long term, short term), the size and scope of your overall client relationship with GS, and legal and regulatory constraints. As an example, certain clients may request to receive notifications when research on specific securities is published, and certain clients may request that specific data underlying analysts' fundamental analysis available on our internal client websites be delivered to them electronically through data feeds or otherwise. No change to an analyst's fundamental research views (e.g., ratings, price targets, or material changes to earnings estimates for equity securities), will be communicated to any client prior to inclusion of such information in a research report broadly disseminated through electronic publication to our internal client websites or through other means, as necessary, to all clients who are entitled to receive such reports.

All research reports are disseminated and available to all clients simultaneously through electronic publication to our internal client websites. Not all research content is redistributed to our clients or available to third-party aggregators, nor is Goldman Sachs responsible for the redistribution of our research by third party aggregators. For research, models or other data related to one or more securities, markets or asset classes (including related services) that may be available to you, please contact your GS representative or go to https://research.gs.com.

Disclosure information is also available at https://www.gs.com/research/hedge.html or from Research Compliance, 200 West Street, New York, NY 10282.

© 2026 Goldman Sachs.

You are permitted to store, display, analyze, modify, reformat, and print the information made available to you via this service only for your own use. You may not resell or reverse engineer this information to calculate or develop any index for disclosure and/or marketing or create any other derivative works or commercial product(s), data or offering(s) without the express written consent of Goldman Sachs. You are not permitted to publish, transmit, or otherwise reproduce this information, in whole or in part, in any format to any third party without the express written consent of Goldman Sachs. This foregoing restriction includes, without limitation, using, extracting, downloading or retrieving this information, in whole or in part, to train or finetune a machine learning or artificial intelligence system, or to provide or reproduce this information, in whole or in part, as a prompt or input to any such system.