

Where Capital Must Go

Seven Ownership Opportunities Framed by AI's Physical Limits

By Chayadol Sundarapura | January 8, 2026

PURPOSE OF THE REPORT

The Core Thesis

The Artificial Intelligence revolution is fundamentally gated by physical constraints. By prioritizing the upstream layers where capital intensity, regulatory barriers, and physics prevent supply, we identify the true bottlenecks of the AI ecosystem. Ownership at these layers captures value regardless of which application, architecture, or hyperscaler succeed turning structural necessity into long term pricing power and compounding durability.

Introduction

This report is built around a single conviction. That the next decade will reward ownership of infrastructure, platforms, and systems that will far out live short narratives. The markets incentivise narratives in the short term, but compound necessity in the long term. Businesses that become essential for the operation in the ecosystem, outlasts cycles, headlines, and sentiment.

AI is no longer an application. It is becoming a foundational layer of the economy. Value is beginning to move away from surface level features to the layers underneath that allows AI to operate at scale. Power that can run continuously. Data centers that can expand. Semiconductor manufacturing that can translate physics into output. Data that can seamlessly flow through networks. These become requirements, and once integrated, operations without them seem risky, expensive, and a lot of the times, impossible.

Many of the companies in this report sell to governments and enterprises. They are embedded in contracts, budgets, and procurement cycles. Their products evolve from tools into essential habits that turn to industry norms. Over time this creates switching costs, durability, and pricing power.

This report is focused on a long term mindset. Intermittent noise becomes buying opportunities. Macro trends fade in and out. Where balance sheets stay strong. Products become critical for survival. The goal of this is not to chase a trend but to own strong compounding companies. With this, comes down quarters and maybe even years that seem bearish or are trading sideways. This is where the conviction becomes simple. Does the ecosystem become incrementally reliant on the business as the world becomes more complex?

The following sections will break down the physical bottlenecks within the AI supply chain. Why those bottlenecks matter. What companies own those bottlenecks. And what risks are apparent. If we can understand how the infrastructure puzzle fits together, we can start thinking in systems and themes, where then headlines and noise are secondary.

THE AI VALUE STACK

We analyze the stack through the lens of inelasticity. While the entire ecosystem must scale together, investments are disproportionately captured by the layers where supply cannot be improved by software or capital alone.

Constraint Chain

Energy and Power

The **Physical Bottleneck Layer**. Secure power is the physical gatekeeper. We focus on Nuclear Baseload (CEG, VST) because grid interconnection delays and reliability constraints create a “natural monopoly” for existing, permitted assets that cannot be replicated within a 5-10 year window.

Thermal Management

The **Operational Scaling Layer**. As thermal design power (TDP) exceeds the limits of legacy air cooling, Vertiv (VRT) captures value through the “Design In” model. Hyperscalers cannot risk expensive clusters on unproven thermal solutions, making Vertiv both a utility provider but a systemic dependency.

Semiconductor Manufacturing

The **IP and Capex Layer**. ASML and LRCX represent a technological monopoly. Their tool qualification process and EUV technology are the sole chokepoints through which global manufacturing must pass. Value accumulates here because there is simply no substitution.

Networking and Interconnects

The **System Highway Layer**. In AI, the “network” is like the nervous system to the human body. Broadcom (AVGO) and Arista (ANET) control standardized interconnects required for high data movement that allows GPU clusters to operate.

Dependency Logic

This stack is only as fast as the slowest layer. The thesis is built on constraint leverage, by owning the companies whose economies improve when the system is the tightest.

BOTTLENECK CHAPTERS

Chapter 1: The Energy Layer

The Quantitative Point of View: We are entering a structural “Permit Scarcity” where the right to consume power at scale is the asset.

- Demand Surge: Global data center power demand is forecasted to increase **165% by 2030**. In the US alone, data centers are projected to consume nearly **6.7%-12% of total national electricity** by 2028, up from 4% today.
- The Scarcity Premium: Goldman Sachs estimates a **\$720 billion grid spending requirement** through 2030 to close the gap between AI demand and aging infrastructure.
- Reliability Risk: Over half of North America faces increased risk of energy shortfalls through 2029 as demand from AI and manufacturing collides with **115 GW** of projected **fossil fuel plant retirements by 2034**.

Why This Bottleneck Exists: Securing energy is no longer buying electricity, it is a race for deliverable megawatts (MW) within congested regions.

- The Interconnection Backlog: In the PJM region, the world’s largest grid operator, there are over 30 GW of data center requests. However, the “interconnection queue” for new projects now has waiting periods exceeding **36 months**.
- Regulatory Friction: The Federal Energy Regulatory Commission (FERC) and regional boards are shifting from “access first” policies to “grid preservation”. This prolonged the procedure for any new large loads exceeding 50 MW, making existing assets significantly more valuable.

The Moat: Value accrues to the companies that own the unreplicable assets, specifically Nuclear Baseload.

- The Reliability Premium: AI data centers require 24/7, carbon free power to meet both uptime requirements and corporate sustainability goals. Renewables cannot meet this requirement without massive storage, making existing nuclear plants the only viable solution.
- The Time to Market Moat (CEG): The 20 year Power Purchase Agreement (PPA) between Constellation Energy and Microsoft to restart the **835 MW** Three Mile Island Unit 1 proves that hyperscalers will pay a premium to bypass 5 year grid waits.
- Long Term Contracts Moat (VST): Vistra recently secured a 20 year PPA for **1,200 MW** from its Comanche Peak nuclear plant. This investment provides cash flow visibility and creates a customer dependence that protects margins during high capex cycles.

Chapter 2: Thermal Management

The Quantitative Point of View: We are in a shift where liquid cooling is no longer optional but a critical requirement for the next generation of AI.

- Market: The global data center liquid cooling market is projected to grow from **\$5.38 billion in 2024 to \$17.77 billion by 2030**, showing a **21.6% CAGR**.
- The Thermal Limit: Traditional air cooling becomes physically limited at rack densities above **20-30 kW**. Standard industry rack densities are averaging around **7.6 kW** in 2025, but are forecasted to reach **1 MW** by 2029.
- Transition: Next gen clusters, such as NVIDIA Blackwell NVL72, draw between **120 kW and 142 kW per rack**. This requires direct to chip liquid cooling for at least 80% of the heat load.

Why This Bottleneck Exists: Data centers cannot scale vertically fast enough to keep up with GPU power, they must scale horizontally.

- Systemic Risk: Heat is the primary cause of hardware failure and performance stall. In a \$10B+ GPU cluster, the failure cost of inadequate cooling is not viable, making cooling a critical addition to compute.
- Sustainability Pressure: Liquid cooling offers superior Power Usage Effectiveness (PUE), which is needed as hyperscalers face strict carbon reduction goals and rising energy costs.

The Moat:

- Technological Standard: Vertiv is a leader in Open Compute Project (OCP) designs, recently unveiling rack and cooling ecosystems capable of supporting 142 kW loads.
- The Blueprint Moat: Once hyperscalers integrate Vertiv's **CoolChip CDU** (Coolant Distribution Units) and scales into their modular data center blueprint, the replacement cost becomes risky.
- Validated Ecosystem: Vertiv's collaboration with NVDA and other major chipmakers ensures their cooling solutions are validated at the silicon level, creating a moat against price oriented competitors.

Chapter 3: Semiconductor Manufacturing

The Quantitative Point of View: As chips shrink, the cost and complexity of manufacturing tools grow, favoring few players with the R&D scale to keep up.

- WFE Record Spend: Global Wafer Fab Equipment (WFE) spending is expected to surpass **\$100 billion for the first time in 2025**, reaching **\$135.2 billion by 2027**.
- Logic Dominance: Foundry and logic equipment spending is projected to hit \$66.6 billion in 2025, driven by sub 2nm architectures.

- Memory Cycle: High Bandwidth Memory (HBM) demand is a critical bottleneck, DRAM related equipment investment is expected to exceed **\$79 billion from 2025 to 2028**.

Why This Bottleneck Exists:

- The Transition: Traditional Deep Ultraviolet (DUV) lithography cannot print the features required for 2nm chips. This makes Extreme Ultraviolet (EUV) lithography the only viable path.
- Stacking Complexity: Advanced AI chip[s] require “3D stacking” and high aspect ratio etching, where tools must drill perfectly through hundreds of layers of silicon.

The Moat:

- ASML Monopoly: ASML holds 100% market share in EUV lithography. Any company building sub 5nm chips must use ASML's tools, giving them the ultimate pricing power.
 - Lam Research Etch: Lam is the gatekeeper for 3D NAND and HBM manufacturing. Their etch and deposition technology is essential for vertical complexity of AI memory.
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Chapter 4: Networking and Interconnects

The Quantitative Point of View: As the market shifts from training models to running them at scale, the bottleneck moves from GPU power to the lines that connect them.

- Global Market Expansion: The global networking market is projected to reach approximately **\$192.42 billion by 2034**, representing a **32.51% CAGR** from \$15.28 billion in 2025.
- Revenue Explosion: Broadcom's AI semiconductor revenue rose **74% YoY to \$6.5 billion in Q4 2025**, with a total consolidated **AI backlog of \$73 billion**.
- ASIC Growth: The AI Application Specific Integrated Circuit (ASIC) market is the fastest growing processor segment, projected to grow from **\$9 billion in 2024 to \$85 billion by 2030**, representing a **45% CAGR**.
- Fabric Value: For every \$1 spent on a GPU, roughly **\$0.20-\$0.25** is now spent on networking and interconnects to ensure it operates at high utilization.

Why This Bottleneck Exists:

- Scaling Limits: Proprietary standards like InfiniBand face scaling and cost challenges as clusters grow. The industry is pivoting toward Open Ethernet Standards to maintain a competitive edge.
- Latency Gate: As clusters split across multiple physical locations due to power constraints, networking must maintain lossless data transfer over distances of up to **60 miles**.

The Moat:

- The Connectivity Standard: Broadcom's Tomahawk 6 is the world's first 102.4 Tbps switch, allowing hyperscalers to scale to over one million accelerators in a single fabric.

- Custom Silicone Lock-In: Broadcom is the primary partner for the “Hyperscale Elite”, co-developing Google’s 7th gen “Ironwood” TPUs and Meta’s “Santa Barbara” ASICs. This the moat where switching architectures would require a replacement of the entire software stack.
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COMPANY LEVEL ANALYSIS

Vistra (VST) - Data Center Power

Company Overview

Vistra Corp acts as an energy provider within the AI era, offering dispatchable, high-reliability, always-on power, necessary for hyperscaler data centers. The company operates an integrated power generation and retail platform with approximately **50,000 MW of capacity**. Diversifying energy across natural gas (65% of Vistra's total capacity), the nation's second largest nuclear fleet (13%), coal (17%), and renewables and storage (5%). Vistra serves the cloud titans Amazon, Microsoft, and Google, who are directly contracting with Vistra to bypass the 4-7 year interconnection queues of the traditional grid. The main offerings are **Vistra Vision**, a zero-carbon nuclear and battery storage, and **Vistra Tradition** which is dispatchable gas. The current 2025-2030 cycle where data centers are projected to consume nearly 6.7-10% of total US electricity by 2028, is the reason Vistra emerges as a key player.

Moat and Defense

Vistra's moat is built on the asset scarcity and the regulatory hurdles of the US power grid. Switching costs for customers are extreme because the physical location of Vistra's co-location deals allows hyperscalers to avoid multi-billion dollar grid upgrade costs and years of permitting. The company owns a unique asset through its nuclear uprate program and a 20-year 1,200 MW PPA at its Comanche Peak facility, which guarantees revenue streams into the 2040s. The defensibility is reinforced by scarcity pricing of the PJM market, where auction prices hit a record of **\$333 per MW day**, essentially pricing out new entrants who lack scale. Vistra's replacement is physically constrained by the lack of new nuclear plants being built in the US within the last couple of decades, meaning Vistra's assets cannot be replicated.

Market Opportunity and Scalability

The US data center power demand is projected to grow by 165% by 2030, adding to an overall US power demand growth rate of 2.6% annually. Vistra's SOM is anchored in the EROCT (Texas) and PJM (Mid Atlantic) energy markets, where it's expanding capacity with two natural gas units totaling **860 MW** in EROTC and the acquisition of a **2,600 MW** gas fleet across seven different plants. Scalability is shown by their ability to repower legacy sites with modern storage and nuclear uprates, with management giving a 2026 EBITDA. Growth can also be interpreted through their **30% reduction in share count** since 2021, showing Vistra can scale its cash generation per share as it reinvests in the grid.

Financial Health and Economics

Vistra's Q3 '25 numbers show **\$1.5 billion of Adjusted EBITDA** in a single quarter, full year 2025 EBITDA at **\$5.7 billion - \$5.9 billion**, and 2026 guidance of **\$6.8 billion to \$7.6 billion**. Adjusted Free Cash Flow is projected to reach **\$3.9 billion to \$4.7 billion by 2026**. They hold a strong capital efficiency, showing a **64% ROE** on a trailing 12-month basis, compared to the industry average of 23%. Vistra reported that as of October 31, 2025 it hedged 98% of expected generation volumes for 2025, 96% for 2026, and 70% for 2027. Vistra is essentially converting uncertain future power prices into predictable cash flow. Vistra's business model has returned over \$5.6 billion to shareholders since 2021 while maintaining a leverage ratio of 2.3x (meaning it would take Vistra 2.3 years of current earnings to pay off its entire debt, which is very healthy for a utility and energy company). The strong balance sheet allows Vistra to acquire assets at attractive valuations (ie. \$1.9 billion Lotus Infrastructure acquisition), which adds low cost gas to support its nuclear output.

Risk Assessment

The primary risk is regulatory and market volatility. Recent FERC rulings and PJM auctions could alter the economics of co-location deals, forcing Vistra to sell power back to the grid at lower rates. Fuel price volatility remains a factor, while nuclear costs are stable, the company's gas fleet is sensitive to long term swings in natural gas prices that can impact margins. The thesis would break if Long Duration Energy Storage (LDES) reached a cost similarity with gas peakers allowing renewables to act as a baseload power. Along with a significant safety event at a nuclear site triggered a nationwide regulatory freeze on the sector. However, given that Vistra's nuclear fleet consistently operates at **91% - 99% capacity**, these operational risks are well mitigated.

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Constellation Energy (CEG) - Data Center Power

Company Overview

Constellation Energy owns the only immediate solution to the AI power crisis, providing the 24/7, carbon free electricity needed to sustain GPU clusters. The company operates the largest competitive nuclear fleet in the US, with over **32,000 MW of capacity** and a carbon free generation rate of nearly 90%. While wind and solar are intermittent and gas is carbon heavy, AI workloads require a reliable carbon load that only nuclear power can provide at scale. CEG serves tech giants, Microsoft and Meta, who are working around the public grid to secure dedicated nuclear capacity. The core offerings are repowering legacy nuclear assets, like the **Crane Clean Energy Center** (formerly Three Mile Island Unit 1), which is being restarted under a 20 year, **835 MW PPA** with Microsoft. Thy “why now” is the critical supply demand gap, where US data center power consumption is projected to grow by **130% by 2030**, making “always on” carbon free power valuable.

Moat and Defense

Constellation’s moat is built on the entry barriers to the nuclear sector. Switching costs for hyperscalers are essentially infinite. If a customer requires 1,000 MW of reliable clean energy, they must contract with an existing plant to wait 10+ years for a new build. The company’s technical strength is in its industry leading **96.8% nuclear capacity factor**, ensuring virtually zero stalls for compute clusters that outpace renewables and traditional thermal plants. The defense is supported by the **2025 “One Big Beautiful Bill Act” (OBBA)**, which preserved the Section 45U Zero-Emission Nuclear Production Tax Credit (PTC) through 2032, creating a federal “price floor” that protects Constellation’s margins from wholesale market volatility. Replacement of Constellation is physically blocked by the decade lead times for Small Modular Reactors (SMRs) and the lack of commercial scale LDES, making Constellation’s existing fleet the only viable option.

Market Opportunity and Scalability

McKinsey projects that **\$1.3 trillion** will be invested in power generation and transmission for AI data centers by 2030. Constellation expanded its growth target to **10% annual EPS growth**, scalability is evident by the “Crane Model”, where they are using a **\$1.6 billion industrial restart program**, backed by a **\$1 billion DOE loan** to bring legacy units back online specifically for AI. Constellation is also scaling through nuclear uprates adding hundreds of megawatts to existing plants like Clinton and Salem to meet Meta’s regional expansion needs, where they signed a **20 year deal for 1,100 MW** of capacity.

Financial Health and Economics

Constellations financials validate their pricing power, 2024 Adjusted Operating Earning of **\$8.67 per share** far exceeded initial guidance. Their capital efficiency projected a **\$3.1 billion in positive FCF** in 2025, compared to negative FCF in previous investment cycles. The company operates on a **44.95% gross margin**, which is higher than industry average at 32%. The business shows a robust share repurchase program which **\$2 billion worth were repurchased**

in **2023**, and a dividend that grew by **25% in 2024**. Their **0.62 D/E ratio** compared to peers like NextEra Energy or Southern Company often carrying a 1.5 and 2.5 DE, indicates an exceptional balance sheet capable of withstanding fleet life extensions into the 2050s.

Risks Assessment

The main risk is Regulatory and Transmission Interference. While federal policy (OBBA) is supportive, regional FERC rulings or state level complaints could restrict Constellation's ability to sell power directly to data centers forcing them to sell to the public grid. Geopolitical risk also rises through Foreign Entity of Concern (FEOC) rules, which require Constellation to verify after 2027 that its nuclear fuel is not sourced from covered nations. The thesis breaks if LDES achieves cost similarity with nuclear before 2030, or if a major safety incident occurs. However, given the **3,400 jobs and \$16 billion in GDP** created by the Crane restart alone, the political and economic momentum for nuclear backed AI appears resilient.

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Vertiv (VRT) - Thermal Management

Company Overview

Vertiv sits at the physical interface between utility power and heat output inside data centers. Vertiv, designs, manufactures, and services infrastructure that provides electrical power and cooling for dense GPU clusters. Their customer base includes, hyperscalers such as AWS, Google, and Meta who require standardized liquid cooling, and colocation providers (Equinix, Digital Realty) who need flexible power distribution. The core product includes Coolant Distribution Units (CDUs), rear door heat exchangers, and high efficiency power systems. AI workloads are projected to reach 600kW to 1MW of energy per rack by 2029, therefore necessitating a transition from air cooling to liquid cooling.

Moat and Defense

Vertiv's moat is based on deep ecosystem integration and high switching costs which means high operational risk. Replacement of Vertiv's systems would cost **\$8,851** per minute in downtime risk, making experimenting with unproven thermal vendors costly. The company

remains deeply embedded with its partners such as its collaboration with NVIDIA “Grid-to-Chip” roadmap, specifically engineering 800V DC power and cooling for upcoming architectures like the NVIDIA Rubin Ultra. This technical relationship is also supported by the 4,000 field engineers and 310 service centers, infrastructure at this scale requires constant maintenance and service representing **17.2%** of their revenue. As AI cluster complexity rises, the moat strengthens because customers prioritize the qualification and reliability over lower upfront capex.

Market Opportunity and Scalability

The global data liquid cooling TAM is projected to expand from approximately **\$5.38 billion in 2025 to \$17.77 billion by 2030**, representing a **CAGR of 21.6%**. Vertiv’s SOM is anchored by the Direct Liquid Cooling (DLC) segment, which holds over **68% of liquid cooling revenue**. As a dominant player in this segment, Vertiv is capturing a disproportionate share of the hyperscale market which accounts for **39% of all liquid cooling spend**. Scalability is supported by a record of **\$9.5 billion in backlog** and organic order growth of **60% YoY**, indicating the company is the primary design partner for the next generation of AI silicon racks.

Financial Health and Economics

Vertiv’s moat is directly translated into durable margins, with operating margins reaching **22.3% in Q3’ 25**, up from 17.9% the previous year. This expansion shows significant pricing power and productivity as the company has offset tariff impacts and supply chain disruptions. Capital efficiency is high, with adjusted free cash flow of **\$462 million in a single quarter**, representing **38% YoY growth**, being reinvested into high ROI expansions like new liquid cooling facilities in EMEA.

Risks Assessment

The primary risk is vertical integration of hyperscalers attempting to build out cooling system designs in house. However, Vertiv’s **20 year average** customer relationship and the high operational risk of managing fluid dynamics and specialized power at scale, makes wholesale in house design difficult for customers to focus on software and chip design. Competitive threats from players like Schneider Electric and Eaton exist, but these companies often struggle with specialized ability required for next generation chips. Geopolitical risks, particularly copper pricing and export controls on high end infrastructure, could pressure margins or delay projects. The thesis breaks only if a significant shift in chip efficiency happens that eliminates the need for advanced thermal management, making heat not an issue.

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ASML (ASML) - Semiconductor Manufacturing

Company Overview

ASML acts as the ultimate gatekeeper of the physical layer in semiconductor manufacturing. ASML provides Extreme Ultraviolet (EUV) and Deep Ultraviolet (DUV) lithography systems that use light to print complex circuit patterns onto silicon wafers. In the AI infrastructure stack, they solve the “shrinking” bottleneck, meaning as AI’s demand increases in compute density, chipmakers must shrink transistors to the 3nm and 2nm which are physically impossible to reach without ASML’s EUV technology. Its customers are the big three foundries, TSMC, Intel, and Samsung, who all cannot avoid this expense because ASML is the **only company in the world capable** of producing EUV machines. The core product stack features the **NXE:3800E** (standard EUV) and the revolutionary **Twinscan EXE:5200B (High-NA EUV)**. High-NA (High Numerical Aperture,) refers to the next generation manufacturing technology needed for most advanced semiconductors. Thus this transition is the main catalyst to ASML’s dominance.

Moat and Defense

ASML’s moat is its monopoly over the unique process that it holds. Switching costs are non-existent because there is no alternative vendor for EUV, a foundry either uses ASML or loses the ability to manufacture leading edge chips. The technical defense is placed in a supply chain of over 5,000 partners, including a 25% stake in Zeiss who is the dominant player for the process of vaporizing droplets to create EUV light. Removing ASML would require competitors to replicate three decades of R&D and a \$150 million - \$400 million hardware stack. This lock-in is so embedded that **lithography equipment now constitutes more than 50% of total fabrication costs**, giving ASML enormous leverage over the entire ecosystem.

Market Opportunity and Scalability

The global semiconductor lithography market is projected to grow from **\$28.4 billion in 2025** to over **\$43 billion by 2030**, with the High-NA EUV segment growing at a **10.7% CAGR**. ASML has guided revenue between **€44 billion and €60 billion** by 2030. Scalability is driven by constraint, where AI servers require a push past a trillion resistors which multiplies the need for their services. This is shown by a record **€3.6 billion in EUV bookings in Q3 2025 alone** and a total net sales growth projection of **15% for FY2025**.

Financial Health and Economics

ASML's financials show gross margins targeted to reach **56%-60%** by 2030 as products shift towards higher margin High-NA systems. In Q3' 25 the company reported **€7.5 billion in net sales with a 51.6% gross margin**, keeping a cash position of **€5.1 billion**. A single High-NA tool can generate more revenue than an entire legacy fab, while the service and upgrades for installed bases generated a revenue of **€2 billion (27% of revenue)** in Q3 2025. This cash flow then supports an annual **€4.8 billion R&D budget**, used to maintain the technical gap between any competitors.

Risks Assessment

The primary risk is geopolitical concerns. ASML expects a "significant decline" in China customer demand for 2026 as US and Dutch restrictions tighten systems. China currently accounts for up to 42% of sales where ASML remains the global gatekeeper for sovereign AI buildout. The thesis breaks if there is a "non-lithographic" manufacturing breakthrough, such as Nanoimprint Lithography achieving increased manufacturing at fractions of the cost, or if 2nm node transition is delayed more than 24 months causing a capex "pocket".

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Lam Research (LRCX) - Semiconductor Manufacturing

Company Overview

Lam Research operates as the primary tool provider for semiconductor manufacturing. Lam provides the etching (selective removal of material) and deposition (additive coating) equipment required to create complex 3D structures on silicon wafers. Lam solves the "scaling limit" problem, as transistors approach physical size limits, they must be stacked vertically to increase density. Lam's customers are world leading foundries and memory manufacturers (TSMC, Samsung, SK Hynix, and Micron) where they cannot avoid this layer because Lam's high-aspect-ratio (HAR) etching is the only way to create the narrow channels required for 3D NAND and HBM. The core product offerings are the Kiyo (etch), Altus (deposition), and Sabre

(electrofill) platforms, which are critical for building these dense transistors. The importance of Lam is driven by the 2025-2030 shift toward “Gate-All-Around” (GAA) transistors and advanced packaging, where process complexity increases thus the number of etch and deposition steps can increase by over **30% per node**.

Moat and Defense

Lam’s moat is built on the “atomic-level lock-in” and extreme operational risk. Switching costs are too expensive because chip manufacturing processes are qualified for specific equipment. Once a foundry creates a recipe for a 2nm node using Lam’s etch tools, replacing it with a competitor would require reengineering the entire production line. Lam owns proprietary process knowledge in cryogenic etching and dry resist technology that allow for more precise patterning. This is reinforced by an installed base of over 90,000 units, creating a “data flywheel” where Lam uses machine learning from its global fleet to optimize yield for customers. Replacement of Lam would require customers to accept not only the cost of new hardware, but the risk of falling behind the Moore’s Law curve due to lower yields.

Market Opportunity and Scalability

The global semiconductor etch equipment market is projected to grow from **\$30.16 billion in 2025 to over \$56 billion by 2034**, representing a **7.14% CAGR**, while the broader wafer fab equipment (WFE) market is expected to surpass **\$100 billion** in 2025. Within this, Lam is targeting an expansion of its SAM from low 30% range to high end 30% range by 2029 by capturing 50% of incremental spend in HBM and advanced packaging. Scalability is constraint driven, as AI workloads demand smaller and more complex stacks where the number of “Through-Silicon Vias” (TSVs) that must be etched grows exponentially. Lam’s revenue growth is tied to its Customer Support Business Group (CSBG), which is expected to grow 1.5x by 2028. Lam disclosed in the September 2025 quarter, that they had generated about **\$3.5 billion** from selling new systems and **\$1.8 billion** from customer support and services. That means a large portion of revenue comes from maintaining and expanding the installed bases and not just selling machines.

Financial Health and Economics

Lam’s financials validate pricing power, with **gross margins reaching a record 50.3% in 2025**. The company shows exceptional capital efficiency, generating **\$6.2 billion in operating cash flow** within their \$18.4 billion in revenue for FY2025, with a ROIC of approximately 38%. Customer concentration is high, with five major players representing a majority of revenue which provides Lam with “design-in” visibility before a factory even breaks ground. Reinvestment is strong, with over **\$2 billion annually** dedicated to R&D to maintain the technical lead.

Risks

The primary risk is geopolitical, 34%-38% of Lam’s revenue is tied to China, leaving it vulnerable to US export controls that could hit revenues by **\$200 million to \$600 million annually**. Vertical integration risk is low, as R&D required to build etch tools is outside the realm of foundries. The thesis would break if “lithography-only” breakthrough occurred which would reduce the need for

multiple etching steps, or if a competitor like Tokyo Electron achieved a generational leap in cryogenic etch efficiency. These risks are monitored through Lam's market share in the "dielectric etch" segment, which currently remains the company's largest share of 50% of the market.

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Arista (ANET) - Networking and Interconnects

Company Overview

Arista Network serves as the high-speed data traffic controller. Arista designs and sells multilayer network switches and software designed networking (SDN) solutions that facilitate rapid movement of data between GPUs, storage, and the broader internet. Its customers are the "Cloud Titans" (Microsoft, Meta) and specialized AI as a service providers. The core offerings are centered on the 7800R4 series, which supports the current shift to **800G port densities** and provides the deep packet buffering required to handle the work of AI training. The draw to Arista is driven by the explosive growth in 800G port shipments which is projected at a **90% five year average annual growth rate**, and the industry push for Ultra Ethernet Consortium (UEC) as the standard.

Moat and Defense

Arista's moat is built on its **Extensible Operating System (EOS)**, a unique "single binary image" software stack that runs across every product in its portfolio. Unlike competitors, Arista's EOS uses a state based database model that allows the network to self heal and update in real time without taking the system offline. Switching costs are extreme because hyperscale engineers have spent over a decade integrating their automations specifically into the EOS APO, making a transition a huge operational risk. The defense is supported by the "Netdi" diagnostic infrastructure leveraging **7,000 person years of software development**, which provides the necessary visibility to prevent packet loss. Arista's approach to silicon makes it the

default choice for customers who want flexibility to mix and match hardware from NVIDIA, AMD, or internal ASIC projects without changing their entire architect network.

Market Opportunity and Scalability

The company recently expanded its TAM estimate to **\$105 billion by 2028**, driven by a new category for “Scale-Up” networking. In this, Arista’s AI revenue is projected to grow from **\$1.5 billion in 2025 to \$2.75 billion in 2026**, representing a **83% growth rate** that outpaces the broader networking sector. Scalability is supported by their 19th consecutive record quarter of growth and leadership within the 800G market. The company is targeting a **\$10 billion annual revenue goal for 2026** by expanding beyond the cloud titans into “Vanguard” customers like neoclouds and sovereign wealth funds who are building their first AI clouds.

Financial Health and Economics

Arista’s non-GAAP gross margins consistently reach **64-65%** despite selling to hyperscalers, proving that their software value add is critical. The business model is capital efficient, generating **operating margins of 48.6% in Q3’ 25** and maintaining **\$10.1 billion in cash and investment with no debt**. This allows Arista to fund its own R&D over **\$1 billion annually** and maintain a strong share repurchase program. The company’s backlog momentum and deferred revenue growth of **\$625 million** indicate that demand continues to outpace supply giving Arista a significant leverage in the supply chain.

Risk Assessment

The main risk is vertical integration. Arista relies heavily on Broadcom for the silicon chips inside its switches, if Broadcom were to significantly raise prices or favor its own networking systems, it could compress their margins. Competitive threats from NVIDIA’s InfiniBand platforms can bundle its networking gear directly with its GPUs, potentially cutting out Arista from certain clusters. If cloud titans successfully internalize their networking stack, Arista’s margin could also compress. The thesis breaks only if Ethernet fails to achieve performance parity with InfiniBand for the next generation of GPU clusters, or if a major security vulnerability in the EOS codebase permanently damages its reputation.

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Broadcom (AVGO) - Networking and Interconnects

Company Overview

Broadcom is positioned as the primary architect of the data interconnects of massive AI clusters. Broadcom provides the high-radix Ethernet switches and custom AI accelerators (XPU/ASICs) required to move data between thousands of chips with very minimal latency. In the bottleneck chain, Broadcom solves the “interconnect bottleneck”, as AI models grow, the speed at which GPUs communicate becomes a substantial limit on training performance. Its customers are primarily hyperscalers like Google and Meta, and AI labs like OpenAI and Anthropic, who use Broadcom to build specialized hardware that is more power efficient than general GPUs. The core offerings are Tomahawk and Jericho switching silicon alongside custom designed AI accelerators that account for **65%** of the company's AI revenue. The need for Broadcom is the industry's transition to the **1.6 Terabyte upgrade cycle** and the emergence of the Ultra Ethernet Consortium (UEC) 1.0 standard, which places Ethernet as the standard fabric.

Moat and Defense

Broadcom's moat is in the “architecture lock” and the extreme complexity of SerDes (Serializer/Deserializer), the foundational technology used to move massive amounts of data at high speeds. Switching costs are high because hyperscaler's entire network software stack is optimized specifically for Broadcom's silicon, moving to a competitor would require an entire replacement of the networking system and management tools. The company holds a dominant **90% market share in the custom AI accelerator segment**, while their total high **end ASIC share sits at roughly 75%**, creating a dual strategy within the cluster scaling. The defensibility is supported by its “Bailly Co-Packaged Optics (CPO), which integrates optical engines directly onto switch silicon reducing power consumption by up to **70%**. Competitor switch is based on performance ability, many struggle to match Broadcom's 51.2 Tbps throughput and minimal latency, making displacement far too risky.

Market Opportunity and Scalability

The global ASIC market is projected to grow from **\$20 billion in 2025** to over **\$40 billion by 2030**, while the AI networking sector is expected to have a **CAGR exceeding 25%** by 2030. Broadcom's AI revenue was projected to hit \$20 billion in FY2025, with a target of long term SAM of **\$60 to \$90 billion by 2027**. Scalability is reinforced by a **\$162 billion consolidated backlog**, of which **\$73 billion** is dedicated specifically to AI infrastructure to be delivered over the next 18 months. They also recently secured their fifth major XPU customer and an **\$11 billion incremental order** from Anthropic.

Financial Health and Economics

Broadcom financially validates their pricing power with non-GAAP gross margins reaching **78.6% in FY2025**. Despite the semiconductor industry being capital intensive, the company generated **\$26.9 billion in free cash flow** (42% of revenue) in FY2025. This cash flow then supports an **\$11.5 billion R&D budget**, maintaining their position at the leading edge of

processing technology. A few hyperscalers driving the majority of XPU revenue, this provides Broadcom with a multi year, multi billion dollar order book that is sustainable for long term growth.

Risks

The structural risk is if hyperscalers can successfully internalize their entire networking and accelerator design without Broadcom's IP. But with Broadcom's 17% R&D to revenue ratio to maintain and advance their networking roadmaps, it makes full vertical integration difficult for even the largest cloud providers. Geopolitical risk is a significant factor, roughly **20% of revenue** is tied to China, leaving it exposed to US exports on advanced networking equipment. The thesis breaks is AI model shift away from massive cluster based training toward small models inevitably decreasing the demand for centralized switching.

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COMPARATIVE POSITIONING

Vistra (VST)

VST sits at the bottleneck of merchant (unregulated) nuclear baseload power, an advantage that regulated utilities like Southern Company or Duke Energy cannot match. Because VST operates in deregulated markets, it captures the full premium of 24/7 carbon free power, whereas regulated competitors are capped by a state level rate. Operational leverage can be seen in their acquisition of Energy Harbor and the 6,400 MW nuclear fleet positions in high growth regions. Regulated companies are disadvantaged because their capital allocation is flowed to the grid upgrade cycles rather than direct to customer contracts. VST wins because it offers the clearest path of revenue from the “dispatchable carbon free electrons”, where their position would only change if nuclear policies collapsed or if LDES reached parity with nuclear.

Constellation Energy (CEG)

CEG controls the most valuable carbon free baseload asset in the United States, making them the primary bottleneck for data center power. Unlike NextEra Energy’s renewable-heavy portfolio and massive grid queue delays, CEG provides immediate 24/7 power. This can be supported in their 20 year PPA for the Crane Clean Energy Center, making it a non-substitutable contract that others cannot replicate with renewables. The ranking would only change if nuclear policies change or a catastrophic event resulted in a shutdown of their nuclear fleets.

Vertiv (VRT)

Vertiv owns the thermal bottleneck, competitors like Schneider Electric, Eaton, and Johnson Controls are too diluted in general industrial and residential electrical infrastructure. Many of these competitors compete for broader grid power distribution while VRT sits at the choke point of liquid to chip cooling. The 360AI integrated stack and the CoolChip fluid network co-developed with major GPU designers, integrates VRT during the initial build out phase of the cycle. Eaton's exposure to older commercial electrical equipment lacks specificity for AI infrastructure, making their exposure to the AI buildout weaker than VRT. This would only change if chip infrastructure shifted back to lower power densities of a breakthrough in other cooling techniques from competitors.

Lam Research (LRCX)

LRCX's ownership of etching and deposition, which is critical for vertical scaling of logic nodes, make competitors like Applied Materials (AMAT) less favorable because their depth in these high precision steps are not suited for next generation designs. LRCX withstands comparative pressure because its tools are integrated into some of the most difficult steps of the fab cycle, making switching risk highest due to yield sensitivity. AMAT's structural dependence on the maturing ICAPS segments dilutes their exposure to the AI build out. Ranking would change if the industry steered away from 3D stacking, replacing it with new architects.

ASML (ASML)

ASML holds the monopoly over the EUV lithography bottleneck, the most critical choke point in the entire semiconductor supply chain. Competitors like Nikon and Canon are nowhere near ASML and still operating with DUV technology, lacking the multiple decade R&D needed for EUV lithography. The ability to replicate ASML's supply chain in 10 years is ultimately non-existent, therefore this ranking is permanent unless Nanoimprint Lithography (NIL) or other techniques reach commercial scale at sub 2nm nodes.

Arista (ANET)

ANET serves as the software defined networking bottleneck, something that Cisco is structurally incapable of owning due to its legacy hardware focused business model. Cisco's attempt to pivot to Silicon One and high end software is late-cycled and diluted by their massive unrelated revenue. Arista's EOS (Extensible Operating System) reduces the coordination struggle for cloud titans which is supported by their dominant wallet share with the "Big Five" hyperscalers. ANET ultimately wins because its exposure purity to the high-radix Ethernet transition is nearly 100% within the AI networking segment. ANET also owns the design-in phase of the networking cycle allowed by their software that permits rapid, automated scaling. This ranking would change only if hyperscalers moved entirely to open source "White Box" networking software.

Broadcom (AVGO)

AVGO represents the bottleneck in custom AI accelerators (ASICs) and networking silicon, a position that Marvell fails to compete at scale with. The ownership is largely based on Broadcom's 90% share in the custom ASIC market, supported by their financials and design partnerships with Google and Meta. Broadcom is further convicted by controlling the Tomahawk and Jericho switching silicon, which acts as the toll roads for AI data. Broadcom wins the full cycles because their software defined silicon creates a hurdle too large for competitors to replicate. The order would change if hyperscalers successfully create 100% of their silicon design inhouse.

WHAT WOULD BREAK THE THESIS

Thesis Dependency

This portfolio only works if AI scaling remains constrained by power availability, heat removal, leading edge silicon throughput, and cluster bandwidth and if those constraints continue to benefit Vertiv, ASML, Broadcom, Arista, Constellation Energy, Lam Research, and Vistra will capture the upside.

Demand Destruction: AI Build Out Pauses Hard Enough to Plateau The Constraint Stack

The thesis breaks if the AI cycles gets delayed and then further canceled, meaning hyperscalers stop spending because AI software revenue isn't growing fast enough to justify the infrastructure capex. For this portfolio, the condition is a multi-quarter collapse in demand at the infrastructure layer and gatekeepers.

This is not a rescission claim, it is the markets commitment to stray away from AI. If the next 12-18 months show that AI capex is discretionary rather than infrastructure, the portfolio loses its central structure.

Architectural Shift: Compute Becomes Less Power, Heat, and Bandwidth Constrained

The thesis dramatically weakens if the dominant AI architecture changes in a way that significantly reduces power density, thermal intensity, and bandwidth needs, fast enough to outrun infrastructure build cycles. The condition is not if efficiency improves, because it always does, but if the efficiency change reduces the total infrastructure demand.

This matters because the portfolio assumes that the physical constraints remain important as efficiency improves because total demand for compute rises at least as fast as efficiency gains. If the next 24 months show the system shifting towards materially lower density deployments without compensating increase in compute demand, Vertiv and Broadcom lose leverage and become cycle exposures.

Supply Response: Power and Grid Constraints Ease Faster Than AI Load Arrives

The thesis fails if the power bottleneck resolves quickly enough that firm power becomes enough in regions that matter for data centers. Current evidence shows otherwise, NERC's 2025-26 assessment cites data centers as a primary load growth driver, and PJM's capacity market produced record pricing behavior consistent with tight supply and reliability stress.

The condition is based on time, either capacity markets normalize or interconnection and transmission additions begin arriving at a pace that sustains incremental load without a price increase. If that happens, Constellation's "scarcity" premium lowers, and Vistra's ability to convert tighter earnings weakens even if load continues to grow.

Policy Changes: Political Intervention Caps Scarcity or Impairs Nuclear Economics

Power is politically governed. The thesis breaks if policy changes directly affect the monetization of scarcity and nuclear support. The Reuters reporting on PJM's auction shows regulatory price capping, where if power prices receive public backlash, governments may intervene to cap the earnings of companies like Constellation and Vistra to protect consumer utility bills.

Geopolitical Disruption: Silicon Supply Becomes Intermittently Unavailable

The thesis breaks if geopolitics disrupts semiconductor supply chains that reduces the relevance of "throughput gatekeepers" and shifts the system into prioritizing shortages rather than scaled build out. ASML is the cleanest choke point in this portfolio because EUV substitution is not an option, however, ASML is exposed to export controls and border policies. Current reporting already flags China related demand uncertainty and export restrictions, so if export rules or geopolitical escalations significantly reduce the industry's ability to deploy leading edge tools for multiple years, the portfolio degrades.

Vertical Integration: Hyperscalers Begin Expanding Inward

The thesis breaks if large buyers capture enough of the value chain from within that the suppliers no longer capture the constraints. Broadcom is exposed to this risk at the networking layer. The portfolio underwrites Broadcom because its AI revenue is already large and growing with their disclosed results, implying a deep integration. The breaking point is when there is a shift where major customers replace merchant solutions at scale and Broadcom's AI revenue growth decelerates sharply from the fiscal 2025 baseline. Vertiv faces a similar risk, if hyperscalers adopt fully in house designed thermal solutions and where differentiation falls into price bidding between vendors.

Conclusion

By looking at these companies collectively, then and only does the broader story begin to emerge. The real power is in how all of these connect. The AI ecosystem is not a single winner but a system made of a multitude of layers all depending on each other. None of these businesses rely on a single outcome, they all benefit from growth of the entire system. When one layer grows, so does the other. This in itself reduces the dependency on any single prediction. Over the long term, system thinking beats stock picking. By understanding how value flows through this stack, it lets noise be just noise and volatility be a lesson of patience.

This document is for informational purposes only and does not constitute financial advice.