SEMICONDUCTOR CAPACITY ANALYSIS

FAB Production to Data Center

Power Demand: 2024-2035

Converting wafer capacity to gigawatts of AI infrastructure demand

80-180 GW	70-85%	10-15x
Global by 2030	U.S. Tech Stack Share	Growth 2024-2035

Executive Summary: The Supply-Demand Gap

AI power demand will structurally outpace supply through 2037 — creating persistent scarcity premium

DEMAND TRAJECTORY

GLOBAL AI DATA CENTER POWER

2024	2030	2035
10-14 GW	80-180 GW	180-400 GW

U.S. TECHNOLOGY STACK (75-80% OF GLOBAL)

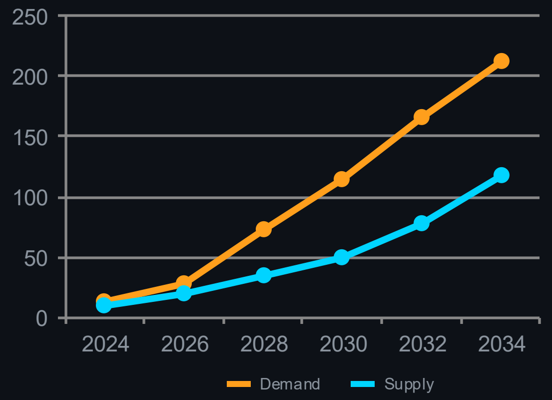
2025	2030	2035
18-23 GW	95-120 GW	180-230 GW

THE DEFICIT

Peak deficit 2029-2032: 15-50 GW shortfall

Deficit persists through 2037 even with aggressive supply build-out

SUPPLY VS DEMAND TRAJECTORY



SUPPLY CONSTRAINTS

Generation Interconnection

2,600 GW generation backlog

4-7 year avg wait time

Equipment Lead Times

Gas turbines: 5-7 years

Transformers: 2-4 years

Switchgear: 18-30 months

Labor Constraint

2,000+ workers per 1GW

HV electricians in shortage

STRATEGIC IMPLICATION

Capacity delivered 2027-2032 captures peak scarcity premium. Speed-to-power is the dominant competitive variable.

Executive Summary: State Prioritization

Geographic arbitrage toward low-queue, utility-friendly states with speed-to-power advantage

TIER 1: PRIMARY TARGETS

Oklahoma
#1 RANKED

SPP market, proactive utilities (OG&E, PSO, GRDA)

Capacity potential: 8-12 GW by 2035

Wyoming
#2 RANKED

Lowest cost power, TerraPower SMR pipeline

Capacity potential: 3.5-5.5 GW by 2035

Arkansas
#3 RANKED

MISO South access, nuclear uprate potential

Capacity potential: 2.5-4.5 GW by 2035

TIER 2: SECONDARY OPPORTUNITIES

Rust Belt Cluster
Ohio, Indiana, W. Virginia — retiring coal, grid capacity, labor pool

Gulf South
Louisiana, Mississippi — industrial gas infrastructure, water access

ERCOT Secondary
West Texas — if grid stability concerns addressed

AVOID

California, New York — regulatory, cost, queue

Northern Virginia — saturated, 7+ year queues

SCORING CRITERIA

Power (40%)
Grid capacity, queue depth, utility posture

Speed (25%)
Permitting timeline, regulatory complexity

Cost (20%)
Power rates, land, labor, incentives

Risk (15%)
Political stability, natural disaster exposure

CENTRAL BELT TOTAL CAPACITY: 14-22 GW BY 2035

Oklahoma alone can absorb 8-12 GW. First movers in the #1 ranked state have 12-18 month advantage before arbitrage window closes.

Executive Summary

Key findings from FAB-to-GW conversion analysis

2030 GLOBAL DEMAND

80-180 GW

Up from 10-14 GW in 2024

2030 U.S. STACK DEMAND

95-120 GW

75% of global, design leadership maintained

BINDING CONSTRAINT

CoWoS Packaging

Not wafers - limits supply through 2027

Supply-Constrained Through 2027

Packaging and HBM capacity - not demand or capital - limit deployment speed. Hyperscalers have committed $200B+ in capex.

Grid Interconnection Becomes Binding Post-2028

As CoWoS scales to 200K+ WPM and HBM4 enters production, constraint shifts to 3-7 year utility interconnection timelines.

No Power Surplus in Any Scenario

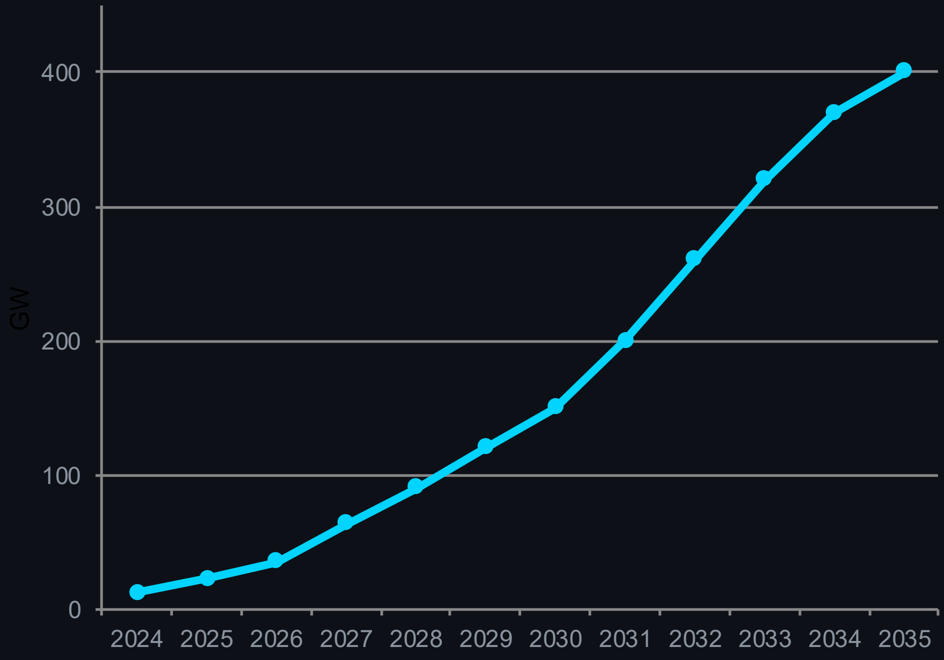
Even if AI business case weakens, existing commitments and base case inference demand ensure deficit through 2035.

Methodology: Wafer → Package → TDP → GW

Explicit modeling through CoWoS constraints, chip TDP mix, server overhead (1.45x), utilization (60-80%), and PUE (1.12-1.4).

Global AI Data Center Power Demand

Base case projections from FAB capacity analysis



2024 BASELINE

10-14 GW

2027 PROJECTION

48-78 GW

CoWoS constraint relaxes

2030 PROJECTION

80-180 GW

Grid becomes binding

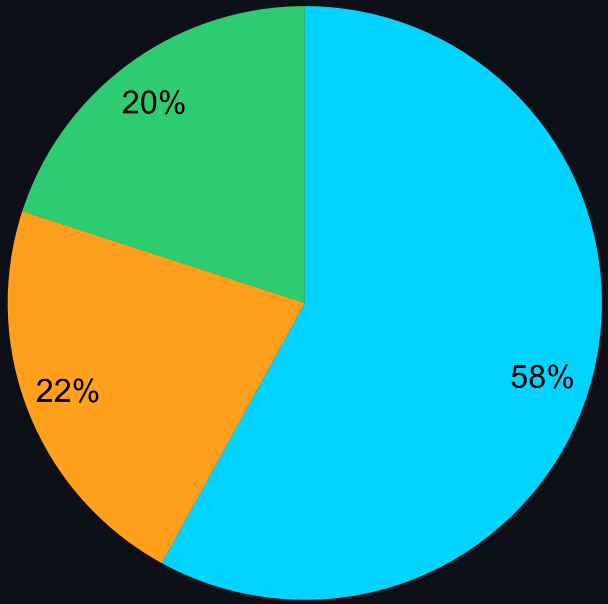
2035 PROJECTION

180-400 GW

Scenario dependent

Demand by Chip Category (2030 Base Case)

Training vs inference vs infrastructure power allocation



Leading-Edge Training — **55-65 GW**

NVIDIA Blackwell/Rubin, AMD MI400+

58% of demand

Inference-Optimized — **21-28 GW**

Groq, Cerebras, custom ASICs, TPUs

22% of demand

Supporting Infrastructure — **19-25 GW**

Networking ASICs, memory controllers

20% of demand

Total 2030 Base Case — **120-140 GW**

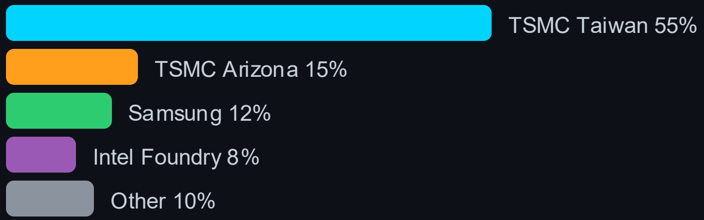
U.S. Technology Stack Deep Dive

Chips designed by U.S. companies regardless of manufacturing location

Scope: NVIDIA, AMD, Google, Amazon, Microsoft, Meta, Broadcom, Marvell, Intel, Qualcomm chip designs — includes TSMC Taiwan capacity serving U.S. hyperscalers

2024 SHARE	2027 SHARE	2030 SHARE	2035 SHARE
85%	**80%**	**75%**	**70-75%**
NVIDIA 80%, AMD 8%	Chinese domestic growing	Design leadership maintained	Supply chain diversified

2030 U.S. STACK FAB LOCATION

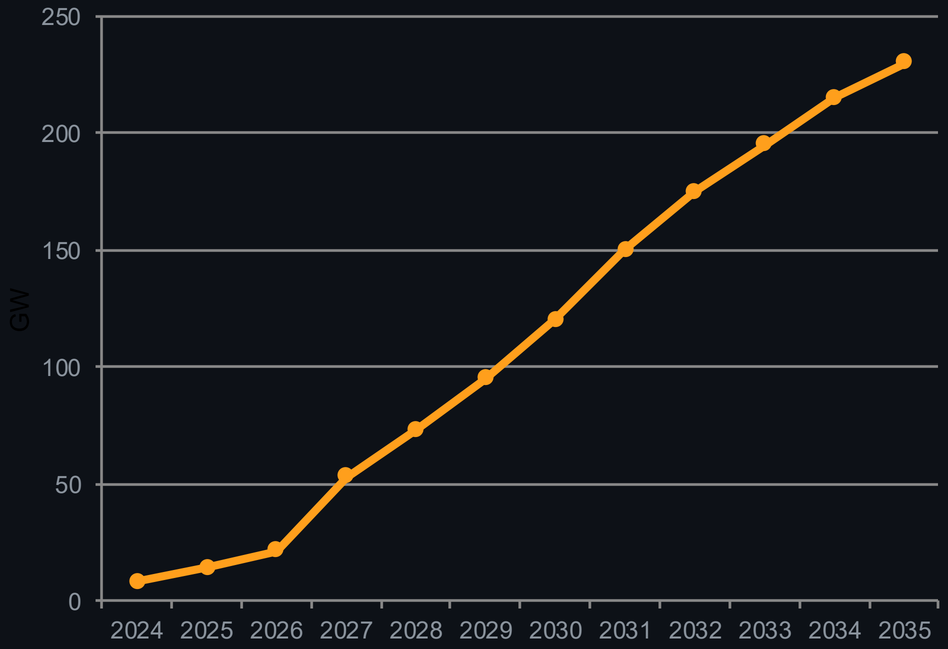


KEY IMPLICATION

Taiwan concentration risk: 55% of U.S. AI chip capacity fabbed in Taiwan. TSMC Arizona + Intel provide only 23% domestic by 2030.

U.S. Technology Stack Power Demand

Year-by-year projections with scenario ranges



KEY MILESTONES

18-23 GW

2025: CoWoS ramp begins

48-58 GW

2027: Packaging constraint eases

95-120 GW

2030: Grid becomes limiting factor

180-230 GW

2035: Scenario dependent

~30% CAGR to 2030, **15-25%** to 2035

Two Futures: Post-2030 Trajectories

Business case determines demand acceleration vs plateau

SCENARIO A: DEMAND ACCELERATES

AI BUSINESS CASE CONTINUES TO SCALE

- **Reasoning inference** drives exponential compute demand
- **Model sizes** continue scaling 10x every 2 years
- **Enterprise adoption** reaches majority of workflows
- **Autonomous systems** (robotics, vehicles) scale

2035 U.S. STACK DEMAND

230-290 GW

25-30% CAGR sustained

SCENARIO B: DEMAND PLATEAUS

AI BUSINESS CASE FAILS TO MATERIALIZE

- **Efficiency gains** outpace demand growth
- **ROI skepticism** reduces enterprise investment
- **Model scaling** hits diminishing returns
- **Regulatory constraints** limit deployment

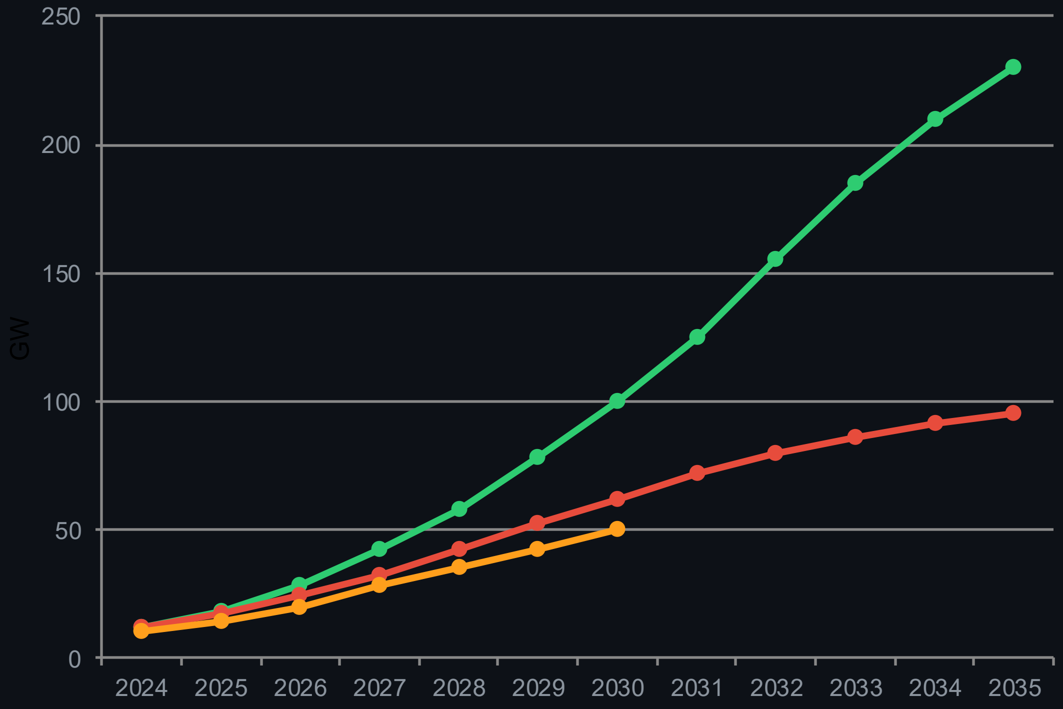
2035 U.S. STACK DEMAND

85-110 GW

Growth slows to 5-10% CAGR

Scenario Trajectory Comparison

U.S. technology stack GW demand under both scenarios



LEGEND

- Scenario A: Acceleration
- Scenario B: Plateau
- Current committed capacity

CRITICAL INSIGHT

Both scenarios converge through 2028-2029 due to supply constraints. Divergence begins only after CoWoS and grid capacity expand.

DECISION WINDOW

Infrastructure committed 2024-2027 will be needed regardless of scenario. Post-2028 commitments carry higher scenario risk.

2035 DIVERGENCE (2.4x)

230 GW	95 GW
Scenario A	Scenario B

No Power Surplus in Any Scenario

The critical infrastructure planning implication

Even under Scenario B (AI business case fails to materialize), U.S. data center power demand reaches 85-110 GW by 2035 — still requiring 4-6x growth from current infrastructure.

1. COMMITTED CAPITAL

$200B+ already committed by hyperscalers for 2024-2026 deployment. These data centers will be built regardless of demand trajectory changes.

2. INFERENCE BASELINE

Current AI applications (ChatGPT, Copilot, etc.) have 100M+ users. Maintaining service at current quality requires sustained infrastructure.

3. CLOUD MIGRATION

Traditional enterprise workloads continue migrating to hyperscale DCs at 15%+ CAGR — independent of AI demand trajectory.

SUPPLY VS DEMAND COMPARISON (2030)

	SCENARIO A	SCENARIO B
U.S. Demand	115 GW	75 GW
Planned Supply	65 GW	65 GW
Deficit	-50 GW	-10 GW

IMPLICATION FOR INFRASTRUCTURE

Power infrastructure investment is a **low-regret strategy** through 2030. The question is not if demand will materialize, but how much beyond baseline projections.

Evolving Constraint Landscape

The binding constraint shifts over time

2024 — 2035

CoWoS Packaging (2024-2027) | HBM Memory (2025-2028) | Grid Interconnection (2028+)

CoWoS PACKAGING

2024-2027 BINDING

35K → 200K WPM capacity

NVIDIA takes 63% allocation

CoWoS-L for B200+

Resolution: TSMC expansion + OSAT partners

HBM MEMORY

2025-2028 CO-BINDING

SK Hynix 54%, Samsung 39%

Sold out through late 2025

8-12 stacks per GPU (192-288GB)

Resolution: HBM4 on logic nodes, capacity expansion

GRID INTERCONNECTION

2028+ PRIMARY BINDING

3-7 year interconnection timelines

120 kW/rack for GB200 NVL72

Only 17% DCs support liquid cooling

Resolution: BTM power, nuclear, transmission upgrades

Strategic implication: Infrastructure planning must address the constraint expected to be binding at time of deployment, not today's constraint. Projects starting in 2025 face grid constraints at completion.

Strategic Implications

1. NEAR-TERM: LOW-REGRET

2024-2028 infrastructure commitments needed under both scenarios.

2. TIMING IS CRITICAL

Grid interconnection takes 3-7 years. Projects today deliver into 2028-2032 crunch.

3. BTM BRIDGING OPPORTUNITY

$120-140/MWh BTM power bridges 2027-2030 grid gap.

4. GEOGRAPHIC ARBITRAGE

TX, OK, Midwest offer 2-3 year advantages over VA, GA.

Bottom Line: 10-15x increase in AI power demand through 2035. No scenario produces a power surplus. Infrastructure development is the rate-limiting factor.

85-290 GW	10-15x	0 GW
2035 U.S. Stack Range	Growth from 2024	Surplus in Any Scenario

Supply Analysis

Constraints, Capacity Additions, and Regional Breakdown

Supply Constraint Executive Summary

Structural 40-90 GW deficit through 2035 under most scenarios

The bottleneck is **infrastructure delivery**, not technology: 2,600 GW generation in queues (5-year avg wait), 5-7 year gas turbine lead times, 2-4 year transformer delays. Policy reforms cannot materially improve conditions before 2028-2029.

GENERATION INTERCONNECTION

2,600 GW

generation in queues (2x installed fleet)

Only 19% of projects reach COD

5-year avg wait, 9+ yrs in CAISO

MANUFACTURING

5-7 Years

gas turbine lead times

80 GW orders vs 30 GW capacity

GE backlog: $119B

TRANSFORMERS

2-4 Years

large power transformer lead time

80% imported, 1 domestic GOES producer

Avg fleet age: 38-40 years

FASTEST PATH: GETs

Grid-enhancing technologies could unlock **50-175 GW** from existing infrastructure but adoption remains minimal

MATERIALS: COPPER CRUNCH

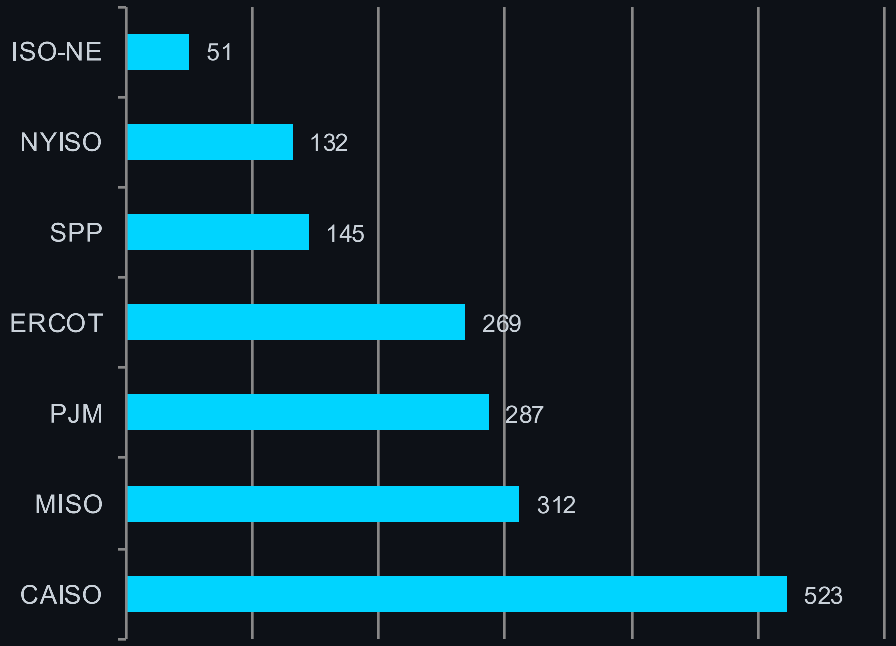
IEA projects **30-35% supply shortfall by 2035**. Renewables need 4-6x more copper per MW than conventional

REFORM TIMELINE

FERC Order 2023 full implementation **2026-2027**. Meaningful backlog reduction begins **2028-2030**

Generation Interconnection Queue Crisis by ISO

The primary binding constraint on new generation capacity additions



2,600 GW
Total generation in U.S. queues

19%
Project completion rate

ISO	QUEUE	WAIT	W/D RATE
CAISO	**523 GW**	9.2 yrs	20%
MISO	**312 GW**	5+ yrs	70%
PJM	**287 GW**	6-7 yrs	46-79%
ERCOT	**269 GW**	4.5 yrs	20%
SPP	145 GW	5-6 yrs	46-79%
NYISO	132 GW	6.5 yrs	High
ISO-NE	51 GW	3.8 yrs	Lowest

FERC Order 2023: Full implementation 2026-27. Meaningful backlog clearing 2028-30.

Manufacturing & Equipment Bottlenecks

Multi-year delivery delays that policy cannot accelerate

GAS TURBINE MANUFACTURING

5-7 yrs	80 GW	30 GW
Lead Time	2024 Orders	Annual Capacity

GE Vernova	$119B backlog, 29 GW orders + 21 GW slots
Siemens Energy	5+ yr quotes, 65% from DC customers
Mitsubishi	Doubling capacity in 2 yrs

LARGE POWER TRANSFORMERS

2-4 yrs	80%	38-40
Lead Time	Imported	Avg Fleet Age (yrs)

– Pre-pandemic: 12-24 week lead times

– Current: 80-210 weeks (specialized: 6 yrs)

– Only Cleveland-Cliffs makes GOES steel domestically

– 60-80% price increases since 2020

COPPER SUPPLY

30-35%

Shortfall by 2035

Renewables need 4-6x more Cu/MW

Mine production peaks 2025-26

BATTERY & SOLAR

$115/kWh

Record low BESS cost

China: 2,600 GWh/yr capacity (adequate)

Risk: 828-921% graphite tariffs

WHEN DO BOTTLENECKS EASE?

2026-27: Mitsubishi expansion online

2027-28: Gas turbines > 3-4 yr leads

2028-30: Potential 2-3 yr leads (high scenario)

U.S. Firm Capacity Additions by Scenario (2024-2035)

ELCC-adjusted for intermittent resources | Cumulative GW

TECHNOLOGY	LOW ★	MEDIUM	HIGH	KEY DRIVER
Natural Gas (CCGTs + peakers)	**33-47 GW**	60-75 GW	95-110 GW	Turbine manufacturing
Nuclear (restarts + SMRs)	**2.1 GW**	4-6 GW	8-12 GW	SMR execution risk
Solar (ELCC-adjusted)	**14-26 GW**	17-35 GW	20-40 GW	ELCC: 50% → 15-30%
Wind (ELCC-adjusted)	**12-17 GW**	21-29 GW	32-44 GW	ELCC: 25% → 10-20%
Battery Storage (ELCC-adj)	**32-50 GW**	42-72 GW	54-96 GW	ELCC: 85% → 50-70%
Geothermal (EGS + conventional)	**2-4 GW**	6-10 GW	15-25 GW	Fervo scaling
GETs (transmission unlocked)	**10-20 GW**	40-80 GW	100-150 GW	Utility adoption risk
Other (hydro, LDES)	**3-6 GW**	8-17 GW	18-30 GW	LDES commercialization
TOTAL FIRM CAPACITY	**~140 GW**	~257 GW	~418 GW	Cumulative 2024-2035

★ LOW scenario most viable: Reflects proven technologies with minimal reliance on GETs adoption or SMR commercialization. Medium/High scenarios require aggressive utility innovation and first-of-kind nuclear deployment that carry significant execution risk based on market feedback.

U.S. Regional Supply Analysis by ISO/RTO

Capacity constraints concentrate in highest data center growth regions

PJM

20+ GW

Dominion zone DC growth by 2037

– 30 GW DC load growth by 2030

– Capacity prices 10x to $8-14/kW-mo

– Queue: 265 GW, only 100 GW by '25

ERCOT

205+ GW

Large load requests (370% increase)

– 73% of requests from data centers

– 35 GW DC demand by 2035

– SB6 "kill-switch" framework

SOUTHEAST

50+ GW

Southern Co pipeline (10 yrs)

– GA Power: 9.4+ GW over 10 yrs

– 80%+ from data centers

– Extending coal life (8.2 GW)

MISO HIGH

312 GW queue, 70% withdrawal rate. Tranche process helping clear backlog.

NYISO HIGH

132 GW queue, 6.5 yr wait. Pipeline constraints, transmission to NYC limited.

CAISO MODERATE

523 GW queue but 9.2 yr wait. Strong solar/storage. CEQA permitting drag.

SPP / ISO-NE MODERATE

SPP: 145 GW queue, wind-rich. ISO-NE: 51 GW, lowest withdrawal, gas constrained.

REGION	2025 PEAK	2030 DEFICIT RANGE	2035 DEFICIT RANGE	SEVERITY
PJM	~152 GW	**15-45 GW**	**25-60+ GW**	**CRITICAL**
ERCOT	~92 GW	**10-35 GW**	**20-70 GW**	**SEVERE**
Southeast	Variable	15-25 GW	30-40 GW	**SEVERE**
Others	~285 GW	14-30 GW	22-48 GW	MODERATE-HIGH

Nuclear Capacity: Restarts and SMR Pipeline

Probability-weighted additions: 2-12 GW by 2035 depending on scenario

PLANT RESTARTS (~2.2 GW POTENTIAL)

Palisades (800 MW)	80-90%	Operating status Aug 2025, restart by EOY
TMI Unit 1 (835 MW)	75-85%	Microsoft 20-yr PPA, target 2028
Duane Arnold (615 MW)	65-75%	Google/NextEra 25-yr PPA, Q1 2029

DATA CENTER NUCLEAR PPAs

Microsoft: TMI restart (835 MW), Constellation

Amazon: Susquehanna (Talen), X-energy SMRs

Google: Kairos SMRs, Duane Arnold restart

Meta: Clinton plant (Constellation)

→ Multi-GW committed, de-risks development

SMR VENDOR PIPELINE

VENDOR	KEY PROJECT	TIMELINE	GW BY 2035	PROBABILITY
TerraPower Natrium	Kemmerer, Wyoming	Fall 2031	0.3-0.5	50-60%
Kairos Power	Hermes 2, TN (Google)	2030	0.3-0.5	45-55%
X-energy Xe-100	Dow Seadrift, TX (Amazon)	Early 2030s	0.3-0.5	40-50%
Oklo Aurora	INL demonstration	2027 target	0.05-0.2	25-35%
NuScale	No active U.S. project	N/A	0-0.5	20-30%

LOW SCENARIO: 2.1 GW
Palisades only + 1-2 demo units

MEDIUM SCENARIO: 4-6 GW
All restarts + early commercial SMRs

HIGH SCENARIO: 8-12 GW
Multiple vendors at commercial scale

Supply-Demand Gap

Crossing Supply and Demand Scenarios

Supply-Demand Gap Analysis (U.S.)

Absolute GW deficit by scenario combination | Negative = shortfall

DEMAND SCENARIO A: ACCELERATION

Business case continues → 115 GW by 2030, 230 GW by 2035

DEMAND SCENARIO B: PLATEAU

Business case doesn't materialize → 85 GW by 2030, 95 GW by 2035

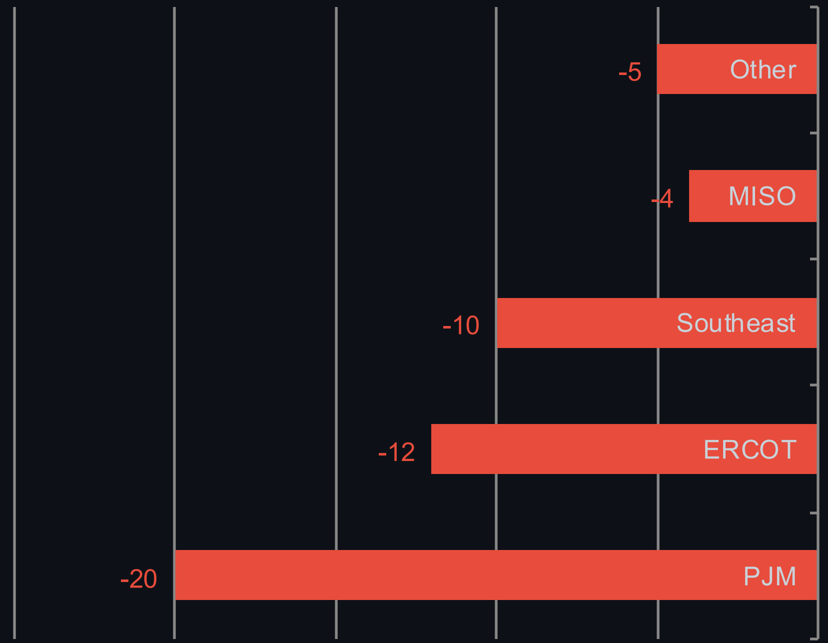
SCENARIO COMBINATION	2027	2030	2035	ASSESSMENT
Low Supply × Demand A	-25 GW	-65 GW	-90 GW	MOST LIKELY ★
Low Supply × Demand B	-10 GW	-35 GW	+45 GW	Tight then surplus
Med Supply × Demand A	-15 GW	-40 GW	+27 GW	Requires GETs/SMR
Med Supply × Demand B	0 GW	-10 GW	+162 GW	Balanced then surplus
High Supply × Demand A	-5 GW	-15 GW	+188 GW	Achievable if aggressive
High Supply × Demand B	+10 GW	+15 GW	+323 GW	Major surplus

CRITICAL FINDING

Under the most likely combination (Low Supply × Demand A), the U.S. faces a **65 GW deficit by 2030** that **widens to 90 GW by 2035**. This reflects utility delivery slippage and minimal reliance on unproven GETs/SMR deployment.

Regional Deficit Concentration (2030)

Medium Supply × Demand A scenario | National gap obscures severe regional crises



REGION	DEMAND	SUPPLY	DEFICIT
PJM	35-40 GW	15-20 GW	**-15 to -25 GW**
ERCOT	25-30 GW	12-18 GW	**-7 to -18 GW**
Southeast	20-25 GW	10-15 GW	**-5 to -15 GW**
MISO	8-12 GW	6-10 GW	-2 to -6 GW
Other	20-28 GW	15-22 GW	-3 to -8 GW

MOST CONSTRAINED SUB-REGIONS

1. **Dominion Zone (VA)** — 20+ GW DC growth, 10x capacity price spike
2. **West Texas (ERCOT)** — 205+ GW requests, transmission-limited
3. **Georgia (Southern Co)** — 9.4+ GW new load, extending coal plants

IMPLICATION: National capacity may appear adequate while specific data center corridors face severe deficits. Geographic arbitrage toward TX, OK will accelerate.

Strategic Implications: Supply-Demand Analysis

Infrastructure delivery is the binding constraint through 2030

The fundamental physics of power system development — **5-year queue timelines, 5-7 year equipment lead times, 10-year major transmission projects** — cannot be compressed by policy or capital alone. AI data center buildout will proceed at the speed of infrastructure delivery.

GEOGRAPHIC ARBITRAGE ACCELERATES

Texas permits 3x faster than California. ERCOT queues are more efficient despite growth. Deregulated markets offer faster delivery despite reliability concerns. Southeast's vertically integrated model offers a middle path — slower but more reliable.

→ TX, OK have 2-3 year advantage

BTM GENERATION ESSENTIAL

With widening deficit through 2035+, on-site generation is not optional but essential: nuclear PPAs, gas island microgrids, co-located renewables + storage. Higher capital intensity but bypasses decade-long interconnection constraints.

→ $120-140/MWh BTM viable indefinitely

DEFICIT WIDENS THROUGH 2035

Under LOW supply scenario (proven tech only), gap grows from -25 GW (2027) to -90 GW (2035). No crossover within forecast window. Seller's market for power capacity. Sustained high capacity prices. Ongoing reliability concerns.

→ Persistent structural shortage

BOTTOM LINE FOR INFRASTRUCTURE INVESTORS

Power infrastructure investment is a **low-regret strategy** through 2035+. The question is not *if* demand will materialize, but *how much beyond* baseline. Even Scenario B (plateau) requires 85-110 GW by 2035 — 4-6x growth from current levels.

LOW SCENARIO ASSUMPTIONS

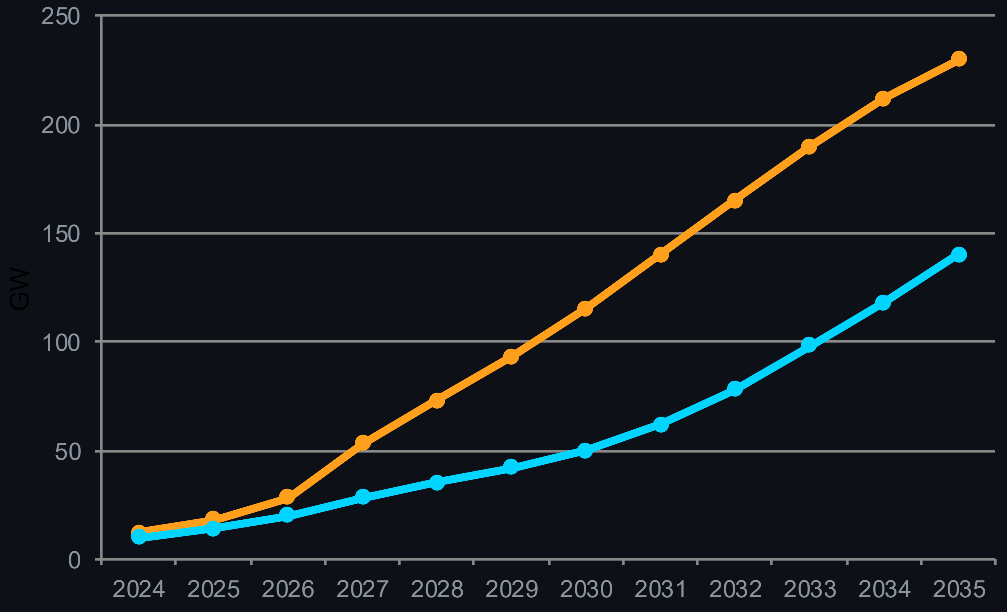
No GETs adoption acceleration

SMRs: restarts only, no new builds

Utility delivery slips 2028→2031

Most Likely Scenario: Supply vs Demand (U.S.)

Low Supply × Demand A | Based on utility feedback and proven technologies only



Orange = Demand | Cyan = Supply | Gap widens through 2035

LOW SUPPLY SCENARIO

Proven technologies only. No reliance on GETs adoption or SMR commercialization. Reflects 2028→2031 utility slippage.

SUPPLY-DEMAND GAP

2027: **-25 GW**

2030: **-65 GW**

2035: **-90 GW**

2040+
Crossover

WIDENING
Gap trajectory

INVESTMENT THESIS

Power infrastructure is low-regret through 2035+. BTM bridging essential for any near-term deployment.

Geographic Demand Distribution

U.S. Technology Stack demand ≠ U.S.-located power demand

THE DISTINCTION

U.S. TECHNOLOGY STACK (75-80% OF GLOBAL)

Chips designed by NVIDIA, AMD, Google, Amazon, Microsoft, Meta, Broadcom, Intel, Qualcomm — regardless of where deployed

↓

U.S. DOMESTIC DEPLOYMENT (~70%)

Power demand that materializes within U.S. borders — training concentration, North American inference, security preferences

INTERNATIONAL OVERSPILL (~30%)

Demand forced overseas by U.S. power constraints — GDPR requirements, sovereign AI initiatives, latency optimization

THE "PRESSURE COOKER" EFFECT

Full stack demand represents *pressure* on the U.S. system. Capacity that wants to be here but is forced overseas. Any deliverable U.S. capacity is immediately absorbed at scarcity premium.

WHY ~70% STAYS DOMESTIC

Training Concentration

Frontier models require proximity to research teams, IP security. 80%+ of training stays U.S.

North American Market

Largest demand market. Central U.S. serves continent with acceptable latency (30-50ms).

Ecosystem Depth

HV electricians, commissioning engineers, EPC capacity concentrated in U.S.

WHY ~30% GOES INTERNATIONAL

U.S. Power Constraints

5-9 year queues force hyperscalers to seek deliverable power abroad.

Sovereign AI / Data Residency

GDPR mandates local deployment. UAE, Saudi, France, UK funding sovereign clouds.

Global Inference Latency

Europe (70ms+) and Asia (150ms+) from U.S. require regional hubs.

OVERSPILL DESTINATIONS

Middle East — 10-15%

UAE, Saudi — cheap power, fast permitting, serves Europe/Africa/South Asia

Europe — 8-12%

Nordics, UK, Ireland — GDPR compliance, renewable power

Asia-Pacific — 5-8%

Japan, Singapore, Australia — regional inference hubs

CRITICAL: SAME SUPPLY CONSTRAINTS

International sites face identical equipment bottlenecks: 5-7 year gas turbine lead times, 2-4 year transformer delays. Building in UAE competes for the same GE/Siemens capacity as Oklahoma.

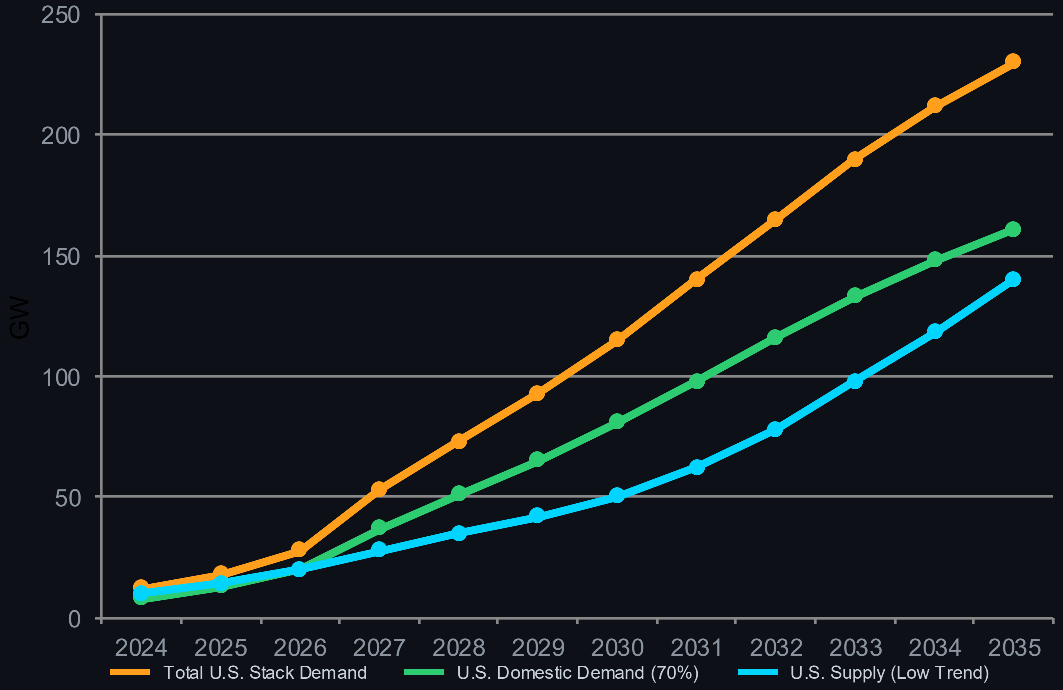
IMPLICATION

Overspill destinations don't relieve pressure — they queue behind it. U.S. capacity remains scarce and premium-priced.

Domestic share range: Estimates vary from 55-80% depending on sovereign AI acceleration and U.S. supply responsiveness. 70% is base case. Higher U.S. share = larger domestic deficit. Lower share still leaves 30-50 GW shortfall.

Recalibrated U.S. Supply vs Demand

Even with 30% international overspill, structural U.S. deficit persists through 2035



DEFICIT ANALYSIS

2030

Stack Demand:	**115 GW**
Domestic (70%):	**81 GW**
U.S. Supply:	**50 GW**
U.S. Deficit:	**-31 GW**

2035

Stack Demand:	**230 GW**
Domestic (70%):	**161 GW**
U.S. Supply:	**140 GW**
U.S. Deficit:	**-21 GW**

THE GAP BETWEEN LINES

Orange → Green = demand forced overseas by U.S. constraints. Green → Cyan = persistent domestic deficit requiring fast-to-power solutions.

INTERNATIONAL DEMAND = SAME SUPPLY CHAIN PRESSURE

The ~35 GW of 2030 overspill competes for the same gas turbines, transformers, and HV equipment. International buildout does not relieve global manufacturing constraints — it adds to them. GE, Siemens, Hitachi backlogs serve global demand.

APPENDIX

State Prioritization Analysis

Powered Land Development Opportunity Ranking

State Prioritization: Scoring Methodology

Weighted criteria for powered land development opportunity

SCORING DIMENSIONS

Dimension	Description	Weight
Queue Efficiency	Interconnection timeline, backlog volume, completion rate	25%
Permitting Speed	State/local approvals, environmental review, political climate	20%
BTM Flexibility	Regulatory pathway for on-site generation at scale	15%
Transmission Headroom	Available capacity without major grid upgrades	15%
Resource Access	Gas pipeline, renewable potential, water availability	10%
Saturation/Competition	Market crowding, competitive pressure for sites	10%
Cost Structure	Land, labor, taxes, incentives	5%

TIER 1: HIGHEST PRIORITY

Score 75-100

Aggressive development. Best deliverability.

TIER 2: STRONG POTENTIAL

Score 60-74

Selective with manageable constraints.

TIER 3: SELECTIVE

Score 50-64

Opportunistic. Specific circumstances.

AVOID

Score <50

Structural barriers. Not viable.

Key Thesis: States that will win data center investment 2030-2035 are those that can actually *deliver power*, not those with the best demand fundamentals. This inverts traditional site selection.

TIER 1

Highest Priority States (Score 75-100)

88 OKLAHOMA

SPP

ADVANTAGES

SPP transmission buildout. OG&E proactive on large loads. Excellent gas + wind. Low competition. BTM straightforward.

RISKS

Smaller utility balance sheets. Workforce depth for mega-scale.

Target: Tulsa corridor, Mayes, Rogers, Washington, Creek Counties

82 WYOMING

WECC / SPP

ADVANTAGES

Fastest permitting in nation. Best wind (45-50% CF). TerraPower SMR 2031. Coal retirement sites. Lowest costs.

RISKS

Transmission export constraints (improving). Distance from markets. Limited ecosystem.

Target: Cheyenne, Casper, Gillette, Kemmerer (SMR)

80 TEXAS (Secondary)

ERCOT

ADVANTAGES

Most permissive BTM. 3x faster permitting. ERCOT market rewards flex. SB6 large load framework. Deep ecosystem.

RISKS

Grid reliability (Uri). Primary markets saturated. "Kill switch" for large loads. Water stress west.

Target: Permian, Panhandle, East TX, Gulf Coast. Avoid DFW/Austin.

TIER 2

Strong Potential — PJM & Southeast (Score 60-74)

76 WEST VIRGINIA
PJM (AEP/FirstEnergy)

ADVANTAGES

Coal retirement sites w/ transmission. Marcellus gas. Very low costs. Governor courting DCs. WV Data Center Act incentives.

RISKS

PJM queue still applies. Limited workforce/ecosystem.

Target: Pleasants, Harrison (coal sites), Eastern Panhandle

72 INDIANA
PJM (AEP) / MISO

ADVANTAGES

Less congested than VA. Coal retirement sites. Central location. AEP proactive. Business-friendly state.

RISKS

PJM/MISO queue. Less BTM flexibility. Utility cooperation required.

Target: Central IN, Indianapolis suburbs, retired coal sites

70 OHIO
PJM (AEP/FE)

ADVANTAGES

Marcellus gas access. Google/Meta/AWS presence. Central location. Some coal sites available.

RISKS

More complex regulatory. Variable county permitting. PJM queue applies.

Target: Columbus suburbs, AEP territory, SE Ohio

70 GEORGIA
SERC (Southern Co)

ADVANTAGES

Utility obligated to serve. Vogtle 3&4 nuclear online. Strong ecosystem. Regulatory certainty once approved.

RISKS

Limited BTM. Must partner with Georgia Power. Near-term capacity tight.

Target: Newton, Douglas Co, metro Atlanta ring

68 PENNSYLVANIA
PJM (Non-Dominion)
W

ADVANTAGES

Marcellus gas abundant. TMI restart (Microsoft). Nuclear restart potential. Less saturated than VA.

RISKS

PJM queue. Environmental opposition in some areas. Complex utility landscape.

Target: York/Lancaster, Pittsburgh suburbs, Scranton

TIER 2 Strong Potential — Gulf South & MISO (Score 60-74)

71 ARKANSAS
SPP / MISO

ADVANTAGES

Entergy proactive on DCs. Low land costs. Good gas access (Fayetteville Shale). Low competition. Central location. Nuclear (ANO) provides baseload.

RISKS

Smaller utility balance sheet. Limited workforce depth. Less developed ecosystem.

Target: Little Rock metro, NW Arkansas (Bentonville corridor), Jonesboro

68 LOUISIANA
MISO

ADVANTAGES

Excellent gas infrastructure (Henry Hub). Industrial load experience. Strong incentives (LED, ITEP). Nuclear (Waterford, River Bend). LNG export infrastructure.

RISKS

Hurricane exposure (coastal). MISO queue challenges. Entergy capacity tight. Transmission constraints in some areas.

Target: Baton Rouge corridor, Shreveport (north, lower hurricane risk), Lake Charles (gas/LNG)

64 MISSISSIPPI
MISO / SERC

ADVANTAGES

Lowest land costs in region. Very low competition. Grand Gulf nuclear station. Business-friendly. Strong state incentives (MDA).

RISKS

Weaker transmission infrastructure. Smaller utility balance sheets. Limited workforce. Hurricane exposure (coastal).

Target: Jackson metro, DeSoto County (Memphis adjacent), Hattiesburg

Gulf South Thesis: Entergy territory spans AR/LA/MS with consistent regulatory approach. Gas infrastructure excellent. Low saturation = early mover advantage. Northern locations (Shreveport, NW Arkansas, DeSoto) avoid hurricane exposure while maintaining cost advantages.

TIER 3

Selective Opportunity (Score 50-64)

67 NEW MEXICO
WECC

ADVANTAGES

Best solar in nation. Low competition. SunZia transmission (under construction). Permian-adjacent gas. Low costs.

RISKS

Severe water stress (critical). Distance from markets. Limited workforce.

Target: Los Lunas, ABQ metro, Las Cruces

58 VIRGINIA (Secondary)
PJM - Dominion Edge

ADVANTAGES

Highest powered land premium in nation (scarcity). Secondary markets (Southside, Valley) less congested than NoVA.

RISKS

NoVA = AVOID. 20+ GW demand vs capacity. Queue closed. 6-7 year timelines.

Target: Southside VA, Roanoke, Valley ONLY w/ existing queue

55 NEVADA
WECC

ADVANTAGES

Good solar. Switch, Apple, Google present. Reno/Sparks better than Vegas for water.

RISKS

Severe water stress (Las Vegas critical). Transmission constraints. NV Energy capacity limited.

Target: Reno/Sparks only. Avoid Las Vegas.

52 ARIZONA
WECC

ADVANTAGES

Excellent solar. Palo Verde nuclear. Microsoft, Google present. SRP/APS large utilities.

RISKS

Critical water stress (Phoenix acute). Capacity hitting limits. Cooling challenges.

Target: N. Arizona (Flagstaff) only. Avoid Phoenix metro.

62 MONTANA
WECC / NorthernGrid

ADVANTAGES

Very low saturation. Colstrip coal retirement (transmission). Good wind. Permitting fast. Cold climate cooling.

RISKS

Transmission export constraints. Limited gas. Distance from markets. Workforce thin.

Target: Colstrip area, Billings, Butte

AVOID

Structural Barriers — Not Viable for New Development

25 CALIFORNIA
CAISO

FATAL CONSTRAINTS

- **9.2-year** average queue wait
- CEQA permitting 2-4 years
- No new gas permitted
- Highest costs in nation
- Severe water stress

Not viable for new development

30 N. VIRGINIA (Primary)
PJM - Dominion

FATAL CONSTRAINTS

- **Queue closed** by PJM
- 20+ GW demand vs capacity
- 6-7 year timelines
- 70%+ of U.S. DC market
- No capacity until 2030+

Only acquire existing queue positions

40 NEW YORK
NYISO

KEY CONSTRAINTS

- High costs (land, labor)
- Environmental opposition
- Upstate transmission limited
- NYC-centric grid design
- Moratorium discussions

Very limited opportunity

35 NEW ENGLAND
ISO-NE

KEY CONSTRAINTS

- Gas pipeline constraints
- Highest power costs
- Limited land availability
- Environmental opposition
- Small geographic area

Not viable for new development

Common Thread: Long queue times, high costs, regulatory complexity. Capital faces 5-10 year timelines vs 2-4 years in Tier 1. Geographic arbitrage strongly favored.

State Prioritization Summary

Powered Land Development Opportunity Rankings (2030-2035 Delivery)

Rank	State/Region	ISO	Score	2027-30	2030-35	Strategy
1	**Oklahoma**	SPP	88	★★★★★	★★★★★	Aggressive. Tulsa corridor well-positioned.
2	**Wyoming**	WECC/SPP	82	★★★★	★★★★★	Emerging. Position now for 2030+.
3	**Texas (Secondary)**	ERCOT	80	★★★★	★★★★	Selective. Permian, Panhandle, East TX.
4	West Virginia	PJM	76	★★★	★★★★	Coal sites + gas. Growing opportunity.
5	Indiana	PJM/MISO	72	★★★	★★★★	Coal retirement sites. AEP proactive.
6	Arkansas	SPP/MISO	71	★★★	★★★★	Entergy territory. Low saturation.
7	Ohio / Georgia	PJM / SERC	70	★★★	★★★★	OH: gas. GA: utility obligation.
8	Louisiana / PA West	MISO / PJM	68	★★★	★★★	LA: gas hub. PA: nuclear restarts.
9	Mississippi	MISO/SERC	64	★★	★★★	Lowest costs. Very low saturation.

IMMEDIATE ACTION

Oklahoma Tulsa corridor is #1 ranked with existing portfolio. Expand position. SPP queue 1-2 years faster than ERCOT, 3-4 years faster than PJM.

NEAR-TERM EXPANSION

Wyoming + West Virginia coal retirement sites offer 2030+ capacity with existing transmission. Gulf South (AR/LA/MS) under-saturated with Entergy cooperation.

CRITICAL FILTERS

Avoid water-stressed markets (AZ/NV/NM coastal). Avoid saturated markets (NoVA, TX primary). Prioritize gas pipeline access for BTM optionality.

AVOID

California (9+ yr queue), NoVA primary (closed), New England (gas constraints), New York (costs + opposition).

Strategic Implications: Geographic Arbitrage

Capacity delivery timeline drives site selection, not demand proximity

SPP / CENTRAL CORRIDOR — 2-3 YR ADVANTAGE

Oklahoma, Arkansas, Wyoming form "Central Power Belt" with 2-3 year delivery advantage. Transmission built for wind now available for DC load. Gas infrastructure excellent.

GULF SOUTH / ENTERGY — UNDER-SATURATED

LA, MS, AR (Entergy) offer consistent regulatory framework. Henry Hub gas unmatched. Northern locations avoid hurricane exposure.

RUST BELT / COAL CONVERSION — INFRASTRUCTURE REUSE

WV, IN, OH, PA offer coal retirement sites with existing HV transmission. Marcellus gas abundant. PJM queue less congested than Virginia.

DELIVERY TIMELINE BY REGION

SPP (OK, AR)	2-3 yrs
ERCOT (TX Secondary)	3-4 yrs
MISO (LA, MS, IN)	4-5 yrs
PJM (WV, OH, PA)	4-6 yrs
PJM-Dominion (NoVA)	6-7+ yrs
CAISO (California)	9+ yrs

PORTFOLIO STRATEGY

Core: OK Tulsa corridor | **Expand:** WY, WV, AR | **Opportunistic:** TX secondary | **Avoid:** CA, NoVA, NE

PART VI

Strategic Analysis

Execution Framework for 2026-2027

FOCUS	WINDOW	IMPERATIVE
Giga-Scale Development	18-36 Month Arbitrage	Speed of Execution

Strategic Imperatives

Core framework for powered land development 2026-2027

PILLAR 1

Giga-Scale Mandate

Focus exclusively on 1GW+ Energy Hubs — smaller sites cannot achieve BTM economies of scale or meet hyperscaler cluster requirements.

KEY DRIVERS

AI training requires contiguous capacity

1GW commands higher $/MW premium

BTM gas economics require scale

Effort-to-yield ratio maximized

PILLAR 2

Geographic Arbitrage

Prioritize speed-to-power over proximity to traditional markets. Generation queue efficiency now drives site selection.

PRIORITY REGIONS

P1: Central Belt (OK, AR, WY) — 2-3 yr

P2: Rust Belt (WV, IN, OH, PA) — 4-5 yr

P3: ERCOT Secondary (TX) — 3-4 yr

Avoid: CA, NoVA, NE, NY — 6-9+ yr

PILLAR 3

BTM / Power Island

Assume the grid will be late. Design all campuses with BTM capability from inception. Reliance on grid alone is a failing strategy.

EXECUTION ELEMENTS

Gas pipeline access mandatory

Brownfield sites (coal retirement)

Dual-fuel capability standard

Battery storage complement

CORE THESIS

Your value proposition: delivering complex, integrated energy solutions faster than hyperscalers can themselves.

Strategic Partnership Model

Partnering for BTM capability rather than building IPP infrastructure in-house

THE STRATEGIC CHOICE

BUILD (HIGH RISK)

In-house energy trading, fuel procurement, generation O&M

PARTNER (RECOMMENDED)

With established IPPs who bring capital, expertise, risk capacity

IDEAL PARTNER PROFILES

Major IPPs: Talen, Vistra, NRG, Calpine — generation fleet, trading desks, fuel contracts

Infrastructure Funds: Stonepeak, EIG, KKR Infra — patient capital, energy expertise

Utility Affiliates: AEP Energy Partners, NextEra — regulatory relationships, balance sheet

O&M Specialists: Mitsubishi Power, GE Vernova — turbine supply + long-term service

PARTNERSHIP STRUCTURES

Development Partner

You contribute: site control, entitlements, utility relationships, end-user pipeline

Partner contributes: generation development, fuel, O&M, capital

PPA + Tolling Structure

IPP builds/owns BTM generation, sells power under long-term PPA to DC. You take spread on powered land.

Build-Transfer-Operate

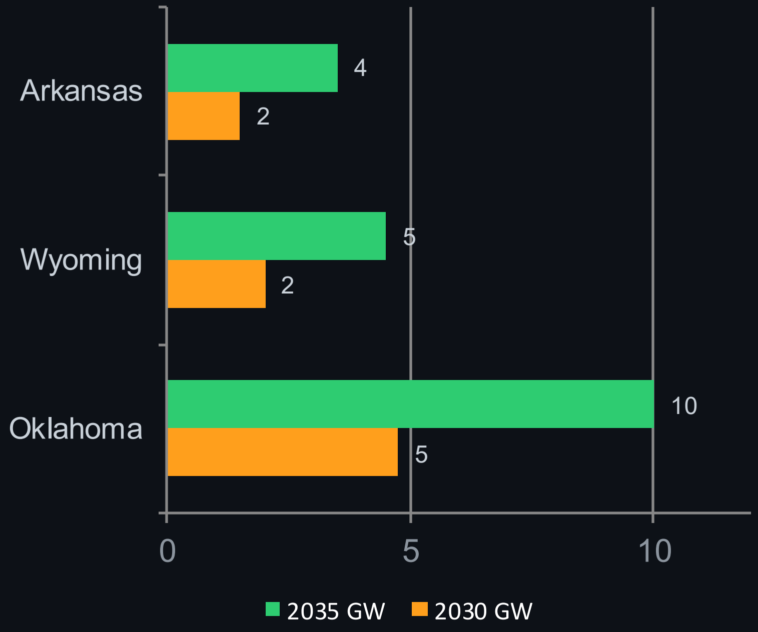
Partner develops generation, transfers to DC owner/operator, retains long-term O&M contract.

YOUR VALUE PROPOSITION TO PARTNERS

Shovel-ready sites in low-queue states + utility relationships + end-user demand pipeline = de-risked development for IPP partners seeking DC exposure.

State Capacity Projections

Realistic new DC capacity (GW) for Central Belt states through 2035



STATE	2030 GW	2035 GW	CONSTRAINT
Oklahoma	3.5 - 6.0	8 - 12	Labor / Supply Chain
Wyoming	1.5 - 2.5	3.5 - 5.5	Acute Labor / Logistics
Arkansas	1.0 - 2.0	2.5 - 4.5	MISO Queue / Infra
TOTAL	**6 - 10.5**	**14 - 22**	

OKLAHOMA SUB-MARKETS (8-12 GW)

Tulsa / MAIP	OKC Metro	Rural / Panhandle
4 - 5.5 GW	**2.5 - 4 GW**	**1.5 - 2.5 GW**

BINDING CONSTRAINT

Labor is underweighted. A 1GW campus requires 2,000+ specialized workers. 3-5 concurrent projects creates acute labor competition.

Binding Constraints Analysis

The brakes on development — assuming unlimited demand and capital

SUPPLY CHAIN

Physical Bottleneck

BTM strategy relies on gas turbines with 5-7 year lead times. Projects initiated now receive equipment 2030-2032.

- Gas Turbines: 5-7 yrs
- Transformers: 2-4 yrs
- Switchgear: 18-30 mo

LABOR FORCE

Human Bottleneck

Most significant localized constraint. These states lack deep specialized labor pools. A single 1GW campus requires 2,000+ workers.

- Per 1GW Campus: 2,000+ workers
- HV Electricians: Critical shortage
- Commissioning: Critical shortage

GAS INFRASTRUCTURE

Pipeline Capacity

Resource-rich states but pipeline capacity for Giga-scale BTM not guaranteed. Local distribution insufficient.

- Pipeline Upgrades: 2-4 yrs
- Firm Transport: Contract required
- OK/AR Access: Strong

UTILITY ABSORPTION

Pace of Scaling

Smaller utility balance sheets and less engineering bandwidth than coastal giants.

- OG&E / PSO: Proactive
- Entergy: Proactive
- Concurrent GW Projects: Limited

Key Insight: You can buy turbines on secondary markets and fund transmission upgrades — but you cannot manufacture experienced HV electricians. Labor is the constraint most likely to bite.

Water vs Power: The Binary Divide

Why power is the fatal flaw and water is a design variable

POWER IS BINARY

0 or 1

Either you have firm capacity or you do not

No design workaround. A data center without power is a warehouse. Cannot be optimized, substituted, or engineered around.

CHARACTERISTICS

- Generation queue position is irreversible
- Timeline slippage = project death
- No substitute for firm MW
- BTM only option when grid fails

FATAL FLAW CRITERION

No power pathway = Kill the deal

WATER IS DESIGNABLE

70x Range

Technology choice drives consumption

Observed variation: End-user requirements range from 120K gal/day to 8M gal/day for equivalent 600-900MW campuses.

DESIGN LEVERS

- Air cooling vs evaporative (10x delta)
- Closed-loop liquid cooling (lowest)
- Reclaimed / industrial water sources
- BTM generation cooling technology

PLUS FACTOR

Water rights are valuable, but absence is manageable

LOW WATER DESIGN

120K - 500K gal/day

Air-cooled + closed-loop liquid | 600-900MW

HIGH WATER DESIGN

5M - 8M gal/day

Evaporative cooling + BTM thermal | 600MW

IMPLICATION

Water adds value but is not disqualifying. Design to context. Power has no substitute.

Strategic Risk Matrix

Second-order effects and hidden risks in BTM/Giga-scale strategy

GAS ISLAND RISK — HIGH

Firm transport does not equal firm delivery during extreme weather (Uri). Pipeline interruption = catastrophic downtime.

Mitigation: Dual-fuel capability, on-site LNG/diesel storage

POLITICAL BACKLASH — MEDIUM

Socialized infrastructure costs lead to residential rate shock, power hogs narrative, moratoriums.

Mitigation: Direct cost allocation, proactive PUC engagement

CLOSING WINDOW — HIGH

Geographic arbitrage is not proprietary. Rush to the Middle will erode speed advantages within 18-36 months.

Response: Lock down best sites, utility commitments NOW

STRANDED ASSET — MEDIUM

BTM gas conflicts with Net Zero commitments. By mid-2030s, risk of regulatory/customer-driven stranding.

Mitigation: H2-ready design (hedge only), CCUS optionality

GAS PRICE VOLATILITY — MEDIUM

Henry Hub: $2-9/MMBtu range. At $4/MMBtu BTM compelling. At $8/MMBtu value proposition weakens.

Mitigation: Long-term hedging, fixed-price contracts

TAIWAN BLACK SWAN — TAIL

55% of US AI capacity still fabbed in Taiwan 2030. Disruption halts new demand but existing infra value spikes.

Implication: Capacity online 2025-2028 = geopolitical hedge

Net Assessment: Risks are manageable with proper mitigation. The dominant risk is moving too slowly. Speed of execution remains the strategic imperative.

The Closing Window

18-36 month arbitrage opportunity — execution priorities for 2026-2027

ARBITRAGE WINDOW EROSION

2025-2026 — MAXIMUM ADVANTAGE

First movers secure best sites, utility relationships, labor

2027 — ERODING

QTS, Vantage, EdgeCore entering OK/TX secondary

2028+ — NORMALIZED

Arbitrage states saturated. Competing on cost.

OKLAHOMA POSITIONING

Sites in #1 ranked state offer 12-18 month advantage over competitors entering now. First movers capture utility relationships and queue positions.

EXECUTION PRIORITIES 2026-2027

1. **Secure 3-5 Giga-Scale Sites**
   Deploy capital for queue positions, land control, utility LOIs
2. **Lock Labor and Equipment**
   Secure HV electrical contractors, turbine positions
3. **Deepen Utility Relationships**
   Embed in OG&E/PSO IRP planning, fund staff expansion
4. **Build IPP Capability**
   Establish energy trading partnership or hire desk

The dominant risk is moving too slowly.

Every month of delay narrows the window. Capacity online 2027-2030 captures peak scarcity premium.

Site Selection Team: Execution Framework

Prioritized actions within your control — organized by impact and urgency

PRIORITY 1: IMMEDIATE (Q1 2026)

Queue Positions

File generation interconnection applications NOW

Fund feasibility studies to advance queue position

Every month delay = 1 month later delivery

Capital Readiness

Stage capital for rapid deployment on sites

Pre-approve land acquisition parameters

Opportunity cost of slow capital is site loss

Utility Relationships

Deepen OG&E/PSO/GRDA engagement

Participate in IRP planning processes

Relationship depth = timeline advantage

PRIORITY 2: NEAR-TERM (H1 2026)

IPP Partnerships

Initiate conversations with 3-5 target IPPs

Define JV term sheet templates

Critical for BTM execution capability

Economic Development

Build relationships with state/local EDCs

Identify incentive programs, expedited permitting

Political support accelerates timelines

Developer Partnerships

Formalize partnership models

Expand developer partner network

Execution capacity for parallel projects

PRIORITY 3: ENABLERS (2026)

DD Standardization

Create repeatable site evaluation checklist

Standardize power pathway assessment

Speed + consistency in evaluation

EPC / Technical MSA

Pre-negotiate MSA for DD

Rapid-deploy technical assessment capability

Eliminates procurement delay on new sites

End-User Pipeline

Expand hyperscaler relationship network

Track demand signals, RFP calendars

Demand visibility de-risks development

All items above are within your direct control. Priority 1 items are time-critical and compound — delay costs more than capital. Execute in parallel, not sequence.

Geographic Flexibility: Why Central Sites Work

70-85% of AI power demand is location-independent — power availability trumps proximity

THE PHYSICS OF LATENCY

Fiber Optic Speed: ~124 miles per millisecond

OKC → NYC	OKC → LA
~22ms	**~20ms**
1,330 miles	1,180 miles

Effective RTT with network overhead: 30-50ms to either coast

THE KEY INSIGHT

For Generative AI, processing latency (100-300ms) dominates network latency. Whether network adds 10ms (local) or 40ms (central) is imperceptible to users.

Total Latency = Network RTT + Processing Latency

WORKLOAD GEOGRAPHIC REQUIREMENTS

Workload	Requirement
AI TRAINING	100% geographically flexible Needs power, not proximity
GENAI INFERENCE Chatbots, Copilots, Search	Flexible (40-100ms+ tolerance) Dominant GW demand driver
LOW LATENCY Gaming, AR/VR, AdTech	Needs regional proximity Medium GW impact
ULTRA-LOW AVs, Robotics, HFT	On-device or metro edge Not centralized DC demand

STRATEGIC CONCLUSION

70-85% of forecasted AI power demand can be served from Central U.S. sites. Prioritize power availability over proximity. The caveat: sites must have diverse, high-capacity fiber routes to coastal exchange points.

Latency Spectrum: Workload Detail

The Hub-and-Spoke architecture validates Central Belt positioning for Giga-scale demand

CATEGORY	THRESHOLD	USE CASES	LOCATION REQ	GW IMPACT
Ultra-Low	< 10ms	Autonomous vehicles, industrial robotics, high-frequency trading	On-device or metro edge	Low
Low Latency	10-40ms	Cloud gaming, complex AR/VR rendering, real-time AdTech	Metro / Regional	Medium
Medium Latency	40-100ms+	Generative AI (chatbots, copilots), search engines, recommendation engines	**Centralized / Continental**	**VERY HIGH**
Tolerant	> 100ms	Batch processing, scientific analysis, non-real-time content moderation	Anywhere	High

THE HUBS: AI Factories (Giga-Scale)

Location: Central U.S. (OK, AR, WY), Rust Belt

Function: All training + majority of inference

Optimized for: Power, cost, deliverability

THE SPOKES: Regional/Edge

Location: NoVA, Dallas, LA, Atlanta metros

Function: Low-latency inference, peering, caching

Optimized for: Proximity (10-200MW sites)

SITE SELECTION CRITERION

Add to DD checklist: Fiber connectivity

Require: Diverse routes to both coasts

Tulsa: Strong (legacy telecom hub)

CAVEAT: This analysis is most robust through 2030. Post-2030, if model inference speeds drop dramatically (to 20-50ms), network latency becomes relatively more important. For the 2026-2030 arbitrage window, power availability clearly dominates proximity.

The Queue Reality: Bimodal Value Distribution

Queue position ≠ value. The market is bifurcating into worthless speculation and premium deliverables.

THE FLOOD OF SPECULATION

90+ GW
PJM DC load requests

100+ GW
ERCOT large load

19%
Historical completion

Most queue entries are speculative — no land control, no end-user, no utility relationship, no execution capability. "Ghost projects" hoping to flip positions.

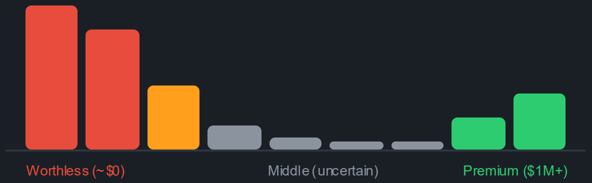
THE GREAT FILTER

FERC Order 2023
"First-Ready, First-Served" — higher deposits, readiness milestones, withdrawal penalties. Full implementation 2026-27.

Escalating Costs
Study deposits, security postings, upgrade cost assignments — filters out undercapitalized speculators.

Utility Triage
Overwhelmed utilities prioritizing real projects with end-user commitment, land control, financial capability.

BIMODAL VALUE DISTRIBUTION



Not a continuum. Most positions worth ~$0. Few with right ingredients command premium.

THE BIFURCATION

THE "HAVE NOTS"
Weak queue, no infrastructure, undercapitalized. Will fail the filter. Value → $0.

THE "HAVES"
Full ingredients, utility commitment, end-user alignment. Unprecedented premiums.

VALUE BY STAGE $/MW (2025)

Queue only, no ingredients	~$0
Queue + land, no pathway	$20-75K
Early real (utility engaged)	$150-300K
Advancing (study + end-user)	$300-500K
Committed (LOI + entitlements)	$500K-1M
De-risked (36-mo certainty)	$800K-1.5M+

Key insight: The $200K/MW in emerging markets isn't pricing a queue. It's pricing real ingredients and credible sponsors.

Strategic implication: Don't buy queue positions. Deploy ingredients. The margin is in transforming $0 optionality into $500K+ committed value through execution capability and relationships.

The Right Ingredients: What Creates Value

Queue position is table stakes. Value comes from the bundle that enables execution.

THE VALUE HIERARCHY

END-USER DEMAND
Hyperscaler commitment validates all

↓ validates

POWER PATHWAY
Utility commitment + transmission + queue

↓ enables

SITE FUNDAMENTALS
Land, water, fiber, zoning, BTM pathway

↓ supports

QUEUE POSITION ALONE
Worth very little without the above

THE INGREDIENTS CHECKLIST

Tier 1: Relationship Capital (Cannot Rush)
Utility trust, end-user pipeline, community relationships, political access
Build time: 2-5+ years. Must pre-exist.

Tier 2: Execution Capability
Transmission expertise, BTM knowledge, EPC relationships, track record
Differentiates serious players from speculators.

Tier 3: Financial Capability
Patient capital, $100M+ security posting, study funding, fast decisions
The "Great Filter" for undercapitalized speculators.

Tier 4: Site-Specific (Table Stakes)
Land control, queue position, water access, fiber connectivity
Acquirable with money. Necessary but not differentiating.

THE 12-18 MONTH SPRINT

Option Window Reality
12-18 months from land option to close or walk. Everything must happen in parallel.

Parallel Workstreams
Utility study, end-user LOI, zoning/permits, technical DD, financing — all simultaneous.

The Chicken-and-Egg
Utility wants end-user. End-user wants power. Zoning wants both. Someone must break cycle with credibility.

THE MOAT
Ability to execute parallel sprint — relationships + capability + capital in 12-18 months.

Who can do this? Perhaps 10-20 organizations nationally have pre-existing relationships, execution capability, and capital to run the parallel sprint successfully.

Geographic Convergence: NoVA as the Ceiling

Location doesn't matter for AI workloads. Power does. Pricing will converge nationally.

WHY LOCATION DOESN'T MATTER

The Latency Reality

Processing latency (100-300ms) dominates network latency (30-50ms) for GenAI workloads.

OKC → NYC	OKC → LA
~22ms	**~20ms**

Workload Distribution

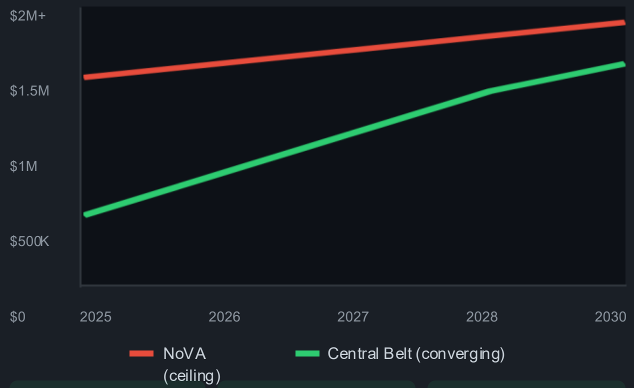
AI Training	100% location flexible
GenAI Inference	80%+ location flexible
Low-latency (gaming, AR)	Regional required

70-85% of AI power demand can be served from Central U.S.

THE CONVERGENCE LOGIC

If location doesn't matter for the workload, and power is the binding constraint everywhere, then the **price of deliverable power should converge nationally.**

THE ARBITRAGE WINDOW



2025	2027	2030
25-35% of NoVA	**45-55%** of NoVA	**70-85%** of NoVA

The arbitrage: Acquire in Central Belt at 25-35% of NoVA pricing. Hold as convergence closes the gap. Capture both development margin and convergence premium.

CURRENT MARKET DATA

Tier 1 (Saturated)

NoV	$1M+/MW

4+ year queues, extreme scarcity

Tier 2 (Competitive)

DFW	$500K-1M/MW

Growing competition, tightening

Tier 3 (Emerging)

Tulsa / OK	~$200K/MW
Rural emerging	$150K+/MW

Early recognition, max arbitrage

NOVA'S DYSFUNCTION = YOUR OPPORTUNITY

Every year NoVA gets more constrained and expensive, the case for Central Belt strengthens and convergence accelerates.

Note: Prices shown are for real sites with credible sponsors and utility engagement (not queue-only positions). Full parity unlikely due to ecosystem maturity discount (10-15%), but convergence to 70-85% of NoVA represents 2-4x appreciation from current Central Belt levels.

Powered Land Valuation Forecast (2025-2030)

De-risked sites with utility commitment, full entitlements, 36-month delivery, 150-200MW/year scaling

500MW CAPABLE SITES ($/MW)

Year	Low	Mid	High
2025	$400K	**$600K**	$900K
2026	$500K	**$800K**	$1.2M
2027	$700K	**$1.1M**	$1.6M
2028	$800K	**$1.3M**	$2.0M
2029	$900K	**$1.4M**	$2.2M
2030	$800K	**$1.3M**	$2.0M

5-Year Mid Appreciation: **~2.2x**

1GW+ CAPABLE SITES ($/MW)

Year	Low	Mid	High
2025	$550K	**$800K**	$1.2M
2026	$700K	**$1.1M**	$1.6M
2027	$1.0M	**$1.5M**	$2.2M
2028	$1.2M	**$1.8M**	$2.8M
2029	$1.3M	**$2.0M**	$3.0M
2030	$1.2M	**$1.8M**	$2.8M

5-Year Mid Appreciation: **~2.3x**

SCALE PREMIUM

1GW vs 500MW Premium

2025	~35%
2027	~40%
2030	~45%

VALUE DRIVERS

- ↑ NoVA further constrained
- ↑ Hyperscaler announcements
- ↑ Equipment bottlenecks persist
- ↑ AI revenue validates faster

VALUE RISKS

- ↓ Hyperscaler capex pullback
- ↓ Supply response faster
- ↓ Efficiency gains reduce demand
- ↓ Interest rates compress multiples

Assumptions: Central Belt/emerging markets. De-risked = utility commitment, full entitlements, 36-mo to day 1 power. Queue-only positions valued at $0-75K/MW (not shown). Peak scarcity expected 2028-2029.

Strategic Implications: The Powered Land Opportunity

Execution capability + scarcity dynamics = asymmetric value creation window

THE THESIS SUMMARIZED

1. STRUCTURAL DEFICIT PERSISTS

30-50 GW U.S. shortfall through 2030+. Even with 30% international overspill and demand moderation, supply cannot catch up.

2. LOCATION DOESN'T MATTER

70-85% of AI workloads geographically flexible. Central U.S. serves continental demand. Pricing will converge nationally toward NoVA ceiling.

3. QUEUE ≠ VALUE

Bimodal distribution. Most positions worth ~$0. Only sites with full ingredients (utility commitment, end-user, entitlements) command premium.

4. CAPABILITY IS THE MOAT

Perhaps 10-20 organizations can execute the parallel sprint. Scarcity of execution capability, not land, drives value.

THE VALUE CREATION MODEL

Entry		Apply Ingredients		Exit
$0-200K /MW	→	12-18 mo sprint	→	**$800K-2M+** /MW

Margin is in ingredient application, not land appreciation

TIMING WINDOWS

2025-2026: Maximum Arbitrage

Entry at 25-35% of NoVA. Early movers secure best sites, relationships, utility priority.

2027-2029: Peak Scarcity

Maximum supply-demand gap. Premium valuations. Delivery in this window captures scarcity premium.

2030+: Convergence/Equilibrium

Geographic pricing converges. New supply begins clearing. First movers already positioned.

EXECUTION IMPERATIVES

1. End-user conversations before you need them
2. Utility relationships at institutional level
3. Community/political trust pre-built
4. Parallel execution capability (team + systems)
5. Portfolio approach for timing optionality

ILLUSTRATIVE ECONOMICS

500MW Site (2027 Exit)

Entry (early real)	$100-150M
Development costs	$25-50M
Exit (de-risked, mid)	$550M
Development margin	**$350-425M**

1GW Site (2028 Exit)

Entry (early real)	$200-300M
Development costs	$50-100M
Exit (de-risked, mid)	$1.8B
Development margin	**$1.4-1.55B**

Note: Illustrative only. Actual returns depend on execution, timing, and market conditions.

Bottom line: The opportunity isn't buying land — it's deploying execution capability into a structurally supply-constrained market. The 18-36 month window for maximum arbitrage is open now. Speed and relationships compound. Delay costs more than capital.

DETAILED ANALYSIS

Appendix

Methodology, Data Sources, and Supporting Analysis

Appendix A: Conversion Methodology

Wafer → Die → Package → TDP → Server → Data Center GW

STAGE 1		STAGE 2		STAGE 3		STAGE 4		STAGE 5		STAGE 6
Wafer Starts	→	Functional Dies	→	CoWoS Packages	→	Chip TDP	→	Server Power	→	DC GW Demand
WSPM by node		Yield adjusted		Binding constraint		Weighted mix		1.45x overhead		PUE adjusted

MASTER FORMULA

$$\text{DC Power (GW)} = [\text{Annual Chips} \times \text{Weighted TDP} \times \text{Utilization} \times \text{Server Overhead} \times \text{PUE}] / 10^9$$

YIELD MODEL

Mature N4/N5: 70-85%

Early N3/N2: 50-65%

H100 die: 814mm² → ~60-73 dies/wafer

UTILIZATION

Training clusters: 75-85%

Inference farms: 50-65%

Blended range: 60-80%

SERVER OVERHEAD

GPU TDP: 55-70% of server

CPU/memory/network: 20%

Factor applied: 1.45x

PUE RANGE

Traditional air: 1.4-1.6

Modern hyperscale: 1.2-1.3

AI-optimized liquid: 1.1-1.2

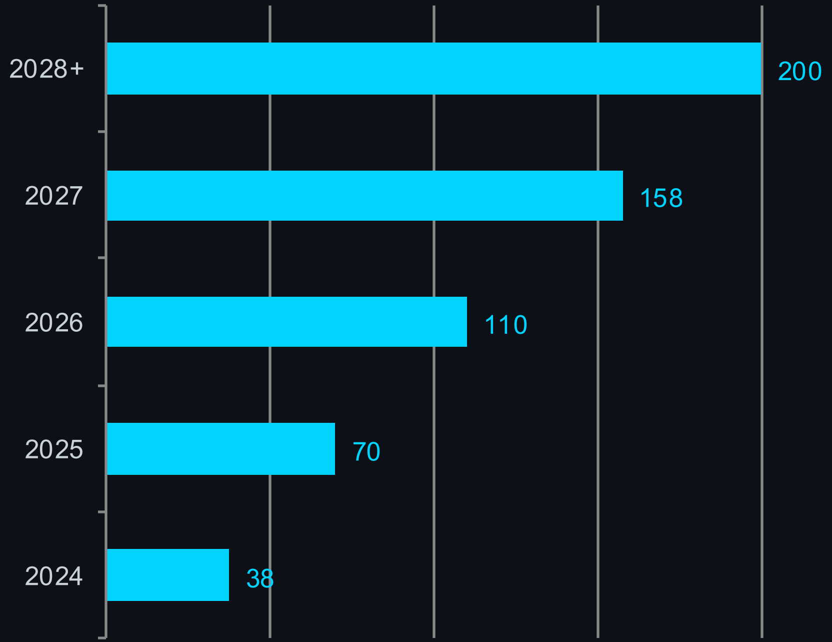
Critical: CoWoS packaging capacity—not wafer fabrication—is the binding constraint through 2027. Model uses CoWoS-constrained output as annual chip production input.

BASELINE CALIBRATION

2024 baseline (10-14 GW) anchored to external estimates (IEA, Goldman, McKinsey) reflecting *operational* capacity. Formula captures growth dynamics; shipped chips have 6-12 month install lag. Forward projections validated against industry forecasts.

Appendix B: CoWoS Packaging Capacity

The binding constraint through 2027



YEAR	WPM	YoY	CHIPS/YR (M)
2024	35-40K	—	22-25
2025	65-75K	+80%	40-47
2026	90-130K	+50%	56-82
2027	135-180K	+35%	84-113
2028+	200K+	+20%	130+

2025 CUSTOMER ALLOCATION

NVIDIA 63%
Broadcom 13%
AMD 8%
Marvell 8%
Others 8%

CoWoS-L: Next-gen packaging for B200+ enables 8-12 HBM stacks (192-288GB). More complex, requires additional capacity.

Appendix C: Chip TDP Specifications

NVIDIA and AMD roadmap driving power projections

NVIDIA ARCHITECTURE ROADMAP

ARCH	H100	B200	B300 Ultra	Rubin	Rubin Ultra
Year	2022-24	2024-25	2025	2026	2027
TDP	700W	1,000W	1,400W	~1,500W	~2,000W
HBM	80GB HBM3	192GB HBM3E	288GB HBM3E	288GB HBM4	1TB HBM4E

AMD CDNA ROADMAP

MI300X	750W	192GB, 2024
MI350X	1,000W	288GB, 2025
MI400	~1,400W	432GB HBM4, 2026

HYPERSCALER CUSTOM

Google TPU v6	~200W
AWS Trainium2	~500W
MSFT Maia 100	500-700W
Meta MTIA v2	90W

WEIGHTED AVERAGE TDP PROJECTION

2024	2026	2028	2030	2035
680W	780W	920W	1,050W	1,300W

Appendix D: Year-by-Year Demand Projections

Global and U.S. Technology Stack (Base Case)

YEAR	CHIPS (M)	TDP (W)	UTIL %	PUE	GLOBAL GW	US SHARE	US STACK GW
2024	22-25	680	65%	1.30	10-14	85%	10-12
2025	40-47	720	68%	1.28	20-28	84%	18-23
2026	56-82	780	70%	1.25	32-52	82%	32-40
2027	84-113	850	72%	1.22	48-78	80%	48-58
2028	105-150	920	73%	1.20	62-112	78%	62-78
2030	160-250	1,050	75%	1.16	**95-180**	75%	**95-120**
2032	220-350	1,150	76%	1.14	130-270	73%	135-165
2035	350-550	1,300	78%	1.12	**180-400**	72%	**180-230**

Note: Global GW = [Chips × TDP × Util × 1.45 overhead × PUE] / 10^9. Ranges reflect conservative to aggressive assumptions.

Appendix E: Scenario Sensitivity Analysis

Variable ranges and 2030/2035 scenario outcomes

VARIABLE RANGES MODELED

Parameter	Conservative	Base	Aggressive
Advanced node yield	65%	75%	85%
Packaging yield	85%	92%	96%
Utilization rate	60%	72%	80%
PUE	1.40	1.25	1.12
CoWoS ramp	Low	Medium	High

2030 SCENARIO OUTCOMES

Conservative	**80-95** / 60-72 GW
Base	**120-140** / 90-105 GW
Aggressive	**165-185** / 124-139 GW

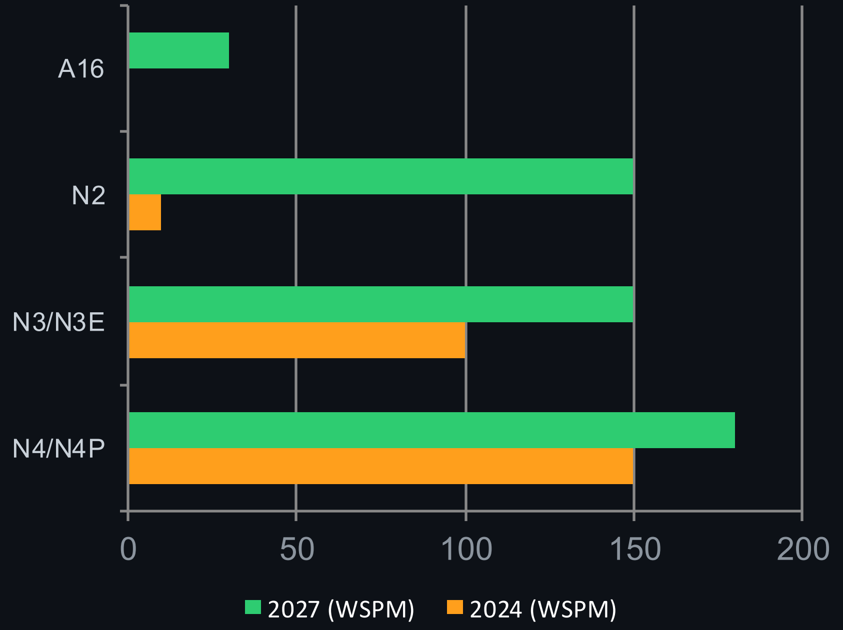
2035 SCENARIO OUTCOMES

Conservative	**120-150** / 85-110 GW
Base	**200-250** / 145-180 GW
Aggressive	**320-400** / 230-290 GW

ANNUAL ENERGY (TWh) 2030: Conservative 700-830 | Base 1,050-1,230 | Aggressive 1,450-1,620

Appendix F: Foundry Capacity by Node

TSMC advanced node wafer starts per month (WSPM) with AI allocation



TSMC CAPACITY (WSPM)

Node	2024	2027	AI %
N4/N4P	150K	180K	40%
N3/N3E	100K	150K	35%
N2	10K	150K	50%
A16 (1.6nm)	0	30K	60%

OTHER FOUNDRIES

Samsung 3nm	Yield issues, <10% share
Intel 18A	HVM late 2025
SMIC 7nm	DUV only, 40-50% yield

TSMC ARIZONA EXPANSION

$165B investment, 60-100K WSPM advanced capacity by 2030. Three fabs + Amkor packaging. ~30% of 2nm+ production on U.S. soil.

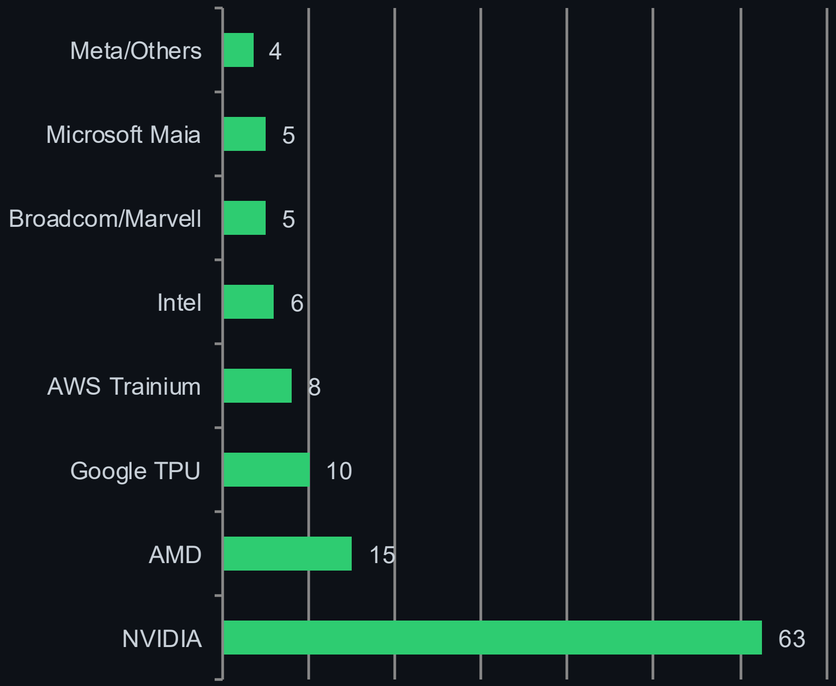
CHINESE DOMESTIC AI CHIPS

2024: 0.5-1M (4%) 2028: 4.5-7M (9%)

2026: 2-3.5M (7%) 2030: 8-15M (12%)

Appendix G: U.S. Stack by Chip Designer (2030)

Projected power demand allocation by company



DESIGNER	2030 GW	% OF US STACK
NVIDIA	55-70	58-65%
AMD	12-18	12-15%
Google TPU	8-12	8-10%
AWS Trainium	6-10	6-8%
Intel	4-8	4-6%
Broadcom/Marvell	4-6	4-5%
Microsoft Maia	4-6	4-5%
Meta/Others	2-5	2-4%

TOTAL U.S. STACK (2030) **95-120 GW**

Appendix H: Validation Against Industry Forecasts

Cross-referencing projections with major analyst estimates

SOURCE	THEIR FORECAST	THIS ANALYSIS	ALIGNMENT
IEA (2030)	945 TWh global DC energy	1,050-1,230 TWh (AI portion)	● Aligned (AI adds to base)
McKinsey (2030)	80+ GW US DC capacity	95-120 GW US stack demand	● Aligned (demand > capacity)
Goldman Sachs (2030)	122 GW global DC capacity	120-140 GW global (base)	● Close alignment
SemiAnalysis (2028)	56+ GW AI IT power	62-78 GW US stack	● Aligned (IT vs DC power)
Bernstein (2027)	30-35 GW AI demand	48-78 GW global	● Higher (CoWoS scaling)

WHY THIS ANALYSIS MAY BE HIGHER

Explicit wafer-to-power conversion through packaging constraints rather than extrapolating historical DC growth trends. Accounts for chip TDP increases (700W→1,400W+) and AI-specific infrastructure scaling.

CONSERVATIVE FACTORS

Supply constraints moderate near-term growth (CoWoS, HBM). Analysis assumes constraints bind through 2027. Actual deployment may lag production by 6-12 months.

KEY VALIDATION POINTS

✓ CoWoS as binding constraint (TrendForce, SemiAnalysis) ✓ HBM supply shortage through 2025 (SK Hynix) ✓ 3-7 year grid interconnection (utility data)