The Supercycle Stack

How the energy boom is driving new supercycles in gas, water, and critical minerals

FLATHEAD FORGE

September, 2026

Can the world build what it has already announced?

$1 trillion

of global data center capital spending in 2026, on the way to **$6.7** trillion a year by 2030

188 GW

of new load asking to connect in Texas alone by 2030, against a grid whose peak is about **85 GW**

228B gal

of water consumed by US data centers in 2023; **92%** of it at the power plant, not the campus

617 kt

of copper a year into data centers by 2030. Friedland: more copper must be mined in the next 20 years than in all of human history.

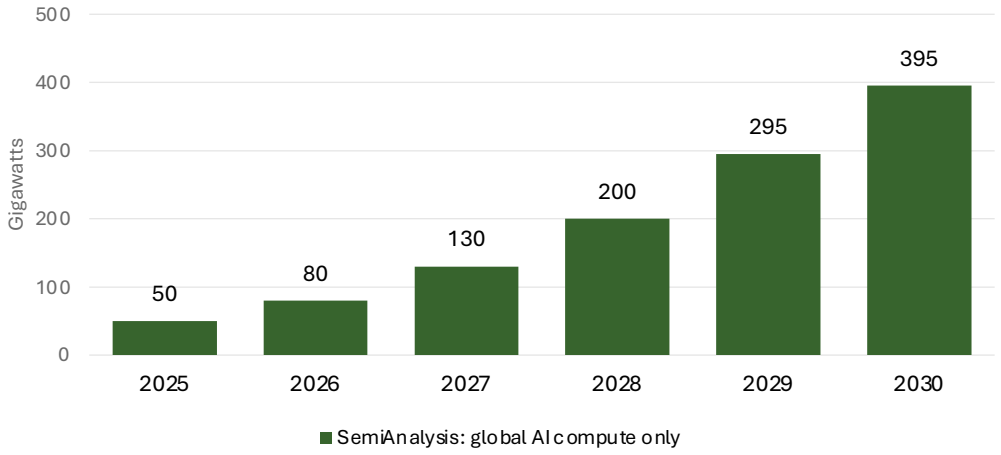
13% **of the power that asked to join the US grid from 2000 to 2025 got built.**

By capacity, status at end of 2025. Median wait for the plants built in 2025: over five years. LBNL, Queued Up 2026.

INVESTOR LENS The dollars are committed. The gas, water, and metal are not, and the scarcity is where the investment opportunity sits

Sources: Dell'Oro Group, Data Center IT Capex 5-Year Forecast (Jan 2026; outlook raised to more than $1 trillion for 2026 in Jun 2026); ERCOT large-load interconnection queue (2026); LBNL, US Data Center Energy Usage Report (Dec 2024), direct and electricity-related water consumption, 2023; Wood Mackenzie Horizons (Oct 2025), base case; Robert Friedland, Ivanhoe Mines, Rule Symposium (Jul 2024), via MINING.COM; LBNL, Queued Up: 2026 Edition (May 2026), interconnection requests 2000 to 2020 by status at end of 2025.

Demand for compute will at a minimum double by 2030



$6.7T

of data center capex by 2030, a quarter of it power, cooling, and electrical (McKinsey). AI capex alone passes $2T a year by 2028 (SemiAnalysis).

1 in 3

US data centers expected to run entirely on on-site power by 2030; power availability is the top site-selection factor (Bloom Energy survey, Apr 2026).

1 to 2%

vacancy in the major US data center markets; rents near $250 per kW against about $70 in 2021. Capacity is sold before it is built (Goldman Sachs, 2026).

INVESTOR LENS Every gigawatt of compute is constrained by its need for energy, water, permitted land, and metal.

Sources: SemiAnalysis (Dylan Patel) on the Dwarkesh Podcast, Aug 25, 2026: global AI compute additions of about 30 GW in 2026, 50 in 2027, 70 in 2028 and 90 to 100 in 2029, passing 200 GW by the end of 2028; the 2025 base of about 50 GW and the 2029 and 2030 totals are Flathead Forge arithmetic on those stated additions. At 2030, Goldman Sachs has 217 GW of total global capacity across all workloads, JLL about 200 GW, and Bain about 200 GW of AI capacity. Goldman Sachs Research (2026) for US vacancy and pricing per kW; McKinsey, The cost of compute (Apr 2025); Bloom Energy (Apr 2026).

Three supercycles, all of them global

AI COMPUTE The accelerant. Three cycles that were already critical were pushed into the same decade.

ENERGY

Demand growing again after a flat decade: compute, electrification, onshoring. Machines and grid are sold out.

WATER

Scarcity in the same basins where power gets built. The hidden bill of generation and chips.

MINERALS

Copper, lithium, rare earths, iodine. Refining concentrated in one country; sovereignty and onshoring.

THE PICKS & SHOVELS:
The equipment and chemistry that gather, measure, purify, treat, process and recover. The physical work that turns gas, water, and brine into power, purity, and metal.

INVESTOR LENS Three cycles, one set of tools. Nobody needs to guess which cycle wins.

One gigawatt of compute is a purchase order for gas, water, land, and metal

1 GW

24 GWh a day

the electricity of about 800,000 US homes

One campus, four supply chains.

ENERGY

~70 Bcf gas / year

gathered, metered, and purified before it burns; 65 Bcf combined cycle, 85 simple cycle.

WATER

~1.8B gal / year

to cool a wet-cooled combined cycle plant; near zero for simple cycle or fuel cells. The campus adds its own loop, which still needs advanced water purification.

LAND

~1,000 acres

for the campus, plus 100 to 250 for the power plant, an air permit, and water rights. Solar and batteries for the same gigawatt = ~22,000 acres.

METAL

~27,000 t of copper

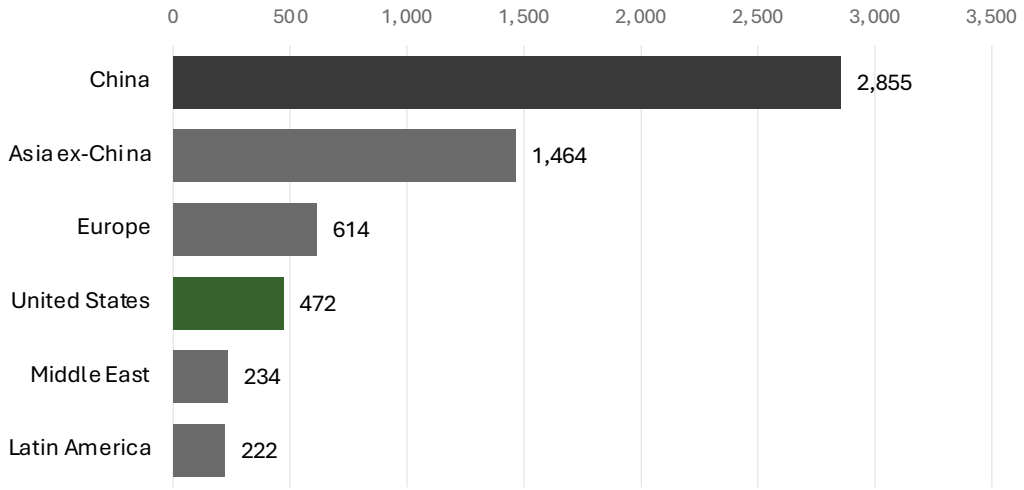
inside the fence at ~27 t/MW. Outside it, gas generators, transformers, and switchgear add ~2,000 t/MW. Solar for the same gigawatt: ~15,000 t in panels alone.

The inputs choose the location. Gas in the ground or a pipeline nearby, water rights, and land that permits: that is why the campuses are landing in the Permian and the Gulf.

INVESTOR LENS You do not need to know which hyperscaler wins to know these orders get placed.

Sources: 1 GW x 8,760 h: gas at 7.5 to 10 MMBtu/MWh (EIA) = 65 to 85 Bcf/yr; water at ~200 gal/MWh wet-cooled combined cycle (Macknick et al., NREL 2011) = ~1.8B gal/yr; homes at ~10,800 kWh/yr (EIA). Land: Crusoe / Stargate Abilene, 1.2 GW on ~1,100 acres; FPL West County, Panda Temple; Masdar / EWEC 5.2 GW solar + 19 GWh storage on 90 km2. Copper: BHP ~27 t/MW inside the campus (2024); IEA (2021) ~1.1 t/MW gas plant, ~2.8 t/MW solar PV; transformers and switchgear- estimate.

Demand is growing on every continent, on a supply chain sized for a flat decade



Electricity demand added between 2025 and 2030, TWh. Worldwide: 6,146 TWh, more than the entire US grid delivers today.

+19%

world electricity demand growth, 2025 to 2030, about 3.6% a year. China alone adds the European Union's entire consumption.

945 TWh

global data center electricity by 2030, roughly double 2024 and about Japan's total use; about half of US demand growth.

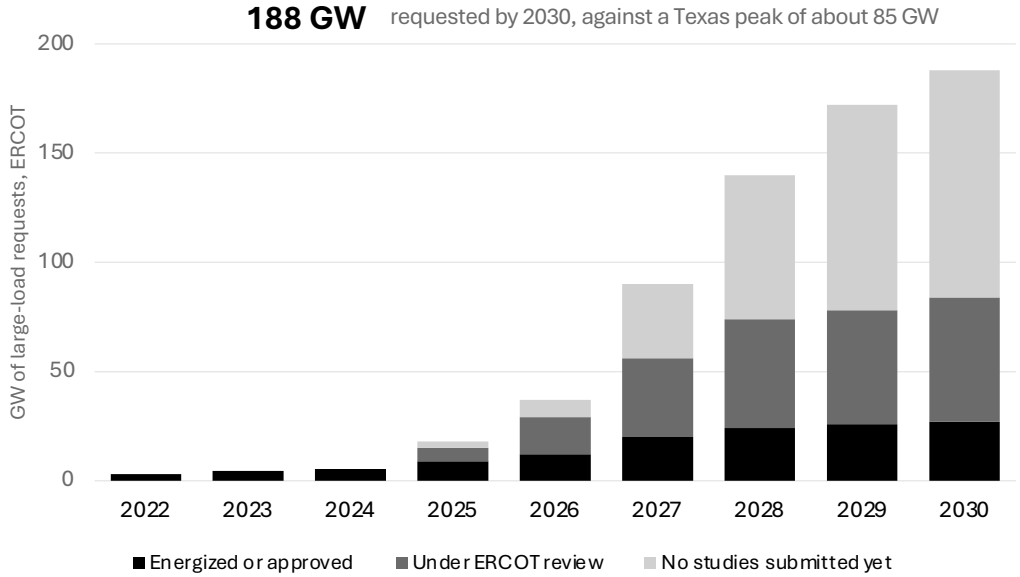
2007 to 2020

the flat years. US demand barely moved for thirteen years, and the turbine, transformer, and grid supply chain was sized to match.

INVESTOR LENS AI is the accelerant, not the cause. The supply chain is the bottleneck.

Sources: Ember, Global Electricity Review (2026) and IEA, Electricity 2026 (demand growth of about 3.6% a year through 2030; China close to half of the increase; data centers about half of US growth); IEA, Energy and AI (2025), data center electricity of about 945 TWh by 2030; EIA, US retail electricity sales 2007 to 2020. Regional additions are Flathead Forge compilation of the Ember and IEA outlooks.

Data centers want power faster than grids can add it



Compute is expensive. Power is cheap.

~$50B

all-in capital per gigawatt of AI campus
(chips, buildings, cooling)

~$2.6B

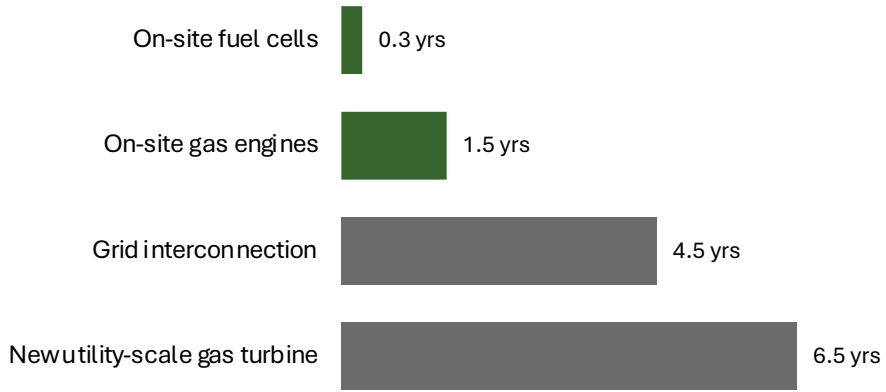
To power it for 5 years 24/7
(at $60 per MWh)

The chips cost 15-20 times what five years of electricity costs. Power is a rounding error to the campus and a permanent shortage for everyone else.

INVESTOR LENS A price-insensitive buyer pays whatever the bottleneck charges. Owning the bottleneck beats owning the campus

Sources: ERCOT large-load interconnection queue (2026); Lawrence Berkeley National Laboratory, US Data Center Energy Usage Report (Dec 2024): 176 TWh in 2023 to 325 to 580 TWh by 2028; IEA Electricity 2026 (world demand); NVIDIA and hyperscaler capital plans, 2025-26.

Every path to a megawatt is queued. What ships before 2030 burns gas.



Years from decision to first power, as quoted to developers in 2025-26.
Green = behind the meter; Gray = through the utility.
All four burn gas: the US grid itself is about 43% gas-fired.

45 months

median wait for a grid interconnection agreement in 2025, three times the 2005 wait; transformers on four-year lead times, prices up ~80% in five years

2031 to 2034

delivery slots quoted on new H-class gas turbines; orders running 3X the pre-2020 pace, the US 1st and Saudi Arabia 2nd in the backlog

2030s +

first new nuclear units, at first-of-a-kind cost; Solar-plus-storage works only where the sun is relentless, at about $6 per watt

INVESTOR LENS Time to power is the scarce asset, and every route to it runs on gas. The premium goes to short delivery megawatts.

Sources: LBNL, Queued Up 2025 (median months from interconnection request to agreement); Bloom Energy data-center power surveys (Apr and Nov 2025); Mitsubishi Power via S&P Global Platts (Jul 2026); Wood Mackenzie transformer analysis (2026); Masdar and EWEC, 1 GW round-the-clock solar plus storage (Abu Dhabi, Jan 2025); company disclosures on SMR first units, mid-2026; EIA, utility-scale generation by source (natural gas ~43%, 2023-24).

Gas is not fuel until ...

1 GATHER	2 DEHYDRATE	3 SWEETEN	4 CONDITION	5 MEASURE	6 CAPTURE	THE MACHINE
wellhead separation, gathering lines, compression *separators, compressors, pipe*	water out before it corrodes or freezes *glycol units, molecular sieves*	H2S and CO2 out to pipeline spec: H2S 4 ppm, CO2 2 to 3% *amine plants, scavengers, membranes, adsorbents*	heavy ends and liquids out; the fuel the machine was built for *dew-point control, fuel-gas skids, filtration*	volume, BTU, contaminants; the meter is the invoice *custody meters, chromatographs, laser analyzers*	methane and CO2 that would be vented or flared *vapor recovery, flare-gas recovery, leak detection*	turbine, engine, or fuel cell; or the pipeline

WHO GETS PAID

EQUIPMENT

skids, compressors, treating units, vapor recovery; bought or leased per site

CHEMISTRY

amines, scavengers, adsorbents, membranes; consumed on every Mcf

INSTRUMENTS

meters, analyzers, calibration gas; a service annuity on the installed base

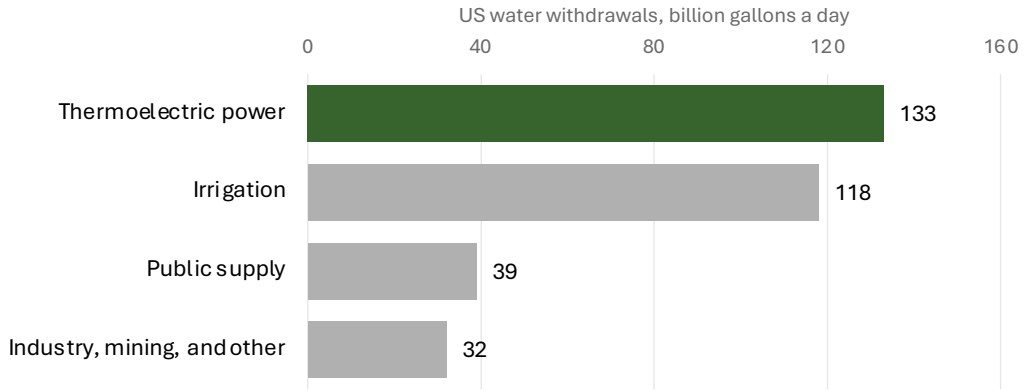
SERVICES

treating-as-a-service, monitoring, O&M; paid per unit handled

INVESTOR LENS The turbine get all the press. The six steps in front of it get paid on every molecule, whichever machine burns it.

Sources: typical US interstate pipeline tariff gas quality specifications (H2S 0.25 gr/100 scf, about 4 ppm; CO2 2 to 3%; water 7 lb/MMscf); OEM fuel specifications for heavy-duty gas turbines and DOE / NETL on fuel cell sulfur tolerance; EPA and state methane rules on venting and flaring; Flathead Forge operating experience in gas treating, measurement, and vapor recovery.

Water was a crisis before AI.



Energy was the largest water user in America before AI: 133 of 322 billion gallons a day, more than every farm in the country. AI does not create a new water problem. It lands on top of one that was already underfunded, permitted out, and short in the same basins where the power gets built.

REPLACEMENT & REGULATION

$91B a year shortfall

The US needs $270B/y for pipes, plants, PFAS, and pipelines and funds $179B, 97% of it from ratepayers.

ENERGY PRODUCTION

1B gal a day

of Permian produced water, 3 to 5 barrels per barrel of oil; zero discharge permits since 2024. Oil and permitting, not compute.

POWER & CHIPS

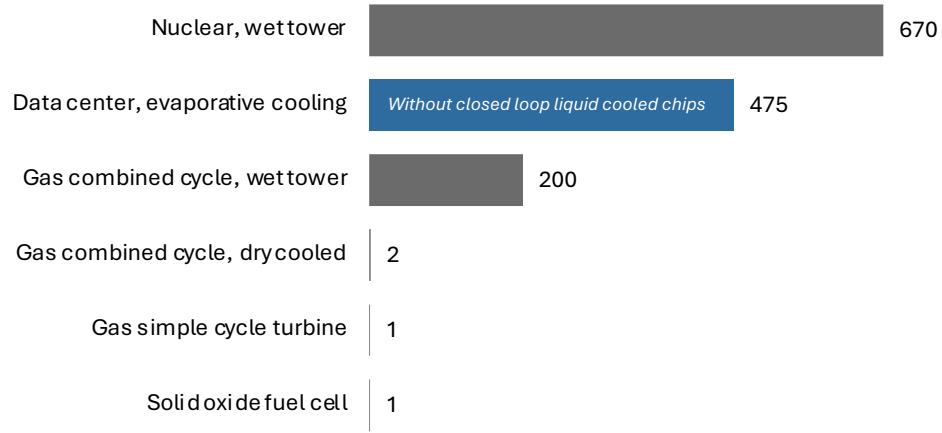
41%

of all US water withdrawals is thermoelectric power. AI demand is incremental: 54% of AI water demand lands at the power plant, 42% at the fab.

INVESTOR LENS Energy does not create the water demand. It removes the buyer's option to wait, and that sets the price.

Sources: USGS Circular 1441, Estimated use of water in the United States in 2015: 322 Bgal/d total; thermoelectric 133, irrigation 118, public supply 39. ASCE and US Water Alliance, Bridging the Gap (2024): $270B need, $179B funded, federal share about 3%. permianproducedwater.com (May 2026): 22M+ bbl/d, 3 to 5 bbl water per bbl oil. Texas Tribune (Aug 21, 2026) and TCEQ on discharge permits. Xylem / Global Water Intelligence (2026): AI water demand to 2050 by destination.

Cooling is 4%. The other 96% is the power plant and the fab.



Gallons of water consumed per MWh, by where the electricity comes from

Where AI's added water lands, 2050

Cooling is only 4% (assumes closed loop liquid cooled chips)

12x

a data center's grid electricity uses ~12x more water than its on-site cooling (LBNL)

+30T L

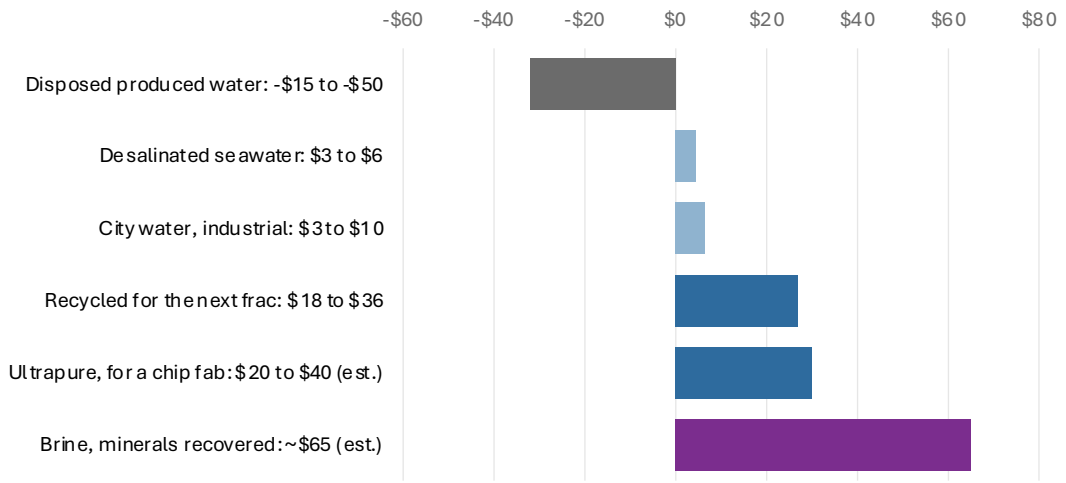
annual water demand added by AI worldwide by 2050, up 129% (Xylem / GWI)

Closed-loop liquid cooling moves the demand upstream in the form of electricity for dry coolers and chillers and adds a treatment loop of its own. It does not remove it.

INVESTOR LENS The water footprint is set by the power source, not the servers. Treatment and reuse are the unlock to constrained supply.

Sources: Macknick et al., NREL (2011), median water consumption by generation type; LBNL 2024 (industry WUE ~1.8 L/kWh; grid electricity for a data center uses ~12x its on-site cooling water); Xylem / Global Water Intelligence (2026), AI water demand to 2050.

One gallon, six prices. Treatment and reuse is the step between them.



Indicative $ per 1,000 gallons: what it costs to get rid of, or what it fetches. Bars at the midpoint of each range.

The Permian holds the bottom and top rung

22 to 25M bbl/d

of produced water, about a billion gallons a day, the largest water stream in Texas

-85%

new disposal permits since injection capacity peaked in 2024; the cheapest rung is closing

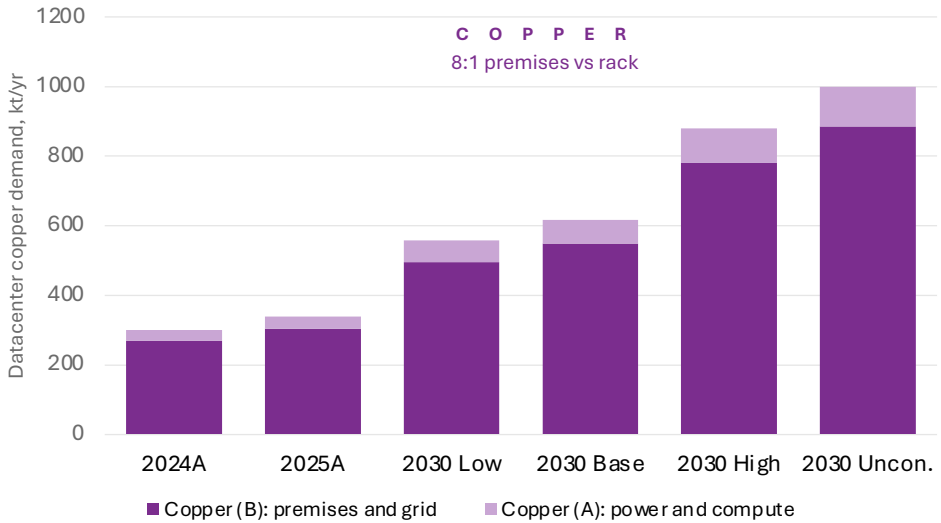
~10 GW

gas-powered cloud campus under way on the same West Texas acreage, over lithium and iodine brine

INVESTOR LENS The Permian pays $30 to get rid of a gallon that a fab will pay $30 for. Treatment and reuse collects both sides of that spread.

Sources: permianproducedwater.com market data (May 2026): disposal $0.60 to $1.25/bbl all-in, recycling for frac $0.75 to $1.50/bbl, 22M+ bbl/d; B3 Insight Permian outlook (May 2026); Texas municipal industrial water rates; IDA / GWI seawater desalination costs; ultrapure water derived from $200 to $500M UPW plant capex per fab, indicative; brine minerals from Flathead Forge arithmetic on slide 11 (~$100M/yr per 100,000 bbl/d); Forbes (Jul 2026) on Permian campuses. Per 1,000 gallons; 1 bbl = 42 gal.

Chips need ultrapure water, electronic-grade chemistry, and copper



Wood Mackenzie 2030 scenarios. Uncon. = unconstrained: demand if neither power nor supply limits bind.

Beyond copper: what a chip pulls in

WATER

5 to 10M gal a day

of ultrapure water per leading-edge fab, purified on site far beyond any drinking-water standard

CHEMISTRY

Parts per trillion

the metal limit in a fab's hydrogen peroxide and acids; electronic grade comes from a few plants, shipped in

MINERALS

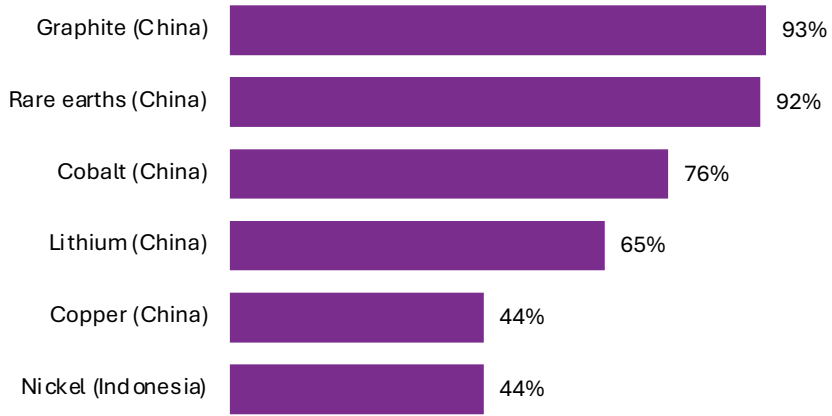
98%

of the world's gallium, the metal in every AI rack's power chips, is refined in China, which banned exports to the US in December 2024

INVESTOR LENS Purity = pricing power. The higher the grade, the fewer suppliers qualify, and the more each gallon and tonne is worth.

Sources: Wood Mackenzie Horizons (Oct 2025), datacenter copper demand by track, via Resource Capital Funds analysis; Copper (A) is chip- and rack-level, Copper (B) is building, transformer, and grid. TSMC Arizona and Intel Ohio water disclosures; SEMI electronic-grade chemical specifications (metal limits at parts-per-trillion levels); USGS Mineral Commodity Summaries (China ~98% of primary gallium); China Ministry of Commerce export ban on gallium, germanium, and antimony to the US (Dec 3, 2024).

The bottleneck is refining, and one country holds it



Share of global refining held by the single largest country, 2023 (IEA)

The shortage is in plants, not deposits

25%
of copper demand unmet in 2035 even if every announced project is built (IEA, 2026)

18 years
average from discovery to first production for mines opened 2020 to 2023 (S&P Global). ~ 61 new copper mines needed by 2030.

72%
average share of refining held by the top country across the key minerals in 2025, up from 70% in 2023 (IEA)

INVESTOR LENS The West is short of plants, not deposits. The capital that closes the gap buys refining, and refining = chemistry and water.

Sources: IEA Global Critical Minerals Outlook 2024 (share of refining held by the top country, 2023) and 2026 (2035 copper supply gap after announced projects; average top-refiner share 72% in 2025 vs 70% in 2023); S&P Global Market Intelligence (2024), 17.9-year average from discovery to production for mines started 2020 to 2023; Benchmark Mineral Intelligence (Jan 2025), 61 new copper mines needed by 2030; US Department of Defense, Energy, and Commerce critical minerals transactions (2025 to 2026).

The next ore bodies are brines

SALT-FLAT LITHIUM

~500,000 gal

of brine evaporated per tonne of lithium; 12 to 18 months a batch

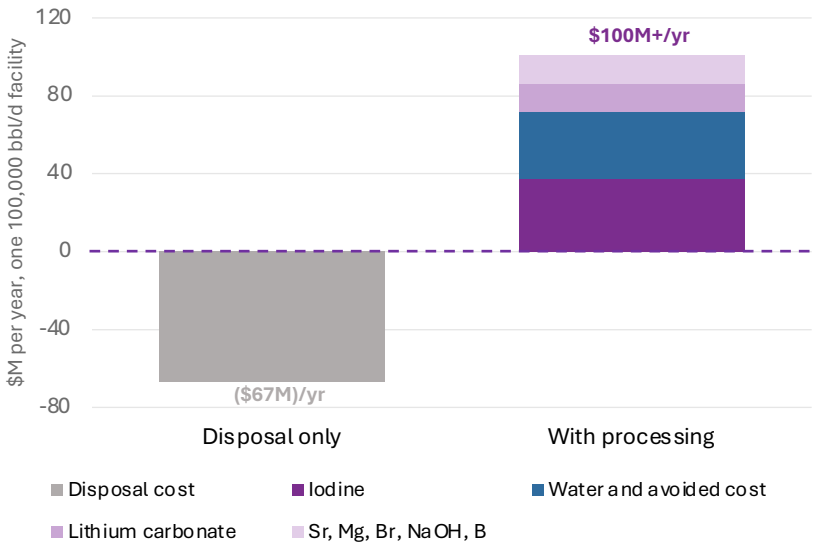
OILFIELD BRINE

~1B gal a day

already at the surface in the Permian alone; run through a plant, not a pond

WHAT THE BRINE CARRIES

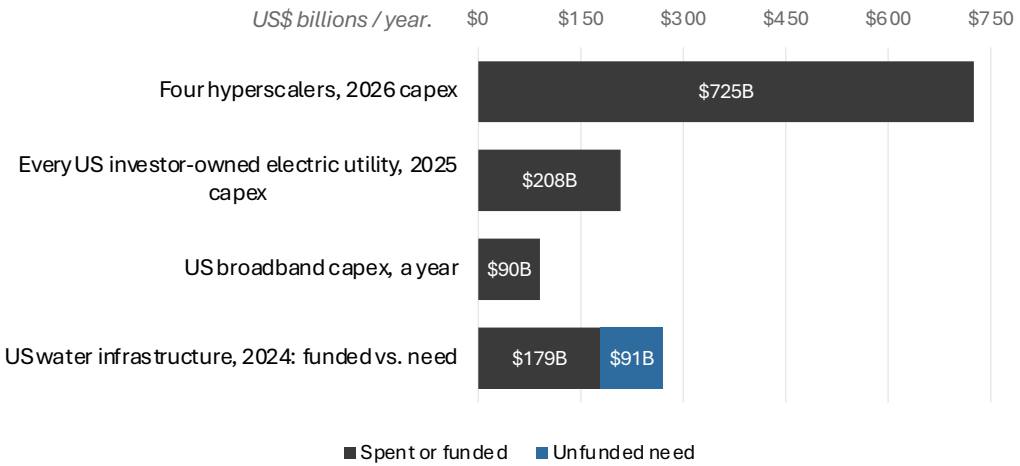
Lithium	batteries; Smackover brines 200 to 500 mg/L
Iodine	medical imaging, LCDs; the US imports ~90%
Bromine	flame retardants, drilling fluids
Mg, Sr, boron	alloys, ceramics, glass
Water	treated for reuse or discharge; disposal avoided



INVESTOR LENS The next ore bodies will look like industrial liabilities. The value accrues to the plants and chemistry that converts them

Sources: USGS; Ground Water Protection Council; Chevron (Jun 2025, ~125,000 net acres acquired in the Smackover from TerraVolta and East Texas Natural Resources); ExxonMobil and Standard Lithium / Equinor Smackover disclosures; Flathead Forge analysis. Economics illustrative for one 100,000 bbl/d facility, not a forecast. Salt-flat lithium: brine evaporated per tonne of lithium (metal content), Friends of the Earth Europe (2013) and SQM extraction and output disclosures; Permian produced water 22M+ bbl/d, permianproducedwater.com (May 2026).

There is no MLP for a water plant and no REIT for a mineral's refinery



+77%

capex growth at the four hyperscalers in one year: about $410B in 2025 to about $725B in 2026 (Jefferies, Apr 2026)

66% funded

is where US water infrastructure sits against need; the gap is $91B a year and $2.4T over twenty years (ASCE / US Water Alliance)

No vehicle

energy scaled through MLPs and yieldcos, telecom through tower and fiber REITs. Water, minerals, and measurement have no equivalent.

INVESTOR LENS Investment into the bottlenecks are asymmetric and structural. The gap is public. The vehicle to close it is not.

Sources: Jefferies via Yahoo Finance (Apr 30, 2026), combined 2026 capital expenditure of Alphabet, Microsoft, Meta, and Amazon; EEI (2025), investor-owned electric company capital expenditures of about $208B; USTelecom, broadband capex (2024); ASCE and US Water Alliance, Bridging the Gap (2024): $270B annual need against $179B spending in 2024 (66% funded), $2.43T twenty-year capital gap; federal share about 3% of water infrastructure spending (2017). Framework: Flathead Forge.

THE ANSWER

Only as fast as the gas, water, and metal can be converted.

WHAT WE FOUND

ENERGY
188 GW asked for in Texas; 13% of past queues got built.

GAS
What ships before 2030 burns gas: 70 Bcf a year per gigawatt.

WATER
92% of the water is at the power plant; one gallon, six prices.

MINERALS
One country refines up to 93% of each metal; plants, not deposits.

DEPLOYMENT

THE CONVERSION

Generate and dispatch
power on site in months, paid per MWh

Gather, purify, measure
paid per Mcf handled, before the turbine

Treat, reuse, recover
paid per gallon that climbs the ladder

Refine, separate, purify
paid per tonne on throughput and purity

Deploy, finance, operate
paid on utilization and uptime

PICKS & SHOVELS

Energy
dispatchable power where the load is; on-site generation in months, not years

Industrial Intelligence
measurement that proves and prices what flows; purification that makes gas turbine-ready

Water
treatment, reuse, desalination, modular supply; paid as a service and on avoided cost

Resource Conversion
chemistry that turns brines and waste streams into product, paid on purity

Industrial Deployment
Development, O&M, finance, and channels every build-out contracts or buys

INVESTOR LENS Bits ride on atoms. Own the bottlenecks, and every supercycle pays you.

What could disrupt the investment thesis ?

OPPOSITION

$130B

of data center projects blocked or delayed in Q1 2026 alone: 75+ projects across 49 states, matching all of 2025 in three months. It hits the campus first and its suppliers second.

PRICE RETALIATION

-80%

lithium carbonate's fall in 2023 when Chinese supply outran demand. The same move broke Western rare earth and polysilicon plants before it. A subsidy is not a moat; a captive feedstock and a spec are.

PERMITTING

0

produced-water discharge permits issued in Texas since applications opened in 2024. The land-application rule drew opposition from two-thirds of commenters. The treatment and reuse strategy is not viable until permits issue.

EXECUTION

18 to 36 months

to build and commission a plant, then a year for the customer to qualify it. Nothing in this layer runs on a software timeline.

The early warning for all four is lease signings and permit dockets, not share prices.

INVESTOR LENS The risk is delivery, not demand. If the power, water, and metal do not show up, neither does the AI.

Sources: Data Center Watch, Q1 2026 report (75+ projects, about $130B blocked or delayed, 49 states); lithium carbonate spot, China, Nov 2022 to Dec 2023; Texas Tribune (Aug 21, 2026) and TCEQ on produced-water discharge and land-application permitting; Flathead Forge operating experience on plant construction, commissioning, and customer qualification.

FLATHEAD FORGE

Investing in the infrastructure of the Industrial Supercycle

Operators and investors in the same room.
Founders who built, ran, and sold industrial water and gas companies, joined by a decade of institutional investing.

Doug Lee
Co-Founder and Managing Director

Founded GLR Solutions (today Enerflex Water); Veolia and Suez. Built and sold Inception and Azoto with Dave. 15+ patents. Houston.

doug@flatheadforge.com

Dave Lee
Co-Founder and Managing Director

Co-founder and CEO of Azoto Energy (sold to WSG) and Inception; thirty years in industrial gas and equipment. Calgary.

dave@flatheadforge.com

Chad Bown
Partner and Managing Director

Managing Director, bp Ventures (2013 to 2026): $1B+ invested in 60+ companies. Boards: Eavor, Xpansiv, Saltworks. Houston.

chad@flatheadforge.com

Noel Knape
Partner, Finance and Operations

CPA and three-time CFO; twenty years in energy services and manufacturing. Runs fund operations, valuations, and reporting.

noel@flatheadforge.com

FIVE CONSTRAINTS - Energy · Water · Resource Conversion · Industrial Intelligence · Industrial Deployment

Advisory board and Sherpa bench: Jeremy Pitts (Activate Houston), Mahesh Konduru (ProSep, Momentum), Luke Burns (Ascent Venture Partners), Ron Melnyk (Six Pines Capital), and 25+ Sherpas, veteran operators embedded in the portfolio.

INVESTOR LENS We invest where physical constraints limit industrial growth, in the systems every winner of the cycle will require.

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Whatever this revolution becomes, it has to come through the bottleneck.

Own it.

Questions and discussion

FLATHEAD FORGE

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