INDUSTRY ANALYSIS · MAY 2026

GENERATION BEFORE GRID.

Why on-site power has moved from a backup strategy to the primary path to energization for AI infrastructure.

THE QUEUE

2,600 GW of capacity now sits in US interconnection queues. New entrants face longer waits, not shorter ones.

THE INVERSION

On-site generation becomes the source. The grid becomes one of several inputs, or a tie-in for resilience.

THE SCHEDULE

Behind-the-meter generation lands on AI deployment windows. Five-year interconnections do not.

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OVERVIEW

When the Grid Stops Being Optional, It Stops Being First

The conversation around data centre power for the last decade assumed the grid was the source. Self-generation was a redundancy strategy, sized for outages, dispatched briefly, and treated as a cost line. That assumption is breaking.

Interconnection queues now run longer than AI build cycles, and a growing share of new capacity is being designed to energize without waiting for the utility to be ready. Behind the meter is no longer a sustainability story or a corporate PPA dressed in different language. It is a delivery strategy.

The question on a new build is no longer whether the grid will arrive in time. It is whether the project needs the grid to arrive at all, or whether on-site generation and storage can carry the load from day one and treat the utility connection as backup.

> THE INVERSION
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> The interconnection queue has grown to roughly twice the size of total US installed capacity. Median wait times have moved from under two years for projects built between 2000 and 2007 to five years for projects built in 2023. Those timelines do not match AI deployment windows, and the financing model for AI infrastructure cannot absorb a five-year energization delay.

Projects approving capex now are sizing on-site generation to carry the workload at energization, and treating the eventual utility connection as an upgrade rather than a requirement. The shift is structural, not cyclical.

What follows is an examination of why the grid stopped being first, what is replacing it, how the operating model changes, and what the new critical path looks like.

Power has moved from a procurement problem to a **schedule problem.** The numbers below set the scale.

2,600 GW	5 yrs	~75%
Total capacity in US interconnection queues at end of 2023	Median time from request to commercial operation for projects built in 2023	Of planned on-site power at US data centres is natural gas
Berkeley Lab, Queued Up 2024	*Berkeley Lab, Queued Up 2024*	*Cleanview, 2025*

EXECUTIVE SUMMARY

The Grid as Backup, Not Source

Most operators still treat behind-the-meter generation as a redundancy layer sitting under a grid-fed facility. The projects energizing fastest in 2025 are inverting that logic. On-site generation runs as the primary source. The grid, when present, becomes a tie-in for resilience, arbitrage, or eventual export.

That inversion changes the design problem. The questions move from how to back up grid power to how to size generation against the actual workload, how to use storage to bridge ramps and outages, how to integrate the grid as a secondary feed, and how to make the whole package permittable and operable on a schedule the AI build cycle can absorb.

WHAT CHANGES BEHIND THE METER	WHY IT MATTERS
Generation sized to workload, not headroom	On-site capacity matches the actual AI load profile, not an oversized buffer against grid uncertainty. Capex is allocated where it earns return.
Storage shifts from UPS to dispatchable asset	BESS bridges generation ramps, captures arbitrage, and provides ride-through. It earns revenue as well as protecting load.
Grid connection becomes optional and additive	The utility tie supports resilience, exports excess generation, or imports during maintenance windows. It does not gate the energization date.
Permitting becomes the new critical path	Behind-the-meter generation shifts schedule risk from utility queues to air permits, gas interconnects, and zoning. Different timelines, often shorter.

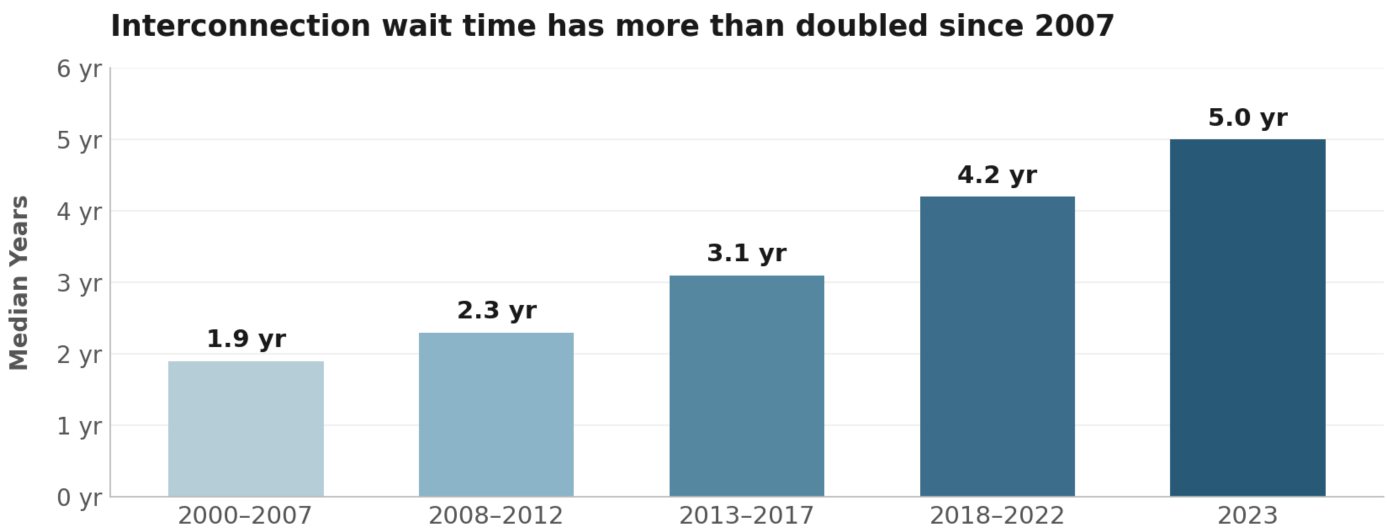
The behind-the-meter site is not a grid-fed facility with bigger generators. It is a **different operating model.** Generation runs continuously, storage is dispatched commercially, and the utility is a counterparty rather than a supplier.

THE QUEUE PROBLEM

Why the Grid Stopped Being First

Berkeley Lab's Queued Up 2024 report sets the numbers cleanly. More than 2,600 GW of generation and storage capacity sits in US interconnection queues, roughly twice the total installed capacity of the US power system.

The wait times tell the operational story. Projects that came online between 2000 and 2007 moved from interconnection request to commercial operation in under two years. The cohort built in 2018 to 2023 averaged just over four years. Projects built in 2023 had a median of five years. The trend is one direction.



Median time from interconnection request to commercial operation, US projects. Source: Lawrence Berkeley National Laboratory, Queued Up 2024.

CONSTRAINT	WHAT IT MEANS FOR AI DELIVERY
Queue saturation	The queue at 2,600 GW is larger than installed US capacity. New entrants face longer queues, not shorter ones.
Median five-year wait	Even a project that clears the queue cleanly is unlikely to energize on a typical AI deployment window without an alternative source.
Withdrawal risk	A majority of projects entering interconnection queues do not complete. Capacity counted on the supply side may never appear.
Cluster study delays	Network upgrade allocations and cluster studies extend timelines further when transmission constraints are discovered late.

THE BEHIND-THE-METER STACK

What Sits On the Site

A behind-the-meter facility is not one technology. It is a stack of generation, storage, and control assets sized against the load profile and the resilience target.

The composition varies with fuel availability, site permitting, water access, and the workload, but the categories repeat across most current builds.

GAS TURBINES	**Natural Gas Turbines** Aeroderivative or industrial frame units sized to base load. Fast ramp, modular installation, proven dispatch. ~75% of planned on-site capacity at US data centres.	PRIMARY GENERATION
RECIP ENGINES	**Reciprocating Gas Engines** Smaller modular blocks suited to medium loads and rapid start. Higher partial-load efficiency, easier permitting in some jurisdictions.	MODULAR GENERATION
FUEL CELLS	**Fuel Cells** Solid oxide or molten carbonate units providing low-emission, low-noise baseload. Longer commissioning, lower fuel flexibility.	LOW-EMISSION BASELOAD
BESS STORAGE	**Battery Storage** Lithium-iron-phosphate systems sized to bridge ramps, cover transients, and arbitrage when the grid tie is present. US BESS deployment hit 11.9 GW in 2024.	DISPATCHABLE ASSET
SOLAR PV	**Behind-the-Meter Solar** Co-located solar reduces gas burn during daylight hours and improves emissions profile. Capacity factor limits make it a complement rather than a primary source.	DAYLIGHT COMPLEMENT
GRID TIE	**Grid Connection (where present)** Becomes a secondary feed for resilience, frequency support, or eventual export. Sized for partial load, not full load.	SECONDARY FEED

The stack is built around the workload. An inference cluster with steady load looks different from a training cluster with sharp ramps. The design choice is the right combination, sized to the load and the schedule.

THE OPERATING MODEL

The Microgrid as the New Default

The shift to behind-the-meter primary generation pushes the operating model toward a microgrid. The site has its own generation, its own storage, and its own controls. The grid, when present, runs as one input among several rather than as the master clock.

The controls layer becomes the defining piece. Dispatch logic decides when to run gas, when to charge batteries, when to draw from the grid, when to export. Resilience logic decides how to ride through fuel interruptions, frequency excursions, or component failures. None of that exists on a grid-fed facility, where the utility carries all of it.

TRADITIONAL GRID-FED SITE	BEHIND-THE-METER MICROGRID
Grid is the source. Generators back it up.	Generators are the source. The grid backs them up or is absent.
Battery is sized for UPS ride-through.	Battery is sized for arbitrage, bridging, and resilience as a dispatchable asset.
Frequency and voltage are the utility's problem.	The microgrid carries its own frequency and voltage regulation.
Outage protocol: switch to generator, ride out the event.	Outage protocol: keep running on the existing stack, with the grid as one of several recovery paths.
Capacity expansion: request more from the utility.	Capacity expansion: add modular generation and storage on site.

The cost difference between a grid-fed site and a behind-the-meter site is no longer the deciding factor. The **scheduling difference** is. A microgrid energizes when its permits land and its equipment arrives. A grid-fed site energizes when the utility says it can.

PERMITTING AND SCHEDULE

The New Critical Path

Behind-the-meter generation does not remove schedule risk. It moves it. The interconnection queue gets replaced by air permits, gas interconnects, water rights, and local zoning.

These timelines vary by jurisdiction, but they are generally measured in months rather than years, and they run in parallel with construction rather than gating it. Gas turbine lead times remain the operational constraint for many builds. GE Vernova's published delivery profile for aeroderivative units now extends into 2028 and 2029 for new orders.

> OPERATOR BEHAVIOUR
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> The Crusoe orders of 29 LM2500XPRESS units across late 2024 and mid-2025 illustrate how operators are securing turbine slots well ahead of site selection. Equipment scheduling has become an early-stage discipline, not a procurement task.

NEW CRITICAL-PATH ITEM	WHY IT NOW SETS THE SCHEDULE
Air permit (Title V or minor source)	Determines emissions cap, allowable hours, and stack monitoring. Sets timeline for construction commencement in many states.
Gas interconnect agreement	Pipeline takeaway, pressure, and capacity allocation. Constrained in markets with limited pipeline expansion.
Turbine or engine slot	OEM delivery schedules now extend years out. Securing the slot is often the earliest commercial decision.
Water rights and cooling agreements	Combustion generation requires water for emissions control and, for some configurations, heat rejection. Drought-sensitive jurisdictions add risk.
Local zoning and noise	Behind-the-meter generation at scale changes the noise and visual profile of a site. Local opposition is a material schedule risk.

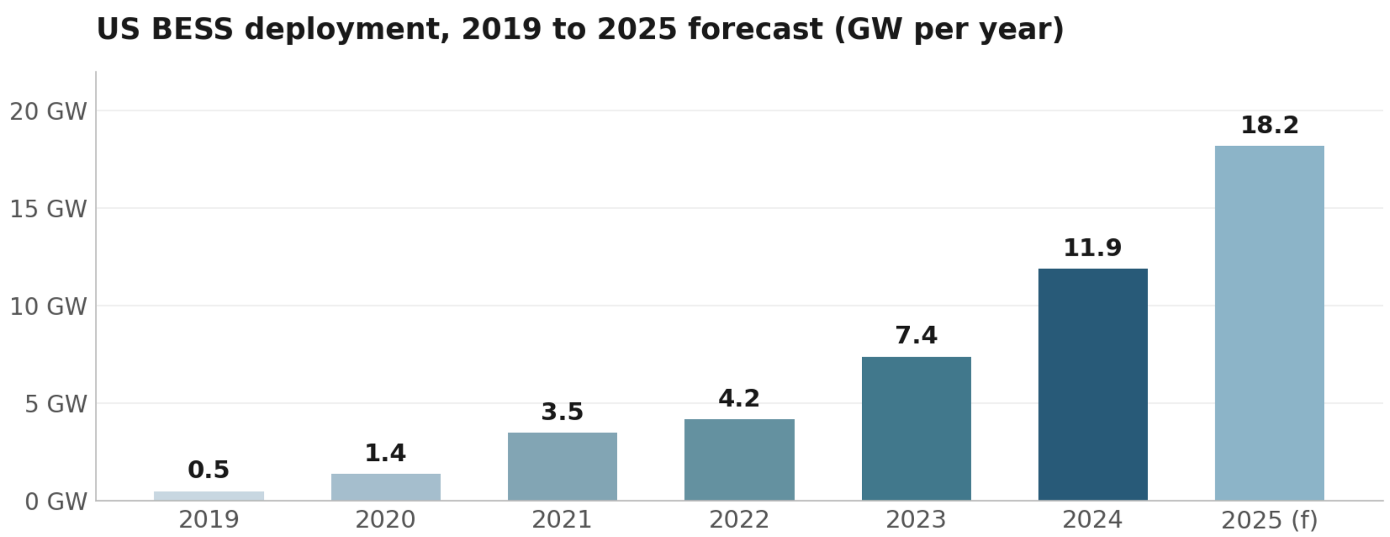
The schedule risk does not disappear with behind-the-meter generation. It **moves to a different desk.** The discipline shifts from utility coordination to permitting strategy, equipment allocation, and jurisdictional selection, all decided before site selection closes.

STORAGE AT SCALE

Battery Storage Becomes a Primary Asset

Battery storage is no longer the UPS layer. It is the dispatchable asset that bridges generation ramps, captures arbitrage, and underwrites the resilience target. US deployment volumes confirm the shift.

EIA's Short-Term Energy Outlook shows BESS deployment moving from a niche line item to a structural one. The volumes deployed in 2024 and forecast for 2025 are large enough that storage cost curves and supply chains are now an operating-model input, not a procurement footnote.



US battery energy storage system (BESS) deployment, GW added per year. Source: US Energy Information Administration, Short-Term Energy Outlook 2025, and Energy Storage News.

WHY IT MATTERS

A behind-the-meter project that sizes storage only for UPS ride-through leaves revenue on the table and forces oversizing on generation. Storage that is dispatched commercially shrinks the generation envelope and improves the project's net energy cost.

HOW DARKNX APPLIES IT

Generation, Storage, and Controls as One Programme

DARKNX treats behind-the-meter as an architecture, not a procurement line. Generation, storage, controls, and the grid tie are designed together against the actual workload and resilience target. The objective is an energization path that does not depend on a utility timeline.

That requires resolving the early-stage decisions before site selection closes. Gas takeaway, permitting jurisdiction, fuel logistics, water availability, and turbine or engine slot allocation all sit upstream of the typical procurement schedule. Pulling them forward is how a behind-the-meter project actually lands on its target date.

CAPABILITY	APPLICATION AND SCHEDULE RELEVANCE
Site selection screened for fuel and permitting	Gas takeaway, water access, air permit class, and zoning assessed alongside grid availability. The behind-the-meter path is sized before the lease is signed.
Generation sized to workload	Turbine, engine, and fuel cell configurations matched to the actual AI load profile. Sizing reflects the workload, not a static peak.
Storage as a dispatchable asset	BESS is engineered for arbitrage, bridging, and resilience. The role extends beyond UPS ride-through.
Controls layer designed early	Dispatch logic, frequency regulation, and grid-interaction protocols are part of the initial design, not added at commissioning.
Equipment slots secured ahead of schedule	Turbine and BESS allocations are committed before site selection closes. Lead time risk is taken out of the critical path.
Grid tie planned as secondary	The utility connection is designed for resilience, export, or partial draw. It does not gate the energization date.

PROGRAMME DISCIPLINE

The capabilities above operate as a single sequenced programme rather than parallel workstreams. Site, fuel, permit, equipment, and controls decisions are linked, and the order they are taken in is what determines whether the energization date holds.

The behind-the-meter advantage is not the technology. It is the **schedule.** A project that energizes on its target date earns revenue. A project that waits five years for an interconnection does not, regardless of how clean its eventual power mix is.

CONCLUSION

Behind the Meter Is the New Default

The grid has not failed. It is still the largest, cheapest, and most resilient power source on the continent. What has changed is the timeline it operates on. Five-year interconnection waits, two thousand gigawatts of queue, and transmission constraints that take eight years to resolve do not fit the AI build cycle, and they do not fit the financing model behind it either.

Behind-the-meter generation, paired with storage and a real microgrid controls layer, is the practical answer. It does not displace the grid permanently. It buys the schedule. The projects energizing now are doing so because they designed for the queue they could not change.

WHAT WE DO

Site selection, behind-the-meter generation design, BESS integration, and microgrid controls as one programme.

WHERE WE WORK

Hyperscale and high-density data centre power delivery across North America, with offices in Seattle and Toronto.

HOW WE ENGAGE

Early-stage involvement before site selection closes. Equipment slot allocation, permitting strategy, controls architecture.

ABOUT THE PUBLISHER

DARKNX develops and delivers high-density data centre infrastructure for AI, HPC, and enterprise environments. We design and build the complete power delivery chain, including utility coordination, behind-the-meter generation, storage, and the microgrid controls that tie them together. Our objective is an energization path that lands on schedule whether or not the grid is ready.

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