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Horizons

Breaking the speed limit:

Can US data centre development outpace grid development?

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INTRODUCTION

The US power sector is under tremendous strain. The revenue opportunities of artificial intelligence (AI) and the national security risk of losing the AI race to China call for massive data centre load growth. Persistent challenges, however, from permitting delays to federal policy uncertainty, are preventing infrastructure development from keeping pace.

Data centre companies have tough choices to make. They can move in tandem with grid development and wait up to 10 years for a massive generation and transmission build-out to be completed on the requisite scale. Or they can go down a riskier route: pay a premium to power data centres with microgrids of unprecedented scale and complexity, or accept conditional grid connections and risk supply interruption and violation of service-level agreements – a chance that increases as more companies choose that alternative.

Grid operators are racing to cover all bases. They are planning regional transmission build-outs to support massive load growth by the mid-2030s, while also developing novel interconnection models that rely on customer interruption and onsite power to achieve speed-to-power.

With more than 90 GW of collocated generation in US interconnection pipelines, it is clear that the need to scale up at speed has sent many data centre developers down the riskier path. Collocating volatile AI workloads with power generation has scarce precedent, though, and is far more difficult than most in the industry understand.

Engineers have expressed frustration at developers who think in terms of generator megawatts and lack a basic understanding of the technical challenges involved. Late-stage rule changes by grid operators, meanwhile, add significant regulatory risk to already precarious operating models. Some changes undermine the value of collocated resources, while others may require a redesign or the procurement of new equipment for late-stage projects.

The challenges facing collocation are surmountable for the most experienced and deep-pocketed developers. For all developers, leaping in at gigawatt scale while regulatory rules are still being written not only risks billion-dollar failures, but also US leadership in the AI race. Furthermore, the enabling market interventions and infrastructure planning could have unintended implications for asset valuations and grid efficiency.

Grid power is coming...for those willing to wait

The US has under-invested in high-voltage transmission infrastructure over the last decade. It has built on average 560 miles per year since 2020, compared with more than 1,300 miles per year during the 2010s. Now, faced with massive load growth and long queues of generation looking to connect, grid operators across the US are having to plan significant regional transmission once again.

In February, PJM, the Mid-Atlantic grid operator, approved a US$11.8 billion investment in its transmission 'superhighway', one of the largest expansions in the market's history. MISO, a grid operator in the Midwest, is planning a transformative long-range transmission investment that could total over US$20 billion, on top of an in-progress investment of US$10 billion. ERCOT, the Texas grid operator, plans to invest US$33 billion in its transmission superhighway, while SPP in the Great Plains states will be investing US$8.6 billion.

These plans are partly driven by data centre load growth and partly by the need to connect far-flung renewable resources with new load centres. ERCOT and SPP also aim to support gigawatts of oil and gas facility electrification in the Permian Basin of Texas and New Mexico.

Each completed project will enable more generation to come online – and with it additional or expanded connections for data centres. Grid operators and data centre companies concur on this long-term plan for how data centres will be powered: through firm service from the grid.

Some transmission projects are already in development – Texas, for instance, aims to be up and running by 2030-31 – but projects will generally take 5-10 years to complete, absent meaningful structural reform, including permitting. It is the intervening period that is in question for AI data centre developers.

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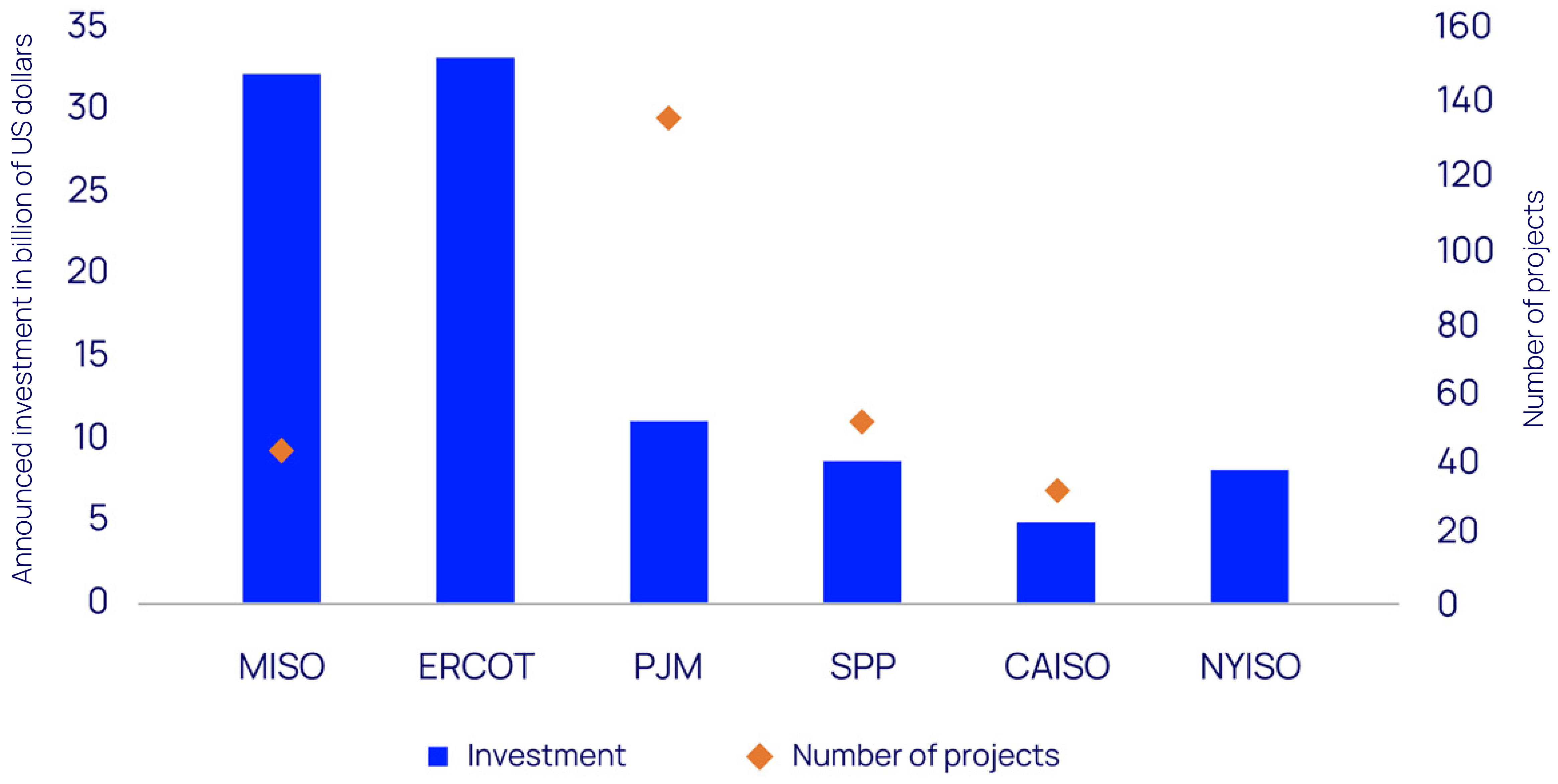
Figure 1: Planned regional transmission investment and number of projects announced since 2022



Note: All investment apart from one MISO tranche originates in or after 2024.
Source: Wood Mackenzie Lens Power & Renewables Americas

The deregulated market model faces its greatest test

While transmission is foundational for load growth, dispatchable generation is also needed. With over 94 gigawatts of coal plant set to retire over the next decade, data centre growth will depend heavily on natural gas.

Wood Mackenzie's accelerated case for large load growth, which results in data centre power demand growing 21% annually through 2035, projects 16.4 gigawatts (GW) per year of gas additions from 2026-35. Even our moderated case, which sees data centre demand growing 13% annually, estimates 13.2 GW per year. This compares with additions of just 4 GW per year from 2023 to 2025.

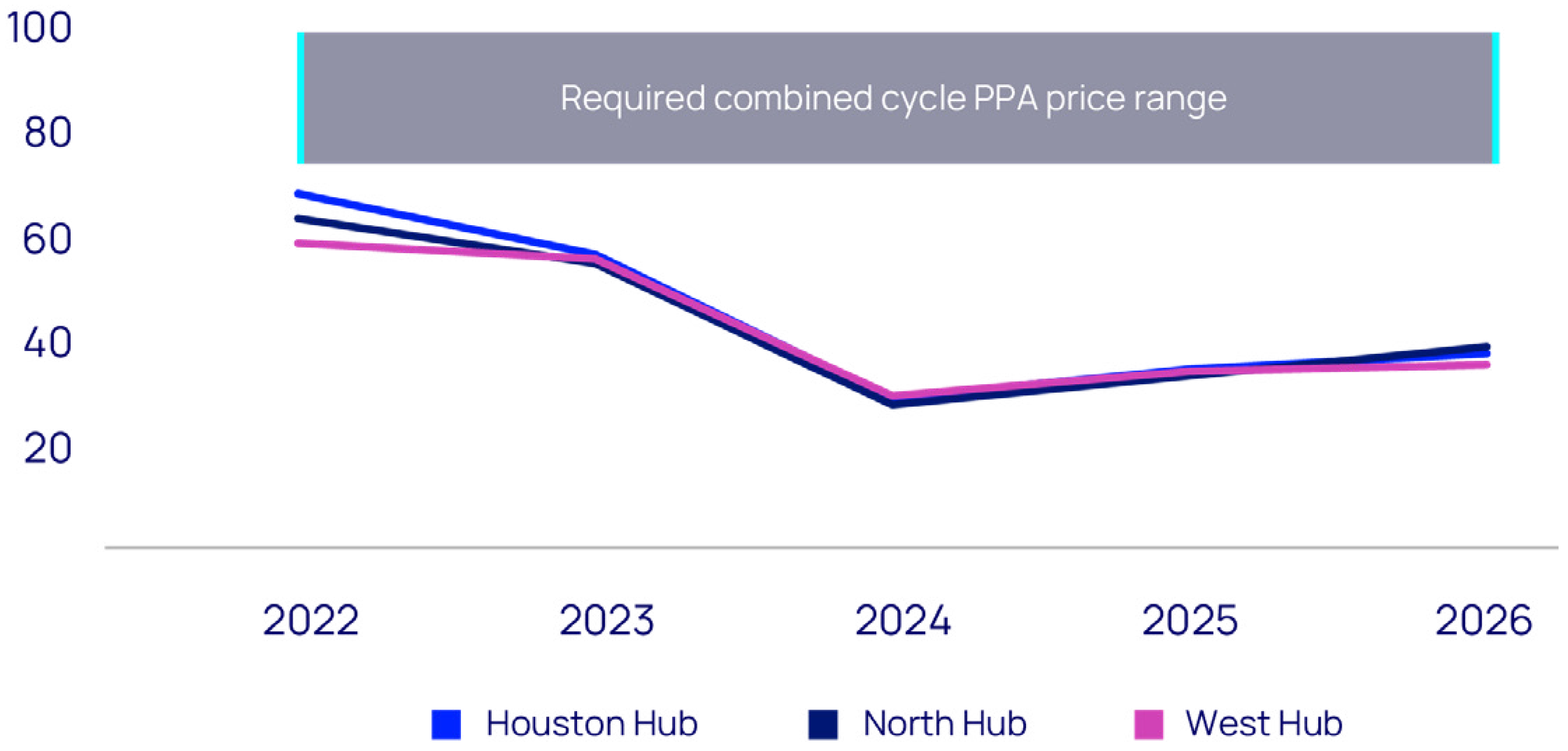
Under all of Wood Mackenzie's load-growth scenarios, the cost of building and operating gas plants will remain historically high.

This presents an enormous challenge in the deregulated markets of PJM and ERCOT, in which utilities are not responsible for providing generation and developers must build power plants purely on an economic basis.

However, market prices in Texas have been in the US$30-40/MWh range, while gas generation developers will require prices ranging from US$78 to US$100/MWh.

With over 94 gigawatts of coal plant set to retire over the next decade, data centre growth will depend heavily on natural gas

Figure 2: ERCOT average annual energy prices vs gas combined cycle economics



Note: Price floor assumes Henry Hub gas prices averaging US$4 per mmBtu and capacity factors for a combined-cycle plant ranging from 50% to 70%.
Source: Wood Mackenzie Lens

The situation in PJM is similar, even with a capacity market in that region that provides additional revenue. PJM has an enormous deficit to overcome: 78 GW of large load commitments made by utilities, compared with a generation pipeline of only 36 GW of accredited capacity as of April 2026.

Load growth and affordability are in direct opposition in these markets: if prices rise to the level necessary to incentivise new generation, it will raise prices for all customers, igniting a political outcry.

PJM has chosen to sidestep this conundrum by bifurcating its generation market. To receive firm transmission service, new large loads will need to sign multi-year contracts with new supply resources, absorbing the cost of new generation. Existing supply resources are ineligible to participate in the new market and will face far lower market prices, which will not reflect data centre demand. The highest-cost existing facilities, including some natural gas and coal plants, may even retire, threatening grid reliability.

Texas has no similar plan in place to incentivise the development of new power plants other than trusting that competitive power markets will deliver new generation.

The Texas Energy Fund provides low-cost financing for dispatchable generation, but has proven insufficient to overcome the poor gas-generation economics in the state. Texas arguably disincentivises new grid-connected generation because, unlike PJM, it does not grant reprieve from interruption in return for contracting with generation.

The uncertainty in gas generation development poses a risk to the state's first large-load cluster study planned for this year. The study, which will analyse all data centre proposals together, will make assumptions about the development of generation in locations where it is most needed – assumptions that may not bear out for the aforementioned reasons.

The consequence could be project online dates and operating limits that ultimately differ from those promised after the cluster study.

Uncertainty in gas generation development poses a risk to the state's first large-load cluster study

Interruption and collocated generation are the bridge, but a creaky one

With transmission development in all regions moving slower than AI data centre ambitions, grid operators have worked to find near-term paths to scale.

Their common strategy comprises two elements:

1 Allow more load to connect than the grid can firmly serve, under terms that it can be interrupted by the operator when the grid is stressed.

2 Allow large-load customers to deploy their own generation near their facility, supporting larger loads than the grid can currently support and providing backup during interruptions.

Texas Senate Bill 6, passed in June 2025, declares data centres to be 'non-critical' loads, subject to interruption before nearly all other customers during shortage periods.

Data centre customers can install collocated generation, enabling them to continue operating even when instructed to disconnect from the grid. This bring-your-own-generation (BYOG) model will also allow data centres to exceed the capacity they will be allotted following the upcoming cluster study.

ERCOT's requirement that this additional load adjust every five minutes to a market signal, however, will make this difficult to achieve. In the absence of adequate price signals or state programmes to support gas generation, BYOG is the most plausible path for gas generation to be built, as it provides protection against interruption.

PJM has not been as strict as Texas in deeming all data centres non-critical. Customers who procure long-term capacity through an upcoming bilateral and centralised contracting process will secure firm service for that capacity, similar to residential customers.

Those who invest in collocated generation will, as in Texas, be able to scale up beyond this firm service level.

Similar to PJM, SPP and MISO do not label all data centres as non-critical loads. Instead, they will offer optional pathways to quickly connect large loads and collocated generation, provided they are mutually dependent. In other words, while the large load can draw from the grid under most conditions, the grid operator has considerable leeway to interrupt it and the generator may *never* sell power to others on the grid.

Ongoing rule changes heighten regulatory risk

With few exceptions, data centre operators are unlikely to accept interruptions outside of emergencies. Their businesses rely on service-level agreements that often guarantee less than an hour of downtime per year. And while nearly all data centres install backup diesel generators for contingencies, should restrictions occur with any frequency, the facilities could run up against air permit-imposed diesel runtime limits.

There are important systemic risks, too:

- Interruptions are likely to be imposed on many data centres at once in the case of a regional weather event.
- Securing diesel resupply could be difficult during a multi-day event, not only in terms of the fuel itself, but the trucks to transport it.
- More data centre firms availing themselves of conditional interconnections without collocated generation will drive the system closer to shortages in the first place, increasing the frequency of interruption.

The need to protect against downtime exposes data centre companies to significant regulatory risk. Grid operators are fast-tracking the development of rules for conditional interconnections to meet requirements, but their ultimate priority is grid reliability.

A number of recent grid operator decisions risk undercutting data centre companies, demonstrating the risks of acting in haste. As key stakeholders understand it, PJM's and SPP's rules give the regional grid priority rights over collocated generation. During shortages, data centres would be forced to reduce demand to their firm service level, even as their onsite generation was instructed to supply the grid.

This effectively makes the model unworkable, according to one large data centre company. SPP says facilities could invest in additional backup generation, but few data centre developers would invest in baseload generation if it could not be utilised when it was most needed. PJM's and SPP's rules ultimately may not stand.

ERCOT, meanwhile, has been working with stakeholders to update its voltage and frequency ride-through requirements in the lead-up to its cluster study. These would prevent data centres from reverting to backup power prematurely to prevent cascading losses of load that could bring down the grid. Such an event almost occurred in Virginia in 2024 after 60 data centres dropped off the grid simultaneously following a non-threatening disturbance.

Data centres in late-stage development are unlikely to be able to comply with the proposed changes, however, potentially requiring a site redesign and the purchase of new uninterruptible power supplies and other electrical equipment.

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Collocation means **technical risk and site-specific mitigation**

Even for developers that see collocation as a viable bridging solution to grid power, the costs and technical challenges are formidable:

- The near-instantaneous changes in AI power demand can damage reciprocating engines and gas turbines.
- Lithium-ion batteries can be used as a shock-absorber to prevent this, but risk burning through their useful lifespan rapidly.
- The battery response time must be extremely short, relying on technology that has not been widely commercialised.
- The irregular manner in which AI cooling and general processing unit (GPU) loads consume power introduces power harmonics, which if unfiltered cause equipment to overheat.
- These loads can also cause sub-synchronous oscillations, which pose fundamental stability risk to not only local generators but also to distant ones on the transmission system.

Technology providers are only beginning to come to terms with this challenge, the mitigation of which is site specific, making solutions hard to scale.

While hyperscalers are likely to successfully operationalise some projects with collocated resources, it will come at considerable cost.

Generation, storage and gas pipeline redundancy will all be required to match standard grid reliability. This cost, along with the technical risk and project-specific mitigation required, will prevent collocation from emerging as a scalable model.

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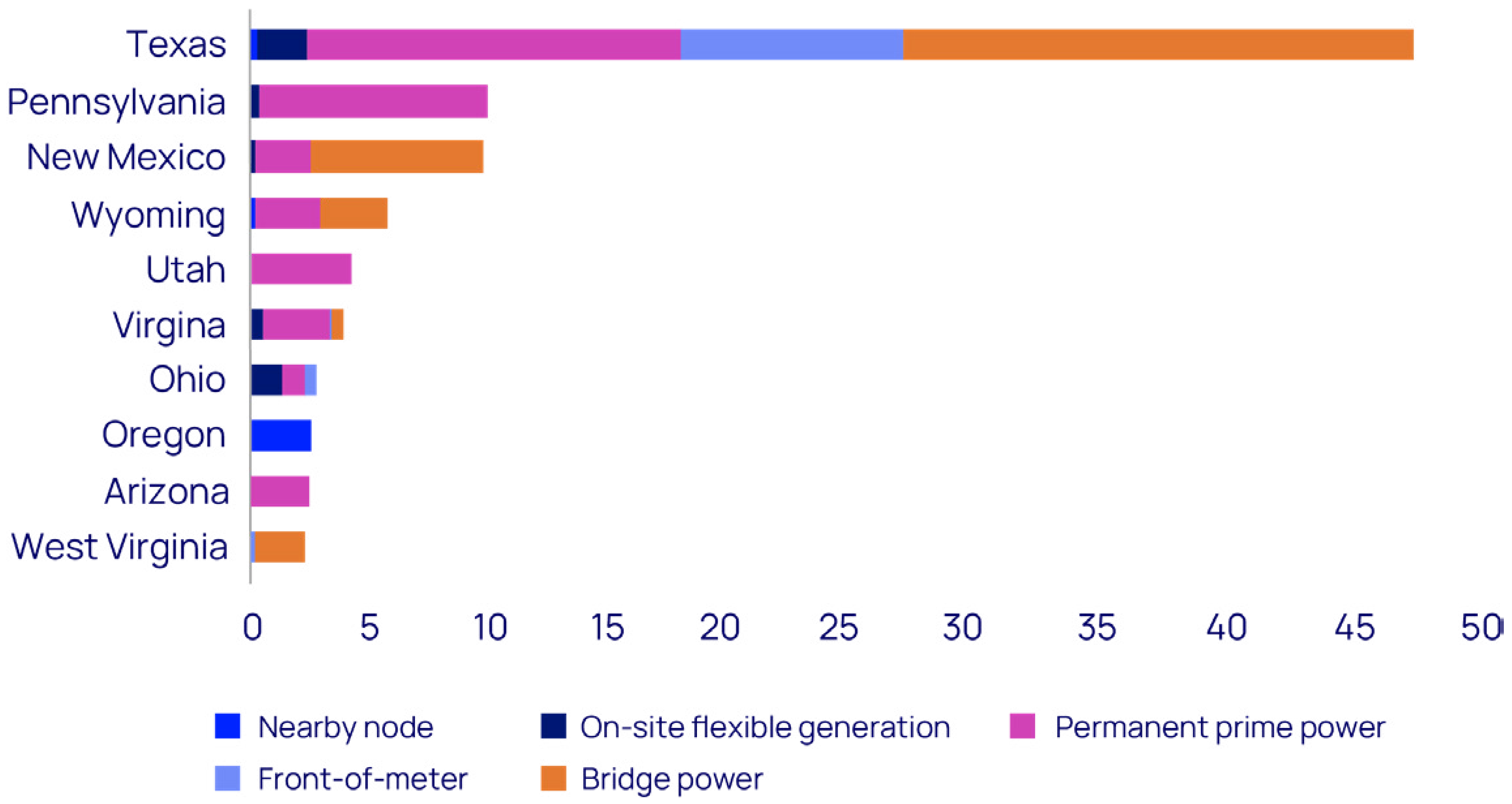
Figure 3: Large load-collocated generation capacity pipeline by use case since 2024 (GW)



Source: Wood Mackenzie Lens Power & Renewables Americas

Implications for **developers and investors**

Power-plant developers' routes to market are changing

PJM has created a clear route for bilateral contracting, giving developers a path to securing long-term contracts. Because of the auctions' focus on procuring accredited capacity, gas-fired generation has an advantage over renewables.

In Texas, in contrast, where the economics of gas generation will demote it largely to collocation setups and transmission build-out will reduce renewable curtailment, renewable developers have the opportunity to edge out gas. Renewables, being cheaper and faster to deploy, can beat gas to market, relegating it to peaking capacity and powering collocated data centres.

Renewable developers can also add to a compelling affordability story: every MWh served by zero-marginal-cost renewables reduces energy prices compared with the inflationary effect of gas prices, which are likely to rise with increasing gas burns and liquefied natural gas (LNG) exports.

Further regulatory intervention in deregulated markets will shape asset valuations

Developers and investors should expect further intervention in deregulated markets, driven by customer affordability. PJM has already shown how intervention can play out – creating one price for new assets and a lower price for existing assets. Upward pressure on power prices in ERCOT is likely to attract more political attention, potentially driving changes in market rules.

Is flexibility a waypoint or the destination?

Despite the power sector's growing fixation with data centre flexibility, grid operators are positioning conditional interconnections as a stopgap rather than the long-term plan. Their models expect and often require transmission to be developed on the understanding that they will eventually provide complete, firm service for large loads.

This aligns with data centre companies' discomfort with non-firm service and the prospect of relying on collocated generation. It has profound implications for affordability, however, as the regional network upgrades necessary to support local large-load connections will be spread among all ratepayers.

This may trigger a political outcry, however, and discussion of changing these long-standing cost allocation methodologies. Regardless, this outcome is a far cry from the lean, flexible and even decentralised grid models for which some companies have advocated, prioritising data centre reliability over minimising overall system cost.

Still, data centre companies capable of operating reliably without firm grid service will be able to scale their AI business faster than others, positioning them to outcompete.

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