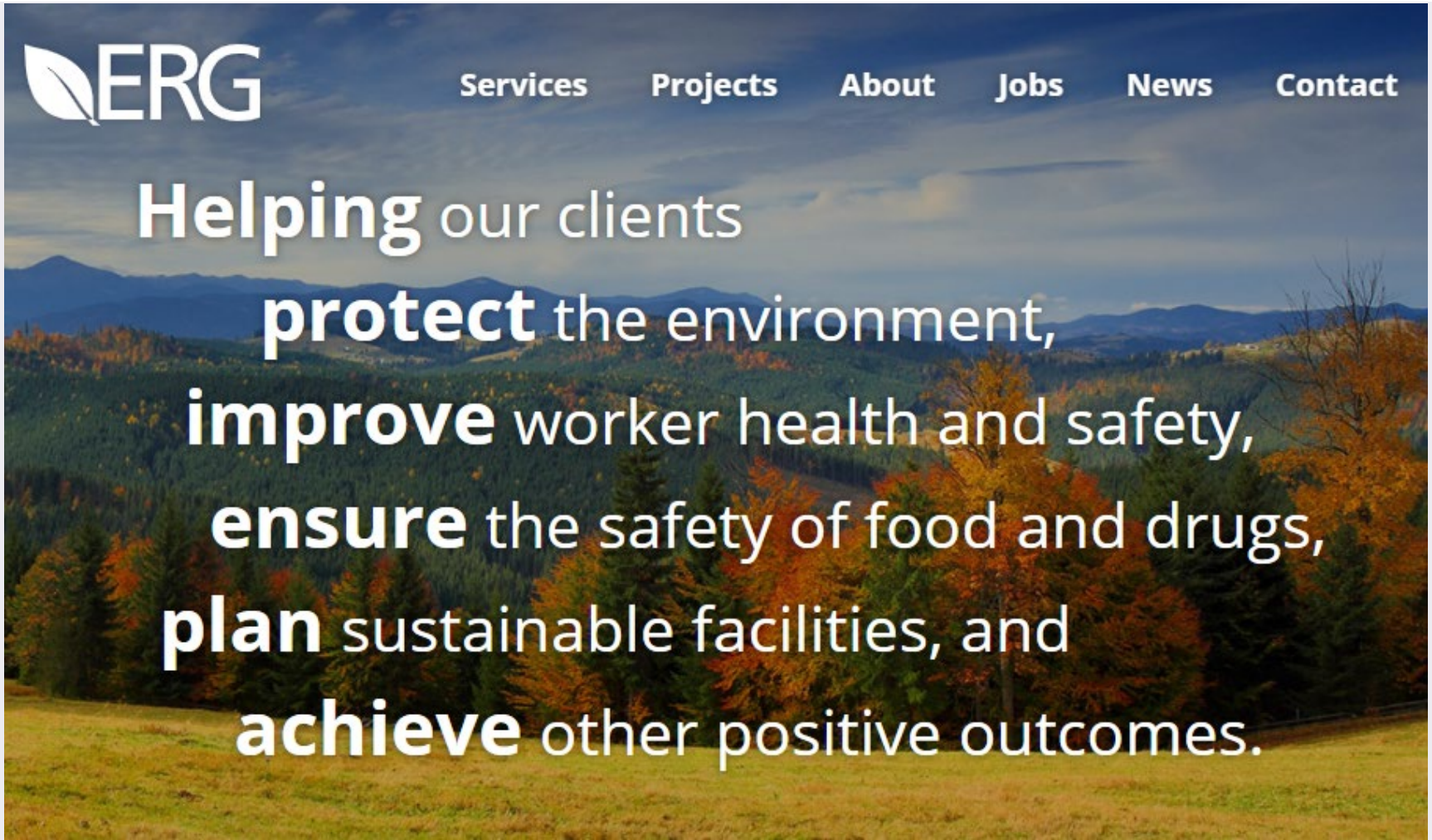
Development at the Speed of Data: Data Centers and Air Permitting, Past and Present

07 April 2026

Zachary Good, Senior Chemical Engineer


ERG
Services
Projects
About
Jobs
News
Contact
Helping our clients
protect the environment,
improve worker health and safety,
ensure the safety of food and drugs,
plan sustainable facilities, and
achieve other positive outcomes.

Time Warp: 2023 Data Center Market Wrap-Up

Historical cloud capex trends

Cloud capex for top hyperscalers has grown at an average of 30% CAGR over the last five years

HYPERSCALER 5-YEAR CLOUD CAPEX ($ BILLIONS)

	2017	2018	2019	2020	2021	2022	Avg. CAGR 3 Yr Growth	Avg. CAGR 5 Yr Growth
Amazon	11	13	17	40	61	64	56%	41%
Google	13	23	24	22	25	32	10%	19%
Meta	7	14	15	15	19	31	28%	36%
Microsoft	9	14	13	18	23	25	22%	23%
Oracle	2	2	3	2	3	6	30%	24%
Total	**42**	**66**	**72**	**97**	**131**	**158**	**30%**	**30%**

Source: Bank of America Global Research

For the Northern Virginia Market:

"[Power and space] Availability is limited and increasing local opposition to new data center development has posed additional challenges, which have slowed the process of bringing new centers online."

AI's impact on the data center industry is still in very early innings. On a macro scale, data center demand in the U.S. is expected to reach 35 GW by 2030, up from 17 GW in 2022.

Northern Virginia

Over 90% of Virginia data centers are in Loudoun County, Prince William County and Fairfax County. Strong demand and supply constraints in Q1 caused vacancy in Northern Virginia to remain near a record low of 1.8%. Electricity rates in Northern Virginia remain steady, despite power availability headwinds. Information provided by Dominion Energy reveals that power availability issues are reflective of transmission and distribution issues, not power generation. There is significant new development despite power challenges, and hyperscaler demand has enticed new operators.

This region significantly benefits from nuclear power. Approximately 34% of the power supply for electricity is sourced via nuclear plants. If significant resources are invested into nuclear energy, this may contribute to easing future power availability issues in five to 10 years.

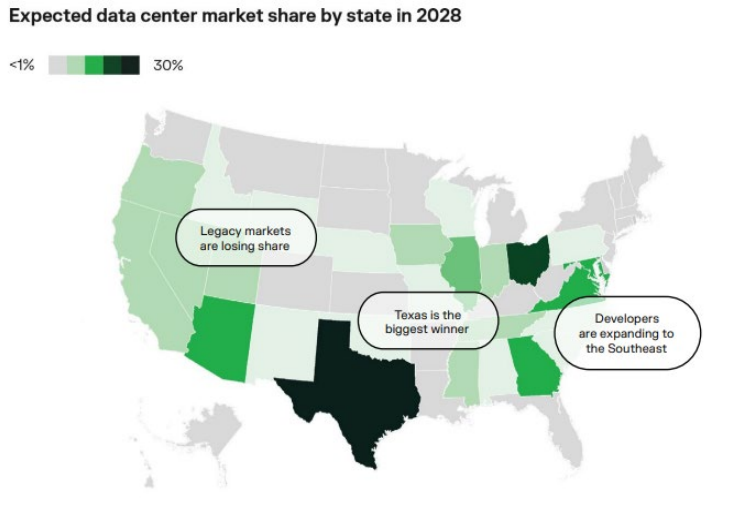
Opportunities

There is more power capacity availability outside Northern Virginia, such as in Central Virginia. Developers and operators have the opportunity to increase development along I-95 to Fredericksburg and Richmond. Maryland and other adjacent Virginia counties could see an uptick in development too.

Challenges

Power supply concerns raise questions about future development, but the bottleneck should ease by 2025 or 2026.

Fast Forward Three Years …



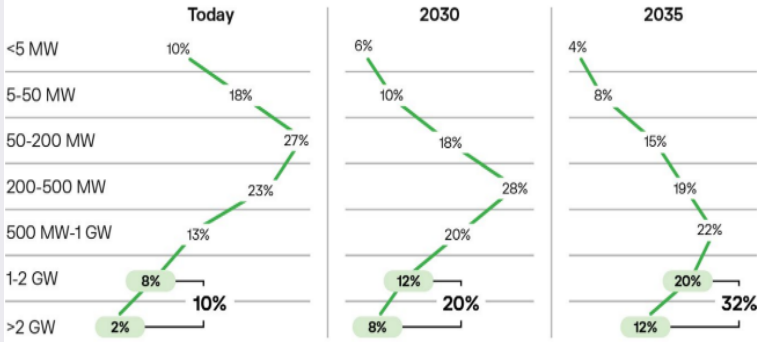
Per Data Center Dynamics:
"Regulatory risk and power limitations continue to constrain development: Local opposition to new data centers has increased in some markets amid mounting public concerns about their power and water consumption. By contrast, regions with supportive laws are likely to continue to experience new development, while some are making changes to their regulatory frameworks to encourage new data center development for AI."

"We're seeing a geographic shift as certain regions become more power-friendly and therefore more attractive for data center construction. While conditions still vary widely, more areas are beginning to recognize the opportunity and are working with operators to make development easier."

VP of Energy at hyperscaler

Developers expect almost one third of data center sites to exceed 1 GW in scale by 2035[9]

Distribution of data center sizes expected to be a part of developers' portfolios



Source: Bloom Energy Data Center Survey (Nov. 2025)

Key Themes for 2026

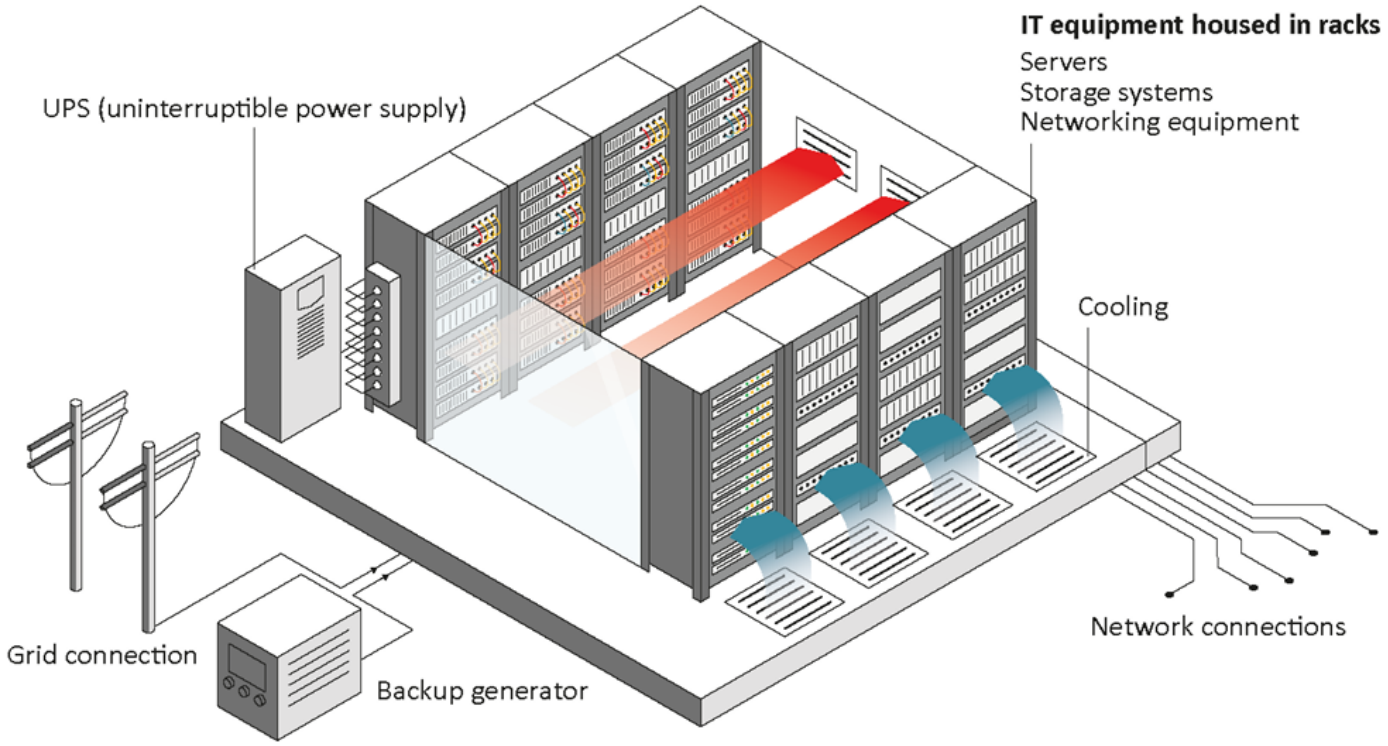
- Power scarcity will remain the defining constraint, making deliverable capacity the primary driver of site selection, valuation, and absorption
- Alternative energy partnerships will expand, with natural gas solutions advancing more quickly than nuclear and SMR deployments
- AI-driven build cycles may create localized overheating, increasing the risk of valuation recalibration where speculative pipelines exceed confirmed demand
- Private credit will continue to institutionalize as a core financing mechanism for digital infrastructure
- Exit strategies will continue shifting toward portfolio- and platform-level transactions, rather than single-asset dispositions

What is a data center?

Physical facility that houses and runs large computer systems

- **Enterprise data centers** – owned and operated by businesses for private data storage and computing
- **Colocation or "managed" data centers and services providers** – rental facilities (e.g., "data hotels") to individual businesses
- **Hyperscale data centers** – Warehouse-sized facilities that store advanced services capable of handling massive processing workloads
  - At least 5,000 computer servers and at least 10,000 sq ft of physical space with an electric power rating (power draw) exceeding 100 MW

What is a data center?

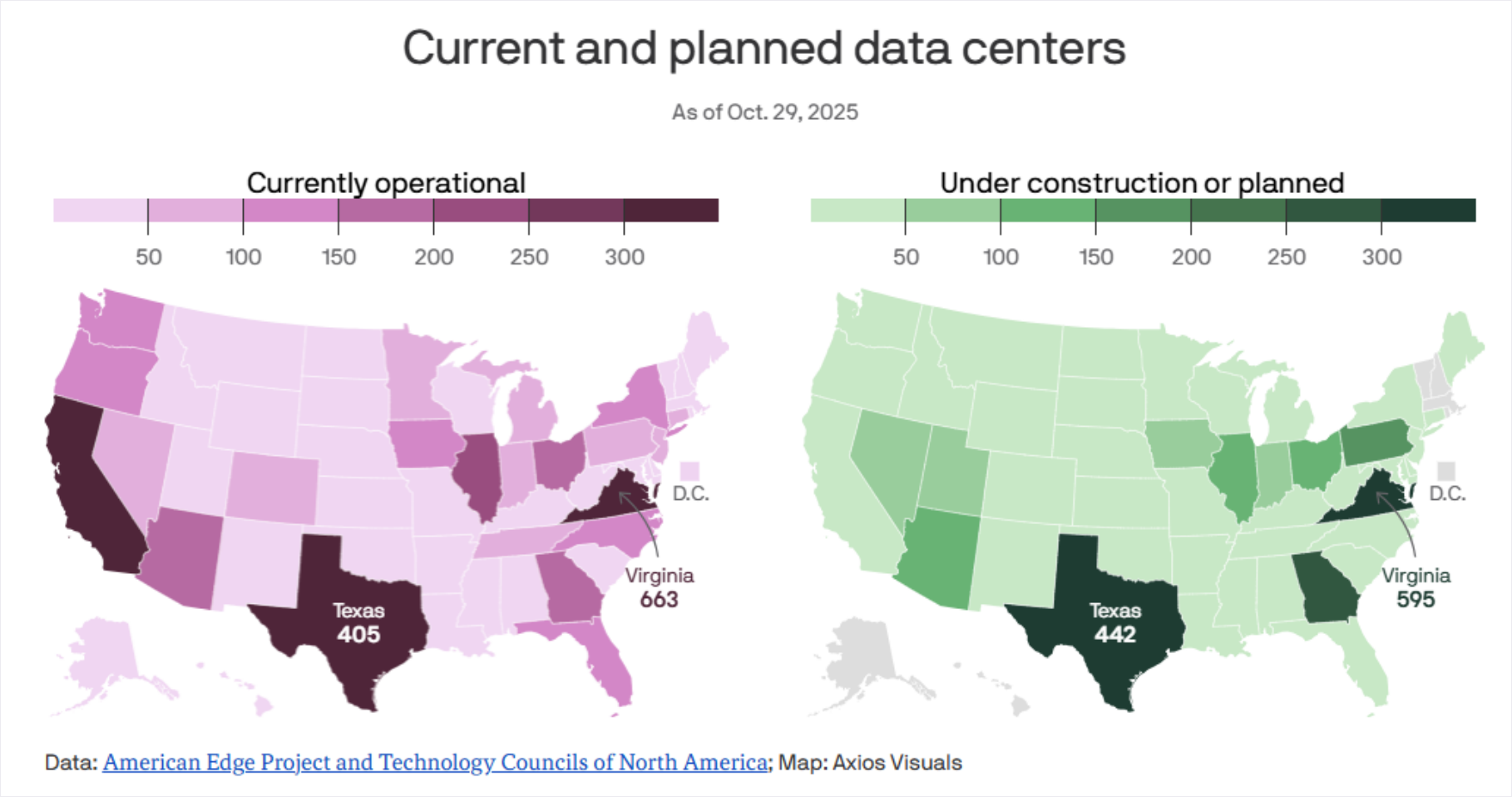


Effective design and integration of key data centre components ensure continuous operation and optimal performance

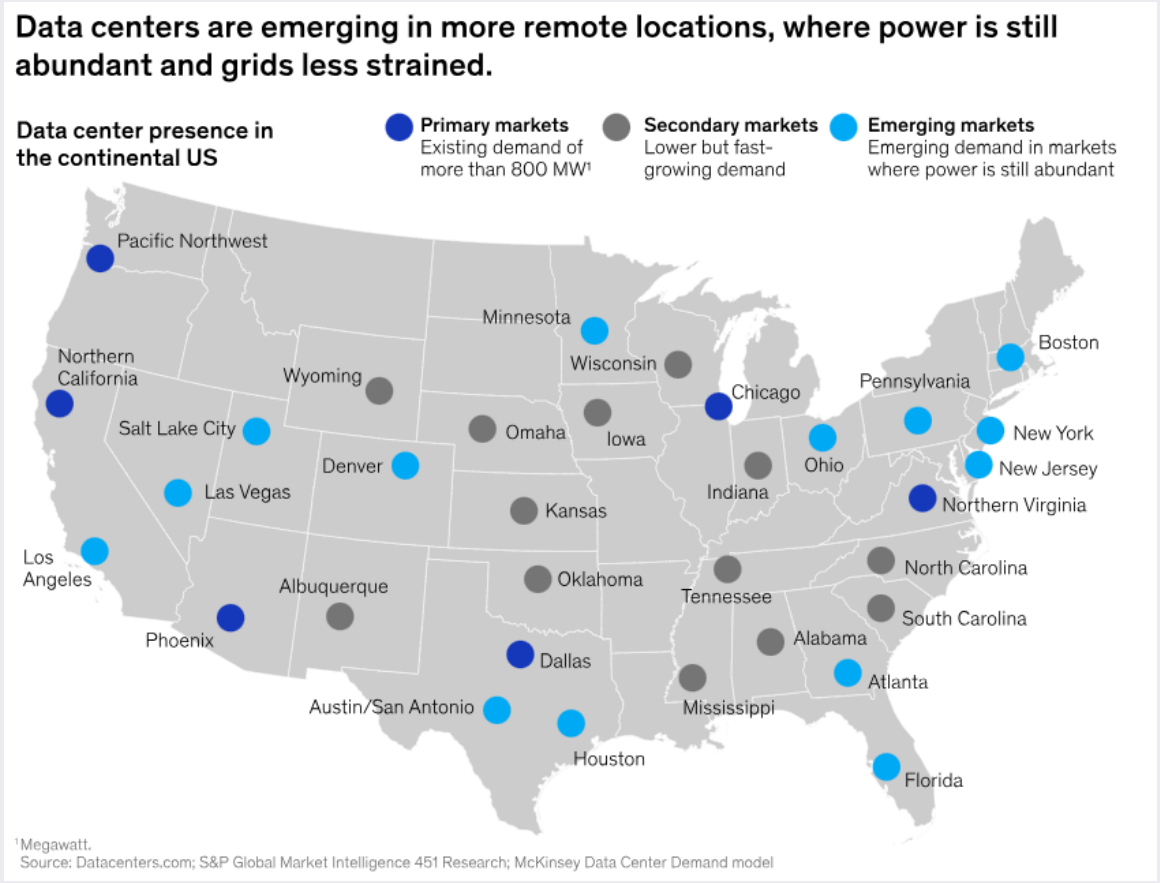
International Energy Agency, "Energy and AI," April 10, 2025, Figure 2.1

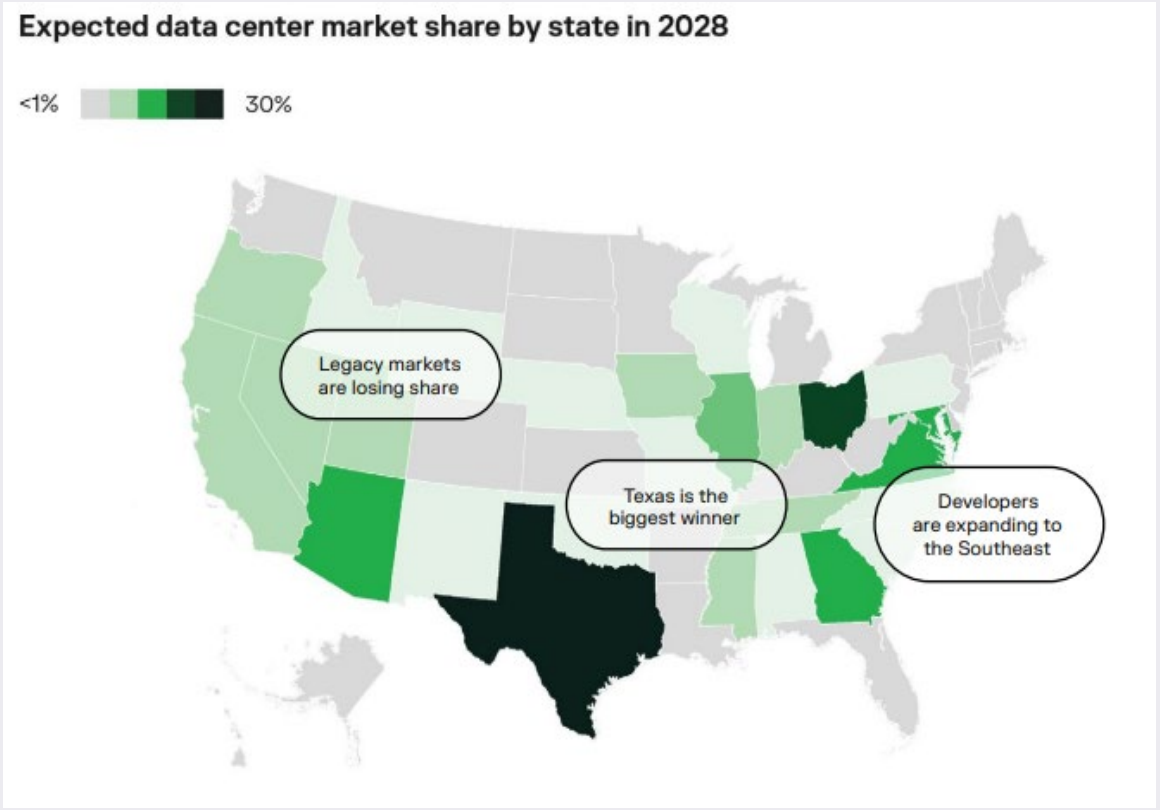
https://www.iea.org/reports/energy-and-ai

Where are Data Centers?

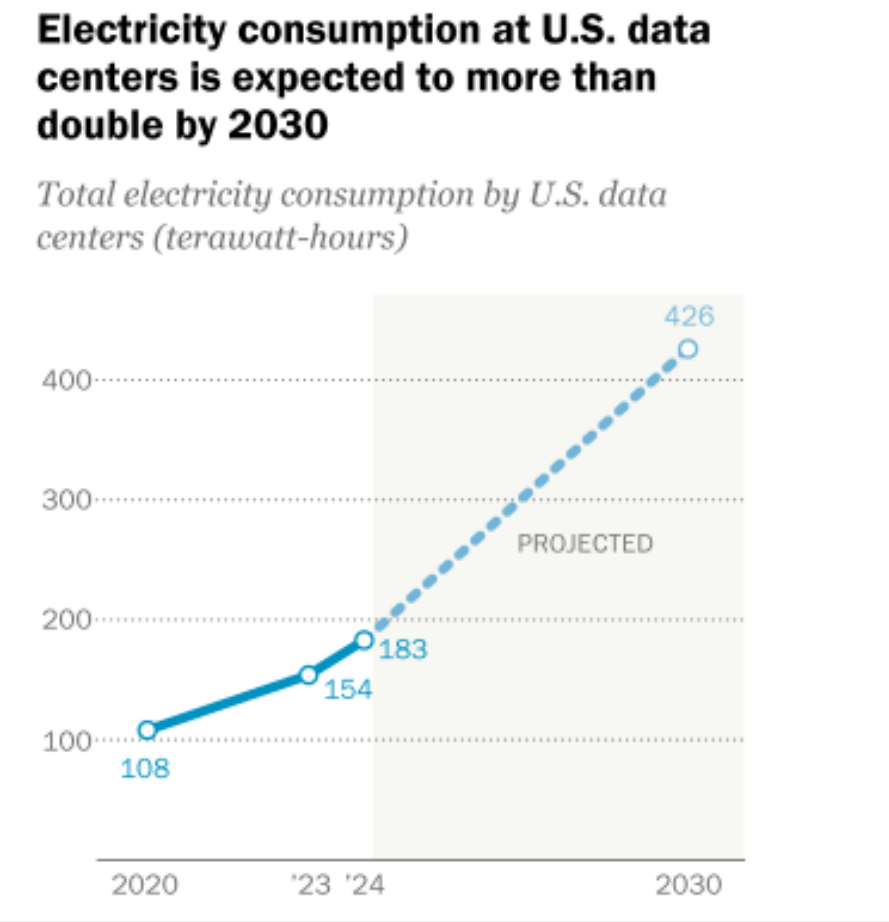


Where are Data Centers Going?





How Much Power do Data Centers Use?



Note: 2030 projection is based on IEA's "base case" scenario, which assumes current industry forecasts and regulatory conditions persist.
Source: International Energy Agency, "Energy and AI," April 2025.

PEW RESEARCH CENTER

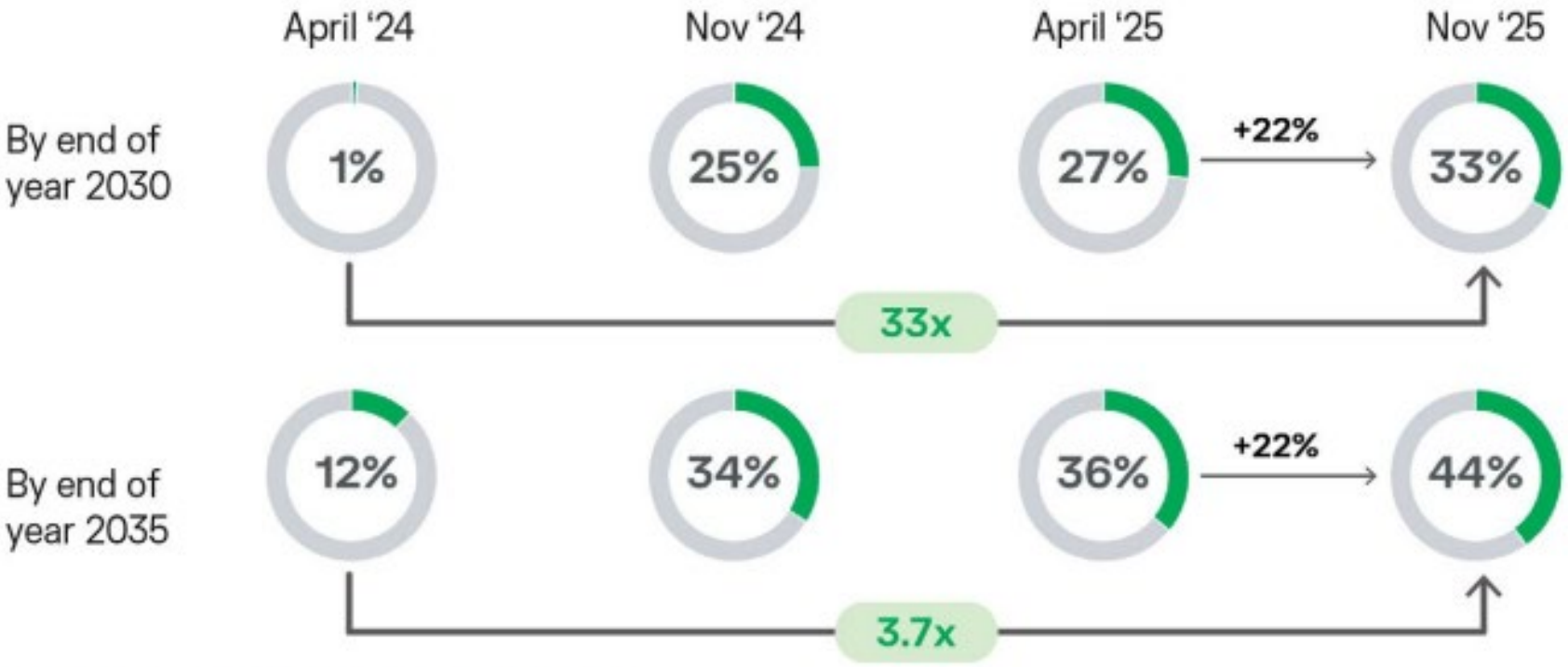
Pew Research Center, "What we know about energy use at U.S. data centers amid the AI boom," October 24, 2025

https://www.pewresearch.org/short-reads/2025/10/24/what-we-know-about-energy-use-at-us-data-centers-amid-the-ai-boom/

On-Site vs. Grid Power

Developers' expectations of onsite power deployment continue to grow, signaling a need for fast, predictable time to power[12]

Expected share of data centers with 100% onsite generation



Source: Bloom Energy Data Center Survey (Nov. 2025)

Energy Consumption & Data Centers

Primary electrical generation capacity, whether from the grid or from on-site generation assets, has started to be and will continue to be a key consideration for data center owner/operators for short- & long-term development

Example – Traditional Data Center Layout

Example – “New” Data Center Layout

The xAI datacenter in Memphis.
Photograph: Steve Jones/Flight by Southwings for Southern Environmental Law Center

Air Permitting Implications – Old vs. New Configurations

Historical Data Center Operating Configuration, Air Permitting Considerations

Typical emissions source types:

- Diesel-fired emergency generator engines (varied ratings)
- Diesel belly tanks (varied sizes)
- Cooling towers (common but not ubiquitous)

Historically, Data Centers have not typically triggered major source air permitting requirements

- Most pre-construction permitting is done at the state level, but some do exceed federal (e.g., Title V) air permitting thresholds
- State regulatory agencies have begun employing new restrictions to ensure data centers will not adversely impact baseline ambient air quality

Emerging Data Center Operating Configurations, Air Permitting Considerations

Typical emissions source types:

- **On-Site Primary Generating Equipment for Microgrid Operations (e.g., turbines, large RICE, etc.)**
- Diesel-fired emergency generator engines (varied ratings)
- Diesel belly tanks (varied sizes)
- Cooling towers (common but not ubiquitous)

This "new normal" brings with it more consistent likelihoods that major source air permitting will be triggered

- Title V and NSR/PSD permitting requirements are likely to become the baseline expectation for this industry with more potential for creative solutions to be encountered for permitting, modeling, and compliance

Optionality for Operational Limitations

Historical Data Center Operating Configuration, Typical Operational Limitations Encountered

"Old" Types of Limits and Restrictions

- Site-wide fuel usage/emission limitations
- Relatively lax testing requirements
  - Few engines
  - NO_X and CO, typically
- Operational restrictions generally consistent with federal restrictions (NSPS / NESHAP)
  - Potential for season/hour-of-day limitations (ozone season)

Nothing groundbreaking, and compliance was relatively straight-forward

Emerging Data Center Operating Configurations, Potential for New Operational Limitations

"New" Types of Limits and Restrictions

- More stringent hour/year limits for "non-emergency" operations (i.e., maintenance, readiness testing)
- Season/hour of day limitations (ozone season)
- Ambient fenceline monitoring (e.g., diesel particulate matter, ozone precursors)
- Stringent stack testing
  - Higher percentage of emergency RICE at a Facility
  - Total PM (filterable + condensable) + other pollutants
  - Testing for engine load-specific factors, based on chosen compliance methods
- Dispersion modeling requirements, regardless of size and/or facility source status

General Overview – Types of Data Center Air Permits

True Minor

- One building, 10-20 emergency diesel-fired emergency RICE
- All regulated pollutants below major source and/or major stationary source thresholds, uncontrolled
- No operational and/or emissions limitations necessary based on potential emissions rates

Synthetic Minor

- Several buildings, 20-100 emergency diesel-fired emergency RICE
- One (or more) regulated pollutants above major and/or major stationary source thresholds, uncontrolled
- Operational (e.g., fuel usage) and/or emissions limitations necessary for synthetic minor source status
- Potential for add-on pollution controls (e.g., SCR, OxyCat, DPF) depending on specific pollutants of concern

General Overview – Types of Data Center Air Permits

Title V Major, NSR/PSD Minor

- Several buildings, >100 emergency diesel-fired emergency RICE
- Multiple regulated pollutants likely above major source and/or major stationary source thresholds on an uncontrolled basis
- Operational (e.g., fuel usage) and/or emissions limitations necessary for synthetic minor stationary source status
- Add-on pollution controls may be utilized (e.g., SCR, OxyCat, DPF) depending on specific pollutants of concern

Title V & NSR/PSD Major

- Several buildings, >100 emergency diesel-fired emergency RICE
- Multiple regulated pollutants likely above major source and/or major stationary source thresholds
- Operational (e.g., fuel usage) and/or emissions limitations
- Add-on pollution controls may be utilized (e.g., SCR, OxyCat, DPF) depending on specific pollutants of concern to satisfy BACT/LAER
- Most likely scenario for data centers collocated with on-site primary electrical generating capacity (e.g., simple cycle and/or combined cycle turbines, large stationary RICE)

Types of Air Permits – True Minor Source Air Permits

- PTE for all regulated pollutants below relevant federal and state air permit thresholds
- Typically, leveraged for facilities with relatively small building footprint and limited number of emergency RICE
- Depending on state permitting requirements, facilities in this category could be subject to anything ranging from no formal approval at all through issuance of a formal air permit with limitations, monitoring, recordkeeping, and reporting requirements
- Minimal compliance burden; however, scrutiny may be necessary to ensure as-built configuration is consistent with pre-construction specifications
    - **<u>Watch out for modular build-out scenarios!</u>**

Key Details to Review and Monitor

- **PTE Calculations and Verification of Accurate Assumptions**
    - **Engine Certifications**
    - **Operational Assumptions (e.g., Hours, Fuel)**
    - **Site-Wide Emissions Truly Below Applicable Federal and State Caps?**
- **NSPS/NESHAP Awareness and Compliance Status**
- **Presumptive BACT / State-Level RACT?**
- **Future Build-Out Plans**
    - **Single Build-Out? First Stage of Many?**
    - **Public Communications and News**

Types of Air Permits – Synthetic Minor Air Permits

Key Details to Review and Monitor

- **PTE Calculations and Verification of Accurate Assumptions**
  - **Engine Certifications**
  - **Operational Assumptions (e.g., Hours, Fuel)**
- **What Types of Limitations Has the Facility Proposed, and How are They Verifying Compliance?**
- **Source Testing Requirements, Frequency, and Reporting/Verification of Results**
- **SM-80 Status and Enhanced Monitoring Requirements?**
- **"One-Time Doubling" (i.e., First and Second Bites and Major NSR Apple)**

- PTE for one or more regulated pollutants above relevant federal and state major source air permit thresholds
- Operational and/or emissions limitations in place to limit facility-wide emissions to below major source air permit threshold(s)
  - Facility-Wide Fuel Usage Limitations
  - Annual Operational Hour Limitations
  - Others
- Increased compliance burden to ensure source status remains consistent with permitting configuration
- Scrutiny may be necessary to ensure as-built configuration is consistent with pre-construction specifications
  - **<u>Watch out for modular build-out scenarios!</u>**

Types of Air Permits – Title V Operating Permits

- PTE for one or more regulated pollutants above relevant federal and state major source air permit thresholds
- Potential air permitting outcome for data center facilities consisting of multiple buildings, significant physical footprint, many diesel-fired emergency RICE and/or supporting emissions units
- Increased compliance burden to ensure source status remains consistent with permitting configuration
  - Semiannual reporting requirements
  - Annual Compliance Certifications
- Scrutiny may be necessary to ensure as-built configuration is consistent with pre-construction specifications
  - **Watch out for modular build-out scenarios!**

Key Details to Review and Monitor

- **PTE Calculations and Verification of Accurate Assumptions**
  - **Engine Certifications**
  - **Operational Assumptions (e.g., Hours, Fuel)**
- **What Types of Limitations Has the Facility Proposed, What has the Agency Included in the Permit, and How are They Verifying Compliance?**
- **Source Testing Requirements, Frequency, and Reporting/Verification of Results**
- **Semiannual and Annual Reporting Obligations and Compliance Status**
- **Differing Compliance Requirements for Emergency RICE and Other Source Types**

Types of Air Permits – NSR/PSD Major Stationary Sources

Key Details to Review and Monitor

- **PTE Calculations and Verification of Accurate Assumptions**
  - **Engine Certifications**
  - **Operational Assumptions (e.g., Hours, Fuel)**
- **BACT/LAER Selection and Evaluation Process**
- **Source Testing Requirements, Frequency, and Reporting/Verification of Results**
- **"One-Time Doubling" (i.e., First and Second Bites and Major NSR Apple)**
- **Differing Compliance Requirements for Emergency RICE and Other Source Types**

- PTE for one or more regulated pollutants above relevant federal and state major stationary source air permit thresholds (i.e., Major PSD/NSR)
- Potential air permitting outcome for data center facilities consisting of multiple buildings, significant physical footprint, many diesel-fired emergency RICE and/or supporting emissions units
  - Primary on-site electrical generation capacity likely present, unless Facility is located in a nonattainment area for a pollutant of interest
- High-profile projects, significant investment, and therefore significant pressure may result on air permitting agencies to move quickly
- Permitting decisions must withstand extensive public and EPA comments
- Scrutiny may be necessary to ensure as-built configuration is consistent with pre-construction specifications
  - **<u>Watch out for modular build-out scenarios!</u>**

Zachary Good
Senior Chemical Engineer
Zachary.Good@erg.com
(215) 964-0694

Questions?