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# Data Centers in Indiana and the Midwest: Assessment of Power and Water Demand in the AI Era

Sherif Attallah<sup>1</sup>, and Jennifer Warrner<sup>1</sup>

<sup>1</sup>Ball State University

The Midwest is experiencing a rapid surge in hyperscale data-center development, largely driven by the growing computational demands of artificial intelligence (AI) workloads. Centering on Indiana while incorporating regional comparisons, this study compiles a verified public dataset of active and announced projects, models their annual electricity consumption across load-factor scenarios, and estimates direct on-site water requirements under alternative Water Usage Effectiveness (WUE) assumptions. Results reveal that a single multi-gigawatt campus can contribute tens of terawatt-hours (TWh) of additional annual electricity demand, while water impacts depend heavily on the choice of cooling technology, ranging from evaporative to dry or hybrid systems. Even when direct on-site water use is minimized, the indirect water footprint embedded in electricity generation remains significant, highlighting the urgent need for integrated energy-water nexus accounting within utility Integrated Resource Plans (IRPs), municipal infrastructure planning, and corporate sustainability reporting. Recent studies converge on projections of exponential load growth from AI operations: global data-center electricity use, estimated at approximately 415 TWh in 2024, is expected to nearly double to 900-1,000 TWh by 2030, with AI emerging as the dominant driver (Takci, 2025). Although many hyperscale operators are adopting dry or hybrid cooling systems that nearly eliminate direct water withdrawals, the indirect consumption associated with thermally based electricity generation continues to pose major sustainability challenges, particularly within grids characterized by high fossil or nuclear generation shares. These findings reinforce the need to couple WUE disclosure with transparent reporting of grid composition and to accelerate the transition toward 24×7 clean-energy procurement strategies.

Keywords: Data Centers, AI, Electricity Demand, Water Demand, WUE, Sustainability.

### Introduction

Indiana has emerged as a central hub in the rapid expansion of hyperscale data centers across the United States, particularly within the Midwest. Major announcements include Amazon Web Services (AWS) in St. Joseph County (New Carlisle), Meta in Jeffersonville, Microsoft in La Porte, Google in Fort Wayne, and Digital Crossroad's proposed expansion in Hammond. Comparable clusters are also expanding regionally, in the Chicago metropolitan area of Illinois, West Des Moines and Altoona in Iowa, the Columbus region of Ohio, and Switch's established facilities in Michigan. Together, these

developments reflect a significant regional trend in digital-infrastructure growth, driven largely by escalating computational demand from artificial-intelligence (AI) applications.

An AI datacenter is a specialized and purpose-built facility that houses high-performance computer systems, advanced networking, and massive storage infrastructure required to train, deploy, and run complex AI and machine-learning models at scale. These centers feature high-end software designed to handle the enormous power, data, and storage demands of AI workloads. They process massive datasets and use deep-learning techniques to enable model development and execution (Digital Reality). AI is already improving productivity and advancing scientific research, causing a rapid evolution of powerful models across industries (Zewe, 2025).

However, this growth comes with steep resource implications. AI datacenters are among the most energy- and water- intensive industrial facilities ever built. The electricity demands of AI clusters are now a major contributor to the environmental impacts of generative AI systems such as ChatGPT (Zewe, 2025). Recent analysis by the Lawrence Berkeley National Laboratory shows that U.S. data centers consumed about 58 TWh in 2014 and 176 TWh in 2023 (Shehabi et al., 2024).

Within the Midwest, such demand surges have pronounced implications for grid coordination across the Midcontinent Independent System Operator (MISO) and PJM Interconnection regions, both of which govern Indiana's transmission and capacity-planning processes. As these large loads arrive in geographically concentrated clusters, their cumulative impact on system reliability, interregional transfer capability, and transmission expansion becomes a central policy concern for regulators and utilities alike. The present study therefore examines Indiana's emerging AI-driven data-center landscape within the broader Midwest infrastructure context in an effort to quantify its electricity and water implications.

### **Background and Literature**

Data-center sustainability performance is commonly evaluated through two key metrics: Power Usage Effectiveness (PUE) and Water Usage Effectiveness (WUE). PUE measures the ratio of total facility energy to the energy consumed by computing equipment, while WUE quantifies the liters of water used per kilowatt-hour (kWh) of IT load. Together, these indicators provide a framework for benchmarking both energy and water efficiency. Industry surveys, such as those conducted by the Uptime Institute (2024), show gradual improvement in median PUE values over the past decade, yet persistent variability remains due to climatic differences, facility scale, and cooling-system design. Public agencies and research consortia including the U.S. Department of Energy (DOE) and the International Energy Agency (IEA) have documented accelerating growth in data-center energy demand, largely fueled by the parallel expansion of AI and cloud-computing workloads.

A recent comprehensive review by the IEA's 4E Technical Program (2025) identified significant variance across historical estimates of data-center electricity use and emphasized the need for standardized, transparent methods to differentiate IT loads from overall facility energy. On the water side, peer-reviewed studies have quantified the trade-offs between cooling strategies in diverse climatic contexts. For example, Karimi, Moazeni, and Shahhoseini (2022) demonstrated that evaporative cooling reduces electricity demand for thermal management but substantially increases on-site water withdrawals, whereas dry or hybrid systems achieve the opposite balance reducing direct water use but increasing electrical load. More recent work on workload-level water intensity, particularly for AI-optimized chips and high-density racks, has revealed that the rapid escalation in

chip power density is reshaping cooling technology choices and driving variability in WUE outcomes (Li, Zhang, & Wang, 2024). Despite advances in design efficiency, practitioner reports continue to cite a benchmark of approximately 1.8 L/kWh as the WUE target to surpass for large-scale facilities (EESI, 2025).

The environmental impact of AI datacenters extends beyond their substantial electricity consumption. Analyses by the Environmental and Energy Study Institute (EESI) note that a typical large data center can consume between one and five million gallons of water per day for cooling—roughly the amount used by a town of 10,000 to 50,000 people (EESI, 2025). This demand mirrors the growth in energy intensity: according to the Lawrence Berkeley National Laboratory (LBNL), total U.S. data-center electricity use climbed from 58 TWh in 2014 to 176 TWh in 2023 (Shehabi et al., 2024). The International Energy Agency (IEA) reports that global data-center electricity consumption reached  $\approx$  460 TWh in 2022, equivalent to the world's 11th-largest national electricity consumer, and could more than double by 2026 due to AI-driven workloads (IEA, 2024). Together these findings indicate that both water and electricity use are accelerating as AI inference loads proliferate.

Despite advances in energy and cooling efficiency, practitioner surveys continue to cite an average Water Usage Effectiveness (WUE) of about 1.9 L/kWh for large-scale data centers, representing a common benchmark operators aim to surpass (Environmental and Energy Study Institute, 2025). However, workload-level analyses show that WUE can vary significantly depending on chip power density and cooling configuration. The ASHRAE TC 9.9 guidelines note that the rapid escalation in power density of AI-optimized chips is reshaping cooling technology choices, from air-cooled to liquid and hybrid systems, and thereby driving variability in WUE outcomes (ASHRAE TC 9.9, 2021). In parallel, the U.S. Department of Energy's Federal Energy Management Program (FEMP) emphasizes that indirect water consumption used in electricity generation for datacenters remains a major contributor to total water footprint (U.S. DOE FEMP). Collectively, these factors highlight that both operational and embedded water use must be considered when assessing sustainability performance.

Building on recent literature, the present study adopts a lifecycle water perspective that accounts for both direct on-site cooling withdrawals and the indirect water embedded in electricity generation. This dual-accounting framework captures the full energy/water nexus of data-center operations. In electricity grids dominated by thermoelectric generation such as much of the U.S. Midwest, the indirect water component remains substantial even when dry or hybrid cooling systems are deployed. Consequently, evaluating data-center sustainability requires integrating these interdependencies into modeling frameworks and public reporting rather than treating water and power as separate resource domains.

### Research Questions

The rapid expansion of hyperscale data centers across Indiana and the broader Midwest raises critical questions regarding regional energy demand, water use, and infrastructure planning. This study focuses on three interrelated lines of inquiry:

RQ1: What is the projected annual electricity demand of large-scale data centers in Indiana under current announcements and plausible load-factor assumptions?

RQ2: How do cooling-system selections influence direct on-site water use across different WUE scenarios, and what is the magnitude of indirect water embedded in electricity generation?

RQ3: What are the implications of these combined energy and water demands for grid capacity, transmission infrastructure, and municipal water systems in Indiana and neighboring Midwest states?

The Midwest’s appeal as a data-center hub is shaped by its relatively cool climate, abundant land, and access to competitive wholesale electricity markets. However, the pace of development is increasingly constrained by queue backlogs, substation commissioning delays, and the structure of large-load tariffs, which often dictate project timelines more than equipment availability. Policy-oriented analyses by the U.S. Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC) highlight that competitive transmission planning and interregional coordination can lower total system costs and improve reliability as large, energy-intensive loads such as AI data centers are integrated into the grid (U.S. DOE Grid Deployment Office, 2024; FERC, 2023). In the Great Lakes region, adjacency to surface water bodies introduces additional environmental and permitting considerations related to intake and discharge management, while inland locations must address drought resilience and aquifer sustainability.

To address these issues, the present study employs reproducible, parameter-driven modeling using sensitivity bands rather than single-point estimates to capture both commissioning-to-operation transitions and the plateauing utilization patterns characteristic of AI-driven facilities. This methodological approach ensures transparency, facilitates peer verification, and reflects the dynamic nature of data-center ramp-up and load-stabilization cycles.

### Study Area and Project Inventory

The core study area for this research is the state of Indiana, supplemented with comparative references to ongoing and completed data-center developments in Illinois, Iowa, Michigan, and Ohio. This regional framing captures the Midwest’s growing significance as a national hub for hyperscale and cloud infrastructure. Indiana’s advantages include ample land availability, moderate climate, competitive electricity pricing, and proximity to both PJM and MISO transmission networks—making it an attractive location for AI-driven data-center clusters.

Table 1 summarizes major projects identified from public, verifiable sources, listing operators, reported investment values, cooling characteristics, and development status as of 2024–2025. These projects represent a cross-section of Indiana’s ongoing digital infrastructure build-out, complemented by established regional clusters in neighboring states that provide comparative operational insights.

**Table 1.** Representative Data Center Developments in Indiana and the Midwest

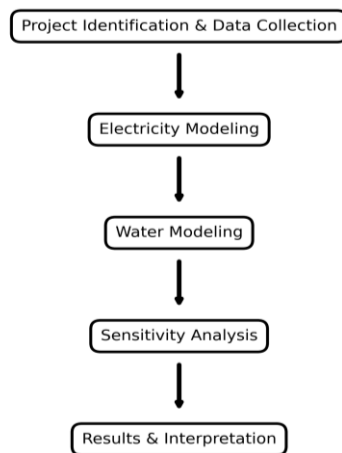
State	Operator / Project	Investment (\$B)	Status	Cooling Notes
IN	AWS – New Carlisle (St. Joseph Co.)	11.0	Announced 2024	mixed; site-specific
IN	Meta – Jeffersonville (River Ridge)	0.8	Announced 2024 (target 2026)	Dry/closed-loop indicated in public communications
IN	Microsoft – La Porte	1.0	Announced 2024	TBD
IN	Google – Fort Wayne (Project Zodiac)	2.0	Expansion approvals 2025	permitting includes wetlands review
IN	Digital Crossroad – Hammond (Expansion)	7.0	Proposed / advancing 2025	Lake-water economization
IA	Meta – Altoona (Complex)	—	In service / expanded	Mixed; site specific

IA	Microsoft – West Des Moines (Complex)	—	In service / expanded	Mixed; site specific
IL	Meta / Google – Chicago Region (Multiple)	—	In service / expanded	Mixed; site specific
OH	AWS / Google / Meta – Columbus Region	—	In service / expanded	Mixed; site specific
MI	Switch – Grand Rapids (Pyramid Campus)	—	In service	Mixed; site specific

Indiana’s expanding project pipeline reveals a clear clustering trend along existing industrial corridors with access to major substations, water infrastructure, and highway logistics. However, the rapid pace of development is now shaped less by construction capacity and more by grid interconnection queues and substation energization timelines. The U.S. Department of Energy’s Grid Deployment Office (GDO) and the Lawrence Berkeley National Laboratory (LBNL) have identified interconnection queue delays as major pacing factors for hyperscale and large-load projects nationwide. In the Midwest context, interregional transfer headroom and competitive transmission planning are critical enablers for accommodating these large, persistent loads while maintaining reliability and system flexibility.

### Methods

This following flow chart summarizes the study workflow from project identification and data collection through electricity and water modeling, sensitivity analysis, and final interpretation of results.



**Figure 1.** Overview of Research Methodology and Modeling Workflow

#### Data Collection.

A comprehensive dataset of data-center projects was compiled using publicly available announcements, state and municipal development releases, reputable industry journalism, and corporate sustainability reports. Each entry includes project location, estimated or disclosed investment value, indicative electrical capacity if available, and statements or inferences about cooling-system design. These data form the foundation for the empirical modeling of energy and water demands presented in subsequent sections.

Electricity Modeling.

Annual electricity consumption was estimated using the formula:

$$E_{\text{annual}} (\text{TWh/yr}) = \text{MW} \times 8,760 \times \text{Load Factor} / 10^6$$

8,760 = total hours in a year. Modeling studies note that the load factor of data-centers varies significantly depending on workload, cooling mode and redundancy architecture, a key input for sensitivity analysis in high-density facilities (IEA 4E TCP, 2025). This approach enables the analysis of both ramp-up and steady-state operating phases. The load-factor sweep also reflects the operational variability between AI training clusters characterized by intermittent high utilization and AI inference clusters, which exhibit more continuous load profiles.

Water Modeling.

Direct on-site water consumption was modeled using Water Usage Effectiveness (WUE), expressed in liters per kilowatt-hour (L/kWh) of IT energy. Conversion to million gallons per year (MGY) followed the relationship:

$$\text{MGY} = (\text{IT\_MW} \times 1000 \times 8,760 \times \text{Load Factor} \times \text{WUE\_L/kWh}) / (3.78541 \times 10^6)$$

Where:

- MGY = Annual on-site water consumption, in million gallons per year (MG/yr).
- IT\_MW = IT equipment electrical demand, in megawatts (MW).
- 1000 = Conversion factor from megawatts (MW) to kilowatts (kW).
- 8,760 = Total number of hours in one calendar year.
- Load Factor = Ratio of average IT load to peak IT load (dimensionless, 0 - 1).
- WUE\_L/kWh = Water Usage Effectiveness, expressed in liters per kilowatt-hour (L/kWh) of IT energy.
- $3.78541 \times 10^6$  = Conversion factor from liters to million gallons ( $1 \text{ MG} = 3.78541 \times 10^6 \text{ L}$ ).

Indirect water use embedded in electricity generation was estimated by applying regional, technology-weighted water intensity coefficients (L/kWh) to the modeled annual electricity demand. These coefficients represent average freshwater withdrawal and consumption rates associated with thermoelectric and non-thermal generation resources supplying the MISO and PJM service territories. Values were drawn from publicly available lifecycle and power-sector water intensity datasets published by the U.S. Department of Energy and Lawrence Berkeley National Laboratory, which report water-use factors by generation technology and cooling system type.

To account for spatial and operational variability, the coefficients were implemented as sensitivity bands rather than fixed point estimates, reflecting differences in regional generation mix, plant-level cooling configurations, and seasonal dispatch conditions.

Three WUE bands were modeled to represent the spectrum of modern cooling designs:

2.4 L/kWh: conservative evaporative cooling (high water use, lower electricity)

1.9 L/kWh: typical mixed/hybrid operation (industry benchmark)

0.7 L/kWh: efficient hybrid or air-cooled systems (low water use, higher electricity)

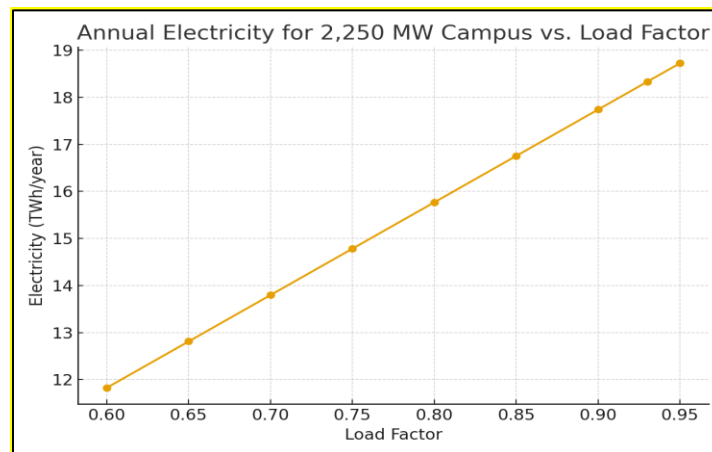
This range captures the trade-offs between energy and water efficiency, as documented in case studies (Karimi et al., 2022) and industry briefs (EESI, 2025). Where operators have explicitly disclosed dry or closed-loop cooling systems, on-site water use was treated as negligible, and analysis instead focused on indirect water embedded in electricity generation, a nontrivial component in thermal-

dominated grids such as MISO and PJM. Modeling Principles and Validation: To maintain methodological transparency, Power Usage Effectiveness (PUE) was deliberately not fixed in campus-level energy modeling. Fixing PUE would risk conflating IT energy with facility overheads; instead, energy and water are presented as parametric bands, illustrating the plausible range of outcomes under different operational conditions.

Finally, by keeping IT energy distinct from total facility energy, the analysis avoids double-counting of load components and provides a more accurate representation of infrastructure-scale impacts. This structure allows sensitivity testing that spans the commissioning phase through to the fully stabilized AI inference regime, offering insights relevant to both system planners and sustainability practitioners.

### Results: Electricity

Electricity Demand Sensitivity Analysis: Figure 2 illustrates the modeled annual electricity demand for a representative 2,250 MW hyperscale campus under varying load-factor assumptions. The 90 percent load-factor case yields approximately 17.7 TWh per year, an amount comparable to a substantial share of several Midwestern utilities' total annual retail electricity sales. Such magnitudes highlight the strategic importance of Integrated Resource Plan (IRP) with aligned phasing and coordinated transmission upgrades to manage the influx of large, continuous loads driven by AI workloads.



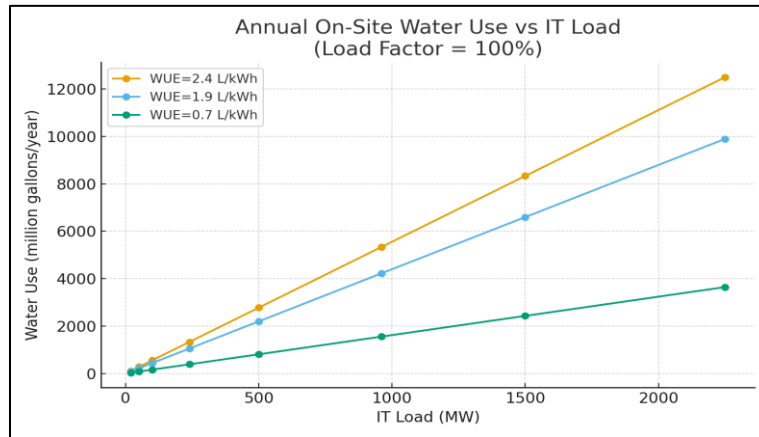
**Figure 2.** Annual Electricity Sensitivity

To quantify the relationship between operational intensity and annual consumption, the load-factor sweep (0.60–0.95) was used to bracket commissioning through full-capacity operations.

These findings demonstrate that even modest variations in load factor produce multi-terawatt-hour differences in annual energy use. When applied across multiple campuses statewide, the aggregate effect could exceed tens of TWh annually, necessitating parallel expansion in generation, transmission, and distribution infrastructure. Short-term outlooks and peer-reviewed studies consistently project material growth in electricity demand from AI-driven data centers (Reuters, 2025; IEA-4E, 2025). Thus, achieving reliable integration will depend less on behavioral curtailment and more on structural solutions including new transmission corridors, energy-storage deployment, and coordinated IRP execution across MISO and PJM service territories.

### Results: Water

Figure 3 illustrates the estimated on-site water consumption at full utilization for IT loads ranging from 20 MW to 2,250 MW, evaluated across three representative Water Usage Effectiveness (WUE) bands. The spread between evaporative and efficient hybrid cases is large, illustrating the critical role of cooling design in water planning. Even with near-zero on-site water (dry cooling), indirect water remains embedded in electricity generation.



**Figure 3.** Annual on-site water vs IT load for three WUE bands (MGY).

A typical Water Usage Effectiveness (WUE) of approximately 1.9 L/kWh aligns with mixed-mode evaporative cooling deployments in temperate climates, whereas hotter regions and high-density AI accelerator systems often exhibit higher values (Environmental and Energy Study Institute, 2025; ASHRAE TC 9.9, 2021). Industry sustainability reports and independent analyses have documented sharp year-over-year increases in water consumption concurrent with large-scale AI build-outs (Li et al., 2024). Even when on-site water withdrawals approach zero under dry or hybrid cooling designs, the indirect water footprint from electricity generation remains substantial in thermoelectric-dominated grids.

### Discussion

Operational demand dominates lifecycle electricity and water implications. Cooling selection shifts burdens between on-site and off-site water. For utilities, large-load tariffs, take-or-pay constructs, and 24×7 clean energy procurement can balance reliability, cost, and sustainability. For municipalities, wetlands protection, intake/discharge management, and public dashboards (electricity, water, 24×7 CFE progress) can improve transparency and trust.

Emerging work frames data centers as potential flexibility resources (e.g., thermal storage, non-critical workload shifting, curtailment windows), yet SLA and latency constraints for AI inference cap near-term flexibility (Takci, 2025). This argues for structural solutions interregional transmission, co-optimized IRPs, and 24×7 CFE contracts instead of relying on large dispatchable reductions from AI clusters during peaks.

### Policy and Practice Recommendations

In the 2025 session of the Indiana General Assembly, lawmakers introduced significant measures aimed at increasing transparency, permitting oversight, and infrastructure cost-allocation for large-scale data centers. One prominent bill, Senate Bill 135 (SB 135), defines “data center” under Indiana

Code, requires operators of such facilities to submit quarterly reports of electricity use (disaggregated by source) to the Indiana Utility Regulatory Commission (IURC), and mandates that local governments, before issuing construction permits, obtain disclosure of projected power and water usage and perform site assessments addressing impacts on the grid, water resources, carbon emissions, and local cultural or agricultural assets (Indiana General Assembly, 2025a).

Simultaneously, legislation such as House Bill 1007 (HB 1007) was passed—pending the governor’s signature—to require utilities planning new generation resources to align with large-load customers (including data centers) in their integrated resource planning and generation replacement strategies (Indiana General Assembly, 2025b).

Beyond reporting and planning, state policy is also seeking to allocate cost burdens more clearly when utilities expand infrastructure to serve large “mega-load” customers such as data centers. For example, consumer advocacy groups note that under recent settlements with large-load customers in Indiana, data centers must commit to long-term usage, pay exit fees if they leave early, and provide financial assurances—measures intended to protect everyday ratepayers from absorbing stranded-cost risks of infrastructure built for data centers (Citizens Action Coalition, 2025). Meanwhile, the IURC has approved expedited pathways for utilities to build generation when large loads commit to cost sharing. However, industry observers caution that some of these “fast-track” processes may still leave residential customers exposed to infrastructure costs if large loads shift or underutilize capacity (Energy News Network, 2025).

### Conclusion

Indiana’s and the broader Midwest’s data-center build-out accelerated by AI adoption demands integrated planning across electricity, water, and environmental systems. Transparent cooling choices, IRP alignment, and comprehensive water accounting are essential to harmonize economic development with sustainability commitments.

The rise of AI-specific datacenters introduces unprecedented infrastructure and environmental pressures. These facilities concentrate thousands of high-performance servers that require immense, continuous power and water for cooling. If unmanaged, such loads could deepen Indiana’s reliance on fossil generation and strain aquifer resources.

This study quantified the combined electricity and water demands associated with large-scale AI data centers through integrated energy–water modeling. Using a 2,250 MW reference campus, the results demonstrated that total electricity consumption can exceed 17 TWh annually under high load factors, positioning AI infrastructure as a material driver of regional power demand growth. Corresponding water requirements, even when limited to on-site cooling, can reach millions of gallons per day under mixed-mode evaporative systems, underscoring the need for balanced energy and water management strategies.

The results presented in this study should be interpreted as scenario-based estimates rather than deterministic forecasts. Key sources of uncertainty include variation in facility load factors during commissioning and stabilized operation, site-specific cooling system design and Water Usage Effectiveness (WUE) performance, and regional differences in electricity generation mix that influence indirect water-use coefficients. While sensitivity bands were employed to bracket these uncertainties, actual project outcomes will depend on local utility infrastructure, regulatory

conditions, and operational practices. Acknowledging these factors provides appropriate context for interpreting the magnitude and applicability of the modeled electricity and water demand impacts.

The analysis also confirmed that indirect water use, embedded in power generation, remains substantial, especially in thermoelectric-dominated grids such as those serving the Midwest. This reinforces the importance of lifecycle accounting frameworks that evaluate both direct and off-site resource dependencies.

Moving forward, sustainable operation of hyperscale AI facilities will depend on solutions that integrate energy and water planning. Strategies such as transitioning toward 24×7 carbon-free energy procurement, deploying advanced heat-recovery or hybrid cooling systems, and coordinating siting with utilities and local governments can mitigate cumulative grid and water-stress impacts. Collectively, these findings provide a quantitative basis for informed infrastructure planning, resource policy, and corporate sustainability practices in the era of accelerated AI deployment.

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