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WHO’S USING ALL THE POWER?Exploring Data Center Sustainability in Illinois

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WHO'S USING ALL THE POWER?

Exploring Data Center Sustainability in Illinois

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Abstract

The rapid expansion of cloud computing and artificial intelligence is driving a surge in data center development across the United States, and Illinois has become one of the fastest-growing markets. Developers have moved into the state quickly, largely drawn by a mix of tax incentives and a power system that is both reliable and relatively low carbon. That pace has outrun the governance frameworks meant to manage it. This capstone looks at how that growth intersects with grid reliability, decarbonization goals, climate and weather risk, and community impacts. It draws on GIS mapping of data center locations alongside electricity infrastructure, along with meteorological and climate stressor visuals developed with Monarch Weather and Climate Intelligence. The goal is to identify where the real pressures are coming from and whether Illinois is prepared to manage them. The analysis finds that the issue is not a lack of authority. The Illinois Commerce Commission, the Illinois EPA, and the Environmental Protection Act already provide the core institutional tools. The problem is that those tools have been applied inconsistently and without data centers clearly in view. The result is a principal-agent problem. Developers control much of the key information, while the state lacks the capacity to independently verify it. This paper lays out four recommendations. These include requiring full environmental review for data center siting, increasing transparency around grid and rate impacts through the ICC, establishing binding protections for environmental justice communities, and using Illinois's position to push for stronger industry accountability. As AI continues to scale and digital infrastructure expands, the decisions being made now about how this growth is powered, sited, and regulated will shape outcomes far beyond Illinois. This is not just a state policy issue. It is a test case for how governments manage the infrastructure behind a technology-driven economy.

INTRODUCTION

Illinois is in the middle of one of the fastest infrastructure buildouts in the state's recent history, and one of the least regulated. Data centers are arriving faster than utilities and grid operators can plan for them, faster than environmental regulators have been asked to review them, and faster than the communities hosting them have been given any real say. Their growth is occurring alongside aggressive decarbonization goals and increasing stress on the energy system from extreme climate and weather events. Understanding how those pressures interact is what this paper sets out to do.

Data centers are the physical backbone of the digital world. Every file, streamed video, AI-generated response, and online translation depends on a facility somewhere running servers around the clock. Not all of these facilities are the same, however. The everyday infrastructure of cloud computing and the internet has driven steady demand growth for years. But the more recent and disruptive driver is AI model training, which requires massive clusters of specialized processors to run continuously for weeks or months at a time[1]. This shift is what is driving the hyperscale buildout. AI model training is not simply more of the same demand. It is a qualitatively different kind of computation, far more energy-intensive and more constrained in where it can be located, given the scale of power and cooling infrastructure it requires. Demand for data center capacity in the U.S has roughly doubled over the past decade and is projected to double again by 2030[2]. The geographic center of this growth in the U.S. has historically been Northern Virginia,

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[1] Sheng, Yu, et al. "Power for AI Data Centers: Energy Demand, Grid Impacts, Challenges and Perspectives." *MDPI*, Multidisciplinary Digital Publishing Institute, 29 Jan. 2026, www.mdpi.com/1996-1073/19/3/722.

[2] Shehabi, Arman, Alex Newkirk, et al. "2024 United States Data Center Energy Usage Report." *Lawrence Berkeley National Laboratory*, eScholarship, Dec. 2024, escholarship.org/uc/item/32d6m0d1.

home to the largest concentration of data center capacity in the world, but that buildout is now spreading rapidly to markets such as Illinois.

Illinois sits at a compelling intersection in this space and offers a unique case study for data center growth, given its heavy reliance on nuclear power and ambitious clean energy goals[3]. The state has the largest nuclear fleet in the country and provides steady, low-carbon baseload power that data centers require around the clock. The Chicago metropolitan area sits as one of the densest fiber interconnection points in the Midwest, and the suburban land surrounding the O'Hare corridor has offered developable sites within reach of that infrastructure. The Climate and Equitable Jobs Act was signed in 2021 and commits Illinois to 100% carbon-free electricity by 2045 and sets interim renewable energy targets[4]. This makes the state's long-term energy trajectory attractive to companies with public clean energy commitments. These factors have made Illinois a very attractive destination for data center developers who are seeking reliable and low-cost power. The question is no longer whether Illinois will become a major data center hub, as that has already happened. The more pressing question is whether the state's grid, its climate goals, and its communities are prepared for what that growth demands.

At the same time, Illinois's grid is under a great deal of pressure. The Illinois Power Agency, Illinois Environmental Protection Agency, and the Illinois Commerce Commission jointly released a 2025 Resource Adequacy Study that identified capacity shortfalls emerging as early as 2029 in Northern Illinois and 2031

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[3] Illinois.gov. "Electricity Generation Mix." *IPA Clean Energy Dashboard*, Illinois.gov, 2025, cleanenergy.illinois.gov/tracking-illinois-progress/electricity-generation-mix.html.

[4] Amy Antoniolli, Jena Watson. "Illinois's Data Center Boom: Incentives, Grid Pressures, and What to Watch." *ArentFox Schiff*, 28 Jan. 2026.

in Southern Illinois[5]. These shortfalls are projected to be driven in substantial part by the rapidly increasing data center load. MISO, the regional grid operator covering much of the state, projects that data center electricity demand will grow from 3% of total load in 2026 to 13% in just 10 years[6]. A separate analysis by Synapse Energy Economics found that data centers could increase Illinois's annual electricity requirements by 30% by 2040, with residential bills rising by 8.3% over that period under a scenario where data center growth continues at its current pace[7]. That estimate will vary depending on how costs are allocated, how much new generation gets built, and how quickly the regulatory framework adapts. What every projection agrees on is that demand is growing faster than the institutions designed to manage it.

This paper examines how data center growth in Illinois intersects with grid reliability, decarbonization goals, and exposure to weather and climate risks. It does not argue that data centers are inherently good or bad for the state because that entirely misses the point. Instead, it focuses on the tradeoffs, looking at who benefits from this growth, who absorbs the costs, and what the evidence shows about the scale of data centers' energy and water demands. The analysis draws on GIS-based mapping of data center locations alongside electricity infrastructure, as well as a set of meteorological and climate stressor visuals developed in collaboration with

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[5] Perelman, Tali. "Illinois Resource Adequacy in 2025: What the Study Finds for PJM, Miso, and Illinois." *Illinois Resource Adequacy in 2025: What the Study Finds for PJM, MISO, and Illinois*, Energy + Environmental Economics, 9 Jan. 2026.

[6] Amy Antoniolli, Jena Watson. "Illinois's Data Center Boom: Incentives, Grid Pressures, and What to Watch." *ArentFox Schiff*, 28 Jan. 2026.

[7] Synapse Energy Economics Inc. "Risks of Rapid Data Center Load Growth in Illinois." *Synapse Energy*, 5 May 2025.

Monarch Weather and Climate Intelligence. The final analysis will be a review of the policy landscape shaping how Illinois is or is not managing this development.

MOTIVATION

The public debate around data centers has generated more heat than light. Media coverage is loud and can be somewhat misleading by attempting to fear-monger the public. Community groups across Illinois have raised legitimate concerns about rising utility bills and water consumption. Environmental advocates have even pushed back on the tax incentives that attract data centers to certain locations – incentives that, in Illinois's case, caused the state to forgo approximately $983 million in sales tax revenue over the first five years of the Data Center Investment Program alone[8]. At the same time, the industry has its own narrative that emphasizes efficiency gains, renewable energy commitments, and economic growth. Sorting through these competing claims requires a different approach. Not advocacy, but analysis.

This project aims to treat this topic as a kind of myth-busting exercise, though not in the sense of simply debunking headlines. The goal is to take the concerns seriously, examine them against available evidence, and be honest about where the data supports alarm and where it does not. Data centers are real and significant electricity consumers. Their growth in Illinois is rapidly accelerating, and the questions around who pays, who bears the risks, and how is impacting the people and environment around them are all legitimate concerns that warrant further exploration. The Union of Concerned Scientists modeled multiple demand growth scenarios and found that under a high data center growth trajectory, power plant

[8] Amy Antoniolli, Jena Watson. "Illinois's Data Center Boom: Incentives, Grid Pressures, and What to Watch." *ArentFox Schiff*, 28 Jan. 2026.

emissions from data centers could be 50-72% higher by 2050 than under a more moderate growth path. They also found that electricity system costs could exceed $1.6 trillion cumulatively through 2050, which is 73% more than the mid growth scenario[9]. The difference between those outcomes depends almost entirely on what policies are put in place now.

Illinois offers a particularly useful context for this kind of examination. The state is not passive in this growth. They are very much an active participant by offering incentives, setting energy policy, and trying to balance economic development against climate commitments that rank among the most ambitious in the country. The decisions being made right now about which facilities get permitted, how costs get allocated, and whether environmental review keeps pace with development will shape the state's energy system and its communities for the next several decades. Illinois is early enough in this process that the policy choices still matter; however, that opportunity will not last forever.

THE INS & OUTS OF DATA CENTERS

To understand why data center growth is generating such intense debate, it helps to start with what these facilities are and how they operate. A data center is a campus of buildings filled with servers, networking equipment, and storage systems that process, store, and transmit digital information[10]. They are the physical infrastructure behind every email, streamed video, and AI-generated response, running 365 days a year. A data center is a campus of buildings filled with servers, networking equipment, and storage systems that process, store, and transmit digital

[9] Clemer, Steve, et al. "Data Center Power Play." *Union of Concerned Scientists*, 1 Jan. 2026.

[10] Murino, Teresa, et al. "Sustainable Energy Data Centres: A holistic conceptual framework for design and Operations." *Energies (MDPI)*, vol. 16, no. 15, 2 Aug. 2023, p. 5764, https://doi.org/10.3390/en16155764.

information[11]. These facilities can vary greatly in size. A small enterprise facility might occupy a few thousand square feet and draw a few megawatts of power. A hyperscale campus, the kind being developed by Amazon Web Services, Microsoft, Google, and Meta, can span hundreds of acres and draw hundreds of megawatts, which is similar to the electricity demand of a small city. At their core, these facilities house servers, networking equipment, and storage systems designed to process, store, and transmit large volumes of digital information. What distinguishes them from traditional buildings is not only their sheer size, but also their continuous operational requirements, including reliable round-the-clock power, intensive cooling systems to manage heat generated by the computing loads, high-capacity fiber connectivity, and strict physical security protocols[12]. Among these factors, electricity demand and cooling are by far the most significant in shaping both grid impacts and environmental outcomes.

One of the most widely used metrics for evaluating data center energy efficiency is Power Usage Effectiveness. PUE is a ratio of total facility energy consumed to the energy delivered specifically to IT equipment. A perfect PUE of 1.0 would mean all energy goes directly to computing, with nothing lost to cooling or outside. In practice, industry averages have improved significantly over the past decade, with hyperscale facilities now routinely achieving PUE values between 1.1 and 1.2. However, it is worth noting that PUE and related metrics account for only about 30% of total IT sector emissions, with hardware manufacturing representing a

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[11] Murino, Teresa, et al. "Sustainable Energy Data Centres: A holistic conceptual framework for design and Operations." *Energies (MDPI)*, vol. 16, no. 15, 2 Aug. 2023, p. 5764, https://doi.org/10.3390/en16155764.

[12] Murino, Teresa, et al. "Sustainable Energy Data Centres: A holistic conceptual framework for design and Operations." *Energies (MDPI)*, vol. 16, no. 15, 2 Aug. 2023, p. 5764, https://doi.org/10.3390/en16155764.

larger but frequently overlooked factor[13]. This is an important caveat for any analysis that relies solely on operational efficiency as a measure of sustainability. Understanding what drives PUE in practice, particularly the role of cooling, requires a closer look at how data centers actually manage heat at scale.

The energy demands of a data center do not fluctuate much. Unlike a factory that ramps production up and down, a data center maintains a relatively flat, continuous load. These high-load factors are part of what makes them attractive to utilities because they are predictable customers, but can also be problematic due to their sheer scale, which adds significant baseline demand to the grid regardless of season or time of day[14]. Cooling is the single largest driver of a data center's energy consumption after the IT equipment itself[15]. Traditional air-cooled facilities circulate chilled air through raised floor systems or overhead ducts to remove heat from the servers. More modern approaches used today include closed-loop liquid cooling, which brings the coolant into direct contact with the hardware in a sealed system, recirculating it to prevent water loss. Another technique used is called air-side economization, which draws in cool outdoor air when ambient conditions allow[16]. Each of these three main strategies carries different implications for energy use, water consumption, and the impact on the environment, all of which will be examined in greater detail in the Sustainability Strategies section of this paper.

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[13] Sharma, Arjun. "We're Measuring Data Center Sustainability Wrong." *IEEE Spectrum*, IEEE Spectrum, 26 Mar. 2026, spectrum.ieee.org/data-center-sustainability-metrics.

[14] Guitart, Jordi. "Toward sustainable data centers: A comprehensive energy management strategy." *Computing*, vol. 99, no. 6, 28 June 2016, pp. 597–615, https://doi.org/10.1007/s00607-016-0501-1.

[15] Murino, Teresa, et al. "Sustainable Energy Data Centres: A holistic conceptual framework for design and Operations." *Energies (MDPI)*, vol. 16, no. 15, 2 Aug. 2023, p. 5764, https://doi.org/10.3390/en16155764.

[16] Shehabi, Arman, et al. "United States Data Center Energy Usage Report." *Ernest Orlando Lawrence Berkeley National Laboratory*, 1 June 2016, https://doi.org/10.2172/1372902.

The recent surge in data center construction has been driven by two factors: the continued expansion of cloud computing and the rapid emergence of artificial intelligence. AI has introduced an additional layer of demand that is different from conventional computing. Training large-scale machine learning models requires massive parallel computation over extended periods of time, resulting in substantial energy consumption and associated emissions[17]. Notably, much of this training demand is concentrated in purpose-built facilities serving private corporate and institutional clients, rather than supporting everyday public-facing services[18]. This distinction has implications for how the grid costs and environmental burdens of expansion are weighed against public benefit. In contrast, inference is the process of running a trained model to answer questions and generate a response. This adds continuous distributed demand every time someone interacts with an AI-powered product[19]. The result is that AI has not simply increased the quantity of data center demand, but it has changed the driver of demand in ways that strain existing infrastructure planning assumptions.

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[17] Strubell, Emma, et al. “Energy and policy considerations for Deep Learning in NLP.” *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*, 2019, pp. 3645–3650, https://doi.org/10.18653/v1/p19-1355.

[18] Eren, Erhan. "Illinois AI Data Center Boom Hits a Wall: Energy Grid Constraints and Policy Shifts in 2026." EnkiAI, 20 Feb. 2026, enkiai.com/data-center/illinois-ai-data-centers-2026-grid-crisis-hits-boom/.

[19] *Electricity 2024 – Analysis and Forecast to 2026*, International Energy Agency, 24 Jan. 2024, www.iea.org/reports/electricity-2024.

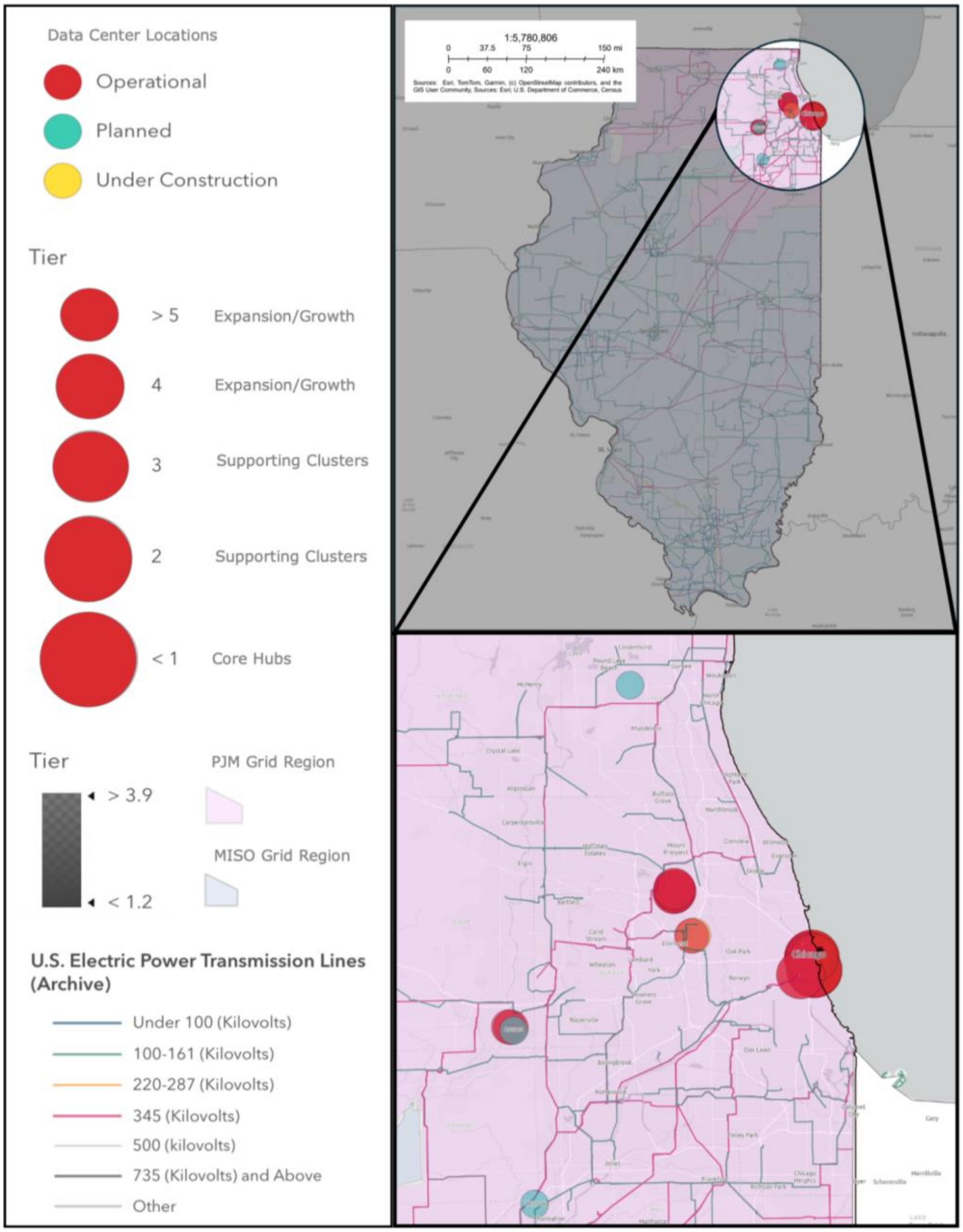

Figure 1: Data center distribution and high-voltage electric grid infrastructure in Illinois, with inset detail of the Chicago metropolitan region. Twenty-five facilities were selected to represent major operational, under-construction, and planned developments. Data centers are symbolized by operational status and scaled across five tiers reflecting locational significance, from core Chicago interconnection hubs (Tier 1) to emerging suburban developments (Tier 5). Transmission lines are differentiated by color, denoting the voltage class. Background shading distinguishes the PJM and MISO grid regions. The inset highlights the dense concentration of facilities in central Chicago and along the O'Hare corridor[20].

[20] Source: Map created in ArcGIS Online using data from Datacenters.com, the U.S Electric Power Transmission Lines Archive, and the U.S Census Bureau boundaries via Esri.

Nationally, the scale of this growth is striking. The United States currently hosts more data center capacity than any other country in the world, and that capacity is growing faster than ever before. Data center power consumption here in the U.S. is driven by cloud and AI demand and is projected to roughly double between 2023 and 2030[21]. This expansion is not evenly distributed by any means. It clusters in locations that offer a combination of reliable power, available land, fiber infrastructure, favorable tax incentives, as well as access to a skilled workforce. Illinois, and the Chicago metropolitan area in particular, checks most of these boxes, which is why, as of early 2026, the state hosted 108 operational data centers, with 24 under construction and 51 more in the planning stages[22]. As illustrated in Figure 1, this growth is highly concentrated geographically, with the bulk of development clustered around Chicago's core interconnection hubs and expanding outward through the O'Hare corridor and into the outer suburbs. The spatial pattern is not accidental. It reflects the degree to which proximity to high-voltage transmission infrastructure and dense fiber networks shapes where data centers can and cannot be built.

The infrastructure demands that shape where data centers are built extend beyond power and fiber. Among the most significant but least visible is water. Most large data centers rely on evaporative cooling systems, which are essentially large cooling towers that consume large amounts of water to dissipate heat. The Environmental and Energy Study Institute estimates that data centers in the U.S consume billions of gallons of water annually, with individual hyperscale facilities capable of using millions of gallons per day depending on climate conditions and

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[21] Shehabi, Arman, Alex Newkirk, et al. "2024 United States Data Center Energy Usage Report." *Lawrence Berkeley National Laboratory*, eScholarship, Dec. 2024, escholarship.org/uc/item/32d6m0d1.

[22] Gopal, Keerti. "Could a New Illinois Bill Be a Blueprint for Curbing Data Centers' Climate Impacts?" *Inside Climate News*, 19 Feb. 2026.

cooling design[23]. In Illinois, the summers bring both heat and humidity, in which the efficiency of evaporative cooling is constrained by atmospheric moisture levels. This dynamic will be examined further in the Climate and Extreme Weather Stressors section. Understanding both the energy and water demands of these facilities is essential context for evaluating the tradeoffs for data centers.

Illinois’s Energy Landscape

To fully comprehend the drivers of data center growth in Illinois, it is important to first understand the grid these facilities are plugging into. Illinois has one of the most diverse electricity systems in the U.S., with a strong reliance on nuclear power. It is split between two major grid operators and is currently transitioning toward a legally mandated clean energy future. Data centers are not entering a stable system by any means. They are arriving at a moment of active transition, and their growth is pushing questions about that transformation to be answered faster than anyone anticipated.

One of the most defining features of that system is its heavy reliance on nuclear. Illinois generates more nuclear power than any other state in the country. Nuclear energy accounts for up to 53% of statewide electricity generation and provides a steady, low-carbon power source that distinguishes Illinois from others in the Midwest[24]. This nuclear foundation has historically given the state a relatively low-carbon grid even before the recent push toward renewable energy. It is also a large reason behind why data centers have been drawn to Illinois due to the reliable, around-the-clock power supply that these continuous loads require. At the same time,

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[23] Yañez-Barnuevo, Miguel. “Data Centers and Water Consumption.” *EESI - Environmental and Energy Study Institute*, 25 June 2025, www.eesi.org/articles/view/data-centers-and-water-consumption.

[24] “U.S. Energy Information Administration - EIA - Independent Statistics and Analysis.” *United States - U.S. Energy Information Administration (EIA)*, 16 Oct. 2025, www.eia.gov/states/IL/analysis.

Illinois's nuclear fleet is getting older, and it is unclear whether new generation, clean or not, can be built fast enough to replace retiring plants[25]. This uncertainty is a key reason why understanding the structure of Illinois's grid is so important.

Regional Transmission Organization (RTO) and Independent System Operator (ISO) Territories in the United States

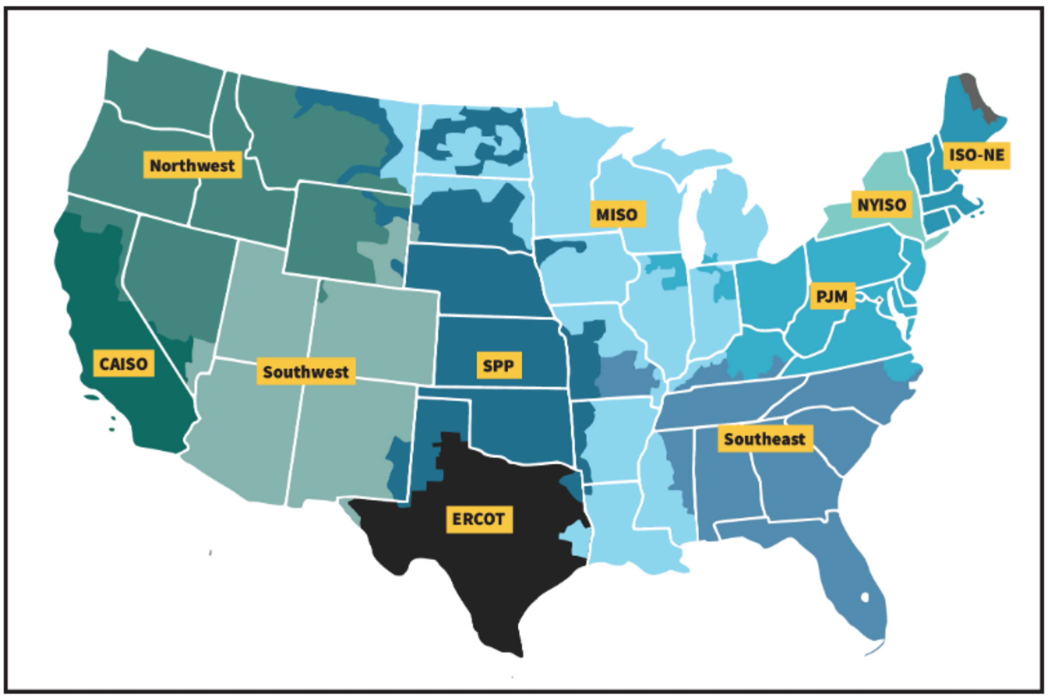

Figure 2: Map showing the major electricity market regions in the United States, including PJM Interconnection, Midcontinent Independent System Operator, Southwest Power Pool, Electric Reliability Council of Texas, and California Independent System Operator. Source from Energy Bad Boys (2024).

The state's grid is split between two regional transmission organizations, a structure that becomes clearer when viewed within the broader national electricity market. As illustrated in Figure 2, the United States is divided into several major regional transmission organizations (RTOs) and Independent System Operators (ISOs), each coordinating electricity planning and markets across multi-state territories. These regions vary greatly in their generation, demand growth, and

[25] Amy Antoniolli, Jena Watson. "Illinois's Data Center Boom: Incentives, Grid Pressures, and What to Watch." *ArentFox Schiff*, 28 Jan. 2026.

capacity planning. Understanding where Illinois sits within this national framework is essential context for evaluating how data center growth is being managed.

Electricity Market Regions in Illinois: PJM and MISO Boundaries

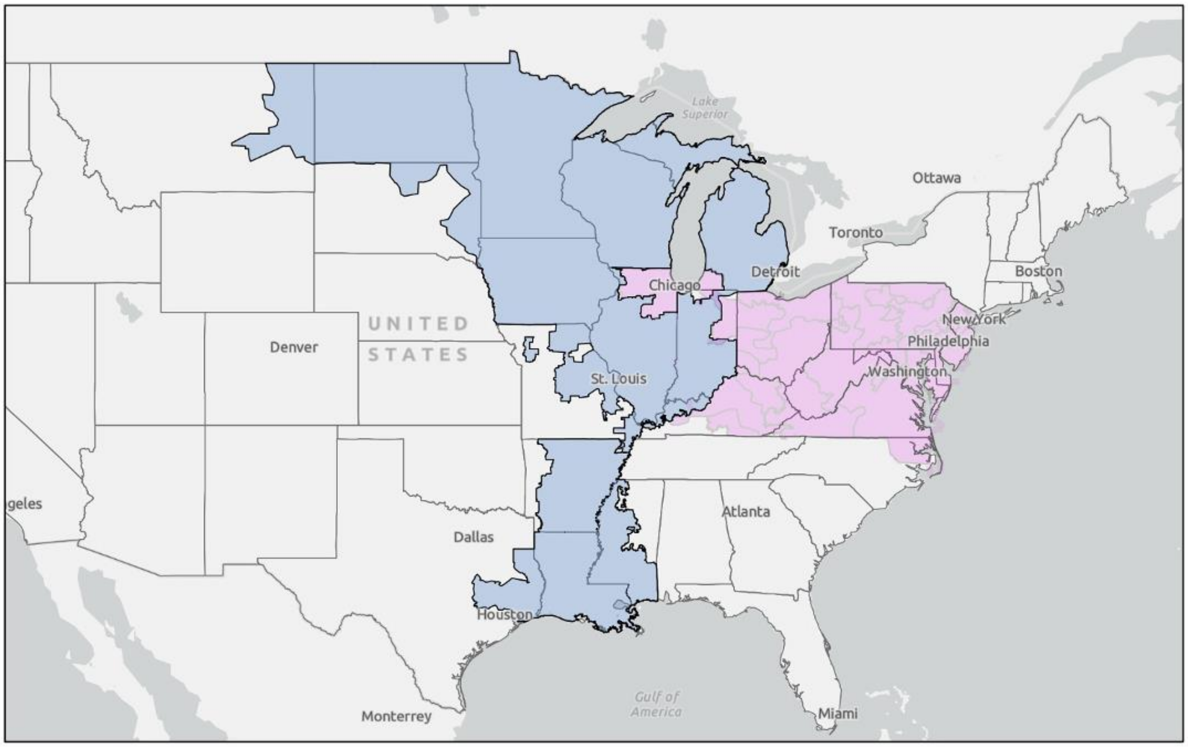

Figure 3: Map created in ArcGIS Online highlighting the boundary between PJM Interconnection and Midcontinent Independent System Operator, with Illinois uniquely split between the two grid operators. Northern Illinois, including the Chicago region, lies within PJM, while central and southern Illinois fall under MISO. This division shapes interconnection processes and influences data center siting decisions.

Within the national electricity system, Illinois occupies a somewhat unusual position. As shown in Figure 3, the state is split between two major grid operators. Northern Illinois, including Chicago and its surrounding suburbs, falls under PJM Interconnection, which is the largest grid operator in the country and serves roughly 67 million customers across 13 states[26]. The rest of the state is served by the Midcontinent Independent System Operator, which covers most of the central

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[26] "PJM | Federal Energy Regulatory Commission." *Federal Energy RegulatoryCommission*, FERC, 2026, www.ferc.gov/industries-data/electric/electric-power-markets/pjm.

United States and serves over 45 million customers across 15 states[27]. This split matters for data center development because it means there is not a single unified planning system governing how large new electricity loads are added in Illinois. Instead, projects in Northern Illinois are evaluated through PJM, while those in the rest of the state go through MISO. Both systems are facing increasing pressure from the rapidly growing demand, particularly from data centers[28]. That makes an already split system even more complicated to manage.

Layered on top of this grid structure is Illinois's ambitious climate policy. The Climate and Equitable Jobs Act was signed into law in 2021 and commits Illinois to 100% carbon-free electricity by 2045 and sets a series of interim targets along the way. It is often regarded as one of the most comprehensive clean energy laws in the country because it goes beyond generation targets to include workforce development, environmental justice, and the planned phaseout of fossil fuel plants[29]. In practice, this means that coal and natural gas retirements are already built into Illinois's long-term grid planning, while new data center demand is adding additional pressure on top of that transition. As older plants retire and are replaced mainly by wind and solar, the gap between supply and demand is shrinking faster than expected[30]. This creates a situation where decarbonization goals and rising electricity demand are happening on the same timeline rather than in sequence. Without dedicated clean

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[27] Amy Antoniolli, Jena Watson. "Illinois's Data Center Boom: Incentives, Grid Pressures, and What to Watch." *ArentFox Schiff*, 28 Jan. 2026.

[28] Chilsen, Jim. *Data Center Distress: Cub, NRDC Experts Warn PJM States Could Get Hit with Forced Blackouts, $163b in Electricity Capacity Costs | Citizens Utility Board*, Citizens Utility Board Fighting for Illinois Consumers, 23 Oct. 2025, www.citizensutilityboard.org/blog/2025/10/23/data-center-concerns-cub-nrdc-experts-warn-pjm-states-could-get-hit-with-forced-blackouts-163b-in-additional-electricity-capacity-costs/.

[29] Amy Antoniolli, Jena Watson. "Illinois's Data Center Boom: Incentives, Grid Pressures, and What to Watch." *ArentFox Schiff*, 28 Jan. 2026.

[30] Amy Antoniolli, Jena Watson. "Illinois's Data Center Boom: Incentives, Grid Pressures, and What to Watch." *ArentFox Schiff*, 28 Jan. 2026.

baseload capacity from the data center operators themselves, this surge in demand could undermine the carbon targets Illinois is relying on for its energy future. This tension sits at the core of the policy debate discussed later in this paper.

The real-world impact of this mismatch is already showing up in people's electricity bills. Capacity prices, which are the reserve electricity costs passed through to utility customers, hit record highs in both PJM and MISO markets in 2025. According to an analysis by the Independent Market Monitor for PJM, about 70% of that year's $9.3 billion increase in electricity costs was driven by data center demand[31]. Customers in the ComED and Ameren service areas felt this directly when a June 2025 price adjustment resulted in some consumers reporting triple-digit increases in their monthly bills[32]. Looking ahead, the Illinois Environmental Council estimates that without stronger regulatory guardrails, data center growth could increase statewide electricity costs by $37 billion through 2050. This 24% increase would ultimately be spread across all Illinois ratepayers[33]. These projected costs have begun to attract legal and regulatory scrutiny. A 2025 Harvard Law analysis found that utility rate structures are effectively forcing everyday ratepayers to subsidize discounted electricity for large technology companies. In response, community groups across several states have begun exploring litigation and

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[31] Chilsen, Jim. *Data Center Distress: Cub, NRDC Experts Warn PJM States Could Get Hit with Forced Blackouts, $163b in Electricity Capacity Costs | Citizens Utility Board*, Citizens Utility Board Fighting for Illinois Consumers, 23 Oct. 2025, www.citizensutilityboard.org/blog/2025/10/23/data-center-concerns-cub-nrdc-experts-warn-pjm-states-could-get-hit-with-forced-blackouts-163b-in-additional-electricity-capacity-costs/.

[32] Chilsen, Jim. *Data Center Distress: Cub, NRDC Experts Warn PJM States Could Get Hit with Forced Blackouts, $163b in Electricity Capacity Costs | Citizens Utility Board*, Citizens Utility Board Fighting for Illinois Consumers, 23 Oct. 2025, www.citizensutilityboard.org/blog/2025/10/23/data-center-concerns-cub-nrdc-experts-warn-pjm-states-could-get-hit-with-forced-blackouts-163b-in-additional-electricity-capacity-costs/.

[33] *Data Center Power Play in Illinois - How Clean Energy Can Meet Rising Electricity Demand While Delivering Climate and Health Benefits*, Union of Concerned Scientists, Jan. 2026, www.ucs.org/sites/default/files/2026-01/Data-Center-Power-Play-Illinois_0.pdf.

permitting challenges as tools for demanding cost-neutrality, especially for environmental justice communities[34]. This is all unfolding within an energy system that combines a relatively strong but aging nuclear sector, ambitious clean energy goals and very fragmented regulatory oversight. Together, these pressures are coming together on a capacity market that is already showing signs of strain.

Climate & Weather Stressors

Illinois is already seeing distinct changes in its climate. It sits in a region that is getting warmer and wetter on average while also experiencing more severe dry spells in between. This combination creates a plethora of challenges for energy infrastructure and for data centers in particular. Understanding how Illinois's climate is changing and how those changes interact with data center operations and grid reliability is essential context for evaluating whether the current pace of development is sustainable.

The 2021 Illinois Climate Assessment is the most comprehensive scientific review of the state's climate trajectory, and it found that changes in extreme heat, heavy precipitation, and flooding are already reshaping Illinois's infrastructure, public health, and water systems. These trends are only expected to intensify throughout the century[35]. Illinois is projected to continue warming and becoming wetter overall, with average temperatures expected to rise by about 4-9 degrees Fahrenheit under a lower emissions scenario and 8-14 degrees under a higher one[36].

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[34] Martin, Eliza, and Ari Peskoe. "Extracting Profits from the Public: How Utility Ratepayers Are Paying for Big Tech's Power." Harvard Law School Environmental & Energy Law Program, Mar. 2025, eelp.law.harvard.edu/extracting-profits-from-the-public-how-utility-ratepayers-are-paying-for-big-techs-power/.

[35] Wuebbles, Donald, et al. *An Assessment of the Impacts of Climate Change in Illinois*, The Nature Conservancy, 2021, www.nature.org/content/dam/tnc/nature/en/documents/IL_Climate_Assessment_2021.pdf.

[36] "Climate Change in Illinois." *Illinois Water Survery-Illinois State Climatologist*, University of Illinois-Urbana Champaign, 2022, stateclimatologist.isws.illinois.edu/climate-change-in-illinois/.

These projections are already showing up in the historical record. Average temperatures in Illinois have increased by roughly 1-2 degrees F across most regions, and nighttime temperatures have risen about three times faster than daytime temperatures over the past century[37]. At the same time, precipitation has increased by about 5-20%, and heavy rainfall events (which is defined as days with at least 2 inches of rain) have increased by roughly 40%[38]. Together, these shifts toward warmer temperatures and more intense precipitation are contributing to less predictable weather patterns and placing additional stress on infrastructure that was not designed for these extremes.

For data centers, these trends translate into a set of intersecting operational and infrastructure risks that can be grouped into four primary stressors: extreme heat, heavy precipitation and flooding, drought and water stress, and winter weather extremes. While each stressor affects data centers differently, they all expose shared underlying vulnerabilities, including water availability, cooling, and grid reliability.

Extreme Heat

Heat is one of the most immediate and direct climate risks to data center operations. These facilities generate massive amounts of heat as a byproduct of continuous computation, and their cooling systems rely on the surrounding environment to remove that heat. As ambient temperatures rise, those systems have to work harder, draw more power, and operate closer to their limits. Research from the Uptime Institute shows that extreme heat places additional stress on cooling infrastructure by forcing components like compressors, pumps, and fans to run more

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[37] Wuebbles, Donald, et al. *An Assessment of the Impacts of Climate Change in Illinois*, The Nature Conservancy, 2021, www.nature.org/content/dam/tnc/nature/en/documents/IL_Climate_Assessment_2021.pdf.

[38] Doran, Tom. "Scientific Assessment Focuses on Illinois Climate." *AgriNews*, AgriNews, 23 Apr. 2021, www.agrinews-pubs.com/news/science/2021/04/22/scientific-assessment-focuses-on-illinois-climate/.

intensely and increasing the likelihood of failure[39]. What this means in practice is that higher temperatures do not just increase energy demand, but they also reduce system reliability at the exact moment when demand is highest. As heat waves become more frequent and intense, data centers are pushed into a tighter operating margin, where even small disruptions can cascade into larger performance or outage risks.

The consequences of ignoring these risks are not hypothetical. In September 2022, Twitter's Sacramento data center was knocked completely offline during a California heat wave in what the company's vice president of engineering described as an "unprecedented event" that led to a total shutdown of physical equipment at the site. A former head of security later testified to the U.S. Senate Judiciary Committee that even a temporary, overlapping outage of a small number of data centers could take the platform offline for weeks, months, or potentially longer. Engineers had raised warnings internally, but leadership failed to act on them. That same summer, both Google and Oracle data centers in London went offline when temperatures exceeded 104 degrees Fahrenheit[40]. These extreme heat events would have been virtually unimaginable under historical climate baselines. While Sacramento and London are different climate contexts from Northern Illinois, the underlying vulnerability is the same. Facilities are designed around historical temperature ranges that are no longer reliable. Illinois's projected increase in extreme heat days means this category of risk is no longer a distant concern, but an

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[39] Donnellan, Douglas, et al. "Uptime Institute Global Data Center Survey 2024." *UII Keynote Report*, Uptime Intelligence, July 2024, datacenter.uptimeinstitute.com/.GlobalDataCenterSurvey.Report.pdf.

[40] Data Center Knowledge.*Twitter Data Center Knocked Offline by Scorching California Heat*, Data Center Knowledge, 3 June 2024, www.datacenterknowledge.com/cooling/twitter-data-center-knocked-offline-by-scorching-california-heat.

increasingly immediate planning challenge for data center facilities being developed across the Chicago metropolitan area.

Illinois summers are already hot and humid, and humidity is a major constraint on data center cooling strategies[41]. The most energy-efficient cooling approaches, such as air-side economization and evaporative cooling, depend on either cool, dry air outside or evaporation to remove heat. When dew points are high, which is becoming more common across Midwest summers, both methods become significantly less effective[42]. In practice, this means that data centers are often forced to rely on mechanical refrigeration instead of "free" or low-energy cooling options during the exact periods when cooling demand is highest. This increases electricity consumption at the same time the grid is already under strain from residential and commercial air conditioning demand[43]. When this happens, there is a layered peak load problem that is harder to manage and smooth out.

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[41] Henry, Chelsea, and Alan W. Black. "Land Cover and Trends in Temperature and Dew Point in Illinois." *Meteorology*, vol. 4, no. 2, 29 Apr. 2025, p. 12, https://doi.org/10.3390/meteorology4020012.

[42] Donnellan, Douglas, et al. "Uptime Institute Global Data Center Survey 2024." *UII Keynote Report*, Uptime Intelligence, July 2024, datacenter.uptimeinstitute.com/.GlobalDataCenterSurvey.Report.pdf.

[43] Silva-Llanca, Luis, et al. "Improving energy and water consumption of a data center via air free-cooling economization: The effect weather on its performance." *Energy Conversion and Management*, vol. 292, Sept. 2023, p. 117344, https://doi.org/10.1016/j.enconman.2023.117344.

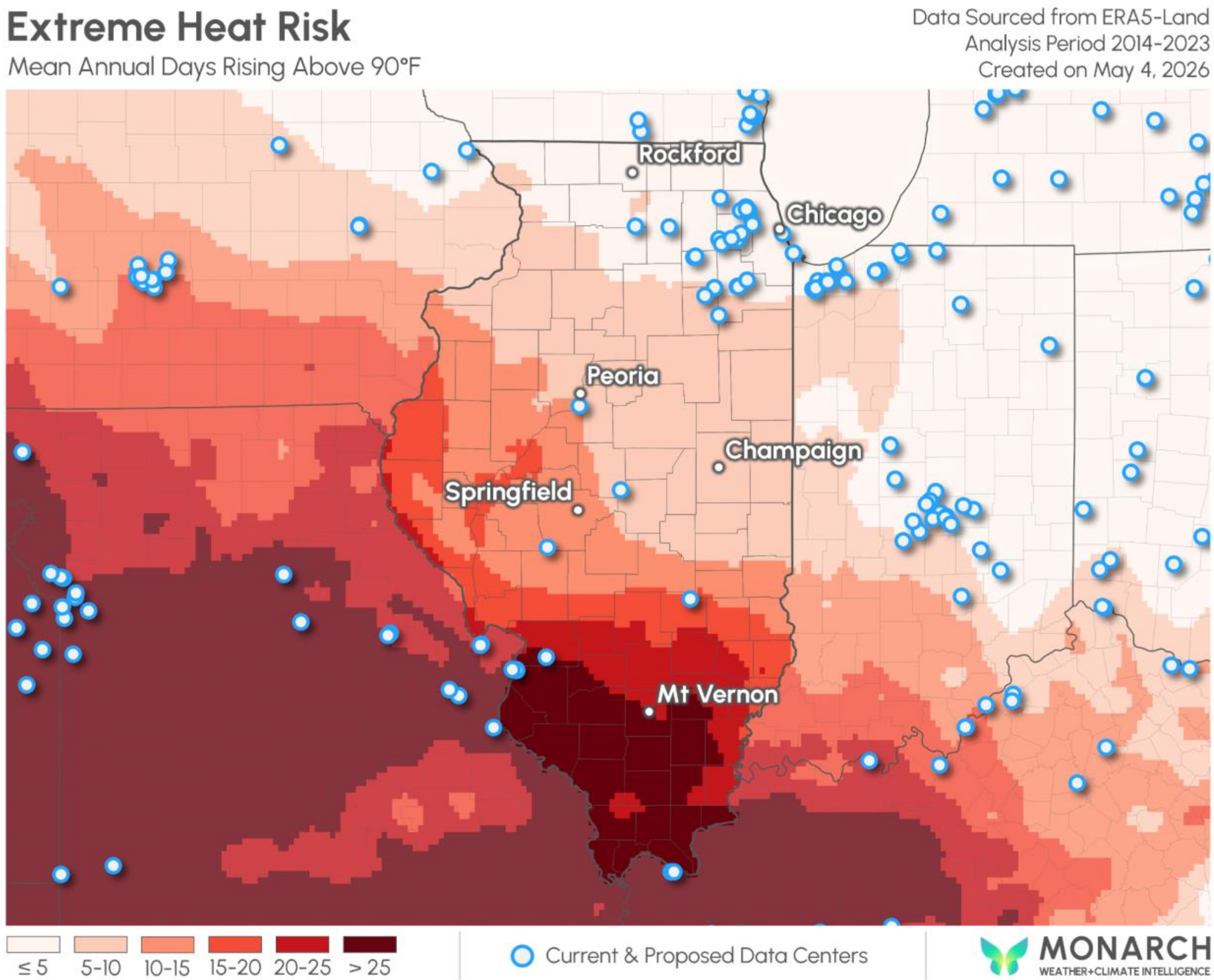

Figure 4: Mean annual number of days with maximum temperatures rising above 90°F across Illinois, averaged over the 2014-2023 period using ERA5-Land reanalysis data. Current and proposed data center locations are overlaid as blue points. The clear north-to-south gradient in extreme heat exposure is visible, with southern Illinois experiencing significantly more high-heat days than the Chicago metropolitan region. Data processed and mapped by Monarch Weather and Climate Intelligence (2026).

As shown in Figure 4, there is a clear north-to-south gradient in extreme heat exposure across Illinois, with the Chicago metropolitan area on the lower end of the range compared to the rest of the state. But that should not be interpreted as low risk. The urban heat island effect — the tendency for dense urban areas to retain more heat due to pavement, buildings, and limited vegetation — adds several degrees of additional warming on top of the regional baseline, so facilities in the O'Hare corridor and Chicago region are often operating in warmer conditions than the surrounding rural areas. Looking ahead, the number of days above 95°F in northern

Illinois is projected to increase from roughly 1-2 days per year historically to as many as 10-60 days by 2090 under a lower emissions scenario, and up to 25-90 days under a higher one[44]. Over time, that trend pushes these facilities further outside the conditions their cooling systems were originally designed for.

The implications extend beyond individual facilities. When extreme heat events drive up cooling demand across multiple data centers at the same time, that load is added directly onto the grid during times when residential and commercial air conditioning is already at its peak[45]. What begins as a facility-level efficiency issue quickly becomes a system-wide challenge, as these overlapping demands compress into the same hour rather than being spread out[46]. As the number and size of data centers continue to grow, this synchronization of demand is becoming harder for grid operators to anticipate and manage.

HEAVY PRECIPITATION AND FLOODING

While flooding is a longstanding hazard in Illinois, recent trends indicate it is becoming more frequent and more intense. Flooding from rivers and streams has already increased and is expected to become more frequent, especially along major systems like the Mississippi and Illinois Rivers[47]. At the same time, the issue is not

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[44] Wuebbles, Donald, et al. *An Assessment of the Impacts of Climate Change in Illinois*, The Nature Conservancy, 2021, www.nature.org/content/dam/tnc/nature/en/documents/IL_Climate_Assessment_2021.pdf.

[45] Silva-Llanca, Luis, et al. "Improving energy and water consumption of a data center via air free-cooling economization: The effect weather on its performance." *Energy Conversion and Management*, vol. 292, Sept. 2023, p. 117344, https://doi.org/10.1016/j.enconman.2023.117344.

[46] Lukawski, Maciej, et al. "Demand Response for Reducing Coincident Peak Loads in Data Centers." *Proceedings of the Annual Hawaii International Conference on System Sciences*, Jan. 2019, https://doi.org/10.24251/hicss.2019.413.

[47] Marti, Mackenzie K. Marti and Thomas M. Over K, and Thomas M Over. "Peak Streamflow Trends in Illinois and Their Relation to Changes in Climate, Water Years 1921–2020." *Science for a Changing World*, USGS, 17 June 2024, www.usgs.gov/publications/peak-streamflow-trends-illinois-and-their-relation-changes-climate-water-years-1921.

just how much precipitation the state receives, but how it is distributed. Rainfall is increasingly concentrated into fewer, more intense events rather than spread out across the season[48]. This suggests a broader shift toward more variable and extreme precipitation patterns.

These changing conditions are what make the system more difficult to manage. Heavier downpours increase the likelihood of flooding, while longer dry periods between storms allow the soil to dry out and reduce its ability to absorb water when rain does arrive. As temperatures continue to rise, higher evaporation rates are expected to intensify drought conditions even as extreme precipitation events become more severe[49]. This means that Illinois is more frequently experiencing both extremes within the same year rather than one or the other.

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[48] Kunkel, K.E. *NOAA National Centers for Environmental Information Illinois State Climate Summaries 2022*, State Summaries, 1 Jan. 2022, statesummaries.ncics.org/chapter/il/.

[49] Seneviratne, Sonia I, and Xuebin Zhang. "Chapter 11: Weather and Climate Extreme Events in a Changing Climate." *Climate Change 2021: The Physical Science Basis*, 2021, doi: 10.1017/9781009157896.013.

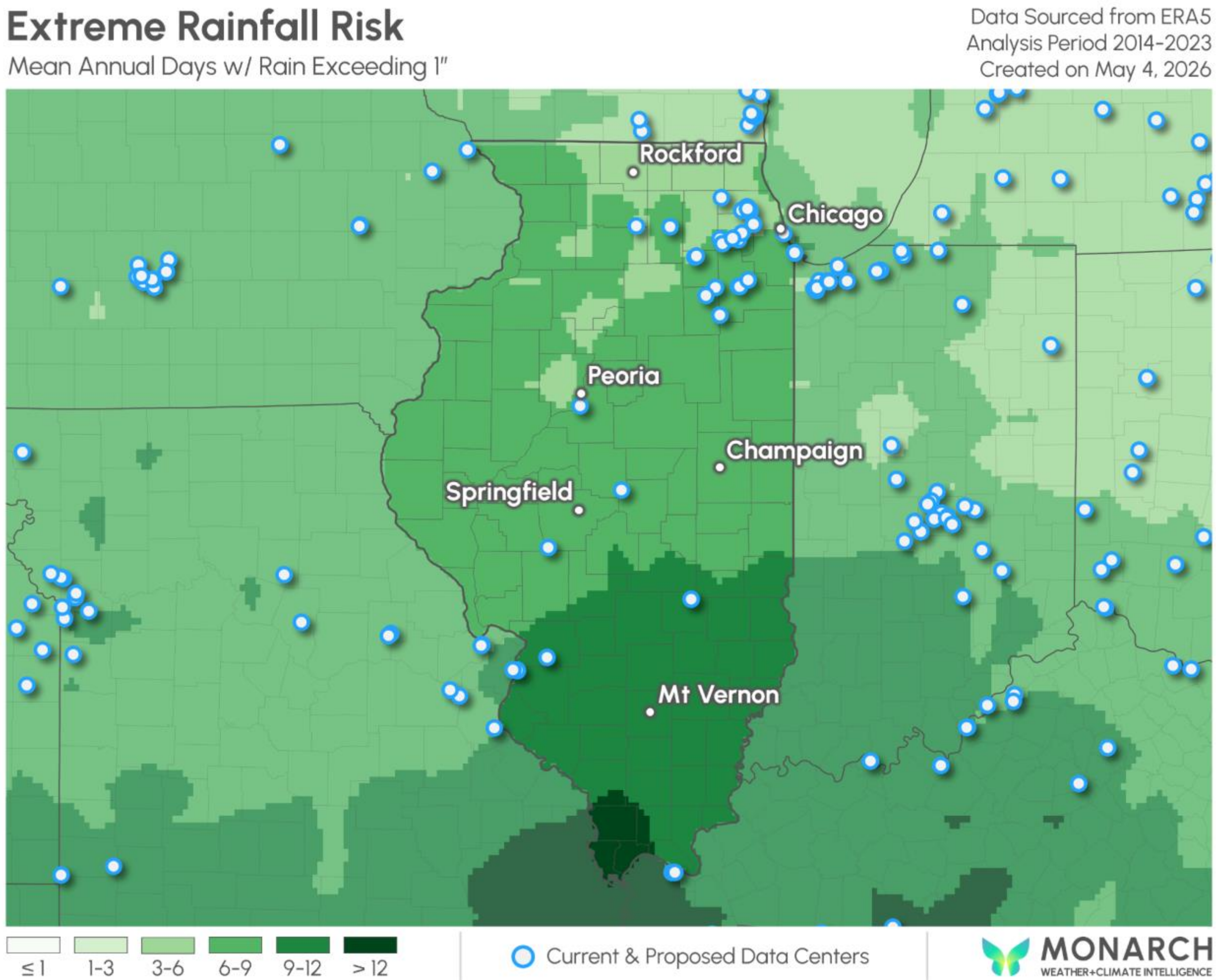

Figure 5: Mean annual number of days with total rainfall exceeding one inch across Illinois, averaged over the 2014-2023 period using ERA5 reanalysis data. Current and proposed data center locations are overlaid as blue points. Extreme rainfall frequency follows a south-to-north gradient, with southern Illinois experiencing considerably more high-precipitation days than the Chicago metropolitan region. Data processed and mapped by Monarch Weather and Climate Intelligence (2026).

Figure 5 shows that extreme rainfall is more frequent in southern Illinois and decreases moving north, with the Chicago metropolitan area on the lower end of the statewide range. But that does not mean precipitation risk is low. The more important issue is not how heavy rain falls, but what happens when it does. Chicago's stormwater infrastructure was largely designed for historical precipitation patterns that no longer reflect current conditions, so even a limited number of high-intensity rainfall events can lead to localized flooding, especially when combined with aging sewer systems and a highly impervious urban landscape[50]. For data centers, the consequences are direct. Most facilities are built at grade with extensive underground infrastructure, including cable vaults, utility connections, and fuel storage systems, which are all vulnerable if water enters the site[51]. Even relatively shallow flooding can disrupt power delivery or damage critical equipment that is not designed for water exposure.

This creates a spatial mismatch that is difficult to ignore. The locations that are most attractive for data center development are also the areas with the highest urban flooding risk, with the oldest stormwater infrastructure, and the most limited capacity for mitigation. As shown in Figure 5, the Chicago metropolitan area concentrates both realities in the same region that is highly desirable for its fiber and transmission infrastructure but is also increasingly exposed to the precipitation extremes that infrastructure was never designed to handle. The facilities being built there today will need to operate reliably for 20 to 30 years in a flood environment that looks different from the one their designers planned for.

Drought and Water Stress

Illinois's climate future is not simply becoming wetter; it is becoming more variable, with more intense periods of heavy precipitation and more prolonged dry spells occurring within the same annual cycle. The 2021 Illinois Climate Assessment projects increases in both heavy rainfall and the length of dry spells, along with rising summer temperatures that are expected to intensify naturally occurring drought

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[50] Brett Chase, Chicago Sun-Times. "Flooding in Chicago Is Getting Worse. Here's Why." *Inside Climate News*, 6 May 2026, insideclimatenews.org/news/04052026/chicago-flooding-climate-change/.

[51] Donaldson, Richard. "Water: The Overlooked Infrastructure Challenge for Data Centers." *Water Infrastructure Challenges in Data Centers*, WSP, 14 Oct. 2025, www.wsp.com/en-us/insights/the-overlooked-infrastructure-challenge-for-dc.

conditions[52]. This kind of variability has direct implications for the water resources that data centers rely on for cooling.

As discussed previously, most large data centers use evaporative cooling systems that consume significant amounts of water. Under typical conditions, Illinois's relatively abundant surface and groundwater supplies make this feasible. However, recent drought conditions show how quickly that availability can change. Between August and early October in 2025, much of the state experienced dry conditions, with at least moderate drought covering 86% of Illinois, severe drought affecting 43%, and pockets of extreme drought in east-central regions[53]. These classifications are based on the U.S. Drought Monitor, which integrates precipitation, soil moisture, and hydrologic indicators to assess drought intensity and impacts. During the same period, much of central and northern Illinois was 8-15 inches below normal precipitation for the 2024-2025 water year, and multiple rivers reached low or no-flow conditions, including the Illinois River (State climatologist). These conditions show how quickly water availability in Illinois can shift, which raises questions about how reliable long-term resources are for data centers.

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[52] Wuebbles, Donald, et al. *An Assessment of the Impacts of Climate Change in Illinois*, The Nature Conservancy, 2021, www.nature.org/content/dam/tnc/nature/en/documents/IL_Climate_Assessment_2021.pdf.

[53] Ford, Trent. "Illinois Drought Update: Illinois State Climatologist Illinois State Water Survey Pri Illinois." *Illinois State Climatologist*, 24 Dec. 2025, stateclimatologist.isws.illinois.edu/2025/10/09/illinois-drought-update/.

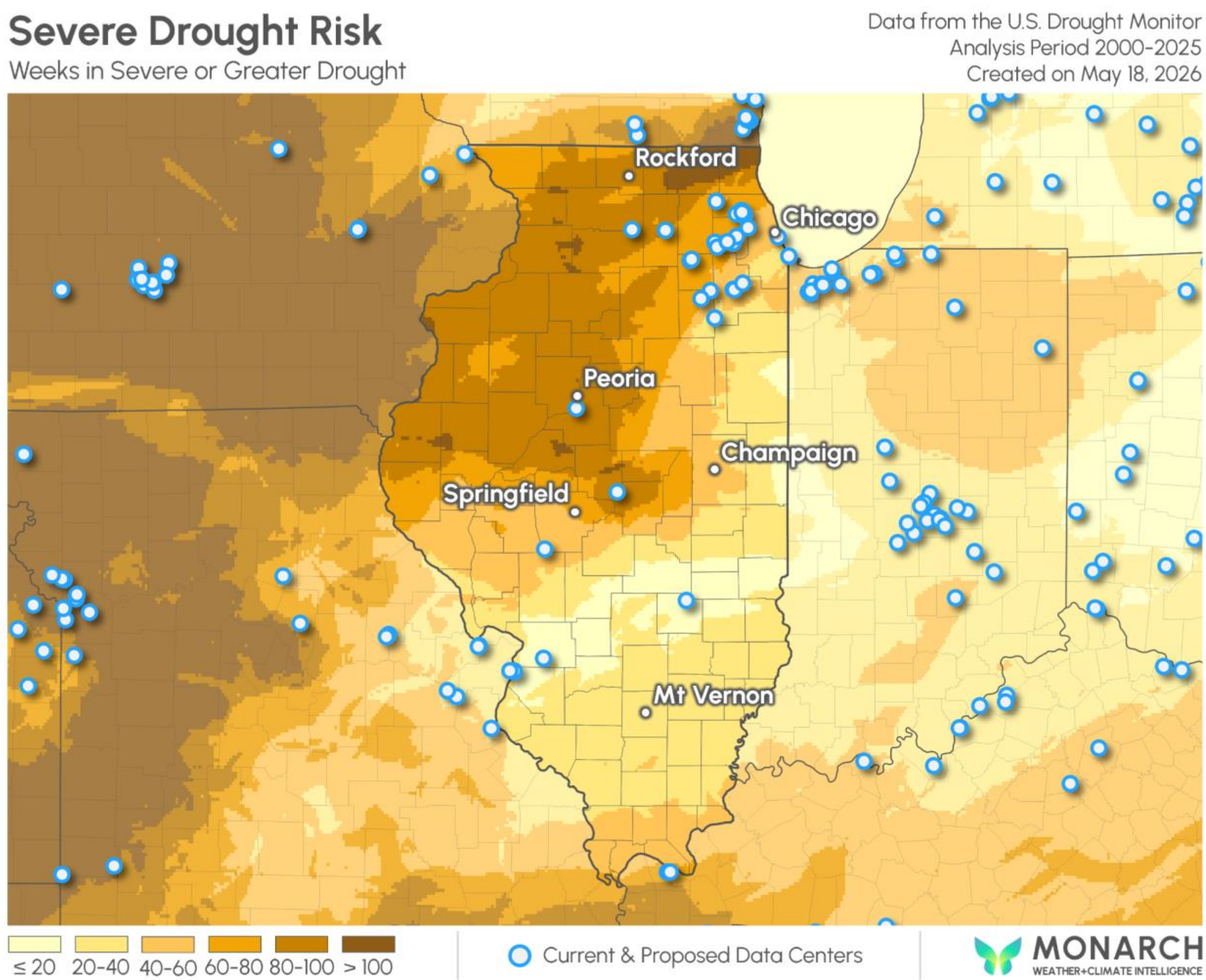

Figure 6: Total weeks in severe or greater drought across Illinois over the 2000–2025 period, based on U.S. Drought Monitor classifications. Current and proposed data center locations are overlaid as blue points. Drought accumulation follows a general north-to-south gradient, with northern Illinois experiencing the greatest cumulative exposure, exceeding 100 weeks in some locations. A distinct band of relatively low drought frequency (fewer than 20 weeks) stretches east-west across central Illinois just south of Springfield, while the southern tip of the state shows moderate accumulation. Data processed and mapped by Monarch Weather and Climate Intelligence (2026).

Figure 6 shows the cumulative weeks of severe or greater drought across Illinois over the past 25 years, and the spatial pattern that emerges is striking in the context of where data centers are concentrated. Unlike the heat and precipitation maps, which follow a consistent north-to-south gradient, drought accumulation is more uneven across the state. Northern Illinois, particularly the areas around the Wisconsin border and the Chicago metropolitan region carry the heaviest cumulative burden with roughly 60-100+ weeks in severe drought. That is the same region where data center development is most concentrated, which means the facilities with the greatest water demand for cooling are located in the part of the state that has experienced the most sustained drought pressure over time. The 2021 Illinois Climate Assessment projects longer dry spells and rising summer temperatures, suggesting that the historical pattern shown here understates what the coming decades will look like[54]. For a sector that depends on reliable, large-volume water access to sustain cooling systems, this overlap between drought exposure and infrastructure concentration is not a coincidence. It is a locational mismatch that is already embedded in current development patterns.

When surface water levels drop and municipalities face their own supply constraints, data center water use becomes a direct point of competition with other users. A facility drawing millions of gallons per day from a stressed municipal system is no longer operating in the background as it becomes visible to the public and something that regulators can no longer ignore[55]. This has already played out in other parts of the country and Illinois is not exempt. A 2026 Illinois bill would require data centers to report expected and actual water use and sourcing[56]. This would be a significant improvement because it suggests that this information is not currently being tracked consistently and that those gaps themselves create a governance issue.

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[54] Wuebbles, Donald, et al. *An Assessment of the Impacts of Climate Change in Illinois*, The Nature Conservancy, 2021, www.nature.org/content/dam/tnc/nature/en/documents/IL_Climate_Assessment_2021.pdf.

[55] Grimm, Marie, et al. "Regulating Data Center Water Use in California." *UC Berkeley Law*, 9 Feb. 2026, www.law.berkeley.edu/research/clee/research/wheeler/water-innovation/data-center-water-use/.

[56] Dahunsi, Abisola. "Illinois Lawmakers Debate Data Center Regulations in Response to Growing Energy and Water Use Concerns." *Saint Louis Public Radio Science Friday*, NPR, 1 May 2026, www.stlpr.org/health-science-environment/2026-05-01/illinois-lawmakers-debate-data-center-regulations-in-response-to-growing-energy-and-water-use-concerns.

Drought is often treated as a regional problem belonging to the American West, and Illinois has historically been protected from that narrative because of its rivers, lakes, and relatively consistent precipitation. But the 2025 drought made it clear that this assumption does not always hold. In a single season, the state shifted from what looked like adequate water availability to conditions where 43% of its area was in severe drought, and major rivers were running at low or no flow. Data centers depend on continuous, high-volume water access to keep their cooling systems running, so that kind of shift is not an acceptable operational variable. The facilities being built in Northern Illinois today will need water stability for 20 to 30 years in a climate that is trending toward longer dry spells, higher temperatures, and more frequent swings between extremes. Planning around historical water availability in that context is not conservative. It is an increasingly risky assumption.

WINTER WEATHER EXTREMES

Illinois winters present a different but equally significant set of risks for both data centers and the grid they depend on. Polar vortex events that periodically affect the Midwest expose vulnerabilities in natural gas supply, freeze generation equipment, and push electricity demand close to system limits. During the January 2019 polar vortex that hit the Midwest, MISO issued a Maximum Generation Alert due to extreme cold and generator performance issues, and many parts of Illinois experienced outages and localized grid stress[57]. These events show just how quickly winter extremes can stress infrastructure that is assumed to be reliable under normal operating conditions.

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[57] Lee, April. "Extreme Cold in the Midwest Led to High Power Demand and Record Natural Gas Demand - U.S. Energy Information Administration (EIA)." *Today in Energy*, EIA, 26 Feb. 2019, www.eia.gov/todayinenergy/detail.php?id=38472.

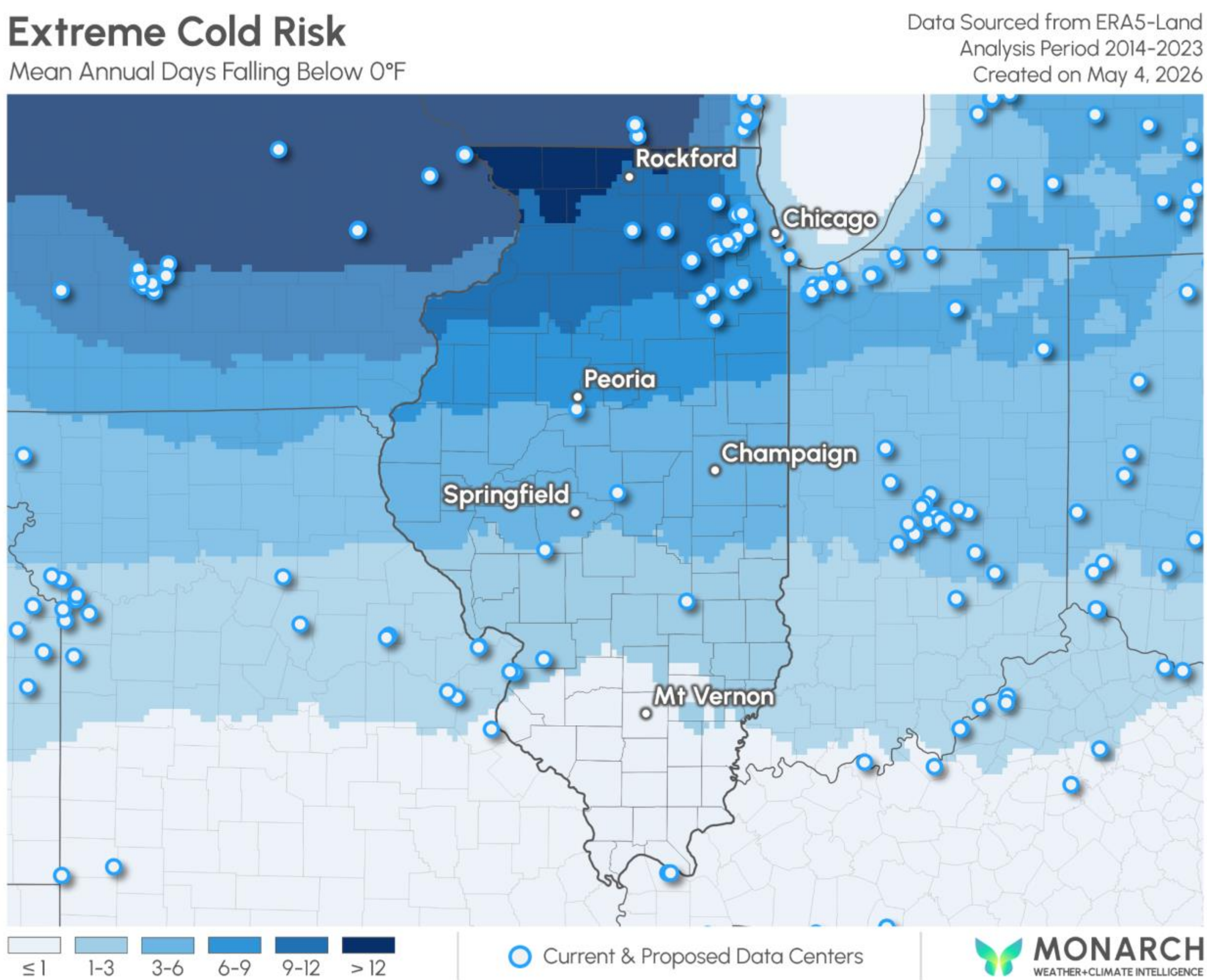

Figure 7: Mean annual number of days with minimum temperatures dropping below 0°F across Illinois, averaged over the 2014-2023 period using ERA5-Land reanalysis data. Current and proposed data center locations are overlaid as blue points. Extreme cold exposure increases sharply from south to north, with northwestern Illinois averaging more than twelve such days per year. A thermal anomaly is visible around Lake Michigan, where lake-effect dynamics moderate temperatures closest to the shoreline. Data processed and mapped by Monarch Weather and Climate Intelligence (2026).

Figure 7 shows the distribution of extreme cold exposure across Illinois using mean annual days below 0°F. The pattern is almost the reverse of the heat map, with cold risk increasing as you move north. Northwestern Illinois averages more than twelve days per year below 0°F, while southern Illinois rarely experiences those conditions. The Chicago metropolitan area sits in a middle range, shaped partly by Lake Michigan's moderating effect. Areas closer to the shoreline are buffered compared to inland locations at the same latitude, which creates a visible gradient moving outward from the lake. But that buffer is limited. Much of the northern

Illinois data center cluster still falls within the zone where polar vortex conditions can drive temperatures low enough to stress both physical infrastructure and the grid at the same time. Importantly, the lake buffer visible in Figure 7 narrows significantly during the most extreme cold events. During the 2019 polar vortex, Chicago recorded -23°F with wind chills approaching -52°F[58]. At those extremes, the gradient between lakefront and inland sites effectively disappears. Even though data centers near the shoreline are supposed to benefit from the lake's moderating effect, they can still face nearly the same extreme cold risk as inland sites at the same latitude.

In January 2026, Winter Storm Fern brought an extended period of extreme cold, widespread snow, and ice across a large portion of the United States as well as parts of Canada and northern Mexico. This storm lasted much longer and was more sustained than most winter events. Data centers were put on high alert as Fern raised concerns about operational disruptions, and the U.S Department of Energy issued an emergency order allowing utilities to reduce large electricity loads, including data centers, if needed to stabilize the grid[59]. At the same time, PJM Interconnection projected that peak demand across its 13-state region would exceed 130,000 megawatts for seven consecutive days, which had never happened during a winter event before[60]. Because of how sustained the great demand was, it pushed the system into a prolonged stress as opposed to a short-lived peak.

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[58] Fritz, Angela. "Chicago Faces Its Coldest Day on Record as Midwest Plunges into Deep Freeze." *The Washington Post*, 30 Jan. 2019, washingtonpost.com/weather/2019/01/30/chicago-faces-its-coldest-day-record-midwest-plunges-into-deep-freeze/.

[59] "Energy Secretary Issues Emergency Orders to Deploy Backup Generation in the Mid-Atlantic and Carolinas Following Winter Storm Fern." *Energy.Gov*, 26 Jan. 2026, www.energy.gov/articles/energy-secretary-issues-emergency-orders-deploy-backup-generation-mid-atlantic-and.

[60] McGovern, Jason. "Jan. 25 Update on PJM Cold Weather Operations." *PJM Inside Lines*, 25 Jan. 2026, insidelines.pjm.com/pjm-issues-precautionary-alerts-ahead-of-expected-cold-spell/.

For data centers, extreme cold creates two main problems. First, it can physically disrupt infrastructure by freezing outdoor systems like cooling towers, piping, and backup generators that are not designed for long periods of subzero temperatures[61]. It is worth noting that these systems do not usually start to fail until closer to -10°F or below, meaning that figures tracking days below 0°F likely understate the frequency of conditions capable of causing direct physical infrastructure damage. The second is more important at the system level, at which point operators are forced to choose between continuing normal operations while drawing heavily from a grid that is already near its limits. The other option is to switch to on-site backup diesel generation, which introduces its own reliability and emissions tradeoffs[62]. While backup systems are designed for short-term interruptions, they are not seamless at scale, and large simultaneous switches can create abrupt swings in demand that add further strain to the grid. This turns what is supposed to be a resilience measure into another source of instability under extreme conditions.

The irony is that cold weather is actually beneficial for data center cooling since outside air can be used to reduce reliance on mechanical refrigeration. But that advantage largely disappears during extreme events when the broader grid is under stress and reliability becomes the primary concern. In that context, data centers are not separate from the system. They are fully embedded in it and share the same vulnerabilities as other large electricity users rather than operating alone. One thing to keep in mind is that the grid does not handle extreme cold the same way

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[61] Lawrence, Andy. *Extreme Cold - A Neglected Threat to Availability?*, Uptime Institute Blog, 1 Mar. 2021, journal.uptimeinstitute.com/extreme-cold-a-neglected-threat-to-availability/.

[62] Kambhampati, Viswambher, et al. "Moving beyond diesel generators: Exploring renewable backup alternatives for Data Centers." *Journal of Physics: Conference Series*, vol. 2929, no. 1, 1 Dec. 2024, p. 012008, https://doi.org/10.1088/1742-6596/2929/1/012008.

everywhere. Urban areas have higher overall demand, but they usually have more redundancy and can recover faster. Meanwhile, a lot of Illinois's data centers are in more suburban areas where the grid relies more on overhead lines and has less built-in backup, so those areas can be more vulnerable to outages during the same cold event.

Compounding Climate Stressors

Taken together, these four primary stressors help paint a picture of the accumulation of ongoing pressures on a system that is already operating with limited margins in terms of available grid capacity, the pace of clean energy transition, and the cooling water demands that Illinois's climate increasingly complicates. An analysis from the World Economic Forum and S&P Global estimates that climate-related costs could reach the equivalent of 9.5% of total data center asset value by 2055 under a high-emissions scenario, with extreme heat driving most of that impact[63]. At the same time, the NOAA National Centers for Environmental Information data shows that Illinois experienced 128 billion-dollar weather and climate disasters between 1980 and 2024, including droughts, floods, severe storms, and winter events, with the annual average rising from 2.8 events per year to 7.8 in just the past five years[64]. The key issue is not only that these events are occurring, but that they are becoming more frequent and compounding over time, creating a pattern that increases long-term risk for infrastructure.

Illinois's data center industry is being built around climate assumptions that are already starting to break down. The facilities being permitted and constructed

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[63] Einhorn, Gill, and Dominic King. "The $3.3 Trillion Question: Can Data Centers Take the Heat?" *World Economic Forum*, 10 Oct. 2025, www.weforum.org/stories/2025/10/data-centres-3-3-trillion-question-heat-cooling/.

[64] NOAA National Centers for Environmental Information (NCEI) U.S. *Billion-Dollar Weather and Climate Disasters* (2025). www.ncei.noaa.gov/access/billions/state-summary/IL, DOI:10.25921/stkw-7w73

today will operate for decades under conditions that look very different from the historical climate their cooling and power systems were designed for. The Monarch Weather and Climate Intelligence visuals referenced throughout this section illustrate how these risks vary spatially across Illinois and ground these broader trends in specific locations where development is taking place.

Sustainability Strategies & Solutions

What tools exist to reduce the environmental footprint of data centers, and how far are they realistically being implemented in practice? The short answer is that there is real progress, but it is uneven, and demand is still outpacing efficiency gains in ways that matter for Illinois's long-term planning. Even where more sustainable practices and measures are being adopted, these improvements tend to be incremental rather than transformative at the scale of growth projected over the next decade.

Facility-Level Efficiency

The most immediate thing operators can improve is how efficiently each facility runs. Industry-wide Power Usage Effectiveness (PUE) has improved significantly over the past decade, with hyperscale data centers now often operating in the 1.1-1.2 range, reflecting significant gains in cooling and infrastructure design[65]. At the same time, more advanced cooling approaches are becoming standard, especially liquid cooling systems that bring coolant directly to hardware rather than relying on air circulation. For example, Microsoft reports that its direct-to-chip and evaporative-free designs can save over 125 million liters of water per facility per

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[65] Davis, Jacqueline. "Large Data Centers Are Mostly More Efficient, Analysis Confirms." *Uptime Institute Blog*, 9 Feb. 2024, journal.uptimeinstitute.com/large-data-centers-are-mostly-more-efficient-analysis-confirms/.

year compared to traditional cooling systems[66]. Air-side economization can also reduce energy use by using outside air when conditions allow, but as discussed in the climate section, Illinois's humid summers limit how often this approach is usable in practice.

These facility-level gains are real, but they have limits that are easy to miss. Research from Lawrence Berkeley National Laboratory shows that while efficiency per unit of compute has improved, total energy use continues to rise due to demand growth being larger than efficiency gains[67]. This is a pattern that is consistent with Jevons' paradox in infrastructure systems, which describes how improvements in efficiency can lead to higher overall resource consumption because lower costs per unit of use drive increased demand across the system. The more fundamental issue is what PUE does not measure. As flagged earlier, operational efficiency metrics like PUE capture only the energy used to run a facility. They say nothing about the emissions embedded in manufacturing the servers, networking equipment, and storage hardware that fill it. Hardware production is actually the larger share of a data center's total lifecycle emissions, yet it is almost entirely absent from industry sustainability reporting[68]. This means that a data center can score at the top of every industry efficiency benchmark and still carry a substantial embedded carbon footprint that none of those metrics capture.

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[66] Chaudhari, Akshay, and Abhirabh Basu "3 Innovation Opportunities in Data Center Water Management." *Lux Research*, 26 Feb. 2026, luxresearchinc.com/blog/3-innovation-opportunities-in-data-center-water management/#:~:text=Microsoft%20has%20disclosed%20that%20its,temperatures%20enabled%20by%20liquid%20cooling.

[67] U.S. Department of Energy, "Doe Releases New Report Evaluating Increase in Electricity Demand from Data Centers." *Energy.Gov*, 20 Dec. 2024, www.energy.gov/articles/doe-releases-new-report-evaluating-increase-electricity-demand-data-centers.

[68] Strubell, Emma, et al. "Energy and policy considerations for Deep Learning in NLP." *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*, 2019, pp. 3645–3650, https://aclanthology.org/P19-1355/.

Renewable Energy

The most visible sustainability strategy in the sector is renewable energy procurement through power purchase agreements (PPAs) and renewable energy certificates (RECs). In theory, this aligns with Illinois's goal of a fully carbon-free electricity system by 2045 under the Climate and Equitable Jobs Act[69]. In practice, however, annual matching systems allow companies to claim renewable energy use without aligning consumption with clean generation in real time. As a result, emissions can remain high during peak demand even when annual accounting appears carbon neutral.

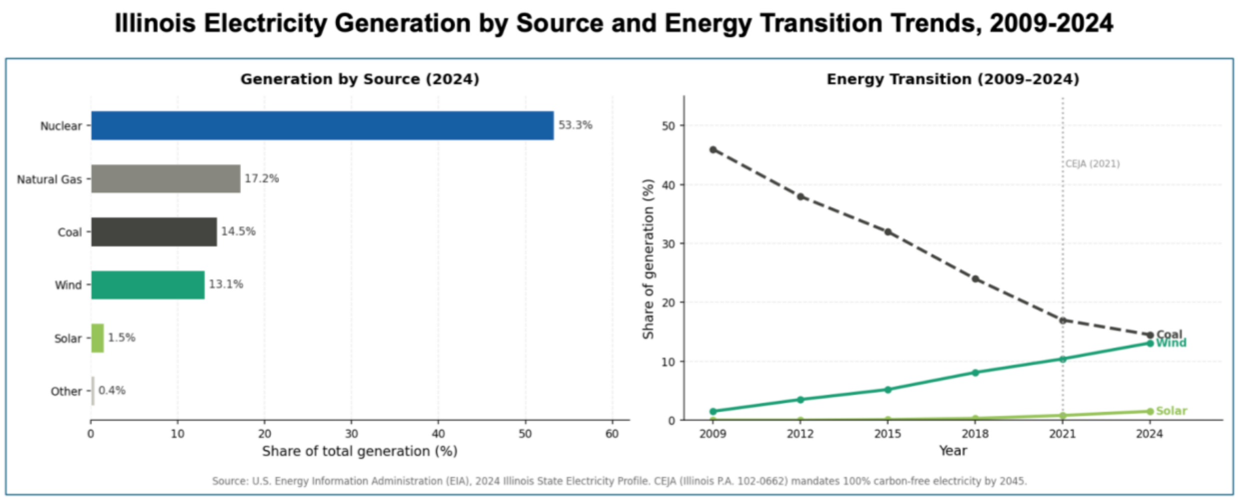

Figure 8: Share of total electricity generation in Illinois by source in 2024, showing nuclear energy's dominant role at 53.3% of statewide output, followed by natural gas (17.2%), coal (14.5%), wind (13.1%), solar (1.5%), and other sources (0.4%). (Right) Trends in coal, wind, and solar generation shares from 2009 to 2024, illustrating the ongoing energy transition under Illinois's decarbonization framework. The vertical dashed line marks the passage of the Climate and Equitable Jobs Act (CEJA) in 2021, which mandates 100% carbon-free electricity by 2045. Data source: U.S. Energy Information Administration (EIA), 2024 Illinois State Electricity Profile.

As Figure 8 shows, Illinois's current energy mix makes the gap between renewable accounting and real-time clean energy delivery particularly significant. Nuclear makes up over half of the state's electricity and provides steady carbon-free

[69] Power, Thomas. "Data Centers: Information Overload for Illinois?" *Third Act*, 6 Feb. 2026, thirdact.org/illinois/2026/02/06/data-centers-information-overload-for-illinois/.

baseload power around the clock. Wind contributes about 13%, while solar is still only 1.5%, which means that during high-demand periods, such as hot summer afternoons, there is often insufficient variable renewable generation to directly match data center load in real time. The right panel reinforces this point. Even after CEJA passed in 2021, the shift away from coal toward wind and solar has been relatively slow. Data center demand is accelerating on a timeline that is fundamentally out of sync with the pace at which the generation mix is changing.

This gap between accounting and actual grid decarbonization is increasingly visible at the industry level. Microsoft has publicly committed to 100% hourly carbon-free energy matching by 2030, but recent reporting shows the company is reconsidering the feasibility of that target as AI-driven data center expansion accelerates electricity demand beyond earlier projections[70]. In response, utilities and developers have increasingly pointed back to natural gas as a near-term reliability solution, highlighting a structural tension between rapid load growth and slower clean energy buildout.

This shows that renewable procurement is widespread, but it does not necessarily reshape how or when electricity is consumed. Illinois has grid decarbonization that is legally mandated on a fixed timeline, and that distinction between accounting and physical grid impact is not merely a technical detail, as it quickly becomes a policy problem.

WATER MANAGEMENT

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[70] Marsh, Alastair, and Brody Ford. "Microsoft Considers Dropping 100/100/0 Clean-Energy Target." *Green Daily*, Bloomberg, 6 May 2026, www.bloomberg.com/news/newsletters/2026-05-06/microsoft-considers-dropping-100-100-0-clean-energy-target.

Water is another major resource issue in data center sustainability, but it receives far less attention than energy in both policy and public discussion. Most large facilities rely on evaporative cooling systems, which use water to remove heat through evaporation. The Environmental and Energy Study Institute estimates that U.S. data centers use billions of gallons of water each year, with individual hyperscale facilities capable of consuming up to 5 million gallons per day during peak cooling demand. For reference, this is the equivalent of the water use of a town populated by 10,000 to 50,000 people[71]. It is also on the same order of magnitude as irrigated agriculture. Corn, which is one of Illinois's dominant crops, can require around 2,000-3,000 gallons of water per bushel when irrigation is used, meaning a single large data center can rival the daily water demand of hundreds of acres of cropland depending on conditions[72]. This matters because it places data centers directly into the same water system as agriculture and municipal use, where scarcity is already a defining issue and where added demand intensifies existing pressure on an already constrained resource.

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[71] Yañez-Barnuevo, Miguel. "Data Centers and Water Consumption." *EESI - Environmental and Energy Study Institute*, 25 June 2025, www.eesi.org/articles/view/data-centers-and-water-consumption.

[72] "USDA ARS Online Magazine Vol. 59, No. 7." *AgResearch Mag*, Aug. 2011, agresearchmag.ars.usda.gov/2011/aug/water.

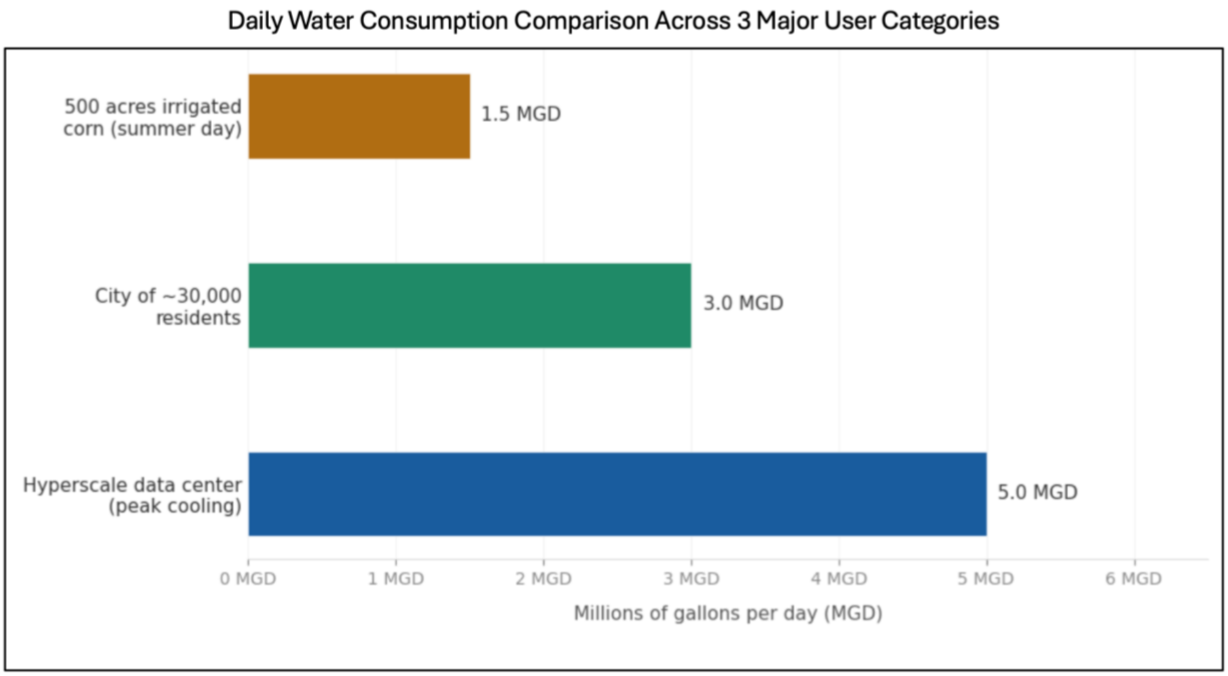

Figure 9: Estimated daily water consumption for a hyperscale data center operating under peak cooling demand, a municipality of approximately 30,000 residents, and 500 acres of irrigated corn during a summer growing day. Values are order-of-magnitude estimates intended for contextual comparison and reflect typical or peak operating conditions. Individual data center water use varies significantly by cooling technology, climate, and operational load. Sources: Environmental and Energy Study Institute; U.S. Geological Survey; Illinois Department of Agriculture.

As Figure 9 shows, the water demand of a single hyperscale data center at peak cooling is not a minor infrastructure detail, as it sits right alongside the kinds of users water planners and regulators have historically designed entire systems around. Illinois agricultural demand already creates strong seasonal pressure, and the 2025 drought conditions pushed large parts of the state into severe or extreme deficit. The scale of this added data center demand does not just add pressure at the margins, but it reshapes how existing supply constraints emerge across the system.

What makes this more complicated is that facilities relying on evaporative cooling typically require fresh, high-quality water for cooling systems to avoid corrosion and damage to the equipment. Closed-loop liquid cooling systems reduce this dependency significantly by recirculating coolant in a sealed system, but they do not eliminate water use entirely and remain less common at hyperscale than evaporative approaches[73]. Unlike some agricultural or industrial uses that can rely on lower-quality or recycled water, this requirement limits flexibility and increases pressure on freshwater supplies. In Illinois, this dynamic becomes more pronounced. Summer humidity already reduces cooling efficiency, and water availability can tighten quickly and across large portions of the state. That combination turns data center water use into a direct point of competition with other users rather than just a background resource issue.

The industry has started to respond with a wide range of water-saving strategies. These include air-cooled or refrigerant-based systems that reduce or eliminate evaporative losses, closed-loop cooling that recirculates water, and the use of reclaimed or non-potable water instead of drawing from municipal supplies[74]. The Equinix data center proposed for Minooka, Illinois, illustrates both the scale of the problem and the potential of reclaimed water as a solution. If approved, the facility could consume up to 30% of the municipality's allocated drinking water, but Equinix has indicated it would prefer to use reclaimed wastewater instead. A 2025 Illinois law now explicitly allows operators to apply for permits to use treated municipal wastewater for industrial cooling purposes[75]. But the infrastructure to deliver reclaimed water to a site like Minooka does not yet exist, which means the policy framework is ahead of reality. Adoption across the state remains uneven, and in Illinois, there is still very limited visibility into how widely these approaches are

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[73] "Myths vs. Reality: Data Centers and Water Usage." *Florida Water and Pollution Control Operators Association*, fwpcoa.org/content.aspx?page_id=5&club_id=859275&item_id=130961.

[74] "Maximizing Efficiency with Water Free Cooling Systems for Data Centers." *Associated Builders and Contractors Carolinas*, 11 Feb. 2026, abccarolinas.org/how-water-free-cooling-systems-are-transforming-sustainable-construction-and-data-center-design/.

[75] "As Data Centers Proliferate Across Illinois, Communities Grapple with How to Supply the Necessary Water." *Inside Climate News*, 16 June 2025, insideclimatenews.org/news/16062025/illinois-data-centers-water-use/.

being used. A proposed 2026 Illinois bill requiring data centers to report water use and sourcing is one of the first attempts to establish a baseline understanding of the issue[76]. The fact that this data is not consistently tracked makes it difficult to even define the scale of the problem, let alone design policies to address it.

CARBON REMOVAL

A newer area of focus in data center sustainability is carbon removal rather than just reducing emissions. Microsoft has piloted a system called DACinDC that integrates direct air capture into data center infrastructure using the wasted heat from computing to help power the capture process[77]. The idea is to reuse heat that would otherwise be expelled and turn it into an input for carbon removal instead of a byproduct. Microsoft reports that a large share of that waste heat can be reused in the process, which makes the system more efficient than a standalone DAC. It is a unique approach because it reframes what a data center produces, but it is still early, and it is not clear how scalable or cost-effective it will be at larger deployment levels.

Beyond DAC, biochar is emerging as another carbon removal pathway being explored by the data center sector. Pure Data Centers has committed £24 million to a large biochar facility in the UK, with projected annual removals in the tens of thousands of tonnes of carbon[78]. Biochar is produced through pyrolysis, which heats plant material without oxygen and converts it into a stable carbon form that can store carbon over long periods rather than releasing it through decomposition. At the same

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[76] Freed, Judy. "Testimony in Support of Power Act to Protect Illinois Water Resources from Data Center Impacts." *Alliance for the Great Lakes*, 29 Apr. 2026, greatlakes.org/2026/04/testimony-in-support-of-power-act-to-protect-illinois-water-resources-from-data-center-impacts/.

[77] Skidmore, Zachary. *Microsoft Pilots Use of Data Center Waste Heat to Power Direct Air Capture Systems - DCD*, Data Center Dynamics, 7 July 2025, www.datacenterdynamics.com/en/news/microsoft-pilots-use-of-data-center-waste-heat-to-power-direct-air-capture-systems/.

[78] "Pure Data Centres Invests £24m in UK's Largest Biochar Facility." *Pure DC*, 21 Nov. 2025, puredc.com/2025/11/19/pure-data-centres-invests-24m-in-uks-largest-biochar-facility.

time, the broader carbon removal market is expanding quickly. According to the CDR 2025 report, over 15 million tonnes of carbon removal contracts were signed in a single quarter in 2025, with Microsoft accounting for the vast majority of that demand[79]. That level of activity shows growing interest but is still being driven by a small number of buyers rather than widespread adoption.

Illinois's geology is an underappreciated asset in this conversation. The Mt. Simon Sandstone, which sits under most of the state, has an estimated storage capacity of up to 150 billion tons of CO2, making it one of the largest sequestration reservoirs in the Midwest. ADM's Decatur facility has been injecting CO2 into this formation since 2011 and has already stored more than 2.7 million metric tons across two projects. More recently, that existing infrastructure has started to attract direct investment from the data center sector[80]. In October 2025, Google signed a first-of-its-kind agreement to purchase power from a new 400-megawatt natural gas plant in Decatur called the Broadwing Energy Center, which is designed to capture about 90% of its emissions and store them in ADM's sequestration site. Construction is expected to begin in 2026, with the carbon capture component operational by 2030[81]. What makes this deal notable is not just that a hyperscale operator is directly funding carbon capture infrastructure, but that it could serve as a model for other data center developers in Illinois, given that state's geology. That said, there are still some real governance concerns. The ADM sequestration site experienced a leak that the city of Decatur was not informed about for several months, which highlights that carbon

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[79] *Durable CDR Market Update Q2 2025: Record-Breaking Quarter*, CDR.fyi, 24 July 2025, www.cdr.fyi/blog/2025-q2-durable-cdr-market-update-biggest-quarter-ever.

[80] "Illinois Basin – Decatur Project (IBDP)." *National Energy Technology Laboratory*, U.S. Department of Energy, netl.doe.gov/coal/carbon-storage/atlas/mgsc/phase-III/ibdp.

[81] Clancy, Heather. "Google Signs First Contract to Capture Emissions at Natural Gas Plant." *Trellis*, 29 Oct. 2025, trellis.net/article/google-funding-new-natural-gas-plant-outfitted-carbon-capture-storage/.

capture only works as a decarbonization strategy if it comes with strong monitoring and clear community notification requirements alongside the investment itself[82].

Illinois's geology makes carbon capture and storage more viable here than in most states, and the Google-Broadwing deal suggests that data center investment could help accelerate that potential. But these approaches still need to be put into context. Carbon removal does not reduce electricity demand, water use, or the siting risks discussed earlier in this paper. It operates alongside those issues rather than solving them head-on. For Illinois specifically, neither DAC nor biochar is integrated into current data center policy or planning, which means their impact remains limited compared to the scale of the underlying infrastructure challenges.

WHAT THIS MEANS FOR ILLINOIS

Taken together, these strategies show an industry investing in sustainability at a scale that is unusual for infrastructure of this kind, but still not keeping up with how fast demand is growing. Efficiency is improving, but those gains are being outpaced by overall expansion. Renewable energy procurement is widespread, but it does not always translate into the level of real, grid-wide decarbonization that the accounting suggests. Water management strategies exist, but they are still inconsistent and rarely standardized or reported in a meaningful way. Carbon removal is emerging as a possible tool, but it is still early-stage and largely disconnected from state-level planning frameworks.

Data centers in Illinois are projected to drive up to 72% of the state's electricity demand by 2030, which requires these gaps to stop being abstract.

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[82] "The Nation's First Commercial Carbon Sequestration Plant Is in Illinois. It Leaks." *Yale Climate Connections*, 20 Nov. 2024, yaleclimateconnections.org/2024/11/the-nations-first-commercial-carbon-sequestration-plant-is-in-illinois-it-leaks/.

Technical solutions on their own, without the policy infrastructure to require, verify, and enforce them, remain options. In a sector scaling this quickly, optional is not enough.

POLICY LANDSCAPE

Illinois did not arrive at this moment without warning signs. The state has been actively shaping, and occasionally avoiding, its response to data center growth for years. What has emerged is not a coherent regulatory framework so much as a mix of policies layered over time, some proactive, others reactive, and some that don't fully align with each other. Understanding that patchwork is key to seeing what is governing this growth right now and where the biggest gaps still exist.

The starting point for Illinois's data center policy is the 2019 Data Center Investment Program, which offered substantial sales tax exemptions to attract data center development to the state[83]. The program worked. Chicago quickly became one of the nation's premier data center markets and gained hyperscale investment from Amazon, Microsoft, Google, and Meta at a scale that few other Midwest cities could match[84]. But those incentives were designed before the full scope of AI-driven demand was clear. In the first five years alone, the state gave up roughly $983 million in sales tax revenue, effectively subsidizing a surge of development that the grid wasn't prepared to handle and that consumers are now paying for[85]. Governor Pritzker acknowledged this tension directly in his February 2026 State of the State

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[83] *Data Center Investment Tax Exemptions and Credits - Incentives*, Illinois Department of Commerce & Economic Opportunity, 2026, dceo.illinois.gov/expandrelocate/incentives/datacenters.html.

[84] Van Aman, Jenna. *North America Data Center Trends H1 2023*, CBRE, 6 Sept. 2023, www.cbre.com/insights/reports/north-america-data-center-trends-h1-2023.

[85] Pritzker, JB. *Data Center Investment Program 2023 Annual Report*, Illinois Department of Commerce & Economic Opportunity, 2024, www.ilga.gov/documents/reports/ReportsSubmitted/Data/Centers/Annual/Report.pdf.

address, where he proposed a two-year pause on new data center tax incentives in response to rising electricity demand and prices[86]. It is not by any means a ban, as it does not affect the projects already in the pipeline, but it does mark a noticeable shift in tone from a state that had been actively competing to attract this kind of investment.

Understanding why that shift happened requires understanding how Illinois's existing regulatory institutions work and where data centers fall within them. The Illinois Commerce Commission is the state's primary utility regulator, which sets the rates, approves infrastructure investments, and oversees how utilities like ComEd and Ameren interact with the customers they serve[87]. In practice, utilities are one of the state's most important levers for shaping how electricity is priced, planned, and delivered. When a large new load like a hyperscale data center connects to the grid, it does so through a utilities service territory, and that utility is then responsible for planning the transmission and distribution infrastructure needed to serve it[88]. The ICC oversees that progress, which gives it real, even if indirect, influence over how data center growth is integrated into the grid and who ends up paying for it. That authority has not been used in a consistent or proactive way when it comes to data centers, but it is already there and could serve as the foundation for more targeted policy.

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[86] Canchola Sánchez, Jesús. *Pritzker Announces Two Year Suspension of State Tax Incentives for New Data Center Developments*, NRDC, 18 Feb. 2026, www.nrdc.org/press-releases/pritzker-announces-two-year-suspension-state-tax-incentives-new-data-center.

[87] *Issue 7 Jan 2026 a Publication by the Illinois Commerce Commission*, Illinois Commerce Commission, Jan. 2026, icc.illinois.gov/api/web-management/documents/downloads/public/press-release/TheWire-Jan2026.pdf.

[88] Stone, Laurie. "Understanding Large Load Interconnection." *RMI*, 17 Apr. 2026, rmi.org/understanding-large-load-interconnection/.

The reason for that shift is not hard to trace. By mid-2025, the financial impacts of rapid, largely unchecked data center growth were starting to show up directly in Illinois ratepayers' bills. When PJM and MISO ran their capacity auctions in June 2025, the PJM Independent Market Monitor found that roughly 70% of the $9.3 billion increase in electricity costs that year was driven by data center demand[89]. The following 2026-27 auction pushed capacity prices even higher, with large electricity users again identified as the primary driver. For customers, this wasn't theoretical. Some ComED and Ameren ratepayers saw triple-digit increases in their monthly bills as a result[90]. These are not just planning-level projections as they are showing up in people's mailboxes. It is also worth noting that both utilities are subsidiaries of publicly traded companies, namely Exelon and Ameren, whose investor materials frame data center load growth as a competitive advantage[91]. So, the same surge in demand that is showing up in ratepayers' bills is also being pitched to Wall Street as upside. The shift from modeled costs to lived experience has started to reshape the political calculus in Springfield in ways the original incentive structure didn't anticipate.

It is also worth noting that Illinois already has environmental permitting mechanisms that apply to large industrial facilities, even if data centers have not always been required to go through them in the same way. The Illinois

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[89] Kunkel, Cathy. *Projected Data Center Growth Spurs PJM Capacity Prices by Factor of 10*, Institute for Energy Economics and Financial Analysis, 30 July 2025, ieefa.org/resources/projected-data-center-growth-spurs-pjm-capacity-prices-factor-10.

[90] L, Elizabeth. *Cub Supporters React to Comed Bill Increases: "I'm Tired of Being Nickled and Dimed to Death" | Citizens Utility Board*, Citizens Utility Board Fighting for Illinois Consumers, 12 Aug. 2025, www.citizensutilityboard.org/blog/2025/08/12/im-tired-of-being-nickled-and-dimed-to-death-cub-supporters-react-to-comed-bill-increases/.

[91] "Projected Data Center Load Growth in Exelon's Footprint." *Exelon Corporation*, Form 8-K, U.S. Securities and Exchange Commission, 4 Nov. 2025, sec.gov/Archives/edgar/data/0001109357/000110935725000179/exc-20251104ex992.htm.

Environmental Protection Act establishes a permitting framework for facilities that generate significant air, water, or land impacts[92]. In practice, large data centers are not that different from other industrial operations in terms of the resources they use and the impacts they create. Diesel backup generators produce localized air emissions. Cooling systems rely heavily on water. The physical footprint of a hyperscale campus can be substantial[93]. The legal authority to review these impacts already exists. The issue is that it has not been applied consistently to data centers as a category. That gap between what the law allows and what regulators actually require is where much of the current governance problem sits.

The policy response that has drawn the most attention is the POWER Act, which was introduced in February 2026. The bill is ambitious, and its supporters describe it as the most comprehensive state-level data center legislation in the country. The POWER Act is specifically aimed at hyperscale data centers, which are defined as any facility with a peak energy demand exceeding 50 megawatts. The Act addresses energy costs, water use, environmental justice, and community impacts all within a single legislative package[94]. What's striking is how much the bill is trying to do all at once. Rather than focusing on a single issue, it targets overlapping challenges that can't really be separated out in practice.

It is important to understand the POWER Act in context. It is a reactive measure, not the result of long-term planning or anticipatory governance. The bill

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[92] "Illinois Environmental Protection Agency History." *Illinois Environmental Protection Agency*, 2022, epa.illinois.gov/about-us/introduction/history.html.

[93] Yañez-Barnuevo, Miguel. "Data Centers and Water Consumption." *EESI - Environmental and Energy Study Institute*, 25 June 2025, www.eesi.org/articles/view/data-centers-and-water-consumption.

[94] Gopal, Keerti. "Could a New Illinois Bill Be a Blueprint for Curbing Data Centers' Climate Impacts?" *Inside Climate News*, 19 Feb. 2026.

emerged after capacity auction prices spiked, after ratepayers began reporting triple-digit bill increases, and after local governments like Aurora and Naperville pushed back on new data center development[95]. By that point, the status quo had already become politically unsustainable. That does not make it a weak bill. Most of its provisions are well-targeted. But it does mean Illinois is building a governance framework in response to pressure rather than ahead of it. The state is trying to catch up, and given the pace of data center development, that gap between policy and on-the-ground reality may continue to widen even if the bill passes.

On the energy side, the bill will require companies to come in with actual clean energy supply plans if they want a firm, always-on grid connection. There's also an incentive built in for faster interconnection for developers who secure their own clean power on a set timeline. It would also push utilities to create separate rate structures specifically for these hyperscale facilities, so the costs tied to their demand are not spread across everyone else's bills[96]. This is not a unique scenario. Ohio's Public Utilities Commission did something similar in 2025 by creating a separate rate class for large loads, and it has been widely pointed to by consumer advocates and grid analysts as a fairer way to deal with a fairly misaligned cost structure[97]. These changes suggest a growing recognition that hyperscale demand cannot simply be absorbed into existing systems without redesigning how costs and clean energy obligations are allocated across the grid.

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[95] City of Aurora. "City Council Approves Regulations on Data Centers." City of Aurora, 25 Mar. 2026, https://www.aurora.il.us/News-articles/City-Council-Approves-Regulations-on-Data-Centers

[96] Illinois General Assembly. *102nd General Assembly, SB4016: Data Centers-Power and Planning Act (POWER Act)*, Illinois General Assembly, 2026, https://www.ilga.gov/documents/legislation/104/SB/PDF/10400SB4016lv.pdf

[97] Public Utilities Commission of Ohio. *PUCO Establishes New Distribution Rates for FirstEnergy's Ohio Utilities*, Public Utilities Commission of Ohio, 19 November 2025, https://puco.ohio.gov/news/puco-establishes-new-distribution-rates-for-firstenergys-ohio-utilities

The bill would also require data centers to report expected and actual water use and sourcing, which would shed light on just how limited current visibility into this issue actually is. As discussed in the Water Management section of this paper, Illinois does not currently track data center water consumption in any consistent or publicly accessible way. Requiring disclosure is a baseline step, but it is a kind of baseline most people would assume already exists. The absence of that basic record is itself a governance gap worth addressing. The POWER Act would also mandate more efficient cooling methods to reduce the water intensity of these operations[98]. These provisions point less to an overhaul of how data centers operate and more to an effort to finally make their resource use legible in the first place, which is a necessary starting point for any more substantive regulation.

The environmental justice provisions are also one of the more consequential parts of the bill. Data centers located within three miles of an environmental justice community would be required to complete a cumulative impact assessment through the Illinois EPA, showing that the project would not add disproportionate health or environmental burdens to the area[99]. The bill also limits backup diesel generators to true emergency use only, which matters given that these systems are currently a major source of localized air pollution tied to data center operations. Research from Virginia Commonwealth University found that the cumulative emissions from data center generators in Northern Virginia produce pollution equivalent to that of a large natural gas power plant. The generators emit fine particulate matter and nitrogen

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[98] Illinois Environmental Council. "Data Centers in Illinois: The POWER Act." Illinois Environmental Council, 2026, https://ilenviro.org/data-centers-in-illinois-power-act/

[99] Gopal, Keerti. "Could a New Illinois Bill Be a Blueprint for Curbing Data Centers' Climate Impacts?" *Inside Climate News*, 19 Feb. 2026.

oxides, which are linked to respiratory disease, heart disease, and asthma[100]. This health burden falls disproportionately on nearby communities. On top of that, it requires legally binding and publicly disclosed community benefits agreements for any new hyperscale facility[101]. This would help build trust between the state and the public by making information more transparent and consistently available, and it also creates a clearer line of accountability in places that have historically absorbed the externalities of infrastructure development with very little leverage.

At the same time, it would be incomplete to frame Illinois's policy landscape as the only state trying to catch up to industry. The data center sector itself has been moving on sustainability, even if unevenly. Major hyperscalers have made public commitments to carbon-free energy matching, with Microsoft targeting 100% hourly clean energy by 2030 and Google pursuing similar goals[102]. Companies like CyrusOne and Constellation Energy have also explored colocation with nuclear and renewable generation as a way to reduce strain on the grid[103]. Industry groups such as the iMasons Climate Accord have developed voluntary frameworks for tracking and reducing energy and water use across the sector[104]. These efforts matter, but they are still voluntary and not consistently reported. More importantly, they are not built into Illinois's regulatory system in any meaningful way. That gap between what

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[100] Pitt, Damian, et al. "Cumulative Emissions Impacts of Data Center Backup Generators in Northern Virginia." *Virginia Commonwealth University Institute for Sustainable Energy and Environment*, 2025.

[101] Illinois General Assembly. *102nd General Assembly, SB4016: Data Centers-Power and Planning Act (POWER Act)*, Illinois General Assembly, 2026, https://www.ilga.gov/documents/legislation/104/SB/PDF/10400SB4016lv.pdf

[102] Chant, Tim De. "Microsoft's AI Data Center Push Is Colliding with Its Clean Power Goals." *TechCrunch*, 6 May 2026, techcrunch.com/2026/05/06/microsofts-ai-data-center-push-is-colliding-with-its-clean-power-goals/.

[103] Constellation Energy. *Constellation and CyrusOne Announce Agreement to Support New Data Center Facility at Freestone Energy Center in Texas*, Constellation Energy, Feb. 2026, https://www.constellationenergy.com/news/2026/02/constellation-and-cyrusone-announce-agreement-to-support-new-data-center-facility-at-freestone-energy-center-in-texas.html

[104] Infrastructure Masons. *iMasons Climate Accord*, Infrastructure Masons, https://imasons.org/initiatives/efficiency/

companies say they are doing and what the state can verify is on its own governance problem, and it is one that the POWER Act begins to address but does not fully resolve.

Without guardrails, the Illinois Environmental Council estimates that data centers could increase statewide electricity costs by roughly $37 billion through 2050, which would be a 24% increase that would ultimately be passed on to all ratepayers[105]. The POWER Act is positioned as the state's attempt to prevent that outcome, but it has also drawn significant opposition. The Data Center Coalition argues that the bill's requirements would add years to project timelines and create enough regulatory complexity to discourage new development in Illinois[106]. That concern is not entirely without basis from a market standpoint. Illinois has already seen local-level resistance, including Aurora's six-month moratorium on new data centers in 2025 and Naperville's decision to reject a proposed facility outright[107]. At the same time, these local actions allude to broader tension that the industry is responding to, primarily that increasing regulatory and community pressure could shift investment toward states with fewer constraints and faster approval pathways.

That tension sits at the heart of what Illinois is trying to navigate. The state is not anti-data center. It has spent years offering incentives to attract the industry, and its nuclear-heavy energy mix remains one of the most compelling low-carbon grid assets in the country for companies looking to power large-scale computing demand.

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[105] Hytrek, Nikoel. "Power Act: Lawmakers Seek to Regulate New Data Centers' Power, Water Usage." *Capitol News Illinois*, 16 Feb. 2026, capitolnewsillinois.com/news/power-act-lawmakers-seek-to-regulate-new-data-centers-power-water-usage/.

[106] Gopal, Keerti. "Could a New Illinois Bill Be a Blueprint for Curbing Data Centers' Climate Impacts?" *Inside Climate News*, 19 Feb. 2026.

[107] Lindburg, Alison. "City Council Approves Regulations on Data Centers | City of Aurora, IL." *Aurora Illinois*, 29 Mar. 2026, www.aurora.il.us/News-articles/City-Council-Approves-Regulations-on-Data-Centers.

What the POWER Act reflects is a shift in how that relationship is being redefined, one that is away from a model centered on attracting investment by reducing friction and toward one where large load customers are expected to internalize more of their energy, water, and community impacts[108]. Whether the bill passes as written, is modified, or ultimately stalled, the direction it signals still matters. It reflects a growing recognition that the policy framework used to bring this industry in was not built for the scale of the infrastructure that has emerged, and that gap between those assumptions and current conditions is no longer something the state can treat as marginal or temporary.

What Illinois is missing, and what the POWER Act begins but does not fully address, is a unified governance framework. Right now, data center policy is scattered across multiple systems. Tax incentives are administered by the Department of Commerce and Economic Opportunity, grid planning is split between PJM and MISO, utility regulation is handled by the Illinois Commerce Commission, and environmental permitting sits with the Illinois EPA. New water reporting requirements are layered on top of that and do not clearly sit with any one agency. None of these pieces really connect in a coordinated way. For developers, that means navigating a patchwork of jurisdictions with no clear point of accountability. For regulators, it means there is no single place to assess the cumulative impacts across energy, water, and emissions. That fragmentation is not just an administrative headache. It is part of why a state with some of the most ambitious clean energy goals in the country is still struggling to stay on track, while continuing to subsidize the same industry driving a majority of that new demand.

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[108] *Data Center Investment Tax Exemptions and Credits - Incentives*, Illinois Department of Commerce & Economic Opportunity, 2026, dceo.illinois.gov/expandrelocate/incentives/datacenters.html.

Policy Recommendations

The policy landscape described above shows that Illinois already has many of the tools it would need to govern data center growth more effectively. The issue is not the absence of authority; it is how unevenly and inconsistently that authority has been used. The Illinois Commerce Commission has rate-setting authority. The Illinois EPA has permitting authority. The Environmental Protection Act already provides a basis for reviewing large industrial facilities[109]. The POWER Act, if passed, would add new requirements around clean energy, water disclosure, and environmental justice. What is missing is a clear framework for using these tools together, along with the political will to apply them more directly.

Before turning to recommendations, it helps to be clear about what is already being addressed and what is not. On the energy side, the POWER Act's rate separation provisions and clean energy interconnection requirements move in the right direction, and the ICC's role in utility planning gives the state real leverage over how new data center load is integrated into the grid. On the environmental side, the EP Act could already be applied to large data centers, and the POWER Act's environmental justice provisions add a layer of cumulative impact review that does not currently exist[110]. What is still missing is basic visibility. The state cannot independently verify how much energy or water these facilities are actually using, and there is no institution responsible for tracking cumulative grid and community impacts over time.

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[109] Illinois Environmental Protection Agency. "Permitting Overview." Illinois EPA, 2026, https://epa.illinois.gov/topics/forms/permitting.html

[110] Gopal, Keerti. "Could a New Illinois Bill Be a Blueprint for Curbing Data Centers' Climate Impacts?" *Inside Climate News*, 19 Feb. 2026.

This all points to a clear principal-agent problem. In this arrangement, Illinois is the principal. It sets the rules, issues permits, designs incentives, and ultimately bears responsibility to ratepayers and communities for the outcomes. Data center developers function as the agents. They control the most important information, such as real energy demand projections, actual water consumption, cooling system design choices, and siting decisions. As Kiewiet and McCubbins describe, agency loss is most severe when agents hold private information, have different incentives than the principal, and face limited accountability[111]. All three conditions are present here. Data centers have far more visibility into their operational footprints than the state does, and their incentives are driven toward speed and cost reduction rather than system reliability or community impacts. Illinois currently lacks the monitoring capacity to independently verify basic claims about energy and water use. The recommendations that follow are therefore designed as a set of forward-looking controls and are focused primarily on the ICC as the institution best positioned to carry them out. Whether the ICC exercises that authority proactively is a different question. The commission is appointed by the governor, and the economic development push around data center growth is strong enough that it can complicate any effort to move faster than the broader political environment is ready for.

1. Require Full Environmental Review for Data Center Siting

Data centers have real impacts on electricity demand, water use, and air quality, all of which should be reflected in Illinois's siting and permitting process. The Illinois Environmental Protection Act already provides a framework for reviewing large industrial projects, but it has not been applied consistently to data centers as a

[111] Kiewiet, D. Roderick, and Mathew D. McCubbins. "The Logic of Delegation: Congressional Parties and the Appropriations Process." University of Chicago Press, 1991.

category[112]. Illinois should require hyperscale data center projects to go through the existing permitting process. This would mean reviewing air emissions from diesel backup generators, water withdrawals and consumption, as well as the impacts of grid interconnection. This is not about creating a new layer of regulation. It is about using the framework that already exists and applying it to a type of facility that has largely avoided it. At the same time, developers should be required to submit load forecasts and grid impact assessments as part of the siting process with joint review by the Illinois EPA and the ICC. The spatial patterns in this paper show that the areas attracting the most data center development are also the ones facing the highest climate exposure and existing grid constraints. Siting decisions that do not account for those conditions are not just incomplete; they are also locking long-term risk into infrastructure that will operate for decades.

2. Increase Transparency Around Data Center Grid Impacts

The most immediate impact of data center growth in Illinois is showing up on people's electricity bills, and the ICC is the institution with the authority to address that. It should open a formal proceeding focused specifically on how large data center loads are affecting grid costs and how those costs are being allocated across customers. As this paper shows, the PJM Independent Market Monitor found that about 70% of the $9.3 billion increase in electricity costs in 2025 was driven by data center demand[113]. Right now, that process is largely invisible to the public. The ICC should require utilities to provide clear, publicly accessible reporting on the load

[112] Illinois Environmental Protection Agency. "Permitting Overview." Illinois EPA, 2026, https://epa.illinois.gov/topics/forms/permitting.html

[113] Chilsen, Jim. *Data Center Distress: Cub, NRDC Experts Warn PJM States Could Get Hit with Forced Blackouts, $163b in Electricity Capacity Costs | Citizens Utility Board*, Citizens Utility Board Fighting for Illinois Consumers, 23 Oct. 2025, www.citizensutilityboard.org/blog/2025/10/23/data-center-concerns-cub-nrdc-experts-warn-pjm-states-could-get-hit-with-forced-blackouts-163b-in-additional-electricity-capacity-costs/.

forecasts submitted by large data center customers, the infrastructure investments needed to serve them, and how those costs are being distributed. This is a customer protection issue as much as a grid planning one. Ratepayers are currently absorbing costs they cannot see, cannot trace, and have no real way to challenge. A dedicated ICC proceeding focused on large load impacts would make that process visible and give the state the information it needs to design rate structures that better reflect who is actually driving system costs.

3. Require Binding Community Agreements for Data Centers

The POWER Act moves in the right direction on environmental justice and should be passed. It requires cumulative impact assessments for facilities within three miles of environmental justice communities, places limits on diesel backup generators, and calls for community benefits agreements[114]. But those provisions only work if there is real oversight behind them. The communities most affected by data center development are also the least equipped to monitor compliance or enforce standards on their own. That is a structural problem. This is where Ostrom's design principles for self-governance become useful. As Ostrom argues, durable resource governance depends on affected communities having a real role in shaping rules, access to clear information, and mechanisms for raising concerns when standards are not met[115]. Illinois should standardize community benefits agreements for hyperscale facilities and make them legally binding. These agreements should be publicly available and tied to specific, measurable commitments. The Illinois EPA should be responsible for tracking compliance and reporting it on a consistent annual

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[114] Gopal, Keerti. "Could a New Illinois Bill Be a Blueprint for Curbing Data Centers' Climate Impacts?" *Inside Climate News*, 19 Feb. 2026.

[115] Ostrom, Elinor. "Governing the Commons: The Evolution of Institutions for Collective Action." Cambridge University Press, 1990.

basis. The diesel generator provision in the POWER Act is especially important and should be prioritized. These systems are often operating as routine emissions sources, not just emergency backups. The local air quality impacts are real, and current regulation does not fully capture them.

4. Make Illinois a Leader in Data Center Accountability

This is less about adding new rules and more about how the state engages with the industry it already hosts. Illinois has real leverage. It is home to some of the largest hyperscalers, has a nuclear grid that is attractive to companies with clean energy commitments, and operates at a scale where its policy choices matter beyond the state. That position is not being fully used. The ICC should establish an ongoing process for engaging directly with major data center operators and industry groups. That process should focus on issues that are already creating problems, including inaccurate load forecasting, clean energy procurement timelines, and water use standards. One of the clearest examples is load over-declaration. Developers often submit inflated interconnection requests, which makes grid planning more difficult and drives unnecessary infrastructure investment[116]. This is a classic example of a coordination problem that the industry should have an interest in solving. Illinois should use its position as a major market to push for more consistent and verifiable load reporting that grid operators can actually rely on. More broadly, the state has an opportunity to set the standard for what responsible data center governance looks like at scale. That means combining its clean energy goals, its existing energy system, and a more direct and transparent relationship with industry. That outcome is not automatic. It depends on whether the ICC treats data center growth as an ongoing priority rather than something addressed only after problems emerge.

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[116] Farrell, Tyler, et al. "Understanding Large Load Interconnection." RMI, 14 Apr. 2026, rmi.org/understanding-large-load-interconnection/.

Taken together, these four recommendations share a common logic. The institutions Illinois needs already exist. The ICC, the Illinois EPA, and the legal frameworks they operate under provide the foundations. What has been missing is the consistent use of that authority for a sector that has grown faster than the policy response. The decisions being made now will shape the state's energy system and local communities for decades. Getting those decisions right is a test of whether Illinois's clean energy goals are matched by the ability to effectively carry them out.

Future Projections and Planning

The trajectory of data center growth in Illinois is not slowing down. MISO projects that data center electricity demand will grow from 3% of total state load in 2026 to 13% by 2035[117]. Synapse Energy Economics estimates that data centers will drive a 30% increase in Illinois's annual electricity requirements by 2040, with residential bills rising by roughly 8.3% over that period[118]. If those projections hold, the capacity shortfalls already identified for Northern Illinois by 2029 will not be temporary. They will become the baseline conditions that the state is planning. Demand forecasts have already been revised multiple times, and there is little reason to expect that trend to reverse as AI-related computing continues to scale.

On the climate side, the risks are also moving in one direction. As seen in Figure 4, extreme heat dates in Northern Illinois are projected to increase under both lower and higher emissions scenarios. Humidity will make cooling less efficient

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[117] Howland, Ethan. "Miso Expects Load to Jump 35% by 2035 on Data Center Growth." *Utility Dive*, 20 Apr. 2026, www.utilitydive.com/news/miso-long-range-forecast-data-center/817917/.

[118] Synapse Energy Economics Inc. "Risks of Rapid Data Center Load Growth in Illinois." Synapse Energy Economics, 5 May 2025, https://www.synapse-energy.com/risks-rapid-data-center-load-growth-illinois

more often, and drought conditions are expected to intensify even as precipitation becomes more variable[119]. The facilities being approved today will be operating in that environment by the 2040s and 2050s, largely without any requirement to plan for it.

One dimension that receives almost no attention in current Illinois policy discussions is what happens at the end of a data center's operational life. A private industry of IT Asset Disposition firms and decommissioning contractors does exist, but their involvement is entirely voluntary and driven by the operator's own decisions. These are companies that handle secure data destruction, hardware recycling, and physical site clearance when facilities close[120]. Illinois has no framework that requires decommissioning plans at a permitting stage, assigns end-of-life liability to developers, or guarantees that land and groundwater remediation will occur after a facility closes. In other industrial contexts, such as manufacturing facilities or power plants, the end-of-life liability is a standard part of the regulatory conversation. For data centers, it is largely absent. As Illinois continues to permit new facilities, the question of who is responsible for clean-up and who pays is one the state has not yet asked.

Several important questions are still unresolved. Actual water use at the facility level is not publicly tracked, so the overall picture is still based on estimates rather than measured data. The long-term reliability of Illinois's nuclear fleet, which is central to the state's low carbon electricity mix, is also uncertain, and its retirement

[119] "Climate Change in Illinois." *Illinois Water Survery-Illinois State Climatologist*, University of Illinois-Urbana Champaign, 2022, stateclimatologist.isws.illinois.edu/climate-change-in-illinois/.

[120] Leach, Tedd. "Data Center Decommissioning: Best Practices for Security & Cost Recovery." Synetic Technologies, 2026, synetictechnologies.com/trends-insights/data-center-decommissioning-best-practices.

timeline has not been clearly modeled alongside rising data center demand[121]. The cumulative environmental justice impacts of concentrated data center development are also under-examined, especially when it comes to air quality from diesel backup generation and the distributional effects of rising electricity costs on lower-income households. These are not gaps that undermine the analysis. They are the next set of questions, and they only become answerable once better disclosure and coordination systems are in place. Illinois is still early enough in the process that current decisions will shape what the system looks like going forward. That window is still open, but it will not stay open for long.

Conclusion

Illinois is at a real turning point. The state has spent years attracting data center investment through tax incentives and a reliable, low-carbon nuclear grid, and that strategy has worked. As of early 2026, Illinois hosts over 100 operational data centers, with many more in development. That growth is not slowing down. But the costs are now visible in ways they were not when those policies were first put in place. Electricity bills are rising, grid capacity is tightening, and communities closest to these facilities are taking on environmental infrastructure burdens that current policy does not fully account for. At the same time, the climate these facilities will operate in over the next few decades is changing in ways their systems were not designed for.

This paper took those dynamics seriously, and the goal is to understand where the pressure points are and whether Illinois is equipped to manage them. Right now, it is not. Illinois already has the tools it needs. The ICC, the Illinois EPA, the

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[121] Clemer, Steve, et al. "Data Center Power Play: Evaluating Illinois's Proposed POWER Act." Union of Concerned Scientists, Jan. 2026, https://www.ucs.org/sites/default/files/2026-01/Data-Center-Power-Play-Illinois_0.pdf

Environmental Protection Act, and the clean energy framework under CEJA are all in place. What has been missing is a consistent and proactive approach to apply those tools to a sector that has grown faster than the policy response.

The recommendations in this paper build on the authority that the state already has. They focus on applying that authority more clearly and more consistently to data centers. That includes stronger environmental review, more transparency around grid and rate impacts, binding community protections, and a more direct relationship between the state and industry. None of this requires choosing between economic growth and responsible governance. It requires recognizing that those goals only align if the rules keep up with the scale of the industry.

The window to get this right is still open, but it will not stay open for long. The facilities being built now will operate for decades, which means that the grid decisions being made now will shape the state's energy system over that same duration. Communities near these developments should not be left dealing with the consequences after the fact. They need enforceable protections and a state that is willing to act before problems become harder to fix. Illinois has the opportunity to be a state leader, but whether it does or not will depend on decisions made in the near term.

However, this paper is ultimately about something bigger than Illinois. Every time someone asks AI a question or sends an email, a data center somewhere is running to make that happen. The digital infrastructure powering modern life is physical, energy-intensive, and expanding at a pace that few people fully comprehend. As artificial intelligence accelerates and becomes embedded in more of the decisions, tools, and systems we rely on every day, the electricity and water demands will only grow. The question of how we power that future, who pays for it, who bears the environmental costs, and whether the communities hosting that infrastructure have any real say in the matter is not a technical one. It is a deeply personal one. Illinois is one place where that question is being answered right now, in real time, through permits being issued, the bills being passed, and the decisions being made about what gets built and where. Getting those answers right matters not solely for Illinois, but as a model for how any state, any community, and any society chooses to manage the infrastructure of a technology-driven future.

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