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Guide to Data Centers

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Pillsbury Winthrop Shaw Pittman LLP

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Introduction

Introduction

***by* Rob James, Data Centers Team Co-Leader**

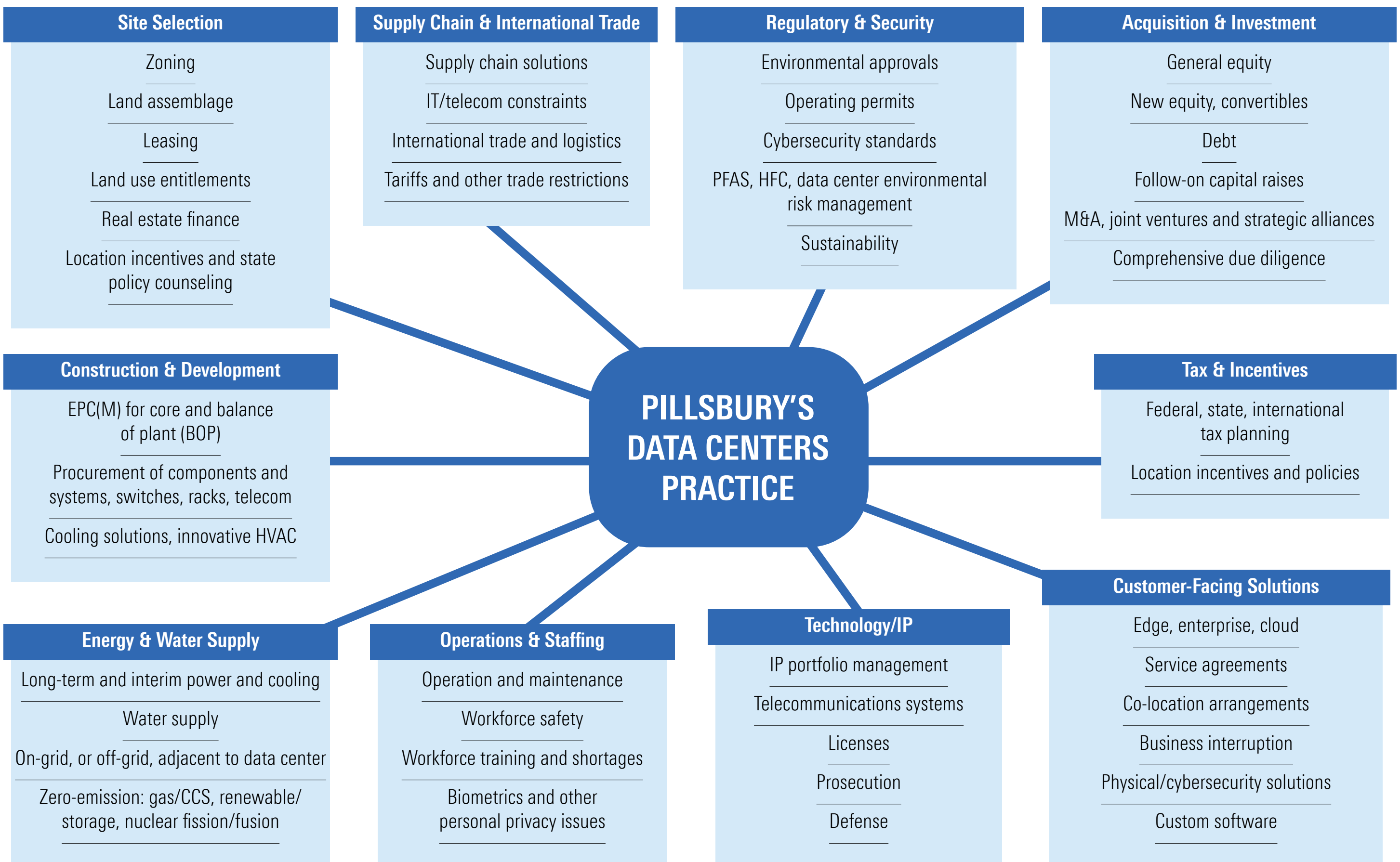
As a law firm, Pillsbury's experience with data centers dates to the dot-com era, when I advised on buildouts in Silicon Valley and New York City and Jamie Bobotek advised on centers of America On-Line (then spelled out!) and others in Northern Virginia. We counseled the industry as proprietary centers were supplemented, and in some cases supplanted, by physical and cloud-based systems of larger dedicated enterprises. The data center landscape is now international in scope and diverse in speciation, with edge, modular, enterprise and hyperscale facilities each playing important yet distinctive roles.

There is no single locus of data center expertise in legal practice, just as there is no single locus of capabilities and users in the business environment. Pillsbury's Data Centers team accordingly deploys a one-stop, hub-and-spoke model that reflects the complex ecosystem in which these localized points of computation sit.

(To let you in on a little secret, Pillsbury employs this same hub-and-spoke approach to many other forms of infrastructure and energy projects—crypto mines, order fulfillment centers, global communication centers, you name it!)

That same philosophy and a similar structure inform this distinctive publication, the *Pillsbury Guide to Data Centers*. It contains articles that we hope are not the typical ephemeral client alert of some episodic deal, proposed bill or trend, but instead are enduring reference pieces that lawyers and clients of all levels of sophistication may wish to keep handy as they encounter questions and challenges in this field.

This eBook brings together a curated selection of articles authored by our firm's interdisciplinary team. They reflect our experience advising clients on the development, acquisition, financing, construction and operation of data centers across the U.S. and internationally. Each chapter can be tied back to one or more of the spokes on our hub-and-spoke system.



Here is a preview of the issues we will cover in the *Pillsbury Guide to Data Centers*.

What Is a Data Center, Anway?

As my dot-com anecdote indicates, even by that name "data centers" have been around for decades. What has thrust them into the headlines today? There has been a confluence of the needs for massive data processing and communication demands of the digital economy, on the one hand, and dramatic increases in the processing speed and memory of graphics processing units (GPUs) and other hardware and software systems on the other hand. The needs of business-to-business and business-to-consumer electronic commerce and the use of massive internet platforms for external transactions and internal administration began a long time ago and show no signs of relenting. Applications such as cloud computing, the internet of things, software as a service, machine learning and generative artificial intelligence have compounded the needs for localized centers capable of receiving, processing, storing and transmitting amounts of data that were unimaginable just a few quarters ago.

At the same time as this increase in data processing, we have witnessed an increase in the physical and cybersecurity risks associated with safeguarding this information, and an explosion in the regulation of the privacy, data ownership and other aspects of the industry. These regulations emanate from specific jurisdictions, but the information technology industry spans every possible boundary, raising complex questions of compliance for every enterprise—both proprietors and users of data centers face these issues.

What exactly is a data center? If you knocked on the door of one, who would answer, and if you were admitted inside (a tall order), what would you see? Read Pillsbury's "**Anatomy of a Data Center**" for a light-hearted survey.

The Species of Data Centers

An admittedly unscientific survey says that there are about 11,000 "data centers" worldwide, about half of which are in the United States. Even within the United States, data centers began in Silicon Valley and Loudon County, Va., but we are now seeing centers and proposals anywhere energy, water and entitlements are hospitable. The global distribution similar patterns. Digital Realty, Equinix and Coresite are among the largest players, along with the "hyperscalers" (the "**BATMMAAN**" companies) that have custody of the largest quantities of data.

These centers range in size from half an office building floor to some of the largest manmade structures on the planet. Read Pillsbury's "**Data Centers: A Field Guide**" to get more of a breakdown of the species in this genus.

Customer-Facing Solutions: Service and Co-Location Agreements

A unique feature of Pillsbury's data centers practice is that we represent both proprietors and users. From either side, a client needs a comprehensive understanding of both the service needs of the customer and the system capabilities of the center. Accordingly, we group our services under the term *Customer-Facing Solutions* to capture the need to understand *both* sides of a harmonious deal.

The core customer relationship is typically structured either as a *service contract* in which the data center enterprise owns the computation facilities and provides a service, or a co-location contract in which the center hosts equipment owned by or leased to the customer. In either model, attention is focused on the service-level expectations of the customer and the corresponding qualities of the data center.

Read Pillsbury's "**From Anatomy to Action: Data Center Service Agreements**," authored by Pillsbury legal personnel as well as a Pillsbury business consultant, for an in-depth look at these complex commercial agreements.

Energy and Water for Data Centers

Power and cooling are the nectar and ambrosia on which data centers feed. They are also the gating factors in determining whether, when and where a data center will be built, and accordingly are top of mind not only to the hyperscalers and other proprietors, but also to the entire ecosystem of real estate developers, financers and investors in the space.

Among the most promising sources of power for data centers is nuclear generation, but few can articulate the advantages and challenges of developing advanced fission and fusion technology. In "**Powering Data Centers with Nuclear Generation**," Pillsbury's highly recognized Energy Transition nuclear and project lawyers combine to do just that.

As the data centers expand in both traditional and new locales, they face grid interconnection challenges, local utility and ratepayer concerns, and expectations of many proprietors for ultra-stable and zero-emission energy sources. One interesting alternative that can finesse many of the siting challenges is the location of both data centers and power sources on federal lands. The recent initiative to co-locate such facilities on property of the Department of Energy is one such solution. Read Pillsbury's chapter on **data centers on Department of Energy facilities** for information about the initial steps.

One tension in the competition for zero-emission energy sources is that data centers face competition from other users of that form of power—for carbon removal, hydrogen production and other facilities that are driven by green mandates or corporate commitments. Read Pillsbury's "**Big Data Meets Big Green**" to learn about that interaction among organizations with climate focuses.

Investing in Data Centers

Pillsbury represents a wide variety of real estate investors, financers, investors and advisers on the complex aspects of selecting the optimal site, including land assemblage, due diligence on land use and environmental regulations, access to the grid, energy and cooling sources, and community reactions. Tax considerations and local incentives (or disincentives) strongly factor into the analysis. Read Pillsbury's "**Investing in Data Centers**" for an in-depth survey of the players in this field. And take a look at the Appendices to this *Pillsbury Guide to Data Centers* for additional detail on the specific places where existing and proposed data centers, and the inputs essential to their development, are located or being considered.

Environmental, Privacy and Security Regulation of Data Centers

Data centers are situated at the crossroads of a bewildering number of public policy concerns. Pillsbury extensively counsels proprietors and users on data security, privacy and operational standards. An oft-overlooked area in identifying data center legal support are the environmental challenges associated with materials used in their operation. Read Pillsbury's "**PFAS, HFCs and Other Chemicals in the Data Center Industry**" to appreciate some of the considerations and the need for experienced counsel.

Designing, Constructing and Converting Data Centers and Crypto Mines

Pillsbury's experience with engineering, procurement and construction (EPC) or construction management (EPCM) of data centers stretches back decades. That body of knowledge extends now to the new build of such centers and the potential conversion of crypto mines to data centers, or vice versa. Read Pillsbury's "**Designing, Constructing and Converting Data Centers and Crypto Mines**" for an overview of the brick-and-mortar aspects of development and redeployment of these localized points of computation.

Future editions of this *Pillsbury Guide to Data Centers* will showcase the additional capabilities—the spokes of our hub-and-spoke model—including our work in intellectual property, privacy regulation, and more. We look forward to working with clients both old and new as we deploy our resources for their benefit and for the superior performance of our digital economy and the data center ecosystem. ❖

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Anatomy of a Data Center

Anatomy of a Data Center

***by* Rob James & Matt Olhausen**

Traditional and social media are thick with reports and predictions of the remarkable increase in size, power consumption and significance of data centers. Not only technology companies but real estate and energy developers, investment funds, lenders, and professionals of all stripes are in or determined to enter this sector. Our inboxes are full—it's data center this, data center that.

But what exactly ***is*** a data center? What infrastructure, technology and human resources come together to create and sustain one of these localized points of computation? By understanding their components, we can glean some understanding of the business, public policy and (our focus) legal issues that arise before and during their operation.

In this article, we cite key characteristics of a reference **Blackacre Data Center**, with occasional glances at other (real) structures that offer variations on themes. Blackacre is a composite of several centers we have encountered in our law practice. These facilities differ widely in size, location and functions, so your mileage will vary.

INFRASTRUCTURE RESOURCES

Blackacre Data Center is built on a 14-acre site consisting of two contiguous legal parcels that were formerly developed as Class C light industrial warehouses in the early 1970s, located on the outskirts of a major United States technology-center city. The property was acquired and developed by a real estate developer specializing in industrial projects, including data centers, and the fee owner is a special-purpose entity subsidiary of an investment fund. The acquisition and construction were **funded by equity investment (aided by tax credits and location incentives) and third-party debt financing**. The improvements were built under a **design-build contract** with an engineering and construction company joint venture. The fee estate is leased to an operating company affiliated with the developer, which then leases interior space to technology companies.

The Blackacre site was selected on the basis of many factors, including real estate cost and availability; telecommunications connectivity; availability of reliable, sustainable power; resilience to natural disasters; ambient temperatures or water supply suitable for cooling systems; taxes and incentives; and human factors to attract employee and contractor workforces. (There is a publication, **ANSI/TIA 942 Annex**, with data center site selection factors.)

To entitle Blackacre, the developer underwent a streamlined planning process with the city, since the project site is located within an existing industrial park within the city's designated "Industrial Technology and Innovation Corridor." The zoning permits a wide range of uses, including, office, business park, industrial, research and development, manufacturing, and information and technology-based uses. Fortunately for Blackacre compared with other projects, the site is bordered by undeveloped land and other industrial and commercial uses, remote from residential districts, and located near a state highway.

Data center businesses often employ one of two approaches—either an enterprise model in which the servers, storage and network switches are controlled by a tenant technology company, or a co-location model in which information technology (IT) equipment and utilities supporting that equipment are leased to individual businesses. Blackacre follows the co-location model.

The outside perimeter is an imposing 10-foot-tall security fence, with gated site access staffed 24/7 and the first of many closed-circuit television (CCTV) cameras. The grounds include parking for 73 cars and a dozen bicycles, outside electricity stepped down to an onsite 75 MVA (mega volt-ampere), 25,000-square-foot substation, a 25,000-square-foot utility switching station, and telecommunications outlets (both satellite dishes and a dedicated T1 fiber optic line). The substation has two transformer lines allowing one to be taken out of operation without interruption of service.

There are two data center structures located on the campus: a three-story main building (350,000 gross square feet) and a one-story auxiliary building housing storage media (15,000 gross square feet). There is also a backup generator yard; a 3,000-square-feet security building; and infrastructure improvements such as fire detection and suppression devices, access driveways, stormwater facilities, and water storage tanks.

On the entry floor of each data center building, there is a lobby to verify access and monitor entry and exit by authorized individuals. Security measures include biometrics and badge access into and around the facility (including the equipment areas), key access to specific racks and servers, logs for employee and visitor/vendor access, physical escorts for all non-employees, video surveillance, and 24/7 on-site security personnel. **Cybersecurity** is maintained through firewalls, virus detection software, encryption, disaster and breach security, backup and recovery systems, and regular tests and audits. Blackacre security personnel are mindful of industry security standards such as **ISO/IEC 27001** and **data privacy regulations and best practices**.

Authorized entrance from the lobby leads to an operations center with monitors of all the data center activities. From that center authorized personnel can next enter the computer rooms, where the servers, storage, network switches and other equipment are located, operated and maintained. When you enter a computer room, besides the hum and whir of storage devices, you will hear the whoosh of cool air being fed and hot air being withdrawn in separate currents called "cold aisles" and "hot aisles."

Blackacre has visions of greater and greater sustainability. Over the longer term, **zero-emission power** is to be supplied for the data center from advanced energy systems; its owners are in negotiations with developers of small modular reactor (SMR) nuclear fission, natural gas with carbon capture, advanced geothermal, sodium-based storage from renewables, and even nuclear fusion, to be located at an adjacent undeveloped project site. This power may be delivered directly physically to the site, or **virtually through a power purchase agreement**.

INFORMATION TECHNOLOGY RESOURCES

The heart of Blackacre Data Center is its information technology, which falls into three broad categories: servers, storage devices, and network devices.

Servers are the computers that perform the customers' desired functions with respect to the data that come to and leave from the data center. Server operation entails the retrieval, storage, and processing of data supplied by the technology company or generated by its user base in engaging with internal and customer-facing application software. These servers have a range of internal memory, processing power, and other specifications, requiring customized support by Blackacre staff. Servers can be self-contained computers installed in racks, or slimmed-down "blades" more dependent on Blackacre support and utilities.

Ancillary to the servers are large storage devices, both hard drive and solid state. They store data in block increments with many terabytes of data capacity. (Lawyers should start getting used to the next thousand-power prefixes: peta, exa, zetta and yotta.) Lastly, a data center relies on network infrastructure. Switches transfer data between nodes on a network; routers transfer data from and to networks; and firewalls and load balancers complement their functions.

Blackacre also has monitoring computers, system software, and application software. The various IT components and technology are partly proprietary to the operating company and partly licensed to them and their customer base. With virtualization and greater employment of cloud resources, the lines separating server, storage, network and other devices are blurring, and the Blackacre configurations will change with the times to keep up with the larger enterprise "hyperscale" data centers.

POWER AND COOLING RESOURCES

Data centers are well known voracious consumers of electricity, not only for powering the computers but also for cooling them down and maintaining the rest of the integrated facility. A metric called Power Usage Effectiveness (PUE) is used to compare the power needs of the IT equipment with the overall power needs of the center. Within that energy budget, there is a target power usage of so many kilowatts per rack or per blade within the facility. The processing power of individual chips and the energy density of servers are increasing at a torrid pace, raising Blackacre's energy needs rack by rack and upgrade by upgrade.

The absolute requirement for a data center is guaranteed power at "five nines" (99.999%) or even higher levels of assurance. The offsite utility power line comes into a transfer switch with the generator circuit, so the generators can step in within several seconds of a grid outage. That is not good enough, though, so an Uninterruptible Power System (UPS) is also connected. The UPS may be a long-life (over 12 years useful life) lead-acid or lithium-ion battery system or a continuously spinning flywheel. (See **APC White Paper No. 92** for their respective merits.) The UPS can keep critical load in steady operation until the generator comes on or the grid source resumes.

The cooling requirements of Blackacre are daunting. Even with built-in fans, the IT equipment would overheat quickly were it not for the complex circulatory systems in the main building. The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) recommends data center IT room temperatures and humidity be kept in a controlled range. While some larger centers have chilled water systems with Computer Room Air Handlers (CRAHs), others use a compressor-based system with Computer Room Air Conditioning (CRAC), in which the familiar **refrigerant cycle** of evaporation, compression, condensation and expansion of a fluid with low boiling point drives the airflow.

For Blackacre, by contrast, Data Hall Air Handling Units (DAHUs) are installed in dedicated galleries. Outside air is drawn from each building's perimeter. The DAHUs use a "flooded room" design, meaning that no ductwork or raised flooring systems direct the cooling air to the IT racks' air intakes. Instead, all DAHUs in each mechanical gallery discharge cooling air into the adjacent common supply air header. The potable water demand for the entire site is relatively modest, with half dedicated to evaporative cooling and the balance to landscaping and domestic needs.

Continued expansion of the data center sector to accommodate AI and other demands will depend on ever more efficient designs and operations of server components, innovative power systems, and cooling systems that minimize energy losses. Pillsbury advised on contracts for Stanford University's **award-winning central energy plant** using heat exchangers to capture excess heat from data centers to warm dormitories. At locations more remote than Blackacre, centers may be able to take advantage of **geothermal temperature gradients** for both power and cooling.

HUMAN RESOURCES

Employee and contractor workforces are a critical part of Blackacre's operation. The campus currently employs 52 local residents on a full-time basis, with monitoring, security and maintenance shifts around the clock 24/7. Representatives of the industrial real estate company, the customer base, and equipment suppliers visit frequently and upgrade the technology assets and security systems. Maintenance contractors are also engaged on a periodic basis, all with the objective of uninterrupted performance at highest industry levels.

Personnel (sometimes even working with their attorneys on **Pillsbury's data centers team**!) also maintain compliance with laws, contracts, permits and industry practices. Relevant standard-setting organizations include ASHRAE, the Uptime Institute, the Telecommunications Industry Association (TIA, which has a comprehensive family of data center specifications **TIA-942**), and the Building Industry Consulting Service International (BICSI). Available sustainability certification sources include LEED, Energy Star, and Building Research Establishment Environmental Assessment Methodology (BREEAM).

CONCLUSION

Everyone talks about data centers, but few can fully describe one. They indeed sometimes even *look* like "black boxes"; the architects do not typically splurge on windows and aesthetic touches. The need for security limits the amount of visibility into how they are built and operated. There are many variations on Blackacre, and this article is no substitute for learning about any given facility's features. We nonetheless find it useful to have a reference to compare to our new projects in this rapidly expanding field. ❖

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A Field Guide to Data Centers

A Field Guide to Data Centers

by **Rob James, Matt Olhausen & Sam Bucher**

By **one count**, worldwide there were some 11,800 data centers in early 2024. Within that census are facilities so small that they fit in office building closets, while others are among the largest manmade structures on the planet. How are we to make sense of this diverse population?

Data centers house servers, storage devices and network devices to store, process and disseminate large quantities of data of organizations and their customers and supply chains. The size and complexity of these facilities vary with their functions in the business ecosystem. Much like the well-known depictions of the **evolution of horses** from tiny brush creatures to mighty stallions, the overall category cries out to be broken down along multiple dimensions.

This post provides a naturalist's field guide to data center types and features.

Enterprise Data Centers

Enterprise data centers are operated by a single organization, either through direct ownership or a leasing arrangement, to support its internal information technology (IT) operations. These are the traditional and longstanding center types, often running on a private cloud. They have customized infrastructure to meet one company's needs, giving it full control over security, compliance standards, and system optimization.

Organizations that can afford to operate an enterprise data center benefit from the ability to fine-tune the environment, ensuring governance over sensitive data, and adhering to industry-specific regulations. They pose challenges such as the need for dedicated staffing and robust backup solutions to mitigate downtime, as well as generally high costs not spread across other users.

Enterprise data centers can be either on-premises or off-premises of the organization they serve. On-premises centers offer greater assurance of reliability and security. In contrast, off-premises centers can be a cost-effective alternative for organizations with less stringent security and speed demands, reducing upfront infrastructure and real estate costs, and alleviating the workload for in-house IT staff.

These enterprise centers can be very modest in scale. One private research university, for example, runs a 12,000-square-foot facility—6,000 square feet of data center space and 6,000 square feet of infrastructure space—on 450 KW of power and cooling. The center costs $12.4 million and hosts the institution's private cloud that supports campus servers.

There are enterprises, and then there are *enterprises*—how about the NSA? The National Security Agency operates a high security center powered by 65 megawatts of electricity in Camp Williams near Bluffdale, Utah. The $1.5 billion campus encompasses one million square feet with a 100,000-square-foot mission critical data center. The other 900,000 square feet in the campus is used for technical support and administrative space. This center facilitates the NSA's efforts, as the executive agent for the Office of the Director of National Intelligence, to monitor, strengthen and protect the nation with regard to digital data.

Colocation Data Centers

Since operating an enterprise data center is costly and requires dedicated expertise, many users turn to the **colocation data center** model. Colocation offers storage and support for computation essentially as a service. These third-party facilities lease space to businesses for their servers, often at a lower initial and potentially reduced operational cost compared to on-premises data centers. The centers host multiple businesses as tenants, each renting the amount of space according to its specific needs — either a full cabinet or often just a fraction of a cabinet.

The centers also supply essential infrastructure, including power, cooling, maintenance services and network connectivity. For organizations lacking around-the-clock expert staff or seeking to minimize upfront investment, colocation can be a practical choice. Additionally, these facilities can offer scalability to meet market demand, enabling businesses to expand their operations as space and resources allow in that specific colocation center.

Colocation can be specifically attractive to e-commerce and financial services companies through faster load times and handling increased traffic and demand due to the site owner's specialized knowledge of the IT industry. This model can allow businesses to adapt to ever-changing demands in the market and scalability if the site has additional space to lease. Health care providers and governmental bodies can depend on these multi-tenant data centers if they lack the expertise in developing and operating their own enterprise sites.

A composite example of a colocation data center is what we called the Blackacre Data Center in northern California. The site houses two data center structures, a three-story main building consisting of 350,000 square feet and a 15,000-square-foot one-story auxiliary building. For an inside look at exactly what goes on in Blackacre Data Center, see our recent post, **Anatomy of a Data Center**.

Hyperscale Data Centers

Hyperscale data centers are vast, highly scalable facilities — often exceeding a thousand cabinets, 10,000 servers, and a million square feet. By one 2024 census there were about a **thousand centers** worldwide in this category, half of them in the United States. Most are owned or operated for the benefit of cloud industry giants, and similar enterprises in China and elsewhere.

These facilities commonly function as enterprise data centers, operated solely by the provider for their own needs, but they can sometimes function as colocation data centers. Regardless of the ownership and operation structure, they are designed to support massive workloads and bring to bear enormous infrastructure capabilities — and enormous infrastructure demands including power and cooling.

Hyperscale facilities are engineered for resilience, featuring robust backup systems and automated failover mechanisms that activate immediately in the event of equipment failure or power loss. While these facilities can be purchased or leased, they are typically custom-built and specifically designed to meet the unique operational needs of the owner and located in rural environments.

It is difficult to convey a sense of the immense scale of these facilities. The world's **largest hyperscaler**, a $3 billion project, is located in China's Inner Mongolia region. This facility consumes 150 MW of power and spans almost 11 million square feet, or the size of 165 regulation U.S. football fields.

A Reno hyperscale is also the single largest colocation data center facility in the world, occupying 1.3 million square feet drawing up to 130 MW of power. It is the first facility to be built within a new data center campus targeting up to 7.2 million square feet of data center space and 650 MW of renewable power.

A hyperscale facility in Mesa, Ariz., occupies 1.3 million square feet, consumes 50 megawatts of renewable power, and cost a reported $2 billion. And **another center** under development in Louisiana occupies land that would constitute a sizable chunk of Manhattan.

Edge Data Centers

Some cutting-edge applications, such as autonomous vehicles, cloud gaming and instant grocery delivery, require data to be hosted close to users to achieve high-speed network functionality. Edge data centers offer a relatively new solution to these challenges. They are often smaller, decentralized facilities located close to the "edge" of a larger telecommunications and IT network.

The unique location and footprint of these centers allow organizations to reduce latency and optimize bandwidth for new applications. Further, because edge data centers lower network bandwidth usage, they can significantly reduce the cost of data transmission and routing — lessening the required amount of expensive circuits and interconnection hubs. Edge data centers are often deployed in various urban locations, such as at a telecommunications central office or at the base of cell towers throughout a major city.

One services provider recently launched a number of edge data centers designed to extend their infrastructure closer to large urban populations. This venture allows visual effects, video and other applications that require single-digit millisecond latency or local data processing to achieve their goals by bringing infrastructure closer to the end user.

Evolutionary Trends

Data centers are categorized not only by size but also by stability of uptime. A **Tier Classification System** runs from Tier 1 with 99.671% uptime and a maximum of 28.8 hours of annual outages to Tier 4, for the most mission-critical applications, with 99.995% and only 26.3 minutes of permitted outage. Getting that last bit of assured uptime is very expensive and demands considerable redundancy of all systems.

An alternative for enterprise and edge centers is the **modular data center**, which can be added or relocated to existing facilities. These prefabricated facilities can finesse issues with real estate acquisition and permitting and allow users to fill interim needs while larger permanent facilities are being developed.

Data centers are running up against economic and land use constraints in their traditional habitats. The increasing size of each center accentuates this challenge; from 2022 to 2024, the average data center parcel grew by 144% to 224 acres. As of October 2024, the weighted average cost of data center land stands at $244,000 per acre. Moreover, the ability of the centers or the local utility grid to support the prodigious power requirements of the data center population is leading to constraints and delays on entitlements and approvals of centers in overheated markets. Data centers are engaged in active management of community, government and public relationships to address the externalities associated with the facilities.

The headwinds in some locations are leading the data center investment and proprietor community to look far beyond the original settings. Thanks to improvements in processing speed and telecommunications capabilities, the largest centers are being situated anywhere in the world that they can find sufficient power, accommodating land acquisition and permitting conditions, and workforces and supply chains suitable for large scale data processing.

Conclusion

Multiple species can thrive in distinct parts of the biosphere. Data centers exist in a diverse range of sizes, locations, operation models, and ownership structures, each tailored to meet a particular set of demands. Selecting the right location, size and model is one of the greatest strategic decisions any organization can face. ❖

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Navigating Data Center Contracts

Navigating Data Center Contracts

***by* Brittney Sandler & Phil Evans**

Our colleagues recently provided a comprehensive overview of the **anatomy of a data center**, which explored the structural, energy and real estate implications of these essential facilities.

As more businesses rely on external data centers to house their critical infrastructure, the importance of a well-negotiated data center services agreement becomes paramount. These contracts require more than just finding space—they require careful consideration of the technical, operational and financial details that will support a customer's business needs.

Although terms may vary depending on whether the contract is with a dedicated data center, shared colocation ("colo") data center, and/or managed services provider (MSP) that subcontracts with a data center to provide space and services, the following are key considerations when negotiating any data center deal.

Space and Specifications: Defining the Environment

The space a customer leases within a data center can vary greatly in size and specifications. When contracting, it is important to detail:

- **Size and Power Requirements:** How much physical space and power the customer's equipment will need. Power density (watts per square foot) is critical, and must align with the customer's anticipated growth. Accordingly, parties should specify initial size and power requirements and negotiate a customer's rights of first refusal for adjacent space and additional power.
- **Cooling and Heating:** Climate requirements to ensure that the data center maintains appropriate temperatures for customer equipment. Excessive heat can damage servers, while proper cooling enhances performance. Accordingly, contracts often specify acceptable temperature ranges and require continuous climate monitoring and alerts for any deviation beyond the acceptable range. The parties can also monitor these data center environment attributes as part of a Service Level Agreement (SLA) to incentivize the provider to meet those tolerances.
- **Connectivity and Redundancy:** Terms that specify failover systems and procedures to ensure business continuity if there is a failure (e.g., backup cooling systems, redundant power and network connections, the ability to connect to different carriers or cloud providers). Often, this takes the form of a detailed backup and recovery plan that meets the customer's requirements and is tested regularly. Thoughtful SLAs that guarantee response and restoration times also help minimize the risk of downtime if there's an incident.

Physical and Data Security: Protecting Your Assets

Security in a data center is twofold: protecting physical assets and ensuring data integrity. The contract should address both, including:

- **Access Controls:** The parties should negotiate access protocols, including who can physically enter the customer's space and how security will be enforced and monitored. For instance, is 24/7 biometric access control available, and how long are video recordings retained? Is there an authorized list of entrants? Who is responsible for escorting approved visitors to a customer's cage (and if it is someone other than the customer, is there a separate charge for this service)? These are some of the many details that should be defined.
- **Data Security:** If a third-party provider has access to a customer's data or equipment, the parties need to ensure that data protection regulations (like the EU's General Data Protection Regulation (GDPR) or the California Consumer Privacy Act (CCPA)) are met, and each party's

obligations and rights are clearly defined. The contract should also include clauses covering encryption and other security requirements, along with each party's obligations with respect to changes in regulations and compliance audits.

Service Delivery: Managing Expectations

Particularly where a customer is leasing space in a colo facility or working with an MSP, the parties need to clearly define what equipment, office/storage space, and services will be delivered, such as:

- **Equipment:** The contract should specify any equipment (e.g., racks, servers, power units) that will be provided or made available for rent by the data center provider or MSP. Where this is the case, the agreement will also need to clearly outline (i) the provider's maintenance and replacement obligations, (ii) who is responsible for the equipment, including liability for damages, and (iii) each party's ownership status during and after the term of the agreement. For example, does the customer have the right or obligation to purchase the equipment at the end of term?
- **Smart Hands Services:** If the customer does not have onsite personnel to manage its equipment, it may need "smart hands" services, whereby the provider's technicians handle troubleshooting and maintenance within the customer's space. The parties will need to specify the hours of operation, access protocols and costs associated with such services.
- **Additional Space:** If an MSP provides smart hands services for a customer, the parties will need to determine whether the MSP will have office space in the data center to work from when the personnel are not on the data center floor. In a colo data center, a customer may also need to rent additional storage space for spare parts and equipment. In addition to accounting for these additional space needs, the contract must specify the corresponding costs and use restrictions for such spaces.
- **Service Level Agreements (SLAs):** To incentivize adequate service delivery, it is crucial to include in SLAs appropriate provider obligations for things like uptime, response times and repair timelines, along with meaningful credit amounts due to the customer if the provider fails to meet the service level commitments.

Pricing Structures: Breaking Down the Costs

Pricing in data center deals often involves multiple layers and can be complex. Understanding the market standards can help avoid surprises.

- **Space and Power:** These are typically charged based on square footage and the amount of energy consumed (often in kilowatts). Some data centers offer tiered pricing depending on power density needs.
- **Energy Costs:** The parties must specify how energy consumption is calculated and whether costs are fixed or variable based on market rates.
- **Services:** Managed services, whether from the colo provider or an MSP, come at additional cost. These include smart hands, monitoring, backups and managed IT services.
- **Flexibility and Scalability:** The contract should specify whether the customer can expand or reduce space or power requirements, along with the associated costs. Including these pre-negotiated terms and rates can help avoid disputes as customer needs evolve.

Other Key Issues to Consider in Contract Negotiations

Finally, the parties will need to address these common issues during contract negotiations:

- **Termination/Extension Rights and Exit Strategy:** The parties should define their options, rights and obligations (and associated costs) if the customer needs to (i) exit the data center early, (ii) extend the term, or (iii) receive assistance transferring to another location/provider ("disengagement assistance"). This is typically done through appropriate termination, extension and disengagement assistance terms. What's "appropriate" depends on the specifics of each deal; however, because exiting a data center can be a long and complex process, the parties should ensure adequate time to exit, ideally with rights to extend for predetermined periods (e.g., three-month blocks) at predetermined costs. This provides certainty for all parties if a customer experiences unexpected (and often, inevitable) data center exit delays. Having the right to a clean exit strategy, with rights to remove equipment and ensure continuous service elsewhere, will help a customer negotiate all other aspects of the services relationship.

- **Energy Efficiency and Sustainability:** With increasing focus on sustainability, the parties may want (or may be required by their regulators or investors) to negotiate terms related to energy efficiency, renewable energy use and the provider's carbon footprint. In some cases, monthly reporting of carbon footprint sustainability may be required, including whether there is a zero-carbon footprint or carbon offset purchases.
- **Liability and Insurance:** The parties will need to define liability in the event of equipment damage, service failure, security incidents and other events. The parties should also define and understand the limits of the provider's insurance coverage and whether additional coverage is required.
- **Regulatory Compliance:** Certain regulated customers may be obligated by their regulators to only use data center facilities that are certified according to applicable standards (e.g., NIST 800-53, ISO/IEC 27001, etc.), in which case the contract must include such flow-down requirements.

Conclusion: Tailoring Your Deal to Your Needs

A successful data center contract requires more than just securing space. It requires aligning the physical, operational and financial aspects of the arrangement to meet a customer's specific needs. Addressing these and other key considerations in data center contracts will help protect each party's interests and ensure a smooth operation. ❖

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Powering Data Centers with Nuclear Generation

Powering Data Centers with Nuclear Generation

***by* Robert A. James, Elina Teplinsky, Jeffrey S. Merrifield and M.C. Hammond**

The rapid growth of electricity demand from data centers has emerged as a major challenge for the U.S. power sector. Much of this demand is being driven by the deployment of large learning models (LLMs) and generative artificial intelligence (AI). These workloads require large-volume, high-uptime computational infrastructure, and correspondingly large, reliable power supplies.

Combined with broader electrification across transportation, buildings and industry, this surge is pushing generation planning as well as grid capacity toward and beyond their limits across many national and international jurisdictions. For utilities and grid operators—many of which have faced decades of ho-hum flat or predictable load growth—this new environment demands rapid, large-scale planning. Build too little, and the risk of blackouts increases. Build too much or in the wrong places or sequence, and ratepayers are stuck funding stranded assets.

Data centers are approaching and exceeding gigawatt-magnitude loads and demand exceptional reliability—up to 99.999% online service—due to the computational and financial costs of power interruptions, and many data center developers are committed to identifying carbon-free generation for their facilities. Traditional generation sources have their limitations. Natural gas-fired projects have been delayed by the current long lead times to procure turbines, and carbon capture is presently an expensive pathway to zero-emission power. Variable renewable energy (VRE) sources like solar and wind, paired with lithium-ion battery storage, have attractive near-term economics but face longer-term impediments for data center applications when taking into account the useful life of panels, turbines and especially batteries, and the large amount of land required for renewable deployment at this enormous scale. **Advanced geothermal** is promising for some quantity of generation or heat content focused in certain geographies and geologies.

The challenge with any mix of existing generation sources is that the demand for power occasioned by data centers is dwarfing the capabilities of gas, renewables/storage and geothermal for baseline operation. "It's crazy because […] the [entire] state of Oregon is about 6 gigawatts (GW)," **says one Amazon manager**, "and you have these large hyperscalers [asking,] 'Can I get 6 GW too?'"

Enter Reliable and Carbon-Free Nuclear Energy

Nuclear power in the United States has long served as a cornerstone of the country's low-carbon energy mix. As of 2025, there are 94 commercial nuclear reactors operating across 28 states, collectively providing nearly 20% of the nation's electricity and almost half of its carbon-free generation. These reactors offer unparalleled reliability, with average capacity factors exceeding 94%, far outperforming most other generation sources. Increasingly, the nuclear fleet is being viewed not only as clean energy infrastructure but as a strategic asset for powering AI workloads and data centers.

In this context, several shuttered nuclear plants are being actively pursued for restart, reversing what had been a trend of premature closures due to market pressures. Most notably, the Palisades Nuclear Plant in Michigan—shut down in 2022 and acquired by Holtec International—is now on track to become the first U.S. commercial nuclear plant to restart after closure, with support from the U.S. Department of Energy's Loan Programs Office (LPO). The plant could return to service as early as 2025.

Another notable example is the 2024 power purchase agreement between Microsoft and Constellation Energy, structured to support the restart of the Three Mile Island Unit 1 (TMI-1) reactor in Pennsylvania. (This is not the TMI-2 unit that was the subject of the 1979 incident.) The deal is among the first of its kind to link a corporate clean energy buyer directly to the revitalization of a retired nuclear asset and reflects growing interest in pairing existing nuclear infrastructure with long-term digital energy demand.

These restart efforts are not sufficient to meet the scale and speed of demand driven by the explosive growth of AI. Even if all viable U.S. reactors currently under consideration for restart were successfully brought back online, their combined capacity would represent only a fraction of projected demand growth—let alone offer the geographical diversity or scalability needed to support the decentralized digital infrastructure emerging across the country. Similarly, many existing nuclear units will be seeking power uprates—potentially adding several thousand megawatts to the grid—but this too will not meet AI-based demand. To close this gap, companies are pursuing a new wave of nuclear construction focused not only on traditional large-scale plants but also on Small Modular Reactors (SMRs). To understand the attraction of SMRs for this application, it is useful first to step back and understand what these reactors are and how they are distinctive in two dimensions—different from prior nuclear builds and suited for the data-center context.

SMRs have the capability to have significant portions of the plants built in a factory environment, where economies of scale can be captured and weather-related impacts are avoided. While today's large nuclear power plants can involve 30-35% fabricated content, many SMRs are **expected** to have 50-60% of such content. The modules are also smaller and designed to be shipped either entirely within a standard rail or truck container or in a modest number of containers for ready assembly on site. The more modules built in a given factory with the same workforce, the better the cost and schedule expectations.

SMRs are generally considered to be reactors between 50 and 300 megawatts of electricity output or MWe, though there are examples, such as the Rolls Royce 440 MWe design, that are larger. Designs smaller than 50 MWe are considered to be microreactors. The range of designs encompasses (a) compact versions of the "Gen III+" widely deployed technology based on light water cooling (either pressurized water reactors (PWR) or boiling water reactors (BWR)), as well as (b) new "Gen IV" designs using non-water cooling and moderating materials (including molten salt, sodium and lead, among others) at higher temperatures for greater efficiency.

Here is the **Pillsbury Guide to Advanced Reactor Designs**, so you can see a subset of the dozens of modular designs being evolved in the regulatory and commercial domains.

SMRs are especially compelling for the data-center use case. They offer:

- Baseload reliability critical for high-throughput AI workloads;
- A small physical footprint compared to land-intensive VRE;
- Flexibility for siting near data centers to minimize latency and interconnection issues. This is because the U.S. Nuclear Regulatory Commission, which normally requires an Emergency Planning Zone (EPZ) of at least 10 miles, supports SMRs having a smaller EPZ that extends only to the plant's site boundary (as little as 1,000 yards from the plant);
- Support for "behind-the-meter" installations that allow developers to bypass increasingly lengthy grid interconnection timelines. (**FERC proceedings are currently under way** that will help determine the contributions co-located facilities will make to share in the grid costs.)

New Nuclear Economic and Regulatory Outlook

Can the promise of new reactor deployments be realized to meet the energy demand occasioned by the data center and other drivers for electrification?

According to a recent study by the Idaho National Laboratory, which facilitates nuclear research, powering a 300 MWe data center entirely with VRE and batteries could cost more than a similarly sized SMR over time. That study recognizes that to address issues of intermittency, wind or solar generation would have to be overbuilt to meet the demand need. Additionally, due to the degradation curves of lithium batteries, their limited useful lives will require more capital investment during the lifespan of a typical data center facility. Admittedly, the study also assumes that SMRs can be built on budget and in about 4.5 years, as is currently envisioned.

Other studies hedge their bets on the possible cost, schedule and efficiency performance of SMRs, given the early stage in their development. Nonetheless, there are certainly conceptual attractions of having a **large amount of zero-emission power** generated with **high uptime** on a **small footprint**. An SMR should be able to achieve 57,000 MWh/acre/year at only 38 GW/acre, better than either gas or VRE on the one hand or large nuclear on the other.

Each SMR design outlined on the chart above is pursuing its own distinctive path to regulatory approvals and commercialization in the United States and beyond. Kairos Power obtained a construction permit from the NRC in December 2023 and completed the first safety-related concrete pour for its Hermes reactor earlier this month. And in April 2025, Ontario Power Generation (OPG) in Canada obtained a construction permit from the Canadian Nuclear Safety Commission (CNSC) for the construction of the first GE-Hitachi BWRX-300 reactor on the site of its Darlington nuclear power plant. TerraPower started site preparation activities last year for its commercial scale reactor in Wyoming. NuScale has now achieved NRC standard design approval for its larger 77 MWe design. Other designs are well along in the regulatory approval and pre-application processes. The various hyperscalers are aligning with several of the modular reactor developers, placing bets in most cases on more than one horse.

The **Pillsbury Nuclear-Powered Data Center Project Tracker** is **available here**. (Fusion generation for data centers deserves, and will receive, its own Pillsbury article.) Pillsbury is active on multiple nuclear projects—both large reactors and SMRs. Please contact the authors for more information and assistance.

De-Risking First-Mover Investment

The on-again, off-again history of new nuclear construction in the U.S. has led to little stability in construction workforces and an inability to validate cost estimates. This has made sponsors and lenders wary of the economic viability of nuclear energy—whether large reactors or SMRs. Any lender is likely to require that project funding plans include some form of large and readily available financing reserves (e.g., cash, letters of credit, or funding availability) to cover unplanned costs. This contingency adds meaningfully to the overall capital commitment. Even with such project cost buffers, there remains some probability that costs will exceed committed financing.

To combat this risk, the Energy Futures Finance Forum—a program within the EFI Foundation—recently published a policy framework for a publicly funded cost stabilization facility (CSF) to address the risk of potential cost overruns to sponsors for early-stage projects, with the intent to mitigate a key hurdle to new nuclear energy projects.

Together, **EFI and Pillsbury developed a model term sheet** for such a CSF. Under this structure, a guaranteed loan would be drawn to support potential cost overruns of at least three SMR projects using the same underlying technology. The CSF could be backed by either a private lender or a public one, such as the Department of Energy's LPO.

The risk of cost overruns is greatest for the earliest projects, and later projects will benefit from identifying the issues encountered in prior projects and how to avoid or mitigate them. Thus, the sponsors should agree to share the repayment of the CSF, again on an equitable basis. In recognition that the first projects may face the greatest challenges, the model term sheet does not specifically allocate the CSF, so the first project could potentially absorb all of the capacity, unless the sponsors choose to specify an allocation.

The model term sheet is by its nature only a starting point, and eventual agreements for a CSF of this type may differ in various ways. However, this model can provide the required conceptual approach needed in order to share the risks of cost overruns across multiple projects and over an extended payback period.

Uncertainty Between Congress and the White House on Nuclear Financing

The Trump administration and Energy Secretary Chris Wright have continued to champion new nuclear development. Indeed, on May 23, 2025, President Trump **signed four executive orders** to speed up commercialization of nuclear power in the U.S., with a goal to quadruple nuclear power capacity by 2050.

The enthusiasm shown by the executive branch needs to be aligned with legislative proposals. The House budget bill proposed shortening the eligibility window for key federal incentives. Under the proposed change, construction would need to begin before the end of 2028 to qualify for Production Tax Credits (PTCs) or Investment Tax Credits (ITCs). This accelerated timeline could disqualify new nuclear projects without a current order book.

The House also proposed rescinding all unobligated credit subsidy funding for the DOE LPO. If enacted, this would require borrowers—particularly those developing first-of-a-kind projects—to bear the full cost of the loan risk, making LPO-backed financing less affordable and accessible. This is at odds with Secretary Wright's indication that LPO monies should be directed toward nuclear projects.

If these proposals were to become law, nuclear project development will rely even more heavily on anchor customers like the hyperscalers. These companies may need to provide upfront equity, development funding, or long-term power purchase agreements (PPAs) to catalyze early deployment.

The Senate is actively considering modifications to the budget bill. Senators Dave McCormick (R-PA) and Chris Coons (D-DE) recently introduced the International Nuclear Energy Financing Act to encourage more nuclear energy financing for projects that would create jobs in the United States. Senator John Barrasso (R-Wyo.) is the Senate Majority Whip and has historically supported nuclear development.

For tech companies aiming to scale AI data centers, nuclear offers firm, clean, scalable power. But making this opportunity a reality will take creative approaches to project finance, including new forms of risk-sharing.

Pillsbury's Energy Transition Group is actively engaging with clients on innovative funding structures for new nuclear. From engaging with the DOE and national laboratories to forming development consortia, we are supporting sponsors, developers, utilities and tech firms navigating this next chapter in energy infrastructure. ❖

Pillsbury Guide to Advanced Reactor Designs

Design	Capacity	Details & Status
Pressurized Water Reactor (PWR)		
Nuscale VOYGR	77 MWe	NRC Certified 50 MWe design in 2022, 77 MWe design certification expected in July 2025. Established supply chains with Doosan in Korea, and ability to use commercial fuel.
Holtec SMR-300	300 MWe	$116 million risk reduction award through DOE ARDP program. Two units to be deployed at Palisades site in Michigan. Pre-application activities with the NRC.
Westinghouse AP300	300 MWe	Smaller version of AP1000. Early discussions with USNRC.
Westinghouse AP1000	1100 MWe	Full size AP1000 PWR. NRC design certified and successfully constructed at Vogtle Units 3 & 4. Installed in many locations in the U.S. and abroad.
Rolls Royce RR SMR	470 MWe	Great British Nuclear selected the RR SMR along with five other SMRs to progress to the next phase of the UK's innovative nuclear technology competition for potential deployment in the country.
Deep Fission Borehole Reactor 1 (DFBR-1)	15 MWe	Pre-application activities with the NRC.
Last Energy PWR-20	20 MWe	Announced plans to build 30 microreactors in Northwest Texas. Nonbinding commercial agreements to deploy 80 units in UK and EU markets.
Boiling Water Reactor (BWR)		
GE-Vernova BWRX-300	300 MWe	Approved for construction by Ontario Power Generation (OPG) at Darlington New Nuclear Project in Lake Ontario. TVA submitted USA's first construction permit application for BWRX-300 SMR at the Clinch River site, near Oak Ridge, Tenn.
High-Temperature Gas Reactor (HTGR)		
BWXT BANR	15-20 MWe	Contract with Wyoming Energy Authority to evaluate placement at mining/industrial sites. Signed a collaboration agreement with Tata Chemicals Soda Ash Partners (TCSAP) to explore the potential deployment of the BANR SMR at the TCSAP's Green River site in Wyoming.
NANO Nuclear Energy KRONOS MMR	15 MWe	Working with University of Illinois at Urbana-Champaign to go through NRC licensing approvals.
Radiant Energy Kaleidos	1.2 MWe	Selected by U.S. DOE in April 2025 to receive HALEU for first reactor test.
X-Energy XE-100	80 MWe	Selected for DOE ARDP–two units at Dow Texas site. Four units at Amazon/EnergyNorthwest with direct investment from Amazon. Allocated initial HALEU amounts by DOE.
Molten Salt Reactor (MSR)		
Natura Resources MSR-1	Non-power research 100 MWe commercial	Initial prototype research reactor received construction license for deployment at Abilene Christian University.
Terrestrial Energy Integral Molten Salt Reactor (IMSR)	195 MWe	NRC pre-application and CNSC review.
Kairos Power KP-FHR (Fluoride-Cooled High Temperature Reactor)	150 MWe (2x75 MWe plants)	Selected for $303 million risk reduction award by DOE. First non power units at Oak Ridge. 500 MWe deal with Google. Allocated initial HALEU amounts by DOE.
Liquid Metal-Cooled Reactor (LMR)		
TerraPower Natrium Sodium Fast Reactor	345 MWe 500 MWe (5.5 hrs)	Selected for DOE ARDP demonstration award. Non-Nuclear construction has begun for coal-to-nuclear site in Kemmerer, Wyo. Allocated initial HALEU amounts by DOE.
ARC Clean Technology ARC-100	100 MWe	The ARC-100 reactor has been selected by NB Power, the primary electric utility in the Canadian province of New Brunswick for deployment at their Point Lepreau Nuclear Generating Station.
Oklo Aurora Sodium Fast Reactor	15 MWe 50 MWe	Power agreement signed in December 2014 with Switch, a data center developer.
High-Temperature Sodium Heat Pipe		
Westinghouse eVinci Microreactor	5 MWe	$7.4 million cost share award through DOE ARDP risk reduction program. Allocated initial HALEU amounts by DOE.

Pillsbury Nuclear-Powered Data Center Project Tracker

June 2025 Edition

Advanced Reactors and Small Modular Reactors (SMRs)

Data Center Offtaker	Reactor Design	Anticipated Operator	Nameplate Capacity/Unit	Anticipated MW in Deal	Announced Deal Structure	Potential Location
Amazon Web Services	X-energy XE-100	Energy Northwest	80 MWe	320 MW with option to scale up to 960 MW	$500 Series C-1 round led by Amazon's Climate Pledge fund, with investment from Citadel founder Ken Griffen, NGP and the University of Michigan.	Pacific Northwest
Amazon Web Services	X-energy XE-100	Dominion	80 MWe	300 MW	$500 Series C-1 round led by Amazon's Climate Pledge fund, with investment from Citadel founder Ken Griffen, NGP and the University of Michigan.	Virginia (North Anna Power Station)
Google	Kairos Power KP-FHR	Various	75 MWe (deployed two at a time for 150 MWe total)	500 MW (1 initial 50 MW reactor with 6x75MW reactors subsequently)	Master Plant Development Agreement	Multiple
Standard Power	NuScale VOYGR	ENTRA1 Energy	77 MWe	Up to 2 GW	In October 2023 Standard Power announced it had selected NuScale as the SMR technology partner for two planned gigawatt-scale data centers. ENTRA1 has the rights to develop, manage, own and operatre the plants.	Ohio, Pennsylvania
Switch	Oklo Aurora Powerhouse	Various	50 MWe	12 GW	Master Power Agreement	Nevada
Meta				1–4 GW	Requests for proposals were due February 7, 2025. Over 50 qualified submissions received for RFP.	
Oracle				TBD	Designing a data center that would be powered by three SMRs	
Google				2.4 GW (at least three sites will deploy 600 MW each)	Elementl Power, an advanced nuclear development company, will identify, acquire and prepare locations to accommodate the reactors.	

Existing Nuclear Plants and Nuclear Plant Restarts

Data Center Offtaker	Nuclear Power Plant	Project Type	Owner	Announced Deal Structure	Expected Online Year	Potential Location
Microsoft	Crane Clean Energy Center (formerly Three Mile Island, Unit 1)	Plant Restart + Long-Term PPA	Constellation	20-year PPA at approximately $100/MWh	Mid-2028	Londonderry Township, Penn.
Amazon Web Services	Susquehanna Nuclear Station	Existing Plant + Co-Location/ Behind-the-Meter	Talen Energy	Direct sale of data center campus to Amazon Web Services	Challenges asserted for co-located data centers and behind-the-meter load.	Salem Township, Penn.
Meta	Clinton Clean Energy Center	Existing Plant + 30 MW	Constellation	20-year Corporate Nuclear Energy Agreement for Zero Emissions Credits (ZEC), taking over when state ZEC program expires	2027	Clinton, Illinois
Public reporting of discussions	Calvert Cliffs Clean Energy Center	Existing Plant + Co-Location/ Behind-the-Meter	Constellation			Calvert County, Md.
Public reporting of discussions	Comanche Peak	Existing Plant + Co-Location/ Behind-the-Meter	Vistra	Vistra in discussion with several parties. Comanche Peak is in ERCOT and outside FERC jurisdiction.	Public reports also note Vistra is in discussion to build new gas power plants to support data center projects directly.	Dallas, Texas
Public reporting of discussions	Hope Creek Nuclear Generating Station	Existing Plant	PSEG		According to public reporting on PSEG, deal is possible this year and is not contingent on the outcome of FERC investigation into PJM colocation rules.	Lower Alloways Creek Township, N.J.
Public reporting of discussions	Salem Nuclear Power Plant	Existing Plant	PSEG		According to public reporting on PSEG, deal is possible this year and is not contingent on the outcome of FERC investigation into PJM colocation rules.	Lower Alloways Creek Township, N.J.

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Energy Development for Data Centers

Energy Development for Data Centers

***by* Rob James & Sid Fowler**

U.S. Department of Energy Pursues Data Centers on Federal Lands

On April 7, the Office of Policy for U.S. Department of Energy (DOE) published a Request for Information (**RFI**) seeking input from industry professionals, grid operators, local communities, Tribal governments, and other stakeholders regarding the development and operation of AI infrastructure—including **data centers**—on DOE-owned or managed lands. This initiative aligns with the January 2025 Executive Order, **Removing Barriers to American Leadership in Artificial Intelligence**, which underscores AI as a national and economic security priority. DOE is hoping the RFI provides information that allows it to better understand site interest, strategic data center design approaches, potential power needs, financial and contractual considerations related to leasing DOE-owned or managed lands, and the potential benefits and challenges associated with hosting AI infrastructure on DOE land.

Key Takeaways

DOE has identified 16 agency-owned or managed locations nationwide, including sites at major research facilities such as **Argonne**, **Brookhaven**, **Los Alamos**, **Oak Ridge** and **Idaho National Laboratory** as potential sites for hosting AI infrastructure. Many of these sites offer unique advantages such as secure land, proximity to advanced energy sources, scalability and access to water and mineral sources. DOE intends to prioritize select sites for future solicitations based in part on the responses to this RFI.

DOE's vision is to designate and entitle these sites for the construction of AI infrastructure by the end of 2025—targeting operational commencement by the end of 2027. The government anticipates authorizing land use rights through long-term ground lease or easement structures, depending on the desired length and terms of the agreements.

The RFI specifies that broad input is sought across 10 categories to assess the feasibility and value of locating potential AI infrastructure on DOE lands. Specifically, the agency is looking for feedback on preferred sites and their characteristics, design and technical considerations for data centers (including cooling and water needs), and opportunities for co-locating innovative energy technologies such as nuclear, geothermal and energy storage.

The RFI also seeks details on off-site power access and transmission requirements, preferred realty agreement structures, and potential economic and collaboration benefits with National Laboratories and local communities. Additionally, DOE requests information on anticipated environmental impacts, permitting needs, potential development challenges—such as supply chain or cybersecurity obstacles—and strategies for engaging Tribes, local governments and other stakeholders.

Finally, the agency is interested in hearing what additional information would be required from the DOE for a respondent to thoroughly respond to a potential future solicitation. This comprehensive inquiry is designed to inform future solicitations and shape a national strategy for scaling secure, sustainable AI infrastructure.

DOE's long-term plan could thus help create opportunities for advanced energy developers to develop co-located energy facilities to power data centers. The agency's publication signals a major federal push to accelerate AI infrastructure development while offering a rare opportunity for private entities to shape how and where that happens, and help influence the structure of future solicitations. With DOE lands offering large, secure and strategically located sites, companies stand to gain early access to prime development opportunities. This pursuit opens the door for long-term federal land use agreements, potential public-private partnerships, and collaboratives with National Laboratories.

Responses to the RFI are requested by May 7, 2025. Information that has the potential to compromise the competitive position of any participants will not be publicly released. Responses containing sensitive information are encouraged to be properly marked as confidential, proprietary or privileged by the DOE.

Pillsbury is available to assist stakeholders in navigating the RFI process and preparing for future DOE solicitations. Our team, led by authorities in energy and infrastructure law, is ready to advise clients on all aspects of engagement with DOE, from drafting RFI submissions and evaluating federal land opportunities to generating competitive responses to future Requests for Proposals (RFPs)—a process that is both **an art and a science**.

Big Data Meets Big Green: Data Centers and Carbon Removal Compete for Zero-Emission Energy

Artificial intelligence, data centers, carbon removal and zero-emission power may sound like a winning line (plus the Free Space) on a 2024 Buzzword Bingo card. But the concepts have come into dramatic real-world tension as private and public actors seek to accommodate the digital and environmental imperatives for green energy.

After years of fairly stable demand, punctuated by declines during the pandemic and economic slumps, **electricity demand is projected to double by 2050**. A principal cause is the rapid expansion in the power needed to energize and cool servers amid explosive growth in the number and size of data centers, crypto miners, and other point sources of computation. Data centers were 3% of U.S. demand and are **projected to be up to 9% or more** by 2030; **AI will drive a 160% surge in data center demand by 2030**. A **commentator notes**, "We haven't seen [growth like] this in a generation."

The large technology companies have vowed to power their enterprises with zero-emission electricity—from renewable sources like solar, wind and geothermal; advanced storage technologies; and nuclear fission and fusion. To achieve their goals, they are contracting with incremental sources of alternative energy that might otherwise have supplanted coal- and gas-fired power for industrial, commercial, residential and public works. A March 2024 report by S&P Global found that **the tech sector led the market for clean energy purchases**, making up over two-thirds of deals completed since February 2023.

Tech companies are exploring the option of partnering directly with advanced energy developers to build energy facilities that would directly supply the data centers—for example, **Microsoft is exploring small modular nuclear reactors**, while Meta **recently announced a partnership with Sage Geosystems**, an advanced geothermal developer, to expand the use of geothermal energy production for data centers. The growth in data center energy demand may be outpacing renewable energy production. Some utilities have responded with plans for new natural gas-fired power plants, sparking concerns that **data center demand growth may impact U.S. climate goals** despite tech's focus on net zero.

Data centers may create competition for limited clean energy resources with other cleantech. After all, renewable energy is not the only response to climate change; a number of projects capture ambient carbon from the atmosphere, both natural (reforestation, afforestation, sequestration of biological carbon sources in the soil and oceans) and manmade. **Direct air capture (DAC) projects** entail large machinery to absorb carbon in the atmosphere—machinery that itself is **energy intensive**.

These simmering factors came to a boil with the announcement last week by CarbonCapture Inc. that it would **suspend its development of a DAC plant in Wyoming** and assess relocation of the project, Project Bison, to another state. Project Bison is on hiatus not because of regulatory obstacles (its Class VI permits have been secured) or funding (it would have been part of a DAC Hub selected for $12.5 million in DOE funds). Rather, the company cited **the inability to contract for enough zero-emission power** given the highly competitive market in Wyoming. Given the Cowboy State's **ambitions to become carbon negative**, large technology companies are targeting Wyoming for data centers and similar facilities and have assertively staked positions with green energy sources. Ironically, **a technology company is an investor** in CarbonCapture Inc. itself.

The tensions between AI and data centers, and the green power sources needed not only for those purposes but for responses to climate change and the economy more generally, are not going away. Policymakers, entrepreneurs and advisers (including **Pillsbury's own data centers team**) must focus on efficient use, rapid prudent deployment, and prioritization of energy generation and transmission across the country and globe. ❖

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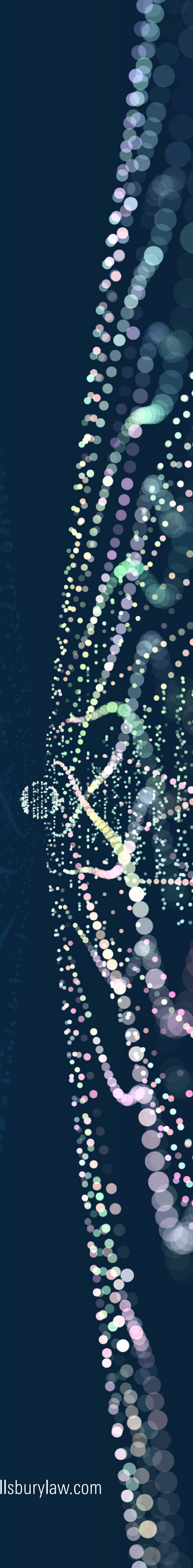
Investing in Data Centers



Investing in Data Centers

***by* Adam Weaver, Dave Lillevand & Allan Van Vliet**

It seems like such a simple question. Who owns data centers?

Ownership structures in the digital economy are more varied than might appear on the surface. While the largest computing and cloud service providers, such as Apple, Amazon (AWS), Microsoft (Azure) and Google (Cloud)—also known as "hyperscalers"—do own and operate a significant portion of their global infrastructure, they are increasingly partnering with third-party developers and investors, including real estate investment trusts (REITs), to expand capacity and deploy capital quickly and efficiently. This article provides a guide to how the most prominent strategic and financial players are engaging in this sector.

The Variety of Investment Approaches

Hyperscalers

Hyperscalers at the largest scale often own core campuses in strategic global regions and carry most if not all of the capital cost on their own books. Publicly reported examples include **Microsoft's data center campus** near San Antonio, Texas, Google's facilities in **The Dalles, Oregon**, and **Northern Virginia**, and **Meta's Kuna data centers** in Kuna, Idaho. Most hyperscalers own and operate a dozen or more of their own data center facilities in **locations around North America**. These companies acquire land (often without leveraging debt), self-fund construction costs, hire employees, and manage and operate these data centers to support their own cloud computing business lines; the economics of hyperscale cloud computing services make these major capital investments worthwhile for these large companies.

This model is less common among smaller (non-hyperscaler) operators. The capital requirements involved in acquiring land and in building and energizing the facility are significant, and non-hyperscaler operators may not have the financial capacity or risk tolerance to pursue direct ownership.

REITs, Developers and Infrastructure Funds

Many large-scale data centers and campuses are owned by infrastructure funds, REITs or private equity-backed developers who specialize in developing, owning and operating data center assets. These data center landlords lease space to hyperscalers, enterprises and other cloud service providers. Though hyperscalers do own campuses and facilities of their own (as described above), many still lease data center capacity from data center-specific REITs (like Equinix or Digital Realty), or partner with developers to build on a sale-leaseback model, which provides the developer/landlord with guaranteed rental income to help mitigate the large financial risk of data center development. REITs and developers on the other hand specialize in acquiring and constructing these facilities, and operators are often happy simply to lease the completed facility.

These arrangements often include long-term, triple-net leases that provide steady, predictable cash flow for the facility owners and reduced capital costs for operators. A hyperscaler or other operator leasing a data center will typically pay a base annual rent, and will reimburse the landlord for all (or a pro rata share, if there are multiple tenants or buildings within a campus) of the landlord's operating costs, such as maintenance, security, cleaning, landscaping and other management activities. Leasing rather than owning gives an operator flexibility to more rapidly adapt to market and technological changes, tying up capital for only a defined lease term rather than an extended period of ownership, and in some cases providing **rights to terminate a lease early**. Leasing also helps operators scale up more quickly—when additional capacity is needed, leased space can be brought online much more quickly than newly constructed space.

Other Investors

It is possible for others to invest in data centers, but options depend on financial capacity, risk appetite and access to institutional networks. Some avenues through which interested investors (including individuals) might gain exposure to the data center market are:

- **Public Markets (REITs).** This is the most accessible route. Publicly traded data center REITs like Equinix (EQIX), Digital Realty (DLR) and newer entrants like CoreSite (now part of American Tower) offer direct exposure to the sector. These REITs provide liquidity, dividends and built-in diversification across geographies and tenants.
- **ETFs and Mutual Funds.** While there aren't many mutual funds focused exclusively on data centers, several tech and infrastructure ETFs include heavy allocations to REITs and hyperscaler-linked real estate. Examples include the Pacer Benchmark Data & Infrastructure Real Estate ETF (SRVR).
- **Private Equity and Infrastructure Funds.** Access to private equity or other infrastructure funds that invest in data centers is more limited. These types of funds often require minimum investments in the seven-figure range and are typically open only to institutional investors and high-net-worth individuals. However, some private wealth platforms are beginning to offer limited access to infrastructure-focused funds.
- **Direct Investment or Syndication.** A more niche option is to invest directly in regional operators or through syndication platforms offering co-investment opportunities in smaller to medium-sized data center facilities. These are higher risk but potentially higher return, often suited for investors with both domain knowledge and capital.
- **Investment in Power Suppliers.** One interesting way to participate in the data center phenomenon is to invest in utilities and independent power producers that have a **particular specialty** in projects to supply energy for power and cooling for data centers.

The Data Center Capital Stack: Equity, Debt and Hybrids

Data centers are capital-intensive to build and operate. A hyperscale facility can cost hundreds of millions of dollars, and even smaller regional data centers often require tens of millions in up-front capital. Data center developers may seek financing for these projects from a range of sources, and may mix and match these sources, depending on the type and scale of the facility as well as regional leasing activity and demand.

Private Equity (PE) and Infrastructure Fund Equity

PE and infrastructure investors have poured capital into both developers and operators, funding greenfield builds and platform acquisitions. For example, Microsoft and BlackRock are publicly reported to have teamed up with technology-focused private equity firms to create a Global AI Infrastructure fund which aims to raise $30 billion for the construction and energizing of data centers; xAI and Nvidia have since **joined the fund**. Investment funds of this kind can deploy capital relatively quickly when opportunities arise, and can leverage debt resources on a project-by-project basis. Once a project is completed and operational, the fund (or other investment vehicle) may seek to sell the project at a profit.

REIT Equity and Debt

Data center REITs access both public equity and debt markets to finance new developments or acquisitions. Their access to capital is one reason hyperscalers increasingly partner with REITs. REITs acquire or invest in the land and facility directly, either independently or by entering a joint venture with an operator. REITs may work with developers to construct new projects or may acquire already-completed facilities and lease them out to operators. As with PE and infrastructure investors, REITs can raise funds from a variety of sources and deploy those funds quickly when opportunities arise. Unlike hyperscaler-owned projects, REITs typically have a specific investment period or horizon, after which they will look for exit opportunities rather than continuing to own a project or facility indefinitely.

Corporate and Project-Level Debt

Securing long-term debt to finance large infrastructure projects such as data centers is common, particularly in stabilized assets with secure tenant leases. For example, a developer may negotiate with a hyperscaler to enter an agreement to lease a yet-to-be-completed data center and then provide a lender with the finalized lease to make the lender comfortable that the project will provide sufficient cash flow as a means to secure more favorable loan terms. Because data centers tend to have long occupancy periods and low turnover as compared to other asset classes, cash flows can be easier to predict, and vacancy risks can be minimized. This in turn attracts potential lenders to underwrite these sizeable projects. Alternatively, hyperscalers themselves can use debt to **defray their own capital outlays** for new projects; the lender can rely on cash flow projections of the hyperscaler itself rather than potential lease income to gain comfort lending money in these cases.

Debt terms can range from traditional bank loans to infrastructure debt and even green bonds when sustainability targets are involved.

Hybrid Approaches

The investment options are also ripe for consideration of hybrid approaches. While some states are straining under the power and other requirements of data centers, other localities are looking to lure them in with tax abatements, grants and other incentives. Government users will increasingly demand data center capacity of their own in the 21st century. These alternative approaches to investment may entail public-private partnerships and joint ventures and other forms of collaboration and equity, convertible debt and conventional debt instruments.

The sheer size, diversity and sophistication of the modern data center can test the most experienced of investors and most robust of capital stacks. For those contemplating investment in data centers and the related digital economy, knowing where to start, what to do on the way, and what comes next after you get there requires its own substantial stack of sector-specific legal, business and regulatory guidance. ❖

7

PFAS, HFCs and Related Chemicals in the Data Center Industry

PFAS, HFCs and Related Chemicals in the Data Center Industry

***by* Sid Fowler, Reza Zarghamee**

Data centers use various chemicals that have recently been the focus of regulatory efforts at the federal and state level. The historic or future use of these chemicals may create liabilities, obligations, or new costs for both existing and planned data centers.

PFAS Use in Data Centers

Per- and polyfluoroalkyl substances (PFAS) are a class of approximately 15,000 synthetic fluorinated organic compounds (by EPA's **most recent reckoning**) that have been widely used for decades in a wide range of products and industries. The carbon-fluorine bond is among the strongest in organic chemistry and gives PFAS their physical properties: fire, water and grease resistance. These properties—chemical stability, resistance to degradation, and oil and water resistance—make PFAS both useful and concerning from an environmental and health perspective, as they tend to persist in the environment and bioaccumulate in living organisms.

As a result, PFAS have become a major focus of regulatory action and litigation in recent years, with governments and plaintiffs increasingly targeting their use, disposal and presence in consumer products and water supplies. Regulatory definitions of PFAS vary depending on the regulatory body. The most expansive definitions of PFAS are those adopted by **certain states** that classify as PFAS any chemical featuring a carbon atom that is saturated with fluorine.

PFAS that meet this definition serve several necessary functions with respect to data centers. For example, certain server components and cables, including switchgears, either integrate or are coated with PFAS, particularly fluoropolymers. The presence of fluoropolymers in such equipment is hardly unique to the data center industry. Because of their relative stability and molecular size, fluoropolymers are not as bioaccumulative or toxic as long-chain alkyl PFAS (i.e., straight-chain PFAS with molecular backbones that are at least seven carbons long).

On the other hand, more focused applications of PFAS occur with respect to one of the main concerns at data centers—namely, the propensity for servers and other equipment to malfunction as a result of overheating. Because of their low boiling point and fire-resistant qualities, PFAS (as defined per the state definitions) are used as refrigerants and cooling agents within chillers and air conditioning centers, which are an important aspect of most data center designs. In addition to impairing server operability, overheating can give rise to a risk of fire, which is exacerbated by the concentration of electrical equipment and combustible materials like cabling and plastics. As such, data centers are equipped with fire suppression systems, which may contain PFAS.

PFAS in Fire Suppression Systems

Because data centers are packed with server racks, they require fire suppression systems that will not destroy the equipment. The best suited are dry pipe fire sprinkler systems and a clean agent fire suppression system.

- Historically, dry pipe fire suppression systems have used Class B aqueous film-forming foams (AFFF) and automatic reactivation AFFF. These AFFF formulations may contain PFAS, and the activation of fire suppression systems may result in the sudden discharge of large quantities of PFAS-containing AFFF. Furthermore, the long-chain alkyl PFAS present in AFFF—perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS)—are dispersible in the environment and (a) subject to stringent de facto cleanup standards in the form of maximum contaminant levels of 4 parts per trillion (ppt) in groundwater, orders of magnitude lower than those for other industrial chemicals, and (b) formally designated as hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), meaning that sites contaminated with these chemicals are subject to strict, joint and several liability. Accordingly, some of the largest PFAS settlements to date have occurred in **multidistrict litigation involving the discharge of AFFF to the environment**. To date, 15 states (AK, CA, CO, CT, HI, IL, ME, MD, MN, NH, NJ, NY, RI, VT and WA) have banned the sale of firefighting foam containing PFAS. There is an expanding market of synthetic fluorine-free foams (SFFFs). However, SFFFs do not have the same efficacy as AFFF technologies.

Clean fire suppression systems use gaseous agents to quickly extinguish fires, leaving no residue behind, which makes them ideal for protecting sensitive equipment and areas where water damage would be undesirable. The most commonly used clean agents like FK-5-1-12 (Novec 1230), HFC-227ea (FM-200), HFC-125, HFC-236fa, and 2-bromo-3,3,3-trifluoropropene are PFAS under various definitions, though they have different properties from PFOA and PFOS and are not subject to CERCLA regulation. Even so, data centers may be regarded as a target for litigation in areas where contamination with fluorinated organic compounds has been identified.

HFC-Refrigerants

Hydrofluorocarbons (HFCs) are synthetic chemicals commonly used in commercial refrigeration and cooling systems. Data centers produce large amounts of heat and often need complex cooling systems to ensure their systems do not overheat.

Starting in the 1990s, HFCs came to replace traditional refrigerants, classified as ozone-depleting substances, in the aftermath of the 1987 Montreal Protocol. However, HFCs themselves present environmental risks as greenhouse gases. Indeed, studies exist to suggest that the global warming potential of HFCs may be many times greater than that of carbon dioxide, and the data center industry is coping with an increasingly stringent regulatory framework focused on HFCs. Hydrofluoroolefins (HFOs), which are increasingly being seen as alternatives to HFCs, have a lower global warming potential but may carry their own risks such as flammability.

Congress passed the **American Innovation and Manufacturing ("AIM") Act of 2020**, mandating an 85% phasedown of HFC production and consumption by 2036. Under the Biden administration, the U.S. Environmental Protection Agency (EPA) moved aggressively to implement the AIM Act through a suite of interconnected regulations:

- A cap-and-trade system, which became effective on November 4, 2021, and which is intended to **phase down** over time the total volume of HFCs in the U.S. market.
- The Technology Transition Rule, 88 Fed. Reg. 73098 (October 24, 2023), restricting the use of most HFC-based refrigerants in new equipment.
- The Emissions Reduction and Reclamation (ER&R) Rule, 89 Fed. Reg. 82682 (October 11, 2024), which mandates leak prevention, repair, and in some cases the replacement of HFC-based cooling systems.

This regulatory approach means that both new and existing data centers may be impacted. Existing data centers that rely on HFCs may be impacted by the ER&R rule, as it imposes **extensive and likely costly compliance obligations** on such systems. For example, operators of existing systems may be required to install automatic leak detection equipment, meet detailed recordkeeping requirements, promptly repair leaks that exceed specified thresholds, and even retrofit or retire systems that cannot be repaired within certain timeframes. New data centers may be impacted by the limitations on new cooling technology available, as the Technology Transitions rule removes HFC-based systems from the market. For example, new data centers systems will be legally prohibited from using systems that rely on R-410a, a popular refrigerant in data center cooling systems.

Despite the increasing availability of alternative refrigerants coming onto the market, it may be difficult to retrofit existing refrigeration systems to use these products. Additionally, the new refrigerants—including some that are HFOs and hydrochlorofluoroolefins—may present other risks not customarily associated with HFCs. For example, A2L refrigerants may raise new concerns due to their flammability, CO2-based systems may require higher energy consumption particular in warmer climates, and adiabatic cooling (temperature reduction via pressure drop) may be water-intensive and therefore unsuitable for drier regions. ❖

8

Designing, Constructing and Converting Data Centers and Crypto Mines

Designing, Constructing and Converting Data Centers and Crypto Mines

by **Jamie Bobotek, Rob James, Arielle Murphy & Polly Gomez**

The ever-increasing demand for digital infrastructure, coupled with continuing cryptocurrency demand volatility, has generated significant interest in transforming building improvements housing crypto mining farms into modern high-capacity data centers. Crypto mines and data centers share certain foundational elements—facilities with a large footprint and the need for high power capacity and cooling—but they have different functions, and their operational models, technical requirements and regulatory considerations are correspondingly diverse.

Below are some key distinctions between the two, as well as issues developers should anticipate, when designing and constructing either type of facility, or considering a crypto farm-to-data center conversion.

Built for Different Purposes

Crypto mines and data centers share a fundamental requirement—both demand enormous computational power, resulting in the need for massive amounts of power and cooling. Their distinct operational goals, however, result in facilities that look and operate differently. Despite their common infrastructure backbone, their distinct purposes result in differing technical and architectural configurations.

It is useful to review the basics. A crypto mine is a facility that solves complex mathematics problems to secure digital currency transactions, particularly for cryptocurrencies akin to Bitcoin. Those transactions are then applied across a large number of decentralized blockchain networks. In return for this work, the "miners" are rewarded with new cryptocurrency.

The Greek poet Archilochus wrote, "the fox knows many things, but the hedgehog knows one big thing." **Crypto mining facilities** are hedgehogs, optimized for one task and one task only: performing vast numbers of computations, often through **proof-of-work** algorithms, to validate transactions on a blockchain. These operations are typically powered by application-specific integrated circuits (**ASICs**) or high-performance graphics processing units (**GPUs**) running nonstop to maximize **hash rate** and, by extension, potential earnings.

By contrast, **data centers** are foxes. They are facilities, often resembling a complex of warehouses, that hold computers, equipment and other multipurpose digital ecosystems designed to store, manage and disseminate large volumes of digital data. They serve a large number of purposes for many audiences, powering everything from websites, apps and cloud services to online banking platforms and streaming media. While their design and complexity may vary depending on operator functions and support needs, most require strong telecommunication capability to interact with the outside world with no lag, and uber-redundancy to maintain service reliability and keep systems running 24/7.

Key Operational Differences

The most fundamental operational distinction between crypto mines and data centers rests in how they are expected to perform under pressure. Crypto operations are inherently tolerant of downtime—if a machine fails, the network adjusts without significant disruption. This tolerance allows crypto mines to operate without the costly layers of **redundancy** common in enterprise-grade data centers. Crypto mines can take advantage of power price differences by operating at optimal times of day or in response to other market signals.

Data centers, on the other hand, are typically built for near-continuous **uptime**. Any interruption can result in **financial losses**, data loss and corruption, negative customer impact, reputational damage, and regulatory and compliance risks. These facilities rely on multiple backup systems, dual power feeds, failover networking, and strict monitoring to ensure performance and availability.

Network speed is another point of distinction. Crypto mines do not require high-speed bandwidth because they only deal with **small bits of transaction data**. In contrast, data centers are constantly sending and receiving large amounts of information between users and systems, so they require fast, reliable internet through fiber-optic and satellite telecommunications.

Another key difference is how intensively each facility works its hardware. Crypto mines usually run their machines—like ASICs and GPUs—at **full power all day, every day**, without much effort to balance the load. This heavy use can **wear out the hardware faster**. Data centers, on the other hand, take a more **measured approach** to extend the life of their cutting-edge hardware.

Shared Infrastructure and Design

Despite these differences, crypto mines and data centers share a common need for underlying infrastructure. That commonality is a large part of the reason that potential conversions are gaining traction.

Both facility types rely on massive computational power—whether through ASICs, **GPUs** or **CPUs**—to deliver nonstop performance. As a result, both require large-scale, efficient power delivery systems and advanced thermal management to keep hardware from overheating.

In addition, crypto mines and data centers often share similar physical layouts, starting with a large warehouse-type space. These facilities typically include raised floors or dedicated conduits for cabling, reinforced structures to accommodate heavy equipment, and secure access points to protect valuable hardware. Generally, the same building codes and industry standards will apply to the infrastructure, including **ANSI/TIA 942** and **APC No. 92**. These basic shared design elements make conversions feasible at a structural level.

Technical Challenges in Conversions

Because of their shared structural infrastructure, converting a crypto mine into a data center—or vice versa—has become an **appealing potential option to developers** as a cost-efficient reuse of an existing facility. However, developers must be cognizant of the technical challenges involved in such a conversion that may affect their bottom line. Below are several to consider.

Power Redundancy

In general, while crypto mines are typically optimized for maximum computation density with less of an emphasis on redundancy and resiliency, resiliency is perhaps the primary consideration when building and operating data centers. Converting a crypto mining facility to meet data center standards requires significant upgrades to power distribution units and the addition of **uninterruptible power supplies** (UPS) and backup generators to ensure reliability and compliance with data center uptime standards.

Cooling Systems

Crypto mining rigs generally operate under sustained maximum load to produce concentrated heat, which often exceeds the load legacy data center HVAC systems were designed to withstand. Conversion to a data center will likely require upgrades from basic or immersion cooling systems to precision computer room air conditioning/computer room air handling **(CRAC/CRAH) units**. Conversely, standard data center server racks are not suitable to accommodate the form factor or thermal output of ASIC miners or high-performance GPUs. Operators must also account for the different power delivery profiles of mining hardware, which often draw higher amperage at lower voltages than traditional information technology equipment.

Network Infrastructure

In either direction, reconfiguring network infrastructure to fit the requirements of each specific use is another key challenge. Crypto mines rely on minimal network throughput and often lack the robust switching and routing equipment needed for enterprise data workloads. A conversion to a data center will likely require procurement and installation of high-speed fiber, routers and redundant connections. Conversely, existing data center fiber and bandwidth capacity may remain underutilized in a mining operation, leading to a potential stranded investment.

Security Requirements

Security requirements can also shift when converting a crypto mine to a data center. Crypto mines prioritize physical security to prevent theft of valuable mining equipment over cybersecurity controls. Data centers typically require both physical and cybersecurity protocols, such as biometric access controls, 24/7 surveillance, audit logs for compliance, multi-factor authentication, and compliance with frameworks such as **ISO 27001** or **SOC 2**. Data centers run on a co-location or leasing model requiring physical and systems segmentation and segregation of customer assets and the utilities directed to serving those specific assets. A crypto facility may not have been originally designed and constructed with that need for segmentation in mind.

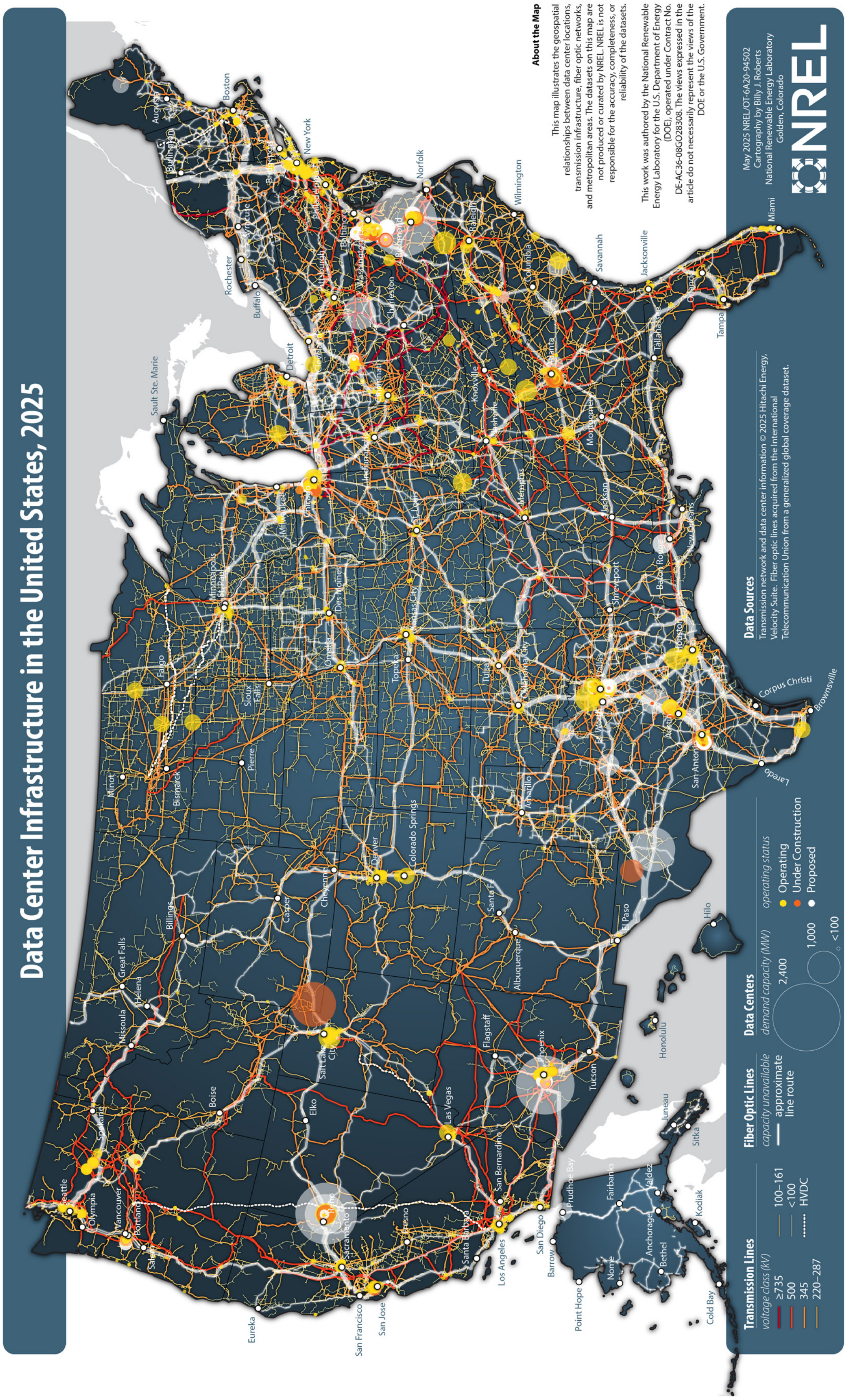
Noise Control

Noise control is another aspect to consider when contemplating a potential conversion, particularly depending on the facility's location. Crypto mines, which often operate in industrial or remote areas, generate substantial noise from ASICs, high-speed fans and dense clusters of mining rigs, with little concern for noise abatement. By contrast, data centers are often planned to operate near commercial or residential zones, especially the edge data centers that are becoming prevalent. Facilities in these locations are typically subject to **stricter noise regulations** and community impact standards. Conversion may necessitate installation of sound dampening infrastructure, such as soundproofing or upgraded HVAC systems, to comply with local ordinances and mitigate operational disruptions.

The bottom line? Converting an existing crypto mine into a data center, or vice versa, may be a viable and effective way to repurpose an existing but no longer fully utilized facility. But it is a complicated process. Developers contemplating these conversions should engage engineering, fire protection, power, acoustic and cooling consultants early in the process to assess feasibility, along with counsel to evaluate contractual, zoning and regulatory implications that may (and likely will) arise from the material change in facility use. ❖

Appendices

Map of Data Centers and Resources



Source: National Renewable Energy Laboratory (high-resolution version available by clicking on the map.)

Roster of Data Center Proprietors and Locations

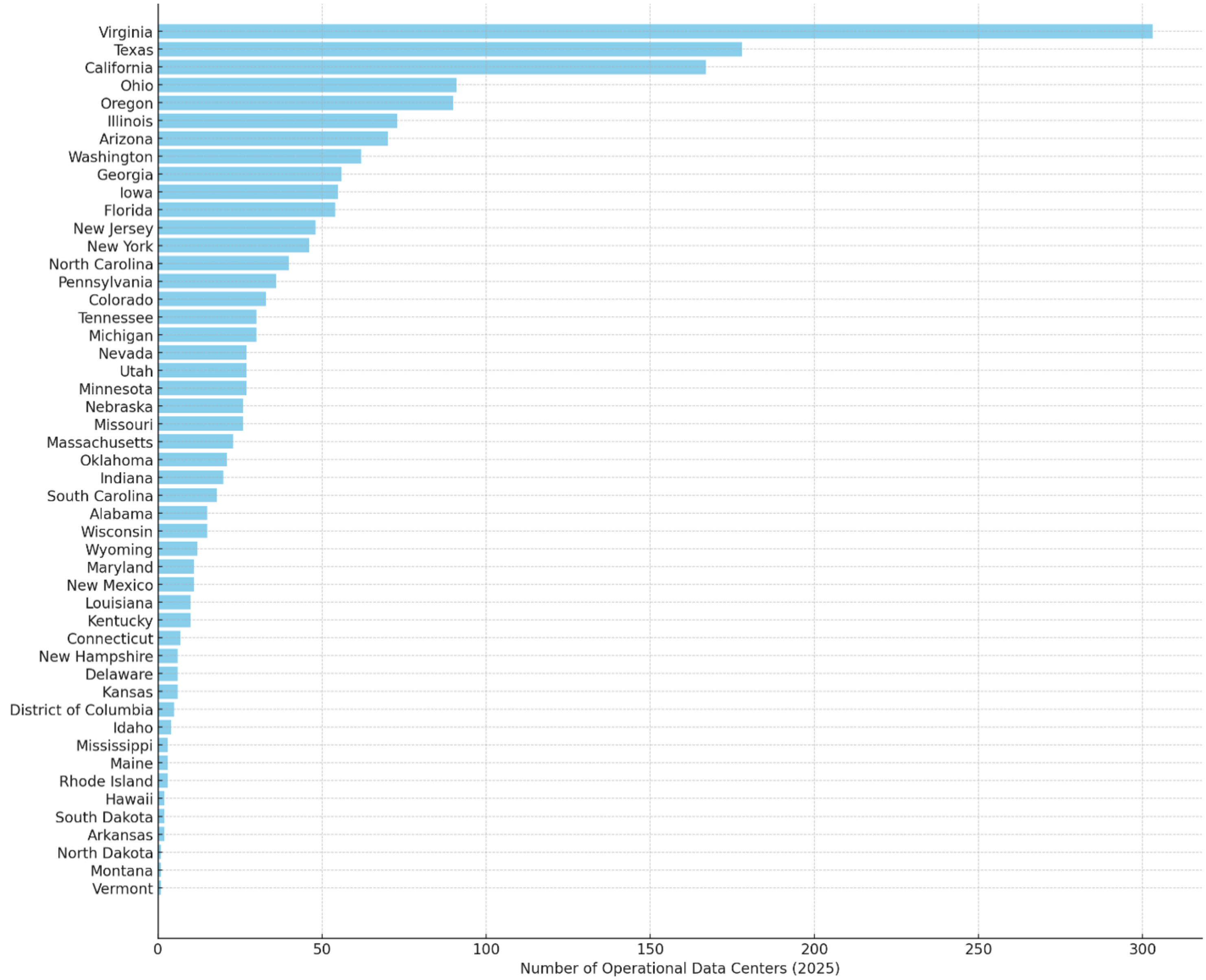
Top 50 Data Center Proprietors (by # of locations)

1. **China Telecom** (362 locations)
2. **Lumen** (340 locations)
3. **Equinix** (270 locations)
4. **Digital Realty** (249 locations)
5. **Zenlayer** (233 locations)
6. **Centersquare** (122 locations)
7. **365 Data Centers** (112 locations)
8. **MOD Mission Critical** (93 locations)
9. **DataBank** (69 locations)
10. **NTT Global Data Centers** (55 locations)
11. **Cogent Communications** (51 locations)
12. **EdgeConnex** (48 locations)
13. **Hivelocity** (46 locations)
14. **CyrusOne** (45 locations)
15. **Enzu** (44 locations)
16. **Cologix** (44 locations)
17. **TierPoint** (41 locations)
18. **Flexential** (39 locations)
19. **Iron Mountain Data Centers** (32 locations)
20. **QTS Data Centers** (31 locations)
21. **Vultr** (30 locations)
22. **H5 Data Centers** (27 locations)
23. **AT&T** (26 locations)
24. **CoreSite** (25 locations)
25. **Vantage Data Centers** (24 locations)
26. **Telehouse** (24 locations)
27. **Ascenty** (23 locations)
28. **Prime Data Centers** (22 locations)
29. **Colocation America** (22 locations)
30. **LightEdge** (19 locations)
31. **iTel Networks Inc.** (18 locations)
32. **Rackspace** (18 locations)
33. **Cirion Technologies** (17 locations)
34. **NorthC** (17 locations)
35. **Data Canopy** (17 locations)
36. **Evocative** (16 locations)
37. **US Signal** (16 locations)
38. **Latitude.sh** (16 locations)
39. **Psychz Networks** (16 locations)
40. **eStruxture** (15 locations)
41. **FirstLight** (14 locations)
42. **Expedient** (13 locations)
43. **Netshop ISP** (12 locations)
44. **Limestone Networks** (12 locations)
45. **Summit** (12 locations)
46. **China Unicom** (11 locations)
47. **AtlasEdge Data Centers** (11 locations)
48. **11:11 Systems** (11 locations)
49. **DartPoints** (11 locations)
50. **Aligned Data Centers** (10 locations)

Source: DataCenters.com

Roster of Data Center Proprietors and Locations

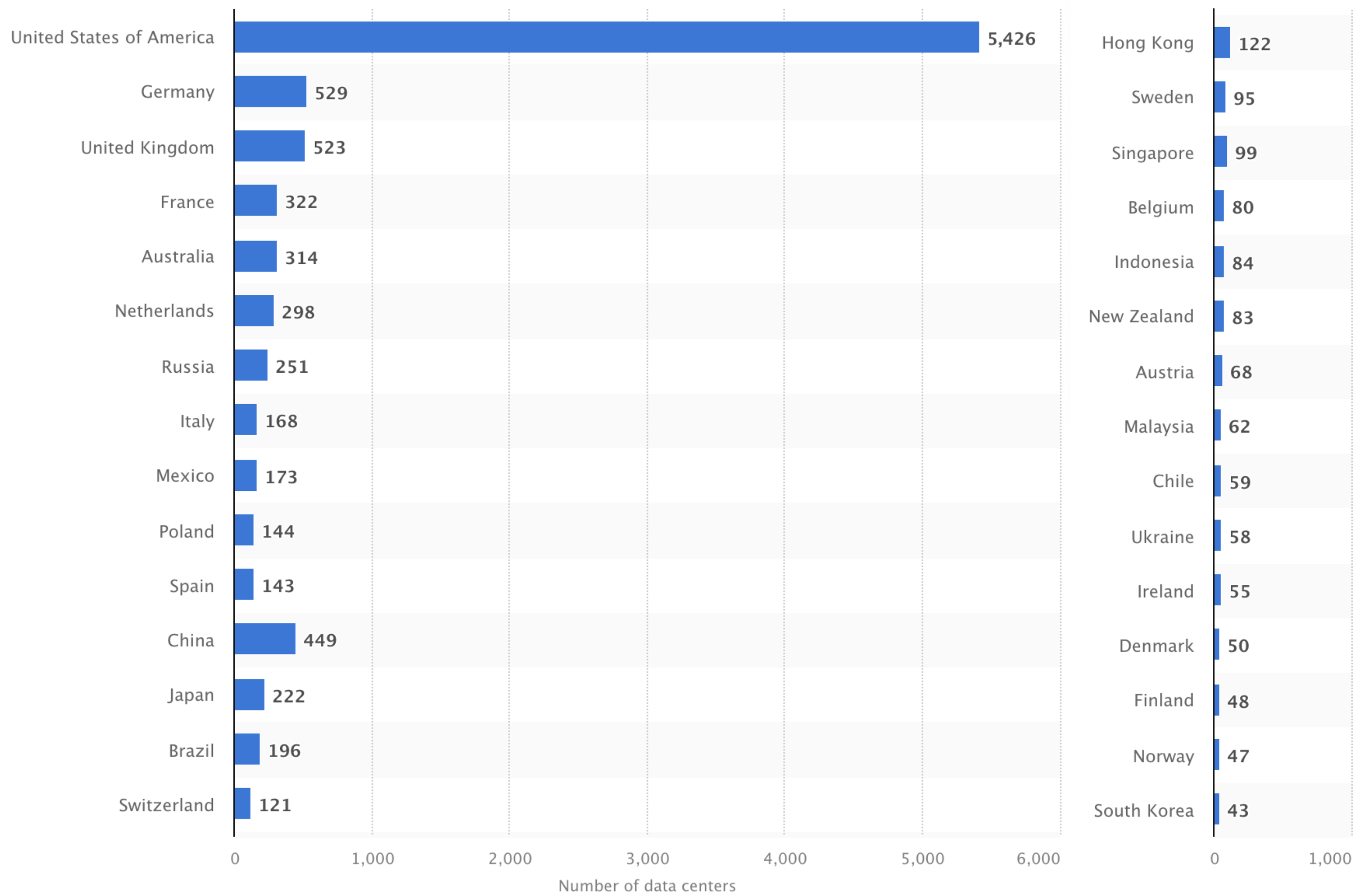
50-State Survey of Data Centers (United States)



Source: DataCenters.com

Roster of Data Center Proprietors and Locations

Key Countries with Data Centers



Source:
DataCenters.com keeps an up-to-date roster of **top 50 providers**, **2025 top providers** and **global data center's locations**.

News, Articles and Podcasts

Data Center Trends 2025: Power, AI, and Progress
Data Center Dynamics (DCD) is the world's largest data center publication that serves as a hub for professionals and stakeholders to stay informed about the latest developments, trends, and best practices related to various aspect of data centers, including infrastructure, technology, energy efficiency and security. Content ranges from news articles and updates to case studies and whitepapers.

Additionally, DCD offers DCD>Academy, personalized training programs for companies, and DCD>Intelligence, launching in 2025 an interactive market intelligence platform.

Data Center POST
Datacenter.com is a technology platform for colocation, bare metal, and cloud services within the data center industry providing information on relevant news and trending topic. In addition, they offer various free resources.

Data Center Knowledge
Data Center Knowledge, part of Informa TechTarget, offers in-depth articles on data center technologies, operations, and trend. Covering topics like energy efficiency, cooling solutions, and AI integration.

DatacenterHawk
DatacenterHawk provides the most accurate and useful data center real estate information on the market.

Data Centre & Network News
Data Centre Magazine covers global data center news, focusing on technological advancements, industry leadership, data center operations, and strategic developments.

Consulting Firms

Ernst & Young | Data Centers
Ernst & Young maintains a data centers page offering consulting services and relevant news. Adam Blaylock recently wrote an article for EY addressing "Why there is not silver bullet for data center financing."

JLL | 2025 Global Data Center Outlook
Jones Lang LaSalle (JLL) publishes an annual Global Data Center Outlook, analyzing capacity growth and investment trends.

Schneider Electric USA | EcoConsult for Data Centers
Schneider Electric offers consulting services, EcoConsult, for data center operators looking to boost efficiency and maximize uptime.

Pillsbury's Integrated Data Center Capabilities

Pillsbury's Data Centers Team works with data center developers and operators, data center customers, power providers, investors, real estate developers and others who develop data centers and keep them running without interruption. We are eager to apply our extensive experience and unwavering commitment to deliver not only exceptional legal services but also strategic guidance and insightful recommendations that will support your objectives.

WHY PILLSBURY?

WE ARE A FULL-SERVICE FIRM FOR THE DATA CENTER ECOSYSTEM.

Pillsbury's Data Centers team delivers operators, developers, investors, power suppliers, and users the counsel required to address all aspects of the data center landscape. Our team's experience with real estate, construction, project development and finance, sourcing, cybersecurity, consumer protection and intellectual property issues directly translates to acquiring, developing, financing, powering, and operating data centers, and protecting the data and privacy interests associated with them. See slide 4 for a complete listing of our services.

WE ARE A LEADING FIRM IN THE POWER SECTOR, INCLUDING NATURAL GAS, RENEWABLES AND NUCLEAR ENERGY.

Pillsbury stands at the forefront of the power sector, including renewable and nuclear energy, with decades of experience advising on transformative transactions in the power generation industry. Our team has played a central role in projects that have collectively contributed tens of thousands of megawatts of clean energy to the grid, powering data centers and other energy-intensive facilities. We are consistently recognized as one of the top law firms in the renewable energy and energy transition space, with expertise spanning key regions, including SPP, CAISO, MISO, ERCOT and PJM. Our client roster includes eight of the top ten U.S. renewable energy companies by revenue.

Particularly unique is our expertise in advanced nuclear energy, considered key to future data center development.

WE ARE RECOGNIZED AS ONE OF THE FOREMOST CYBER LAW FIRMS.

Pillsbury has advised businesses ranging from privately held startup companies to publicly traded global conglomerates on all manner of data privacy issues, with particularly deep knowledge in connection with the energy, communications, financial services, government/defense contracts, health care and technology sectors, as well as with critical infrastructure generally.

WE OFFER A FLEXIBLE APPROACH AND EXCEPTIONAL TEAM.

We are committed to adding value to our clients' bottom lines by enabling them to execute transactions more effectively and efficiently. We take a proactive approach to identifying and addressing critical business and legal issues, ensuring that our clients are well-positioned to complete their deals successfully.

DATA CENTERS
The Ecosystem

PILLSBURY'S DATA CENTERS PRACTICE

Site Selection
- Zoning
- Land assemblage
- Leasing
- Land use entitlements
- Real estate finance
- Location incentives and state policy counseling

Tax & Incentives
- Federal, state, international tax planning
- Location incentives and policies

Supply Chain & International Trade
- Supply chain solutions
- IT/telecom constraints
- International trade and logistics
- Tariffs and other trade restrictions

Acquisition & Investment
- General equity
- New equity, convertibles
- Debt
- Follow-on capital raises
- M&A, joint ventures and strategic alliances
- Comprehensive due diligence

Energy & Water Supply
- Long-term and interim power and cooling
- Water supply
- On-grid, or off-grid, adjacent to data center
- Zero-emission: gas/CCS, renewable/storage, nuclear fission/fusion

Regulatory & Security
- Environmental approvals
- Operating permits
- Cybersecurity standards
- PFAS, HFC, data center environmental risk management
- Sustainability

Construction & Development
- EPC(M) for core and balance of plant (BOP)
- Procurement of components and systems, switches, racks, telecom
- Cooling solutions, innovative HVAC

Operations & Staffing
- Operation and maintenance
- Workforce safety
- Workforce training and shortages
- Biometrics and other personal privacy issues

Technology/IP
- IP portfolio management
- Telecommunications systems
- Licenses
- Prosecution
- Defense

Customer-Facing Solutions
- Edge, enterprise, cloud
- Service agreements
- Co-location arrangements
- Business interruption
- Physical/cybersecurity solutions
- Custom software

CASE STUDY

Helping a Client Navigate Complex Power Purchase Agreements with a Leading Hyperscaler

OPPORTUNITY

In a landmark project attracting global attention as a model for the future, a leading hyperscaler chose advanced nuclear technology to supply power to its data center population in rural Washington state, involving several power providers.

Our client, a major public power company, was selected as a provider of that power. The client turned to Pillsbury to navigate the complex multi-party relationships supporting the underwriting of advanced nuclear technology, power purchase agreements and related infrastructure agreements.

Small modular nuclear reactors (SMRs) and fuel are at the heart of these transactions. Our client in Washington state and utilities in Virginia are engaged on these projects. Four reactors will initially generate 320 megawatts of capacity for our client, but the project could increase to 960 megawatts, enough to power approximately 770,000 homes.

The small footprint and modular construction of SMRs allow them to be constructed more quickly and in more places than traditional nuclear reactors.

The announcements come as tech companies scour the nation for electricity to power their increasingly power-hungry data centers. The U.S. government and private firms have been trying to advance SMR technology for years.

Tech industry power needs, however, are giving SMRs new momentum. AI developers see the plants as a potential major source of power that can scale quickly and provide energy around-the-clock. Data centers — and tech companies' willingness to pay above-market prices for reliable and carbon-free energy — could be what SMRs need to establish themselves as viable power generation resources.

Data Centers Experience: Energy

Pillsbury's Data Centers Team works with data center developers and operators, data center customers, power providers, investors, real estate developers and others who develop data centers and keep them running without interruption. We are eager to apply our extensive experience and unwavering commitment to deliver not only exceptional legal services but also strategic guidance and insightful recommendations that will support your objectives.

Energy for Power & Cooling: Bridge, Conventional and Zero-Emission PPAs and VPPAs, On and Off the Grid

- Assisting on long-term strategic planning for advanced large-scale sources of zero-emission power for data centers. Next-generation sources include advanced nuclear fission (small modular reactors (SMR) and Generation IV larger reactors), advanced geothermal, nuclear fusion, and advanced sodium-based storage solutions.
- Advising on a broad range of physical power purchase agreements (PPAs) and virtual power purchase agreements (VPPAs) for supply of electricity for data centers.
- Representing a utility in connection with contemplated power purchase agreement for data center needs in connection with development, construction, financing, and operation of SMRs.
- Review of numerous data center power purchase agreements (virtual and involving energy delivery) in connection with acquisitions and contemplated acquisitions of renewable energy generation asset portfolios.
- Representing a large renewable energy producer in connection with contemplated development, construction, and operation of small modular nuclear reactor (SMR) designed to meet data center energy needs.
- Representing a joint venture in proposing zero emission power sources for hyperscale facilities, including colocation of data centers and modular reactor projects.
- Representing a joint venture in developing a data center and crypto mining campus co-located behind the meter with a power generation facility converting from conventional fuel sources to hydrogen.
- Working with an international environmental organization on its Nuclear Scaling Initiative, which seeks to aggregate demand for SMRs among energy intensive end-users, including data centers.
- Working with a separate international environmental organization on a contracting methodology to spread the risks for first-of-a-kind (FOAK) nuclear reactor design, construction and operation amongst a group of users, including data centers.
- Advising a startup company seeking to develop and deploy nuclear assets for generating the power needs of data centers and other industrial users.
- Advising several SMR and advanced reactor nuclear vendors on regulatory and generation issues associated with power development for data centers.
- Advising a national energy association on regulatory and policy matters supporting the deployment of SMRs and advanced reactors for a variety of commercial and industrial applications.

CASE STUDY

Deploying Data Centers at Scale Across the Country

OPPORTUNITY

Our client, a global data centers operator and services provider, has been actively expanding its U.S. operations aligning with key trends in the data center market, particularly the growing demand for AI infrastructure, sustainability, and strategic geographic diversification. It operates nearly one million square feet of data center space across seven U.S. campuses, including locations in Virginia, California, Texas, Illinois, Oregon and Arizona. The surge in AI workloads is transforming the data center industry, driving unprecedented demand for power-intensive infrastructure. This client's expansion and investments position it to meet this growing need.

This client turned to Pillsbury to standardize and streamline its acquisition and development processes to ensure that it can quickly and efficiently capitalize on opportunities regardless of which state or jurisdiction the property is located. This client's presence in diverse U.S. markets reflects a strategic approach to site selection, considering factors like power availability, connectivity and regional demand, which are critical in the current data center landscape.

Our work includes a standardized bespoke set of documents tailor-made to address data center development and site selection issues (instead of relying on generic forms or the counterparty's preferred forms). Not having to start over from scratch each transaction helps this client execute much more efficiently. Finally, as developers have caught on and are now creating "data center ready" sites that include access to utilities, completed power studies, and in some cases are even pre-entitled, these sites are flying off the shelves—so being able to act quickly is critical.

Developers aiming to attract major data center companies are increasingly tailoring their site development strategies to meet the unique and evolving needs of hyperscale operators. Developers prioritize sites with access to robust and scalable utility power, especially in areas with redundant grid infrastructure. With operators committed to sustainability, proximity to wind, solar or hydroelectric power sources with storage is also a major factor in the site selection process. Developers work closely with utilities to ensure quick deployment of substations and reduced time to energization, while also working with state and local governments to pre-entitle land to remove permitting friction.

As demand for "data center ready" sites in key markets across the country continues to rise, institutional players who have a tested strategies and a legal framework tailored to address specific data center needs and risks are well positioned to capitalize on those opportunities.

Data Centers Experience: Development & Investment

Acquisitions, Leases and Project Development

- Represented a major energy company on the transition of its data center requirements from a proprietary physical facility in Texas to a cloud-based system of a major technology company. We advised on the sale, lease, transfer or termination of the data center real and personal property assets, leases, contracts, and associated technology and the negotiation of the long-term data services contracts and licenses.
- Counseled the owners of a data center business in connection with an investment by a leading merchant bank and buy-out of existing investors.
- Represented a Japanese technology company in the sale and long-term leaseback of its one million-square-foot Texas data center campus, allowing the client the opportunity to monetize their asset and secure below market lease rates for operational efficiencies.
- Represented the owner in the sale and leaseback of a 200,000-square-foot data center in Quincy, WA.
- Representing a large renewable energy producer in connection with contemplated sale of interest in data center, together with related loan and power purchase agreement restructurings.
- Represented a real estate investment firm on its $212 million divestiture of a Paris data center.
- Represented a major data center developer on its $874 million acquisition of "Project Cheetah" assets, a divestiture directed by the European Commission.
- Represented the acquirer of a nationwide provider of data center and cloud infrastructure in the UK.

CASE STUDY

Financial Technology Data Center Solutions for a G-SIFI Client

OPPORTUNITY

A Global Systemically Important Financial Institution (G-SIFI) recently embarked on a multibillion-dollar technology modernization program to drive innovation, reduce technical debt and improve operational resilience across its global infrastructure.

A key pillar of this effort involved consolidating the company's 79 data centers down to 13 critical locations (Japan, Singapore, Hong Kong, China, Germany, Ireland, Canada and the United States) and migrating core workloads to public cloud platforms, including both AWS and Microsoft Azure, with cloud spend commitments approaching $1 billion. To help execute this ambitious transformation, this G-SIFI sought the advice of Pillsbury to lead the legal and commercial negotiations across numerous high-impact transactions.

Our work includes:

- A 7-year, $500 million AWS agreement
- 5-year, $250 million Microsoft Azure commitment
- $250 million managed services contract covering co-location data centers and "smart-hands" services globally
- Negotiating complex co-location data center lease and buildout terms for all data centers in the reimagined portfolio
- Advising on multiple sales, leases and leasebacks of data center properties
- Providing ongoing hypercare services to both client and its vendors, including restructuring key migration agreements to drive efficiency and accountability with vendors

Data Centers Experience: Customer-Facing Solutions

The Core Services Relationship Between Data Centers & Users

- Advised numerous Fortune 100 and emerging growth companies, including in regulated industries like financial services and healthcare, in connection with data centers.
- Activity includes consolidation initiatives, data center migrations, co-location deals, and information technology outsourcing deals (ITOs) that include data center support on a remote and hosted basis. Additionally, our team has negotiated data center leases and agreements for space and services for our clients with nearly all of the leading data center providers, which has given us deep familiarity with their market terms, structures, and other essential aspects of these types of deals.
- Negotiated a large outsourcing that includes data center hosting, end-user support, help desk, application management) and claims processing.
- Advised a public entity on sourcing of data center services (including co-location and hosting), shifting from older mainframe-centric data centers to more modern high-density server-centric data centers.
- Represented a retail company in a full scope IT outsourcing, including data center, network (voice and data), end user computing, store support, web hosting, and applications development and maintenance services.
- Representing a life insurance company in the negotiation of multiple colocation agreements in various data centers.
- Represented multiple U.S. corporations establishing and operating IT capability centers in India.

CASE STUDY

IP Protection for Critical Data Center Infrastructure

OPPORTUNITY

A client engaged in providing data center solutions wanted to protect its innovative solutions, which included:

- Semi-freight container sized air-handling unit capable of handling many different environmental conditions throughout each 24- hour period in the desert ('782 patent)
- Integrated wiring system and thermal shield system within aisles of the cabinets, capable of handling wiring for telecommunications, power, and internal data communication ('780 patent)
- Overhead-air air handling with multi-level roof ('538 patent)
- Control system for air handling in a data center ('495 patent)
- Various efficient facility configurations ('331 and '643 patents)
- And numerous others

Pillsbury worked directly with the client in putting together a broad patent portfolio that has been licensed, asserted, and recognized for its value, representing a key asset of the company.

Data Centers Experience: Counseling

Mission-Critical Advice on Operations, Physical and Cybersecurity, and Compliance

- Developing due diligence program and action plan for all permits and approvals required for buildout of data centers in both established and key emerging jurisdictions.
- Assisting several nuclear utilities on physical security and cybersecurity issues associated with current and advanced reactors.
- Advising on artificial intelligence applications for data centers, including operation, data center infrastructure management (DCIM), power, cooling, and cybersecurity threat detection and response.
- Assisted a data center developer in obtaining patents for technologies related to the efficient cooling of data centers.
- Advising on complete range of information technology and telecommunications technology solutions, including patent prosecution, licensing, enforcement
- Advising on regulatory compliance advice germane to data centers, including:
  - environmental compliance standards
  - sustainability standards for electrical usage and end-of-life management of e-waste
  - Advice on HFC and other regulated chemicals in HVAC systems
  - general OSHA provisions pertaining to high voltage electrical usage
  - fire protection and PFAS regulation for fire suppression equipment
  - facility and contractor safety policies
  - data protection and cybersecurity policies and processes
  - trade issues associated with the import and export of “dual-use” IT hardware, software and technology
  - tenant insurance coverage
  - waste management

PILLSBURY AT A GLANCE

Pillsbury is a forward-thinking law firm thriving in an environment of intense competition and change.

Entrenched in elite markets, we do cutting-edge work for market leaders, innovators and disruptors throughout the United States and globally. Whether advising entrepreneurs working out of a garage or the world's largest public and private companies, we deliver exemplary client service and results, with highly regarded lawyers and business professionals operating across a diversity of leading practices.

We are one of the world's foremost advisors to energy companies and their lenders and investors, as well as clients in the technology, financial, life sciences and digital health, and real estate and construction industries.

A VALUES-DRIVEN LAW FIRM

Opportunity, community, and belonging are bedrock values at Pillsbury. We reward high performance, collegiality, collaboration, and inclusivity, with a prized culture that sets us apart.

Pillsbury 360 is a firmwide commitment to leverage the unique qualities of individuals across our global law firm. We believe this is essential to helping clients and each other effectively pursue opportunities, address challenges and thrive in an ever-changing world. Our approach fosters innovation, encourages the development of creative solutions, and engenders strong external and internal relationships. To make this possible, we seek out and recruit the industry's top talent with varied backgrounds and experiences. We identify future leaders and invest in professional development to provide opportunities for all to reach their full potential.

GLOBAL REACH

Pillsbury operates from key global positions and across an integrated platform. More than 30% of our work crosses borders, and Pillsbury lawyers are fluent in 35 different languages. These capabilities are complemented by a bespoke network of 100 law and advisory firms in more than 70 countries, providing clients with access to one of the largest and most sophisticated legal platforms in the industry.

BY THE NUMBERS

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