

DATA CENTRES, AI, AND ELECTRIFICATION — LEGAL AND CORPORATE APPROACHES TO GROWING POWER DEMANDS IN CANADA

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As the use of generative AI increases, data centres have become increasingly common, with corporations seeking to rapidly expand their infrastructure to sustain their technology and services in response to rising demand. This growth in data centres presents shareholders and governments with new investment opportunities. In this context, this article unpacks the physical, economic, and legal implications of the increased demand for data centres and considers the potential consequences of their accelerated construction, which is currently set to outpace electricity generation and the necessary transmission investments. This article also explores the challenges faced by electricity regulators, as well as corporations, that wish to construct data centres, including legislative constraints, strained electricity grids, and the difficulty of implementing sustainable energy sources.

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INTRODUCTION

Data centre load growth is the single largest driver of forecast electricity demand growth in North America. Data centres are the physical backbone of the modern information society and the digital services industry. As the number and scale of data centres have increased, so has their energy consumption. The advent of generative artificial intelligence (gen AI),¹ with its much greater computing power requirements, has turned an expansion into an explosion. Alberta and other Canadian jurisdictions are positioning themselves to attract data centre investment (and the associated jobs and tax revenue), leveraging their advantages of cooler ambient temperatures and reliable and inexpensive electricity potential.

Data centre load growth, however, is outpacing the electricity generation and transmission investment required to serve it. This is disrupting the electricity industry across North America and creating opportunities for investors in renewable, dispatchable, and baseload generation; energy storage and demand response; and transmission. At the same time, the risks created by this pace of growth threaten to limit that growth. Long payback periods and unproven revenue streams introduce corresponding risks of overbuild and stranded costs. Behind-the-fence (BTF) generation raises concerns with uneconomic bypass of the transmission system, increasing costs for other transmission system customers. Adding large loads to strained grids and intermittent power sources in order to serve data centre load growth is also creating reliability concerns, which affect both household and industrial customers. Regulators and legislators across North America are exploring a variety of responses to these risks as they strive to attract data centre investment while promoting sustainable development and protecting existing customers.

Data centre load growth also introduces novel commercial considerations for stakeholders. Proponents seeking BTF generation will encounter the typical issues associated with generation project development, including load forecasting, counterparty credit assurances, schedule risk, and cost overrun risk. In addition, they will also be acutely aware

¹ AI can be generally defined as the science of making machines that are capable of learning to perform tasks traditionally considered to require human intelligence, normally by learning from data to find patterns, make predictions, and perform actions, rather than relying explicitly on programmed instructions. Gen AI refers to applications that focus on new content, text, images, audio, and video, including reasoning models.

of guaranteed availability rights, change of law risk, expansion rights, planned and unplanned outages, and force majeure issues. With electricity being the largest contributor to Scope 2 carbon emissions for data centres, operators are also increasingly entering into renewable Power Purchase Agreements (PPAs) and virtual PPAs (VPPAs) to offset their data centre carbon footprint. These operators will also be negotiating pricing structures (fixed price, indexed, discounts, floors/ceilings), environmental attributes (including who gets credit), and considering around-the-clock carbon-free matching, in a manner that is specifically tailored to data centres. Proponents will need to consider the commercial aspects of power procurement that are unique to data centres, as well as their regulatory and public policy implications.

Each data centre project attracts unique energy-related considerations based on its location, jurisdiction, purpose, workload, the commercial objectives of its proponent(s), and how it is proposed to be supplied with electricity. This article attempts to provide an overview of key considerations for investors in data centres and the infrastructure required to supply them with electricity. In the sections that follow, we briefly set out the relevant facts about data centres and AI and their current respective load projections; discuss the opportunities and risks associated with supplying data centres with electricity and some of the legislative and regulatory responses seen to date; and comment on some of the commercial and project issues specific to data centres.

I. DATA CENTRES, AI, AND POWER ISSUES

A. WHAT ARE DATA CENTRES?

There are several concepts of what constitutes a data centre, but there is no universally agreed-upon definition. Data centres can generally be categorized by the types of their users and their intended function, but the spectrum of these categories is broad and rapidly evolving.²

Generally speaking, a data centre is a facility that houses digital assets such as information technology (IT) equipment (such as servers, storage systems, and networking equipment) that supports AI, cloud services, cryptocurrency mining, and other data storage and generation. As the name suggests, data centres channel, process, manage, and store the data we create, including business and customer data, financial records, personal data (such as photos and videos), as well as AI and “big data” produced by machine learning and gen AI (such as ChatGPT).

Data centres can be grouped into two broad categories:

1. Enterprise data centres are private facilities that are owned and operated by a single organization to meet its own data processing and storage requirements. They can be customized to meet the organization’s specific processing and network requirements and sized to achieve economies of scale for the processes being

² We note, for example, that AI model training and use can take place on laptops and smartphones or smart cars (known as “at the edge”) as well, but the larger AI models are too complex and are processed in data centres.

conducted. They may be located on-site or off-site as best suits the organization, having regard for factors such as network connectivity, security, and the availability of power and cooling water. As proprietary facilities, enterprise data centres allow an organization maximum control over design and operations, which may be advantageous for ensuring privacy or redundancy or even necessary to meet certain regulatory requirements.³

Large enterprise data centres are termed “hyperscale” data centres. They can occupy hundreds of thousands of square feet (or more) and house tens of thousands of servers. Most hyperscale data centres built to date provide computing, storage, and networking resources to support large internet companies and cloud service providers such as Apple, Amazon Web Services, Google, and Microsoft.⁴

Enterprise data centres “represent around 28% of data centre capacity today,” but this has decreased from 85 percent in 2005.⁵ Hyperscale data centres represent approximately 37 percent of today’s data centre capacity, an increase from 10 percent in 2010.⁶

2. Multi-tenant data centres (also termed “co-located data centres”)⁷ are used by multiple organizations and are often run by a separate operator. These facilities house IT infrastructure and the associated “power, cooling, and networking equipment” and lease space and equipment to tenants.⁸ They offer organizations access to data centre capabilities without the capital and internal expertise required for an enterprise solution, and can allow for rapid scaling through the lease of additional space.⁹ Multi-tenant data centres represent approximately 36 percent of data centre capacity today.¹⁰

The ultimate end user of power at a data centre is typically the entity with direct control of, and commercial interest in, the required power load and the timing of their data centre operation’s development and expansion. The end user may also have an interest in claiming credit for the facility’s renewable energy use toward their corporate sustainability goals. Both control and credit may be more complicated for multi-tenant data centres, however, especially where the tenants have different energy requirements and power consumption profiles than the operator that procures the power.

³ Mary Zhang, “Types of Data Centers: Enterprise, Colocation, Hyperscale” (26 November 2023), s 1, online: [perma.cc/5N7F-MAP3].

⁴ *Ibid.*, s 3.

⁵ International Energy Agency, *Energy and AI* (Paris: IEA, 2025) at 51–52, online (pdf): [perma.cc/9LXL-XJ9M] [IEA, *Energy and AI*].

⁶ *Ibid.*

⁷ In this article, the term “multi-tenant data centres” is used to avoid confusion with co-location of generation.

⁸ Zhang, *supra* note 3, s 2.

⁹ *Ibid.*

¹⁰ IEA, *Energy And AI*, *supra* note 5 at 52.

B. POWER DEMAND CONSIDERATIONS

Data centre demand for electricity is driven mainly by two processes: computing and cooling.¹¹ Data centres contain high-performance computers tasked with processing massive amounts of data, especially those associated with machine learning and gen AI. The servers that process and store data may be equipped with central processing units and more energy-intensive graphics processing units (GPU). Servers account for approximately 60 percent of electricity demand in modern data centres. However, this varies widely, with more efficient hyperscale data centres using nearly 80 percent of their power for servers and IT equipment.¹²

These computing processes also produce a significant amount of heat,¹³ requiring efficient cooling to mitigate the risk of hardware damage and to maintain operation continuity. Cooling methods used by AI-driven data centres range from traditional air cooling (chilled air circulated through the computing system) to more advanced liquid cooling systems that use water or other coolants to absorb heat from the operating hardware.¹⁴ Cooling may drive up to 40 percent of a data centre's energy consumption.¹⁵ Innovations in cooling processes, however, offer an ongoing opportunity to improve efficiency and sustainability.¹⁶ Cooling requirements can also enable passive efficiency gains by taking advantage of natural cooling in areas with relatively low ambient temperatures.¹⁷ In addition to server operations and cooling, data centres use energy to maintain various levels of fail-safes to protect their core computing processes and prevent costly downtime.¹⁸

Data centres' electricity demand must be met reliably to maximize uptime and reduce the likelihood of unplanned operational issues. Accordingly, data centres require a continuous power supply, often supported by redundant power systems to ensure continuity in the event of outages or maintenance. It is not uncommon for grid-connected data centres to have their own backup generation, giving rise to several important policy issues and commercial considerations as discussed below.

¹¹ IEA, *Electricity 2024: Analysis and Forecast to 2026* (Paris: IEA, 2024) at 31, online (pdf): [perma.cc/J9M4-7GRB] [IEA, *Electricity 2024*].

¹² IEA, *Energy and AI*, *supra* note 5 at 52–53.

¹³ While outside the scope of this article, we note the opportunity to recover and use heat for industrial purposes and for district heating networks.

¹⁴ Though it will not be addressed in this article, the water demands of AI data centres should be noted. While water usage varies significantly by data centre depending on the cooling technology, the local climate, and the source of electricity, the IEA estimates that “on average a 100 MW hyperscale data centre in the United States consumes around 2 million litres [of water] per day in total – equivalent to about 6500 households”: IEA, *Energy and AI*, *supra* note 5 at 242.

¹⁵ US Department of Energy, “DOE Announces \$40 Million for More Efficient Cooling for Data Centers” (9 May 2024), online: [perma.cc/A8DW-C85F].

¹⁶ IEA, *Energy and AI*, *supra* note 5 at 62–63 (discussing how technological advancements are projected to contribute to significant reductions in data centre cooling requirements).

¹⁷ National Renewable Energy Laboratory, “NREL Joins \$40 Million Effort to Advance Data Center Cooling Efficiency” (14 December 2023), online: [perma.cc/J86M-FFFN] [NREL].

¹⁸ Steven Gonzalez Monserrate, “The Staggering Ecological Impacts of Computation and the Cloud”, *The MIT Press* (14 February 2022), online: [perma.cc/H9HP-FURN].

C. DATA CENTRES AND AI

Starting in late 2022, breakthroughs in gen AI have contributed to a boom in data centre investment.¹⁹ AI processes require many times the computing power — and therefore the electricity — of conventional applications. A conventional internet search, for instance, requires approximately 0.3 watt-hours (Wh), whereas a query using OpenAI’s ChatGPT requires nearly ten times as much, about 2.9 Wh,²⁰ which is enough to run a light bulb for 20 minutes.²¹ Gen AI, which creates new content using patterns “learned” by reviewing enormous datasets, uses vastly more power: a gen AI-based query (or “inference”²²) can consume up to ten times as much electricity as a conventional internet search query,²³ and training the large language models (LLMs) used in gen AI processes can consume over a gigawatt-hour per training run,²⁴ which is enough electricity to power a small city for an hour.²⁵

Consequently, new AI data centres can consume between five and ten times as much power as conventional data centres.²⁶ A typical AI-focused data centre may have a capacity of 100 megawatts (MW) and consume as much electricity annually as 100,000 households; the largest data centres may consume 20 times as much.²⁷ A significant portion of this power is used directly for data processing, which employs increasing quantities (and densities) of powerful hardware.²⁸ To increase data processing capacity, data centre servers are packed tightly and run continuously, which generates significant heat. This makes effective cooling even more power-intensive, as it becomes critical to maintain operations and prevent hardware damage.

Unlike many conventional data centre functions, which often have variable workloads averaging 30 percent or 40 percent of total processing capacity, many AI processes, such as LLM training, can run at 100 percent capacity for weeks or months.²⁹ This distinguishes AI from applications like cryptocurrency mining, which is frequently run intermittently in order to take advantage of low power prices or currency fluctuations. The higher workload of an AI data centre therefore requires more robust and redundant data centre design, leading some

¹⁹ IEA, *Energy and AI*, *supra* note 5 at 22–24; EPRI, *Powering Intelligence: Analyzing Artificial Intelligence and Data Centre Energy Consumption* (Palo Alto: EPRI, 2024) at 7, online (pdf): [perma.cc/D55Q-G4MV] [EPRI].

²⁰ EPRI, *supra* note 19 at 4; see also Alex de Vries, “The Growing Energy Footprint of Artificial Intelligence” (2023) 7:10 Joule 2191.

²¹ Dara Kerr, “Artificial Intelligence’s Thirst for Electricity”, *NPR* (10 July 2024), online: [perma.cc/2MX5-6L93].

²² An inference is the process of a trained model analyzing data to generate outputs such as predictions, decisions or responses. Unlike training which involves learning from data, inference uses patterns to develop outputs: see IEA, *Energy and AI*, *supra* note 5.

²³ IEA, *Electricity 2024*, *supra* note 11 at 34.

²⁴ de Vries, *supra* note 20 at 2191–94.

²⁵ Approximately 780,000 households consuming at the average 2021 Canadian household’s rate of 905 kilowatt-hours (kWh) per month (1.28 kWh per hour): Statistics Canada, *Household energy consumption, Canada and provinces*, Table 25-10-0060-01 (Ottawa: Statistics Canada, 2024), online: [perma.cc/CF3T-7C4J].

²⁶ Laszlo von Lazar & Jim Doull, *2024 Electric Report* (Overland Park: Black & Veatch, 2024) at 18, online (pdf): [perma.cc/6VK8-VPK3].

²⁷ IEA, *Energy and AI*, *supra* note 5 at 13, 38.

²⁸ *Ibid* at 52–55; EPRI, *supra* note 19 at 19.

²⁹ Brian Martucci, “The 2025 Outlook for Data Center Cooling”, *Utility Dive* (22 January 2025), online: [perma.cc/A2N6-MDS7], quoting Steven Carlini, Vice President of Innovation and Data Centers at Schneider Electric [Martucci, “2025 Outlook”].

operators to transition from traditional air-cooled facilities to higher-performance (and more energy-intensive) liquid cooling systems.³⁰ It is prompting others to consider locating data centres that require less frequent access (that is, archival data storage) in relatively cold-climate areas (like Alberta), where natural ambient temperatures can help to reduce the cooling load.³¹

Ultimately, AI data centres consume vastly more electricity, for more sustained periods, than alternative data centre usages, and generate significantly more heat, which requires additional electricity for cooling. As gen AI becomes more sophisticated and data centres become increasingly dense, the resulting energy usage is intensifying.

D. DATA CENTRE AND AI-DRIVEN GROWTH IN ELECTRICITY DEMAND

Rapid growth in data centre load is a major contributor to forecast increases in electricity demand worldwide. According to the International Energy Agency (IEA), in 2022, data centres (including both AI and cryptocurrency operations) globally consumed roughly 460 terawatt-hours (TWh) of electricity.³² This amount equates to approximately 71 percent of Canada's electricity generation in 2022, or about 1.4 to 1.7 percent of world power consumption in that year.³³ In 2024, data centres alone accounted for 415 TWh or "around 1.5% of the world's electricity consumption."³⁴ Growth in data centre electricity consumption has increased by approximately 12 percent per year since 2017, "more than four times faster than the rate of total electricity consumption,"³⁵ and this growth is expected to accelerate.

The IEA forecasts that worldwide data centre electricity demand will "more than double to around 945 TWh," or around 3 percent of the world's electricity consumption, by 2030.³⁶ A 2025 estimate from Goldman Sachs anticipates "global power demand from data centers will increase 50% by 2027 and by as much as 165% by [2030]."³⁷ This growth is particularly evident in North America. In the United States, which hosts half of data centres globally and "account[s] for the largest share of global data centre electricity consumption in 2024 (45%),"³⁸ data centres accounted for 4.4 percent of all energy consumed in 2023, more than double the figure in 2018 (1.9 percent), and have been forecasted to account for between 6.7 and 12.0 percent of consumption by 2028³⁹ and 9 percent of national electricity generation by 2030.⁴⁰ In Canada, there were over 239 data centres in operation as of 2024, led by Ontario

³⁰ *Ibid*, noting recent announcements from Meta and multi-tenant provider Equinix; NREL, *supra* note 17.

³¹ Martucci, "2025 Outlook", *supra* note 29.

³² IEA, *Energy and AI*, *supra* note 5 at 8.

³³ Canada Energy Regulator, *Market Snapshot: Energy Demand from Data Centres is Steadily Increasing, and AI Development is a Significant Factor* (Calgary: CER, 10 October 2024), online: [perma.cc/3LP5-L9FE] [CER Market Snapshot].

³⁴ IEA, *Energy and AI*, *supra* note 5 at 14.

³⁵ *Ibid*.

³⁶ *Ibid* at 14, 63.

³⁷ Goldman Sachs, "AI to Drive 165% Increase in Data Centre Power Demand by 2030" (4 February 2025), online: [perma.cc/9WG9-MASA].

³⁸ IEA, *Energy and AI*, *supra* note 5 at 14.

³⁹ Arman Shehabi et al, *2024 United States Data Center Energy Usage Report* (Berkeley: Lawrence Berkeley National Laboratory, 2024) at 5–6, online (pdf): [perma.cc/J35U-LUYB].

⁴⁰ EPRI, *supra* note 20 at 2.

(105), Quebec (57), British Columbia (35), and Alberta (22).⁴¹ These data centres accounted for approximately 1 percent of national electricity use in 2022, and this share is expected to rise rapidly, especially as AI adoption expands.⁴² Canadian utilities and system operators have begun factoring data centre demand estimates into their projections.⁴³

Data centres represent the single largest contributor to forecast growth in utility load forecasts, according to several analyses, outpacing manufacturing and electrification.⁴⁴ By one estimate, data centres could represent 44 percent of the US' electricity load growth from 2023 to 2028.⁴⁵ This is complicating planners' ability to forecast electricity load growth and properly invest in required resources. In its 2024 resource adequacy analysis, the Western Electricity Coordinating Council, the authority responsible for reliability planning in western Canada and the US, found its "alarming" forecast increase in electricity demand between 2025 and 2034 to be driven by "[d]ata centers, manufacturing facilities, and to a lesser extent electrification."⁴⁶

Of this growing data centre electricity consumption, AI seems to be a significant if not the preponderant component. While it is difficult to clearly distinguish between AI-related and non-AI related workloads performed at data centres in order to determine how much electricity demand comes from AI specifically, it is clear that AI is at the epicentre of the explosion of forecast data centre demand. The IEA suggests that AI accounts for "24% of server electricity demand and 15% of total data centre demand"⁴⁷ and has forecasted that electricity demand from dedicated AI data centres will expand tenfold between 2023 and 2026,⁴⁸ driving an estimated 70 percent of the growth in total forecasted data centre demand between 2025 and 2030.⁴⁹ This is supported by other analyses forecasting massive new demand for servers and energy specifically to support the AI boom.⁵⁰

Forecasts of data centre electricity demand are notoriously fraught with uncertainty. Recent reports suggest that many more interconnection requests are being filed than data centres are being built.⁵¹ Speculators and developers can pursue the same project in multiple jurisdictions simultaneously in order to reserve space in each connection queue — which mitigates regulatory and power availability risk while the developer finds customers,

⁴¹ Daniel Weeks, "Canada Prepares for Increased Electric Loads as Country Attracts Data Centres", *S&P Global* (2 October 2024), online: [perma.cc/KN2V-5LEW].

⁴² Natural Resources Canada, *Data Centres* (Ottawa: NRC, 2025), online: [perma.cc/2NDE-NCNE].

⁴³ Canada Energy Regulator, *supra* note 33.

⁴⁴ John D Wilson, Zach Zimmerman & Rob Gramlich, *Strategic Industries Surging: Driving US Power Demand* (Washington, DC: Grid Strategies, 2024) at 9, 12, online (pdf): [perma.cc/P876-NLEM]; Maeghan Rouch et al., "Utilities Must Reinvent Themselves to Harness the AI-Driven Data Center Boom" (October 2025), Figure 2, online: [perma.cc/KCW7-HW9T]; Lalit Batra et al., "Rising Current: America's Growing Electricity Demand" (Reston: ICF, 2025) at 7, online (pdf): [perma.cc/M7SM-3CGX].

⁴⁵ Rouch et al, *supra* note 44.

⁴⁶ WECC, "Western Assessment of Resource Adequacy" (2024), Annual Demand, online: [perma.cc/EP8N-B5EQ].

⁴⁷ IEA, *Energy and AI*, *supra* note 5 at 56.

⁴⁸ IEA, *Energy 2024*, *supra* note 11 at 35.

⁴⁹ IEA, *Energy and AI*, *supra* note 5 at 64.

⁵⁰ EPRI, *supra* note 19 at 14–16.

⁵¹ One report quotes a former Google executive as claiming that there are "five to 10 times more interconnection requests than data centers actually being built": Brian Martucci, "A Fraction of Proposed Data Centers Will Get Built. Utilities Are Wising Up", *Utility Dive* (May 15, 2025), online: [perma.cc/6T2X-WFMD] [Martucci, "Fraction of Proposed Data Centers"].

compares jurisdictions, or makes a final business decision — and face few barriers to doing so.⁵² One recent study suggested that forecasts of data centre demand may be overstated simply due to the limited availability of high-performance processors.⁵³

Initial forecasts of the impact of AI on data centre electricity demand may also be tempered by recent indications of various ways that AI can be made more efficient. In January 2025, it was announced that the DeepSeek LLM had been trained at a fraction of the cost and computing power required by competing LLMs. This gave rise to speculation that energy requirements for training LLMs could be greatly reduced without compromising output quality.⁵⁴ However, subsequent review cast doubt on DeepSeek's apparent efficiency and found it to be offset by its "[tendency] to generate much longer responses."⁵⁵ Forecasts of the impact of AI on data centre electricity demand may also be impacted as AI workload moves from data centres to end-user devices (such as laptops, smartphones, and cars) known as "the edge." Other technological improvements, such as low-power processors, AI Accelerators (hardware which can perform AI tasks quickly), photonic integrated circuits (that use light instead of electricity), task-specific AI models, and quantum computing,⁵⁶ also have the potential to reduce electricity demand. However, improvements in either processes or technology will take time to flow through to project forecasts. In February 2025, American Electric Power's president and CEO was quoted as saying that the release of DeepSeek had not caused his utilities' data centre customers to change their development plans.⁵⁷ These developments illustrate that the broad spectrum of forecasted electricity demand attributed to data centres supporting AI workloads is complicated by technological innovations and efficiencies, as well as uncertainties about AI adoption and usage patterns impacting electricity consumption. Ultimately, accurately forecasting electricity demand for data centres hosting AI workloads is exceedingly difficult, as the hardware, software, and operational practices involved rapidly evolve.

Concerns have also been raised that the recently imposed US tariffs could also dampen data centre growth forecasts. The tariffs have raised the costs of construction materials like steel and aluminum as well as data centre components like servers, transformers, and cooling equipment. Some observers have noted that these cost pressures have contributed to project delays and increased capital expenditures,⁵⁸ which have aggravated already strained energy

⁵² This phenomenon, which results in so-called "phantom load," is discussed below.

⁵³ London Economics International LLC, *Uncertainty and Upward Bias are Inherent in Data Center Electricity Demand Projections* (Boston: Southern Environmental Law Center, 2025), s 3, online (pdf): [perma.cc/4ZX3-ZK4W].

⁵⁴ James Vincent, "DeepSeek Panic Reveals an AI World Ready to Blow", *The Guardian* (28 January 2025), online: [perma.cc/V2MX-6KPR].

⁵⁵ James O'Donnell, "DeepSeek Might Not be Such Good News for Energy After All", *MIT Technology Review* (31 January 2025), online: [perma.cc/45P8-J2QW]. Salesforce has launched a standardized AI Energy Score Leaderboard, with data from hundreds of AI models scored based on GPU Energy (Wh) and filtered based on model class as well as response type.

⁵⁶ IEA, *Energy and AI*, *supra* note 5 at 69–70.

⁵⁷ Ethan Howland, "AEP Expects Electric Sales to Jump 8.6% Annually Over 3 Years", *Utility Dive* (18 February 2025), online: [perma.cc/994W-26Z4].

⁵⁸ Casey Weaver & Katelyn M Hilferty, "The Impact of US Tariffs and Trade Policy on Data Centers"" (1 May 2025) online (blog), [perma.cc/VJ6S-DE8N]; Brian Martucci, "Despite Semiconductor Exemption, Trump Tariffs Could Chill US Data Center Investment: Analysts", *Facilities Dive* (10 April 2025), online: [perma.cc/2SDA-GLBW]; Matt Vincent, "How Tariffs Could Impact Data Centers, AI, and Energy Amid Supply Chain Shifts", *Data Center Frontier* (3 April 2025), online: [perma.cc/LL7Q-ABMR].

equipment supply chains.⁵⁹ Tariffs are driving some tech firms to diversify their manufacturing and sourcing strategies to avoid some of the heaviest impacts,⁶⁰ or to attempt to “onshore” their supply chains, despite the numerous challenges involved.⁶¹ Some large industry participants appear to be taking this in stride: Meta has raised its 2025 data centre capex forecast partly in response to higher material and equipment costs caused by the tariffs.⁶²

US tariffs may also drive some data centre investment away from the US to jurisdictions like Canada, where trade barriers remain relatively low. However, trade barriers are only one cost of doing business, and investors looking outside of the US will likely consider other costs — such as corporate tax rates — and compare potential investment destinations in holistic terms. At least one observer has raised concerns that rising costs caused by the tariffs could prompt even major data centre investors with an established Canadian presence to consider redirecting investment to lower-cost jurisdictions.⁶³ On the other hand, the same observer suggested that Canadian companies with US data centre operations could reduce their risk exposure by relocating those operations to Canada, citing, among other things, the relatively stable energy costs in some Canadian jurisdictions.

E. SITING CONSIDERATIONS FOR DATA CENTRES

Siting a data centre is informed by a wide range of factors. Every project is different, but siting analyses tend to converge on a few practical considerations, including rapid access to a reliable electricity source, low latency, proximity to users and urban centres (depending on workload), and land use limitations. Underlying these factors, and many others, are the regulatory, legal and political environments of the jurisdictions being considered. This section briefly outlines each of these considerations.

1. ACCESS TO ELECTRICITY AND “TIME TO POWER”

In today’s market, the primary consideration for most developers of new data centres is “time to power,” or the time required to obtain the electricity to serve their facility, whether through a connection to the local electrical grid or a stand-alone generating unit. Timely access to electricity often determines a project’s siting, economic viability, and competitiveness.⁶⁴ “Time to power” can be affected by factors ranging from technical to political, but the options available to a proponent in a given jurisdiction are fundamentally determined by the legislation and regulatory scheme.

⁵⁹ The IEA estimates that supply chain constraints for key components like transformers and gas turbines could contribute to a delay in 20% of the data centre additions forecast for 2030: see IEA, *Energy and AI*, *supra* note 5 at 49.

⁶⁰ Billy Perrigo, “How Trump’s Tariffs Could Make AI Development More Expensive”, *TIME* (8 April 2025), online: [perma.cc/MFG4-6JDG].

⁶¹ Christian Davies et al., “Tech Industry Fears Donald Trump’s Trade War Will Hamper US AI ‘Dominance’”, *Financial Times* (17 April 2025), online: [perma.cc/DQE8-AC4J].

⁶² Sebastian Moss, “Meta Raises AI Data Center Capex Forecast to up to \$72bn, Blames Trump Tariffs for Increased Cost”, *DCD* (2 May 2025), online: [perma.cc/7RJU-92JC].

⁶³ Lance Mortlock & Pradeep Karpur, “Clouds on the Horizon: Analyzing Canada’s Data Centre Boom and Tariff Bust”, *Chief Executive* (22 April 2025), online: [perma.cc/M47V-6JLD].

⁶⁴ Cy McGeady et al., *The Electricity Supply Bottleneck on U.S. AI Dominance* (Washington, DC: Center for Strategic and International Studies, 2025), online (pdf): [perma.cc/BGQ2-XMWF].

An important consideration for developers during the siting process is whether to build their own power supply or to rely on grid power. It is becoming increasingly common for data centres to build their own dedicated power sources.⁶⁵ Building an on-site power source can reduce “time to power” by avoiding transmission connection queues or by allowing a data centre to operate while it remains in a connection queue.⁶⁶ It can give a developer control over the source of its power and its carbon profile, while potentially offering additional income streams through the sale of excess power or renewable energy credits (both discussed below). A data centre that supplies most of its own power requirements can also reduce pressure on the grid, which is one of the factors that has prompted officials in Alberta (and in other jurisdictions) to suggest that big data centres “bring [their] own power.”⁶⁷

On the other hand, building on-site power requires a large incremental investment that may not be fully offset by avoided distribution costs. It may also be necessary to overbuild on-site generation to provide the requisite degree of reliability in the absence of a grid connection. Building on-site power also requires careful attention to entity structuring, location, and regulatory approval, all of which are highly jurisdiction-specific considerations. In addition, the only reliable electricity sources that can be constructed in a timeframe that is concurrent with data centre construction timelines are solar photovoltaic and gas turbines.⁶⁸ Finally, since owning power assets is not normally within the preferred business model for AI data centres, developers may prefer to support new clean energy projects by acting as offtakers in corporate VPPAs, or by establishing a joint venture or partnership with a conventional power developer.

In addition to determining whether to build their own power or rely on grid power, data centre developers may also consider the carbon intensity of the power source in their procurement decisions. Access to renewable energy has historically been a priority for many data centre operators, both to reduce their carbon footprint and, through the use of fixed-price PPAs, to lock in low-cost power for the long term. Data centre investment has been noted to correlate with renewable PPA availability. According to the IEA, over 30 percent of the nearly 120 GW of operational renewable capacity procured globally has been procured by companies that operate data centres.⁶⁹ But as Daniel Weeks recently noted, reduced availability of renewable PPAs in Alberta in 2024 made it more difficult for developers of large data centres to find green energy sources.⁷⁰ Notwithstanding their carbon reduction objectives, however, as access to extant generation becomes ever more constrained, data centre proponents have increasingly pursued “time to power” irrespective of immediate access to green electricity. For many of today’s developers, it may be enough for a site to

⁶⁵ USA News Group, “Behind the Scenes: Developers Tackling the AI Data Center Dilemma” (23 October 2024), online: [perma.cc/FVP5-6B8C].

⁶⁶ These benefits depend on onsite generation coming online in less time than a transmission connection. Recent developments, including backlogs for turbines and building materials and tariff-strained supply chains, have the potential to delay some generation projects considerably, potentially weakening the appeal of this approach.

⁶⁷ Chris Varcoe, “Varcoe: Alberta Sizes Up \$100B Data Centre Opportunity, But Says ‘Bring Your Own Electricity’”, *Calgary Herald* (13 July 2024), online: [perma.cc/JSM8-LPKQ].

⁶⁸ IEA, *Energy and AI*, *supra* note 5 at 79.

⁶⁹ *Ibid* at 77.

⁷⁰ Weeks, *supra* note 41.

have the *potential* to accommodate renewable or low-carbon electricity, even if such a power source is not available at present.

2. LATENCY

In the data centre context, “latency” is the time taken for a packet of data to travel between two points across a network connection.⁷¹ The data will normally travel between a local network, the internet service provider network, and then to the data centre for response. A network with high latency will have slower response times, which can negatively affect application performance, efficiency, and overall operational costs. The speed at which these data packets move across the network can be influenced by a number of variables, including internet infrastructure, bandwidth, data packet size, network congestion, and importantly for data centres, the geographic distance that data must travel and the medium across which it is travelling. Therefore, depending on the intended workload, data centre proponents may prefer to reduce or optimize the distance between the client initiating the request and the responding server or network of distributed servers. This can lead to clusters of AI data centres near metropolitan centres. Other data centre workloads, however, such as AI training workloads and certain kinds of AI inference work, do not require such proximity, and so low latency may have less importance than other locational factors such as generation capacity, grid availability or congestion, and land access. Similarly, if inference tasks can be conducted at “the edge” — that is, on user devices like laptops, phones, or cars — rather than at centralized data centres, then latency (and power demand) can be distributed among the user base.⁷² In any event, data centre sites should ideally have direct access to high-speed fibre-optic internet connections with minimal network devices like routers and network hops and a reliable power infrastructure.

3. PROXIMITY TO USERS

Proximity to users may be important for some types of data centre applications, but it is not always a primary consideration. While data centres require significant power sources, and often benefit from proximity to large urban centres due to their population density and network accessibility, certain AI-focused data centres, such as those focused on AI training, can be located far from major cities, even in locations with minimal fibre-optic infrastructure, so long as developers can access abundant, low-cost power.⁷³ As such, geography can be more flexible for AI training clusters and other workloads that are less latency-sensitive. Urban centres will typically entail higher land costs and property taxes, increasing projects’ up-front investment requirements and long-term operational costs. Rural locations, on the other hand, often offer more affordable land and lower taxes. These factors can make remote areas attractive options for certain types of data centre projects, particularly those that need more space. Developers are increasingly willing to locate data centres in remote areas with cheap electricity.⁷⁴

⁷¹ Michael Goodwin, “What is Latency?”, *IBM* (15 August 2023), online: [perma.cc/UL4G-SZZF].

⁷² IEA, *Energy and AI*, *supra* note 5 at 72–74.

⁷³ Dan Rabb, “Lagging Data Center Construction in Canada May Be a Missed Opportunity”, *BISNOW* (14 July 2024), online: [perma.cc/2D68-749M].

⁷⁴ Steve McLean, “Record Growth Continues in Data Centre Sector: C&W”, *Real Estate News EXchange* (18 September 2024), online: [perma.cc/P494-67ZF].

4. LAND USE

In addition to the typical land use and zoning issues associated with the development of commercial infrastructure, data centre developers must take into account the benefits and burdens of BTF generation (if being considered) and consider the associated geographic footprint. Land use and zoning restrictions will vary significantly depending on factors such as whether renewable or other types of generation facilities are also being installed. The physical footprint required will also vary considerably depending on the type of generation proposed by the data centre developer. For example, solar and wind generation facilities can require substantial amounts of land, on the order of 7.9 acres/MW for solar and 2.5 acres/MW for wind.⁷⁵ By contrast, other types of generation use less space: nuclear power plants, for instance, can require closer to 0.5 acres/MW, and according to one estimate, small modular reactors (SMR) or microreactors can use less than a tenth of that figure. Thus, the BTF generation technology selected will impact the siting and land use needs of the associated BTF and data centre facilities.

5. JURISDICTIONAL CONSIDERATIONS

From a purely technical perspective, given an adequate internet connection and sufficient land and resources, many data centre applications, including many AI applications, can be located almost anywhere. Data centre investment is therefore guided to a considerable extent by developers' evaluation of different jurisdictions' regulatory, legal, and political environments as they relate to factors like land and water use, tax and trade policy, and electricity. These differences can be significant. Electricity in particular is highly jurisdictional, with local grids and generation being subject to regulation at the state or provincial level, often in fundamentally different ways and with different approaches to the challenges posed by data centre energy use. As discussed below, while most jurisdictions share the same kinds of concerns with reliability, avoiding stranded costs, and uneconomic bypass of the grid, they are pursuing a wide range of policy, regulatory, and legislative responses.

Given the relative lack of geographical constraints on many new data centre applications, incumbency may not confer much advantage on a jurisdiction in the race to attract investment. "Time to power" is emerging as the main consideration for many data centre projects, and the industry recognizes the savings in time and cost that can be realized from a strategic siting decision. As a result, businesses operating large data centres are expanding into unconventional locations beyond traditional data centre hubs, creating an incentive for jurisdictions eager to attract data centre investment to show that they can offer available, affordable, and accessible energy.⁷⁶

⁷⁵ Gabriel J Soto et al, *Powering Data Centers with Clean Energy*, RPT-24-79307 (Idaho: Idaho National Laboratory, 2024) at 15, online (pdf): [perma.cc/F4Ds-A6B7].

⁷⁶ Alastair Green et al, "How Data Centers and the Energy Sector Can Sate AI's Hunger for Power", *McKinsey & Company* (17 September 2024), online: [perma.cc/8CQC-6DXN].

F. THE ALBERTA CLIMATE FOR DATA CENTRE INVESTMENT

Alberta is one of many jurisdictions actively soliciting investment in data centres. It has billed itself as uniquely positioned for successful data centre development, highlighting its robust power generation capabilities, ample land and cool climate, abundant natural resources, streamlined regulations, affordable water, and competitive tax rates.⁷⁷ Alberta's efforts are bolstered by a Canadian federal government program to fund the development of AI and data centres anywhere in Canada.⁷⁸ As of the beginning of May 2025, the Alberta Electric System Operator (AESO) had 15 GW of data centre load in its connection queue, including multiple hyperscale data centre proposals.⁷⁹

However, on 4 June 2025, the AESO announced that it will only enable the connection of up to 1.2 GW of data centres and other large load projects through 2028.⁸⁰ In materials posted on 4 June 2025, the AESO noted that load proposals have vastly outstripped proposed new generation⁸¹ and explained that the 1.2 GW limit, which it calculated on the basis of the system's ability to serve load using existing infrastructure and forecast supply,⁸² "represents the maximum additional large load capacity that the grid can serve without negatively impacting grid reliability."⁸³ The limit, which the AESO described as "interim," is to be allocated pro rata among load projects larger than 75 MW that the AESO "qualifies" on the basis of demonstrated municipal support, posted financial security, and confirmation that no system reinforcement will be required.⁸⁴ In the meantime, the AESO intends to develop a "long-term framework for connecting large loads in alignment with government policy," which may include changes to the connection requirements applicable to these projects.⁸⁵

The AESO's announcement demonstrates that not even Alberta, with its many advantages, is immune to the challenges of accommodating these large new loads. Industry and commentators have found much to criticize in the AESO's approach and its potential impacts on investors' views of Alberta as a desirable destination for data centre investment. Whatever the merits of these concerns, the announcement has at least provided a degree of certainty around the AESO's data centre connection policy in Alberta, at least through to 2028, and has shown that the AESO does not intend to prioritize new investment above the reliability of Alberta's electric system. The AESO's approach fits within a spectrum of

⁷⁷ Ministry of Technology and Innovation, *Alberta's AI & Data Centre Strategy* (Edmonton: Government of Alberta, 2024) at 7, online (pdf): [perma.cc/GJ9P-3CWZ]; Joel Dryden, "Alberta Wants to Build Huge Data Centres for AI. That Could Bring a Big Emissions Challenge", *CBC* (18 December 2024), online: [perma.cc/D93M-LFZ5].

⁷⁸ Government of Canada, Innovation, Science and Economic Development Canada, *Canadian Sovereign AI Compute Strategy* (Ottawa: ISED, 2025) online: [perma.cc/5MNJ-EGMM]. The federal government has also been reported to be considering a CAD\$15 billion incentive plan to attract investment in AI-focused, green-powered data centres to support the industry's rapid expansion: Reuters, "Canada Proposed \$15 Bln Incentive to Boost AI Green Data Centre Investment, Globe and Mail Reports" (12 December 2024), online: [perma.cc/22NU-JZKH].

⁷⁹ AESO, "Connection Project List Dashboard" (May 2025): online: [perma.cc/P2J9-LKYP].

⁸⁰ AESO, "AESO Announces Interim Approach to Large Load Connections" (4 June 2025), online: [perma.cc/LV5N-Y98B] [AESO, "Interim Approach"].

⁸¹ AESO, *Large Load Integration Phase I: Interim Connection Limit and Assignment* (Calgary: AESO, 2025) at 18, online (pdf): [perma.cc/LTZ6-MKUA] [AESO, *Large Load Integration*].

⁸² *Ibid* at 21–30.

⁸³ AESO, "Interim Approach", *supra* note 80.

⁸⁴ AESO, *Large Load Integration*, *supra* note 81 at 31–39.

⁸⁵ *Ibid* at 42–43.

legislative and regulatory responses to the challenges posed by data centre connections, which we discuss further below.

II. ELECTRICITY SUPPLY TO DATA CENTRES: RISKS AND OPPORTUNITIES

As data centres' need for electricity continues to grow at a pace that outstrips investment in new generation and transmission infrastructure, legislators, regulators, and system operators like the AESO are grappling with both opportunity and risk. On one hand, the proliferation of data centres offers economic benefits for jurisdictions ready to meet the resulting load demands; on the other hand, such proliferation threatens to strain existing energy systems and drive up costs for other users. In response, various jurisdictions are exploring a range of policy mechanisms, some of which are canvassed in this section.

A. DATA CENTRES PRESENT AN OPPORTUNITY FOR GENERATION AND TRANSMISSION INVESTMENT

1. THE OPPORTUNITY

As already noted, the IEA estimates that data centres' worldwide electricity consumption could double between 2024 and 2030. Canada's relatively cold climate, combined with its unique access to cheap and predominantly renewable energy and various national and regional incentives, has resulted in data centre project proponents looking to establish operations in this country. Ontario's system operator anticipates data centres will make up 13 percent of new electricity demand and 4 percent of the province's total demand by 2035.⁸⁶ Hydro Quebec has estimated a 25 TWh increase for Quebec's demand for the 2023–2032 period, 16 percent of which (4.1 TWh) it has attributed to data centres.⁸⁷ In response to unprecedented demand, Alberta has limited its data centre connections to 1.2 GW through 2028, as discussed above.

Meeting the growing power needs of data centres will require substantial investments in generation and transmission infrastructure. Goldman Sachs estimates up to USD\$720 billion will need to be invested globally through to 2030.⁸⁸ The wave of demand driven by data centres is estimated to drive peak demand growth at a rate of 3 percent per year, which would require up to six times the current pace of transmission infrastructure planning and construction to meet capacity.⁸⁹ The massive infrastructure investment required to meet this forecast load demand is illustrated by the recent announcement of PJM Interconnection LLC, a regional transmission organization responsible for transmission across 13 US states, which

⁸⁶ Independent Electricity System Operator, News Release, "Electricity Demand in Ontario to Grow by 75 Per Cent by 2050" (16 October 2024), online: [perma.cc/U4BW-F3EX].

⁸⁷ CER Market Snapshot, *supra* note 33; Hydro-Québec, "Growth in Electricity Demand Expected to Continue in Québec" (3 November 2022), online: [perma.cc/PL6S-M7ZC].

⁸⁸ Goldman Sachs, *supra* note 37.

⁸⁹ Wilson, Zimmerman & Gramlich, *supra* note 44 at 5.

approved a USD\$6 billion plan to upgrade its transmission systems, in large part to meet load demand driven by data centres.⁹⁰

As it currently stands, however, the power demand of data centres is outpacing the generation and transmission investment required to serve it, creating a fundamental constraint on data centre growth.⁹¹ Part of this imbalance is due to the discrepancy in construction timelines between data centres and electricity infrastructure. The timeline for constructing data centres (approximately 18 to 24 months) is much shorter than that for constructing new or upgrading existing generation and transmission grid infrastructure (which typically ranges from three to ten years, depending on the project and jurisdiction).⁹² This discrepancy is expected to strain electricity systems and delay data centre project development. Such energy sector bottlenecks are also expected to factor significantly into developers' jurisdiction selection criteria.

Ironically, the global rush to build data centres has itself contributed to the delay in building generation and transmission facilities and to shortages of key components like high-capacity power transformers and switchgear.⁹³ As a result, data centre developers are confronted with urgent demands to build data centres to support AI, cloud, and other rapidly emerging technologies, but must carefully stage procurement of equipment and often endure significant lag time to procure electrical gear and equipment. The lag time may be further aggravated by US tariffs, which could extend the timelines for both data centres and supporting electrical infrastructure, as both depend to varying degrees on imported construction materials and specialized hardware.

Lengthy connection queue wait times further contribute to the growing imbalance between surging data centre power demand and the ability of regional energy providers to deliver adequate supply. To connect to the grid, data centres and other large load customers must comply with interconnection processes established by the jurisdiction's transmission system operator. These typically include impact studies to identify the infrastructure upgrades required to meet the requested load and allocate costs for such upgrades. The lag time between connection requests and energy deployment for projects is significant, and it often takes several years before an applicant can be supplied with grid-sourced power.⁹⁴ The IEA's

⁹⁰ PJM Interconnection LLC, Planning, "PJM Board Approves New Transmission Projects to Support Grid Reliability" (26 February 2025), online: [perma.cc/WYU6-H62A].

⁹¹ Jones Lang LaSalle IP, Inc, "2025 Global Data Center Outlook" (12 January 2025), online: [perma.cc/46QA-QGWD].

⁹² Green et al, *supra* note 76. Another author notes that gas and renewable energy projects typically take three to five years, while transmission projects can take seven to ten years to complete: Soto et al, *supra* note 75 at 6. See also IEA, *Energy and AI*, *supra* note 5 at 79: the IEA notes that the only reliable electricity sources that can be developed within the short timeframe aligned with data centre construction are solar and gas turbines.

⁹³ McLean, *supra* note 74; Wood Mackenzie, "Making the Connection: Meeting the Electric T&D Supply Chain Challenge" (September 2025), online (pdf): [perma.cc/VZD6-THJU].

⁹⁴ Joseph Rand et al, *Queued Up: 2024 Edition: Characteristics of Power Plants Seeking Transmission Interconnection as of the End of 2023* (Berkeley: Berkeley Lab, 2024), online (pdf): [perma.cc/MGY4-QZZP]. Connection wait times in the US are over four years and are expected to rise (*ibid* at 44). However, at least one grid operator has announced plans to use AI to speed up its connection process: PJM Inside Lines, Planning, "PJM, Google & Tapestry Join Forces to Apply AI to Enhance Regional Planning, Generation Interconnection" (10 April 2025), online: [perma.cc/JQG4-L7PF].

analysis suggests that such “grid constraints could delay around 20% of the global data centre capacity planned for construction by 2030.”⁹⁵

Part of the lag can be attributed to a recent trend of speculative load proposals being brought by large project proponents keen on securing their place in the interconnection queue. This has the effect of creating “phantom” load estimates that may fail to materialize, exaggerating demand projections and obscuring utility connection processes.⁹⁶ It can also contribute to delays by diverting resources away from other projects in the queue.⁹⁷ System operators and utilities have been challenged to respond, as connection processes tend to lack transparency and are not often standardized within the same planning region.⁹⁸ Because the cost of submitting a connection request tends to be low, at least at the early stages of the connection process, there is little financial disincentive for developers to make speculative applications or even to apply for the same project in multiple jurisdictions.⁹⁹

Speculative proposals aside, technological advances can offer some respite to the problem of lag time. Improvements in data centre efficiency, such as better server utilization, cooling technologies, and chip advancements, can help mitigate data centres’ substantial power demands. According to the IEA, high-efficiency cooling technologies offer an opportunity to reduce data centre demand by 10 percent, while governments have also committed to collaborate in developing next-generation cooling tech.¹⁰⁰ AI itself can also contribute to data centre efficiency by using machine learning to optimize servers’ reactions to different operating scenarios.¹⁰¹

Another mitigating mechanism is increasing coordination between data centres and the grid within which they operate, referred to as a “shared economy model.”¹⁰² This synergy between load and grid entails data centres transitioning from passive consumers to active partners in grid infrastructure, through, for example, supplying the grid with power from otherwise unused backup power sources, thereby contributing to the grid’s reliability while also increasing affordability and sustainability for the data centre’s operations,¹⁰³ or by data centres implementing operating flexibility frameworks (shifting or delaying workloads,

⁹⁵ IEA, *Energy and AI*, *supra* note 5 at 96.

⁹⁶ See the discussion in Bianca Giacobone, “Phantom Data Centers are Flooding the Load Queue”, *Latitude Media* (26 March 2025), online: [perma.cc/VQN4-XFYA].

⁹⁷ See discussion in Martucci, “Fraction of Proposed Data Centers”, *supra* note 51.

⁹⁸ Peter Freed & Allison Clements, “How to Reduce Large Load Speculation? Standardize the Interconnection Process.”, *Utility Dive* (19 February 2025), online: [perma.cc/2SU9-LNYA].

⁹⁹ London Economics International LLC, *supra* note 53 at 12–15; Paul Moser & Michael Lahoud, “The Rise of the ‘Fake’ Data Center Developer — And How to Tell the Difference”, *Data Center Frontier* (17 March 2025), online: [perma.cc/FM3W-MZEM].

¹⁰⁰ IEA, *Electricity 2024*, *supra* note 11 at 36; Ministry of Technology and Innovation, *supra* note 77 at 9.

¹⁰¹ IEA, *Electricity 2024*, *supra* note 11 at 36–37 (the IEA notes Google’s claim to have reduced the amount of energy used to cool its data centres by up to 40 percent: see also Richard Evans & Jim Gao, “DeepMind AI Reduces Google Data Centre Cooling Bill by 40%” (20 July 2016), online (blog): [perma.cc/5S97-PSUA]).

¹⁰² EPRI, *supra* note 19 at 22.

¹⁰³ *Ibid.*

timing use of back up generation) which reduce demand at critical times.¹⁰⁴ This type of partnership and collaboration will be essential to the efficient integration of data centre load.

While the precise extent of the challenge remains open to speculation, the emerging need for timely and reliable energy for data centres presents a clear opportunity for investors in generation and transmission to help fill the infrastructure gap.

2. CO-LOCATED GENERATION

Given the long lead times for grid interconnection and the importance of “time to power,” many data centre developers are pursuing co-location strategies in an effort to accelerate operations and ensure reliability of power supply. Co-located generation involves the strategic placement of energy generation facilities in direct proximity to a data centre or vice versa. Co-location can appeal to data centre proponents, as it offers enhanced reliability and greater autonomy over power quality and availability while reducing the risks associated with grid congestion or downstream system outages.

Co-located generation can be either BTF (also termed “behind the meter” (BTM)) or “outside the fence” (OTF; also termed “front of the meter”). In a BTF arrangement, the generation facility is integrated into the data centre operation and supplies power to the data centre exclusively. Where technically possible and permitted by law, BTF generators can also export unused surplus energy to the grid.¹⁰⁵ In Alberta, for instance, the law allows self-supplying market participants and designated industrial systems with internal electricity supplies to offer surplus electric energy into the electricity markets.¹⁰⁶ In an OTF arrangement, by contrast, the generating facility is not physically integrated with the data centre but is located nearby, supplying the data centre with a reliable source of power that is relatively free from the risk of grid congestion or downstream system outages.

As already noted, the Alberta government is promoting co-located BTF generation. Elsewhere in North America, long lead times for system investments required to meet the load requirements of data centres have led data centre proponents to construct BTF co-located generation on a temporary or staged basis pending the approval and construction of a transmission connection. Earlier this year, for example, Hyperscale Data Inc. announced an

¹⁰⁴ IEA, *Energy and AI*, *supra* note 5 at 100. The IEA notes that grid congestion usually occurs during a limited number of hours per year, and a reduction of grid demand by data centre operators of less than 1 percent of the time would substantially improve grid stability or the ability of the grid to accommodate new data centre integration (*ibid*).

¹⁰⁵ In 2022, Alberta amended its electric utility legislation to make this more accessible, through the *Electricity Statutes (Modernizing Alberta's Electricity Grid) Amendment Act*, SA 2022, c 8.

¹⁰⁶ *Electric Utilities Act*, SA 2003, c E-5.1 [*EU Act*]. The *EU Act* s 18(2) requires “all electric energy entering ... the interconnected electric system must be exchanged through the power pool”). Exempt from this requirement is electric energy that satisfies the definition of “self-supply” (s 2(1)(b)) and electric energy that the Commission has exempted from regulation, which may include energy produced by an industrial system designated under the *Hydro and Electric Energy Act*, RSA 2000, c H-16, s 4 for its own consumption (*EU Act*, *supra* note 106, ss 2(1)(d), 117). The effect of these provisions is that BTF energy produced and consumed on-site by these consumers is exempt from regulation under the *EU Act*, while surplus energy may be offered into the markets. At the time of writing, proposed amendments to the *EU Act* would replace references to the “power pool” with references to the real-time and the day-ahead markets contemplated as part of Alberta’s Restructured Energy Market: see Bill 52, *Energy and Utilities Statutes Amendment Act*, 2025, 1st Sess, 31st Leg, Alberta, 2025 (as of May 8, 2025, Bill 52 passed its third reading in the Legislative Assembly and is awaiting Royal Assent).

agreement with a Michigan natural gas utility to enhance its power capacity by 40 MW through a BTM gas arrangement that could be brought on in 18 months, pending a longer-term 300 MW utility electrical upgrade anticipated to take 44 months.¹⁰⁷ In effect, the data centre proponent invests in BTF generation to partially satisfy its “time to power” requirements and to mitigate the delay in connecting to the grid.

While co-located generation offers certain advantages for data centre proponents, it has raised or exacerbated questions regarding utility cost recovery and rate design. For instance, and as discussed further below, some applications of BTF can contribute to uneconomic bypass of the transmission system, foisting additional costs on utility ratepayers. Regulators in many jurisdictions are acting quickly to establish rules specific to data centres and other large load customers seeking to connect. In February 2025, the US Federal Energy Regulatory Commission (FERC) commenced a proceeding to consider tariff issues related to the co-location of large loads, particularly data centres, with generating facilities (the FERC Co-Location Proceeding).¹⁰⁸ Guidance from FERC is expected by the end of 2025.

The FERC Co-Location Proceeding was announced amid, and in partial response to, debates among data centre developers, transmission operators, utilities, and customer advocates regarding regulatory jurisdiction over co-located generation, cost allocation, access to grid services, grid reliability, and unduly discriminatory rates, some of which issues are discussed further below. The outcome of that proceeding will play a large role in shaping the future treatment of co-location arrangements within FERC’s jurisdiction and likely beyond. In Alberta, the AESO is participating in various analyses and initiatives to assess and address the impacts of large loads on the electricity grid¹⁰⁹ and is likely monitoring the FERC Co-Location Proceeding with interest.

3. NEED FOR RELIABLE POWER GENERATION

AI data centres are frequently characterized by a continuous demand for power. A central factor in their siting, if not the most important factor, is the availability of a constant and reliable source of electricity. While some data centre operations invest in on-site generation, most still rely on the grid for redundancy in order to ensure a reliable electricity supply at times of peak load, as backup during maintenance of on-site generation facilities, or in emergencies. Finding a grid with the right mix of energy sources to deliver uninterrupted power that data centres require to support AI will be of primary importance. According to the IEA, “[r]enewables and natural gas [currently] take the lead in meeting data centre electricity demand, but a range of sources are poised to contribute.”¹¹⁰

¹⁰⁷ Hyperscale Data, Inc., “Hyperscale Data Subsidiary Reaches Agreement in Principle to Add Capability for an Incremental 40 Megawatts to its Michigan Data Center, Boosting AI Infrastructure Development”, *GlobeNewswire* (27 February 2025), online: [perma.cc/Q5GV-6UU4]. See also Dan Swinhoe, “Hyperscale Data to Scale Michigan Data Center to 300MW”, *DCD* (25 February 2025), online: [perma.cc/Q7GB-PGAD].

¹⁰⁸ *Order Instituting Proceeding Under Section 206 of the Federal Power Act and Consolidating with Other Proceedings*, 190 FERC ¶ 61,115 (2025), Docket No EL25-49-000 [FERC Order EL25-49-000].

¹⁰⁹ AESO, “2025 Long-Term Transmission Plan” (31 January 2025) at 8, online (pdf): [perma.cc/NN74-DFMX].

¹¹⁰ *Energy and AI*, *supra* note 5 at 14.

As global demand for electricity grows, natural gas power plants in particular are being relied upon as a timely, deployable, and dependable energy source to either self-supply data centres completely, or as a backup.¹¹¹ Notwithstanding the renewable energy aspirations of data centre proponents and their users, therefore, there is a continued and increasing reliance on natural gas-fired electricity generation. Indeed, the availability of natural gas generation is central to Alberta's AI Data Centre Strategy, which touts it as a proven and cost-effective source of energy.¹¹² Likewise, in the US, data centre operators are looking to natural gas generation as a reliable and timely option to meet surging energy demand.¹¹³ Meta, for instance, is building a USD\$5 billion data centre project in Louisiana that will require a 2,300 MW expansion in natural gas power.¹¹⁴ Perhaps most illustrative of data centre power demand being met by natural gas, however, is the recent USD\$10 billion repurposing of a retired Pennsylvania coal plant into the largest US natural gas-powered plant intended to serve a data centre campus (as well as thousands of grid-connected residences).¹¹⁵

There are also opportunities for other dispatchable sources of electricity. Data centre demand presents a lifeline for aging nuclear facilities as well as an opportunity for SMRs.¹¹⁶ Nuclear reactors, including SMRs, offer stable and carbon-free power, which aligns with data centres' demand for around-the-clock and sustainable power. From the perspective of a data centre proponent, the consistency of a nuclear power plant's output may represent an advantage relative to intermittent renewables. SMRs may be particularly appealing, as they offer the beneficial features of nuclear power in a compact and modular (that is, scalable) form.

The trend toward nuclear power generation is gaining momentum in the US,¹¹⁷ specifically as a source of electricity for data centres. Tech giants have expressly committed to tripling nuclear capacity by 2050,¹¹⁸ and some have partnered with developers to accelerate the deployment of SMRs to help meet the demand driven by data centres.¹¹⁹ In late 2024, Constellation Energy announced it will reopen the Three Mile Island nuclear power plant in

¹¹¹ Valerie Volcovici & Laila Kearney, "Data-Center Reliance on Fossil Fuels May Delay Clean-Energy Transition", *Reuters* (26 November 2024), online: [perma.cc/G9KM-M6R8].

¹¹² Ministry of Technology and Innovation, *supra* note 77 at 7.

¹¹³ McGeady et al, *supra* note 64 at 7.

¹¹⁴ Jeffrey Tomich, "Meta Goes All In on Gas to Power a Mega Data Center", *Politico* (21 November 2024), online: [perma.cc/LQ24-8MUB]. Nextera Energy and GE Vernova are also developing gas-fired power generation in the US to meet data centre electricity demand: see Emma Penrod, "NextEra Partners with GE Vernova to Build "Gigawatts" of Gas Generation", *Utility Dive* (27 January 2025), online: [perma.cc/ALL4-52FN].

¹¹⁵ Business Wire, "Homer City Redevelopment and Kiewit Announce Country's Largest Natural Gas-Powered Data Center Campus to Support AI and HPC Demand" (2 April 2025), online: [perma.cc/NA4C-Y7YG].

¹¹⁶ In the IEA base case forecast, it is estimated that the "share of nuclear in the data centre electricity mix [will range] between 16% to 18%" between 2030 and 2035: see IEA, *Energy and AI*, *supra* note 5 at 92.

¹¹⁷ Currently, there are plans to build up to 25 GW of SMR capacity associated with data centre demand worldwide, with almost all announced projects in the United States: *ibid* at 76.

¹¹⁸ *Large Energy Users Pledge*, World Nuclear Association (12 March 2025), online (pdf): [perma.cc/UYD2-YEDD].

¹¹⁹ See e.g. X-energy, Financing Update, "X-energy Closes Upsized \$700 Million Series C-1 Financing Round to Accelerate the Development of Advanced Small Modular Nuclear Technology" (6 February 2025), online: [perma.cc/ZS8L-DV94]; Kairos Power, "Google and Kairos Power Partner to Deploy 500 MW of Clean Electricity Generation" (14 October 2024), online: [perma.cc/H2Z2-93VQ]; Meta, "Accelerating the Next Wave of Nuclear to Power AI Innovation" (3 December 2024), online: [perma.cc/9GSV-GNF2].

a deal with Microsoft to power its cloud computing and artificial intelligence program.¹²⁰ Another proposal would see the Susquehanna nuclear power plant in Pennsylvania supply a co-located data centre, although the terms of the project's interconnection to the PJM grid continue to be considered by FERC.¹²¹ These industry efforts mirror American federal government policy, including recent steps to promote the development of uranium resources and SMRs through the creation of the National Energy Dominance Council.¹²² Staff at the Deloitte Research Center for Energy and Industrials, estimate that “new nuclear power capacity ... could meet about 10%” of projected US data centre demand by 2035.¹²³

Nuclear energy and SMRs are also being encouraged in Canada. The federal government has recognized nuclear energy as a key part of the country's energy supply and recently announced major investments to advance next-generation nuclear energy, including financial support for the development of SMRs.¹²⁴ Alberta and Saskatchewan have signed a memorandum of understanding agreeing to collaborate on advancing nuclear power generation to support both provinces' electricity grids,¹²⁵ and in 2022, the governments of Ontario, Saskatchewan, New Brunswick, and Alberta collaborated on a joint strategic plan outlining the path forward for SMRs and key provincial priorities to this end.¹²⁶ Policy is beginning to translate into practice. Following a two-and-a-half-year regulatory process, in April 2025, the Canadian Nuclear Safety Commission approved the construction of the first commercial SMR in Canada, a 300-MW reactor at Ontario Power Generation's Darlington site in Clarington, Ontario.¹²⁷

While nuclear energy offers a promising solution for meeting the novel data centre power demand, several obstacles remain. High cost (relative to other low-emission technologies like carbon capture-equipped natural gas), lengthy timeframes for regulatory approvals, supply-chain challenges, and issues related to the management of nuclear waste continue to impede expedited adoption of nuclear energy.¹²⁸ Development times also remain very long. In the US, nuclear plant construction times range from three to ten years over and above regulatory approval processes. Modularized technologies like SMRs and microreactors have the potential to improve construction learning rates and may reduce construction times; however,

¹²⁰ Constellation, “Constellation to Launch Crane Clean Energy Center, Restoring Jobs and Carbon-Free Power to The Grid” (20 September 2024), online: [perma.cc/E372-EXNP].

¹²¹ Ethan Howland, “FERC Rejects Interconnection Pact for Talen-Amazon Data Center Deal at Nuclear Plant”, *Utility Dive* (4 November 2024), online: [perma.cc/5RUU-BDNX]. An appeal of FERC's decision has been stayed pending rehearing.

¹²² US, Donald J Trump, Executive Order No 14213, *Establishing the National Energy Dominance Council*, 90 FR 9945 (2025), online: [perma.cc/764J-UGR2].

¹²³ Kate Hardin et al, “Nuclear Energy's Role in Powering Data Center Growth”, *Deloitte* (9 April 2025), online: [perma.cc/PP62-7QRN].

¹²⁴ Natural Resources Canada, News Release, “Canada Invests in the Next Generation of Canadian-Made, Clean, Affordable Nuclear Energy” (5 March 2025), online: [perma.cc/T5MX-DHJB].

¹²⁵ Saskatchewan, “Saskatchewan and Alberta Partner to Advance Nuclear Power Generation” (2 May 2024), online: [perma.cc/8RRT-VM8R].

¹²⁶ Government of Ontario, “A Strategic Plan for the Deployment of Small Modular Reactors” (2 March 2022), online: [perma.cc/5F8U-QGNF].

¹²⁷ Government of Canada, “Decision by the Commission to Authorize Ontario Power Generation Inc. to Construct 1 BWRX-300 Reactor at the Darlington New Nuclear Project site” (4 April 2025), online: [perma.cc/863K-77YT].

¹²⁸ Jones Lang LaSalle IP, Inc., “Is Nuclear a Viable Power Solution for Data Centers?”, online: [perma.cc/U84V-UHFE]; NESCOE, *Data Centers and the Power System: A Primer* (Calgary: NESCOE, 2024), online (pdf): [perma.cc/7P7G-WAUK]; Hardin et al, *supra* note 123.

the expected construction time for SMRs, estimated as 55 months,¹²⁹ is still considered lengthy in the context of rapid data centre development. Nonetheless, technological evolution and policy change are helping to position nuclear generation as a potential option for data centre supply over the longer term at least.

Because of the need for a constant and reliable electricity supply, data centres also rely on added redundancy. Data centre operators will often look to traditional sources of redundancy for such backup supply. “Combustion turbines can be installed relatively quickly” and are fuel flexible, but their lengthy start-up times typically make them better suited as backups for “longer-term uninterruptible power supply or battery systems.”¹³⁰ Fuel cells have also been adopted for data centres:¹³¹ their discharge profile can be made to match the steady electrical load of the typical data centre. Energy storage systems, including flow batteries, thermal energy storage, pumped storage hydroelectric power, compressed air, hydrogen and gravity storage technologies, and battery energy storage systems (BESS) can also be ideal for systems that need brief generation backup while they shift data and network traffic to other locations when an outage occurs.

In summary, data centre requirements for reliable power generation have not only incentivized investments in traditional dispatchable generation, such as natural gas, but have also stimulated investment opportunities in innovative nuclear and SMR supply and a broader array of redundant power sources.

4. NET-ZERO OBJECTIVES

Many data centre proponents, or their users, have zero-emissions or sustainability objectives that encourage them to power their facilities using renewable energy or to otherwise reduce or offset their energy-related emissions.¹³² For example, Meta and Google have both expressed commitments to energy-efficiency and decarbonization initiatives to supplement their data centre operations.¹³³

In the drive to quickly secure access to reliable generation for data centres, sustainability objectives may be relegated to secondary considerations. In the words of one energy executive, “[t]he decarbonization discussion ... isn’t driving the decision-making [around data centre siting]. It’s speed.”¹³⁴ However, some jurisdictions are considering data centre-specific emissions standards or net-zero mandates, which would make net-zero operations a regulatory requirement in those jurisdictions, rather than a voluntary or aspirational goal.¹³⁵ In this sense, voluntary and regulatory net-zero objectives associated with data centres are creating further opportunities for renewable generation in many jurisdictions.

¹²⁹ Soto et al, *supra* note 75 at 16.

¹³⁰ HDR, “Rethinking Data Centre Power: Overcoming Data Center Power Interconnection Challenges” (8 May 2023), online: [perma.cc/L2N5-3QKG].

¹³¹ *Ibid.*

¹³² Ethan Howland, “Duke to Offer Expanded Suite of Clean Energy Options to Amazon, Google, Other Large Customers”, *Utility Dive* (30 May 2024), online: [perma.cc/HK45-QE2Q].

¹³³ Meta, “Sustainability” (2025), online: [perma.cc/PR3P-NAAU]; Google, “Operating Sustainably” (2024), online: [perma.cc/76KX-PWSF].

¹³⁴ Dryden, *supra* note 77, quoting John Kousinouris, CEO of TransAlta Corporation.

¹³⁵ See Part II.C.1 below for low-emission initiatives being adopted by some jurisdictions.

The decreasing cost of renewable energy infrastructure, especially solar photovoltaic systems, has made it increasingly possible for industrial customers like data centres to access renewable sources of electricity. This can be done directly or indirectly. While locating next to a solar or wind facility is difficult in most instances, theoretically, direct access merely requires a physical link between the data centre and a renewable generation facility, such as a solar or wind plant, located on- or off-site. This link may be supplemented with a BESS to help manage supply reliability.¹³⁶ A BESS can allow a data centre to store surplus energy at times when generation outpaces the data centre's demand and to supply it back to the data centre at times of higher system demand, or, for grid-connected data centres, to sell it into the market. The inclusion of a BESS in a data centre design and operations can offer numerous benefits to a data centre owner, including additional reserve power and decreased reliance on traditional grids, reduced need for backup generation to compensate for intermittent resources, and financial opportunity in selling surplus electricity and providing grid services.¹³⁷

Data centres that do not directly access renewable energy can access it indirectly through mechanisms such as PPAs. These mechanisms give data centre proponents greater control over their supply mix than they otherwise would have by simply connecting to the grid. Currently, technology companies operating data centres account for over 30 percent of the 120 GW of operational renewables capacity that has been procured through corporate PPAs globally, and in 2024, this would be sufficient to cover 20 percent of the global electricity demand from data centres.¹³⁸

For commercial and regulatory purposes, the carbon offsets represented by renewable generation are typically encapsulated in renewable energy certificates (RECs). A typical REC represents 1 megawatt-hour of electricity produced from a renewable source. RECs are traded in jurisdictional carbon markets, and their prices are influenced by the supply and demand forces of the particular carbon market. By purchasing RECs, data centre proponents can support their carbon-reduction goals even if they are not engaged in renewable generation themselves.¹³⁹

Technological advances have also made it possible to reduce emissions from non-renewable energy sources like natural gas, using techniques like carbon capture and storage (CCS). CCS has the support of both the Canadian federal and several provincial governments (including Alberta's) and has been put forward by Alberta's Technology and Innovation Minister as an option for data centre proponents seeking to achieve net-zero natural gas.¹⁴⁰ At present, CCS implementation has been limited, including in Alberta. However, the technology's availability, along with appropriate geology and technical expertise (as in

¹³⁶ A BESS is a battery that stores electricity sourced variously from the grid or from an on-site generation facility (frequently renewable generation) and is configured to supply that energy either to the data centre or to the grid, depending on the financial, environmental, or reliability motives of the participant: Patrick Donovan, *Understanding BESS: Battery Energy Storage Systems for Data Centres* (Schneider Electric, 2024) at 2, online (pdf): [perma.cc/8J8L-4RLF].

¹³⁷ *Ibid* at 7.

¹³⁸ IEA, *Energy and AI*, *supra* note 5 at 77.

¹³⁹ Government of Canada, "Clean Electricity Initiative" (8 May 2025), online: [perma.cc/546X-YMKA].

¹⁴⁰ Dryden, *supra* note 77.

Alberta), could be enough to satisfy data centre proponents in search of rapid access to cheap energy so that emissions can be managed in future.

Voluntary or regulatory carbon reduction targets for data centres have prompted additional interest in renewable energy generation, BESS, PPAs, carbon credits and CCS, as proponents evaluate the quality, as well as the availability, of their required electricity.

B. RISKS ASSOCIATED WITH INVESTMENT IN DATA CENTRE ENERGY SUPPLY

While data centre load expectations are providing opportunities for investment in new and innovative generation and transmission infrastructure, co-located generation and net-zero-oriented generation, there are also significant risks associated with these new investments. The following sections discuss important risks presented by the need to supply data centres with energy and outline some of the legislative and regulatory responses that have been proposed and adopted to date.

The need for new generation and transmission infrastructure to supply forecasted data centre demand raises important questions regarding the allocation of the cost and risk associated with that infrastructure. New generation and transmission could, in theory, benefit all utility customers through increased capacity and reliability. However, those benefits are often contingent on the location of new generation, transmission and large load infrastructure, and on the demand that new system infrastructure is intended to serve actually materializing. If these factors are not carefully considered and balanced in siting decisions and utility rate designs, the costs to customers of new system infrastructure required to serve data centres could be out of proportion to the benefits. Rising customer costs could limit data centre demand growth and spur legislative and regulatory efforts to protect customers from data centre-driven infrastructure costs. Some studies suggest that American ratepayers are already footing the bill for electrical infrastructure constructed to serve data centres.¹⁴¹ This has sparked discussions on whether customers should be ring-fenced from data centre-driven infrastructure costs.¹⁴²

1. STRANDED COSTS

As utilities, regulators, and investors scramble to respond to the unprecedented surge in forecasted load growth from data centres, concerns are mounting over the risk of overbuilding grid infrastructure that may later prove to be underutilized. This presents the potential for stranded costs, where capital investments in utility infrastructure are justified on the basis of anticipated revenues that ultimately fail to materialize. The risk of stranded costs stems from the scale and uncertain longevity of data centre load.

¹⁴¹ Cathy Kunkel, “Data Centers Drive Buildout of Gas Power Plants and Pipelines in the Southeast”, *Institute for Energy Economics and Financial Analysis* (29 January 2025), online: [perma.cc/5SJ9-8WEN]. Note that this observation occurs in the context of increasing customer cost forecasts driven by a multitude of factors, of which data centres are only one: see e.g. Batra et al, *supra* note 44 at 10.

¹⁴² Abraham Silverman, Suzanne Glatz & Mahala Lahvis, “Can Regulators Protect Small Customers from Rising Transmission Costs for Big Data Centers?”, *Utility Dive* (11 December 2024), online: [perma.cc/WL99-5PPP].

Investments in new power generation and transmission needed to serve massive new loads like those associated with data centres often require billions of dollars in capital with decades-long timelines for recovering the costs. The FERC Co-Location Proceeding is focused in part on appropriate cost allocation rules for co-located data centres.¹⁴³ Absent clear and fair cost allocation rules, data centres may avoid paying for transmission services they benefit from, undermining established rate-setting principles and leaving existing customers to absorb the costs.

The risk of stranded costs is also founded in concerns that the AI power demand could be a “bubble,” whereby investment in AI-driven data centre investment outstrips the actual eventual market demand.¹⁴⁴ In this case, the costs of the resulting oversupply of electricity generation, along with the underlying infrastructure costs, would be borne by utility customers. This risk is exacerbated by the lag time associated with infrastructure upgrades driven by speculative data centre demand, as today’s major investment decisions may need to be made with a level of uncertainty as to whether the data centre demand driving the investment will remain years in the future when the infrastructure becomes operational. Any discrepancy in demand projections for data centres and the long-term timelines for the infrastructure upgrades required to power them raises the risk that utilities and ratepayers could be left with the bill for stranded costs if demand growth fails to materialize to the extent projected.

To date, approaches to mitigating the risk of stranded costs associated with data centre-driven utility investment have focused on requiring project proponents to pay more of the costs of the infrastructure required to serve them, and to pay more of it up front. For instance, FERC has required the proponent of one co-located generation facility to pay the entire cost of the system upgrades required to connect it.¹⁴⁵ Additionally, legislators and regulators in several jurisdictions are considering making data centres subject to minimum monthly charges, financial security requirements, or long-term contracts with substantial exit fees in the event service is terminated or if expected load does not materialize.¹⁴⁶

2. UNECONOMIC BYPASS

Increased cost to customers can also arise where data centres (or other customers) that normally supply their own electricity needs with BTF generation also rely on the system for backup. For instance, if the fixed costs of the system investment required to serve a data centre are recovered through a charge that is based on customers’ actual demand on the system, the data centre’s decision to reduce its demand on the system by installing BTF generation can result in those costs being shifted to other system customers. This is an

¹⁴³ FERC Order EL25-49-000, *supra* note 108.

¹⁴⁴ Melissa Farney, “AI, Data Centers, and the Next Big Correction: Will Growth Outpace Market Reality?”, *Data Center Frontier* (28 February 2025), online: [perma.cc/R6NU-HFJ6].

¹⁴⁵ *Order Accepting Proposed Tariff, Subject to Condition*, 190 FERC ¶ 61,080 (2025), Docket Nos. ER24-1658-000, ER24-1658-001, ER24-1658-002 at note 29.

¹⁴⁶ See discussion below.

example of “uneconomic bypass” of the transmission system,¹⁴⁷ which is a phenomenon that has been recognized in many jurisdictions including Alberta.¹⁴⁸

Uneconomic bypass is an important consideration in transmission rate design. It can be mitigated in various ways, such as by allocating a greater share of system costs to the connecting customer (for example, by requiring a financial contribution in aid of construction);¹⁴⁹ recovering any remaining system costs through a charge based on connection capacity (as opposed to actual demand); or disincentivizing BTF generation altogether. Another approach, recently passed into law in Utah, attempts to avoid the cost of bypass (and other cost impacts to system customers) by allowing data centres or other large loads to negotiate supply contracts with utilities outside of the standard regulated framework, effectively requiring them to pay their own costs of service and establishing a “firewall” between them and other utility customers.¹⁵⁰

However, Utah’s approach appears to be unique, with most other jurisdictions treating data centres as typical system customers. Nor is there a current trend to disincentivize BTF generation: many governments, including Alberta’s, have been keen to encourage BTF generation for data centres as a means of reducing data centres’ impacts on system power levels, power prices, and reliability.¹⁵¹ In most cases, therefore, the task of mitigating increased costs to customers from uneconomic bypass is likely to fall to system operators and utility regulators as a matter of rate design. Several rate proposals advanced to date in the US include provisions designed to mitigate the risk of uneconomic bypass, such as enhanced customer contribution requirements and minimum monthly charges based on contract capacity.¹⁵² Alberta recently passed legislation requiring the AESO to implement tariff provisions to ensure that a “just and reasonable share of the costs of the transmission system” is recovered from customers that self-supply,¹⁵³ but those provisions have yet to be designed and are unlikely to be put forward for approval until the AESO’s next rate design application in 2027.

¹⁴⁷ The AUC has stated that uneconomic bypass describes “a situation where a customer’s bypass decision (i.e., supplying its needs through other means) shifts the recovery of fixed system costs, in whole or in part, to other customers due to tariff design”: *Distribution System Inquiry: Final Report*, Proceeding 24116 (Calgary: AUC, 2021) at s 3.4, online (pdf): [perma.cc/R67Z-HW5D].

¹⁴⁸ In Alberta, AUC, *Decision 26911-D01-2022* (Calgary: AUC, 2022) at para 93, online (pdf): [perma.cc/AD8A-G3EH], the AUC noted that customers that normally supply their own electricity needs but rely on the system for backup “face lower supply risk and avoid costs that would otherwise be incurred to manage their supply risk as a result of the availability of the bulk transmission system but do not contribute significantly to recovering its costs.”

¹⁴⁹ In Alberta, section 4 of the AESO tariff requires load customers connecting to the transmission system to pay the costs of their connection that exceed a calculated amount of “system-related” costs. Section 7 of the AESO tariff requires connecting generation customers to pay a contribution, calculated based on the maximum capability of the connecting generating facility and the location of the facility (pursuant to the *Transmission Regulation*, Alta Reg 86/2007, s 29).

¹⁵⁰ US, SB 132, *Electric Utility Amendments*, Reg Sess, UT, 2025.

¹⁵¹ BTF may also be an attractive option for data centre proponents themselves for a number of reasons, as discussed above.

¹⁵² See discussion below.

¹⁵³ *EU Act*, *supra* note 106 at s 122(2)(b). The AUC may also impose conditions on industrial system designations requiring their owners to be responsible for paying a “just and reasonable share of the costs associated with the interconnected electric system” (*ibid*, s 117(2)).

3. RELIABILITY OF THE TRANSMISSION SYSTEM

Ironically, data centres' need for a reliable power supply is contributing to reliability concerns on transmission systems. Their underlying need for a reliable energy supply can increase pressure on the grid in several ways.

The demand accompanying data centres has the potential to increase the risk of blackouts in regions with high data centre concentration. An example of this occurred in 2024 in the region of Virginia nicknamed "Data Centre Alley," when a transmission line fault triggered 1,500 MW of data centre load to be automatically disconnected from the grid and deferred to backup generation to protect the data centre's operating systems.¹⁵⁴ While the transmission system was able to recover quickly in this case, the North American Electric Reliability Corporation (NERC), the entity that monitors and assesses the reliability of the bulk power system in North America, warned that abrupt disconnections such as this and uncoordinated reconnections posed significant reliability risks if not managed adequately, especially as more large load customers are integrated into the network.¹⁵⁵

Large loads such as data centres can pose risks to voltage stability on the systems to which they connect, even when they do not disconnect. Part of NERC's incident review recognized that data centre reliance on uninterrupted power supply (UPS) systems¹⁵⁶ to protect from fluctuations in voltages and the differences in UPS designs make data centre behaviour on the grid unpredictable in the event of system faults.¹⁵⁷

Reliability was a central consideration in FERC's November 2024 decision to reject PJM Interconnection LLC's proposed terms of interconnection that would have facilitated expanded power sales to a co-located Amazon data centre from the Susquehanna nuclear power plant in Pennsylvania. In concurring reasons, then-Commissioner Mark Christie pointed to concerns raised by PJM's market monitor that the project would effectively remove a significant amount of baseload generation from the PJM markets, and that the reliability and rate impacts of this had not been considered by PJM.¹⁵⁸ The impacts of co-location on grid reliability loom large in the FERC Co-Location Proceeding.

In parallel with the FERC Co-Location Proceeding, FERC has scheduled a technical conference to address resource adequacy risks in areas of the US transmission system under its jurisdiction. The agenda for the conference specifically mentions data centres, further highlighting FERC's concerns with reliability amidst rising demand and evolving energy supply.¹⁵⁹

¹⁵⁴ This aspect of data centres is referred to as "voltage-sensitivity."

¹⁵⁵ NERC, "Incident Review: Considering Simultaneous Voltage-Sensitive Load Reductions" (8 January 2025) at 4, online (pdf): [perma.cc/NCP5-93YU].

¹⁵⁶ UPS systems secure the uptime of large data centres and provide facility-wide protection for sensitive electronics: see VERTIV, "Network, Server and Storage UPS", online: [perma.cc/MD2L-Y73K].

¹⁵⁷ NERC, *supra* note 155.

¹⁵⁸ US, FERC, Statements, "Commissioner Christie's Concurrence in PJM's Susquehanna Co-Location Proposal, ER24-2172" (1 November 2024), online: [perma.cc/784X-MQ3R].

¹⁵⁹ US, FERC, Headlines, "FERC Issues Notice & Agenda for the Commissioner-led Technical Conference Regarding the Challenge of Resource Adequacy" (3 April 2025), online: [perma.cc/4EJT-WSQD]. The technical conference is scheduled to take place in June 2025.

Similarly, in Alberta, the AESO has recognized that data centre proposals are driving rapid forecast load growth without adding corresponding generation capacity — or are not doing so quickly enough — raising concerns about grid reliability.¹⁶⁰ This exacerbates existing reliability concerns arising from other factors, including an increasing proportion of intermittent supply and extreme weather events, putting strain on the province's electricity system.

C. LEGISLATIVE AND REGULATORY RESPONSES TO DATE

1. DATA CENTRE-SPECIFIC ENERGY LEGISLATION

Some jurisdictions are changing laws to protect customers from bearing disproportionate costs of data centre-driven infrastructure investment. Utah recently passed a law allowing large energy users (greater than 100 MW) to contract directly with generators outside of the standard regulated framework, with the objective of allowing large loads to be served without affecting demands and rates for existing utility customers.¹⁶¹ Other jurisdictions, including California,¹⁶² Oregon,¹⁶³ and Virginia,¹⁶⁴ are considering legislation that would insulate utility ratepayers from the costs of serving data centre customers by various means, including by requiring state utility regulators to establish data centre-specific rate classes or by mandating long-term supply contracts for data centres. A proposed bill in Texas would require the state utility commission to implement minimum rates for data centres and other BTF-served customers based on the customer's peak demand, effectively requiring them to pay the costs of their grid connections whether or not they use those connections.¹⁶⁵

Some legislative responses also address reliability. The proposed Texas bill would allow the state to effectively cut off power to data centres when the grid is facing an emergency, indirectly compelling data centre proponents to invest in a back up power supply.¹⁶⁶ Utah's legislation directly requires large customer contracts for intermittent resources to include arrangements for backup power supply, though not the 100 percent backup supply that the bill initially contemplated.¹⁶⁷ Utah's approach represents a step away from resource neutrality (state legislators rejected a competing bill that would not have constrained the sources of generation),¹⁶⁸ and reflects considerations regarding the role of renewable energy in serving new data centre loads that are informing market reform initiatives in other jurisdictions, including Alberta, where the Restructured Energy Market (REM) initiative is driven, in part, by perceived reliability concerns surrounding the increased share of generation provided by intermittent resources.

¹⁶⁰ AESO, "Update on Data Centres" (March 2025) at 3, online (pdf): [perma.cc/8FJN-6HR8] [AESO, "Update on Data Centres"].

¹⁶¹ *Electric Utility Amendments*, *supra* note 150, s 54-26-301.

¹⁶² Digital Democracy, "SB 57: Electrical Corporations: Data Centers: Report" (2025), online: [perma.cc/DNT9-MMC2].

¹⁶³ The Oregonian, "House Bill 3546" (2025), online [perma.cc/5DUY-VBY8].

¹⁶⁴ US, SB 1243, *A Bill to amend and reenact § 56-585.1 of the Code of Virginia, relating to electric utilities distribution infrastructure serving data centers*, Reg Sess, VA, 2025.

¹⁶⁵ US, SB 6, *An Act relating to the planning for; interconnection and operation of; and costs related to providing services for certain electrical loads and to the generation of electric power by a water supply or sewer service corporation*, 2025-2026, 89th Legislature, TX, 2025 (enacted).

¹⁶⁶ *Ibid.*

¹⁶⁷ *Electric Utility Amendments*, *supra* note 150, s 54-26-301.

¹⁶⁸ US, SB 227 S1, *Electric Supply Amendments*, Reg Sess, UT, 2025.

Conversely, several jurisdictions are contemplating objectives and incentives for data centres to monitor and invest in efficient and environmentally conscious power supply by setting data centre-specific efficiency standards or emissions targets. A framework for monitoring and regulating data centre energy use and efficiency has been established in the US through the *Energy Act of 2020*, which “requires the development of a metric for data center energy efficiency... [and] a data center energy practitioner program.”¹⁶⁹ At the state level, California is considering legislation that would require the developers of AI models to publicly report the energy used to train the model, require data centres to report their energy usage to the California Energy Commission (CEC), and authorize the CEC to implement efficiency requirements on data centres in the state.¹⁷⁰ Other proposed California legislation offers tax cuts to data centres that draw a certain proportion of their energy from zero-emission and BTF sources.¹⁷¹ A proposed bill in New Jersey would require new AI data centres in the state to source their electricity from nuclear or new renewable sources to avoid a net decrease in such energy to the grid, if other states in the region impose similar requirements.¹⁷² For its part, the European Union (EU) is moving to track key sustainability measures of data centres and mandate best practices and technologies to optimize energy consumption,¹⁷³ in what some commentators see as an important first step toward regulating their energy use and supply.¹⁷⁴ These efforts build on the EU’s common framework of measures to promote energy efficiency¹⁷⁵ and existing measures to reduce the environmental impact of IT infrastructure by establishing eco-design requirements for servers and data storage systems.¹⁷⁶

2. REGULATORS’ RESPONSES TO DATA CENTRE-RELATED ISSUES

Utilities and transmission operators in several jurisdictions have also proposed data centre-specific rate classes, tariff provisions, or connection requirements. Most of these proposals aim to manage risks to existing customers by insulating them from the reliability and cost impacts of data centre-related projects.

The ongoing FERC Co-Location Proceeding was prefigured by a number of proposals seeking to accommodate various forms of co-location within FERC-jurisdictional transmission grids and rates. In addition to the Susquehanna proposal discussed above, these included a proposal by Wyoming’s Basin Electric Power Cooperative to introduce three new rate schedules for cryptocurrency mining operations and other related schedules. FERC rejected the proposed rate schedules on the basis that Basin had not demonstrated that the

¹⁶⁹ US, Senate Committee on Energy and Natural Resources, “Energy Act of 2020” at 1, online (pdf): [perma.cc/G8JT-ZTB5].

¹⁷⁰ US, AB 222, *An Act to Add Section 25302.9 to the Public Resources Code, and to Add and Repeal Section 913.18 of the Public Utilities Code*, 2025, Reg Sess, Cal.

¹⁷¹ US, SB 58, *An Act to Add Section 6372 to the Revenue and Taxation Code*, 2025-2026, Reg Sess, Cal, 2025.

¹⁷² US, State of New Jersey Senate Environment and Energy Committee, “Bill S 4143: Statement to Senate” (17 March 2025), online: [perma.cc/3FLG-RYGE].

¹⁷³ European Commission, News Announcements, “Commission Adopts EU-Wide Scheme for Rating Sustainability of Data Centres” (15 March 2024), online: [perma.cc/5UJ7-9MCC].

¹⁷⁴ Grant Gross, “EU Moves Toward Regulating Data Center Energy and Water Use”, *CIO* (15 May 2024), online: [perma.cc/N75N-5KMG].

¹⁷⁵ EC, *Directive 2012/27/EU*, [2012] OJ, Annex L 315/1.

¹⁷⁶ EC, *Commission Regulation (EU) 2019/424*, [2019] OJ, Annex L 74/46.

proposed rates met the requirements of the *Federal Power Act*, including that they be “just and reasonable” and not “unduly discriminatory or preferential.”¹⁷⁷ However, FERC was sympathetic to Basin’s concerns regarding its ability to serve expected load growth and clarified that its rejection of its proposal was without prejudice.¹⁷⁸ In another docket, a group of utilities within the Exelon family proposed a suite of tariff revisions designed to address uneconomic bypass arising from co-located load, among other matters. FERC rejected the proposal on technical grounds but ruled that generic issues regarding co-location would be considered in what would become its Co-Location Proceeding.¹⁷⁹

At the time of writing, the Public Utilities Commission of Ohio (PUCO) was considering a proposed new “data centre tariff” for large data centres in the service territory of transmission utility AEP Ohio. The proposal, advanced by AEP Ohio, includes 12-year contract commitments, a requirement that data centres pay for at least 85 percent of their peak demand, exit fees equivalent to three years of minimum charges, restrictions on load ramping, and collateral requirements equal to 50 percent of projected costs for lower-credit customers. AEP Ohio justified these terms as necessary to prevent stranded costs, ensure cost recovery for grid expansions, and protect other ratepayers from subsidizing high-energy users. AEP Ohio’s proposal was supported by a broad coalition of interested parties, including ratepayer representatives,¹⁸⁰ but was opposed by another coalition, including generators and data centre proponents, who brought forward a competing proposal of their own.¹⁸¹ PUCO staff filed a brief supporting AEP Ohio’s proposal, and framed the fundamental issue as whether data centres or other customers should bear the risk of large-scale transmission investments necessary to support data centre growth.¹⁸²

In Indiana, transmission utility Indiana Michigan Power and certain stakeholders, including ratepayer representatives and data centre proponents (including Amazon Data Services, Microsoft, and Google) reached an agreement outlining the terms for connecting new large loads (including but not limited to data centres) to the grid. The Indiana Utilities Regulatory Commission (IURC) approved the filed agreement with minor modifications.¹⁸³ It includes a 12-year minimum contract term following a ramp-up period of no more than five years; a minimum charge of 80 percent of monthly billing demand intended to provide the utility with a stable and predictable revenue stream to support required capital investments; collateral requirements; and exit fees set based on contract amounts and triggered by capacity reductions or early termination of service. The IURC determined that

¹⁷⁷ *Order Rejecting Proposed Rate Schedules*, 188 FERC ¶ 61,132 (2025), Docket Nos ER24-161-000, ER24-1610-001 at para 2 [FERC Order ER24-161-000].

¹⁷⁸ *Ibid* at para 1.

¹⁷⁹ *Order Rejecting Tariff Revisions*, 190 FERC ¶ 61,109 (2025), Docket Nos ER24-2888-001, ER24-2889-001, ER2890-001, ER2891-001, ER24-2893-001, ER24-2894-001.

¹⁸⁰ Letter from David F Proaño to PUCO Examiners (10 October 2024) Re: In the Matter of the Application of Ohio Power Company for New Tariffs Related to Data Centers and Mobile Data Centers - Case No 24-508-EL-ATA, online (pdf): [perma.cc/4XXA-V7ZJ].

¹⁸¹ *In the Matter of the Application of Ohio Power Company for New Tariffs Related to Data Centers and Mobile Data Centers* (10 October 2024), Case No 24-508-EL-ATA (Joint Stipulation and Recommendation), online (pdf): PUCO [perma.cc/24YC-WVH2].

¹⁸² *In the Matter of the Application of Ohio Power Company for New Tariffs Related to Data Centers and Mobile Data Centers* (2025), Case No 24-508-EL-ATA (Initial Brief Submitted on Behalf of the Staff of the Public Utilities Commission of Ohio), online (pdf): PUCO [perma.cc/C5EG-3TAL].

¹⁸³ *Order of the Commission*, IURC (2025), Cause No 46090, online (pdf): [perma.cc/MLW7-WMP3].

its order would be beneficial for existing customers, provide certainty for utility providers, and increase risk for data centre developers.¹⁸⁴

No data centre-specific rates, rate classes, or tariff provisions have been proposed in Alberta to date. However, on 16 June 2025, the AESO released connection process requirements specific to data centres, including proposed technical and operational information, such as load composition, backup generation, and operational behaviour, that project proponents would be expected to provide as their projects advance through the connection process.¹⁸⁵ These requirements are not yet mandatory but serve as an initial framework that the AESO expects to refine over time.¹⁸⁶ Various aspects of Alberta's REM and transmission policy development processes are also likely to affect the way data centres participate in the Alberta electricity markets and, correspondingly, investor perceptions of those markets and the province generally as a destination for investment.

Some data centre-specific rates, rate classes, or tariff provisions have been challenged on the basis that they contravene legal requirements that public utilities serve all customers in a non-discriminatory manner. In its *Susquehanna* decision, for instance, FERC voiced concerns over whether PJM had the intention of offering the terms found in the ISA to all "similarly situated interconnection customers."¹⁸⁷ Power producers opposed to the Exelon utilities' proposal claimed that the proposal was discriminatory because it would require them to become transmission service customers whether they take service or not.¹⁸⁸ Similar concerns have been raised about the AEP Ohio proposal under the no-discrimination provisions in Ohio legislation.¹⁸⁹

The availability and strength of discrimination arguments depend on the proposed rate and tariff provisions and the applicable legislation. Most jurisdictions have legislation prohibiting "undue" discrimination in tariffs and rate design. This is the requirement under the United States' *Federal Power Act* (which governs FERC's jurisdiction)¹⁹⁰ and in Alberta, under the *Electric Utilities Act*, which requires that tariffs be "not unduly preferential [or] arbitrarily or unjustly discriminatory."¹⁹¹ Discrimination cases thus typically turn on whether the facts disclose a reasonable basis for treating a given customer or class of customers differently.¹⁹² Discrimination arguments may be harder to raise in response to proposals that

¹⁸⁴ *Ibid.*

¹⁸⁵ AESO, "Data Centre Technical and Operating Characteristics" (16 June 2025), online (pdf): [perma.cc/US9J-S74A] [AESO, "Data Centre Characteristics"]; see further AESO, "Update on Data Centres", *supra* note 160 (the AESO has supplemented their March 2025 Update in September 2025: AESO, "Update on Data Centres" (September 2025), online (pdf): [perma.cc/578V-WVWC]).

¹⁸⁶ AESO, "Data Centre Characteristics", *supra* note 185.

¹⁸⁷ *Order Rejecting Amendments to Interconnection Service Agreement*, 189 FERC ¶ 61,078 (2025), Docket Nos ER24-2172-000, ER24-2172-001 at para 87.

¹⁸⁸ *Protest of Constellation Energy Generation, LLC*, FERC (2025) Document Accession No 20241002-5247, at 1–2, online (pdf): FERC [perma.cc/8QPL-RPUT].

¹⁸⁹ See commentary in Yoon Kim, "Guest Blog: Connecting Data Centers to the Grid: An Innovative and Controversial Proposal from AEP Ohio" (12 September 2024), online (blog): [perma.cc/A7U8-M3BR].

¹⁹⁰ 16 USC § 824e(a).

¹⁹¹ *Supra* note 106 at s 121(2)(b).

¹⁹² In Alberta, the AUC considers that undue discrimination can arise (1) "when a utility fails to treat all its users equally where no reasonable distinction can be found between those favoured and those not favoured", or (2) "when a utility treats all its users equally where differences between users would

are less specific in their application, such as proposals that apply to large load customers generally, rather than data centre customers specifically. The burden of demonstrating a proposed tariff's compliance with the legislation often rests with the proponent, as FERC noted in rejecting Basin Electric's proposed rate schedules.¹⁹³

Proponents of data centre-specific rates and tariff provisions have defended different treatment for data centres based on the scale of their potential loads, expectations of future growth, economic impact, and their sheer novelty. However, few decided cases have considered discrimination in the context of data centres specifically. In Indiana, the IURC approved a rate framework that applied to large load customers generally, implicitly finding that it did not contravene that state's statutory prohibition on discriminatory tariffs. The Government of British Columbia cited the unique attributes of cryptocurrency mining operations as justification for a crypto-specific moratorium, in a determination recently upheld by that province's Court of Appeal.¹⁹⁴ In the Court's words, the Government reasonably concluded that cryptocurrency mining operations exhibited "distinctive electrical consumption characteristics that had both cost-of-service and economic impacts" that justified their different treatment relative to other loads.¹⁹⁵

The high degree of interconnectedness of the North American transmission system can also give rise to discrimination concerns to the extent that a patchwork of policies and tariffs emerges within a single regulatory jurisdiction. For instance, AEP Ohio's proposal could save Ohio customers money but would do little to protect other PJM customers within FERC's jurisdiction. It has been argued that this constitutes a form of undue discrimination, which is prohibited by legislation at both FERC and Ohio state levels. This concern emphasizes the need for coordination and cooperation between utilities and jurisdictions to ensure that customers are fairly treated. Discrimination is a live issue in the FERC Co-Location Proceeding and may receive some treatment there.

3. MORATORIUMS ON DATA CENTRE CONNECTIONS

In some jurisdictions, the recent surge of data centre connection applications has been met with absolute moratoriums on certain types of projects. In Canada, the provinces of BC, Quebec, and Manitoba have each imposed moratoriums on the connection of cryptocurrency mining facilities to provincial power grids.¹⁹⁶ In the US, AEP Ohio's data centre rate proposal was accompanied by a utility-imposed moratorium on new data centre connection

justify different treatment": K David Campbell, *Appeal on EPCOR Water Services Inc Water Rates for 2012–2017* (9 August 2013), 2013-295 at para 36, online: [perma.cc/VL7V-47UW].

¹⁹³ FERC Order ER24-161-000, *supra* note 177 at paras 94–97.

¹⁹⁴ *Conifex Timber Inc. v British Columbia (Lieutenant Governor in Council)*, 2025 BCCA 62 at paras 87–105 [Conifex].

¹⁹⁵ *Ibid* at para 99.

¹⁹⁶ *Cryptocurrency Power Regulation*, BC Reg 163/2024; Manitoba, Honourable Minister Adrien Sala, *A Directive to Manitoba Hydro Electric Board Respecting Service to Cryptocurrency Operations* (Winnipeg: Ministry of Finance, 2024) online (pdf): [perma.cc/7WUQ-8VYS]; *Décision relative à la demande d'ordonnance de sauvegarde* (10 January 2023), D-2023-002, R-4210-2022, online (pdf): Régie de l'énergie [perma.cc/8YE9-EBZM].

applications, and moratoriums on data centre connections have been called for in Indiana¹⁹⁷ and before FERC.¹⁹⁸

Moratoriums are commonly presented as temporary measures to pause development while industry and regulators develop measures to address emerging issues. While they can buy time, they also risk shaking investor confidence and dampening enthusiasm for investment in the jurisdiction.¹⁹⁹ Depending on the applicable laws, a moratorium can also be subject to legal challenge. BC’s cryptocurrency mining moratorium, for example, was (unsuccessfully) challenged in the courts on legal grounds, including undue discrimination,²⁰⁰ and AEP Ohio’s moratorium has been challenged before the state utilities regulator as a contravention of the utility’s statutory duty to serve its customers.²⁰¹

It is notable that various jurisdictions have addressed data centre expansion with a wide — and sometimes inconsistent — array of regulatory and legislative measures, ranging from incentives and data centre-specific rate classes, tariff provisions, or connection requirements, to outright moratoriums. It seems clear that regulators and legislators are struggling to respond to the rapid and perhaps existential opportunities and risks associated with data centre electricity demands.

III. COMMERCIAL AND PROJECT ISSUES SPECIFIC TO DATA CENTRES

Moving from electricity-supply considerations from the perspective of utilities, regulators, and generators to the perspective of the consuming data centre, we note a number of innovative commercial solutions that are developing in response to the distinctive features of data centre power procurement. While in many respects similar to other large load requirements, data centres also have unique power load shape, ramping, reliability, pricing, and performance issues that require specialized commercial treatment. The following offers a consideration of some of the unique commercial issues related to data centre power procurement arrangements.

A. ELECTRICITY PRICE

The IEA notes that procuring “reliable and cost-effective [electricity] is crucial to meeting the rapidly growing electricity demand from data centres.”²⁰² In addition to procuring the grid

¹⁹⁷ Citizens Action Coalition, “CAC Calls for Data Center Moratorium” (15 October 2024) online: [perma.cc/E8RN-M4HB].

¹⁹⁸ Ethan Howland, “AEP, Others Press for FERC Guidance on ‘Gargantuan’ Issue of Data Center Colocation”, *Utility Dive* (4 November 2024), online: [perma.cc/GU47-G4VF], citing comments from Maryland state Senator Katie Fry Hester (D).

¹⁹⁹ This was alleged to have been among the effects of Alberta’s recent seven-month moratorium on renewable power plant applications (as argued by the Pembina Institute: see e.g. Will Noel, Jason Wang & Patrick Connolly, *Creating (Un)certainly for Renewable Projects* (Calgary: Pembina Institute, 2024), online (pdf): [perma.cc/VW6F-7FBB]; although the responsible Minister criticized the findings of Pembina’s report in Bob Weber, “Alberta Renewable Energy Pause Left Legacy of Cancelled Development: Study”, *CBC News* (2 August 2024), online: [perma.cc/LR8L-NGAQ]).

²⁰⁰ *Conifex*, *supra* note 194 at paras 87–105.

²⁰¹ Kim, *supra* note 189.

²⁰² IEA, *Energy and AI*, *supra* note 5 at 75.

electricity mix, data centres are frequently acquiring electricity through PPAs. PPAs between private generators and consumers of electricity are only available in some jurisdictions,²⁰³ notably the deregulated Alberta market, which allows generators to enter contracts directly with private offtakers. The use of PPAs to provide price and supply certainty to an industrial user is common in other sectors, but may involve subtle nuances for data centre load. The regulatory context and key terms of PPAs have been explored in depth by others,²⁰⁴ so this section will focus on certain features of PPAs and VPPAs that may be of specific interest to data centres.

Electricity price predictability is a fundamental goal of data centre power procurement arrangements. Variations on pricing formulas may include having the energy price-fixed for the duration of the contract; having the price fixed but with set escalations based on usage, inflation, or milestone dates; having the energy price fixed but with settlements between different parties depending on wholesale prices; and having the price indexed to energy markets with various discounts and/or floors and ceilings. Each of these can be customized so that the revenue cost risks are allocated between the generator and user in a manner which is consistent with the data centre risk profile.

Pricing can also be impacted by load factor. Load factor is the average power use compared to peak power usage during the same period, measured as a percentage. The load factor for a cryptocurrency mining facility that is dependent on the value of the currency may be lower due to the sharp changes in monthly usage, whereas a large load data centre, such as one involved in training LLMs for gen AI, may have a higher load factor of 90 to 100 percent since its demand is generally constant.²⁰⁵ In other words, the load factor may be dependent on the type of customer and use. The commercial arrangement, therefore, may include a load factor charge to penalize those customers who do not maintain a certain load factor to secure greater certainty of revenue for the power supplier. The parties may also have to consider the effects of efficiencies over time, including technological efficiencies (computing and chip efficiency), data centre architecture (server placement), and cooling technologies, which may have the effect of reducing load requirements over time.

In addition to a charge based on energy usage, large commercial and industrial loads may also include a demand charge component, which is used to cover the load's associated fixed costs. The demand charge is used to cover fixed costs associated with the customer's load and is based on the peak demand during the billing period. To reduce the risks from serving customers with large swings in demand, a demand charge is calculated using a demand ratchet which establishes the level of demand charge based on the actual peak demand for the billing period, or a percentage of the highest peak recorded (say, 80 percent) during the

²⁰³ Simon Baines et al, “#HowtoPPA: An Examination of the Regulatory and Commercial Challenges and Opportunities Arising in the Context of Private Power Purchase Agreements for Renewable Energy” (2019) 57:2 Alta L Rev 389 (“Manitoba and Saskatchewan prohibit the retail supply of power from any persons other than Manitoba Hydro or SaskPower” at 369). See also *Manitoba Hydro Act*, CCSM c H190, s 15.2; *Power Corporation Act*, RSS 1978, c P-19, s 38. Ontario has recently introduced regulatory amendments that allow certain market participants to enter PPAs with renewable generators, which are expected to come into force in May 2025: *Ontario Regulation 429/04 Amendments Related to the Treatment of Corporate Power Purchase Agreements*.

²⁰⁴ Baines et al, *supra* note 203 at 389.

²⁰⁵ Stacy Sherwood, *Review of Large Load Tariffs to Identify Safeguards and Protections for Existing Ratepayers*, Energy Futures Group report on behalf of Earthjustice (28 January 2025) at 7, online (pdf): [perma.cc/76AU-MXPS].

previous specified months (say, 11 months), whichever is greater. For example, if the facility experiences a peak demand of 1,000 kW for one hour, the customer is billed for a minimum of 800 kW during the next 11 months, even if the actual demand is much lower. This is designed to require the customer to pay for the assurance of having the high capacity when needed and to provide for the recovery of fixed charges for peak demand. It also encourages the customer to maintain a level of demand that is consistent, since the customer would have to pay for demand not used if it does not do so. This commercial formula provides an incentive for consistent demand and may mitigate the risk that a data centre customer can shift usage to other jurisdictions or to different times, resulting in demand fluctuations.

B. EMISSIONS REDUCTION GOALS

Data centres are projected to consume approximately 3 percent of global electricity and may contribute roughly one percent of global carbon emissions by 2030 (equal to 330 million tons of carbon dioxide equivalent).²⁰⁶ By one estimate, “the Cloud ... has a greater carbon footprint than the airline industry.”²⁰⁷ As noted above,²⁰⁸ data centre users often look to PPAs as a way to offset the carbon emissions and meet corporate or regulatory objectives, restricting carbon emissions.

While typical renewable PPAs enable new clean generation capacity, they are not compatible with full data centre decarbonization because of the timing mismatch between generation and consumption, also known as temporality.²⁰⁹ In other words, while a typical PPA seeks to match *annual* electricity consumption with renewable energy consumption, it does not account for *hourly* variations in energy demand and supply. Variable renewables cannot generally match hourly demand throughout the year. For example, solar generation’s hourly output profile generally aligns with only about 35 to 45 percent of a data centre’s energy demand; this misalignment — stemming from solar’s inherent intermittency — renders it an unfavourable option for meeting a data centre’s continuous baseload requirements,²¹⁰ and where on-shore wind alone is procured to meet annual demand, on an hourly basis the wind output is only able to meet approximately 65 percent of the data centre demand.²¹¹ In order to further reduce their carbon footprint and achieve their sustainability objectives, some large data centre proponents have committed to powering their operations with around the clock renewable energy through modified PPAs that employ hourly load matching, termed “24/7 carbon-free energy” (CFE) matching.²¹² The 24/7 PPA is designed to ensure that every hour of electricity consumption is matched with renewable energy generation through real-time tracking and verification of energy production and

²⁰⁶ IEA, *Energy and AI*, *supra* note 5 at 246.

²⁰⁷ Monserrate, *supra* note 18.

²⁰⁸ See *ibid* and accompanying text.

²⁰⁹ ENGIE Impact, “Build a Strategic Approach to Renewable Electricity Sourcing”, *The Climate Drive*, online: [perma.cc/2AKN-W62Z].

²¹⁰ IEA, *Energy and AI*, *supra* note 5 at 82.

²¹¹ *Ibid* at 84. Note that 65 percent is an average; hourly coverage can range “from 55% to 75% depending on the US state,” with a wider range in Europe and China. IEA acknowledges that hybrid projects that integrate solar, on-shore wind, and battery storage provides a more effective alignment with baseload demand, as battery storage mitigates the inherent variability in renewable generation (*ibid*).

²¹² Google, for example, has committed to transitioning to 24/7 matching by 2030: Google, *supra* note 133.

consumption.²¹³ This requires a “portfolio of renewable energy and storage [projects],” and access to dispatchable sources of low-emissions electricity such as hydro, nuclear, and geothermal.²¹⁴ Hybrid portfolios of wind, solar, and storage can often cover 80 percent of hourly matching at a price competitive with industry retail price, although exceeding that percentage involves a premium price.²¹⁵ Interestingly, technologies such as blockchain and real-time data analytics could themselves be crucial for tracking green electrons by origin and timing.

In effect, 24/7 PPAs refine the traditional PPA and REC models, which simply offset a data centre’s annual consumption with green-energy credits. 24/7 CFE matching involves an energy buyer procuring green energy to match its facility’s load every hour.

One weakness in 24/7 CFE matching, however, is that it does not resolve the issue of intermittency inherent to renewable energy sources, which can result in mismatches between generation and data centre consumption. This means that data centres employing 24/7 CFE matching may still need to rely on alternative, reliable power sources in order to maintain seamless operations. Moreover, current energy infrastructure lacks the sophistication to support concurrent tracking and procurement processes necessary for 24/7 CFE matching at scale.²¹⁶

In addition to commercial solutions to achieve emissions reduction goals, such as PPAs and 24/7 CFE matching, data centre users may also try to better match generation and consumption by managing data centre operations. By shifting workload amongst various data centres over time (enabling data centres to shift flexible tasks to different times of the day), and by migrating certain moveable parts of their own workload between different facilities, data centre operators may “try and achieve the greenest operations.”²¹⁷ Users may also encourage their own customers to make decisions on where to host workloads to ensure workload and consumption are better matched to renewable generation profiles.²¹⁸ In effect, the data centre and its users, unlike a typical utility load, co-operatively manage their operations to better match consumption with intermittent renewable energy supply. While potentially beneficial to data centres and the environment, however, this operational shifting can make load forecasting and grid operations significantly more difficult by causing facilities’ actual load profiles to differ from the profiles used to model the system. This can

²¹³ Mark Dyson, Sakhi Shah & Chaz Teplin, *Clean Power by the Hour: Assessing the Costs and Emissions Impacts of Hourly Carbon-Free Energy Procurement Strategies* (Basalt: RMI, 2021) at 9, online (pdf): [perma.cc/9QTL-XUB8].

²¹⁴ IEA, *Energy and AI*, *supra* note 5 at 75.

²¹⁵ *Ibid* at 85.

²¹⁶ Nate Hausman & Lori Bird, “The State of 24/7 Carbon-free Energy: Recent Progress and What to Watch”, *World Resources Institute* (5 May 2023), online: [perma.cc/B5U2-4B7J].

²¹⁷ Dan Swinhoe, “Everything Data Center Operators Need to Know About Power Purchase Agreements (PPAs): A PPA Primer for Data Centre Companies”, *DCD* (26 May 2023), online: [perma.cc/JY3M-Q9ER]. Tasks such as media processing, which encode, analyze, and process millions of multimedia files, including videos and photos. Not all tasks are movable, as workloads covered by data sovereignty laws or cloud customer tasks will still be based out of their original data centre. See also Ross Koningstein, “We Now Do More Computing Where There’s Cleaner Energy” (18 May 2021), online: [perma.cc/S7M3-PJ2].

²¹⁸ Swinhoe, *supra* note 217. Google has a Carbon Free Energy Percentage tool which shows the average mix of renewable energy to its data centres (which shows how often a region was supplied with carbon free energy on an hourly basis, on average) so that customers can make choices about where data and applications are hosted (i.e., to pick lower carbon regions for new applications or batch jobs). Microsoft also publishes the energy mix data of its Azure cloud regions.

shift an additional burden to the system operator, and from a commercial perspective, can incentivize the electricity provider to seek contractual minimum load requirements or price assurances in order to mitigate revenue uncertainty and risk.

C. MULTI-TENANT DATA CENTRES

In multi-tenant data centre models, the data centre operator hosts a data centre where servers, networking hardware, and data traffic are shared by a variety of tenants. These structures give rise to additional commercial considerations for a PPA relative to single-enterprise data centres or hyperscalers,²¹⁹ where the end-users of the energy are also the owners and operators, since in a multi-tenant model, the load and duration required by each tenant may not align with the duration or load that the host is trying to acquire on their behalf. This creates a potential mismatch between the timing and volume of electricity procured under the master PPA and the actual usage by the tenants. Tenants may also have differing views on bearing the additional costs and risks of the PPA, or may have different tenancy terms which are inconsistent with the longer term PPA duration. In addition, tenants may have differing energy usage over time depending on the proportion and type of AI usage and the status of the server processes (data storage, learning, inferences). As a result, multi-tenant PPAs may require greater flexibility to increase and decrease supply, or to extend or abridge the duration to better match tenant needs.

D. RAMPING

During at least the first six months and perhaps up to three years after a data centre building comes online, its usage is usually sporadic, ramping up for a while as the server cabinets and other IT equipment come online.²²⁰ To address this, data centres may arrange a “standard contract” with a generator until the load is more stable, and then procure a standard, long-term PPA once stable. Generating parties may also set out load ramp periods that establish monthly peak load requirements as the data centre comes online and stipulate that the overall requested load of the data centre will commence services within a set period of time.²²¹ These provisions of the contract would also require that billing demand not be lower than a minimum percentage of the data centre’s load ramp contract capacity to ensure the fixed costs of serving the load are covered even if the customer has not reached the threshold level of demand. In addition to the ramp-up periods, there may also need to be “ramp-down” periods. Ramp down requirements may arise if technological or process efficiencies reduce power load over time, and also due to the nature of AI data centre phases (during the training phase, for instance, the AI program is digesting vast amounts of data to build the associations needed for the model to work and thus has consistently high power requirements).²²² In the utilization phase, by contrast, “the completed model is responding to user queries” and may

²¹⁹ Examples of hyperscalers include major cloud providers such as Amazon Web Services, Google Cloud, Microsoft Azure, and IBM Cloud.

²²⁰ IEA, *Energy and AI*, *supra* note 5 at 60.

²²¹ This is the commercial equivalent to the regulatory solutions noted in Part III above.

²²² While energy consumption for training varies according to the model size and complexity and hardware configuration, it is estimated that GPT-4 was trained for 14 weeks, and assuming a load factor of 84%, the training energy demand of that model was approximately 42.4 GWh: IEA, *Energy and AI*, *supra* note 5 at 41.

have lower power requirements.²²³ Efficiencies may also come from more productive cooling systems. The load profile of any commercial arrangement, therefore, may have to take into account these ramp-up and ramp-down periods.

E. DAILY USE LOAD SHAPE

Currently, AI data centres tend to be high load factor, mostly base load facilities with a relatively flat shape. This reflects the fact that AI is currently in continuous development and primarily dedicated to model training. However, there is a possibility that the daily load shape may change as the function and usage of AI evolve. For example, if AI evolves from a mostly “training phase” to a greater “usage phase” (responding to user enquiries), the daily peak would be more dependent on usage time. When AI is used as a business tool, for example, the AI usage would coincide with business hours, whereas when AI is used as a personal tool, the usage would coincide with morning and evening peaks, like a residential load.²²⁴ There is substantial uncertainty around future load shape, but it is unlikely to be truly flat. This has significant ramifications for grid planners, system operators, and also for data centre proponents and their electricity suppliers, who must ensure their commercial power arrangements reflect the risks and consequences of these varying daily load shapes.²²⁵ Compounding this commercial issue, it is expected that there will be uneven distribution of data centres geographically, with clusters attracted to certain hubs due to population centres, low electricity and land costs, internet connections, and local incentives.²²⁶ The evolution and fluctuations of load shape over a long-term PPA will be a difficult risk to negotiate and properly allocate.

F. CHANGE IN LAW

Project proponents and their lenders will be anxious to ensure that the cash flows of the data centre project are appropriately protected against changes in law. The concept of addressing the risk of a change in law in a PPA is a familiar concern that has been well canvassed by others, but that may be more acute in the data centre context. In the event of a change of law that results in a change to the economic or financial performance of a contract without preventing or prohibiting actual performance,²²⁷ parties to a commercial power arrangement may agree in advance how the costs or benefits resulting from the change are to be allocated between them. In addition to the “ongoing development (and revisiting) of policies regarding electricity market structures and renewable energy policies by many governments and the ensuing legislative and regulatory changes to implement such policies,”²²⁸ the policy and legislative changes applicable to data centres are (almost) as rapidly evolving as the underlying technology. The change of law clause, therefore, may not only be triggered by changes in the market structure or applicable legislation or regulation, but it may also be triggered by the regulation of AI technology and AI usage itself.

²²³ Isabelle Riu et al, *Load Growth is Here to Stay, but Are Data Centres?* (San Francisco: Energy and Environmental Economics, 2024) at 10, online (pdf): [perma.cc/3RR8-T2GQ].

²²⁴ *Ibid* at 14.

²²⁵ This is the commercial equivalent of the regulatory forecasting difficulty discussed in Part III above.

²²⁶ Riu et al, *supra* note 223 at 15.

²²⁷ Baines et al, *supra* note 203 at 407–10.

²²⁸ *Ibid* at 408.

As noted above, we have also seen differing government policy approaches to entice or discourage data centre development in various jurisdictions. For example, many jurisdictions and local governments have expressed policies and offered incentives to lure data centre operations to their jurisdictions, including active policies in Alberta²²⁹ and other provinces, and state sales and use tax exemptions in Maryland and North Carolina,²³⁰ among many other incentives. However, since data centres are largely automated, do not require much maintenance, and do not always trigger additional local investment, some governments, including Virginia and Idaho, and countries such as Sweden and the Netherlands,²³¹ have since been considering limiting or even eliminating tax and other incentives for data centres. We may also see moratoriums on further data centre development or restrictions on certain usages. Depending on the scope of the change in law provision in the commercial arrangement, change of law remedies may be triggered by such shifts in government policies and incentives.

G. TERM

Due to the uncertainty associated with the uptake, usage, and longevity of data centre facilities, and the rapid depreciation, evolution, and replacement of the technology, the parties to the PPA should define their rights and obligations (and associated costs) if the consumer needs to exit the data centre or extend the term of the contract. There should be adequate time for termination or extensions since developing and engaging with a data centre can be a long and complex process. The contract term may also be longer than the term related to pricing due to the difficulty of forecasting pricing over an extended period; however, the parties are then left to reconsider the pricing formula or arrangement at a later date in unknown market circumstances. There may be penalty payments, including acceleration payments, if the term of the PPA is ended early. This also gives rise to a corresponding need for financial assurances to support this obligation. To ensure funding for the electricity infrastructure investment, the data centre proponent may be asked to enter into a longer-term (for example, a ten-year term) service contract or agree to an exit fee to pay to either leave the contract prior to the expiry date, or to reduce the contract capacity below an agreed threshold. Considering the significant costs of data centre development, including the associated power facilities and procurement investments, a form of acceleration payment may be a reasonable solution to the mismatch between rapidly developing and rapidly obsolete technology, contrasted with long-term and slow-depreciating power facilities.

H. TAKE-OR-PAY AND MINIMUM TAKE PROVISIONS

Parties can utilize these provisions to guard against volatility in the energy-intensive computing industry to require the data centre's users to pay for a certain amount of power regardless of how much it uses. The PPA may indicate if the minimum demand is based upon the location, service point, or customer to avoid a customer structuring its demand below the minimum demand threshold by, for example, having multiple meter points. It may be difficult, however, for parties to forecast a minimum power commitment considering that

²²⁹ Ministry of Technology and Innovation, *supra* note 77.

²³⁰ Christopher Tozzi, "The State of Data Center Tax Incentives and Legislation in 2023", *Data Center Knowledge* (15 March 2023), online: [perma.cc/Z5PH-DJZL].

²³¹ NESCOE, *supra* note 128.

rapid innovation in software and hardware energy efficiency may be partially or entirely offset by greater usage and higher complexity models.

I. INVESTMENT FUNDING AND CONTRIBUTIONS TO CONSTRUCTION

Depending on whether the data centre will connect with existing infrastructure or partially depend on BTF generation, there may be significant capital costs for the generating party. For instance, at the commencement of the project, the data centre proponent may be required to pay for or contribute to a feasibility study to determine the system upgrades that are required to accommodate the new load, including new electric infrastructure, line extension, or service upgrade.²³² Assigning such costs to the customer for new or expanded electrical services is not unusual, but data centre proponents may be asked to provide deposits, contributions in aid of construction, surety bonds, or other financial support for substations and other infrastructure investments to defray the generating party's upfront cost and to mitigate the risks of stranded assets. This provides for an allocation of upfront costs to the project proponent. Such contributions may be more difficult to secure in multi-tenant data centres than in hyperscale enterprise data centres.

J. FORCE MAJEURE PROVISIONS

In a typical force majeure clause, a contracting party is relieved from complying with its contractual obligations (and liability for damages) for disruptions arising from specified events over which it has no control. It is common for the parties to negotiate the scope of the force majeure relief and the triggering events. Data centres and their operations may present unique triggering events or specific consequences of invoking force majeure. Considering the need for reliable power, data centre proponents may consider whether an inability of the generating party to obtain or sustain government approvals should be a force majeure event; whether the force majeure relief should be adapted to different technologies considering that a gas-fired power plant may have different disruption risks than a wind or solar generator; whether failure of the generator's suppliers, subcontractors, or carriers should be sufficient to invoke force majeure relief; and whether an inability to secure materials or failure of equipment and machinery should be a force majeure event. The scope and triggering event of the force majeure clause may also differ depending on whether the generator is the UPS or the redundant power supply, where reliability needs are even more acute. Considering the pressure to complete data centres on time and the 24/7 demand of data centres, the nature, scope, and effect of force majeure events may impact the data centre user's need to invest in redundancy. Force majeure clauses should also not be so broad as to negate or compromise the reliability of the data centre itself.

K. PERFORMANCE STANDARDS

PPAs may be structured to include sanctions or require the power supplier to pay liquidated damages if it fails to deliver power when or as promised. This may include

²³² In Alberta, any transmission-level additions or upgrades required to serve new load are detailed in a Needs Identification Document (NID) prepared by the AESO and filed with the Alberta Utilities Commission. A project proponent may be required to fund, or contribute to, the AESO's engineering and cost-estimate studies that form the basis of the NID pertaining to transmission upgrades required for their particular project.

liquidated delay damages if the construction of the power project is not completed on schedule or tariff abatements where the facility does not meet agreed performance standards during the operational phase. While these contractual features are not unique to data centres, data centre offtakers may be less satisfied with liquidated damages as a remedy for failed or delayed performance, given the requirement for a timely and 24/7 power supply, and instead seek redundancy or back-up generation to ensure performance.²³³

IV. CONCLUSION

The discussion surrounding AI-driven data centre development is continuously evolving and much remains uncertain. Whether the projected surge in electricity demand driven by global uptake of AI-based technologies fully materializes or is fundamentally reshaped by advances in technology remains to be seen. In the face of this uncertainty, regulators have the tall task of allocating risk fairly among customers, developers, and utilities, balancing responsible infrastructure investment with ratepayer protection and encouraging innovation. Data centre proponents and investors in energy infrastructure must navigate changing seas. What is clear, however, is that differences in geography, infrastructure readiness, and regulatory landscapes across jurisdictions will be critical in determining where data centres are built and how they are powered. Local energy policies, permitting and connection processes, and access to reliable, low-emission power will all play a role in determining where data centre proponents decide to establish their operations, what those operations look like, and how they are structured from a commercial perspective. The increasing trend of large-scale BTF arrangements will also impact data centre investment trends. This is particularly so as major players pursue BTF arrangements at a scale that rivals incumbent utility generation capacity, raising novel queries about whether and how massive new generation and load will interact with existing grids. In Alberta, where a deregulated power market, diverse energy resources, and unique transmission cost allocation mechanisms coexist, these dynamics are particularly pronounced. Harmonizing the wide range of technical, economic, environmental, and inherently political issues raised by large-scale data centre development will require an unprecedented level of regulatory and private-sector coordination.

The issues facing regulators and governments are also reflected in the commercial and project issues specific to data centres. Users of data centres will seek to arrange supply and price certainty, achieve voluntary and regulatory emissions reduction goals, and maintain performance standards. Data centres will also introduce unique commercial risks associated with ramping, load shape, and the hazards of rapid technological innovation, obsolescence, and replacement outpacing slower and more deliberate energy facilities investments. New customized commercial terms will have to be developed to allocate and mitigate these bespoke risks.

²³³ Cliff Vrielink, Jessica Adkins & Tiph Kugener, “Five Things to Know about Power Supply to Data Centres”, *POWER* (30 January 2025), online: [perma.cc/A8TQ-4VUU]: “Due to constant demand for their use, AI operations have sustained high levels of power needs and demand power availability in excess of 99.9%. Such a level of availability is more than a single generation source (or the grid) can generally provide, and thus redundant power supplies are typically required.”