UBC SAUDER SCHOOL OF BUSINESS · ROBERT H. LEE GRADUATE SCHOOL

Canada's AI Moment

What the wave of artificial intelligence data centres means for Canada, and for whom

~20 GW
requested in Alberta against a 12,785 MW peak

1,200 MW
actually allocated a firm grid connection

3.9 vs 0.01
megatonnes of CO2 for the same gigawatt, Alberta or Quebec

Chunhua Wu

A research book, built with AI, from 12 briefs and 534 sources

Figures verified to 2 September 2026

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What the wave of artificial intelligence data centres means for Canada, and for whom

Chunhua Wu
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Prepared for the Robert H. Lee Graduate School opening week session on artificial intelligence in the classroom, 3 September 2026. Figures verified to 2 September 2026.

How this book was made. The research was gathered by fourteen artificial intelligence research agents working in parallel, one per dimension, each producing a written brief, a machine-readable dataset and a folder of downloaded primary documents. Roughly five hundred searches were run and 884 files totalling 716 megabytes were saved. The charts are generated directly from the datasets. The framing, the ordering, the judgement calls and any errors are the author's. Appendix A sets out the method and its limits in full.

On accuracy. Where sources disagree, the disagreement is reported rather than resolved. Where a figure could not be verified it is marked as contested. Before quoting any number from this book in your own work, open its source. Appendix G lists all 534 of them.

Developed with the assistance of Anthropic's Claude. Typeset from Markdown and JSON by `research/book/build_book.py`.

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Preface

Why this book exists

This book began as a classroom exercise. On 3 September 2026 the incoming Full-time MBA, Master of Management and Master of Business Analytics cohorts at the UBC Sauder School of Business were given twenty-five minutes, a team of four and any artificial intelligence tool they liked, and asked one open question: the wave of artificial intelligence data centres is coming to Canada, so what should it mean for Canada, and for whom?

It seemed only fair to do the exercise myself. This book is the result. Fourteen research agents worked in parallel, one per dimension of the question, each producing a written brief, a machine-readable dataset and a folder of downloaded primary documents. Between them they ran roughly five hundred searches, saved 884 files and 716 megabytes of source material, and recorded every figure with a link. What you are reading is those fourteen briefs, edited into a single argument, with the charts and the connective tissue added.

I want to be exact about what that means, because the method is part of the subject. The research was gathered by machines. The framing, the ordering, the judgement calls and the errors are mine. Where two sources disagreed, the disagreement is reported rather than resolved. Where a number could not be verified, it is marked as contested rather than quietly dropped. Two of the scores that appear in the companion software are explicitly labelled as my judgement rather than published data, and the reasoning is shown beside them. Readers who want to check anything will find the full source for every figure in Appendix G.

The subject deserves that care, because it is moving quickly and it is being argued about badly. In the fifteen months to August 2026 the Alberta Electric System Operator's data-centre connection queue was reported at 16.2, 19.6 and 20.7 gigawatts by three different counters on three different dates. All three numbers are true of the moment they describe. Quoted without a date, any of them is misleading. Much of the public conversation about data centres in Canada consists of numbers quoted without their dates.

There is a second reason for care. A great deal of what has been announced will not be built. Roughly twenty-one gigawatts of Canadian capacity has been announced or proposed; about two point three gigawatts is actually under construction. The federal government's own documents say most of the proposed pipeline is not expected to proceed. An argument built on the announcement number and an argument built on the construction number are arguments about different countries.

The book is organised in three parts. Part I sets the global picture and the physics, because you cannot argue about megawatts without knowing what one is. Part II is Canada on the ground: the projects, the rules and the ledger of costs and benefits. Part III is the strategic frame: the border, the inheritance and the money. The appendices hold the inventory, the timelines, a glossary and every source.

My own conclusion, which readers are free to reject, appears at the end of the executive summary. The students were not asked to reach it. They were asked to reach one they could defend.

Chunhua Wu
Marketing and Behavioural Science, UBC Sauder School of Business
Vancouver, September 2026

FRONT MATTER

Executive summary

The argument in nine pages

Artificial intelligence has to live somewhere. That somewhere is a building full of processors that consumes electricity, water, capital and land, and it has to be built in a specific place, under a specific government, on a specific grid. The question of where those buildings go is now one of the larger industrial questions in the world, and Canada is unusually well placed to answer it and unusually unprepared to.

What is happening

World data-centre electricity consumption was about 415 terawatt hours in 2024 and 485 in 2025, and the International Energy Agency's base case puts it near 945 by 2030. The growth alone is roughly another Japan. Forecasts keep being revised upward: BloombergNEF's estimate of American data-centre demand in 2035 went from 78 gigawatts in April 2025 to 106 in December to 194 in July 2026. The four largest hyperscale operators plan about 725 billion United States dollars of capital spending in 2026, up from 410 billion in 2025, and almost a third of it is now debt funded, against nine per cent two years earlier.

The constraint has moved. It is no longer processors. It is electricity, and the iron that delivers it. A power transformer takes about 160 weeks. A large gas turbine takes about five years. Average grid connection in the Americas takes five years. Capacity that exists is essentially full: North American vacancy has sat near one per cent for three years, and ninety-five per cent of the sixty-six gigawatts under construction is already leased.

Why Canada

Canada's advantage is specific and measurable. Six of the seven cheapest large-power cities in North America are Canadian: Winnipeg at 5.09 cents per kilowatt hour, Montreal at 5.52, Vancouver at 6.72, against Toronto at 12.66 and New York at 22.88. Seventy-eight per cent of Canadian generation is non-emitting. The prairie cities sit at or below fifteen degrees for nine months of the year, which is free cooling. The country is politically stable and legally predictable, and it is not the United States, which since 2025 has become a commercial argument in itself.

Why it is harder than it looks

There is almost no spare room. Every large province is now rationing rather than recruiting. British Columbia caps new data-centre load at 400 megawatts over two years and 145 megawatts per project, written into regulation, against about 800 megawatts requested. Quebec requires a ministerial decision for any load above five megawatts and has asked its regulator to charge data centres about 13 cents per kilowatt hour, roughly double the general large-power rate. Ontario makes data centres pay the full cost of their grid impact and screens every connection at the minister's desk. Alberta received requests near twenty thousand megawatts against a record provincial peak of 12,785 and allocated 1,200 megawatts of firm capacity in total, all of which went to two projects.

The consequence is the central fact of this book. The only route to gigawatt scale in Canada this decade is to build your own power station, and the only province that will let you is the one whose grid runs at about 490 grams of carbon dioxide per kilowatt hour. Meta's campus in Sturgeon County, Alberta, is the template: thirteen billion dollars, one gigawatt, groundbreaking in July 2026, with its own 932 megawatt gas plant. Canada's cleanest power and Canada's only buildable gigawatt sit in different provinces. A one gigawatt campus on the Alberta grid emits about 3.9 megatonnes of carbon dioxide a year. The same machine in Quebec emits about 0.01. That is a factor of nearly three hundred, decided entirely by which province signs the contract.

What it is worth, and to whom

The investment is real and large: Meta's project alone is about 17.6 billion Canadian dollars including its power plant, with roughly 250 million a year in provincial revenue and 40 million in municipal tax by government estimate, and a 60 million dollar community package. The employment case is much weaker: about thirty permanent jobs per hundred megawatts, against construction crews ten to a hundred times larger that then leave. Electricity costs can be shifted onto other customers, as they were in one American capacity auction to the tune of 6.5 billion dollars. This asymmetry, large capital and tax against small permanent employment, is why the argument is so often about whether the community got a fair price rather than about technology.

Communities have begun to answer. Rocky View County refused a campus and later imposed a moratorium. Mississauga and Oakville paused approvals. The Alberta Utilities Commission refused a 1.4 gigawatt gas plant at Olds. Manitoba's premier dropped a proposal after a petition gathered more than thirteen thousand signatures. There were coordinated demonstrations in fourteen cities in June 2026. Social licence is no longer a communications problem; in several provinces it is the binding constraint.

The two arguments that could overturn everything

The first is the bubble. Bain estimates that artificial intelligence needs about two trillion dollars of annual revenue by 2030 to fund the compute being built, and will fall roughly 800 billion short. A widely cited study from MIT found that ninety-five per cent of enterprise pilots produced no measurable profit. The International Energy Agency notes that only about a fifth of American grid connection requests ever materialise. A province that builds transmission for a load that never arrives has made an expensive mistake, which is precisely why Ontario and Alberta now make the developer carry that risk.

The second is repricing. Canada's advantage is the price of firm clean power, and Canada is in the process of raising it. If Quebec's proposed 13 cent rate takes effect, the country's cheapest clean electricity becomes roughly as expensive as Ontario's, and much of the arithmetic in Chapter 8 changes. Any recommendation that rests on 5.5 cents should say what happens at 13.

The conclusion

THE ARGUMENT OF THIS BOOK

Canada is not choosing whether artificial intelligence happens. It is choosing **what to charge, in money and in conditions, for firm clean power delivered soon**. That is the only thing the build-out needs which it cannot easily get elsewhere, and it is a genuinely scarce asset that Canada has been in the habit of selling cheaply.

The provinces that are rationing are not being obstructive. They are discovering that they own something valuable and are working out the price. The open question is whether they charge for it in dollars, which is easy, or in conditions such as clean supply, community benefit, Indigenous equity, demand flexibility and domestic compute access, which is harder and worth more.

Four answers are defensible on this evidence, and they disagree about weights rather than facts. **Alberta** is the only province that can deliver scale this decade, and the price is carbon and contested local consent. **Quebec** has the cleanest and cheapest firm power and is rationing it, so it suits a hundred-megawatt project and not a gigawatt one. **Ontario** has the largest system, a nuclear build-out and the customers, and it charges full freight and takes three to five years. And **not building at all** is defensible too: leasing capacity rather than owning it may be the right call if the revenue does not arrive.

For a student, an investor or a minister, the useful discipline is the same. Name the number your case depends on. Say which date and which counter it came from. Then say what would have to be true for you to change your mind.

FRONT MATTER

How to read this book

Chapter shape, notation and conventions

Each of the eight chapters follows the same shape, so the book can be read straight through or opened at any point.

- **An opener** giving the chapter's kicker number, the questions it answers and a short standfirst.
- **Key takeaways**, six to ten of them, each carrying a figure and the source that produced it.
- **The picture in numbers**, the tables and charts, with the unit, the year, the region and the source for every value.
- **The narrative**, roughly a thousand words of plain-English explanation at the level of a graduate business student, defining each technical term the first time it appears.
- **Contested or uncertain figures**, which is the section to read before quoting anything.
- **Open questions**, written for students looking for a research topic.
- **Sources**, numbered, with publisher, date and link.

Notation and conventions

- Currency is Canadian dollars unless the unit says otherwise. Where a figure is in United States dollars it is written US$ or stated in the surrounding text.
- Energy is quoted in the unit the source used. A megawatt (MW) is a rate of power; a megawatt hour (MWh) is an amount of energy. A gigawatt (GW) is a thousand megawatts, and a terawatt hour (TWh) is a million megawatt hours. Appendix F defines the rest.
- Project capacity is given as announced. Announced, under construction and operating are different things and the book keeps them apart.
- Figures were verified to 2 September 2026. Several move monthly, particularly the Alberta connection queue.
- Where a claim rests on a single secondary source, or where sources conflict, it is flagged in the chapter's contested section rather than presented as settled.

> ONE WARNING WORTH REPEATING
>
> The research in this book was gathered by artificial intelligence and has been checked, but not exhaustively. Several claims were found to be unverifiable during preparation and are marked as such. Before you put any figure from this book into your own work with your name on it, open the source.

01

PART I · THE GLOBAL PICTURE

The wave: demand, money, and the thing that is actually running out

Compute demand is growing faster than any industrial load in living memory, and the capital behind it now exceeds the annual output of most countries. The constraint has moved from chips to electricity, transformers and permits. That shift is what brings the story to Canada.

415 → 945 TWh World data-centre electricity demand between 2024 and 2030, on the International Energy Agency base case. The growth alone is roughly another Japan added to the world's grid.

WHAT THIS CHAPTER ANSWERS

- ? How much electricity will AI actually need, and how confident is anyone in that number?
- ? Where is the money coming from, and how much of it is borrowed?
- ? What is genuinely scarce: chips, power, iron, or permission?
- ? How large is Canada in this picture, and how large could it be?

KEY TAKEAWAYS

- Data centres used about 415 TWh of electricity in 2024 (1.5% of the world total) and 485 TWh in 2025, up 17% in a year while total electricity demand grew 3%. The International Energy Agency expects roughly 950 TWh by 2030, with AI-focused facilities tripling (IEA, Energy and AI 2025; IEA, Key Questions on Energy and AI, April 2026).
- The United States is the centre of gravity: 45% of global data-centre electricity in 2024 (IEA 2025), 54% of hyperscale capacity (Synergy Research 2025) and about 90% of Americas capacity (JLL 2026). US data centres

used 192 TWh (4.7% of US electricity) in 2024 and could reach 649 TWh (11.8%) by 2030 in the Lawrence Berkeley National Laboratory Reference Case (LBNL 2025 Update, published 2026).

- Forecasts keep being revised upward: BloombergNEF's US data-centre demand estimate for 2035 went from 78 GW (April 2025) to 106 GW (December 2025) to 194 GW (July 2026), the last implying about 20% of US electricity (BloombergNEF via Bloomberg, July 2026). NERC's ten-year summer peak growth forecast jumped 69% in one year to 224 GW (NERC 2025 Long-Term Reliability Assessment, January 2026).
- Global data-centre capacity is about 103 GW today and could reach 200 GW by 2030 (JLL, January 2026); McKinsey puts capacity demand at 82 GW in 2025 rising to 219 GW in 2030 and the capex bill at USD 6.7 trillion (McKinsey 2025). Capacity that exists is essentially full: North American vacancy has sat at about 1% for three years, 66 GW is under construction and 95% of it is already pre-committed (JLL Midyear 2026).
- Money is flowing at an unprecedented scale: the four largest hyperscalers plan about USD 725 billion of capital expenditure in 2026, up 77% from USD 410 billion in 2025 (Yahoo Finance compilation of guidance, June 2026); the IEA counts more than USD 400 billion in 2025 for five firms and a 75% rise in 2026. Nvidia's data-centre revenue reached USD 89.0 billion in a single quarter, up 117% year over year (Nvidia Q2 FY2027, August 2026).
- Power, not chips, is now the binding constraint. Average grid connection waits are 4.4 years globally, 5.0 years in the Americas and 5.2 years in EMEA (Cushman & Wakefield 2026). AI projects entering service in PJM in 2025 took more than seven years from request to operation (Data Center Knowledge citing PJM, May 2026). GE Vernova's gas-turbine backlog and slot reservations hit 116 GW and new orders are for 2031 delivery (Utility Dive, July 2026). Power-transformer lead times exceed 160 weeks (2026).
- Chips remain tight upstream: high-bandwidth memory (HBM) output at Micron and SK hynix is sold out through 2026 and the IEA expects the HBM shortage to last through at least end-2027, limiting AI-server additions to roughly 25 GW a year (IEA 2026; Barrack AI compilation 2026).
- The bubble debate is serious: Bain estimates AI needs USD 2 trillion of annual revenue by 2030 to fund compute and will fall USD 800 billion short (Bain 2025); MIT found 95% of enterprise GenAI pilots delivered no measurable profit impact (MIT NANDA 2025); debt now funds 32% of hyperscaler capex versus 9% two years earlier (FactSet, July 2026).
- Canada is small but has an outsized pipeline: about 1.4 GW live (September 2025) against 40.6 GW in the US (DC Byte via BLG 2026); 10.3 GW in all pipeline stages (DC Byte 2025); and 20 to 22 GW of proposed projects in federal documents, more than 18 GW of it in Alberta, of which the government itself says most "is not expected to proceed" (Canadian Press, July 2026). Alberta received more than 20 GW of connection requests against a 1,200 MW interim cap (AESO 2025).
- Canada's power cost advantage is real but uneven: large-power rates were 5.55 cents per kWh in Montreal, 7.91 in Vancouver and 8.88 in Toronto versus 12.01 in Houston, 18.07 in New York and 26.32 in Boston, but 23.77 in Calgary (Hydro-Quebec comparison, rates in effect April 2023). Quebec now proposes charging data centres 13 cents per kWh from late 2026 (Hydro-Quebec, February 2026).

Narrative

What is being built, and why the numbers are so large. A data centre is a building full of servers; AI has filled it with racks of accelerators such as Nvidia graphics processing units (GPUs) that draw far more power per rack. A terawatt-hour (TWh) measures energy used over time: one TWh is one billion kilowatt-hours, and 415 TWh, the IEA's estimate of data-centre electricity in 2024, is roughly 1.5% of everything the world consumed that year. A gigawatt (GW) measures power drawn at an instant: 1 GW is 1,000 megawatts (MW), about the output of a large nuclear reactor, and a 100 MW data centre running all year uses roughly the electricity of 100,000 households (IEA 2025). Capacity figures from real-estate firms are usually expressed in MW of "critical IT load", the power available to servers; total power drawn is higher by the facility's power usage effectiveness (PUE), the ratio of total energy to server energy, typically 1.1 to 1.5.

Demand. The IEA's April 2025 Energy and AI report set the reference numbers: 415 TWh in 2024, rising about 15% a year to 945 TWh in 2030 and 1,200 TWh in 2035 in its Base Case, with 2035 scenarios spanning 700 to 1,720 TWh. Its April 2026 update reported 485 TWh in 2025, a 17% rise, with AI-focused facilities up 50%, and left the 2030 figure at about 950 TWh. The United States dominates (45% of 2024 consumption, 180 TWh), followed by China (25%) and Europe (15%). US-specific work by Lawrence Berkeley National Laboratory (LBNL) shows the acceleration: the December 2024 report had 176 TWh in 2023 (4.4% of US electricity) and 325 to 580 TWh by 2028; the 2025 Update, published in 2026, has 192 TWh in 2024 and a 649 TWh Reference Case for 2030 (11.8%), with data centres supplying a third of all US load growth this decade. The important nuance is between energy and peak power: utilities plan for peak demand, and the aggregate five-year peak forecast filed by US utilities has risen six-fold since 2022 to 166 GW, about 90 GW of it data centres (Grid Strategies, November 2025).

Capacity and markets. Real-estate data describe what has actually been built. JLL counts about 103 GW of data-centre capacity worldwide at the start of 2026 and expects 200 GW by 2030, with the Americas holding half and the US about 90% of the Americas. Cushman & Wakefield's 2026 comparison shows the pipeline's scale: 43.4 GW operating in the Americas, 25.3 GW under construction and 191.3 GW planned. The market has no slack. "Vacancy" is the share of built capacity available to lease; "absorption" is the amount newly leased; "pre-leasing" means signing tenants before a building is finished. North American vacancy has been about 1% for three years, H1 2026 absorption doubled to 25 GW, and 95% of the 66 GW under construction is already committed, so tenants signing today are getting 2028 deliveries (JLL Midyear 2026); Northern Virginia, the world's largest market, had 0.3% vacancy in Q1 2026 (CBRE). Hyperscalers, the largest cloud and internet companies, now run 1,360 large data centres and hold 48% of all capacity, heading to 67% by 2031 (Synergy Research). Outside North America the story is one of clusters and constraints: Johor in Malaysia and Mumbai in India are growing fastest; Ireland, where data centres take 22% of electricity, only ended a four-year connection moratorium in December 2025 by requiring new sites to bring their own generation and 80% renewables; Amsterdam allows no new data centres; the Gulf is building the 5 GW UAE-US AI campus with a 1 GW Stargate cluster.

Money. Four companies, Amazon, Alphabet, Microsoft and Meta, spent about USD 410 billion of capital expenditure (capex, spending on long-lived assets) in 2025 and guide to about USD 725 billion in 2026; with Oracle the IEA counts more than USD 400 billion in 2025 and a 75% rise. Nvidia's data-centre revenue was USD 193.7 billion in its fiscal 2026 and USD 89.0 billion in the quarter to July 2026. The money is increasingly borrowed: FactSet finds debt funded 32% of hyperscaler capex in the last twelve months versus 9% in fiscal 2024, and JLL counts USD 250 billion of AI-related bonds in the first half of 2026. Flagship projects show the gap between announcement and operation: OpenAI's Stargate has more than 9 GW planned by 2029 but only 0.3 GW operating in April 2026.

The shortages. Chips were the first bottleneck and are still tight at the memory layer: high-bandwidth memory (HBM), the stacked memory bonded to each AI accelerator, is sold out at Micron and SK hynix through 2026, and the IEA expects the shortage to last through at least end-2027, capping AI-server additions at roughly 25

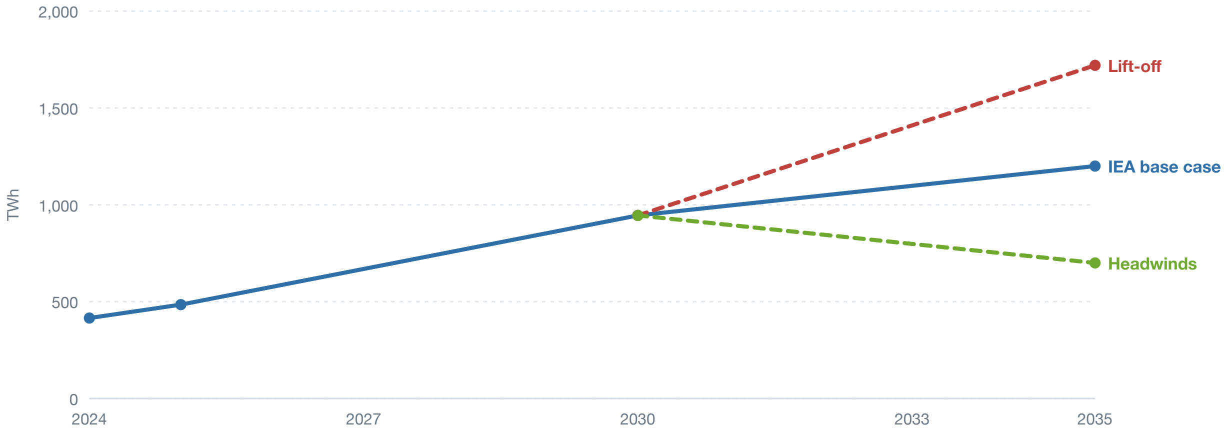
GW a year. Power has become the binding constraint, captured in the industry phrase "time to power". An interconnection queue is the waiting list on which a utility or grid operator studies requests to connect large new loads or generators; in PJM, the grid covering 13 US states around Northern Virginia, AI projects entering service in 2025 waited more than seven years from request to operation, and Cushman & Wakefield puts average connection times at 5.0 years in the Americas. Behind the queue sit physical shortages: GE Vernova's gas-turbine backlog and reservations reached 116 GW with new orders delivering in 2031; large power transformers take more than 160 weeks and cost 77% more than in 2019; more than 60% of operators report difficulty hiring, and electricians are the tightest trade. Water and permitting add local friction: US data centres consumed 66 billion litres of water directly in 2023 and about 800 billion litres indirectly through the power they used, and LBNL expects hyperscale sites alone to use 60 to 124 billion litres in 2028; a JLL survey found only 14% of Americans support a data centre near them.

The demand gap. Put the two halves together and a gap appears. Demand-side models (McKinsey 219 GW of capacity demand by 2030; Bain 200 GW of incremental AI compute by 2030; Epoch AI's finding that frontier training compute grows four to five times a year) exceed what the supply side can plausibly deliver (JLL's 200 GW of total capacity by 2030 in its base case, HBM at 25 GW a year, turbines booked to 2031). Bain frames the gap financially: USD 2 trillion of annual AI revenue would be needed by 2030 to fund the build, and it expects an USD 800 billion shortfall. BloombergNEF sees a 19 GW US power shortfall even at record connection rates. For a country with spare clean electricity and land, the implication is that power delivered within two to three years is now worth more than cheap power delivered in seven.

Where Canada fits. Canada ranks fifth in the world by number of data centres (337) but is small by capacity: about 1.4 GW live against 40.6 GW in the US. The pipeline is disproportionate: DC Byte counts 10.3 GW across all stages, and federal documents list 20 to 22 GW of proposed projects, more than 18 GW of them in Alberta, against a government estimate that the country needs 5.5 GW of AI compute by 2030 and a warning that most proposals will not proceed. The advantage is cheap, clean power in the hydro provinces: Montreal's large-power rate of 5.55 cents per kWh compares with 12.01 in Houston and 18.07 in New York, and Vancouver (7.91) and Toronto (8.88) also undercut most US hubs, though Calgary and Edmonton were above 23 cents in the 2023 comparison. The constraint is allocation and time to power. Alberta received more than 20 GW of connection requests, more than its peak demand, and capped interim connections at 1,200 MW to 2028, pushing developers toward "bring your own generation". BC Hydro is releasing just 400 MW over two years. Quebec, where data-centre load is expected to rise from 200 MW to more than 1,000 MW by 2035, proposes to charge data centres 13 cents per kWh, about double its industrial rate, from late 2026. Canada's opportunity is therefore less about total scale than about whether it can convert a small number of large, well-sited, quickly powered projects while the global gap is widest.

FIGURE 1.1

World data-centre electricity demand (TWh a year)

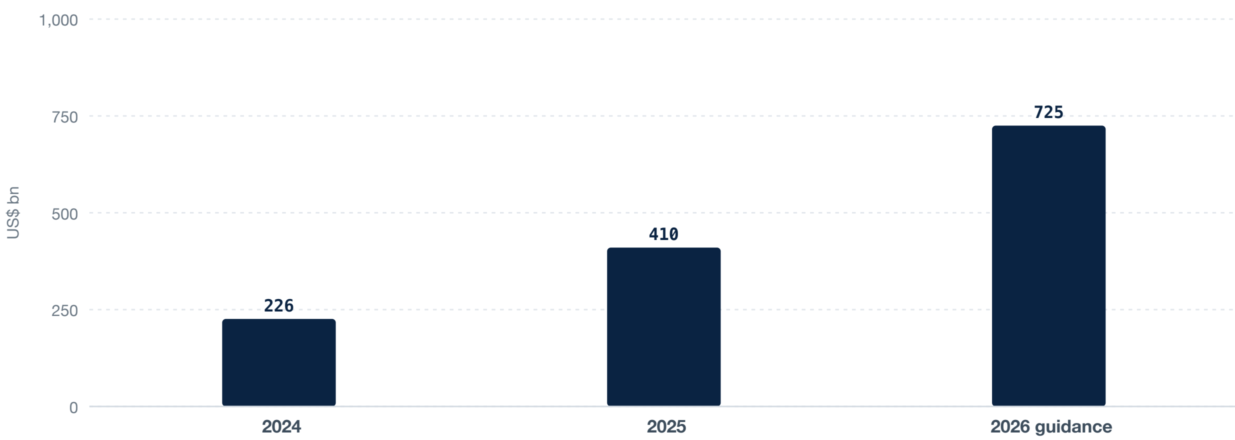


The gap between the two dashed lines in 2035 is about a thousand terawatt hours, roughly one and a half times everything Canada generates in a year. Nobody knows which line is right, and that uncertainty is the whole investment debate.

Source: International Energy Agency, *Energy and AI* (2025) and *Key Questions on Energy and AI* (2026).

FIGURE 1.2

Capital spending by Amazon, Alphabet, Meta and Microsoft (US$ billion)



Capital committed to data centres by the four largest operators. Almost a third of the 2026 figure is debt funded, against nine per cent two years earlier.

Source: Earnings guidance compilation (2026); FactSet (July 2026).

The picture in numbers

A. Electricity demand

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Data-centre electricity consumption	415	TWh	2024	Global	IEA, Energy and AI (Apr 2025)
Data-centre electricity consumption (+17% y/y)	485	TWh	2025	Global	IEA, Key Questions on Energy and AI (Apr 2026)
Data-centre consumption, Base Case	945 (about 950 in 2026 update)	TWh	2030	Global	IEA (Apr 2025)
Data-centre consumption, 2035 cases	700 (Headwinds), 1,200 (Base), 1,720 (Lift-Off)	TWh	2035	Global	IEA (Apr 2025)
Regional shares of data-centre electricity	US 45, China 25, Europe 15	%	2024	Global	IEA (Apr 2025)
Global electricity demand growth, 2026-2030 average	3.6	% per year	2030	Global	IEA, Electricity 2026
Share of US data-centre connection requests that materialise	about 20	%	2026	United States	IEA, Electricity 2026
US data-centre electricity use	176 (4.4% of US)	TWh	2023	United States	US DOE / LBNL (Dec 2024)
US data-centre electricity use, 2028 range	325-580 (6.7-12.0% of US)	TWh	2028	United States	US DOE / LBNL (Dec 2024)
US data-centre electricity use, 2025 Update	192 (4.7%) in 2024; 649 (11.8%) Reference Case, range 521-843	TWh	2030	United States	LBNL 2025 Update (2026)
Data-centre share of US electricity	9-17 (4-5 today)	%	2030	United States	EPRI Powering Intelligence 2026
Utility five-year peak load growth forecast	166 (about 90 from data centres)	GW	2030	United States	Grid Strategies (Nov 2025)
Ten-year summer / winter peak growth	224 / 246	GW	2035	US and Canada (NERC)	NERC 2025 LTRA via Utility Dive (Jan 2026)
BNEF US data-centre demand, by edition	78 (Apr 2025), 106 (Dec 2025), 194 (Jul 2026)	GW	2035	United States	BNEF via Tom's Hardware/Yahoo (Jul 2026)
US data-centre power demand (AI share)	33 (12%) in 2024; 176 (70%) in 2035	GW	2035	United States	Deloitte (Jun 2025)
Ireland data-centre share of metered electricity	22	%	2024	Ireland	IEA, Electricity 2026

B. Capacity, markets and the pipeline

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Global data-centre power demand	55 (2023), 84 (2027), 122 (2030)	GW	2030	Global	Goldman Sachs via APPA (Feb 2025)

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Global capacity demand (AI portion)	82 (44) in 2025; 219 (156) in 2030	GW	2030	Global	McKinsey via The Data Score (Feb 2026)
Global capacity, all segments	103 today; 200 by 2030	GW	2030	Global	JLL 2026 Global Data Center Outlook
Americas capacity: operating / under construction / pipeline	43.4 / 25.3 / 191.3	GW	2026	Americas	Cushman & Wakefield (May 2026)
EMEA capacity: operating / under construction / planned	11.4 / 2.7 / 12.1	GW	2026	EMEA	Cushman & Wakefield (May 2026)
APAC capacity	32 (2025) to 57 (2030)	GW	2030	Asia-Pacific	JLL (Jan 2026)
Hyperscale data centres in operation (pipeline)	1,360 (about 800)	facilities	2025	Global	Synergy Research (Apr 2026)
Hyperscale share of capacity (2031)	48 (67)	%	2025	Global	Synergy Research (Apr 2026)
North America absorption H1 2026 / under construction / pre-committed	25 / 66 / 95	GW, GW, %	2026	North America	JLL Midyear 2026 (Aug 2026)
US primary markets: inventory, vacancy, absorption	9,432 MW, 1.4%, 2,497.6 MW	MW, %, MW	2025	US eight primary markets	CBRE H2 2025 (Feb 2026)
Northern Virginia inventory / vacancy	4,182 / 0.3	MW / %	Q1 2026	Northern Virginia	CBRE Global Data Center Trends 2026 (Jun 2026)
Vacancy Europe / Asia-Pacific	7.3 / 7	%	Q1 2026	Europe, APAC	CBRE (Jun 2026)
Malaysia capacity (Johor pipeline)	2,055 by end-2026 (Johor 2,700 in pipeline)	MW	2026	Malaysia	The Edge Malaysia / JLL (Apr 2026)
India capacity	1.7-2.0 (2026); about 6 (2029)	GW	2029	India	Business Today / Vestian (Apr 2026)
Stargate UAE cluster (first phase)	1 GW (200 MW due Q3 2026) inside a 5 GW campus	GW	2026	UAE	The National (Dec 2025)

C. Money: capex, chips and flagship projects

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Combined capex, Microsoft + Alphabet + Amazon + Meta	226 (2024), 410 (2025), about 725 (2026 guidance)	USD billion	2026	Global	Yahoo Finance (Jun 2026)
2026 guidance by company	Amazon 200; Alphabet 180-190; Meta 125-145; Oracle about 50	USD billion	2026	Global	FactSet (Jul 2026), Futurum (Feb 2026)
Microsoft capex incl. finance leases, fiscal 2026	115.9	USD billion	FY to Jun 2026	Global	Microsoft (Jul 2026)
Five-hyperscaler capex, calendar 2026 incl. leases and prepayments	about 800	USD billion	2026	Global	FactSet (Jul 2026)
Debt-funded share of hyperscaler capex	32 (9 in FY2024)	%	2026	Global	FactSet (Jul 2026)

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Nvidia Data Center revenue	193.7 (fiscal 2026); 89.0 (Q2 fiscal 2027, +117%)	USD billion	2026	Global	Nvidia (Aug 2026)
Stargate: planned by 2029 / operating	more than 9 / 0.3	GW	2026	United States	Epoch AI (Apr 2026)
Nvidia-OpenAI letter of intent	10 GW, up to USD 100 billion	GW	2025	Global	NBC News (Oct 2025)
xAI Colossus (Memphis)	about 1.5 operating, 2 target	GW	2026	United States	Introl (Jan 2026)
Meta Hyperion (Louisiana)	1.5 by end-2027, scaling to 5	GW	2027	United States	Data Center Frontier (Aug 2025)
AI revenue needed / shortfall in 2030	2,000 / 800	USD billion	2030	Global	Bain (Sep 2025)
GenAI pilots with no measurable P&L impact	95	%	2025	Global	MIT NANDA (Aug 2025)

D. Bottlenecks

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
GE Vernova gas-turbine backlog plus slot reservations	83 (end-2025), 100 (Q1 2026), 116 (Q2 2026); deliveries booked to 2031	GW	2026	Global	Utility Dive (Jul 2026)
Gas-turbine orders growth	70	%	2025	Global	IEA (Apr 2026)
Power-transformer lead time	50 (2021), 120 (2024), 150 (2025), 160+ (2026)	weeks	2026	United States	Data Center Knowledge (May 2026)
Power-transformer price increase since 2019	77	%	2025	United States	POWER Magazine (Jan 2026)
Average grid connection time	4.4 global; 5.0 Americas; 5.2 EMEA; 2.7 APAC	years	2026	Global	Cushman & Wakefield (May 2026)
PJM: time to operation for AI projects entering service in 2025	more than 7 (3+ to agreement, 4+ after)	years	2025	PJM	Data Center Knowledge (May 2026)
PJM large-load adjustment requests	54 (95 requests)	GW	2025	PJM	Data Center Knowledge (May 2026)
PJM capacity-market cost	2.2 (2023) to 16.1 (2025)	USD billion	2025	PJM	Canary Media (Nov 2025)
HBM supply limit on AI servers	about 25 per year through 2027	GW	2027	Global	IEA (Apr 2026)
HBM market share (SK hynix / Micron / Samsung)	62 / 21 / 17	%	Q2 2025	Global	Barrack AI compilation (Mar 2026)
Data-centre providers reporting hiring difficulty	more than 60	%	2026	United States	BRG ThinkSet (2026)

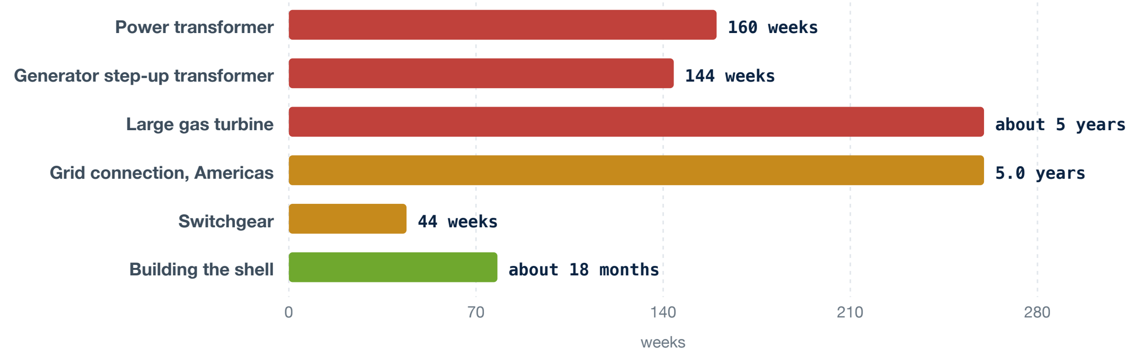
METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
US data-centre direct water consumption	21.2 (2014); 66 (2023); hyperscale sites alone 60-124 expected (2028); indirect via electricity about 800 (2023)	billion litres	2028	United States	LBNL (Dec 2024)

E. Where Canada fits

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Live data-centre IT capacity, Canada vs US	1.4 (Sep 2025) vs 40.6 (early 2026)	GW	2025	Canada, US	BLG (Jul 2026)
Canada total pipeline (all stages)	10.3 (more than 75% early stage or committed)	GW	Q2 2025	Canada	DC Byte (Sep 2025)
Share of Canadian IT load in Toronto, Montreal and Alberta	93	%	2025	Canada	DC Byte (Sep 2025)
AI data-centre capacity operating / proposed (Alberta share)	337 MW / 20-22.1 GW (Alberta more than 18 GW)	MW, GW	2026	Canada	Canadian Press via Daily Commercial News (Jul 2026)
Federal estimate of AI compute needed by 2030	5.5	GW	2030	Canada	Canadian Press (Jul 2026)
Data centres by count (rank)	337 (5th; US 5,427)	facilities	Nov 2025	Canada	Cargoson / Cloudscene (Jan 2026)
Toronto / Montreal rank in Cushman & Wakefield Americas lists	8th primary / 5th secondary	rank	2026	Canada	Cushman & Wakefield (May 2026)
Alberta connection requests vs interim cap	more than 20,000 vs 1,200 (to 2028)	MW	2025	Alberta	AESO (Sep 2025)
BC Hydro capacity for data centres (two years from Feb 2026)	400 (145 per project cap)	MW	2026	British Columbia	BLG (Jul 2026)
Quebec data-centre load today / 2035	200 / more than 1,000	MW	2035	Quebec	Hydro-Quebec (Feb 2026)
Proposed Quebec data-centre rate (5 MW+) vs Rate L energy charge	13 vs 3.821 plus CAD 15.027 per kW	CAD cents per kWh	2026	Quebec	Hydro-Quebec (Feb 2026), Rates 2026
Large-power price, selected cities (5,000 kW, 3,060,000 kWh per month)	Montreal 5.55; Winnipeg 5.90; Vancouver 7.91; Chicago 8.67; Toronto 8.88; Seattle 11.98; Houston 12.01; New York 18.07; Calgary 23.77; Boston 26.32	CAD cents per kWh	Apr 2023	North America	Hydro-Quebec comparison
Federal Sovereign AI Compute Strategy	2 (700 million challenge fund, 1 billion public compute, 300 million access fund)	CAD billion	2024-2029	Canada	ISED (page updated Jun 2026)

FIGURE 1.3

What actually takes the time

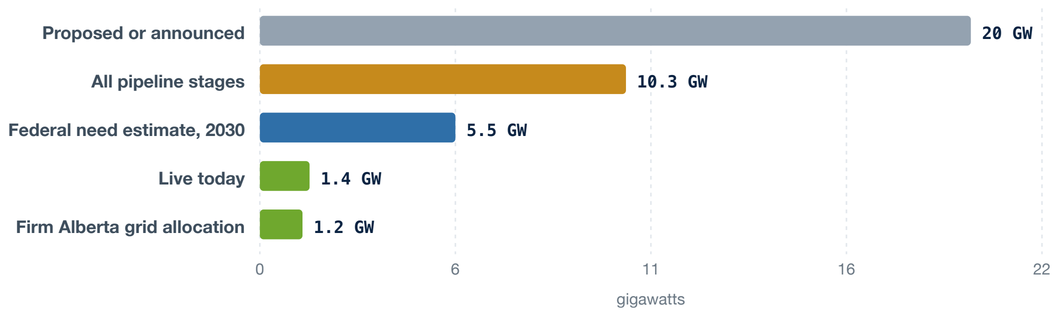


You can put up the building in eighteen months. You cannot get the transformer in eighteen months. This is why time to power beats price of power in most siting decisions.

Source: Data Center Knowledge (2026); Cushman and Wakefield (2026); POWER Magazine (2026).

FIGURE 1.4

Canada's data-centre capacity, by how real it is



The distance between the top bar and the bottom bar is the most useful thing to understand about the Canadian file. Ten times more has been announced than has been allowed to connect.

Source: DC Byte via BLG (2026); Canadian Press (2026); Alberta Electric System Operator.

Contested or uncertain figures

- **What counts as "capacity".** Goldman Sachs counted about 55-59 GW of global data-centre power demand in 2023-2025, McKinsey 82 GW of capacity demand in 2025, JLL 103 GW of total capacity at the start of 2026 and Cushman & Wakefield 43.4 GW operating in the Americas alone. The differences come from definitions (critical IT load versus total facility power, and whether enterprise on-premise sites are included), not disagreement about the trend. Compare growth rates across sources, not levels.
- **US 2030 electricity use.** LBNL's 2025 Reference Case (649 TWh) is far above the IEA's US estimate for 2030 (about 430 TWh, as cited by LBNL) and inside EPRI's 380-790 TWh range. LBNL attributes the divergence to assumptions about accelerator shipments, so the range, not the point estimate, is the honest answer.

- **Speculative and duplicated load requests.** The IEA finds only about 20% of US data-centre connection requests materialise in the short to medium term; Grid Strategies says utility forecasts overstate data-centre load by roughly 25 GW and rest on unrealistic 96% load factors; Canary Media reports developers pitching the same project to several utilities. Grid Strategies argues NERC's reliability shortfalls largely disappear once queued generation is counted; NERC disputes this. Alberta's 20 GW of requests against a 12 GW peak illustrate the same phenomenon in Canada.
- **Forecast whiplash.** BloombergNEF's 2035 US figure rose 2.5 times in fifteen months; NERC's ten-year peak growth rose 69% in a year. Rapid upward revision is itself evidence of low forecast reliability, in either direction.
- **Hyperscaler capex totals** differ by USD 100 billion or more depending on whether finance leases and customer prepayments are included and on Microsoft's June fiscal year (USD 630 billion, 690 billion, 725 billion and 800 billion all appear in reputable compilations for 2026). Nvidia's fiscal 2025 data-centre revenue (USD 115.3 billion) in the data file is derived from reported growth rather than quoted directly.
- **Goldman Sachs' US path (31 GW in 2025, 41 GW in 2026, 66 GW in 2027)** and Meta's USD 50 billion Louisiana investment come from search summaries of pages that blocked automated access and are marked unverified in the data file.
- **Canadian market statistics.** CBRE's H2 2025 North America report has no Canadian markets; its H1 2025 Toronto profile is descriptive, and the widely repeated 7.6% Toronto vacancy and 223 of 236 MW pre-committed figures could not be verified in the page text. Synergy, JLL and CBRE do not publish Canada's share of global capacity; the 1.4 GW versus 40.6 GW comparison relies on DC Byte via BLG. The "337 MW of AI capacity" in the federal document uses a narrower definition than the 1.4 GW of live capacity.
- **Electricity price comparison.** The Hydro-Quebec city comparison served at the public URL is the edition with rates in effect April 2023; Alberta's figures reflect the 2022-2023 pool-price spike and have since fallen, and Quebec's proposed 13-cent data-centre rate would erase most of Montreal's headline advantage for new AI sites.
- **The bubble.** MIT's 95% figure is based on 52 interviews, 153 survey responses and 300 deployments and has been criticised as unrepresentative; Goldman's finding that only 2% of S&P 500 firms quantify AI benefits sits alongside hyperscaler earnings growing 54%. Circular financing (Nvidia investing up to USD 100 billion in OpenAI, AMD warrants, Oracle's USD 300 billion contract) inflates the apparent size of demand.

Open questions students could investigate

1. If only about 20% of US connection requests materialise, what is the equivalent conversion rate for Canada's 20-22 GW pipeline, and which project features (secured generation, water, permits, tenant) predict conversion?
2. What is the all-in cost per MW-year of a 300 MW AI campus in Montreal, Toronto, Calgary and Vancouver versus Northern Virginia, Dallas and Phoenix once Quebec's 13-cent rate, Virginia's new data-centre tax and Alberta's bring-your-own-generation requirement are included?
3. How much is "time to power" worth? Build a model of the value of a 2027 versus 2031 connection date to a hyperscaler, given GPU depreciation over four to six years.
4. Does Canada's clean-power advantage survive if data centres are powered by on-site gas turbines in Alberta, and how would that interact with the federal Clean Electricity Regulations and buyers' carbon

commitments?

5. Which of the demand forecasts (IEA, LBNL, EPRI, BloombergNEF, McKinsey) has the best track record so far, and what does the pattern of revisions say about how to weight them?
6. If Bain is right about an USD 800 billion revenue gap by 2030, which parts of the buildout get cancelled first, and would Canadian projects be early or late casualties?
7. How should a province allocate scarce grid capacity among data centres, electrification and industry: first come first served, auctions, or economic scoring like BC Hydro's 145 MW per-project cap?
8. What share of Canada's proposed projects are training clusters (latency tolerant, could sit anywhere with power) versus inference capacity (needs proximity to users), and what does that imply for Alberta versus Toronto?
9. Could Canada capture value beyond hosting: transformers, switchgear, turbines, cooling and skilled trades, given 160-week transformer lead times and a 116 GW turbine backlog?
10. What community-acceptance conditions (water, noise, local rates, jobs) have derailed projects in Ireland, the Netherlands and US counties, and are Canadian municipalities prepared?

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02

CHAPTER 2

The history: the eight years when computing grew sixfold and used no more power

Data-centre electricity was almost flat from 2010 to 2018 while the work being done grew about sixfold, because four efficiency offsets absorbed the growth. Around 2022 those offsets ran out at the same moment a new workload arrived. This chapter is the long series, the reasons it bent, and a warning about the numbers people quote from it.

6x work, 6% power

Global data-centre compute grew roughly sixfold between 2010 and 2018 while their electricity rose about six per cent. The efficiency that did that has now largely been spent.

WHAT THIS CHAPTER ANSWERS

- ? How much electricity did computing actually use before the current wave, and how well is that known?
- ? Why was the curve flat for eight years, and what changed?
- ? How much of the growth is artificial intelligence rather than data centres in general?
- ? Is a large digital electricity load ever reversible?

KEY TAKEAWAYS

- Global data centres used about 485 TWh in 2025, roughly 1.5 per cent of world electricity, up 17 per cent in a single year and adding about 70 TWh, which is more than the Netherlands generates in half a year (IEA, Key Questions on Energy and AI, 2026).
- For most of this century that share barely moved. It went from 1 per cent in 2005 to 1.5 per cent in 2024 (IEA, Energy and AI, 2025). Between 2010 and 2018 global data-centre compute instances grew about 550 per cent,

roughly sixfold, while their electricity grew about 6 per cent, from 194 to 205 TWh (Masanet et al., Science, 2020).

- The offsets that held it flat have run out. Power usage effectiveness at American AI facilities was 1.145 in 2024 and is forecast to reach only 1.136 by 2030, so there is essentially nothing left to squeeze (LBNL, 2025 Update, published June 2026). Meanwhile accelerator power went from 300 watts a chip in 2016 to 1,400 watts in 2025, and AI server power density rose elevenfold between 2020 and 2025 (NVIDIA and AMD datasheets; IEA, 2026).
- The United States is where the acceleration is sharpest and best measured: 60 TWh flat from 2014 to 2016, 76 TWh in 2018, 176 TWh in 2023, 192 TWh in 2024 (4.7 per cent of national electricity), and a Reference Case of 649 TWh by 2030, or 11.8 per cent, with an honest uncertainty band of 521 to 843 TWh (LBNL, 2025 Update, 2026).
- AI is now roughly a sixth of the load and heading for roughly a half. Accelerated servers were 15 per cent of total global data-centre electricity in 2024, about 62 TWh (IEA, 2025). By 2030 the IEA puts AI-focused data centres at about 465 TWh out of 950 TWh, and an independent review puts AI at 200 to 400 TWh, or 35 to 50 per cent (IEA, 2026; Kamiya and Coroama, IEA 4E EDNA, 2025).
- Inference, not training, is the bill. All the large AI models ever trained together account for about 1.7 TWh cumulatively, roughly 0.35 per cent of one year of data-centre electricity (IEA, 2025, on Epoch AI data). LBNL now puts training at about 35 per cent of American AI server power draw in 2024, falling to about 20 per cent by 2030, which reverses its own 2024 forecast that training would overtake inference (LBNL, 2025 Update, 2026).
- The published estimates disagree wildly and the disagreement is measurable. For 2020, a year that has already happened, published figures span about 200 to 1,200 TWh, a factor of six. Projections for 2030 diverge by nearly forty times. Studies graded low quality averaged 1,013 TWh for 2023; studies graded high averaged 335 TWh (Kamiya and Coroama, IEA 4E EDNA, 2025).
- The famous per-query numbers are the weakest part of the field. Google measured 0.24 watt-hours for a median Gemini text prompt, and 0.10 watt-hours for the same prompts on an accelerator-only boundary, a 2.4-fold difference from boundary choice alone (Google, August 2025). The circulating figure of 2.9 watt-hours traces back through a 2023 paper that said "at most" to a Google blog post of January 2009 that has never been updated. Of 100 news articles sampled, 75 per cent gave a figure with no uncertainty or source and 5 per cent urged caution (Luccioni et al., 2025).
- Cryptocurrency is the control case. Bitcoin went from about 13 TWh in 2017 to about 189 TWh in 2025, more than the entire global electric vehicle fleet used in 2024 (Cambridge Bitcoin Electricity Consumption Index, v1.8.0). Then Ethereum switched consensus rules on 15 September 2022 and removed about 21 TWh a year of demand in a day, a cut of roughly 99.99 per cent (Cambridge Blockchain Network Sustainability Index).
- Scale, for a Canadian audience: global data centres in 2025 used about 74 per cent of everything Canada generates (652 TWh) and about 97 per cent of Germany's entire output. The IEA's 2030 Base Case of 950 TWh is about 92 per cent of Japan's whole electricity system (Ember Yearly Electricity Data, 2026 release; IEA, 2026).
- Perspective cuts both ways. In 2023 end-user devices used more electricity than all the world's data centres, 440 TWh against 360 TWh, and televisions and cable networks used about 500 TWh. Between 2014 and 2024 air conditioning added 700 TWh of demand while data centres added 250 TWh (IEA, Energy and AI, 2025).
- Wrong numbers have consequences. In 1999 Mark Mills and Peter Huber claimed the internet already used 8 per cent of American electricity, 13 per cent including stand-alone computing, and would take half the grid within a decade. LBNL found the internet figure was too high by a factor of eight, personal computers were assumed at 1,000 watts against 150 to 200 measured, and the forecast had already influenced a generator manufacturer and researchers at five investment banks (Koomey et al., LBNL-44698, 1999; Koomey et al., 2002).

Narrative

Here is the shape of the thing, in plain English.

For the first twenty years of this century, computing got enormously more useful without getting much hungrier. That is the fact almost everyone leaves out. Between 2010 and 2018 the world's data centres ran roughly six times as much computing work while their electricity bill rose about 6 per cent, from 194 to 205 terawatt-hours. Storage capacity went up twenty-five-fold over the same period. Internet traffic went up more than tenfold. Electricity went sideways. As a share of world electricity, data centres moved from about 1 per cent in 2005 to about 1.5 per cent in 2024. That is nineteen years for half a percentage point.

This did not happen by luck, and it did not happen because chips got better, though they did. It happened for a mostly boring reason: the work moved buildings. In 2014 more than sixty per cent of American server energy sat in company-owned rooms and closets where the average server ran at about ten per cent utilisation and the building wasted about as much electricity on cooling as it delivered to the computers. By 2023, nearly ninety per cent of that work had moved into hyperscale and colocation facilities where servers run at forty-five per cent utilisation and the best buildings waste ten per cent instead of one hundred per cent. Virtualisation, which lets one machine carry many workloads, meant that servicing more demand needed fewer physical boxes: American server shipment growth fell from fifteen per cent a year in the early 2000s to three per cent after 2010, even as the internet exploded.

Lawrence Berkeley National Laboratory put a price on all of this. It ran the counterfactual: freeze American efficiency practice at 2010 levels and let only the chips improve. On that path, 2020 consumption would have been 170 per cent higher, and the industry's efficiency work saved about 620 terawatt-hours over the decade. That is roughly Canada's entire annual electricity generation, saved by engineering that got no press at all.

Now the second half of the story. Every one of those offsets is either exhausted or exhausting.

The building migration is nearly complete: with enterprise rooms down to single-digit percentages of server energy, there is almost nothing left to move. Power usage effectiveness, the cooling-overhead ratio, has fallen from 2.0 in 2007 to about 1.45 across the American fleet, and at facilities built for AI it is already 1.145 and forecast to reach only 1.136 by 2030. A building at 1.1 has ten per cent of overhead left to remove, ever. Koomey's law, the fifty-year trend of computations per kilowatt-hour doubling every eighteen months, slowed to a doubling every 2.6 years after 2000, when the physics of shrinking transistors changed.

And into that exhausted set of levers walked a workload with the opposite characteristics. An NVIDIA P100 accelerator drew 300 watts in 2016. The B300 and AMD's MI355X draw 1,400 watts in 2025. The power density of AI servers rose elevenfold between 2020 and 2025 and is expected to rise fourfold again by 2027, at which point a single rack the size of a large refrigerator could peak at the electricity demand of sixty-five households. The chips got more numerous, each one got heavier, and the building could not get any more efficient. Three multiplicative terms, all pointing the same way, at the same time.

So the curve bent. Global data-centre electricity grew about twelve per cent a year from 2017, then seventeen per cent in 2025 alone. In the United States it grew fourteen per cent in 2024 with twenty-two and twenty-nine per cent forecast for 2025 and 2026. Accelerated servers were fifteen per cent of global data-centre electricity in 2024; by 2030 AI-focused facilities are forecast to be about half the total.

Three things a business audience should take from this rather than the headline.

First, the numbers are softer than they look. Every historical global figure in this brief is a model output, not a meter reading. The IEA says so explicitly. When an independent review graded over a hundred studies, the estimates for 2020, a year that has already finished, spanned two hundred to twelve hundred terawatt-hours, a factor of six. Projections for 2030 diverge by nearly forty times. And there is a pattern: studies with weak methods produced systematically bigger numbers, averaging 1,013 terawatt-hours for 2023 against 335 from the strong ones. Peer review did not filter this; five of the nine peer-reviewed global estimates since 2014 were graded low or low-medium.

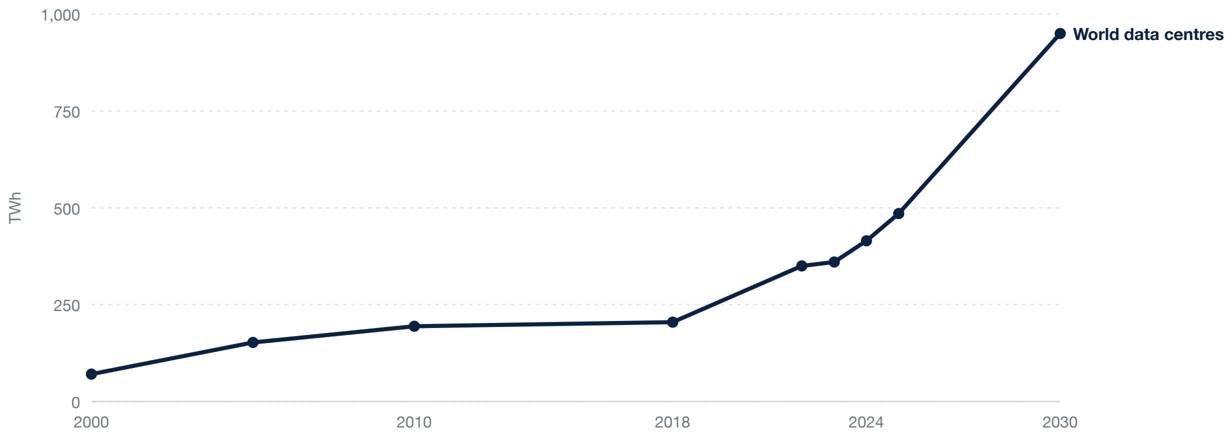
Second, the famous per-query numbers are the weakest part of the field, and the failure is instructive. The figure most people have heard, that a ChatGPT query uses about ten times a Google search, decomposes into three separate errors. The "Google search uses 0.3 watt-hours" anchor comes from a Google blog post of January 2009 which has never been updated. The "ten times" came from an Alphabet chairman talking to Reuters about DOLLARS, not electricity. And the resulting 2.9 watt-hours was published with the words "at most," a hedge that vanished when a consultancy repeated it. When researchers sampled a hundred news articles about AI energy, seventy-five per cent gave a figure with no uncertainty or source and five per cent urged caution. Meanwhile the three organisations that actually did the work by different methods, Google with production telemetry, Microsoft with a peer-reviewed bottom-up model, and Epoch with an independent one, landed at 0.24, 0.31 and 0.30 watt-hours. The convergence is the news; nobody reported it. The honest caveat is that Google's own paper computes 0.24 and 0.10 watt-hours for the same prompts on the same day, purely by changing where the boundary sits, and that a reasoning query measures thirteen times a short one.

Third, cryptocurrency is the control case, and it teaches in both directions. Bitcoin grew from thirteen terawatt-hours in 2017 to about 189 in 2025, which is more than the entire global electric vehicle fleet used in 2024. It is driven by coin price, not by anyone's demand for a service. Then on 15 September 2022 Ethereum changed a consensus rule and removed roughly twenty-one terawatt-hours a year, about two thirds of Ireland's whole annual generation, in a single day. Digital electricity demand is not a law of nature; it is a set of choices. But the disanalogy is just as important. Proof-of-work mining was wasteful by design, which is exactly why it could be deleted without losing anything. AI compute does work that customers are paying for, so there is no equivalent switch to flip, and anyone who suggests otherwise is selling something.

Where does that leave a decision-maker? With a load that is real, growing fast, geographically concentrated, and roughly a sixth AI today heading toward roughly a half by 2030. Also with a load that is smaller than air conditioning's growth, smaller than the world's televisions, and roughly one and a half per cent of world electricity. Both of those sentences are true, and anyone using only one of them is arguing rather than informing.

FIGURE 2.1

World data-centre electricity, 2000 to 2030 (TWh a year)

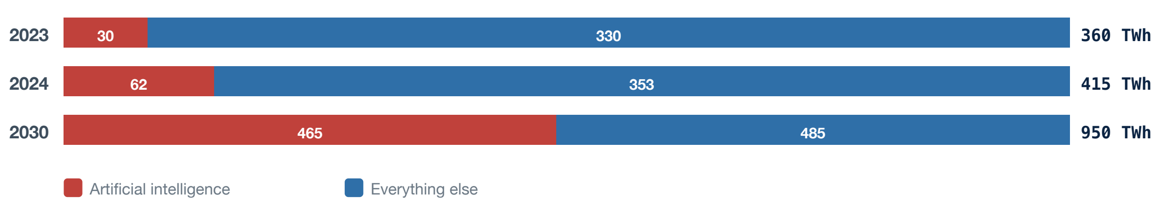


The flat section between 2010 and 2018 is the whole argument of this chapter. Compute grew about sixfold across those eight years and electricity rose about six per cent. The last point is a forecast, not a measurement.

Source: Koomey (2011) to 2005; Masanet et al., *Science* (2020) for 2010 and 2018; International Energy Agency (2025, 2026) from 2022, base case for 2030. The two halves are different studies, so read the step at 2010 with care: Koomey's own midpoint for that year is 237.6 TWh, not 194. Estimates by other authors range wider still, and Appendix G lists them.

FIGURE 2.2

Artificial intelligence as a share of data-centre electricity (TWh)



About eight per cent in 2023, fifteen per cent in 2024, and roughly half by 2030 on the base case. The buildings are not the story. One workload inside them is.

Source: International Energy Agency (2025, 2026); IEA 4E EDNA (2025). No source publishes this split directly. It is assembled from published totals and published shares, and the 2030 row uses a wider definition of an artificial intelligence facility than the earlier rows.

The long series

Read the boundary column before the number column. Four questions decide whether two rows can share an axis: does it count storage and network equipment or only servers; does it count facility infrastructure such as cooling; does it count cryptocurrency mining; does it count telecom networks and end-user devices. A fifth question applies only to crypto, and it bites hard: is this a calendar-year total or an annualised instantaneous rate.

Global, by source lineage

YEAR	TWH	SOURCE (YEAR PUBLISHED)	BOUNDARY	KIND
2000	58	Koomey (2007)	Servers plus cooling and auxiliary only. No storage, no network.	esti-mate
2000	70.8	Koomey (2011), from Koomey (2008)	Servers, storage, communications, infrastructure at PUE 2.0	esti-mate
2005	123	Koomey (2007)	As above, servers only	esti-mate
2005	152.5	Koomey (2011)	Full boundary	esti-mate
2007	216	Van Heddeghem et al. (2014)	Full, plus a 1.25 uplift for orphaned servers, PUE 1.95	esti-mate
2010	194	Masanet et al., Science (2020)	Full, region-specific PUE, closets to hyperscale	esti-mate
2010	203.4 to 271.8 (midpoint 237.6)	Koomey (2011)	Full, PUE 1.83 to 1.92	esti-mate
2012	268 (text rounds to 270)	Van Heddeghem et al. (2014)	Full, PUE 1.83	esti-mate
2014	194	IEA (2017)	Global expansion of the LBNL United States model	esti-mate
2015	245	Malmodin and Lunden (2018)	Data centres PLUS enterprise networks, crypto excluded	esti-mate
2015	397	Andrae and Edler (2015), "expected"	Extrapolation from data-centre internet traffic. Graded LOW quality.	esti-mate
2017	704	Belkhir and Elmeligi (2018)	Extrapolation at 12 per cent a year from a 2008 figure. Graded LOW.	esti-mate
2018	205	Masanet et al., Science (2020)	Full boundary. About 1 per cent of world electricity.	esti-mate
2018	200	IEA (2019 to 2023 series)	Full boundary	esti-mate
2020	223	Malmodin et al. (2024)	Data centres including support activities, crypto excluded	esti-mate
2020	345 to 1,200	Andrae and Edler (2015) forecasts	Forecast made in 2015. It did not happen.	fore-cast
2022	350	IEA (2024)	Excludes crypto. 460 TWh including crypto.	esti-mate
2022	375	SemiAnalysis (2024)	Bottom-up from 3,000 sites. Graded HIGH but with high assumed utilisation.	esti-mate
2023	300 to 380	Kamiya and Coroama, IEA 4E EDNA (2025)	Excludes crypto. Triangulated three ways.	esti-mate
2023	360	IEA, Energy and AI (2025)	Excludes crypto, networks and devices	esti-mate

YEAR	TWH	SOURCE (YEAR PUBLISHED)	BOUNDARY	KIND
2024	415	IEA (2025)	Same. About 1.5 per cent of world electricity.	esti-mate
2025	485	IEA (2026)	Same	esti-mate
2030	950 (range 670 to 1,260)	IEA (2026) Base Case, four cases	Same	fore-cast
2035	1,200 (range 700 to 1,720)	IEA (2025), four cases	Same	fore-cast

Three warnings on that table. First, Koomey's 2010 midpoint of 237.6 TWh and Masanet's 194 TWh are different models, not a revision of one another, and the 44 TWh gap for the same year is the honest measure of how much model choice matters. Second, the 220 TWh often attributed to Malmodin and Lunden for 2015 is a third party's back-out; the paper's own table says 245 TWh for data centres plus enterprise networks. Third, the 2030 rows are scenarios, and the IEA 4E review advises against projections reaching more than five years ahead.

United States, the best documented series in the world

The Energy Act of 2020 requires the United States Department of Energy to publish this, which is why it exists.

YEAR	TWH	SHARE OF UNITED STATES ELECTRICITY	SOURCE	KIND
2000	28.2	0.82 per cent	Koomey (2011)	esti-mate
2005	45 (servers only) / 56.0 (full)	1.2 / 1.53 per cent	Koomey (2007) / Koomey (2011)	esti-mate
2006	61	1.5 per cent	EPA Report to Congress (2007)	esti-mate
2008	69	1.8 per cent	Masanet et al. (2011)	esti-mate
2010	76.4 (range 67.1 to 85.6)	about 2 per cent	Koomey (2011)	esti-mate
2014	70 / 60	1.8 per cent	LBNL 2016 report / LBNL 2024 report, revised	esti-mate
2016	60	not stated	LBNL 2024 report	esti-mate
2018	76	1.9 per cent	LBNL 2024 report	esti-mate
2020	73 (a 2016 forecast)	not stated	LBNL 2016 report "current trends"	forecast
2023	176	4.4 per cent	LBNL 2024 report	esti-mate
2024	192	4.7 per cent	LBNL 2025 Update	esti-mate

YEAR	TWH	SHARE OF UNITED STATES ELECTRICITY	SOURCE	KIND
2024	180	about 4 per cent	IEA (2025)	esti-mate
2028	464 (Reference) / 325 to 580	not stated / 6.7 to 12.0 per cent	LBNL 2025 Update / LBNL 2024 report	forecast
2030	649 (range 521 to 843)	11.8 per cent (9.5 to 15.3)	LBNL 2025 Update	forecast

Note two disagreements that are worth showing students. The same laboratory put 2014 at 70 TWh in 2016 and at about 60 TWh in 2024, a 17 per cent revision from updated shipment data. And the IEA and LBNL differ by 12 TWh for the United States in 2024, the same country in the same year.

The inflection points

Mainframes and early servers, 1946 to 1999. No credible global electricity series exists. What is documented is efficiency: computations per kilowatt-hour doubled about every 1.57 years from ENIAC in 1946 to 2009, measured across 76 machines with an R-squared of 0.983 (Koomey, Berard, Sanchez and Wong, 2009 and 2011). ENIAC managed 437 computations per kilowatt-hour on 150,000 watts. The whole modern debate rests on a series that only begins in 2000.

The dot-com build-out and the internet-electricity myth, 2000 to 2005. World consumption roughly doubled, from 70.8 to 152.5 TWh, about 16.6 per cent a year. Almost all of it came from the sheer number of cheap volume servers, which went from 19.7 to 50.5 TWh worldwide; power per box barely moved. United States server shipments grew 15 per cent a year, nearly doubling the installed base. **Why the curve bent upward:** the internet was being built, and each new service needed its own physical machine. This is also the era of the field's biggest public error, covered in its own section below.

Rapid growth meets the financial crisis, 2005 to 2010. World consumption rose about 56 per cent rather than doubling, to a midpoint of 237.6 TWh, about 9.3 per cent a year. The United States rose about 36 per cent. **Why the curve bent downward:** the 2008 to 2009 recession cut server purchases hard, server virtualisation arrived and let one physical box carry many workloads, and cost pressure made operators care about efficiency for the first time. American server shipment growth fell from 15 per cent a year to 5 per cent. The IEA dates the decoupling of data-centre electricity from digital service demand to 2007 and 2008.

The efficiency plateau, 2010 to 2018. From 194 to 205 TWh, about 0.7 per cent a year, while compute instances grew about 550 per cent, storage capacity 25-fold and internet traffic more than tenfold. **Why the curve went flat:** four offsets, quantified in the next section. This is the central fact of this dimension and the thing most commentary still gets wrong in both directions.

The cryptocurrency surge, 2017 onward. Bitcoin went from about 13 TWh in 2017 to about 96 TWh in 2022 and about 189 TWh in 2025, roughly 49 per cent a year over the first five years. **Why the curve bent:** nothing to do with demand for a service. Mining hardware is added whenever the coin price exceeds the electricity cost of running it. It appeared outside every official data-centre statistic and remains outside them.

The Merge, 15 September 2022. Ethereum switched from proof of work to proof of stake and removed roughly 21 TWh a year of demand in one day, about two thirds of Ireland's entire annual generation. **Why the**

curve bent: a rule change. This is the counter-example that stops anyone treating digital demand as a law of nature, and the disanalogy matters as much as the analogy, because proof of work was wasteful by design while AI compute does work people are paying for.

The artificial intelligence inflection, 2022 to 2026. From 350 TWh in 2022 to 485 TWh in 2025, about 11.5 per cent a year, accelerating to 17 per cent in 2025 alone, with AI-focused facilities up 50 per cent in that year. In the United States: 14 per cent in 2024, a forecast 22 per cent in 2025 and 29 per cent in 2026. **Why the curve bent:** the offsets ran out at the same moment the demand arrived. That is the whole story, and it is the next section.

The projected decade, 2026 to 2030. The IEA Base Case doubles global consumption to 950 TWh, about 14.4 per cent a year, with AI-focused facilities more than tripling to about 465 TWh. Accelerated server electricity grows 30 per cent a year against 9 per cent for conventional servers. Treat every number after 2026 as a scenario.

Why it was flat, and why it broke

The four offsets that held the line, quantified

1. Migration out of enterprise rooms. In 2014 more than 60 per cent of American server energy sat in internal company data centres. By 2023 that was nearly 10 per cent, with hyperscale and colocation facilities taking almost 80 per cent, and by 2028 internal facilities fall below 2 per cent (LBNL, 2024). This mattered because of utilisation: LBNL modelled internal data centres at 10 per cent average server utilisation against 45 per cent for hyperscale. Moving a workload from a 10 per cent box to a 45 per cent box removes roughly four servers.

2. Virtualisation and utilisation. Virtualisation, which lets one physical server carry many independent workloads, arrived between 2005 and 2010 and is the main reason American server shipment growth fell from 15 per cent a year to 5 per cent and then to 3 per cent after 2010 (LBNL, 2016).

3. Falling power usage effectiveness. At the time of the 2007 EPA Report to Congress the average was 2.0, meaning every kilowatt-hour reaching the servers needed another for cooling and power conversion. Some sites measured above 3.0. By 2014 the American fleet average was 1.6, by 2024 it was 1.45, and by 2030 it is forecast at 1.36. The gains came almost entirely from the shift to big buildings, not from improving small ones: LBNL's 2014 modelling put hyperscale at 1.2 and a server room at 2.5, and the best hyperscale operators were already recording 1.1 or less by 2016.

4. Chip efficiency, Koomey's law. Computations per kilowatt-hour doubled about every 1.57 years from 1946 to 2009. Energy per compute instance fell about 20 per cent a year through the 2010 to 2018 plateau (Masanet et al., 2020).

The counterfactual that prices all four. LBNL froze American industry efficiency at 2010 levels (server utilisation 14 per cent, idle draw 59 per cent of maximum, 11.3 watts per hard disk drive, weighted average PUE 1.89) while letting chip performance keep improving. Result: 2014 consumption would have been 60 per cent higher and 2020 consumption 170 per cent higher, a saving of about 620 TWh over the decade (LBNL, 2016). That is roughly Canada's entire annual generation, saved by engineering that nobody wrote about.

Why they stopped working

Koomey's law slowed first. After about 2000 the doubling time for peak-output computations per kilowatt-hour stretched from roughly 1.5 years to about 2.6 years, as Dennard scaling ended (Koomey and Naffziger, 2016). Note also the metric's own caveat: Koomey's law measures peak output, and servers in typical business applications run near full load only 5 to 15 per cent of the time.

The migration lever is spent. With internal data centres already down to a few per cent of American server energy, there is almost nothing left to move.

The PUE lever is spent. American facilities serving AI equipment were at 1.145 in 2024 and are forecast to reach 1.136 in 2030. That is a 0.8 per cent improvement over six years. A hyperscaler at 1.1 has at most 10 per cent of overhead left to remove, ever.

Accelerator power went vertical. NVIDIA's Tesla P100 drew 300 watts in 2016 and its V100 the same in 2017. The A100 reached 400 watts in 2020, the H100 700 watts in 2022, the B200 1,200 watts in 2024, and the B300 and AMD's MI355X 1,400 watts in 2025. That is a 4.7-fold rise in nine years, at the same time as the number of chips was rising and PUE had stopped falling. Three multiplicative terms, all pointing the same way.

Density followed. AI server power density rose elevenfold between 2020 and 2025 and is set to rise a further fourfold by 2027, when a single rack the physical size of a large refrigerator could peak at the demand of 65 households (IEA, 2026). At server level, average annual power draw of an eight-GPU server passes 4 kilowatts by 2026 (LBNL, 2025 Update).

And idle power turned out to matter more than anyone assumed. LBNL cut its assumed AI inference utilisation from 40 per cent to about 20 per cent by 2030, because inference is user-facing and must be sized for peak demand, so it idles between peaks. Industry experts told LBNL idle draw could reach 50 per cent of rated power in latency-sensitive facilities against the 20 per cent LBNL assumes. That single assumption moves the 2030 American forecast by more than 20 per cent, from 649 to 782 TWh.

The breakdown

By segment, the chart that matters

No published source gives a clean four-way split of traditional, cloud, crypto and AI in terawatt-hours across a run of years. The IEA says why: there is no comprehensive data on workload shares, colocation and cloud operators often cannot see what runs in their own halls, and definitions of AI differ. What follows is assembled from published totals and published AI shares, with every derivation labelled. It should be charted with the caveat on the face of the chart.

YEAR	TOTAL DATA CENTRES (TWH)	AI (TWH)	NON-AI DATA CENTRES (TWH)	CRYPTO, SEPARATE BAND (TWH)
2020	not verified	not verified	not verified	71 (Bitcoin only; about 78 including Ethereum)
2022	350	not verified	not verified	96
2023	360	30 (range 10 to 50)	330	121

YEAR	TOTAL DATA CENTRES (TWH)	AI (TWH)	NON-AI DATA CENTRES (TWH)	CRYPTO, SEPARATE BAND (TWH)
2024	415	62 (derived: 15 per cent of 415)	353	159
2025	485	not published as a level	not derivable	189
2030	950	465 (IEA facility basis) or 200 to 400 (EDNA hardware basis)	485	not forecast here

Sources: IEA Energy and AI (2025) and Key Questions (2026) for totals and the 15 per cent accelerated-server share; Kamiya and Coroama, IEA 4E EDNA (2025) for the AI ranges; Cambridge Bitcoin Electricity Consumption Index v1.8.0 for crypto calendar-year totals. Crypto sits OUTSIDE the IEA and LBNL data-centre totals, so it is a band on top, never inside.

The 2030 row deserves a moment. The IEA's 465 TWh counts AI-FOCUSED FACILITIES, including their cooling and their conventional servers. EDNA's 200 to 400 TWh counts AI HARDWARE. Both are defensible; they are answering different questions, and the gap between them is roughly the non-AI equipment sitting inside AI buildings.

By share

YEAR	MEASURE	VALUE	SOURCE
2023	AI share of global data-centre electricity	10 per cent (range 5 to 15)	IEA 4E EDNA (2025)
2024	Accelerated servers, share of total data-centre electricity	15 per cent	IEA (2025)
2024	Accelerated servers, share of server electricity	24 per cent	IEA (2025)
2030	AI share of global data-centre electricity	35 to 50 per cent	IEA 4E EDNA (2025)
2030	AI-focused facilities, share of the 950 TWh total	about 49 per cent	derived from IEA (2026)
2030	AI servers, share of total United States data-centre electricity	55 per cent	LBNL 2025 Update
2030	AI servers, share of United States SERVER electricity	84 per cent	LBNL 2025 Update

Training against inference, where two authoritative sources disagree

YEAR	TRAINING	INFERENCE	SOURCE
2023	about 40 per cent	nearly 60 per cent	LBNL 2024 report, United States
2028	50 to 53 per cent	47 to 50 per cent	LBNL 2024 report forecast, United States
2024	about 35 per cent	about 65 per cent	LBNL 2025 Update, on Omdia data, United States
2030	about 20 per cent	about 80 per cent	LBNL 2025 Update forecast, United States

Eighteen months apart, the same laboratory forecast training rising to about 52 per cent by 2028 and then falling to about 20 per cent by 2030. This is not a data correction. It is a change of view about where AI activity and spending go, and the newer report follows industry feedback that inference now dominates both. Chart both lines and let students argue about which is right. Use the newer one and say so.

The perspective number: every large AI model ever trained accounts for about 1.7 TWh cumulatively across 283 models. Against 485 TWh of data-centre electricity a year, all frontier training in history is about 0.35 per cent of a single year.

By data-centre type

Two different bases. Do not mix them.

BASIS	YEAR	ENTERPRISE OR INTERNAL	HYPERSCALE PLUS COLOCATION	SOURCE
Share of United States SERVER ENERGY	2014	over 60 per cent	not split in the text	LBNL 2024 report
Share of United States SERVER ENERGY	2023	nearly 10 per cent	almost 80 per cent	LBNL 2024 report
Share of United States SERVER ENERGY	2028	below 2 per cent	over 90 per cent	LBNL 2024 report
Share of GLOBAL INSTALLED CAPACITY	2025	not published	hyperscale 48 per cent	Synergy Research (April 2026)
Share of GLOBAL INSTALLED CAPACITY	2031	not published	hyperscale 67 per cent	Synergy Research (April 2026)

The only published terawatt-hour split by data-centre type that could be verified is the World Bank and ITU's 2022 figure: colocation 110 TWh, cloud 53 TWh, content 32 TWh, totalling 195 TWh. It EXCLUDES enterprise data centres entirely, which is why it sits well below the IEA's 350 TWh for the same year. The roughly 155 TWh gap is a rough measure of the enterprise and unreported remainder.

By server type

MEASURE	2018	2024	2030
United States installed servers, total (millions)	16.3	30.9	48.6 (Reference Case)
of which accelerated (millions)	almost none	4.2	19.0, about 40 per cent
United States AI server electricity (TWh)	not published	50 to 75	about 357 (derived: 55 per cent of 649)
United States infrastructure share of data-centre electricity	36 per cent	31 per cent	falling
United States networking share	3.4 per cent	4.5 per cent	roughly constant

Globally, accelerated server electricity grows 30 per cent a year to 2030 against 9 per cent for conventional servers. Accelerated servers deliver almost half the net increase in total data-centre electricity, and about 70 per cent of the increase in server electricity alone (IEA, 2025).

By end-use industry

Not verified, and not manufactured. No credible published breakdown of data-centre electricity by customer industry (finance, telecoms, healthcare, government, retail, media and streaming) could be found. This cut is genuinely absent, for a structural reason the IEA states plainly: colocation and cloud operators often have limited visibility over the workloads running in their own facilities, so nobody holds the data. Vendor reports on IT SPENDING by industry vertical exist, but spending is not electricity, and converting one to the other would be invention. Any chart a student meets showing data-centre electricity by end-use industry should be treated as unsourced until proven otherwise.

Context anchors

Against whole countries and the world

COMPARISON	TWH	YEAR	SOURCE
World electricity generation	31,734	2025	Ember (2026 release)
ALL data centres worldwide	485	2025	IEA (2026)
ALL data centres worldwide, 2030 Base Case	950	2030	IEA (2026)
Japan, total generation	1,030	2025	Ember (2026)
Canada, total generation	652	2025	Ember (2026)
Germany, total generation	500	2025	Ember (2026)
United Kingdom, total generation	292	2025	Ember (2026)
Netherlands, total generation	135	2025	Ember (2026)
Ireland, total generation	31	2025	Ember (2026)

So: global data centres in 2025 used about 74 per cent of everything Canada generates, about 97 per cent of Germany's output, and about 3.6 times the Netherlands'. The 2030 Base Case is about 1.5 times Canada's entire system and about 92 per cent of Japan's. Ireland already gives about 22 per cent of its metered electricity to data centres.

Against other loads

COMPARISON	TWH	YEAR	SOURCE
Global electric vehicle fleet, charging	180	2024	IEA Global EV Outlook (2025)
Global electric vehicle fleet, 2030 Stated Policies	780	2030	IEA Global EV Outlook (2025)
Bitcoin mining	189	2025	Cambridge CBECI v1.8.0
All cryptocurrencies	125	2023	IEA (2025)
Telecommunication networks	280	2023	IEA (2025)
End-user devices (computers, phones, connected devices)	440	2023	IEA (2025)
Televisions, peripherals and cable networks	500	2023	IEA (2025)
Entire information and communication technology sector	over 1,000	2023	IEA (2025)
Growth in space cooling electricity, 2014 to 2024	+700	2024	IEA (2025)

COMPARISON	TWH	YEAR	SOURCE
Growth in data-centre electricity, 2014 to 2024	+250	2024	IEA (2025)

Three of these are worth saying out loud in a classroom. Data centres in 2024 used more than twice the electricity of every electric vehicle on earth. In 2023 end-user devices used MORE electricity than all the world's data centres, and televisions used more still. And over the decade in which data centres added 250 TWh, air conditioning added 700 TWh, which got a fraction of the coverage.

On heavy industry and aviation, honesty is required. Global steel and cement electricity in terawatt-hours could not be verified from a primary source, and cement is dominated by thermal fuel rather than electricity, so an electricity-only comparison would mislead. The defensible statement is the IEA's own: by 2030 the United States is set to consume more electricity for data centres than for the production of aluminium, steel, cement, chemicals and all other energy-intensive goods combined. Aviation runs on jet fuel, so there is no honest terawatt-hour comparison at all; on carbon, data-centre electricity emitted about 180 million tonnes of CO_2 in 2024, but the corresponding aviation figure was not verified here and is therefore not given.

Per unit

ITEM	ENERGY	BOUNDARY	SOURCE	VERDICT
Median Gemini text prompt	0.24 Wh	Full facility: accelerator, host processor and memory, idle reserve, overhead	Google (August 2025)	SOLID
The SAME prompts	0.10 Wh	Accelerator silicon only, best tenth of sites	Google (August 2025)	SOLID
Median text prompt	0.31 Wh (IQR 0.16 to 0.60)	Full facility, bottom-up	Oviedo et al., Joule (2026)	SOLID, peer reviewed
Typical ChatGPT query	0.3 Wh	Modelled, GPT-4o assumed	Epoch AI (February 2025)	SOLID as a model
Average ChatGPT query	0.34 Wh	Unstated	Sam Altman (June 2025)	WEAK
Reasoning query	3.91 Wh (IQR 2.15 to 7.05)	Full facility	Oviedo et al., Joule (2026)	SOLID
Agentic query with reasoning	about 50 Wh	GPU only, indicative	IEA (2026), their figure 2.1	ORDER OF MAGNITUDE ONLY
Six-second AI video	115 Wh	GPU only, lab	IEA (2025)	SOLID but not comparable
"A ChatGPT request"	2.9 Wh	Derived, not measured	de Vries (2023) via EPRI (2024)	DISPUTED, do not use
A Google web search	0.3 Wh	Per search including index building	Google blog, 12 January 2009	OBSOLETE
Charging a smartphone	15 Wh		IEA (2025)	SOLID
Charging a laptop	60 Wh		IEA (2025)	SOLID
An hour of television	100 Wh	at about 100 watts	Google (2025)	SOLID

ITEM	ENERGY	BOUNDARY	SOURCE	VERDICT
Boiling one litre of water	about 110 Wh		derived physics; Murray et al., Applied Energy (2016)	SOLID as physics
Driving an electric car one kilometre	186 Wh	2024 Tesla Model 3 Performance AWD, EPA combined	fueleconomy.gov	SOLID for that model

Useful ratios on Google's measured figure: one kettle boil is about 458 prompts, one kilometre of electric driving about 775 prompts, one phone charge about 62 prompts, and one prompt is about nine seconds of television.

Training energy, for completeness: GPT-3 took 1,287 megawatt-hours and 552.1 tonnes of CO2e (Patterson et al., 2021). The IEA estimates GPT-4 at 42.4 gigawatt-hours on a full-facility basis for training compute of 2.2e25 calculations. Llama 3.1 405B took 30.84 million GPU-hours and 8,930 tonnes of CO2e location-based, or zero market-based because Meta matches its electricity with renewables; note that the widely quoted 11,390 tonnes is the whole model family, not the 405B alone, and Meta publishes no megawatt-hour figure at all.

Contested or uncertain figures

This section matters more here than in any other dimension of the pack.

The whole historical series is modelled, not measured. The IEA states plainly that all historical data on global data-centre consumption are estimates. Very few governments require reporting, and operators do not disclose data-centre electricity specifically.

The 2020 estimates span a factor of six. From about 200 terawatt-hours to 1,200. For 2030 the spread is nearly forty times. Studies graded low quality averaged 1,013 terawatt-hours for 2023; high-quality studies averaged 335 (IEA 4E EDNA, 2025).

Koomey's 2010 figure and Masanet's 2010 figure differ by 44 TWh (237.6 against 194) for the same year. They are different models, not a revision. Never treat one as superseding the other without saying so.

LBNL revised its own 2014 estimate down by about 17 per cent between its 2016 and 2024 reports, from 70 to about 60 TWh.

The IEA and LBNL disagree about the United States in 2024 by 12 TWh, 180 against 192.

LBNL contradicts itself on training against inference. The 2024 report forecast training rising to 50 to 53 per cent of AI server energy by 2028. The 2025 Update forecasts training falling to about 20 per cent by 2030. Both are current publications from the same laboratory.

The AI share depends entirely on what "AI" means. Accelerated-server electricity in 2024 was about 62 TWh. AI-focused FACILITIES in 2030 are 465 TWh on the IEA's basis and 200 to 400 TWh on EDNA's. These are different boundaries answering different questions.

Per-query energy figures span a factor of 400, from 0.10 to about 40 watt-hours, and almost none of that is disagreement about physics. The drivers are: where the boundary sits (Google gets 0.10 or 0.24 for the same prompts), whether idle reserve capacity is counted, whether requests are batched (academic benchmarks often are not, and batching roughly halves per-task energy), how long the answer is, whether a reasoning model is thinking, whether a median or a mean is reported, and the fact that no closed model discloses its size, hardware or location.

The 2.9 watt-hour figure is disputed and should not be used as current. Its chain is documented in full in the data file and the manifest.

The "500 millilitres per conversation" water claim is a misquotation. The paper says 500 millilitres per ten to fifty medium-length responses, which is roughly 10 to 28 millilitres each, for GPT-3 in specific American data centres. The paper's own headline total moved 54 per cent between its versions. Water figures are the least comparable numbers in the field: Google's measured 0.26 millilitres is about 173 times below Mistral's audited 45 millilitres, mainly because of boundary.

The Llama 3.1 emissions figure is routinely misattributed. 11,390 tonnes is the whole model family; the 405B model alone is 8,930 tonnes location-based and zero market-based. Meta publishes no energy figure, so any megawatt-hour number for Llama is somebody's arithmetic, and the two published attempts differ by a factor of two.

Cryptocurrency has two separate traps. First, the headline Cambridge number is an ANNUALISED INSTANTANEOUS RATE, not a calendar-year total: on 2 September 2026 the live rate was 150.9 terawatt-hours a year while the 2025 calendar total was 188.6. Second, Cambridge serves five model vintages simultaneously, and 2021 Bitcoin is 89.0 terawatt-hours on the current model against 104.0 on the old one, a 17 per cent difference from methodology alone. Digiconomist reads about 35 per cent higher than Cambridge and has been frozen at an unchanged value for 259 days; its Ethereum index reads exactly zero from 6 May 2026 and should not be cited live.

The four published Merge reduction percentages are not variants of one number. 99.84 per cent is de Vries's most conservative bound; 99.95 per cent is an Ethereum Foundation forecast made sixteen months BEFORE the Merge; 99.988 per cent is the Crypto Carbon Ratings Institute's measurement; 99.99 per cent is Cambridge's day-of-Merge figure. Name the owner when you quote one.

The IEA has no crypto figure after 2023. Its only published number is about 125 terawatt-hours for 2023. Also, on the same page, DATA CENTRES grew by over 90 terawatt-hours between 2020 and 2023 while CRYPTOCURRENCY grew by over 50; the two are frequently swapped.

Could not be verified at all: any breakdown of data-centre electricity by end-use industry; global steel and cement electricity in terawatt-hours; a global level (as opposed to growth) for residential air conditioning electricity; global aviation for a carbon comparison; the energy of an LED bulb-hour or a laundry load from a primary source. None of these were invented.

Could not be obtained: the Masanet et al. Science paper itself, the Koomey et al. IEEE Annals paper itself, and the Malmodin et al. Telecommunications Policy paper itself are all paywalled. Their headline figures here come from freely available companion documents by the same authors and from the IEA 4E review's reading, both of which are in the downloads folder. Two citation corrections came out of this: Malmodin et al. 2024 is in Telecommunications Policy, not the Journal of Industrial Ecology, and the "1.57 years" of Koomey's law is verified in the 2009 companion report rather than in the 2011 article text.

Open questions students could investigate

1. LBNL reversed its own training-versus-inference forecast in eighteen months. Which report is right, and what evidence would settle it? What would a cloud provider's revenue mix tell you that a shipment forecast cannot?
2. Idle power at AI inference facilities is assumed at 20 per cent of rated power by LBNL and hypothesised at 50 per cent by industry practitioners. That single number moves the 2030 American forecast by more than 20 per cent. How would you measure it, and who has the incentive to?
3. The four offsets that produced the flat decade are exhausted. Name the next four. Which of liquid cooling, custom silicon, model right-sizing, sparsity, load shifting or something not yet invented could plausibly deliver another 620 terawatt-hours of avoided demand?
4. If per-task AI energy really is falling by an order of magnitude a year, as the IEA says, why is total energy rising? Work through the Jevons argument with the numbers in this file and decide whether it holds.
5. Ethereum deleted 21 terawatt-hours a year with a rule change. Is there any analogous lever in AI? Consider inference-time compute budgets, mandatory model right-sizing, or disclosure requirements, and estimate what each could plausibly save.
6. Build the segment chart yourself from the data file, then write the two-sentence caveat that has to appear on it. Which parts of the split are published, which are derived, and which do not exist?
7. Studies with weak methods systematically produced bigger numbers. Why would that be? What does it imply about how to read the next forecast that crosses your desk?
8. Canada generates 652 terawatt-hours a year. Global data centres will use around 950 by 2030. What share of that could Canada realistically host, given the provincial reserve margins in dimension 10, and what would it do to Canadian electricity prices?
9. Data centres in 2024 used more than twice the electricity of the global electric vehicle fleet, and end-user devices used more than data centres. Why does one of these get the coverage and the others do not, and does that misallocation of attention have policy consequences?

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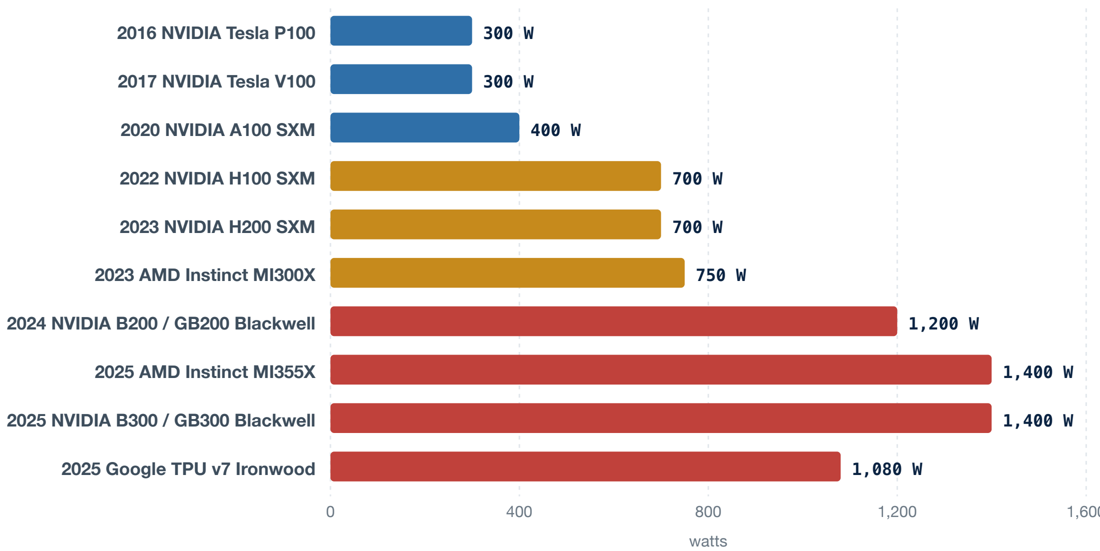
FIGURE 2.3

Power drawn by a single accelerator

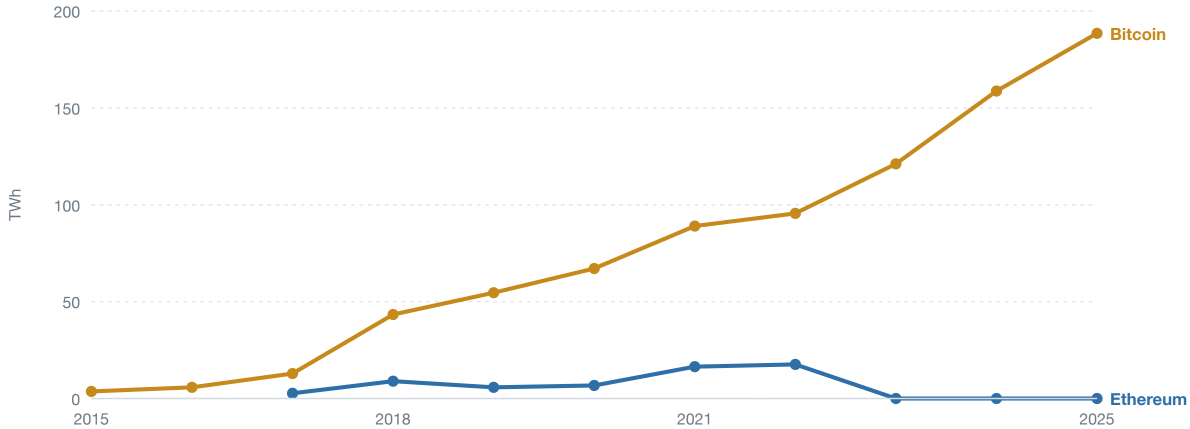


The offset that held the line for a decade was efficiency. This is the force pushing the other way, and it is not incremental.

Source: Manufacturer specifications for each part, compiled 2026.

FIGURE 2.4

Cryptocurrency mining electricity (TWh a year)



On 15 September 2022 Ethereum changed its consensus rule and its electricity use fell by more than 99.8 per cent in a day, from roughly seventeen terawatt hours a year to a few gigawatt hours. A country-sized digital load was erased by a software decision. It is the only clean evidence anyone has that this kind of demand is reversible.

Source: Cambridge Bitcoin Electricity Consumption Index (2026). Crypto sits outside the data-centre totals in the other figures, never inside them.

03

CHAPTER 3

The world: is Canada actually cheap, actually clean, and actually big?

Every Canadian pitch for this industry rests on three adjectives. This chapter turns them into ranked numbers against the countries Canada is competing with, and one of the three answers is uncomfortable.

2.06% Canada's share of world electricity generation. Seventh by generation, tenth by capacity. The country is clean and cheap, but it is not big.

WHAT THIS CHAPTER ANSWERS

- ? How large is Canada's electricity system next to the countries bidding for the same projects?
- ? Is Canadian power genuinely the cheapest, or only cheap?
- ? How clean is the grid once you agree which carbon number you are using?
- ? Where in the world is there actually spare room, and is any of it in Canada?

KEY TAKEAWAYS

- Canada generated 652 TWh of electricity in 2025 from 156 GW of installed capacity: seventh in the world by generation and tenth by capacity, with 2.06 per cent of world generation and 1.53 per cent of world capacity (Ember Yearly Electricity Data, 2026 release, and Statistics Canada Table 25-10-0022 for the 156.4 GW cross-check). Canada is not big. It is a mid-sized system that looks large only because its population is small.
- China added 315 GW of solar and 119 GW of wind capacity in 2025 alone. That single year of Chinese additions is 2.8 times Canada's entire installed generating fleet. Canada added about 1.1 GW of non-emitting capacity in the same year (Ember, 2026 release).
- Canada's industrial electricity price in 2024 was 6.72 Canadian cents per kWh, or 4.91 United States cents at the Bank of Canada 2024 average rate. The United States industrial average that year was 8.13 United States

cents. Canadian industry pays about 60 per cent of what American industry pays (Statistics Canada Table 25-10-0021; US EIA Electric Power Monthly Table 5.3).

- At the largest published customer profile, 50,000 kW of demand and 30.6 GWh a month, Montreal charges 5.52 Canadian cents per kWh and Winnipeg 5.09, against 12.66 in Toronto, 12.90 in Houston, 22.88 in New York and 24.58 in Boston. In United States cents that is Montreal 3.85 against Houston 8.99 and Boston 17.13 (Hydro-Quebec, 2025 Comparison of Electricity Prices in Major North American Cities, rates in effect 1 April 2025, excluding taxes).
- Canada is not the cheapest place in the rich world. Finland's large-industrial price was 4.70 United States cents per kWh in the second half of 2025 and Norway's 5.28 on the same Eurostat band IF basis, both below Canada's national industrial average. On the band IG basis for consumers above 150 GWh a year, Norway is 4.61 United States cents (Eurostat nrg_pc_205, 2025-S2, excluding taxes).
- Ireland, the European data-centre capital, has the most expensive large-industrial power in the European Union: 16.80 euro cents per kWh at band IF and 15.62 at band IG in the second half of 2025, which is 18.97 and 17.64 United States cents. Data centres take about 22 per cent of Ireland's metered electricity (Eurostat 2025-S2; IEA, Electricity 2026).
- Canada is fifth in the world on non-emitting share of generation among countries producing more than 100 TWh, at 77.0 per cent in 2025, behind Norway 99.0, Sweden 98.8, France 94.8 and Brazil 88.7, and well ahead of the United States 43.0 and China 41.6 (Ember, 2026 release).
- On carbon intensity Canada is genuinely clean but not as clean as the usual number implies. Ember, on a lifecycle basis, puts Canada at 190.7 grams of CO_2 per kWh in 2025, twelfth among the 48 countries generating more than 50 TWh, behind Norway 28, Sweden 35, France 42, Brazil 110 and Spain 154. Environment and Climate Change Canada, on an operational basis, reports about 86 grams for 2024. Both are correct on their own method and must never be mixed (Ember 2026; Canadian Climate Institute, 440 Megatonnes, on the 2026 National Inventory Report).
- The competitive set of countries that are both cheap and clean is small and Canada is in it: Norway, Sweden, Finland, France, Quebec and Manitoba within Canada, and Iceland at very small scale. Everywhere else is cheap and dirty (Texas, Malaysia, the Gulf), or clean and expensive (Denmark, Ireland, Germany), or neither.
- Canada's spare room is in the wrong provinces. NERC's 2025 Long-Term Reliability Assessment gives Alberta an anticipated reserve margin of 36.2 per cent in 2026-27 against a reference level of 11.8, but puts Quebec at 15.6 per cent falling to 11.5 by 2030-31 against a reference level of 12.2, with an explicit warning of winter shortfalls, and Manitoba at 1.2 per cent by 2030-31 against a 12.0 target. The cheapest, cleanest provinces have the least headroom (NERC LTRA 2025, published January 2026).
- Canada's roughly 1.4 GW of live data-centre capacity is about 1.4 per cent of the world's roughly 103 GW, against about 29 GW in the United States on a comparable consumption basis. Canada's 20 GW of proposed projects, if all built, would be larger than the entire announced Stargate programme and roughly one fifth of today's global installed base. The federal government itself says most of it "is not expected to proceed" (DC Byte via BLG 2026; JLL 2026; IDCA 2026; Canadian Press, July 2026).
- The gap between announced and operational sovereign AI capacity worldwide is roughly 30 to 1. About 25 to 30 GW has been announced across Stargate, the UAE campus, HUMAIN, France, the European Union gigafactories, the United Kingdom, Korea and Canada. Verified live capacity from those programmes is under 1 GW, of which Stargate's Abilene site is 0.3 GW (OpenAI; Epoch AI, April 2026).

Narrative

The claim that Canada should attract a large share of the world's new AI data centres rests on three adjectives: cheap power, clean power, lots of it. Each one is testable. Two of the three hold up. The third does not, and the way the first two interact with the third is the actual strategic problem.

Start with size, because it disciplines everything else. Canada generated 652 terawatt hours of electricity in 2025 from about 156 gigawatts of installed capacity. That makes it the seventh largest producer in the world and the tenth largest by capacity, with 2.06 per cent of global generation. Statistics Canada and Ember, working independently, agree on the capacity figure to within one per cent, which is reassuring. But the ranking flatters. Canada is roughly the same size as South Korea and smaller than Russia, Japan and India. China generates sixteen times more.

The number that should reframe the whole conversation is the rate of addition. In 2025, China added 315 gigawatts of solar capacity and 119 gigawatts of wind. That single year of Chinese additions is 2.8 times the entire Canadian generating fleet, built from scratch, in twelve months. In the same year Canada added about 1.1 gigawatts of non-emitting capacity: 0.1 gigawatts of solar and 0.3 of wind. Canada's whole national build rate is a rounding error against the pace of its largest competitor. Any strategy that assumes Canada can out-build anyone is not a strategy.

Now price, which is where the real advantage lives and where the debate is most often misled. There are at least four different numbers that people call "the electricity price" and they differ by a factor of five. A residential customer in Montreal pays 8.29 Canadian cents per kilowatt hour. A small business pays 12.08. A medium industrial customer at 500 kilowatts pays 14.70. A 5,000 kilowatt industrial customer pays 5.83, and a 50,000 kilowatt customer pays 5.52. The large-power price is one third of the medium-power price in the same city, in the same month, from the same utility. Comparing a residential number in one country with an industrial number in another produces conclusions that are wrong by hundreds of per cent, and this happens constantly in press coverage of data centres.

Done properly, Canada's advantage is real. Statistics Canada reports an implied industrial price for mining and manufacturing of 6.72 Canadian cents per kilowatt hour in 2024, which is 4.91 United States cents. The United States Energy Information Administration reports 8.13 United States cents for the same year on the same conceptual basis, revenue divided by volume for the industrial class. Canadian industry pays about sixty per cent of what American industry pays. Hydro-Quebec's annual city comparison, the only source that puts twenty-two North American utilities on a single customer profile and a single exchange rate, gives the same answer at the level that matters for a data centre: at a 50,000 kilowatt profile, Montreal is 5.52 Canadian cents, Winnipeg 5.09 and Vancouver 6.72, against Toronto 12.66, Houston 12.90, New York 22.88 and Boston 24.58.

But Canada is not the world's cheapest. Eurostat's band IF and band IG series, which cover exactly the consumption levels a data centre reaches, put Finland at 4.16 euro cents per kilowatt hour and Norway at 4.68 in the second half of 2025, excluding taxes. Converted at the 2025 average rate those are 4.70 and 5.28 United States cents. Norway's band IG price, for consumers above 150 gigawatt hours a year, is 4.08 euro cents, or 4.61 United States cents, the cheapest large-industrial power in Europe. France sits at 6.86 United States cents on that basis. So the honest ranking puts Norway and Finland ahead of Canada's national average, with Quebec alone beating them.

Europe's price story since 2020 is worth understanding because it is what created the current competitive map. The European Union's band IF industrial price roughly tripled between the first half of 2020 and the second half of 2022, from 5.30 to 18.92 euro cents. It has since fallen back to 10.95, but that is still double the pre-crisis level and it is not falling much further. Germany is stuck at 12.83 against 4.34 in 2020, a 196 per cent rise, which is why Berlin has legislated a subsidised industrial price of 50 euros per megawatt hour retroactive to January 2026. Italy has done something similar at 65 euros. The International Energy Agency's assessment is blunt: European prices for energy-intensive industry are more than double United States prices and more than fifty per cent above China and India, and the European Central Bank estimates that a permanent ten per cent price rise costs two per cent of employment in those industries. This is why Europe's AI gigafactory programme, for all its 20 billion euros, faces a structural cost disadvantage that money does not fix.

Ireland is the cautionary tale inside that story. It is the European data-centre capital and it now has the most expensive large-industrial electricity in the European Union: 16.80 euro cents at band IF and 15.62 at band IG. Data centres take about twenty-two per cent of Ireland's metered electricity. Concentrating a lot of inflexible load on a small system does not lower prices; it raises them and then triggers connection moratoria. Singapore reached the same place by a different route: about 1.46 gigawatts live, only about 20 megawatts under construction, and 5.5 per cent non-emitting generation.

On cleanliness, Canada is genuinely strong but the usual framing overstates it. Ember, the only source that applies one method to every country, puts Canada at 77.0 per cent non-emitting generation in 2025, fifth in the world among large producers behind Norway, Sweden, France and Brazil. Its carbon intensity figure for Canada is 190.7 grams of carbon dioxide per kilowatt hour, which is higher than the 100 to 120 grams often quoted, because Ember uses lifecycle emission factors and assigns non-zero emissions to hydro, wind, solar and nuclear. Environment and Climate Change Canada, counting only what comes out of stacks, reports about 86 grams for 2024. Both numbers are defensible; mixing them is not. What matters commercially is that Canada is three to seven times cleaner than every large market it competes with for AI load, and that the provincial range runs from 1.7 grams in Quebec to 730 in Saskatchewan.

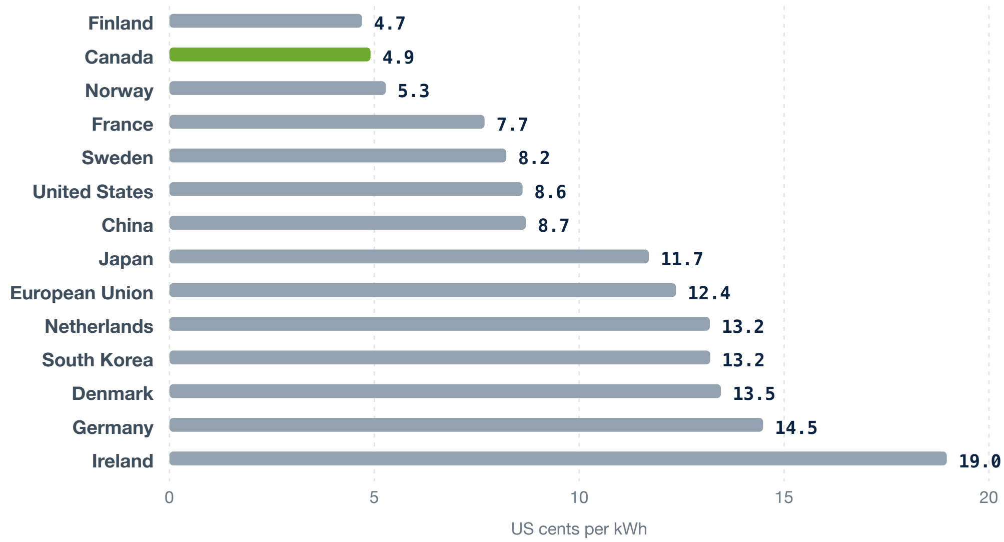
The set of jurisdictions that are simultaneously cheap and clean at scale is therefore very short: Norway, Sweden, Finland, France, and four Canadian provinces. Everywhere else forces a trade. Texas is cheap and dirty. Malaysia is cheap and among the dirtiest destinations at 603 grams. The Gulf is the cheapest gas in the world and the dirtiest grid, at 692 grams in Saudi Arabia. Denmark and Ireland are clean and expensive. That short list is Canada's actual competitive set, and it is small enough that Canada's position in it is a genuine asset.

Which brings the argument to its uncomfortable end. The North American Electric Reliability Corporation assesses Canadian and American systems on the same reserve-margin basis. Alberta has an anticipated reserve margin of 36.2 per cent against a reference level of 11.8, and holds above 33 per cent through 2030-31. Saskatchewan and British Columbia are similarly comfortable. Quebec is not: its margin falls from 15.6 per cent to 11.5 by 2030-31 against a 12.2 per cent reference, with an explicit warning of winter shortfalls. Manitoba falls to 1.2 per cent. The Maritimes are already below target.

So the province with abundant spare capacity is Alberta, where industrial power costs 10.01 Canadian cents, the highest in the country, and the grid runs at 335 to 540 grams, comparable to Germany. The provinces where the pitch of cheap, clean power is true have no room. That is the real Canadian constraint, and it is not solved by attracting more announcements. It is solved by building generation and transmission in Quebec, British Columbia and Manitoba, or by accepting that Canadian AI capacity will largely be gas-fired Alberta capacity with a carbon story to manage. Given that Canada added 1.1 gigawatts of non-emitting capacity last year and the pipeline is 20 gigawatts, the arithmetic does not currently work.

FIGURE 3.1

Industrial electricity price, cheapest first

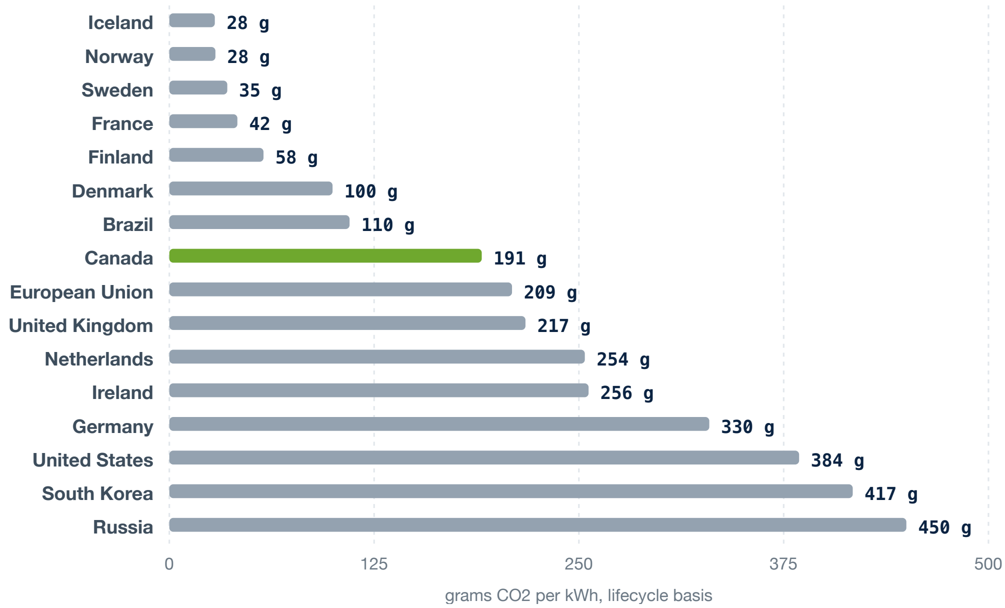


Canada is cheap but not cheapest. Finland and Norway undercut the Canadian average, and the gap between Canadian provinces is wider than the gap between many countries.

Source: Eurostat band IF excluding taxes; United States Energy Information Administration; Statistics Canada. Green is Canada.

FIGURE 3.2

Grid carbon intensity, cleanest first



This chart uses lifecycle intensity, which counts construction and fuel supply and therefore assigns about 24 grams even to hydro. On the operational basis used elsewhere in this book Canada reads about 86 grams rather than 191. Both are correct, and mixing them is the most common error in this debate.

Source: Ember (2026), lifecycle basis. Environment and Climate Change Canada publishes the operational figure.

The picture in numbers

A. Installed capacity and generation

All Ember figures are from the 2026 release of the Yearly Electricity Data file, downloaded 2 September 2026 and stored in this pack. Ember's capacity total is clean plus fossil capacity; it is not a nameplate registry and should be treated as within a few per cent.

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Total generation	31,734	TWh	2025	World	Ember Yearly Electricity Data (2026)
Total installed capacity	10,195	GW	2025	World	Ember (2026)
Total generation	10,578	TWh	2025	China	Ember (2026)
Total installed capacity	3,726	GW	2025	China	Ember (2026)
Total generation / capacity	4,520 / 1,333	TWh / GW	2025	United States	Ember (2026)
Total generation / capacity	2,792 / 1,200	TWh / GW	2025	European Union (27)	Ember (2026)
Total generation / capacity	2,082 / 556	TWh / GW	2025	India	Ember (2026)
Total generation / capacity	1,193 / 238	TWh / GW	2025	Russia	Ember (2026)

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Total generation / capacity	1,030 / 323	TWh / GW	2025	Japan	Ember (2026)
Total generation / capacity	751 / 261	TWh / GW	2025	Brazil	Ember (2026)
Total generation / capacity	**652 / 156**	**TWh / GW**	**2025**	**Canada**	Ember (2026)
Total installed capacity, cross-check	156.4	GW	2024	Canada	Statistics Canada Table 25-10-0022
Total generation / capacity	625 / 159	TWh / GW	2025	South Korea	Ember (2026)
Total generation / capacity	570 / 168	TWh / GW	2025	France	Ember (2026)
Total generation / capacity	500 / 268	TWh / GW	2025	Germany	Ember (2026)
Total generation / capacity	455 / 104	TWh / GW	2024	Saudi Arabia	Ember (2026)
Total generation / capacity	292 / 111	TWh / GW	2025	United Kingdom	Ember (2026)
Total generation / capacity	287 / 116	TWh / GW	2025	Australia	Ember (2026)
Total generation / capacity	201 / 42	TWh / GW	2025	Malaysia	Ember (2026)
Total generation / capacity	177 / 54	TWh / GW	2024	United Arab Emirates	Ember (2026)
Total generation / capacity	170 / 55	TWh / GW	2025	Sweden	Ember (2026)
Total generation / capacity	161 / 41	TWh / GW	2025	Norway	Ember (2026)
Total generation / capacity	135 / 59	TWh / GW	2025	Netherlands	Ember (2026)
Total generation / capacity	82 / 26	TWh / GW	2025	Finland	Ember (2026)
Total generation / capacity	60 / 14	TWh / GW	2025	Singapore	Ember (2026)
Total generation / capacity	35 / 17	TWh / GW	2025	Denmark	Ember (2026)
Total generation / capacity	31 / 15	TWh / GW	2025	Ireland	Ember (2026)
Total generation / capacity	19 / 2.2	TWh / GW	2024	Iceland	Ember (2026)
Canada rank by generation	**7th of 195**	rank	2025	Canada in world	Ember (2026)
Canada rank by capacity	**10th**	rank	2025	Canada in world	Ember (2026)
Canada share of world generation	**2.06**	%	2025	Canada in world	Ember (2026)
Canada share of world capacity	1.53	%	2025	Canada in world	Ember (2026)

Net capacity additions, the pace test:

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Solar capacity added	315.1	GW	2025	China	Ember (2026)
Wind capacity added	119.4	GW	2025	China	Ember (2026)
All non-emitting capacity added	441.1	GW	2025	China	Ember (2026)
Fossil capacity added	92.3	GW	2025	China	Ember (2026)
Solar capacity added	511.1	GW	2025	World	Ember (2026)

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
All renewable capacity added, IEA basis	800	GW	2025	World	IEA, Electricity 2026
Battery storage capacity added	about 110 (up about 40%)	GW	2025	World	IEA, Electricity 2026
Solar / non-emitting capacity added	34.0 / 40.1	GW	2025	United States	Ember (2026)
Solar / non-emitting capacity added	37.0 / 45.6	GW	2025	India	Ember (2026)
Solar / non-emitting capacity added	56.3 / 68.1	GW	2025	European Union	Ember (2026)
Solar / wind / all non-emitting added	**0.1 / 0.3 / 1.1**	**GW**	**2025**	**Canada**	Ember (2026)
World electricity demand growth	about 3	%	2025	World	IEA, Electricity 2026
Forecast demand growth, annual average	3.6	% per year	2026-2030	World	IEA, Electricity 2026

B. Generation mix and carbon intensity

Non-emitting share is Ember's "clean" category: hydro, nuclear, wind, solar, bioenergy and other renewables. Carbon intensity is Ember's published figure, which is a LIFECYCLE number (see "Contested or uncertain figures").

COUNTRY OR REGION	NON-EMITTING SHARE, %	CO2 INTENSITY, GCO2/KWH (EMBER, LIFECYCLE)	YEAR	SOURCE
Iceland	100.0	27.8	2024	Ember (2026)
Norway	99.0	28.1	2025	Ember (2026)
Sweden	98.8	35.4	2025	Ember (2026)
Finland	96.3	57.5	2025	Ember (2026)
France	94.8	41.5	2025	Ember (2026)
Denmark	94.2	99.6	2025	Ember (2026)
Brazil	88.7	110.0	2025	Ember (2026)
Canada	**77.0**	**190.7**	**2025**	Ember (2026)
European Union (27)	71.2	209.2	2025	Ember (2026)
United Kingdom	64.4	217.4	2025	Ember (2026)
Germany	59.1	329.6	2025	Ember (2026)
Netherlands	54.2	253.6	2025	Ember (2026)
Ireland	48.2	255.9	2025	Ember (2026)
United States	43.0	384.4	2025	Ember (2026)
China	41.6	526.2	2025	Ember (2026)
South Korea	40.0	417.1	2025	Ember (2026)
Australia	38.7	524.6	2025	Ember (2026)
Russia	35.7	449.9	2025	Ember (2026)

COUNTRY OR REGION	NON-EMITTING SHARE, %	CO2 INTENSITY, GCO2/KWH (EMBER, LIFECYCLE)	YEAR	SOURCE
Japan	32.7	477.4	2025	Ember (2026)
United Arab Emirates	31.7	467.5	2024	Ember (2026)
India	26.7	670.5	2025	Ember (2026)
Malaysia	20.6	603.2	2025	Ember (2026)
Singapore	5.5	497.1	2025	Ember (2026)
Saudi Arabia	2.2	692.0	2024	Ember (2026)
World	42.6	458.5	2025	Ember (2026)

Canada on the Canadian method, and the provincial spread that the national number hides:

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
National electricity emissions intensity, operational basis	about 86	gCO2e/kWh	2024	Canada	Canadian Climate Institute, 440 Megatonnes, on ECCC NIR 2026
Same measure in 2008, for context	about 195	gCO2e/kWh	2008	Canada	440 Megatonnes
Grid consumption intensity, Quebec / Manitoba / British Columbia / Ontario	1.7 / 2.0 / 15 / 30	gCO2e/kWh	2023-2024	Canadian provinces	Environment and Climate Change Canada, 2025, via dimension 05 of this research pack
Grid consumption intensity, Alberta / Saskatchewan	540 / 730	gCO2e/kWh	2023-2024	Canadian provinces	Environment and Climate Change Canada, 2025, as above
Alberta emissions intensity, alternative provincial series	335 (629 in 2019)	gCO2e/kWh	2024	Alberta	Government of Alberta
Renewable share of generation	63.9	%	2024	Canada	Statistics Canada
Hydro share of generation	52.8	%	2025	Canada	Ember (2026)
Nuclear share of generation	13.1	%	2025	Canada	Ember (2026)
Gas plus other fossil share of generation	19.0	%	2025	Canada	Ember (2026)
Coal share of generation	4.0	%	2025	Canada	Ember (2026)

Which countries are both cheap and clean. Naming them explicitly, using large-industrial price below about 8 United States cents per kWh and non-emitting share above 75 per cent:

- **Norway.** 4.61 United States cents at band IG, 99.0 per cent non-emitting, 28 gCO2/kWh. The best combination in the world, and the reason Norwegian data-centre capacity keeps growing.
- **Sweden.** 7.21 United States cents at band IG, 98.8 per cent non-emitting, 35 gCO2/kWh.
- **Finland.** 4.70 United States cents at band IF, 96.3 per cent non-emitting, 58 gCO2/kWh. The cheapest band IF price in the European Union.
- **France.** 6.86 United States cents at band IG, 94.8 per cent non-emitting, 42 gCO2/kWh, and the only one of these at real scale (570 TWh).

- **Canada, but only in four provinces.** Quebec at 3.59 and Newfoundland and Labrador at 2.55 United States cents industrial, Manitoba at 4.45 and British Columbia at 4.86, all with grids at or below 15 gCO2e/kWh on the Canadian method. Alberta at 7.31 United States cents is the country's most expensive province and its dirtiest at 335 to 540 gCO2e/kWh.
- **Iceland** and **Paraguay** qualify on the metrics (100 per cent non-emitting) but are too small to matter: 2.2 GW and 8.9 GW of capacity respectively.
- **Brazil** is a borderline case: 88.7 per cent non-emitting at 110 gCO2/kWh and historically low industrial prices, but no comparable published industrial tariff in this dataset.

Everywhere else fails one test. Texas is cheap (6.65 United States cents) and dirty. Malaysia is cheap and very dirty (603 gCO2/kWh). Denmark and Ireland are clean-ish and expensive. Germany is neither. Singapore is dirty (497 gCO2/kWh from 5.5 per cent non-emitting) and constrained. The Gulf states are the cheapest gas power in the world and among the dirtiest grids anywhere, at 692 gCO2/kWh in Saudi Arabia.

C. Industrial electricity price, the part that matters most

Every row states the basis. Residential prices appear only in the clearly labelled block at the end and are not comparable to anything above it. Conversions use the Bank of Canada 2025 annual averages of 1.3978 Canadian dollars per United States dollar and 1.5782 Canadian dollars per euro, implying 1.1291 United States dollars per euro, except where the source uses its own rate.

C1. Eurostat, industrial band IF (70,000 to 149,999 MWh a year, roughly an 8 to 17 MW continuous load), second half of 2025, EXCLUDING taxes and levies.

COUNTRY	EUR/KWH	US CENTS/KWH	YEAR	REGION	SOURCE
Finland	0.0416	4.70	2025 H2	EU	Eurostat nrg_pc_205
Norway	0.0468	5.28	2025 H2	EEA	Eurostat nrg_pc_205
France	0.0681	7.69	2025 H2	EU	Eurostat nrg_pc_205
Sweden	0.0728	8.22	2025 H2	EU	Eurostat nrg_pc_205
Spain	0.0914	10.32	2025 H2	EU	Eurostat nrg_pc_205
Poland	0.0915	10.33	2025 H2	EU	Eurostat nrg_pc_205
European Union (27) average	**0.1095**	**12.36**	2025 H2	EU	Eurostat nrg_pc_205
Netherlands	0.1168	13.19	2025 H2	EU	Eurostat nrg_pc_205
Denmark	0.1192	13.46	2025 H2	EU	Eurostat nrg_pc_205
Germany	0.1283	14.49	2025 H2	EU	Eurostat nrg_pc_205
Italy	0.1341	15.14	2025 H2	EU	Eurostat nrg_pc_205
Ireland	**0.1680**	**18.97**	2025 H2	EU	Eurostat nrg_pc_205
Czechia	0.1747	19.73	2025 H2	EU	Eurostat nrg_pc_205

C2. Eurostat band IG (150,000 MWh a year and over, roughly 17 MW and up, the right band for a real data centre), second half of 2025, EXCLUDING taxes.

COUNTRY	EUR/KWH	US CENTS/KWH	YEAR	SOURCE
Norway	0.0408	4.61	2025 H2	Eurostat nrg_pc_205
France	0.0608	6.86	2025 H2	Eurostat nrg_pc_205
Sweden	0.0639	7.21	2025 H2	Eurostat nrg_pc_205
Belgium	0.0857	9.68	2025 H2	Eurostat nrg_pc_205
Netherlands	0.0919	10.38	2025 H2	Eurostat nrg_pc_205
European Union (27) average	0.0998	11.27	2025 H2	Eurostat nrg_pc_205
Germany	0.1190	13.44	2025 H2	Eurostat nrg_pc_205
Ireland	0.1562	17.64	2025 H2	Eurostat nrg_pc_205

C3. North America and the rest of the world, industrial or large-power basis.

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Industrial average retail price, all sectors basis	8.62	US cents/kWh	2025	United States	EIA Electric Power Monthly Table 5.3
Industrial average retail price	8.13	US cents/kWh	2024	United States	EIA Table 5.3
Industrial price, Texas	6.65	US cents/kWh	Jan-Jun 2026	Texas	EIA Table 5.6.B
Industrial price, Virginia	10.08 (from 9.18)	US cents/kWh	Jan-Jun 2026	Virginia	EIA Table 5.6.B
Industrial price, Ohio / Pennsylvania	10.21 / 10.91 (from 8.00 / 8.87)	US cents/kWh	Jan-Jun 2026	PJM states	EIA Table 5.6.B
Cheapest US industrial states	New Mexico 5.41, Oklahoma 6.44, Arkansas 6.63, Texas 6.65	US cents/kWh	Jan-Jun 2026	United States	EIA Table 5.6.B
Industrial price (mining and manufacturing), implied average revenue	**6.72 CAD = 4.91 US**	**cents/kWh**	**2024**	**Canada**	Statistics Canada Table 25-10-0021
Same, by province	NL 3.49, QC 4.92, MB 6.09, BC 6.66, ON 6.79, SK 8.82, AB 10.01	CAD cents/kWh	2024	Canadian provinces	Statistics Canada Table 25-10-0021
Large power, 50,000 kW, 30.6 GWh/month, excl. taxes	Winnipeg 5.09, Montreal 5.52, Vancouver 6.72, Calgary 7.99, Toronto 12.66	CAD cents/kWh	1 Apr 2025	Canadian cities	Hydro-Quebec 2025 comparison
Same, US cities	Detroit 6.43, Chicago 6.45, Seattle 8.48, Houston 8.99, New York 15.95, Boston 17.13	US cents/kWh	1 Apr 2025	US cities	Hydro-Quebec 2025 comparison
Large power, 5,000 kW, 3.06 GWh/month, excl. taxes	Montreal 5.83, Winnipeg 6.00, Calgary 8.02, Vancouver 8.42, Toronto 12.80, Houston 14.35, Boston 28.19	CAD cents/kWh	1 Apr 2025	22 cities	Hydro-Quebec 2025 comparison
Hydro-Quebec Rate L, large-power industrial tariff	3.821 cents/kWh plus $15.027 per kW per month, 5,000 kW minimum	CAD	effective 1 Apr 2026	Quebec	Hydro-Quebec 2026 Electricity Rates

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Hydro-Quebec Rate CB, cryptographic use (blockchain), medium power	6.292 cents/kWh plus $18.242 per kW per month	CAD	effective 1 Apr 2026	Quebec	Hydro-Quebec 2026 Electricity Rates
Industrial tariff, 36-city average, supply at 35 kV and above	0.620 CNY = about 8.7 US cents	per kWh	Jul 2026	China	NDRC price monitoring via CEIC
Industrial price, indicative	about 17.5 JPY = about 11.7 US cents	per kWh	Oct 2025	Japan	Intratec / GlobalPetrolPrices compilation
Large-industry rate after a 10.2 per cent increase	about 182.7 KRW = about 13.2 US cents	per kWh	2025	South Korea	Energynews on KEPCO
EU price for energy-intensive industry versus peers	more than 2x the United States, more than 50% above China and India, about 1.6x its own 2019 level	ratio	2025	EU	IEA, Electricity 2026
Average wholesale price (not retail)	EU about 95, Germany about 100, United Kingdom just under 115, United States about 48, Nordics about 40	USD/MWh	2025 (US and Nordics H1 2025)	various	IEA, Electricity 2026

C4. The 2020 to 2026 price trend, Eurostat band IF, EUR/kWh excluding taxes. This is the European price spike and where it has settled.

European Union (27)

2020 H1
0.0530

2021 H2
0.0938

2022 H2 (PEAK)
0.1892

2023 H2
0.1398

2024 H2
0.1151

2025 H2
0.1095

CHANGE 2020 H1 TO 2025 H2
+107%

Germany

2020 H1
0.0434

2021 H2
0.0732

2022 H2 (PEAK)
0.1728

2023 H2
0.1535

2024 H2
0.1313

2025 H2
0.1283

CHANGE 2020 H1 TO 2025 H2
+196%

France

2020 H1
0.0537

2021 H2
0.0855

2022 H2 (PEAK)
0.1341

2023 H2
0.1255

2024 H2
0.0788

2025 H2
0.0681

CHANGE 2020 H1 TO 2025 H2
+27%

Ireland

2020 H1
0.0801

2021 H2
0.1609

2022 H2 (PEAK)
0.2174

2023 H2
0.2141

2024 H2
0.1881

2025 H2
0.1680

CHANGE 2020 H1 TO 2025 H2
+110%

Netherlands

2020 H1
0.0565

2021 H2
0.0700

2022 H2 (PEAK)
0.1489

2023 H2
0.2272

2024 H2
0.1506

2025 H2
0.1168

CHANGE 2020 H1 TO 2025 H2
+107%

Sweden

2020 H1
0.0372

2021 H2
0.0840

2022 H2 (PEAK)
0.1253

2023 H2
0.0666

2024 H2
0.0584

2025 H2
0.0728

CHANGE 2020 H1 TO 2025 H2
+96%

Finland

2020 H1
0.0405

2021 H2
0.0740

2022 H2 (PEAK)
0.1512

2023 H2
0.0650

2024 H2
0.0496

2025 H2
0.0416

CHANGE 2020 H1 TO 2025 H2
+3%

Norway

2020 H1	2021 H2
0.0145	0.0585
2022 H2 (PEAK)	2023 H2
0.1479	0.0506
2024 H2	2025 H2
0.0441	0.0468
CHANGE 2020 H1 TO 2025 H2	
+223%	

Denmark

2020 H1	2021 H2
0.0400	0.1236
2022 H2 (PEAK)	2023 H2
0.2417	0.1136
2024 H2	2025 H2
0.1106	0.1192
CHANGE 2020 H1 TO 2025 H2	
+198%	

Italy

2020 H1	2021 H2
0.0609	0.1489
2022 H2 (PEAK)	2023 H2
0.3334	0.1525
2024 H2	2025 H2
0.1407	0.1341
CHANGE 2020 H1 TO 2025 H2	
+120%	

Spain

2020 H1	2021 H2
0.0519	0.1096
2022 H2 (PEAK)	2023 H2
0.1943	0.1013
2024 H2	2025 H2
0.0831	0.0914
CHANGE 2020 H1 TO 2025 H2	
+76%	

Source for the whole table: Eurostat nrg_pc_205, extracted 2 September 2026, dataset last updated 11 August 2026.

North America over the same period, for contrast: the United States industrial price rose from 6.67 cents in 2020 to 8.62 in 2025 and 8.89 year to date through June 2026, a 33 per cent rise (EIA Table 5.3). Montreal's large-power rate rose from 5.24 Canadian cents in 2021 to 5.83 in 2025, an 11 per cent rise (Hydro-Quebec). Alberta spiked to 23.77 Canadian cents in 2023 and fell back to 8.02 by 2025.

C5. Residential prices, kept separate on purpose. These are a different and much higher number and must not be compared with anything above.

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Residential average retail price	17.30 (2025), 18.16 year to date	US cents/kWh	2025-2026	United States	EIA Table 5.3
Residential implied average revenue	11.70 CAD = 8.54 US	cents/kWh	2024	Canada	Statistics Canada Table 25-10-0021
Residential, 1,000 kWh a month, excl. taxes	Montreal 8.29, Winnipeg 10.53, Vancouver 12.60, Toronto 15.57, Calgary 22.90, Houston 26.07, Boston 47.87, New York 52.48, San Francisco 59.94	CAD cents/kWh	1 Apr 2025	22 cities	Hydro-Quebec 2025 comparison
Non-household price, Eurostat medium band IC (500 to 1,999 MWh), incl. non-recoverable taxes	EU average 0.1837; Ireland 0.2552; Germany 0.2264	EUR/kWh	2025 H2	EU	Eurostat news release, 8 May 2026

The last row is the number most often quoted as "European industrial electricity prices." It is 68 per cent higher than the band IF figure for the same countries in the same half-year, because it covers small businesses and includes taxes. Using it to describe a data centre's cost is wrong by more than half.

C6. Data-centre specific tariffs and large-load rules. The important trend is that regulators everywhere are creating a separate price and a separate queue for data centres, which means the general industrial tariffs above are increasingly the wrong number for a new AI facility.

JURISDICTION	RULE OR RATE	VALUE	DATE	STATUS	SOURCE
Quebec	Proposed data-centre rate, roughly double the large-power rate	about 13 CAD cents/kWh	February 2026	Proposed, from late 2026	Hydro-Quebec, via dimension 03 of this pack
Quebec	Rate L, the existing large-power industrial tariff	3.821 CAD cents/kWh plus $15.027 per kW per month	effective 1 Apr 2026	In force	Hydro-Quebec 2026 Electricity Rates
Quebec	Rate CB, cryptographic use applied to blockchains, the existing precedent for load-specific pricing of computing	6.292 CAD cents/kWh plus $18.242 per kW per month (medium power)	effective 1 Apr 2026	In force	Hydro-Quebec 2026 Electricity Rates
Ontario	Data Centre Playbook: facilities above 1 MW charged more than industrial programs; the minister states data centres pay 100 per cent of costs	not a published rate	posted August 2026, comments to 12 September 2026	Draft	Ontario ERO 026-0853, via dimension 04 of this pack
Alberta	AESO interim large-load connection limit to 2028, against more than 20 GW of requests	1,200 MW	4 June 2025, fully allocated by October 2025 to Meta's GLDC Load (970 MW) and Keephills Phase I (230 MW)	In force	AESO
British Columbia	BC Hydro capacity released to data centres over two years	about 400 MW	2025-2026	In force	BC Hydro, via dimension 03 of this pack

JURISDICTION	RULE OR RATE	VALUE	DATE	STATUS	SOURCE
Virginia	Dominion Energy proposes a separate GS-5 rate class for large load: 14-year contract terms, 85 per cent minimum charges, USD 1.5 million per MW collateral	contract terms, not a per-kWh rate	filed 3 September 2025	Proposed	Virginia Mercury
PJM (United States mid-Atlantic)	Data-centre share of the capacity auction cost	USD 6.5bn of a USD 16.4bn auction (40 per cent); USD 29.4bn (46 per cent) across four auctions	December 2025 auction	Settled	Monitoring Analytics via Utility Dive, 2026, per dimension 05 of this pack
Ireland	The EirGrid Dublin moratorium on new grid connections for data centres was ENDED, replaced by a bring-your-own-power model	n/a	12 December 2025	In force	Energy Connects
Singapore	The 2019 moratorium was lifted in 2022 and replaced by a capacity allocation regime; the effect is visible in the numbers	about 1.46 GW live but only about 20 MW under construction against a 980 MW pipeline; 2 per cent vacancy	2026	In force	BMI via TechNode
Denmark	Grid-driven pause on new data-centre connections	398 MW installed, 208 MW under construction	2026	In force	CNBC
Canadian municipalities	Local moratoria: Rocky View County (Alberta), Oakville (first Ontario municipality, one year), Mississauga pause	n/a	July to August 2026	In force	Canadian Press, CBC, City of Mississauga, per dimension 03 of this pack

Texas and ERCOT belong in this table and are not fully covered here. ERCOT's industrial price of 6.65 United States cents makes it the cheapest large United States market, its anticipated reserve margin of 28 to 30 per cent gives it the most headroom of any large North American system, and Texas passed large-load legislation in 2025 imposing curtailment obligations on data centres. The specific thresholds and curtailment terms of that legislation could not be verified from a primary source within this dimension and should be checked against the Public Utility Commission of Texas and ERCOT protocols before being quoted.

D. Data-centre capacity and where the AI capacity is going

Read the metric column before quoting anything. The four main research houses measure four different things and their global totals differ by nearly a factor of two.

COUNTRY OR REGION	VALUE	METRIC	YEAR	SOURCE
World	103 GW today, 200 GW by 2030	Installed capacity	2026	JLL 2026 Global Data Center Outlook
World	122.2 GW	Installed IT power capacity	Q1 2025	Synergy Research via Data Center Knowledge

COUNTRY OR REGION	VALUE	METRIC	YEAR	SOURCE
World	67.7 GW, up 36% in two years	Facility power draw	2026	IDCA 2026 Data Center Report
United States	29.2 GW, about 43% of global, about 6% of US electricity	Power consumption	2026	IDCA 2026
United States	about 50 GW	Operating IT load	end-2025	Global Data Center Hub, FERC-derived
Americas	43.4 operational, 25.3 under construction, 191.3 pipeline (GW)	Operational capacity	2026	Cushman & Wakefield
China	32 GW end-2025, about 40 GW end-2026	Installed capacity	2026	Rystad Energy
EMEA	11.4 operational, 2.7 under construction, 12.1 planned (GW)	Operational capacity	2026	Cushman & Wakefield
FLAP-D (Frankfurt, London, Amsterdam, Paris, Dublin)	3.8 GW live, up from 1.8 GW in 2019	Live capacity	H1 2026	JLL EMEA
Ireland (Dublin)	11.4 MW added; data centres take about 22% of national metered electricity	New supply; share	H1 2026; 2024	JLL EMEA; IEA Electricity 2026
Denmark (Nordics)	about 398 MW installed, 208 MW under construction	Installed capacity	2026	CNBC
India	about 1,530 MW operational IT stock, 3.1 GW pipeline	Operational IT stock	2025-26	CBRE India
Japan	about 3.8 GW; Tokyo alone above 1,000 MW at 6% vacancy	Installed IT load	2026	Mordor Intelligence (vendor); CBRE
Malaysia (Johor)	1,110 MW operational, 602 MW under construction, 2,486 MW planned	Operational IT	H1 2026	Fitch via TechNode
Singapore	about 1.46 GW live, only about 20 MW under construction, 2% vacancy	Live capacity	2026	BMI via TechNode
United Arab Emirates	more than 400 MW operational colocation, largest in the Gulf	Operational colocation	2026	Data Center World Middle East
Saudi Arabia	467 MW operational against a 1.5 GW 2030 target	Operational capacity	Q1 2026	Semafor
Australia	about 1.39 GW (derived)	Operating capacity	2025	Climate Council, derived
Brazil (Sao Paulo)	536.7 MW inventory, 9.6% vacancy	Wholesale inventory	Q1 2026	CBRE
Canada	**about 1.4 GW live; 10.3 GW pipeline all stages; 20 to 22 GW proposed**	Live and pipeline	2025-26	DC Byte; Canadian Press, Jul 2026

E. Sovereign and national AI compute programmes

United States

PROGRAMME
Stargate

ANNOUNCED
21 Jan 2025

MONEY
USD 500bn over four years (private)

CAPACITY OR CHIPS
10 GW target, 9+ GW committed, 0.3 GW live

STATUS
Partially live

SOURCE
OpenAI; Epoch AI

United States

PROGRAMME
DOE Genesis Mission

ANNOUNCED
24 Nov 2025

MONEY
USD 320m initial, more than USD 5bn by Jul 2026

CAPACITY OR CHIPS
No GW published; 278 projects

STATUS
In execution

SOURCE
US DOE

European Union

PROGRAMME
InvestAI, AI Gigafactories

ANNOUNCED
11 Feb 2025

MONEY
EUR 20bn fund inside a EUR 200bn ambition

CAPACITY OR CHIPS
Up to seven sites, about 100,000 accelerators each

STATUS
Tender open, deadline 12 Nov 2026, nothing built

SOURCE
EuroHPC JU

European Union

PROGRAMME
EuroHPC AI Factories

ANNOUNCED
2024-2025

MONEY
about EUR 10bn, 2021-2027

CAPACITY OR CHIPS
19 AI Factories, 13 Antennas

STATUS
Partly operational

SOURCE
EuroHPC JU

France

PROGRAMME
EUR 109bn package, Campus AI

ANNOUNCED
Feb 2025

MONEY
EUR 109bn pledged private and foreign investment

CAPACITY OR CHIPS
Campus AI up to 1.4 GW from 2028, expanded to a 3 GW network

STATUS
Pre-construction; Fluidstack withdrew Mar 2026

SOURCE
MGX

United Kingdom

PROGRAMME
AI Opportunities Action Plan, AI Growth Zones

ANNOUNCED
Jan and Jun 2025

MONEY
GBP 2bn public plus about GBP 31bn US private

CAPACITY OR CHIPS
20-fold AIRR expansion by 2030; up to 120,000 GPUs by end-2026

STATUS
Partly live

SOURCE
NVIDIA

Japan

PROGRAMME
METI AI and semiconductor framework

ANNOUNCED
Nov 2024; FY2026 budget Dec 2025

MONEY
More than JPY 10tn to FY2030; JPY 1.23tn in FY2026

CAPACITY OR CHIPS
No national MW target

STATUS
Funded and disbursing

SOURCE
Japan Times

South Korea

PROGRAMME
National AI Computing Center

ANNOUNCED
Oct 2025; groundbreaking Aug 2026

MONEY
KRW 2.5tn (about USD 1.74bn)

CAPACITY OR CHIPS
15,000 accelerators by 2028, 50,000 by 2030; 260,000+ GPUs nationally

STATUS
Under construction

SOURCE
NVIDIA

India

PROGRAMME
IndiaAI Mission

ANNOUNCED
Mar 2024

MONEY
INR 10,372 crore (about USD 1.2bn) over five years

CAPACITY OR CHIPS
38,000+ GPUs onboarded

STATUS
Live but under-disbursed

SOURCE
PIB

Saudi Arabia

PROGRAMME
HUMAIN (PIF)

ANNOUNCED
May 2025

MONEY
about USD 23bn in partner deals

CAPACITY OR CHIPS
6.4 GW over a decade, about 1.9 GW by 2030

STATUS
Under construction, none confirmed live

SOURCE
NVIDIA

United Arab Emirates

PROGRAMME
Stargate UAE, UAE-US AI Campus

ANNOUNCED
May 2025

MONEY
Part of a USD 1.4tn UAE-US framework

CAPACITY OR CHIPS
5 GW campus; 1 GW cluster; 200 MW due Q3 2026

STATUS
Under construction

SOURCE
OpenAI

China

PROGRAMME
East Data West Computing, AI Plus

ANNOUNCED
2022, Aug 2025

MONEY
RMB 43.5bn direct to mid-2024; RMB 4tn planned 2026-2030

CAPACITY OR CHIPS
12.5m+ racks nationally; about 1.5m AI-grade

STATUS
Operating and expanding

SOURCE
State Council

Canada

PROGRAMME
Canadian Sovereign AI Compute Strategy

ANNOUNCED
Dec 2024, expanded Jun 2026

MONEY
CAD 2bn, with the AI Compute Access Fund topped up to CAD 1bn

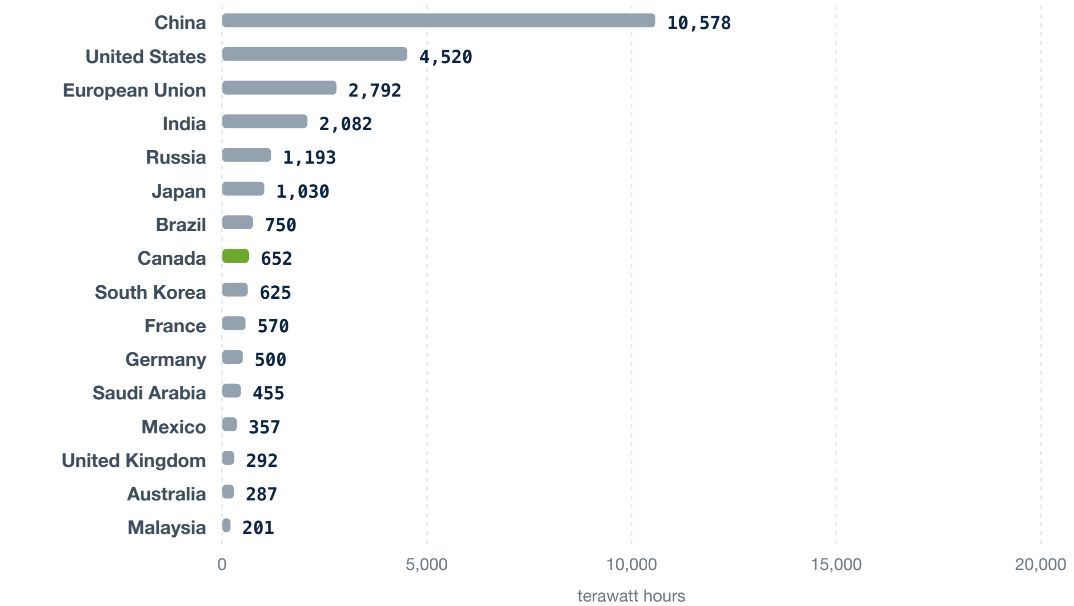
CAPACITY OR CHIPS
No national MW target; TELUS 85 MW initial, Bell AI Fabric targets 500 MW

STATUS
Mixed

SOURCE
ISED

FIGURE 3.3

Annual electricity generation

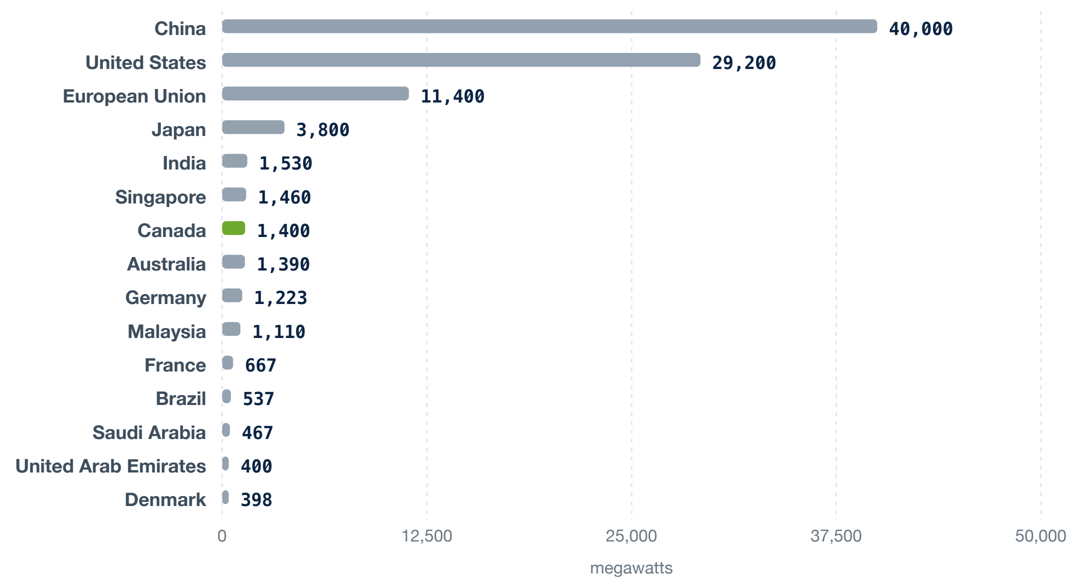


Canada generates about 652 terawatt hours a year, roughly 2 per cent of the world total, seventh among countries. China added more solar and wind capacity in 2025 alone than Canada's entire generating fleet.

Source: Ember (2026); Statistics Canada Table 25-10-0022-01.

FIGURE 3.4

Installed data-centre capacity



Compare this chart with the one above it. Canada's share of the world's electricity is far larger than its share of the world's data centres. That gap is the entire opportunity, and the rest of this book is about whether Canada converts it.

Source: Synergy Research, DC Byte, Cushman and Wakefield, JLL, as compiled in the dataset.

Where Canada sits

The four questions, answered as rankings.

Is Canada cheap? Yes, and it is one of the cheapest in the developed world, but it is not the cheapest and the advantage is concentrated in four provinces.

On the most defensible like-for-like comparison, Statistics Canada's implied industrial price against the EIA's, Canada was at 4.91 United States cents per kWh in 2024 against the United States at 8.13. Canada was 40 per cent cheaper. On the Hydro-Quebec comparison of posted large-power tariffs, Montreal at the 50,000 kW profile was 3.85 United States cents against Houston at 8.99, Toronto at 8.82, New York at 15.95 and Boston at 17.13. But on the Eurostat band IF and IG measures for large industrial consumers in Europe, Finland at 4.70 and Norway at 4.61 to 5.28 United States cents undercut Canada's national average. Ranking the large-industrial prices in this brief from cheapest to most expensive: Norway (4.61 band IG), Finland (4.70), Canada national average (4.91), Norway band IF (5.28), Texas (6.65), France (6.86 band IG), Sweden (7.21 band IG), United States average (8.62), China (about 8.7), Japan (about 11.7), European Union band IF average (12.36), South Korea (about 13.2), Germany (14.49), Ireland (18.97). Canada is third. Quebec alone, at 3.59 United States cents, would be first.

Two honest caveats. Alberta, the province with by far the largest data-centre pipeline, is Canada's most expensive at 7.31 United States cents industrial, above the Nordics and above Texas. And Quebec has proposed a data-centre specific rate of about 13 Canadian cents per kWh from late 2026, roughly double its industrial rate, which would erase most of Montreal's headline advantage for new AI load.

Is Canada clean? Yes, and it is a genuine top-five country, but not top-three and not uniform.

Canada is fifth in the world on non-emitting share among countries generating more than 100 TWh, at 77.0 per cent in 2025, behind Norway (99.0), Sweden (98.8), France (94.8) and Brazil (88.7). On Ember's lifecycle carbon intensity it ranks twelfth of the 48 countries generating more than 50 TWh, at 190.7 grams, behind Norway (28), Sweden (35), Switzerland (39), France (42), Finland (58), Belgium (109), Brazil (110), Austria (117), Portugal (128), Spain (154) and Colombia (187). On Canada's own operational method the number is about 86 grams, which would place it much higher. The provincial spread from 1.7 grams in Quebec to 730 in Saskatchewan is a factor of more than 400 and makes the national figure meaningless for siting.

Canada is unambiguously cleaner than every large competitor it actually competes with: the United States at 384 grams, China at 526, Japan at 477, Korea at 417, Malaysia at 603, Singapore at 497 and Saudi Arabia at 692. Against the Nordics and France, Canada loses.

Is Canada big? No.

Canada is seventh in the world by generation with 2.06 per cent of the world total, and tenth by capacity with 1.53 per cent. It is smaller than Russia, Japan and India and about the same size as South Korea, a country with 40 per cent more people on a quarter of the land. China generates 16 times as much electricity as Canada. The United States generates seven times as much. The more telling comparison is the rate of change: China added 434 GW of solar and wind capacity in 2025, 2.8 times Canada's entire fleet, while Canada added 1.1 GW of non-emitting capacity, or one four-hundredth of China's addition. Canada is not big and it is not adding capacity quickly.

Does Canada have spare room? Yes in Alberta, British Columbia and Saskatchewan. No in Quebec, Manitoba and the Maritimes.

NERC's 2025 Long-Term Reliability Assessment, which covers Canadian and United States areas on the same basis, gives Alberta an anticipated reserve margin of 36.2 per cent in 2026-27 falling only to 33.0 per cent in 2030-31, against a reference margin level of 11.8 to 17.6 per cent. Saskatchewan runs at 25.9 to 35.0 per cent against 15.0. British Columbia is 19.1 to 24.2 per cent against 11.6 to 12.1. Those three have real headroom.

Quebec does not. Its anticipated margin falls from 15.6 per cent in 2026-27 to 11.5 per cent in 2030-31 against a reference level of 12.2 per cent, and NERC's own summary states that "demand growth projections are outpacing planned resource additions, leading to projected resource shortfalls in the winter season." Manitoba collapses to 1.2 per cent by 2030-31 against a 12.0 per cent target. The Maritimes sit below their 20 per cent target in the first two years. Ontario is adequate but thin, at 18.7 per cent in 2029 against a 15.8 per cent reference.

For context, the United States comparators are worse in the two biggest markets: MISO falls to 4.3 per cent by 2030 against an 8.5 per cent reference, and PJM to 13.9 per cent against a reference rising to 26.3 per cent. ERCOT and California have large margins. So Canada's spare-room position is better than PJM's and MISO's, and worse than ERCOT's and California's, and inside Canada the headroom sits in exactly the province where the power is dirtiest and dearest.

The uncomfortable synthesis: Canada's competitive advantage is real but it is a Quebec, Manitoba, British Columbia and Newfoundland advantage, and those systems are either short of reserve margin or committed. The province with room to grow is the one where the pitch of cheap, clean power does not hold.

Contested or uncertain figures

1. **Carbon intensity for Canada: 190.7 or 86 grams?** Ember reports 190.7 grams of CO2 per kilowatt hour for 2025 on a lifecycle basis; Environment and Climate Change Canada reports about 86 grams of CO2 equivalent for 2024 on an operational basis. Reverse-engineering Ember's own data file confirms it assigns 23.8 grams to hydro, 47.6 to solar, 11.7 to wind and 5.3 to nuclear, and uses a gas factor of 593 grams globally and 722 for Canada, well above direct combustion. Use Ember for country comparisons and ECCC for Canada alone. Never put them in the same column.
2. **Price comparisons are sensitive to four things at once: taxes, exchange rate, consumption band and year.** Eurostat band IC (500 to 1,999 MWh, including non-recoverable taxes) gives an EU average of 18.37 euro cents. Band IF for the same half-year excluding taxes gives 10.95, and band IG gives 9.98. That is a 45 per cent range on the same continent in the same six months, driven entirely by definition. Add exchange rate volatility (the Canadian dollar moved 5.4 per cent against the United States dollar in the year to April 2025 by Hydro-Quebec's own reckoning; the euro moved further) and the year of the data, and a careless comparison can be wrong by a factor of two in either direction. Every price in this brief carries its band, its tax treatment, its year and its conversion rate.
3. **The IEA's "United States" industrial price is Texas.** The IEA's chart of estimated final electricity prices for large industrial customers in energy-intensive industries uses Texas as its United States reference point and Eurostat's above-150 GWh band for Europe. Texas was 6.65 United States cents year to date through June 2026, 23 per cent below the national industrial average of 8.89 and 64 per cent below New

England's 18.31. The IEA's headline that European prices are "more than double" United States prices is true against Texas and would be a smaller multiple against the United States average.

4. **Ember's installed-capacity totals are constructed, not registry data.** Ember's total is the sum of its clean and fossil capacity series. It agrees with Statistics Canada for Canada to within one per cent (156.0 against 156.4 gigawatts) which is reassuring, but it should not be treated as a definitive nameplate figure for every country, and 2025 capacity data are available for only about 90 countries against 195 for generation.
5. **Data-centre capacity by country is the weakest data in this brief.** Synergy, JLL, Cushman and Wakefield and IDCA report global totals of 122.2, 103, 43.4 (Americas only) and 67.7 gigawatts respectively, on four different definitions. A figure of about 5.5 gigawatts for Germany and about 2.0 for the United Kingdom circulates in aggregated coverage but could not be verified and is inconsistent with JLL's 3.8 gigawatt total for all five FLAP-D markets combined. No credible free national total exists for Korea, and Canada's roughly 1.4 gigawatts comes from DC Byte via a single law-firm summary. The United States ranges from 17.2 to 50 gigawatts depending on whose definition is used.
6. **Statistics Canada's implied industrial price is average revenue, not a tariff.** It is value of sales divided by quantity sold for the mining and manufacturing class. It blends contract and posted rates, includes some self-generation arrangements differently by province, and is not a price a new customer could sign. It is nevertheless the only official, consistent, province-by-province Canadian series, and its EIA counterpart is constructed the same way, which is why the two are compared here.
7. **Quebec's proposed 13 cent data-centre rate is a proposal.** It has been reported and is discussed in the companion dimensions of this pack, but its final level, scope and approval status are not settled. If approved at that level it would put Montreal's data-centre price above Toronto's current large-power rate and roughly at the level of the European Union band IF average, which would materially change the Canadian case.
8. **Japan, Korea and China industrial prices in this brief are indicative, not official tariffs.** The Japanese figure of about 17.5 yen per kilowatt hour and the Korean figure of about 182.7 won come from press and price-aggregator sources, not METI or KEPCO tariff sheets. The Chinese 36-city average of 0.62 yuan is an official NDRC monitoring series but covers supply at 35 kilovolts and above generally, not a data-centre tariff, and Chinese provincial rates vary from about 0.49 to 0.68 yuan. Treat all three as within roughly 20 per cent.
9. **Sovereign programme money is not comparable across countries.** Stargate's 500 billion United States dollars is a private consortium pledge. France's 109 billion euros is pledged foreign and private investment. The European Union's 200 billion euros is a mobilisation ambition. India's 1.2 billion United States dollars is an appropriated budget that is being under-spent. The United Kingdom's 2 billion pounds is appropriated. Adding these together produces a meaningless number.
10. **Reserve margins are forecasts made by system operators with incentives.** NERC's Anticipated Reserve Margin counts Tier 1 resources only and reflects each operator's own demand forecast. Since data-centre load forecasts are themselves contested (the IEA finds only about 20 per cent of United States connection requests materialise), the margins for areas with large speculative queues, notably Alberta, may be more comfortable than they look, or less, depending on which load actually shows up.

Open questions students could investigate

1. At what data-centre tariff does Quebec stop winning? Build the model: take Hydro-Quebec's 50,000 kW large-power rate of 5.52 Canadian cents, apply the proposed 13 cent data-centre rate, and find the power-usage-effectiveness and utilisation combination at which Montreal loses to Texas at 6.65 United States cents, to Alberta at 10.01 Canadian cents plus behind-the-meter gas, and to Norway at 4.61 United States cents.
2. Canada added 1.1 gigawatts of non-emitting capacity in 2025 and has a 20 gigawatt data-centre pipeline. How many years of Canada's current build rate would that pipeline consume, and what would the build rate have to be to serve even one quarter of it by 2032?
3. Does the Ember lifecycle carbon intensity or the ECCC operational intensity better reflect what a hyperscaler's Scope 2 accounting will actually recognise, and which one drives siting decisions in practice? Check the greenhouse gas protocol location-based and market-based rules against both.
4. Reserve margin is a peak-demand metric. Data centres are baseload. Construct an energy-adequacy measure rather than a capacity-adequacy one for Quebec, Manitoba and British Columbia, and test whether the NERC warning about Quebec's winter shortfalls actually binds on a 24/7 industrial load.
5. Ireland's large-industrial price is the most expensive in the European Union and it also has the highest data-centre share of national electricity in the world at about 22 per cent. Is that causal, and if so what is the elasticity? What does the Irish experience predict for Alberta at 20 gigawatts?
6. The competitive set of cheap and clean jurisdictions is Norway, Sweden, Finland, France and four Canadian provinces. How much unallocated capacity does each actually have, and what is the combined ceiling on genuinely cheap clean AI capacity worldwide? Is it 5 gigawatts or 50?
7. Announced sovereign AI capacity is roughly 25 to 30 gigawatts against under 1 gigawatt live. Build a base-rate model from historical megaproject delivery in energy and infrastructure, and estimate what fraction of announced capacity is likely to exist by 2030.
8. Alberta's industrial price of 10.01 Canadian cents is set in a competitive pool market while Quebec's 4.92 is set by a regulated monopoly. Which structure serves a 500 megawatt data centre better over a 15-year contract, and what does the 2023 Alberta spike to 23.77 cents and subsequent collapse to 8.02 say about price risk?
9. Canada exports electricity to the United States. If Canadian power is genuinely cheaper and cleaner, why is the marginal Canadian electron worth more exported than sold to a domestic data centre, and what does that imply about the value Canada captures from AI load versus exports?
10. China added 434 gigawatts of solar and wind in 2025 while its grid intensity remained at 526 grams. Model how long China's additions must continue at that rate before Chinese AI data centres are cleaner than Alberta's, and what that means for the durability of Canada's clean-power pitch.

Sources

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04

PART II · THE MACHINE

The physics: what a data centre needs, and what Canada has

Four ideas carry every argument in this file: the megawatt, power usage effectiveness, rack density and water. This chapter explains them in plain language, then sets them against Canada's electricity, climate and industrial prices, province by province.

1 MW ≈ 750 homes

One megawatt running for a year is 8,760 megawatt hours, roughly the annual electricity of 750 average Canadian households. A gigawatt campus is a city.

WHAT THIS CHAPTER ANSWERS

- ? What does a megawatt actually mean in homes, dollars, carbon and water?
- ? Why can a building full of chips not simply be plugged in?
- ? Which Canadian provinces have cheap power, clean power, or both?
- ? Where is there genuinely spare capacity, and where is that a myth?

KEY TAKEAWAYS

- An AI data centre is measured in megawatts (MW) of continuous electrical draw, not square feet. One MW running around the clock uses 8,760 MWh a year, roughly the annual electricity of 750 average Canadian homes (11,650 kWh each in 2022, NRCan Comprehensive Energy Use Database, 2022 data). A 100 MW site at full load equals about 75,000 average Canadian homes, or 45,000 electrically heated Quebec homes.
- Rack power is the physical break with the past. Uptime Institute's 2025 survey puts the typical rack at about 9 kW and finds more than 80% of operators have no rack above 30 kW; an Nvidia GB200 NVL72 AI rack draws about 120 kW (Nvidia, April 2025), which is why AI halls need direct liquid cooling rather than air.

- Efficiency is a spread, not a constant. Industry average power usage effectiveness (PUE) was 1.54 in 2025, flat for six years (Uptime Institute, 2025), while Google's fleet ran at 1.09 (Google, 2025) and new high-latitude facilities commonly reach 1.3 or better. Cooling is 7% of load in an efficient hyperscale site and over 30% in an old enterprise one (IEA, 2025).
- Global data centre electricity use was about 485 TWh in 2025 and is projected to reach 950 TWh by 2030, about 3% of world demand (IEA, Key Questions on Energy and AI, 2026). For scale, Canada generated 622 TWh in 2024 (Statistics Canada, October 2025).
- The binding constraints are equipment and interconnection, not chips: transformer lead times average two to three years, gas turbine deliveries about five years, and grid connection waits run five to ten years in many jurisdictions (IEA, 2026; Wood Mackenzie via POWER, January 2026: power transformers 128 weeks, generator step-ups 144 weeks).
- Canada's grid is 78% non-emitting (hydro, nuclear, wind, solar; StatCan Table 25-10-0015, 2024) and its cheapest industrial power is among the lowest on the continent: 5.09 cents per kWh in Winnipeg and 5.52 in Montreal for a 50 MW customer, versus 12.66 in Toronto, 12.16 in Seattle and 22.88 in New York (Hydro-Quebec price comparison, rates in effect 1 April 2025).
- Cheap and clean does not mean available. Quebec needs 60 TWh and 8,000 to 9,000 MW of new supply by 2035 (Hydro-Quebec Action Plan 2035) and now screens every load above 5 MW; BC is offering only 400 MW to AI and data centres over two years (BC Industrial Electricity Allocation Framework, 2026); Manitoba gates every request above 5 MW (Manitoba Hydro, September 2025).
- Alberta is the exception in scale and the exception in fuel: 29 data centre applications totalled 16,229 MW in June 2025 and 20.7 GW by September 2025, against a record winter peak of 12,785 MW (AESO, 2025 and 2026). Only 1,200 MW of firm grid capacity was allocated for 2027/28; everything else must bring its own generation, almost all of it natural gas.
- Ontario expects data centres to be 13% of new demand by 2035 (Ontario Energy for Generations, July 2025) and 8.6% of total demand by 2050, inside a system whose demand grows 65% to 250 TWh by 2050 (IESO 2026 Annual Planning Outlook). Its answer is nuclear: Darlington refurbishment finished February 2026 ($12.8 billion, 3,500 MW), Pickering B approved at $26.8 billion for 2,200 MW, and four 300 MW small modular reactors budgeted at $20.9 billion.
- Cold is a real but modest advantage. Calgary, Edmonton, Winnipeg and Quebec City have nine or ten months a year with mean temperatures at or below 15 degrees C (Environment and Climate Change Canada normals 1991-2020); a Montreal operator claims outside-air economization up to 80% of the year (Vantage Data Centers). Climate lowers PUE from perhaps 1.5 to 1.2; it does not change the megawatts of IT load, which is the number utilities must supply.

Narrative

Start with the unit. A data centre is sized in megawatts because everything inside it, from the graphics processing units (GPUs) to the pumps and fans, turns electricity into heat, continuously. A conventional cloud facility considered by the International Energy Agency (IEA) is about 25 MW; a hyperscale site is 100 MW; the largest campuses under construction are around 2,000 MW and the largest planned about 5,000 MW. One MW running all year is 8,760 MWh, which is the electricity of roughly 750 average Canadian homes, or 450 Quebec homes that heat with electricity, or 1,160 Ontario homes that mostly heat with gas (NRCan, 2022 data). That is why a single 1 GW campus, at a 90% load factor, would use about 7.9 TWh a year, 1.3% of everything Canada generated in 2024 and about 9% of Alberta's 2025 output.

The AI difference is density and duty cycle. Traditional data centres serve web traffic, cluster near users to keep latency low, and run at moderate utilization. AI training clusters pack tens of thousands of GPUs into tightly coupled racks and run flat out for weeks; the IEA notes that training "is less latency-sensitive than traditional data centre workloads," which is why training sites can sit far from cities, next to power. Inference, the serving of trained models, is more mixed: a chatbot query tolerates tens of milliseconds and can be served from a distant region, while autonomous driving or trading cannot. In practice, the industry is separating remote, power-led training campuses from smaller, metro-located inference and colocation capacity, with edge computing on devices at the extreme.

Density drives cooling. For fifteen years a rack drew 4 to 10 kW and air cooling was enough. Uptime Institute's 2025 survey finds the typical rack still at about 9 kW and more than 80% of operators with nothing above 30 kW. An Nvidia GB200 NVL72 rack draws around 120 kW, and hyperscale halls now support over 135 kW per rack. Air cannot move that heat, so liquid is piped directly to the chips and rejected outdoors through dry coolers, cooling towers or evaporative systems. The choice sets the water bill: closed-loop designs use almost nothing (Meta's Alberta campus is designed to consume no water in normal operation), while evaporative cooling can consume 1.9 to 2.5 litres per kWh of IT load. Lawrence Berkeley National Laboratory (LBNL) puts the US average at 0.36 L/kWh in 2023, rising as liquid-cooled AI grows. A 100 MW IT load at 85% utilization therefore uses anywhere from near zero to about 1.4 billion litres a year depending on design, a fact that matters in Alberta's dry south and much less in Quebec or coastal BC.

Efficiency is summarized by power usage effectiveness (PUE), total facility energy divided by IT energy. The industry average of 1.54 has not moved in six years, but the frontier has: Google reports 1.09, hyperscale facilities average 1.14 worldwide, and new high-latitude builds routinely reach 1.3 or better. Cold climates help because economizers can use outside air or cold water for most of the year; Calgary has ten months with mean temperatures at or below 15 degrees C, Winnipeg, Edmonton and Quebec City nine, Montreal, Toronto and Vancouver eight. The gain is real but bounded: moving from PUE 1.5 to 1.2 cuts overhead by 30 percentage points of IT load, whereas the IT load itself is fixed by the chips. Climate improves the operating bill; it does not shrink the megawatts the utility must deliver.

Those megawatts are the hard part. Transformers, switchgear and substations are the bottleneck of the decade: Wood Mackenzie's mid-2025 survey shows power transformers averaging 128 weeks and generator step-up units 144 weeks, with prices up 77% since 2019. Grid connection queues run one to three years in the US on average, up to seven in Northern Virginia, up to ten in the Netherlands, and Dublin has paused new connections until 2030 (IEA). The IEA's 2026 update states plainly that grid waits of five to ten years and turbine deliveries of about five years are now the pacing items. Developers respond with behind-the-meter gas plants, batteries and long-dated nuclear deals, but each has its own queue: GE Vernova ended 2025 with an 80 GW turbine backlog and expects to be sold out through 2030; reliable onsite gas must be overbuilt by 30 to 70%; the first Canadian small modular reactor at Darlington costs $7.7 billion for 300 MW and arrives in 2030. Capital intensity follows: about US$11 million per MW to build the shell and power systems, up to US$25 million per MW more for AI compute, and in Canadian terms C$30 to 40 million per MW fully loaded.

Against that backdrop Canada's resource position is strong on paper. The grid is 78% non-emitting, hydro alone supplies 55% of generation, and the country exported 36 TWh to the United States in 2024. Industrial power in Winnipeg (5.09 cents per kWh) and Montreal (5.52) is the cheapest of 22 North American cities benchmarked by Hydro-Quebec, roughly a quarter of Boston or San Francisco and less than half of Toronto or Seattle. Canada has gas (17.9 Bcf/d, the Montney alone 8.1 Bcf/d), water, land, a critical minerals strategy covering copper and rare earths, a trans-Pacific fibre landing at Port Alberni and Vancouver (Topaz, 240 Tbps), and a construction workforce of 1.6 million.

The catch is that surplus has become scarce almost everywhere at once. Quebec, long the continent's exporter, was a net importer in 2023 after drought, exported only 5.9 TWh to the US in 2024, and plans 60 TWh and 8,000 to 9,000 MW of new supply by 2035 at a cost of $155 to 185 billion; it now requires ministerial authorization for any load above 5 MW and proposes a data centre rate of 13 cents per kWh, about double today's large-power rate. British Columbia imported 14.5 TWh from the US in 2024, has just absorbed Site C's 1,100 MW, and is offering a total of 400 MW to AI and data centres over two years through a competitive call that was roughly twice oversubscribed. Manitoba's hydro is spoken for by export contracts and needs new capacity by 2029; it screens every request above 5 MW and has already rejected one 100 MW proposal. Ontario plans for demand to grow 65% to 250 TWh by 2050, with data centres 13% of new demand by 2035, and is betting on refurbished and new nuclear while legislating priority for data centres that bring jobs and domestic hosting. New Brunswick faces a capacity shortfall by 2028 before any data centre connects; Nova Scotia still burns coal and says supply comes first.

Alberta is where the numbers are largest and the fuel is different. Its deregulated market delivered the lowest pool price in eight years in 2025 ($43.68/MWh) and has a supply cushion, but 20.7 GW of data centre requests against a 12.8 GW peak cannot be served by the grid; only 1,200 MW was allocated for 2027/28, and the 2026 Data Centre Regulation now gives priority to "tethered" projects that bring their own generation. Meta's Sturgeon County campus is the template: 1 GW growing to 1.8 GW, a dedicated 932 MW combined-cycle gas plant, closed-loop cooling with no water draw, and a 2030 in-service date for the power plant. The province can host gigawatts, but on gas, which is what the Canada Energy Regulator's scenarios, Ottawa's emissions rules and the tech companies' own clean-energy commitments will all have to reconcile.

For managers the arithmetic is simple. Every 100 MW of AI capacity needs a 110 to 150 MW grid connection, a substation whose transformers take two to three years, water or dry-cooling choices that fix the local footprint, and either a utility with firm surplus or a power plant of its own. Canada has the cheapest clean electrons in North America in Manitoba and Quebec, the largest gas-backed pipeline of projects in Alberta, the deepest nuclear build-out in Ontario, and almost no uncommitted capacity anywhere before 2028 to 2030. The opportunity is real; the constraint is time, iron and firm megawatts, and the provinces that move fastest on new supply and connection rules will capture it.

FIGURE 4.1

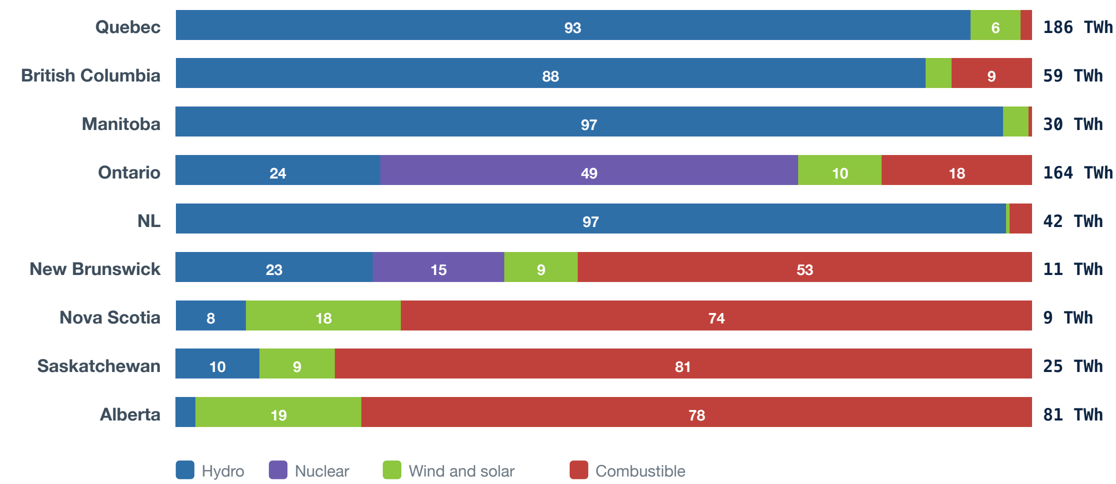
Large-power electricity price, North American cities (cents per kWh)

Green bars are Canadian. Six of the seven cheapest large-power cities in North America are in Canada. This single chart is the whole Canadian pitch.

Source: Hydro-Québec, *Comparison of Electricity Prices in Major North American Cities*, rates in effect 1 April 2025.

FIGURE 4.2

Where each province's electricity comes from (share of generation, 2024)



Quebec, Manitoba, British Columbia and Newfoundland run on hydro; Ontario on nuclear and hydro; Alberta and Saskatchewan on natural gas and coal. A siting decision is therefore also an emissions decision.

Source: Statistics Canada, Table 25-10-0015-01 (2024).

Physics for managers

1. Power, energy, time. A megawatt (MW) is a rate; a megawatt-hour (MWh) is a quantity. 1 MW for one hour = 1 MWh; 1 MW for a year = 8,760 MWh = 8.76 GWh; 1 TWh = 1,000 GWh = 1,000,000 MWh. (Definitions; Canada generated 622.2 TWh in 2024, Statistics Canada.)
2. Data centres are near-baseload. Modelled load factors are about 50% for the fleet and higher for AI training clusters; a large training run was estimated at an 84% load factor (IEA Energy and AI, 2025, citing Shehabi et al.). Utilities must plan for the nameplate MW around the clock, unlike a factory with shifts.
3. Servers eat most of the power. Servers with CPUs and GPUs take about 60% of a modern data centre's electricity, storage about 5%, networking up to 5%, cooling 7% to over 30% depending on efficiency (IEA, 2025).
4. PUE = total facility energy divided by IT energy. Industry average 1.54 (Uptime, 2025); hyperscale world average 1.14 in 2024 falling to about 1.10 by 2030 (IEA, 2025); Google 1.09 (2025); US fleet 1.4 in 2023 heading to 1.15 to 1.35 by 2028 (LBNL, December 2024). A 100 MW IT load needs 154 MW at PUE 1.54 and 110 MW at 1.10.
5. Water usage effectiveness (WUE) is litres per IT kWh. US average site WUE about 0.36 L/kWh (360 L/MWh) in 2023, rising to 0.45 to 0.48 by 2028 as liquid-cooled AI grows (LBNL, 2024); evaporative cooling can reach 1.9 to 2.5 L/kWh (EESI, June 2025); closed-loop hyperscale designs report 0.1 to 0.3 L/kWh (LBNL) and Meta's Alberta campus is designed to use no water in normal operation (Data Center Frontier, July 2026).
6. Racks went from 4 to 10 kW to 100 kW plus. Typical racks are 10 to 30 kW today; AI training is the main driver only above 60 kW per rack (Uptime, 2025). A GB200 NVL72 rack is about 120 kW and hyperscale halls now support over 135 kW per rack (Nvidia, 2025). Above roughly 30 to 50 kW air cannot carry the heat away; direct-to-chip liquid cooling becomes mandatory.

7. Cold air is free cooling. Air-side or water-side economizers replace compressor cooling whenever outdoor air is cool and dry enough. New facilities at high latitudes in North America and Europe often achieve PUE 1.3 or better (Uptime, 2025). Monthly mean temperatures in Canadian cities are below 15 degrees C for 8 to 10 months a year (ECCC normals, 1991-2020).
8. Capacity factor is output divided by nameplate over a year. Hydro and nuclear can run 80 to 95%; wind counts for only about 15% of its nameplate toward Quebec's winter capacity need (Hydro-Quebec Action Plan 2035) and 20% falling to 5% in Nova Scotia at high penetration (IESO Nova Scotia 2026 outlook). Data centres need firm capacity, so wind must be paired with hydro, gas, storage or nuclear.
9. Interconnection takes years because iron takes years. Power transformers 128 weeks, generator step-up transformers 144 weeks, switchgear 44 weeks, with power-transformer prices up 77% since 2019 (Wood Mackenzie Q2 2025 via POWER, January 2026). Grid queues: 1 to 3 years in the US on average, up to 7 in Northern Virginia, up to 10 in the Netherlands, paused in Dublin until 2030 (IEA, 2025, Table 2.4).
10. Behind-the-meter gas is a bridge with its own queue. GE Vernova expected an 80 GW turbine backlog at end 2025 stretching into 2029 and sold out through 2030 (Utility Dive, December 2025). Reliable onsite gas must be overbuilt by 30 to 70% relative to the data centre load (IEA, 2026). Diesel generators remain the standard backup for outages, not a source of daily energy; 20 to 25 GW of batteries could sit inside data centres globally by 2030 (IEA, 2026).
11. Small modular reactors are real but slow and costly. Darlington's four BWRX-300 units (1,200 MW) are budgeted at $20.9 billion, $7.7 billion for the first 300 MW unit in service in 2030, about 14.9 cents per kWh projected (World Nuclear News, May 2025). Global conditional SMR offtake agreements rose from 25 GW to 45 GW in about a year (IEA, April 2026).
12. Capital cost scales with MW. Construction runs about US$10.7 million per MW in 2025 and US$11.3 million in 2026, excluding tenant fit-out that can reach US$25 million per MW for AI (JLL, January 2026); Canadian shell-and-core C$7 to 12 million per MW and C$30 to 40 million per MW fully loaded with compute (Encor Advisors, June 2026); Meta's Alberta campus is over C$13 billion for 1 GW plus C$4 to 4.6 billion for its 932 MW gas plant (Data Center Frontier, July 2026).

The picture in numbers

Table 1. Data centre fundamentals

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE (URL)
Global data centre electricity consumption	415 (2024); 485 (2025); 950 (2030 projection)	TWh	2024-2030	World	IEA Key Questions on Energy and AI (https://iea.blob.core.windows.net/assets/3179f7f8-01f6-4dd6-bffa-c9f7b73f1dc9/KeyQuestionsonEnergyandAI.pdf)
Growth in data centre electricity demand	17	% year on year	2025	World	IEA news, 16 April 2026 (https://www.iea.org/news/data-centre-electricity-use-surged-in-2025-even-with-tightening-bottlenecks-driving-a-scramble-for-solutions)
Installed data centre capacity, world / North America	97 / 43 (2024); 226 / 102 (2030 Base Case)	GW	2024, 2030	World, North America	IEA Energy and AI, Table A.2 (https://iea.blob.core.windows.net/assets/de9dea13-b07d-42c5-a398-d1b3ae17d866/EnergyandAI.pdf)

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE (URL)
US data centre electricity use	176 (4.4% of US); 325 to 580 (2028)	TWh	2023, 2028	United States	LBNL 2024 report (https://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report_1.pdf)
Share of electricity used by servers / cooling	60 / 7 to over 30	%	2025	World	IEA Energy and AI (same URL)
Average PUE, industry survey	1.54 (all); 1.44 (20 MW+); 1.48 (built since 2020)	ratio	2025	World	Uptime Institute survey 2025 (https://datacenter.uptimeinstitute.com/rs/711-RIA-145/images/2025.Annual.Survey.Report.pdf)
PUE by type, world average	1.14 hyperscale; 1.53 colocation; 1.92 enterprise; 1.41 total	ratio	2024	World	IEA Energy and AI, Table A.1
PUE, North America	1.32 (2024); 1.24 (2030)	ratio	2024, 2030	North America	IEA Energy and AI, Table A.3
Best-in-class fleet PUE	1.09	ratio	2025	Google fleet	Google (https://datacenters.google/efficiency/)
US average PUE	1.4 (2023); 1.15 to 1.35 (2028)	ratio	2023, 2028	United States	LBNL 2024
Site WUE, US average	0.36 (2023); 0.45 to 0.48 (2028)	L per IT kWh	2023, 2028	United States	LBNL 2024
WUE, industry average / evaporative maximum	1.9 / about 2.5	L per kWh	2025	US	EESI (https://www.eesi.org/articles/view/data-centers-and-water-consumption)
US data centre direct water use	66 (2023); hyperscale alone 60 to 124 (2028)	billion litres	2023, 2028	United States	LBNL 2024
Typical rack density (modal average)	9 (8.3 in 2024); over 80% of sites have no rack above 30 kW	kW per rack	2025	World	Uptime 2025
GB200 NVL72 rack power	about 120 (132 observed at full load in third-party deployments)	kW per rack	2025	Product	Nvidia blog (https://blogs.nvidia.com/blog/blackwell-platform-water-efficiency-liquid-cooling-data-centers-ai-factories)
Power transformer / GSU / switchgear lead time	128 / 144 / 44	weeks	Q2 2025	North America	POWER citing Wood Mackenzie (https://www.powermag.com/transformers-in-2026-shortage-scramble-or-self-inflicted-crisis/)

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE (URL)
Grid connection queue	US 1 to 3; N. Virginia up to 7; Netherlands up to 10; Dublin paused to 2030	years	2025	Selected	IEA Energy and AI, Table 2.4
Gas turbine delivery / backlog	about 5 years; GE Vernova 80 GW backlog into 2029	years, GW	2025	World	IEA 2026; Utility Dive (https://www.utilitydive.com/news/ge-vernova-gas-turbine-investor/807662/)
Onsite gas overbuild needed for reliability	30 to 70	% above load	2026	World	IEA Key Questions 2026
Construction cost, global	US$10.7 million (2025); US$11.3 million (2026); US$7.7 million (2020)	per MW	2020-2026	World	JLL (https://www.jll.com/en-us/insights/global-data-center-outlook)
Construction cost, Canada	C$7 to 12 million shell and core; about C$20 million AI-optimized; C$30 to 40 million fully loaded	per MW	2026	Canada	Encor Advisors (https://encoradvisors.com/data-center-cost/)
Darlington SMR cost	$20.9 billion for 4 x 300 MW; first unit $7.7 billion; 14.9 cents per kWh projected	C$	2025	Ontario	World Nuclear News (https://world-nuclear-news.org/articles/what-is-the-budget-for-canadas-first-smr-project)
Average Canadian household electricity	11,650 (Canada); 19,600 (Quebec); 7,560 (Ontario); 10,190 (BC); 7,320 (Alberta)	kWh per year	2022	Canada	NRCan NEUD (https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=res&juris=ca&year=2022&rn=1&page=0)
Homes served by 1 MW at 100% load	about 750 (Canada average); 450 (Quebec); 1,160 (Ontario)	homes	2022 basis	Canada	Analyst calculation from NEUD, 8,760 MWh per MW-year
Site C output versus homes	5,100 GWh for about 500,000 homes (10,200 kWh each)	GWh, homes	2025	BC	BC Hydro (https://www.bchydro.com/news/press_centre/news_releases/2025/site-c-full-operation.html)

Table 2. Canada's electricity system, 2024

METRIC	VALUE	UNIT	YEAR	SOURCE (URL)
Total generation	622.2	TWh	2024	Statistics Canada, The Daily 22 Oct 2025 (https://www150.statcan.gc.ca/n1/daily-quotidien/251022/dq251022c-eng.htm)
Hydro share / renewables share	55.2 / 63.9	%	2024	Same
Non-emitting share (hydro, nuclear, wind, solar, tidal)	77.9 (2024); 77.0 (2025)	%	2024, 2025	Analyst calculation from StatCan Table 25-10-0015-01 (https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2510001501)
Nuclear generation	80.7	TWh	2024	StatCan Daily
Exports to US / imports from US	36.1 / 23.5	TWh	2024	StatCan Daily
Largest exporters to US	Ontario 12.8; BC 6.3; Manitoba 6.0	TWh	2024	StatCan Daily
Largest importer from US	BC 14.5	TWh	2024	StatCan Daily
Sales to end users / residential sales	503.3 / 179.6	TWh	2024	StatCan Table 25-10-0021-01 (https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2510002101)
Installed capacity, all Canada	about 160	GW	2023	CER Energy Future 2026 (https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2026/results/)
Demand growth to 2050	+30 (Lower) to +120 (Net-zero); about +50 (Current Measures)	% vs 2023	2050	CER Energy Future 2026
Data centre demand by 2050	1.5 to 12 GW; about 100 TWh (a quarter of growth) in Higher scenario	GW, TWh	2050	CER via Canadian Press (https://www.pentictonherald.ca/news/national_news/article_2d1def2f-1143-598d-8076-90a558ba8a52.html); CER results page
Provincial system outlooks, aggregate demand	604 (2025) to 982 (2050), +62%	TWh	2025-2050	Transition Accelerator, Nov 2025 (https://transitionaccelerator.ca/wp-content/uploads/2025/11/Forecasting-Canadas-Electricity-Future-Report-Final-November-2025.pdf)
Natural gas production, Canada / Montney	17.9 (2023) / 8.1 (2022, 47% of Canada)	Bcf/d	2022-2023	CER Canada profile; CER Energy Future 2023 (https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2023/canada-energy-futures-2023.pdf)

Table 3. Province by province (generation mix 2024 from StatCan 25-10-0015; industrial price 2025 from Hydro-Quebec for a 50,000 kW, 85% load factor customer; policy status as of August 2026)

British Columbia

HYDRO %	NUCLEAR %
87.6	0
WIND %	SOLAR %
3.0	0
COMBUSTIBLE FUELS % (MAIN FUEL)	NON-EMITTING %
9.4 (biomass 6.6, gas 2.8)	90.6
INDUSTRIAL PRICE, CENTS/KWH (CITY)	SURPLUS OR DEFICIT OUTLOOK
6.72 (Vancouver)	Deficit in dry years: net importer, 14.5 TWh imported from US in 2024; Site C (1,100 MW, 5,100 GWh) fully in service Aug 2025 (+8% supply); wind calls for power 2024 and 2025
LARGE-LOAD POLICY STATUS	MAIN UTILITY OR OPERATOR
Bill 31 (Nov 2025): competitive call; 300 MW AI + 100 MW data centres over 2026-2028; 10 to 145 MW per project; $25,000/MW bid security; results Sept 2026; about 800 MW requested for 400 MW (secondary source)	BC Hydro

Alberta

HYDRO %	NUCLEAR %
2.3	0
WIND %	SOLAR %
15.9	3.5
COMBUSTIBLE FUELS % (MAIN FUEL)	NON-EMITTING %
78.2 (natural gas; coal ended June 2024; gas 76.8% of 2025 generation per AESO)	21.6
INDUSTRIAL PRICE, CENTS/KWH (CITY)	SURPLUS OR DEFICIT OUTLOOK
7.99 (Calgary), 8.05 (Edmonton); pool price $43.68/MWh in 2025	Surplus energy at low prices today (supply cushion 1,960 MW), but 20.7 GW of data centre requests versus 12,785 MW record peak; only 1,200 MW firm for 2027/28
LARGE-LOAD POLICY STATUS	MAIN UTILITY OR OPERATOR
AESO interim 1,200 MW allocated (970 + 230 MW); Data Centre Regulation AR 117/2026: large data centre 75 MW+, tethered (self-supplied) projects prioritized	AESO (system operator), deregulated market

Saskatchewan

HYDRO %	NUCLEAR %
9.7	0
WIND %	SOLAR %
8.6	0.2
COMBUSTIBLE FUELS % (MAIN FUEL)	NON-EMITTING %
80.9 (gas 44%, coal 41% in 2021)	18.5
INDUSTRIAL PRICE, CENTS/KWH (CITY)	SURPLUS OR DEFICIT OUTLOOK
8.05 (Regina)	Constrained by dispatchable baseload; coal units refurbished (Boundary Dam 4 and 5, 278 MW); BWRX-300 decision 2029, mid-2030s; 1,000 MW-class reactor selection under way
LARGE-LOAD POLICY STATUS	MAIN UTILITY OR OPERATOR
No cap or formal allocation; Bell 300 MW near Regina with 300 MW gas backup (construction spring 2026)	SaskPower

Manitoba

HYDRO %
96.7

WIND %
3.0

COMBUSTIBLE FUELS % (MAIN FUEL)
0.4

INDUSTRIAL PRICE, CENTS/KWH (CITY)
5.09 (Winnipeg, lowest of 22 cities)

LARGE-LOAD POLICY STATUS
Manitoba Hydro Act changes (1 Sept 2025): every request above 5 MW screened; crypto ineligible; 100 MW Jet.AI proposal rejected June 2026 (secondary)

NUCLEAR %
0

SOLAR %
0

NON-EMITTING %
99.6

SURPLUS OR DEFICIT OUTLOOK
Surplus largely committed to exports (6.0 TWh to US 2024); new capacity needed by 2029; 13 data centre requests

MAIN UTILITY OR OPERATOR
Manitoba Hydro

Ontario

HYDRO %
23.9

WIND %
8.4

COMBUSTIBLE FUELS % (MAIN FUEL)
17.5 (natural gas)

INDUSTRIAL PRICE, CENTS/KWH (CITY)
12.66 (Toronto), 12.31 (Ottawa)

LARGE-LOAD POLICY STATUS
Electricity Act s.28.1 (Dec 2025) gatekeeping; prioritization of data centres with local benefits (Energy for Generations, July 2025); ICI pricing; data centres 13% of new demand by 2035

NUCLEAR %
48.7

SOLAR %
1.4

NON-EMITTING %
82.5

SURPLUS OR DEFICIT OUTLOOK
Demand +65% to 250 TWh by 2050; energy need 8.5 TWh by 2032; capacity need 3,800 MW by 2040; nuclear refurbishments and SMRs; exports 12.8 TWh in 2024

MAIN UTILITY OR OPERATOR
IESO, Hydro One, OPG

Quebec

HYDRO %
92.8

WIND %
5.9

COMBUSTIBLE FUELS % (MAIN FUEL)
1.3

INDUSTRIAL PRICE, CENTS/KWH (CITY)
5.52 (Montreal)

LARGE-LOAD POLICY STATUS
Ministerial authorization for 5 MW+ since 2025; Bill 69; proposed Rate CD about 13 cents/kWh (double); data centres 200 MW today to 1,000 MW by 2035

NUCLEAR %
0

SOLAR %
0

NON-EMITTING %
98.7

SURPLUS OR DEFICIT OUTLOOK
Deficit emerging: net importer in 2023 (14.2 TWh) and only 5.9 TWh exported to US in 2024 versus 22.6 TWh gross in 2022; needs +60 TWh and 8,000 to 9,000 MW by 2035 (10,000 MW wind, 3,800 to 4,200 MW hydro, $155 to 185 billion)

MAIN UTILITY OR OPERATOR
Hydro-Quebec

New Brunswick

HYDRO %
23.0

NUCLEAR %
15.4 (2024 outage year; 25.5 in 2025)

WIND %
8.6

SOLAR %
0

COMBUSTIBLE FUELS % (MAIN FUEL)
53.0 (gas, coal, oil)

NON-EMITTING %
47.0 (54.2 in 2025)

INDUSTRIAL PRICE, CENTS/KWH (CITY)
10.63 (Moncton)

SURPLUS OR DEFICIT OUTLOOK
Capacity shortfall forecast for 2028; new dual-fuel combustion turbine (about 400 MW) with PROENERGY

LARGE-LOAD POLICY STATUS
No framework; NB Power seeks flexible, interruptible loads; Lorneville proposal 190 to 390 MW

MAIN UTILITY OR OPERATOR
NB Power

Nova Scotia

HYDRO %
8.2

NUCLEAR %
0

WIND %
18.1

SOLAR %
0

COMBUSTIBLE FUELS % (MAIN FUEL)
73.6 (coal about 55% in 2021)

NON-EMITTING %
26.4

INDUSTRIAL PRICE, CENTS/KWH (CITY)
13.43 (Halifax, highest in Canada)

SURPLUS OR DEFICIT OUTLOOK
Peak about 2,500 MW growing 1.1% per year; coal out by 2030, 80% renewable target; Wind West 5 GW by 2033 ($60 billion)

LARGE-LOAD POLICY STATUS
No data centre framework; premier says supply must come first

MAIN UTILITY OR OPERATOR
Nova Scotia Power, IESO Nova Scotia

Newfoundland and Labrador

HYDRO %
96.9

NUCLEAR %
0

WIND %
0.4

SOLAR %
0

COMBUSTIBLE FUELS % (MAIN FUEL)
2.6

NON-EMITTING %
97.4

INDUSTRIAL PRICE, CENTS/KWH (CITY)
7.66 (St. John's)

SURPLUS OR DEFICIT OUTLOOK
Large surplus committed to Quebec (29.6 TWh interprovincial deliveries 2024); new Churchill Falls and Gull Island deal keeps 2,350 MW plus 400 MW wind in NL

LARGE-LOAD POLICY STATUS
No data centre framework

MAIN UTILITY OR OPERATOR
NL Hydro

Prince Edward Island

HYDRO %	NUCLEAR %
0	0
WIND %	SOLAR %
93.4	5.6
COMBUSTIBLE FUELS % (MAIN FUEL)	NON-EMITTING %
1.0	99.0 (own generation only)
INDUSTRIAL PRICE, CENTS/KWH (CITY)	SURPLUS OR DEFICIT OUTLOOK
11.27 (Charlottetown)	Imports about 69% of electricity from New Brunswick
LARGE-LOAD POLICY STATUS	MAIN UTILITY OR OPERATOR
None	Maritime Electric

Yukon

HYDRO %	NUCLEAR %
77.8	0
WIND %	SOLAR %
1.0	0.1
COMBUSTIBLE FUELS % (MAIN FUEL)	NON-EMITTING %
21.0 (diesel, LNG)	79.0
INDUSTRIAL PRICE, CENTS/KWH (CITY)	SURPLUS OR DEFICIT OUTLOOK
n/a	Small isolated grid (0.6 TWh)
LARGE-LOAD POLICY STATUS	MAIN UTILITY OR OPERATOR
None	Yukon Energy

Northwest Territories

HYDRO %	NUCLEAR %
20.0	0
WIND %	SOLAR %
2.8	0.5
COMBUSTIBLE FUELS % (MAIN FUEL)	NON-EMITTING %
76.7 (diesel, gas)	23.3
INDUSTRIAL PRICE, CENTS/KWH (CITY)	SURPLUS OR DEFICIT OUTLOOK
n/a	Small isolated grids (0.7 TWh)
LARGE-LOAD POLICY STATUS	MAIN UTILITY OR OPERATOR
None	NT Power Corp

Nunavut

HYDRO %	NUCLEAR %
0	0
WIND %	SOLAR %
0	0
COMBUSTIBLE FUELS % (MAIN FUEL)	NON-EMITTING %
100 (diesel)	0
INDUSTRIAL PRICE, CENTS/KWH (CITY)	SURPLUS OR DEFICIT OUTLOOK
n/a	Diesel micro-grids (0.2 TWh)
LARGE-LOAD POLICY STATUS	MAIN UTILITY OR OPERATOR
None	Qulliq Energy

Non-emitting share here counts hydro, nuclear, wind, solar and tidal only; biomass is excluded. The StatCan monthly table totals 609.5 TWh for 2024 against 622.2 TWh in the annual survey; shares are internally consistent within each table.

Table 4. Industrial electricity prices, 50,000 kW customer, 85% load factor, 30.6 GWh per month, rates in effect 1 April 2025 (Hydro-Quebec, https://www.hydroquebec.com/data/documents-donnees/pdf/comparaison-prix-2025-en.pdf)

CITY	CENTS PER KWH (C$)	INDEX (MONTREAL = 100)
Winnipeg, MB	5.09	92
Montreal, QC	5.52	100
Vancouver, BC	6.72	122
St. John's, NL	7.66	139
Calgary, AB	7.99	145
Edmonton, AB	8.05	146
Regina, SK	8.05	146
Miami, FL	8.68	157
Detroit, MI	9.22	167
Chicago, IL	9.25	168
Nashville, TN	10.04	182
Moncton, NB	10.63	193
Charlottetown, PE	11.27	204
Seattle, WA	12.16	220
Ottawa, ON	12.31	223
Portland, OR	12.35	224
Toronto, ON	12.66	229
Houston, TX	12.90	234
Halifax, NS	13.43	243
New York, NY	22.88	414
San Francisco, CA	23.88	432
Boston, MA	24.58	445
Average of 22 cities	11.61	

For a 5,000 kW customer at 85% load factor the same ranking holds: Montreal 5.83, Winnipeg 6.00, Calgary 8.02, Vancouver 8.42, Regina 9.57, Edmonton 10.17, Ottawa 12.75, Toronto 12.80, Halifax 13.43 cents per kWh. Alberta's 2025 average pool price of $43.68/MWh (4.37 cents) is energy only; the Hydro-Quebec figures for Calgary and Edmonton are estimated all-in bills.

Table 5. Climate and free cooling, monthly mean temperature, ECCC normals 1991-2020 (via Wikipedia city climate tables and the Calgary weatherbox template)

CITY	ANNUAL MEAN, DEG C	COLDEST MONTH	WARMEST MONTH	MONTHS WITH MEAN AT OR BELOW 15 DEG C (ILLUSTRATIVE ECONOMIZER PROXY)
Winnipeg	2.9	Jan -16.3	Jul 19.5	9
Edmonton	4.2	Jan -10.3	Jul 18.1	9
Calgary	4.5	Jan -7.6	Jul 16.9	10
Quebec City	4.7	Jan -11.9	Jul 19.5	9
Montreal	7.0	Jan -9.2	Jul 21.7	8
Toronto	9.7	Jan -3.5	Jul 22.5	8
Vancouver	10.5	Dec 3.9	Jul and Aug 18.2	8

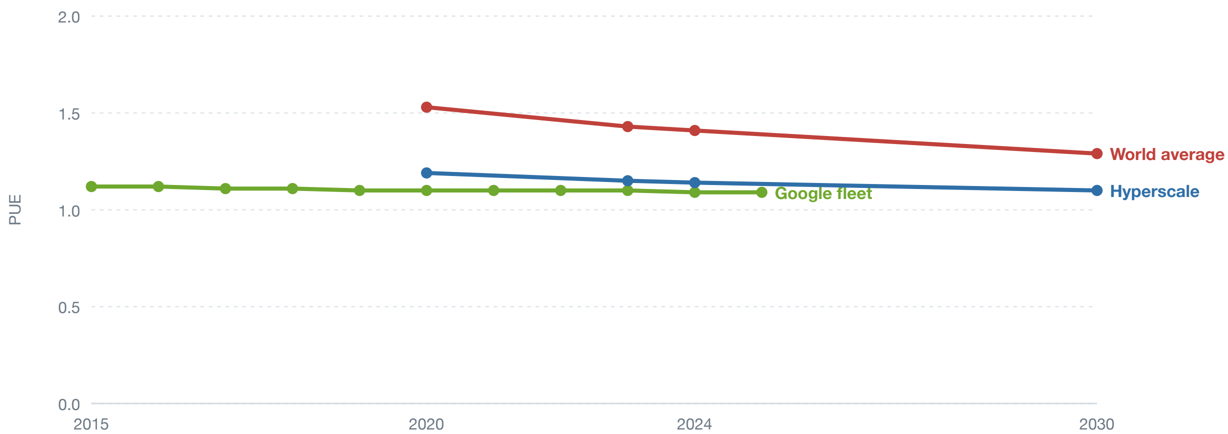
The 15 degree threshold is an analyst simplification for comparing cities; actual economizer hours depend on humidity, design supply temperature and cooling architecture. A Montreal operator claims outside-air economization up to 80% of the year (Vantage Data Centers).

Table 6. Alberta market snapshot, 2025 (AESO Annual Market Statistics, March 2026, https://www.aeso.ca/assets/Annual-Market-Stats-2025.pdf)

METRIC	2024	2025
Average pool price ($/MWh)	62.78	43.68 (median $23; 10-year inflation-adjusted average $78)
Average Alberta Internal Load (MW)	10,112	10,316
Winter peak (MW)	12,241	12,785 (record, December 2025)
Installed capacity (MW)	23,122	23,242 (gas 14,182; wind 5,684; solar 1,850)
Average supply cushion (MW)	1,794	1,960
Gas-fired share of generation		76.8%; wind, solar and hydro 21.0%

FIGURE 4.3

Power usage effectiveness, lower is better

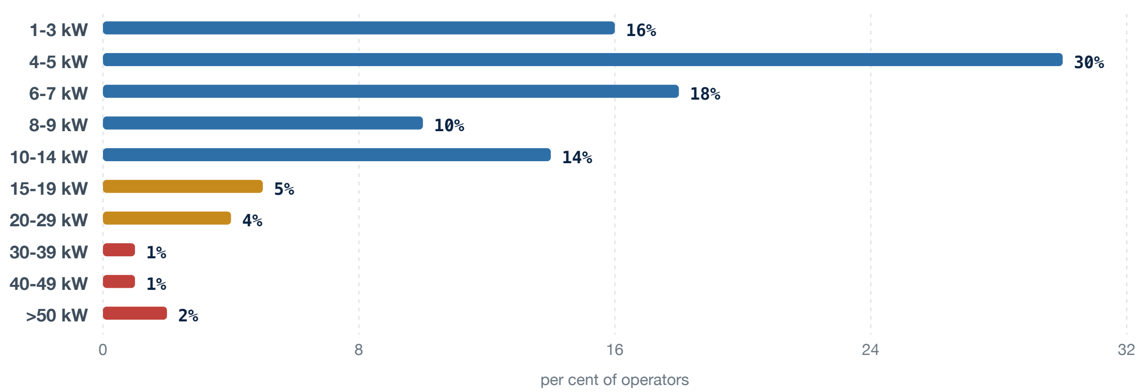


The world average has been stuck near 1.5 for six years while the best operators run at 1.1. On a two hundred megawatt campus that gap is about seventy megawatts of pure waste, which is an entire mid-sized project's worth of grid connection.

Source: Google data centres; IEA *Energy and AI*, Table A.1.

FIGURE 4.4

Most common rack density in operators' own halls (2025)



More than eighty per cent of operators have nothing above thirty kilowatts a rack. A current artificial intelligence rack draws about a hundred and twenty. This is why so much existing Canadian floor space is useless for this workload.

Source: Uptime Institute Annual Survey (2025).

Contested or uncertain figures

- Land per MW. No primary source with a defensible acres-per-MW figure could be retrieved; industry rules of thumb vary widely with density and the power plant footprint. Only building-floor anchors were found (Vantage Montreal I: 11 MW of IT in 60,000 square feet). Treat any acreage figure as unverified.
- Alberta's queue. AESO reported 16,229 MW (29 projects, June 2025) and 20.7 GW (September 2025); a secondary tracker counts 19.6 GW (July 2026) and 9,762 MW "announced." These are requests, not commit-

ments; the queue median slip is reported at 416 days. DeSmog's emissions (33 to 63 Mt CO2e for 15.5 GW) and water (200 billion litres for 20 GW) figures are third-party estimates.

- CER data centre range. The 1.5 to 12 GW by 2050 figure comes from a Canadian Press report on the April 2026 release; the CER results page itself gives about 100 TWh (a quarter of growth) in the Higher scenario. Both are scenario outputs, not forecasts.
- Generation totals. StatCan's monthly table (25-10-0015) sums to 609.5 TWh for 2024 while the annual survey (25-10-0020/21) reports 622.2 TWh; shares in Table 3 come from the monthly table. CER provincial profiles use 2021 data and split gas from coal; StatCan does not.
- Household conversions. NEUD household electricity (2022) ranges from 7,300 kWh in Alberta to 19,600 kWh in Quebec; "homes per MW" changes by a factor of 2.7 depending on the province chosen, and assumes 100% load factor.
- PUE and WUE. Survey PUE is self-reported and skewed toward larger operators; Google's 1.09 is a fleet average across mild and cold sites. WUE conventions differ (site versus source water; litres per IT kWh versus per facility kWh).
- Capital cost per MW. JLL (US$10.7 to 11.3 million construction), Encor (C$7 to 12 million shell, C$30 to 40 million fully loaded) and project anchors (Meta C$13 million per MW campus; Darlington SMR C$17 million per MW average, C$26 million first unit) define scope differently; compare only like with like.
- Free cooling hours. The month counts in Table 5 use a 15 degree mean-temperature proxy; the Vantage "80% of the year" claim is a vendor statement.
- Churchill Falls values. The 2024 MOU (5.9 cents per kWh average; $225 billion nominal) and the August 2026 agreement ($49 billion 2026 NPV; $273 billion nominal) use different bases and are politically contested in Newfoundland and Labrador.
- Labour gap. BuildForce's July 2026 outlook shows a 34,300-worker shortfall by 2034; the prior-year outlook cited in search results showed 108,300. Neither isolates electricians.
- Nova Scotia and New Brunswick project sizes. The Lorneville data centre is reported at 190 MW (CBC, November 2025) and 390 MW (secondary tracker, August 2026).

Open questions students could investigate

1. If Quebec's proposed 13 cents per kWh data centre rate is approved, at what PUE and utilization does Montreal still beat a gas-backed Alberta site at 8 cents plus the capital cost of a dedicated plant?
2. What is the realistic firm surplus, in MW by year from 2027 to 2032, in each of BC, Manitoba, Quebec and Ontario once export contracts, electrification and committed industrial loads are netted out?
3. How much of Alberta's 20 GW queue would survive a federal clean electricity standard or a carbon price on behind-the-meter gas, and what would carbon capture add per MWh?
4. Which Canadian cities can support 100 kW liquid-cooled racks with closed-loop dry cooling year-round, and how many hours per year would compressor cooling still be required?
5. What would a 300 MW Darlington-type SMR cost per MWh for a data centre offtaker compared with the 14.9 cents per kWh OPG projection, and who carries construction risk?
6. Can Ontario's Industrial Conservation Initiative be redesigned so that flat AI loads provide peak flexibility (workload shifting, batteries) rather than simply paying more Global Adjustment?

7. How many electricians, power engineers and pipefitters does a 1 GW campus plus its substation and power plant require at peak, and can Canada's 306,200-worker hiring requirement absorb three or four such projects at once?
8. Is Churchill Falls and Gull Island power (2,350 MW retained in Newfoundland and Labrador) better used for data centres in Labrador, for export through Quebec, or for green industry, on a dollars-per-MWh and jobs-per-MW basis?
9. What fibre latency, in milliseconds, separates Montreal, Toronto and Calgary from New York, Chicago and Seattle, and which AI inference workloads can tolerate it?
10. How should provinces rank competing 100 MW applicants: jobs per MW, tax per MW, domestic data sovereignty, or willingness to be curtailed at peak?

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05

CHAPTER 5

The machines: chips, racks, cooling, and the plan to put data centres in orbit

Underneath every megawatt figure is a processor with a power rating. This chapter works from the chip upward: what one accelerator draws, how many fit in a building, what that costs, and how seriously to take the argument that all of this belongs in space.

300 W → 1,400 W

Power drawn by a single accelerator, from the 2016 generation to the 2025 generation. The rack that holds them has gone from about nine kilowatts to more than a hundred.

WHAT THIS CHAPTER ANSWERS

- ? What does one accelerator actually consume, and how fast is that rising?
- ? How many chips are in a hundred megawatt building, and what do they cost?
- ? At what point does air cooling stop working?
- ? Is orbital computing a real alternative this decade, or an announcement?

KEY TAKEAWAYS

- A megawatt is a rate, a megawatt-hour is an amount, and the bridge is time. One MW sustained for a year is 8,760 MWh, that is 8.76 GWh. At a realistic 90% load factor a 1 MW AI hall consumes 7.88 GWh a year, the electricity of about 677 average Canadian homes at 11,650 kWh each (Natural Resources Canada Comprehensive Energy Use Database, 2022 data).
- Canada generated 625.2 TWh of electricity in 2025, up 2.6% (Statistics Canada, Electricity year in review 2025, published March 2026). That is an average output of 71.4 GW across the year, so a single 1 GW AI campus at 90% load takes 7.88 TWh, or 1.26% of everything the country generates.

- Price is the whole argument for Canadian siting. A 1 GW campus costs about C$434 million a year in electricity at the cheap Canadian industrial rate of 5.5 cents per kWh and about C$1.02 billion at 13 cents (derived from Hydro-Quebec's comparison of electricity prices, rates in effect 1 April 2025). The spread is roughly C$590 million a year.
- Power per accelerator has escalated relentlessly: 300 W for a Tesla P100 in 2016, 400 W for an A100 in 2020, 700 W for an H100 in 2022, 1,400 W for AMD's MI355X and NVIDIA's Blackwell Ultra in 2025 (vendor datasheets). AMD's own published maximum total board power went from 750 W (MI300X, 2023) to 1,400 W (MI355X, 2025) in about two years.
- The rack, not the chip, is now the unit. NVIDIA's GB200 NVL72 puts 72 GPUs in one cabinet at about 120 kW, and NVIDIA's own reference architecture states the GB300 NVL72 requires up to 142 kW, delivered by eight 33 kW power shelves. NVIDIA projects 1 MW racks by 2027 (NVIDIA Technical Blog, May 2025).
- The installed base is nowhere near ready. More than 80% of operators report no rack above 30 kW and only 22% use direct liquid cooling (Uptime Institute Global Data Center Survey, July 2025). Above roughly 30 to 50 kW air stops working, and NVIDIA and AMD now ship their top parts as liquid-only, so the operator no longer gets a vote.
- The usable rule of thumb: one accelerator needs roughly 1.5 to 2.5 kW of facility power once server overhead, networking, storage and PUE are included, so an AI data centre holds roughly 400 to 500 accelerators per megawatt and about half a million per gigawatt. Two real installations validate it: xAI's Colossus ran 100,000 H100s on 150 MW of approved grid supply (NVIDIA newsroom, October 2024), and TELUS's British Columbia cluster is 60,000-plus GPUs against 150 MW by 2032 (TELUS, May 2026), which is exactly 400 per MW.
- Chips alone are roughly US$2.2 billion for a 100 MW Blackwell-class campus, using about 725 NVL72 racks at an estimated US$3 million each (HSBC estimate, 2025). That cross-checks against JLL's up to US$25 million per MW of AI technology fit-out and against Jensen Huang's claim of US$50 to 60 billion per gigawatt, of which about US$35 billion is NVIDIA content.
- Two independent haircuts sit under every headline GPU number. Operationally, Meta measured 38% to 43% model FLOPs utilisation and above 90% goodput on a 16,000 H100 Llama 3 run, so delivered compute is roughly 35 to 39% of nameplate (Meta, July 2024). Financially, in the same twelve months Amazon shortened server lives from six years to five, citing the pace of AI, at a US$1.0 billion cost to FY2025 net income, while Meta lengthened them to 5.5 years for a US$2.59 billion benefit (10-K filings, early 2026).
- Orbital compute is real research and a real demonstration, not a product. Google's Project Suncatcher paper (4 November 2025) reports Trillium TPUs surviving 15 krad(Si) with no hard failures and a bench demonstration of 1.6 Tbps bidirectional free-space optics, and states that space compute becomes cost-comparable to terrestrial data centre energy costs only if launch reaches about US$200 per kilogram to low Earth orbit, which its own learning curve puts in the mid-2030s at about 180 Starship launches a year.
- Starcloud put a single NVIDIA H100 in orbit on Starcloud-1 in November 2025, the first data centre class GPU to operate in space. Everything larger, including SpaceX's stated ambition of gigawatts per year of solar-powered compute satellites and Jeff Bezos's forecast of gigawatt data centres in space within 10 to 20 years, is intention rather than hardware.
- For Canada the practical conclusions are unglamorous. Liquid cooling erodes the free-cooling advantage but creates a usable waste-heat product, which only has a buyer in a cold place. The United States' 25% Section 232 semiconductor tariff carries no CUSMA exemption and exempts chips destined for US data centres, which is a direct wedge against Canadian siting (Government of Canada Trade Commissioner Service, updated 27 August 2026). And orbital compute will not change a 2026 to 2032 Canadian siting decision.

Narrative

Start with one chip and one number. An accelerator is a specialised processor that does the arithmetic behind AI. The best known is NVIDIA's H100 graphics processing unit (GPU), and NVIDIA's own specification says its maximum thermal design power, the heat its cooling system must be built to remove, is up to 700 watts. That single figure is the seed from which every other number in this brief grows. A domestic kettle is about 1,500 watts, so two H100s running flat out are roughly one kettle, permanently on, for five years.

The escalation is the story, not the level. In 2016 NVIDIA's flagship data centre chip, the Tesla P100, drew 300 watts. The A100 in 2020 drew 400. The H100 in 2022 drew 700. In 2025 AMD published a maximum total board power of 1,400 watts for its Instinct MI355X, and NVIDIA's Blackwell Ultra is reported at the same figure. AMD is the cleanest illustration because it publishes one comparable number per part in a datasheet: 750 watts for the MI300X in 2023, 1,000 for the MI350X and 1,400 for the MI355X in 2025. That is a near doubling in two years, and it happened because performance per chip rose faster than efficiency per watt. Chips did become more efficient; they just got bigger faster.

Above roughly forty kilowatts a rack, air stops working. A rack is a standard cabinet about the size of a fridge. For twenty years the typical rack drew under ten kilowatts and was cooled by blowing cold air through it. Uptime Institute's July 2025 survey found more than 80% of operators still have no rack above thirty kilowatts and only 22% use direct liquid cooling. Meanwhile NVIDIA's GB200 NVL72, which packs 72 Blackwell GPUs and 36 Grace central processing units into one cabinet, draws about 120 kilowatts, and NVIDIA's own reference architecture states its successor, the GB300 NVL72, requires up to 142 kilowatts, fed by eight power shelves of 33 kilowatts each. Air physically cannot move that much heat. So the industry has moved to direct-to-chip liquid cooling, in which water or a coolant runs through a metal cold plate bolted onto the chip, capturing roughly 80% of the heat in a closed loop. Immersion cooling, in which whole servers sit in a bath of non-conductive fluid, handles even higher densities but is still rare. The practical threshold where liquid becomes mandatory is somewhere between thirty and fifty kilowatts a rack, and NVIDIA and AMD have settled the question for their customers by shipping their top parts as liquid-only. NVIDIA now says today's racks exceed 200 kilowatts and projects one-megawatt racks in 2027.

From one chip to one building. The manager's question is how many accelerators fit in a given amount of power. Build it in three steps. First, chip to server: NVIDIA's own DGX H200 puts eight 700-watt GPUs in a chassis rated at 10.2 kilowatts, a multiplier of about 1.8 once the host processors, memory, storage, fans and power supply losses are counted. In a rack-scale system that overhead is already inside the published rack figure, so 120 kilowatts divided by 72 GPUs is about 1,670 watts per GPU. Second, add the network switches and storage that sit outside the compute rack, roughly 8 to 10% more. Third, multiply by power usage effectiveness (PUE), the ratio of total building power to information technology (IT) power, which is about 1.15 for a new cold-climate liquid-cooled hall and 1.30 for a merely competent one. The answer is that **one accelerator needs roughly 1.5 to 2.5 kilowatts of facility power**, and a modern AI data centre holds **roughly 400 to 500 accelerators per megawatt, about half a million per gigawatt**.

Two real installations confirm it. xAI's Colossus in Memphis ran 100,000 NVIDIA Hopper GPUs, a figure NVIDIA itself published in October 2024, against 150 megawatts of grid supply approved by the local utility and the Tennessee Valley Authority. That is 1.5 kilowatts per GPU, within 10% of the bottom-up estimate. TELUS announced in May 2026 that its British Columbia cluster will hold over 60,000 NVIDIA GPUs against more than 150 megawatts by 2032: exactly 400 accelerators per megawatt, which is what the arithmetic gives for a Blackwell Ultra or Rubin class part. Larry Ellison's claim of more than 450,000 GB200 GPUs at Stargate Abilene against a 1.2 gigawatt grid interconnect implies 2.67 kilowatts per GPU, at the high end of the same band. The rule holds across three companies, two countries and three chip generations, which is the best evidence that it is not a coincidence.

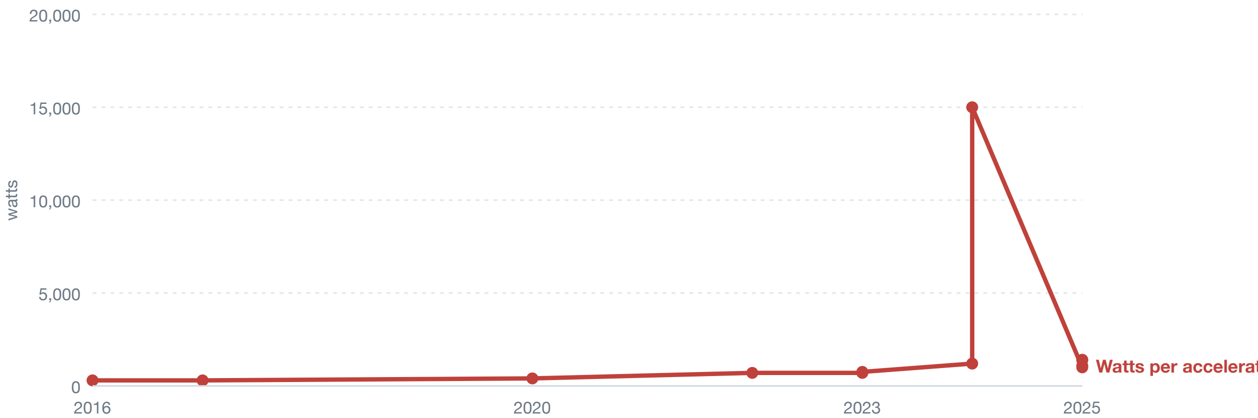
What that costs. At Epoch AI's transparent estimate of US$25,000 per H100 and US$37,000 to US$43,000 per Blackwell part, a 100 megawatt campus contains roughly 43,000 to 48,000 Blackwell GPUs, which is about 725 GB200 NVL72 racks. At HSBC's estimated US$3 million per rack, that is about US$2.2 billion of silicon and racks before a single wall is built. Two independent checks agree: JLL puts AI technology fit-out at up to US$25 million per megawatt, that is US$2.5 billion for 100 megawatts, and Jensen Huang's stated US$50 to 60 billion per gigawatt with about US$35 billion of NVIDIA content implies US$3.5 billion of NVIDIA content per 100 megawatts. Against that, the electricity is almost cheap: C$43 million a year at Manitoba or Quebec industrial rates. The capital is the constraint, and the capital sits in a five-year asset.

Which is why depreciation is the real argument. Two haircuts sit under every headline GPU count. The first is operational. Meta's own Llama 3 paper reports model FLOPs utilisation, the share of a cluster's theoretical arithmetic actually used, of 38% to 43% on up to 16,000 H100s, with effective training time above 90%. So the compute actually delivered is roughly 35 to 39% of the nameplate number in the press release. The same paper records 466 job interruptions in 54 days, with about 78% traced to hardware and 220 of them to failed GPUs or failed high-bandwidth memory: a failure roughly every three hours. The second haircut is financial. In the same twelve months, Amazon shortened the assumed useful life of a subset of its servers from six years to five, explicitly citing the pace of AI, which added about US$1.4 billion of depreciation and cut fiscal 2025 net income by about US$1.0 billion. Meta went the other way, lengthening most servers to 5.5 years, which reduced depreciation by about US$2.92 billion and lifted net income by about US$2.59 billion. Alphabet uses six years, Microsoft two to six, CoreWeave six. Michael Burry's November 2025 argument was that the real economic life is two to three years and that the industry is therefore understating depreciation by roughly US$176 billion between 2026 and 2028. The counter-argument is that older accelerators cascade to cheaper work rather than becoming scrap, and that A100s from 2020 still rent. Both sides are arguing about the same unknown, which is how fast a 700-watt chip becomes uneconomic when a 1,400-watt chip delivers five times the work. For anyone financing a Canadian data centre, this single assumption swings the return more than the electricity price does.

The units, one last time. A megawatt is a rate; a megawatt-hour is an amount. A gigawatt data centre in Canada would consume 7.88 terawatt-hours a year at a 90% load factor, which is 1.26% of the 625.2 terawatt-hours Canada generated in 2025 and about 1.4% of the 71 gigawatts the entire country produces on average. It would hold roughly half a million accelerators, about six thousand liquid-cooled racks, and about US$20 billion of silicon. It would cost between C$434 million and C$1.02 billion a year to power depending on where in Canada it sits. Those five numbers, held together, are enough to interrogate almost any claim made about this industry.

FIGURE 5.1

Power drawn by a single accelerator, by year

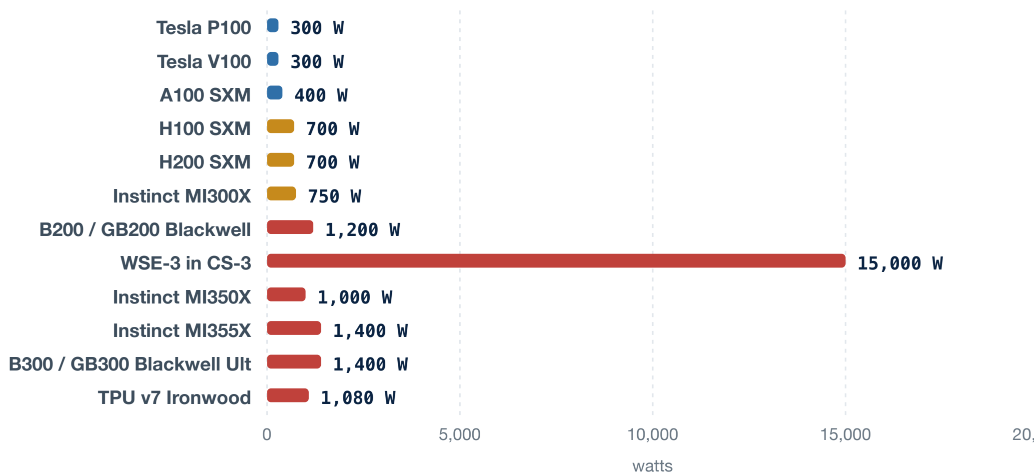


Thermal design power for one accelerator, from vendor datasheets. The rise from 300 watts to 1,400 watts in under a decade is the engine behind every megawatt figure in this book, and it is why buildings designed in 2020 cannot host 2026 hardware.

Source: Nvidia and AMD datasheets, as listed in the chapter.

FIGURE 5.2

Accelerators by power draw



Every one of these is a vendor-published figure rather than a measurement in service. Real facility power per accelerator is higher once servers, networking, storage and cooling are included.

Source: Vendor datasheets.

The units, in plain language

Everything in this brief reduces to one distinction. **Power** is a rate: how fast energy is being used, measured in watts. **Energy** is an amount: how much was used, measured in watt-hours. A grid operator sizes wires, transformers and generators against the rate. A finance team pays for the amount. Confusing the two is the most common error in public discussion of data centres.

Power: the rate

UNIT	SYMBOL	WHAT IT IS	ROUGHLY EQUAL TO
Watt	W	One joule per second	An LED bulb, 8 to 10 W
Kilowatt	kW	1,000 W	A hair dryer, or a home fast charger at 7 kW
Megawatt	MW	1,000 kW, one million W	About 750 average Canadian homes at their annual average draw
Gigawatt	GW	1,000 MW, one billion W	One Darlington CANDU unit is about 0.9 GW
Terawatt	TW	1,000 GW, one trillion W	Canada's whole electricity system averages 0.071 TW, that is 71 GW

Nameplate, or capacity, is the maximum rate the equipment is designed to draw or produce. It is what the utility must be able to deliver at any instant.

Energy: the amount

UNIT	SYMBOL	WHAT IT IS
Watt-hour	Wh	One watt sustained for one hour
Kilowatt-hour	kWh	The unit on the electricity bill, and the unit in which power is priced
Megawatt-hour	MWh	1,000 kWh
Gigawatt-hour	GWh	1,000 MWh
Terawatt-hour	TWh	1,000 GWh, one billion kWh; the unit of national statistics

The bridge between rate and amount is time, and it is exact:

- 1 MW sustained for 1 hour = 1 MWh.
- 1 MW sustained for a full year (8,760 hours) = 8,760 MWh = 8.76 GWh.
- 1 GW sustained for a full year = 8,760 GWh = 8.76 TWh.

Data centres run close to baseload, near their maximum almost all the time, unlike a factory with shifts. At a 90% load factor, a realistic planning figure for an AI campus, one MW delivers 7.884 GWh a year rather than 8.76.

Worked conversions a manager can use

All rows assume a 90% load factor. Homes use the Natural Resources Canada figure of about 11,650 kWh per Canadian household per year. The Canadian share uses Statistics Canada's 625.2 TWh of total generation in 2025. Costs are Canadian cents per kilowatt-hour at the two ends of the Canadian industrial range: 5.5 cents, roughly Winnipeg (5.09) or Montreal (5.52) for a 50 MW customer, and 13 cents, roughly Toronto (12.66) or Halifax (13.43), from Hydro-Quebec's price comparison at rates in effect 1 April 2025.

FACILITY SIZE	ENERGY PER YEAR	AVERAGE CANADIAN HOMES	SHARE OF CANADA'S 2025 GENERATION	BILL AT 5.5C/KWH	BILL AT 13C/KWH
1 MW	7.88 GWh (0.0079 TWh)	677	0.001%	C$0.43 million	C$1.02 million
10 MW	78.8 GWh (0.079 TWh)	6,767	0.013%	C$4.3 million	C$10.2 million
100 MW	788 GWh (0.79 TWh)	67,674	0.126%	C$43.4 million	C$102.5 million
1 GW	7,884 GWh (7.88 TWh)	676,738	1.26%	C$434 million	C$1.02 billion

Three things fall straight out of that table. First, the electricity bill for a gigawatt campus is roughly half a billion Canadian dollars a year at cheap Canadian industrial rates and about a billion at expensive ones, so a 7.5 cent spread is worth about C$590 million a year. That is why siting is a board-level decision. Second, one gigawatt campus is 1.26% of everything Canada generates, and Canada's whole system averages only 71 GW, so the 20.7 GW of Alberta data centre applications reported in September 2025 is not a rounding error. Third, at a 100% load factor the homes figure is 752 per MW, so the common shorthand "a megawatt powers 750 homes" is right for a facility running flat out and about 10% too high at a realistic load factor.

Capacity, energy and peak demand, and why the two audiences differ

- **Capacity (MW)** is what the utility must be able to deliver at any instant. It sets the transformer, the substation, the line and the reserve margin. It is the thing that takes five to ten years to get in a congested interconnection queue.
- **Energy (MWh or TWh)** is what is metered and billed. It sets fuel burn, emissions and the operating cost line in the model.
- **Peak demand** is the highest instantaneous draw over a period. For a normal industrial customer, peak is much higher than average. For a data centre the two are almost identical, which is exactly why utilities find them hard: a data centre uses the expensive capacity all year rather than for a few hours.

A grid operator cares about the rate because a power system must match supply and demand instant by instant, and because building the rate is slow and lumpy. A finance team cares about the amount because the amount is what appears in the cash flow statement. The bridge between them is the load factor, and for AI the load factor is high, which is good for a utility's revenue per dollar of asset and bad for its ability to say yes.

Nine terms, each in a sentence or two

- **Power factor.** In an alternating-current system, real power (kW, which does useful work) divided by apparent power (kVA, which is what the wires and transformer must actually carry). A power factor of 0.9 means equipment must be sized about 11% larger than the kW figure suggests. Modern data centre power supplies run near 0.99, so kW and kVA are nearly interchangeable for AI halls, but the concept still governs equipment sizing.
- **Load factor.** Average load divided by peak load over a period. An office runs 0.3 to 0.5; an AI training campus runs 0.85 to 0.95.

- **Capacity factor.** The generator-side twin: energy actually produced divided by energy that would have been produced at continuous full power (US Energy Information Administration definition). Mid-latitude solar runs roughly 0.15 to 0.20. This matters in the frontier section, because the entire case for orbital compute rests on pushing solar capacity factor toward 1.0.
- **N+1 redundancy.** Install the number of units needed to carry the load (N) plus one spare, so any single unit can fail or be serviced without dropping the load.
- **2N redundancy.** Two complete, independent systems, each able to carry the whole load. Twice the capital, and the basis of fault tolerance.
- **Tier ratings.** Uptime Institute's four-level classification of facility topology: Tier I basic, Tier II redundant components, Tier III concurrently maintainable (dual paths, so anything can be serviced without a shutdown), Tier IV fault tolerant (2N, survives any single failure). AI training halls are often deliberately built to a lower tier than a bank's data centre, because a training job can restart from a checkpoint whereas a payment system cannot.
- **IT load versus facility load.** IT load is the power drawn by servers, storage and network equipment. Facility load adds cooling, power conversion losses, lighting and everything else in the building. The utility bills facility load; the vendor quotes IT load.
- **PUE, power usage effectiveness.** Facility load divided by IT load, standardised as ISO/IEC 30134-2. A PUE of 1.0 would be a building that spends nothing on cooling. The global average has sat near 1.5 for years; best-in-class hyperscale runs 1.1 or better; a cold-climate liquid-cooled AI hall should reach 1.15 to 1.25.
- **WUE, water usage effectiveness.** Litres of water per kWh of IT energy. Closed-loop liquid cooling can drive it near zero; evaporative cooling in a hot climate cannot.

The picture in numbers

Table 1. Accelerator thermal design power by generation

Thermal design power (TDP) is the maximum sustained heat, and therefore power, the cooling solution must remove for that part alone. It excludes the host processor, storage, the network card and everything in the building. AMD publishes the equivalent as total board power (TBP).

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
NVIDIA Tesla P100 (SXM2) max power	300	W	2016	Global	NVIDIA P100 datasheet
NVIDIA Tesla V100 (SXM2) TDP	300	W	2017	Global	NVIDIA Volta architecture whitepaper
NVIDIA A100 PCIe / SXM max TDP	300 / 400	W	2020	Global	NVIDIA A100 datasheet
NVIDIA H100 SXM max TDP	up to 700 (configurable)	W	2022	Global	NVIDIA H100 product page
NVIDIA H100 PCIe / NVL max TDP	350 / 350 to 400	W	2022-24	Global	NVIDIA H100 NVL product brief
NVIDIA H200 SXM max TDP	up to 700 (configurable)	W	2023	Global	NVIDIA H200 datasheet

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
AMD Instinct MI300X max TBP	750	W	2023	Global	AMD MI300X datasheet
NVIDIA B200 / GB200 Blackwell per GPU	about 1,000 air, about 1,200 liquid	W	2024-25	Global	derived from NVIDIA GB200 NVL72 rack figures
AMD Instinct MI350X max TBP	1,000	W	2025	Global	AMD MI350X datasheet
AMD Instinct MI355X max TBP (liquid only)	1,400	W	2025	Global	AMD MI355X datasheet
NVIDIA B300 / GB300 Blackwell Ultra per GPU	about 1,400 (reported, not an NVIDIA datasheet figure)	W	2025	Global	Tom's Hardware
Google TPU v7 Ironwood, derived per chip	about 1,080	W	2025	Global	derived from Google Ironwood announcement (9,216 chips, nearly 10 MW)
Cerebras WSE-3 wafer / CS-3 system	about 15,000 / 23,000	W	2024	Global	Cerebras CS-3
NVIDIA Rubin R200 per GPU (analyst estimate)	about 1,800 (Max Q) to 2,300 (Max P)	W	2026	Global	Ming-Chi Kuo supply chain note

Table 2. Rack and system power

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
NVIDIA DGX H200 system (8 GPUs) max power	10.2	kW	2023	Global	NVIDIA DGX H200 datasheet
NVIDIA GB200 NVL72 rack (72 GPUs)	about 120	kW	2024-25	Global	NVIDIA GB200 NVL72 (specification table omits power; 120 kW is NVIDIA and partner deployment guidance)
NVIDIA GB300 NVL72 rack (72 GPUs)	up to 142	kW	2025	Global	NVIDIA NVL72 AI Factory reference architecture
GB300 NVL72 power delivery	8 shelves of 33 kW, six 5.5 kW PSUs each	n/a	2025	Global	NVIDIA reference architecture
Google TPU v7 Ironwood pod (9,216 chips)	nearly 10	MW	2025	Global	Google
NVIDIA stated rack power today	exceeds 200	kW	2025	Global	NVIDIA 800 VDC blog
NVIDIA projected IT rack power, 2027 (Kyber)	1	MW per rack	2027	Global	NVIDIA 800 VDC blog
Copper busbar in a 1 MW rack at 54 VDC	up to 200	kg	2025	Global	NVIDIA 800 VDC blog
Copper in a 1 GW data centre	up to 200,000	kg	2025	Global	NVIDIA 800 VDC blog
Operators with no rack above 30 kW	more than 80	% of operators	2025	Global	Uptime Institute Global Data Center Survey 2025

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Organisations using direct liquid cooling	22	%	2025	Global	Uptime Institute cooling survey 2025

Table 3. Where the power goes, and the units of a data centre

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Global data centre electricity	415	TWh	2024	World	IEA, Energy and AI
Global data centre electricity, base case	about 945	TWh	2030	World	IEA, Energy and AI
Servers share of data centre electricity	about 60	%	2024	World	IEA, Energy and AI
Cooling share, efficient hyperscale to inefficient enterprise	7 to over 30	%	2024	World	IEA, Energy and AI
Storage share / networking share	about 5 / up to 5	%	2024	World	IEA, Energy and AI
Canada total electricity generation	625.2	TWh	2025	Canada	Statistics Canada
Canada average electrical output	71.4	GW	2025	Canada	derived from Statistics Canada 625.2 TWh over 8,760 hours
Average Canadian household electricity use	11,650	kWh per year	2022	Canada	NRCan Comprehensive Energy Use Database

Table 4. Accelerators per facility, built up from watts

Method: take the accelerator TDP, apply the system overhead (NVIDIA's own DGX H200 is 10.2 kW for eight 700 W GPUs, a multiplier of about 1.8; in a rack-scale system the overhead is already inside the published rack figure), add 8 to 10% for scale-out networking and storage outside the compute rack, then multiply by PUE.

ACCELERATOR	CHIP TDP	IT W PER ACCELERATOR	FACILITY W AT PUE 1.15	FACILITY W AT PUE 1.30	ACCELERATORS PER MW
H100 / H200 SXM	700 W	about 1,400	about 1,610	about 1,820	550 to 620
GB200 Blackwell in NVL72	about 1,200 W	about 1,800	about 2,070	about 2,340	430 to 480
GB300 Blackwell Ultra in NVL72	about 1,400 W	about 2,130	about 2,450	about 2,770	360 to 410

1 MW

H100-CLASS ACCELERATORS
550 to 620

GB200-CLASS
430 to 480

GB300-CLASS
360 to 410

GB300 NVL72 RACKS
5 to 6

HOMES EQUIVALENT
677

ENERGY PER YEAR AT 90%
7.88 GWh

10 MW

H100-CLASS ACCELERATORS 5,500 to 6,200	GB200-CLASS 4,300 to 4,800
GB300-CLASS 3,600 to 4,100	GB300 NVL72 RACKS 55 to 61
HOMES EQUIVALENT 6,767	ENERGY PER YEAR AT 90% 78.8 GWh

100 MW

H100-CLASS ACCELERATORS 55,000 to 62,000	GB200-CLASS 43,000 to 48,000
GB300-CLASS 36,000 to 41,000	GB300 NVL72 RACKS 545 to 612
HOMES EQUIVALENT 67,674	ENERGY PER YEAR AT 90% 788 GWh

1 GW

H100-CLASS ACCELERATORS 550,000 to 620,000	GB200-CLASS 430,000 to 480,000
GB300-CLASS 360,000 to 410,000	GB300 NVL72 RACKS 5,400 to 6,100
HOMES EQUIVALENT 676,738	ENERGY PER YEAR AT 90% 7,884 GWh

Table 5. Real installations, as a check on the arithmetic

Colossus phase 1

OPERATOR xAI	LOCATION Memphis, Tennessee
ACCELERATORS 100,000 NVIDIA Hopper	MW 150 (grid supply approved)
YEAR 2024	IMPLIED KW PER ACCELERATOR 1.50
SOURCE NVIDIA newsroom	

Colossus doubling

OPERATOR xAI	LOCATION Memphis, Tennessee
ACCELERATORS 200,000 Hopper class	MW n/d
YEAR 2025	IMPLIED KW PER ACCELERATOR n/a
SOURCE NVIDIA newsroom	

Colossus 2

OPERATOR
xAI

LOCATION
Memphis, Tennessee

ACCELERATORS
about 1.11 million H100-equivalents (estimate, plus or minus 50%)

MW
946 (estimate, plus or minus 40%)

YEAR
2026

IMPLIED KW PER ACCELERATOR
n/a, compute-normalised

SOURCE
Epoch AI

GenAI clusters

OPERATOR
Meta

LOCATION
United States

ACCELERATORS
two clusters of 24,576 H100

MW
about 39 each (derived)

YEAR
2024

IMPLIED KW PER ACCELERATOR
1.60 (assumed)

SOURCE
Meta Engineering

Hyperion

OPERATOR
Meta with Blue Owl

LOCATION
Richland Parish, Louisiana

ACCELERATORS
not published

MW
5,000 claimed; 1,676 by 2028 (Epoch estimate)

YEAR
2026

IMPLIED KW PER ACCELERATOR
n/a

SOURCE
Meta

Stargate Abilene

OPERATOR
OpenAI, Oracle, SoftBank, MGX; built by Crusoe

LOCATION
Abilene, Texas

ACCELERATORS
450,000+ GB200 (Larry Ellison claim)

MW
1,200 (Lancium interconnect)

YEAR
2025-26

IMPLIED KW PER ACCELERATOR
2.67

SOURCE
Crusoe newsroom

Fairwater Atlanta

OPERATOR
Microsoft

LOCATION
Atlanta, Georgia

ACCELERATORS
hundreds of thousands GB200/GB300

MW
300+ stated; 636 (Epoch estimate)

YEAR
2025

IMPLIED KW PER ACCELERATOR
n/a

SOURCE
Microsoft

Project Rainier

OPERATOR
AWS for Anthropic

LOCATION
New Carlisle, Indiana

ACCELERATORS
about 500,000 Trainium2

MW
n/d

YEAR
2025

IMPLIED KW PER ACCELERATOR
n/a

SOURCE
AWS

Dojo

OPERATOR
Tesla

LOCATION
Buffalo, New York

ACCELERATORS
cancelled August 2025

MW
n/a

YEAR
2025

IMPLIED KW PER ACCELERATOR
n/a

SOURCE
TechCrunch

Sovereign AI Factory

OPERATOR
TELUS

LOCATION
Rimouski, Quebec

ACCELERATORS
NVIDIA Hopper and Blackwell, count not published

MW
n/d

YEAR
2025

IMPLIED KW PER ACCELERATOR
n/a

SOURCE
TELUS

BC sovereign AI cluster

OPERATOR
TELUS with Government of Canada

LOCATION
Kamloops and Vancouver, BC

ACCELERATORS
over 60,000 NVIDIA GPUs by 2032

MW
85 initial, over 150 by 2032

YEAR
2026

IMPLIED KW PER ACCELERATOR
2.50

SOURCE
TELUS

Bell AI Fabric BC cluster

OPERATOR
Bell Canada with Groq

LOCATION
Kamloops, Merritt, TRU, BC

ACCELERATORS
Groq LPUs, count not published

MW
7 + 7 + 26 + 26, upwards of 500 total

YEAR
2025-27

IMPLIED KW PER ACCELERATOR
n/a

SOURCE
BCE

Bell AI Fabric Sherwood

OPERATOR
Bell Canada; Cerebras and CoreWeave tenants

LOCATION
near Regina, Saskatchewan

ACCELERATORS
not published

MW
300

YEAR
2026-27

IMPLIED KW PER ACCELERATOR
n/a

SOURCE
PR Newswire

CoreWeave Cambridge

OPERATOR
CoreWeave; Cohere anchor tenant

LOCATION
Cambridge, Ontario

ACCELERATORS
not published

MW
54 (expansion)

YEAR
2025

IMPLIED KW PER ACCELERATOR
n/a

SOURCE
Government of Canada

HIVE, Bell and Cohere contract

OPERATOR
HIVE (BUZZ HPC)

LOCATION
Merritt, British Columbia

ACCELERATORS
2,304 Grace Blackwell GPUs (32 NVL72 racks)

MW
about 5 (derived)

YEAR
2026

IMPLIED KW PER ACCELERATOR
about 2.2

SOURCE
Cointelegraph

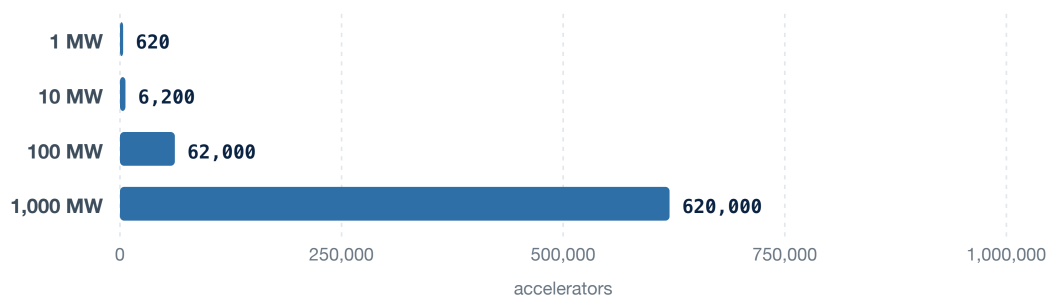
Table 6. What the silicon costs, and what it is worth

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Estimated cost per H100 or H200	25,000	US$	2026	Global	Epoch AI methodology
Estimated cost per B200 / B300	37,000 / 43,000	US$	2026	Global	Epoch AI methodology
Jensen Huang on Blackwell GPU price	30,000 to 40,000	US$	2024	Global	TechSpot reporting a CNBC interview

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Fully equipped GB200 NVL72 rack	about 3,000,000	US$	2025	Global	HSBC estimate via TweakTown
Chip and rack capital, 100 MW Blackwell campus	about 2.2	US$ billion	2026	Global	derived: about 725 NVL72 racks at US$3 million
AI technology fit-out per MW	up to 25	US$ million	2026	Global	JLL 2026 Global Data Center Outlook (via brief 08)
Jensen Huang on cost of 1 GW of AI factory	50 to 60, of which about 35 is NVIDIA	US$ billion	2025	Global	Crypto Briefing report of G20 remarks
NVIDIA data centre revenue, fiscal 2026	193.7	US$ billion	2026	Global	NVIDIA
NVIDIA AI accelerators shipped, calendar 2025 (estimate)	about 4.46	million units	2025	Global	Epoch AI
Measured model FLOPs utilisation, 16,000 H100 Llama 3 run	41 (range 38 to 43)	%	2024	United States	Meta, The Llama 3 Herd of Models
Hardware interruptions in a 54 day training run	466	interruptions	2024	United States	Meta, The Llama 3 Herd of Models
Amazon server useful life	5, reduced from 6	years	2025	United States	Amazon 10-K FY2025
Meta server useful life	5 to 5.5, raised from 5	years	2025	United States	Meta 10-K FY2025
Alphabet server useful life	6	years	2025	United States	Alphabet 10-K FY2025
Burry estimate of understated depreciation, 2026-28	176	US$ billion	2025	United States	CNBC

FIGURE 5.3

Accelerators a facility can hold, by size



Roughly four to five hundred accelerators per megawatt, cross-checked against two real installations: xAI's Colossus at 100,000 accelerators on 150 megawatts, and the TELUS British Columbia cluster at more than 60,000 on 150 megawatts.

Source: Calculated in the chapter from vendor power ratings, then cross-checked against announced installations.

The frontier, including space

Nothing in this section is a product. The most useful discipline is to sort every claim into three tenses: what has flown and worked, what has been filed with a regulator, and what has been said on a stage. The gap between the three is about three orders of magnitude.

What has actually flown

OPERATOR	HARDWARE	DATE	WHAT IT DID	SOURCE
ADA Space and Zhejiang Lab (China)	12 satellites, Three-Body Computing Constellation	14 May 2025	5 POPS combined, 30 TB storage, 100 Gbps laser links (company claims). Target constellation 2,800 satellites and 1,000 POPS, 100 satellites by 2027	SpaceNews
Axiom Space with Red Hat	AxDCU-1 prototype unit on the ISS	August 2025	Hybrid cloud, AI/ML and cybersecurity workloads on orbit	Axiom Space
Starcloud with NVIDIA	Starcloud-1, 60 kg, one NVIDIA H100	Launched 2 November 2025 on Falcon 9 Bandwagon-4	First data centre class GPU in orbit; trained nanoGPT on Shakespeare in December 2025, the first language model trained in space; also ran Gemma	Starcloud
Axiom Space	Two free-flying Orbital Data Center nodes	11 January 2026	Optical links at 2.5 Gbps, upgradable to 10 Gbps+, on Kepler's relay constellation. Power described only as "kilowatts"	Axiom Space
Lonestar Data Holdings	"Freedom", an 8 TB SSD and one FPGA on Intuitive Machines IM-2	26 February 2025	Lunar transit success; the lander tipped over on landing	DCD

The first operational orbital AI computing constellation is Chinese, launched about six months before either Starcloud-1 or Google's paper. That is the most useful geopolitical fact in this section. Note also the honest scale: nanoGPT is a teaching-scale model, and Axiom's operating optical links run at 2.5 Gbps against Google's 1.6 Tbps bench demo.

What has been filed with a regulator

OPERATOR	FILING	DATE	SCALE	SOURCE
SpaceX	FCC ICFS SAT-LOA-20260108-00016, "SpaceX Orbital Data Center System"	filed 30 January 2026, accepted 4 February 2026	up to 1,000,000 satellites, 500 to 2,000 km, 30 degree and sun-synchronous	FCC DA 26-113
Blue Origin, Project Sunrise	FCC SAT-LOA-20260310-00118	19 March 2026	up to 51,600 data centre satellites, plus a 5,408 satellite TeraWave relay constellation	SpaceNews
Starcloud	FCC filing	2026	up to 88,000 satellites	TechCrunch

Those three filings total roughly 1.14 million satellites. There are about 11,000 operational payloads in orbit today and about 40,000 tracked objects (European Space Agency, Annual Space Environment Report, data to end 2024, published April 2025). A filing is an option bought cheaply; treat it as such.

What has been said

- **Jeff Bezos, Italian Tech Week, Turin, 3 October 2025:** "One of the things that's going to happen next is we're going to start building these giant gigawatt data centers in space. These giant training clusters will be better built in space because we have solar power there 24/7. There are no clouds, no rain, no weather. We'll be able to beat the cost of terrestrial data centers in the next couple of decades." His timeline: "10-plus years but I bet it's no more than 20 years." He said this five months before Blue Origin filed.
- **Elon Musk, on X, about 30 October 2025:** "Simply scaling up Starlink V3 satellites, which have high-speed laser links, would work. SpaceX will be doing this."
- **Elon Musk, on X, 19 November 2025:** "Starship should be able to deliver around 300 GW per year of solar-powered AI satellites to orbit, maybe 500 GW. The 'per year' part is what makes this such a big deal. Average US electricity consumption is around 500 GW, so at 300 GW/year, AI in space would exceed the entire US..."
- **Elon Musk, June 2026, in a SpaceX-produced interview:** the AI1 satellite is 20 m tall with a 70 m wingspan, 150 kW peak power, about 120 kW of average compute, in a 600 to 800 km orbit, at about 3 ms latency, with solar at 250 W per square metre and radiators at 1,400 W per square metre. A scaling ladder of about 1 GW a year by the end of 2027, then 10, then 100, then eventually 1 TW a year, roughly an order of magnitude a year.
- **SpaceX and NVIDIA, 4 August 2026:** "Starmind", putting NVIDIA's Vera Rubin NVL72 platform on the first AI1 satellites, prototype testing early 2027, first launches reported for the fourth quarter of 2027.

A precision point that matters. Starlink V2 mini downlink is about 100 Gbps and V3 is expected at about 1 Tbps downlink; the inter-satellite **laser** links are about 100 Gbps. Google's own paper independently states Starlink's laser system operates at about 100 Gbps over up to about 5,400 km. Quoting "1 Tbps lasers" conflates the downlink with the laser link, and is the most common error in coverage of this topic.

Google Project Suncatcher, the most rigorous public work

Announced 4 November 2025, with a paper submitted to arXiv on 22 November 2025 (arXiv 2511.19468) and a partnership with Planet Labs to launch two prototype satellites by early 2027. The measured results are genuinely new science.

FINDING	VALUE	STATUS
Radiation environment in target dawn-dusk sun-synchronous orbit	about 150 rad(Si) per year behind 10 mm aluminium	analysis
Five-year mission total ionizing dose requirement	about 750 rad(Si)	requirement
First irregularities, in high bandwidth memory	2 krad(Si), about 3x the requirement	demonstrated, ground beam test
Maximum dose tested with no hard failures	15 krad(Si)	demonstrated, ground beam test
Silent data corruption rate from single event effects	about 1 event per 17 rad, about 1 failure per 3 million inferences	demonstrated
Free-space optical link, bench demonstrator	800 Gbps one way, 1.6 Tbps bidirectional	demonstrated on a bench, not in orbit

FINDING	VALUE	STATUS
Aggregate bandwidth required per link	on the order of 10 Tbps	design requirement
Formation flying	81 satellites, 1 km radius, 650 km altitude, neighbours 100 to 200 m apart	simulation
Solar energy advantage over a mid-latitude panel	up to 8 times more per year	analysis
Launch cost breakeven	about US$200 per kg to LEO	analysis
Radiator area, mass or temperature	not published anywhere in the paper	absent

Google's economic argument, and it is worth quoting precisely because it is so often over-read: at its own assumption of US$3,600 per kg for Falcon 9 the launched power price is about US$14,700 per kW-year; at US$200 per kg it falls to about US$810 per kW-year, against US terrestrial data centre power costs of about US$570 to US$3,000 per kW-year. Google concludes that at US$200 per kg "the cost of launch amortized over spacecraft lifetime could be roughly comparable to data center energy costs, on a per-kW basis". That sentence compares **launch cost only** against **energy cost only**. It excludes the satellite, the radiator, the chips and all ground infrastructure. Getting to US$200 per kg requires a sustained 20% learning rate and about 180 Starship launches a year, and Google notes this is "still far below stated launch targets for Starship".

The physics that decides it

QUESTION	THE NUMBER	VERDICT
Solar	Solar constant 1,361 W per square metre (NASA TSIS-1, measured). At 22 to 30% cell efficiency, about 300 to 400 W per square metre delivered. SpaceX's own AI1 claim is 250 W per square metre. In dawn-dusk sun-synchronous orbit the capacity factor approaches 1.0 against roughly 0.19 for a mid-latitude terrestrial panel.	**Favours space.** But only in one narrow orbital band that every player wants; generic LEO at 400 to 500 km gets only about 60% solar exposure.
Cooling	In vacuum the only way to shed heat is to radiate it: P = A x sigma x T to the fourth. NASA's operating ISS radiators reject 70 kW from 475 square metres weighing 6,736 kg, that is 147 W per square metre and 96 kg per kW. NASA's Photovoltaic Radiator does better at 330 W per square metre and 52.9 kg per kW. SpaceX claims 1,400 W per square metre. Google publishes nothing.	**The decisive objection.** A 1 MW orbital facility needs about 96 tonnes of ISS-class radiator alone. SpaceX's claim is roughly 10x the only large operating example, and unverified.
Launch cost	SpaceX's own published price is US$74 million for up to 22,000 kg to LEO, that is about US$3,364 per kg. Google assumes US$3,600 per kg for Falcon 9 reusable. Transporter rideshare lists at about US$7,000 per kg. Analysts estimate SpaceX's internal marginal cost near US$629 per kg. Starship targets range from about US$67 to US$250 per kg.	**The gating variable.** The spread between US$629 and US$7,000 per kg for the same rocket tells you how much depends on which number an advocate picks.
Mass per MW	A Starlink V2 mini is 575 kg for about 28 kW, that is 20.5 kg per kW, or 20.5 tonnes per MW, for a complete flight-proven spacecraft. At US$3,364 per kg that is about US$69 million per MW just to launch, US$69 billion for a gigawatt. At US$200 per kg it falls to about US$4.1 million per MW.	**Launch cost must fall about 18 times** before the arithmetic changes character.
Radiation	Google's measured results: no hard failures to 15 krad(Si), against a five-year requirement of 750 rad(Si). Silent data corruption at about 1 event per 17 rad.	**The weakest objection.** Commercial silicon survives better than expected. But Google explicitly says the impact on training "requires further study".
Latency	Light travel time at 550 km is 1.83 ms one way, 3.67 ms round trip; SpaceX claims about 3 ms for AI1. Real measured Starlink median peak-hour latency in the US is about 26 ms; multi-hop inter-satellite paths accumulate 30 to 80 ms one way.	**Fine for inference, irrelevant for training**, because training is bandwidth-bound, not latency-bound to the ground.

QUESTION	THE NUMBER	VERDICT
Networking	Van Berkel (TU Eindhoven, July 2026) for an 8,000 node system: bisection bandwidth 28,800 TB/s for a terrestrial Clos fabric against 2.25 TB/s for a 2D orbital torus and 10 TB/s for a 3D torus. Network latency 4 microseconds against 1,800 and 600.	**The objection that does not go away.** About 1,000 times lower bisection bandwidth, raising training cost "100+ times". This is geometric, not economic, so cheaper launch does not fix it.
Servicing	Google's own words: "Currently, failed TPUs are manually replaced by technicians, which is relatively simple and low-cost on Earth, but obviously impracticable in space. The simplest solution is redundant provisioning." Meta measured a hardware failure roughly every three hours on a 16,000 GPU cluster.	**Structural cost penalty.** Every failed accelerator is a permanent loss, paid for with spare capacity launched in advance.
Debris and sky	Over 1.2 million objects larger than 1 cm already in LEO; over 1,400 recorded impacts on the ISS. Marcy (March 2026) calculates that a 4 km by 4 km array at 500 km would span about 0.4 degrees, comparable to the Moon, at magnitude about -5.5 to -7, roughly 100 times brighter than the brightest stars.	**The social licence problem, in orbit.** Exactly the same argument Canadian communities are having about buildings, moved 500 km up.
Carbon	The European Commission's ASCEND study (Thales Alenia Space with Airbus, HPE, ArianeGroup and DLR, published June 2024) concluded that orbital data centres would only meaningfully cut digital carbon emissions with "a launcher ten times less emissive over its entire lifecycle".	**No such launcher has been proposed.** This is the least quoted and most disciplined finding in the literature.

The honest synthesis is more interesting than either the hype or the dismissal: **inference may well move to orbit; frontier training almost certainly will not this decade.** Van Berkel puts it directly: cost-effective frontier training in space "within the next 2-3 years is not credible and even a 10-year horizon appears optimistic with current technology trends".

One more signal is worth more than any forecast. In August 2026 SpaceX, the company proposing a million compute satellites, was building a natural gas power plant in Texas, hiring a natural gas trading team, and starting in-house turbine blade manufacturing to cut generator delivery delays by 18 months, all for terrestrial AI data centres. Watch what the capital does, not what the founder says.

The terrestrial frontier, which is where Canada actually competes

OPTION	THE NUMBER	CANADIAN STATUS	SOURCE
Small modular reactors	Four BWRX-300 units at Darlington, 1,200 MW, budgeted at C$20.9 billion, with C$7.7 billion for the first 300 MW unit in service in 2030, at a projected 14.9 cents per kWh	Under construction; the most advanced grid-scale SMR programme in the G7	World Nuclear News, May 2025 (see brief 02)
Natural gas with carbon capture	Alberta's Malachite One proposes 930 MW of on-site gas with carbon capture under consideration, plus a 74.9 MW grid request, for a 1,000 MW data centre	Proposed, August 2026. Alberta's AESO capped interim grid connections at 1,200 MW against roughly 20 GW of applications, so almost every Alberta project is bring-your-own-gas	See brief 03
Geothermal	O'Leary Ventures' Wonder Valley (7,500 MW proposed, 1,400 MW phase 1) lists possible geothermal alongside off-grid gas	Proposed only; no Canadian geothermal is powering a data centre today	See brief 03
Hydro repowering and new build	Hydro-Quebec's Action Plan 2035 targets 3,800 to 4,200 MW of new hydro plus 10,000 MW of wind, inside a C$155 to 185 billion programme	Committed but slow; Quebec now screens every load above 5 MW	See brief 02
Curtailable and grid-interactive load	Manitoba's Bill 20 already gives the Crown utility curtailment powers for crypto load; the same instrument could apply to AI	The most under-used Canadian lever: a data centre that accepts curtailment can be connected years earlier	See brief 04

OPTION	THE NUMBER	CANADIAN STATUS	SOURCE
Waste heat reuse	QScale's 96 MW at Levis could heat 15,000 households and avoid 146,576 tonnes of CO_2 a year; Stockholm supplies about 3.5% of city heat from data centres; Bell's Thompson Rivers University site feeds a campus district energy system	Real but early: the Levis greenhouses were still ramping in 2026, and TELUS's "150,000 homes" claim for Vancouver is unverified	See brief 05

The pattern is that Canada's real frontier options are boring, slow and already on the books. None of them arrive faster than a gas turbine, and all of them arrive faster than a gigawatt in orbit.

Why this matters for Canada

Three hardware facts bear directly on where Canadian data centres get built.

Liquid cooling changes what the climate is worth, and mostly reduces it. The old Canadian pitch was free cooling: cold outside air means the chillers run less, so PUE falls and the power bill falls with it. That advantage is real and quantifiable. Cooling is 7% of load in an efficient hyperscale facility and over 30% in an inefficient one (IEA, April 2025), and the climate is worth roughly 0.2 to 0.3 on PUE. On a fixed 80 MW IT load, moving from PUE 1.45 to 1.20 removes 20 MW of facility draw, which at a 90% load factor is 158 GWh a year, worth about C$8.7 million at 5.5 cents per kWh and about C$20.5 million at 13 cents. But the AI racks arriving now are liquid cooled by vendor mandate: NVIDIA ships GB200 and GB300 NVL72 only as liquid-cooled racks, and AMD's MI355X is liquid only. Direct-to-chip cooling captures most of the heat in a closed loop and is far less sensitive to outside air temperature than an air-cooled hall. So the marginal value of Canadian cold falls just as the absolute value of Canadian electricity price and carbon intensity rises. The Canadian argument has to shift from "our air is cold" to "our electricity is cheap, clean and, where there is capacity, available", plus the one cold-climate bonus that liquid cooling creates rather than destroys: usable waste heat. Bell's Thompson Rivers University site feeds its heat into a campus district energy system, and TELUS claims its BC cluster will produce waste heat equivalent to heating 150,000 homes, a claim this research set has not verified. Warm water out of a cold-plate loop is worth something in Kamloops in February and nothing in Phoenix in July.

The chip supply chain is a tariff exposure, not just a procurement problem. No AI accelerator is made in Canada. The United States applies a 25% Section 232 tariff to a subset of semiconductors and derivative products, with exemptions for goods used in US domestic production including US data centres, and there is no CUSMA-compliant exemption (Government of Canada, Trade Commissioner Service, updated 27 August 2026). That asymmetry runs against Canadian siting: the same rack can be cheaper on the American side of the border. Add NVIDIA's own figure of up to 200 kg of copper busbar per megawatt-class rack and up to 200,000 kg of copper per gigawatt facility, and the equipment supply chain, rather than the chip, becomes the part with Canadian content: transformers, switchgear, busbar, cooling distribution units and copper. Canada mines copper; it does not make GPUs.

Orbital compute is not a threat to a Canadian siting decision this decade. Google's own analysis says orbital compute becomes cost-comparable to terrestrial energy costs only if launch reaches about US$200 per kilogram to low Earth orbit, which its learning curve puts in the mid-2030s and only if roughly 180 Starship launches a year are sustained. The only accelerator-class hardware demonstrated in orbit is a single NVIDIA H100 on a 60 kg satellite, and the strongest quantified objection, a roughly 1,000-fold bisection bandwidth deficit for distributed training, does not improve with cheaper launch. Every larger constellation is a regulatory filing or a statement. The right way for a Canadian decision maker to treat space is as a terminal-value question, not a siting question: it belongs in the residual value assumption for a 15 or 20 year asset, not in the choice between Kamloops and Sturgeon County.

Contested or uncertain figures

- **The GB200 NVL72 rack does not have an NVIDIA-published power figure.** NVIDIA's public specification table for GB200 NVL72 lists GPUs, FLOPS, memory and NVLink bandwidth, but no kilowatts. The widely used 120 kW comes from NVIDIA presentations, partner documentation and press coverage. Deployed racks are reported at 130 to 132 kW. NVIDIA's own enterprise reference architecture does state a figure for the successor, GB300 NVL72: up to 142 kW. Use the GB300 number when a primary citation matters.
- **Per-GPU TDP for Blackwell is reported, not published.** NVIDIA does not put a "1,200 W" or "1,400 W" line in a public datasheet the way AMD does. The B200 at 1,000 W air and 1,200 W liquid, and the B300 at 1,400 W, come from reporting and from partner documentation. AMD's MI355X at 1,400 W is the one directly citable vendor figure at that level.
- **Rubin power is a supply-chain estimate.** The figures of about 1.8 kW per GPU and 190 kW per rack (Max Q), rising to 2.3 kW and 230 kW (Max P), come from analyst Ming-Chi Kuo, not from NVIDIA. NVIDIA also renamed VR200 NVL144, counting GPU dies, to VR200 NVL72, counting packages, which makes cross-source comparison genuinely confusing.
- **Google and AWS do not publish per-chip wattage.** The Ironwood figure of about 1,080 W per chip in this brief is derived from Google's own "9,216 liquid cooled chips" and "nearly 10 MW" per pod. The commonly quoted 450 W for TPU v5p and 600 W for Ironwood are not Google figures. AWS has never stated a Trainium wattage; the inference that Trainium3 is above 1,000 W rests on AWS's own statement that chips above 1,000 W require liquid cooling and that Trainium3 does.
- **xAI Colossus figures beyond 2025 are unreliable.** The widely circulated 555,000 GPUs, US$18 billion and 2 GW for January 2026, and roughly 770,000 GPUs for mid-2026, trace only to aggregator blogs with no primary source. This brief uses NVIDIA's own 100,000 and 200,000 Hopper figures and Epoch AI's estimate of 946 MW and about 1.11 million H100-equivalents, with Epoch's stated bands of plus or minus 40% on power and 50% on compute.
- **"H100-equivalents" is not a chip count.** Meta's "nearly 600,000 H100s" and Epoch's H100-equivalent figures are compute-normalised measures. A facility with 400,000 Blackwell parts may report over a million H100-equivalents. Always ask which is being quoted.
- **Stargate Abilene is an Oracle site, not a Microsoft site.** The Stargate partners are OpenAI, Oracle, SoftBank and MGX, with Crusoe building on Lancium's campus. Microsoft's comparable asset is Fairwater in Wisconsin and Atlanta. The "450,000+ GB200" figure is a keynote claim by Larry Ellison, reported by Data Center Dynamics, not a filed disclosure. The "50,000 GB200 per building" figure that circulates is unsourced.
- **TELUS has not published a Kamloops GPU count.** The only published unit figure is "over 60,000" NVIDIA GPUs by 2032 across the whole British Columbia cluster (TELUS, 11 May 2026). A separate BetaKit report gives 75,500 GPUs across the three sites, which is cited in brief 07. The two do not reconcile and neither is a site-level Kamloops figure. TELUS's claims of 98% renewable power, 80% cooling energy reduction

and waste heat equal to heating 150,000 homes are company claims; the last of these could not be verified in this research set.

- **Bell's Merritt site is 7 MW, not 26 MW.** The 26 MW figures are the Thompson Rivers University site (2026) and its Kamloops twin (2027). Bell's "upwards of 500 MW" is a six-site total, most of it not yet sited.
- **Chip prices are estimates, not list prices.** Epoch AI's US$25,000 per H100 is derived from revenue divided by units. Jensen Huang's US$30,000 to US$40,000 per Blackwell GPU is an executive statement in an interview. The US$3 million GB200 NVL72 rack is an HSBC analyst estimate. Street-price ranges of US$35,000 to US$40,000 for an H100 come from vendor blogs and should be treated as indicative only.
- **Useful life is the largest unresolved number in the industry.** Book lives run from two to six years across Microsoft, Amazon, Meta, Alphabet and CoreWeave, and moved in opposite directions at Amazon and Meta in the same year. Michael Burry's US$176 billion of understated depreciation and his 2 to 3 year economic life are estimates by an investor with a position, not audited figures. The counter-argument, that older parts cascade to cheaper work, is plausible but this research found no clean primary disclosure of A100 utilisation or rental economics from Amazon or Google to settle it.
- **The GB200 NVL72 rack mass of about 1,360 kg could not be verified.** NVIDIA's own DGX GB200 documentation gives the power but no mass, and the Supermicro datasheet gives dimensions and power but no weight. Any launch-mass calculation built on 1,360 kg per rack should be discarded. This brief uses the Starlink V2 mini figure of 20.5 kg per kW instead.
- **SpaceX's 1,400 W per square metre radiator claim is unverified and pivotal.** It is roughly 10 times the planform figure of NASA's operating ISS radiators and about 4 times NASA's Photovoltaic Radiator. If it is right, orbital compute is far more feasible than the skeptics allow. If it is wrong, the mass penalty is decisive. No independent verification exists.
- **Solar capacity factors here are arithmetic, not citations.** The roughly 19% mid-latitude terrestrial figure in this brief is derived from about 1,700 kWh per square metre per year divided by 8,766 hours at standard test conditions. The commonly quoted 15 to 25% range could not be pinned to a single primary source in this research.
- **The Duke University "Rethinking Load Growth" curtailment headroom figure** (76 to 98 GW in the United States at 0.25 to 1% annual curtailment) is widely cited in this debate but was not independently verified in this research. Treat it as unconfirmed.

Open questions students could investigate

1. Build the bottom-up model. Take a 100 MW Canadian AI campus and compute, from vendor datasheets only, the number of GB300 NVL72 racks, the accelerator count, the chip capital, the annual electricity bill in Manitoba versus Ontario, and the depreciation charge at 3, 5 and 6 year lives. Which assumption moves the internal rate of return most?
2. Value the useful-life assumption. Amazon shortened server lives to five years and lost US$1.0 billion of FY2025 net income; Meta lengthened them to 5.5 years and gained US$2.59 billion. Model both policies on the same 100 MW asset. At what assumed life does a Canadian project stop clearing its cost of capital, and who bears that risk in a build-to-suit lease?
3. Test the 400-accelerators-per-megawatt rule against every publicly disclosed Canadian project. Where it fails, is the discrepancy PUE, chip generation, or a company inflating a GPU count for a press release?

4. Quantify the Canadian cold-climate advantage now that liquid cooling is mandatory. Model PUE 1.45 versus 1.20 on a fixed 80 MW IT load and price the difference at Winnipeg, Montreal, Toronto and Halifax rates. Then ask how much of that advantage survives when direct-to-chip cooling makes outside air temperature nearly irrelevant.
5. Price the waste heat. A 26 MW Kamloops hall rejects roughly 26 MW of low-grade heat. What is that worth to a district energy system, a greenhouse or an aquaculture operation in a Canadian winter, and what contract structure would make a data centre operator care?
6. Model the tariff wedge. Given the 25% US Section 232 semiconductor measure, its exemption for goods used in US data centres, and the absence of a CUSMA carve-out, estimate the landed cost difference for an identical 100 MW rack order in Ontario versus Ohio. What would Canada have to offer to close it?
7. Interrogate the orbital case with Google's own numbers. At US$200 per kg and 20.5 kg per kW, orbital compute is roughly cost-comparable to terrestrial energy on a per-kW basis. Rebuild that comparison including the satellite, the radiator at NASA's measured 96 kg per kW, the chips and the ground segment. What launch price does the full system need?
8. Settle the inference-versus-training split. Using van Berkel's bisection bandwidth figures and Meta's measured 41% model FLOPs utilisation, estimate what an orbital training run would actually cost per token compared with a terrestrial one. Then do the same for inference, where the satellite can be self-contained.
9. Follow the copper, not the silicon. NVIDIA says a 1 MW rack needs up to 200 kg of copper busbar and a gigawatt data centre up to 200 tonnes of copper. Map the Canadian content of an AI data centre build: copper, transformers, switchgear, cooling distribution units, construction trades. Is the industrial opportunity in the building rather than the chips?
10. Ask what "sovereign" means physically. Canada funded Cohere's compute at a facility operated by CoreWeave, an American company, and TELUS's cluster runs NVIDIA silicon under US export control. Define a measurable test of compute sovereignty that a Canadian government could actually apply at procurement.

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06

PART III · CANADA ON THE GROUND

The map: forty-six projects, and the gap between announced and built

An inventory of every large Canadian data-centre project found between 2024 and August 2026, with what is under construction, what is merely proposed, what has been paused and what has been refused outright. The distance between those categories is the single most useful thing to understand about this file.

21.2 GW vs 2.3 GW

Announced and proposed capacity against capacity actually under construction. Nine tenths of the Canadian data-centre story is, so far, an announcement.

WHAT THIS CHAPTER ANSWERS

- ? What is actually being built in Canada, and by whom?
- ? How much of the announced capacity has power, a tenant and a grid contract?
- ? Why did Alberta receive almost twenty gigawatts of requests?
- ? What is stopping the rest, province by province?

KEY TAKEAWAYS

- Alberta is where the wave has landed. As of July 30, 2026 developers had asked the Alberta Electric System Operator (AESO) to connect about 19,565 MW of data-centre load against a record provincial peak of about 12,800 MW (Government of Alberta, 2026). AESO's own updates put the queue at 29 projects and more than 16 GW in June 2025 and "over 20,000 MW" by September 2025; press coverage cites about 21 GW in late 2025 (AESO, 2025; DeSmog, 2026).
- Only 1,200 MW of that has a grid contract. AESO's interim large-load limit (June 4, 2025) covered projects of 75 MW or more that needed no new transmission; 15 projects from 5 developers qualified with 4,800 MW, the 1,200 MW was assigned pro rata with a trading window, and two projects ended up holding it all: P2936 GLDC

Load, 970 MW (Meta's Sturgeon County campus) and P3083 Keephills Data Centre Phase I, 230 MW (TransAlta with CPP Investments and Brookfield). Everything else moved to Phase 2 (AESO, 2025 and 2026).

- The largest committed project in Canada is Meta's C$13 billion-plus, 1 GW Sturgeon County campus, which broke ground July 8, 2026. It stacks a 970 MW grid position, 250 MW from Capital Power from the second half of 2028, and the 932 MW, roughly C$4 billion Greenlight gas plant (Pembina, Morgan Stanley Infrastructure Partners, Kineticor) that took final investment decision July 2, 2026 for service in the second half of 2030 (Meta, Pembina, 2026).
- Outside Alberta, the projects actually being built are mid-sized and hydro or grid-fed: Bell's 300 MW, C$1.7 billion campus near Regina (early works April 21, 2026; tenants Cerebras and CoreWeave; first data halls in the first half of 2027), Microsoft's C$7.5 billion two-year expansion of its Quebec City and Toronto regions, QScale's 60 MW, C$700 million second building in Lévis, Vantage's 32 MW QC24, and eStruxture's 90 MW, C$750 million CAL-3 near Calgary (Bell, QScale, Vantage, Alberta Major Projects, 2025 to 2026).
- Alberta's "bring your own power" direction is now law: Bill 8 and Bill 12 received Royal Assent December 11, 2025, and the Data Centre Regulation (AR 117/2026, filed June 9, 2026) puts "tethered" projects with dedicated generation at the front of the queue, allows up to three years of bridging grid supply within an initial 1,600 MW bridging pool, and imposes a 1 to 2 per cent levy on computing equipment for sites of 75 MW or more from December 31, 2026 (Osler, Gowling WLG, 2026).
- Every other large province is rationing rather than racing. British Columbia caps new data-centre connections at 400 MW per two years (300 MW AI, 100 MW conventional, 145 MW per project) through a competitive call that closed in March 2026 with results due in fall 2026 (BLG, 2026). Quebec requires ministerial authorization above 5 MW and will about double the data-centre rate to roughly 13 cents per kWh from November 1, 2026 (Hydro-Québec, BLG, 2026). Ontario's draft Data Centre Playbook (August 13, 2026) makes data centres pay full grid costs and screens them on economic, sovereignty and community tests (Torys, 2026). Saskatchewan (August 27, 2026) requires Canadian ownership and self-supplied power for the 30-plus applications it holds (BNN Bloomberg, 2026).
- Social licence is now a binding constraint. Rocky View County refused Kineticor's 1,107-acre plan 6-1 on September 9, 2025 and voted 5-2 for a moratorium in late July 2026; the Alberta Utilities Commission denied Synapse's 1.4 GW gas plant for a 1 GW Olds campus on August 17, 2026 after about 1,500 parties sought standing; about 750 people marched in Vancouver against TELUS's sites on May 23, 2026; Manitoba's premier dropped a 350-acre gas-fired hyperscale proposal in June 2026; New Brunswick's 390 MW Lorneville project faces an organized "Save Lorneville" campaign (StrathmoreNow, Medicine Hat News, The Hub, Daily Hive, Capital Hill Group, The Narwhal, 2025 to 2026).
- Most announced gigawatts have no tenant, no generation and no grid contract. Wonder Valley (7.5 GW, C$70 billion) has land but no announced tenant or power plant and its start has slipped to about late 2028 (The Walrus, 2026); Beacon's six Alberta campuses and at least ten other tracker-listed proposals above 400 MW are at application stage (Alberta Data Centre Watch, 2026).
- Supply chains and money are tightening: large gas turbine backlogs exceed five years and gas plant capital costs doubled in two years (TD Economics, June 2026); the Greenlight plant costs about 2.6 times a comparable plant built two years earlier (Pembina Institute, 2026); Canadian construction inflation of 3 to 4 per cent in 2026 reflects metal tariffs and electrician shortages (Linesight, 2026); lenders have "shut off the taps" for projects without investment-grade tenants (Coolvector, March 2026).
- Indigenous ownership is becoming a differentiator that regulators reward: Woodland Cree First Nation owns 51 per cent of the 650 MW Mihta Askiy project, George Gordon First Nation partners on Bell's Regina campus, Upper Nicola Band voted to host a C$500 million Bell facility, Prophet River First Nation would majority-own a Fort St. John project, and the federal, BC and Ontario screening criteria all score Indigenous participation (Indigenous Energy Monitor, ISED, 2025 to 2026).

Narrative

Canada's AI data-centre boom is really two stories that are easy to confuse. The first is an announcement wave, concentrated in Alberta, that adds up to more electricity than the province has ever consumed at once. The second is a much shorter list of projects that have secured land, power, a tenant and a construction contract. The distance between the two lists is where the business questions live.

Start with what is real. Meta's Sturgeon County campus is the anchor. Announced and broken ground on July 8, 2026, it is a 1 GW, AI-optimized facility with more than C$13 billion of private capital, about 3,000 construction jobs and 300-plus permanent roles. Its power plan shows how Alberta now works: a 970 MW grid position won under AESO's one-time Phase 1 process, a 250 MW supply contract with Capital Power from the second half of 2028, and a dedicated 932 MW combined-cycle gas plant, Greenlight, owned by Pembina, Morgan Stanley Infrastructure Partners and Kineticor, that took final investment decision on July 2, 2026 for service in the second half of 2030. Meta expects to be running two years before its own plant is finished, so the grid carries the campus in between. The second Alberta project with a grid contract is TransAlta's Keephills site, where CPP Investments and Brookfield signed a memorandum of understanding on February 27, 2026 for an initial 230 MW that could grow to 1 GW.

Outside Alberta, the projects under construction are smaller and mostly hydro-fed. Bell's 300 MW campus outside Regina (C$1.7 billion, tenants Cerebras and CoreWeave, first data halls in the first half of 2027) is the largest purpose-built AI site being built in Canada today and the only one where a Crown utility, SaskPower, agreed to supply the full load. Microsoft is spending C$7.5 billion over two years on its Quebec City and Toronto regions, QScale is adding 60 MW in Lévis for C$700 million under new owner Goldman Sachs, Vantage is finishing a 32 MW building in Quebec City, Keel (formerly Bitfarms) is consolidating 96 MW of bitcoin capacity in Sherbrooke into an AI campus, eStruxture's 90 MW CAL-3 near Calgary opens in fall 2026, and TELUS opened a sold-out Rimouski facility in September 2025 with 85 MW secured from BC Hydro for a Kamloops and Vancouver cluster that scales past 150 MW by 2032.

Now the announcement wave. AESO counted 29 projects and 16 GW of requests in June 2025, "over 20,000 MW" by September 2025, and the province reported 19,565 MW on July 30, 2026, against a record peak of about 12,800 MW. Alberta Data Centre Watch lists 30 active projects with a published maximum of 13.1 GW. The biggest names, Wonder Valley (7.5 GW, C$70 billion), Beacon's six campuses (roughly 2,000 MW), Malachite One (1 GW), Travers (up to 2,000 MW), Wild Rose (1.3 GW) and Newell (1.2 GW), are applications, not projects. Wonder Valley illustrates the gap: 20 months after its announcement it has a land deal, a water certificate held by the municipality, an exemption from provincial environmental assessment, no announced tenant, no gas-plant partner, and a construction start that has slipped from 2026 to about late 2028.

Alberta's response to the queue is the most important policy development in the country. AESO's interim limit of 1,200 MW through 2028 was allocated pro rata among 15 qualified projects holding 4,800 MW; after a trading window and withdrawals, two projects took everything. The province then passed Bill 8 and Bill 12 (December 11, 2025) and filed the Data Centre Regulation on June 9, 2026. The model is "bring your own power": a data centre that pairs its demand with new dedicated generation or storage goes to the front of the connection queue, may use up to three years of bridging grid supply inside an initial 1,600 MW pool, and pays a levy of 1 to

2 per cent of the value of its computing equipment, lower if it draws less from the grid. Developers, not existing customers, pay for transmission upgrades. In practice this means every large Alberta project is also a gas-plant project, which pulls in a second set of constraints: turbine delivery slots that now stretch beyond five years, capital costs that have doubled in two years, Alberta Utilities Commission siting approval, water licences that rank behind existing users, and carbon exposure.

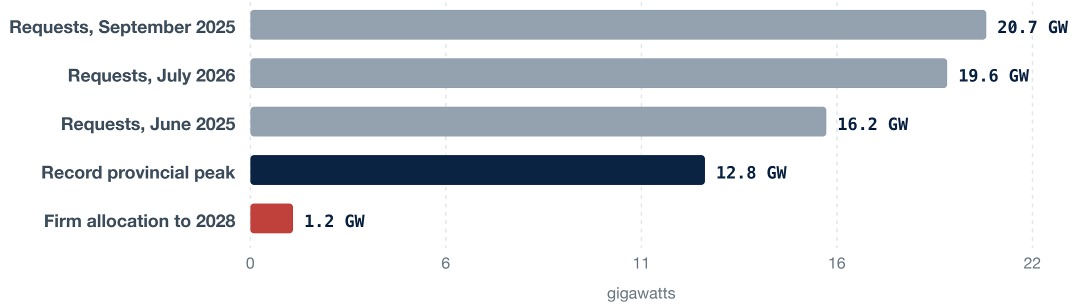
The other provinces are rationing. British Columbia replaced first-come, first-served with a competitive call, capped at 400 MW per two years and 145 MW per project, and permanently banned crypto connections. Quebec requires ministerial authorization for any load of 5 MW or more, evaluates projects comparatively, and is doubling the data-centre rate to about 13 cents per kWh from November 1, 2026. Ontario now requires approval under section 28.1 of the Electricity Act, and its draft Playbook makes data centres pay full grid costs, screens them for jobs, sovereignty and community benefit, and creates a higher Class C rate. Saskatchewan will only consider Canadian-owned projects that supply their own power. Manitoba passed a law letting Manitoba Hydro refuse large loads and its premier walked away from a gas-fired hyperscale proposal. Nova Scotia has no active file. New Brunswick is consulting on a framework while a 390 MW gas-and-grid project at Lorneville sits in environmental assessment. Ottawa's 100 MW-plus sovereign data-centre call closed February 15, 2026 and had named no proponents by September 2, 2026, although TELUS says it is advancing work under it.

Which roadblock binds where? In Alberta it is no longer policy but execution: siting and social licence (Rocky View, Olds, Sturgeon County), generation lead times, water, and above all the absence of tenants and financing for speculative land. In British Columbia and Quebec the binding constraint is administrative allocation of scarce hydro, and the price of it. In Ontario it is process time and cost. In Saskatchewan and Manitoba it is Crown-utility capacity and politics. In New Brunswick it is emissions and environmental assessment. Nationally, the financing market has turned selective: lenders want investment-grade tenants, and the tenants (Meta, Microsoft, CoreWeave, Cerebras, Cohere) are few.

For students, the useful frame is a funnel. Roughly 20 GW is requested in Alberta; 4.8 GW qualified; 1.2 GW is contracted; about 1.3 GW (Meta plus Keephills Phase I) is credibly funded; and, across all of Canada, less than 1 GW of new AI-grade capacity is actually under construction in 2026. Watch the events that move projects down the funnel: BC Hydro's call results (fall 2026), Ontario's final Playbook (fall 2026), the Régie's decision on Quebec's tariff, AESO's first Phase 2 bring-your-own-generation intake, federal MOUs, a gas-plant partner for Wonder Valley, the Rocky View moratorium, Synapse's appeal, and first power at Meta's campus in 2028.

FIGURE 6.1

Alberta's data-centre queue, three published counts

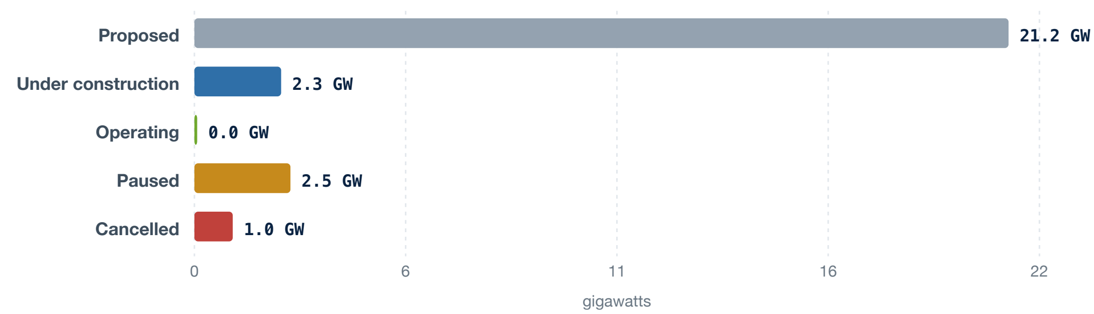


Three counts of the same queue, from three dates and three counters, against the province's record peak demand and the capacity actually allocated. When you quote one of these numbers, say which.

Source: Alberta Electric System Operator; Government of Alberta (July 2026); DeSmog (2026).

FIGURE 6.2

Announced Canadian capacity by status (GW)



The operating bar reads zero because the handful of sites already running never published a megawatt figure. Absence of a number is not absence of a project, but the shape of this chart is real: Canada has announced roughly nine times more than it is building.

Source: Project inventory, Appendix B.

Project inventory

Ordered by announced size. "n/d" means not disclosed in sources reviewed. Status is as of the latest source (date in brackets). Rows marked "tracker" rely on the independent Alberta Data Centre Watch tracker and have not been confirmed against filings.

1. Wonder Valley

DEVELOPER / TENANT
O'Leary Ventures; no tenant announced

PROVINCE, MUNICIPALITY
AB, MD of Greenview (Greenview Industrial Gateway, ~40 km south of Grande Prairie)

SIZE (MW, ANNOUNCED PHASES)
7,500 total; Phase 1 1,400

CAPEX
C$70 billion total; Phase 1 ~US$2 billion

POWER SOURCE
Off-grid natural gas, possible geothermal

STATUS (AS OF)
Proposed: land purchase deal March 2026, no provincial EIA (April 2026), construction now expected ~late 2028 (June 2026)

ANNOUNCED
Dec 9, 2024

PARTNERS (INDIGENOUS PARTNERS NOTED)
MD of Greenview; HPC and AI Data Centres; Sturgeon Lake Cree Nation objects on water and consultation

SOURCE
[11], [12], [13]

2. Travers AI Data Centre

DEVELOPER / TENANT
Developer not verified (tracker)

PROVINCE, MUNICIPALITY
AB, Vulcan County

SIZE (MW, ANNOUNCED PHASES)
Up to 2,000 (planning target)

CAPEX
n/d

POWER SOURCE
Grid, new 500 kV substation

STATUS (AS OF)
Proposed (Sept 2026, tracker)

ANNOUNCED
2025 to 2026

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[15]

3. Genesee Data Centre

DEVELOPER / TENANT
Capital Power with an unnamed developer

PROVINCE, MUNICIPALITY
AB, Leduc County (Genesee mine permit area)

SIZE (MW, ANNOUNCED PHASES)
Up to 1,500

CAPEX
n/d

POWER SOURCE
Grid at Genesee (1,857 MW gas on site)

STATUS (AS OF)
Proposed; received too little in Phase 1, deferred to AESO Phase 2 (Dec 2025)

ANNOUNCED
June 2024 (AESO application)

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[9]

4. Wild Rose Power Hub

DEVELOPER / TENANT
Developer not verified (tracker)

PROVINCE, MUNICIPALITY
AB, Rocky View County

SIZE (MW, ANNOUNCED PHASES)
1,300 (grid request)

CAPEX
n/d

POWER SOURCE
Grid; dry cooling

STATUS (AS OF)
Paused by county moratorium (Aug 2026)

ANNOUNCED
2025 to 2026

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[15], [18]

5. Beacon Indus

DEVELOPER / TENANT
Beacon AI Centers

SIZE (MW, ANNOUNCED PHASES)
1,200 load; first phase 400

POWER SOURCE
1,494 MW on-site gas plus solar

ANNOUNCED
2025

SOURCE
[15], [18]

PROVINCE, MUNICIPALITY
AB, Rocky View County (near Indus and Langdon)

CAPEX
~C$4 billion (first phase)

STATUS (AS OF)
Proposed; under county moratorium (Aug 2026)

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

6. Newell Data Center

DEVELOPER / TENANT
Developer not verified (tracker)

SIZE (MW, ANNOUNCED PHASES)
1,200 (grid request)

POWER SOURCE
Grid

ANNOUNCED
n/d

SOURCE
[15]

PROVINCE, MUNICIPALITY
AB, County of Newell

CAPEX
n/d

STATUS (AS OF)
Proposed (Sept 2026, tracker)

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

7. Meta Sturgeon Data Centre

DEVELOPER / TENANT
Meta (owner and operator)

SIZE (MW, ANNOUNCED PHASES)
1,000 (reported scalable to 1,800)

POWER SOURCE
970 MW grid (AESO P2936); Capital Power 250 MW from H2 2028; Greenlight 932 MW gas from H2 2030 (permitted to 1,864 MW)

ANNOUNCED
July 8, 2026

SOURCE
[7], [8]

PROVINCE, MUNICIPALITY
AB, Sturgeon County (Alberta Industrial Heartland)

CAPEX
C$13 billion-plus; Greenlight plant ~C$4 billion separately

STATUS (AS OF)
Approved and under construction: groundbreaking July 8, 2026; online in 2 to 3 years

PARTNERS (INDIGENOUS PARTNERS NOTED)
Greenlight LP (Pembina 47.5%, Morgan Stanley Infrastructure Partners 47.5%, Kineticor 5%), Capital Power, AltaLink, AESO

8. Malachite One

DEVELOPER / TENANT
Tourmaline and Emerald (per EnergyNow)

SIZE (MW, ANNOUNCED PHASES)
1,000

POWER SOURCE
930 MW on-site gas, carbon capture considered; 74.9 MW grid request

ANNOUNCED
2026

SOURCE
[16], [15]

PROVINCE, MUNICIPALITY
AB, Yellowhead County

CAPEX
~C$15 billion data centre plus C$5 billion power

STATUS (AS OF)
Proposed (Aug 2026)

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

9. Synapse Olds

DEVELOPER / TENANT
Synapse Real Estate Corp.; no tenant

PROVINCE, MUNICIPALITY
AB, Town of Olds

SIZE (MW, ANNOUNCED PHASES)
1,000 (10 x 100)

CAPEX
~C$10 billion

POWER SOURCE
1,400 MW on-site gas with 1,800 MW diesel backup

STATUS (AS OF)
Cancelled as proposed: AUC denied the plant Aug 17, 2026; proponent says it will not proceed as proposed

ANNOUNCED
Jan 2026

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[19]

10. Keephills Data Centre

DEVELOPER / TENANT
TransAlta (site and power); CPP Investments and Brookfield (developers)

PROVINCE, MUNICIPALITY
AB, Parkland County

SIZE (MW, ANNOUNCED PHASES)
230 Phase I; up to 1,000

CAPEX
n/d

POWER SOURCE
Keephills on-site gas plus grid (AESO P3083, 230 MW)

STATUS (AS OF)
Proposed: MOU Feb 27, 2026; grid contract executed; definitive agreements pending

ANNOUNCED
Feb 27, 2026

PARTNERS (INDIGENOUS PARTNERS NOTED)
CPP Investments, Brookfield

SOURCE
[10], [1]

11. Beacon Heartland

DEVELOPER / TENANT
Beacon AI Centers

PROVINCE, MUNICIPALITY
AB, Sturgeon County

SIZE (MW, ANNOUNCED PHASES)
800 load; 920 to 960 on-site generation

CAPEX
n/d

POWER SOURCE
On-site natural gas

STATUS (AS OF)
Proposed; completion target 2027 (approvals being sought)

ANNOUNCED
2025

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[14], [15]

12. Goldfinch Technology Park

DEVELOPER / TENANT
Developer not verified (tracker)

PROVINCE, MUNICIPALITY
AB, Wheatland County

SIZE (MW, ANNOUNCED PHASES)
950 (grid request)

CAPEX
n/d

POWER SOURCE
Grid

STATUS (AS OF)
Proposed (tracker)

ANNOUNCED
n/d

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[15]

13. HubOne AI and BTC

DEVELOPER / TENANT
Developer not verified (tracker)

PROVINCE, MUNICIPALITY
AB, Wheatland County

SIZE (MW, ANNOUNCED PHASES)
750-plus AI load; up to 3,000 generation

CAPEX
n/d

POWER SOURCE
On-site gas

STATUS (AS OF)
Proposed (tracker)

ANNOUNCED
n/d

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[15]

14. Mihta Askiy Data Centre

DEVELOPER / TENANT
Mihta Askiy Datacenter LP (51% Woodland Cree First Nation) with Sovereign Digital Infrastructure

PROVINCE, MUNICIPALITY
AB, Northern Sunrise County (~40 km NE of Peace River)

SIZE (MW, ANNOUNCED PHASES)
650

CAPEX
~US$1.5 billion (BlackRidge, unconfirmed)

POWER SOURCE
On-site gas: two 200 MW Siemens turbines procured; former Carmon Creek plant

STATUS (AS OF)
Proposed; first power targeted mid-2027 (July 2026)

ANNOUNCED
2025

PARTNERS (INDIGENOUS PARTNERS NOTED)
Woodland Cree First Nation (Indigenous majority owner); Siemens Energy Canada

SOURCE
[24], [39]

15. Bell AI Fabric BC cluster

DEVELOPER / TENANT
Bell Canada

PROVINCE, MUNICIPALITY
BC, Kamloops, Merritt, Thompson Rivers University, two sites TBD

SIZE (MW, ANNOUNCED PHASES)
~500 total: 7, 7, 26, 26, and 400-plus combined

CAPEX
"Nine-figure" investment

POWER SOURCE
BC Hydro (hydro)

STATUS (AS OF)
Kamloops 7 MW operating since June 2025; others planned 2025 to 2027

ANNOUNCED
May 28, 2025

PARTNERS (INDIGENOUS PARTNERS NOTED)
Groq; Thompson Rivers University; Upper Nicola Band (candidate host)

SOURCE
[26]

16. Beacon Foothills

DEVELOPER / TENANT
Beacon AI Centers

SIZE (MW, ANNOUNCED PHASES)
400

POWER SOURCE
400 MW on-site generation plus solar; grid tie expected late 2026

ANNOUNCED
2025

SOURCE
[14]

PROVINCE, MUNICIPALITY
AB, Foothills County (near High River)

CAPEX
C$4.0 billion

STATUS (AS OF)
Proposed; approvals being sought

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

17. Beacon Chestermere

DEVELOPER / TENANT
Beacon AI Centers

SIZE (MW, ANNOUNCED PHASES)
400

POWER SOURCE
On-site generation

ANNOUNCED
2025

SOURCE
[15]

PROVINCE, MUNICIPALITY
AB, City of Chestermere

CAPEX
~C$4 billion

STATUS (AS OF)
Proposed

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

18. Beacon Harry Smith

DEVELOPER / TENANT
Beacon AI Centers

SIZE (MW, ANNOUNCED PHASES)
400 (grid request)

POWER SOURCE
Grid

ANNOUNCED
2025 to 2026

SOURCE
[15]

PROVINCE, MUNICIPALITY
AB, Parkland County

CAPEX
n/d

STATUS (AS OF)
Proposed

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

19. Beacon Saunders Lake

DEVELOPER / TENANT
Beacon AI Centers

SIZE (MW, ANNOUNCED PHASES)
400 (grid request)

POWER SOURCE
Grid

ANNOUNCED
2025 to 2026

SOURCE
[15]

PROVINCE, MUNICIPALITY
AB, Leduc County

CAPEX
n/d

STATUS (AS OF)
Proposed

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

20. Spruce Lake AI Hub (Lorneville)

DEVELOPER / TENANT
Beacon Data Centers and VoltaGrid

SIZE (MW, ANNOUNCED PHASES)
390

POWER SOURCE
190 MW on-site gas (VoltaGrid) plus ~200 MW from NB Power

ANNOUNCED
Oct 2025

SOURCE
[38]

PROVINCE, MUNICIPALITY
NB, Saint John (Spruce Lake Industrial Park)

CAPEX
~C$2 billion

STATUS (AS OF)
Proposed; environmental impact assessment under review; construction planned 2026, operation 2028

PARTNERS (INDIGENOUS PARTNERS NOTED)
VoltaGrid; "Save Lorneville" opposes

21. Teton Digital Black Bear

DEVELOPER / TENANT
Teton Digital (tracker)

SIZE (MW, ANNOUNCED PHASES)
466 (gas generation)

POWER SOURCE
On-site gas

ANNOUNCED
n/d

SOURCE
[15]

PROVINCE, MUNICIPALITY
AB, Swan Hills region

CAPEX
n/d

STATUS (AS OF)
Proposed (tracker)

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

22. Bell AI Fabric Sherwood

DEVELOPER / TENANT
Bell Canada; tenants Cerebras and CoreWeave

SIZE (MW, ANNOUNCED PHASES)
300

POWER SOURCE
SaskPower grid; first transmission interconnection phase due end 2026

ANNOUNCED
Mar 16, 2026

SOURCE
[25]

PROVINCE, MUNICIPALITY
SK, RM of Sherwood (outside Regina)

CAPEX
~C$1.7 billion (C$1.3 billion in 2026)

STATUS (AS OF)
Under construction: early works April 21, 2026; first data halls H1 2027, remainder H2 2027

PARTNERS (INDIGENOUS PARTNERS NOTED)
Government of Saskatchewan; George Gordon First Nation (Indigenous procurement and workforce); SaskTel; Bird Construction

23. Data District Phase 1

DEVELOPER / TENANT
Technologies New Energy and Data District Inc.

SIZE (MW, ANNOUNCED PHASES)
240 across four sites

POWER SOURCE
n/d

ANNOUNCED
2025

SOURCE
[14]

PROVINCE, MUNICIPALITY
AB, Olds, Bonnyville, Calgary, Edmonton

CAPEX
C$1.26 billion

STATUS (AS OF)
Proposed; Olds construction from 2026, Bonnyville 2027

PARTNERS (INDIGENOUS PARTNERS NOTED)
Unnamed European partners

24. Teton Digital Northern Forge

DEVELOPER / TENANT
Teton Digital (tracker)

PROVINCE, MUNICIPALITY
AB, MD of Greenview

SIZE (MW, ANNOUNCED PHASES)
200 (gas generation)

CAPEX
n/d

POWER SOURCE
On-site gas

STATUS (AS OF)
Proposed (tracker)

ANNOUNCED
n/d

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[15]

25. Crusoe and Kalina energy parks

DEVELOPER / TENANT
Crusoe with Kalina Distributed Power

PROVINCE, MUNICIPALITY
AB, Alsike (Red Deer County per tracker), Myers (Brazeau County); Crossfield (Rocky View County) withdrawn

SIZE (MW, ANNOUNCED PHASES)
3 x 170 (power plants)

CAPEX
n/d

POWER SOURCE
On-site gas plants

STATUS (AS OF)
Proposed; Crossfield withdrawn (2026)

ANNOUNCED
2025

PARTNERS (INDIGENOUS PARTNERS NOTED)
Kalina Distributed Power

SOURCE
[15], [16]

26. TELUS Vancouver and Kamloops cluster

DEVELOPER / TENANT
TELUS

PROVINCE, MUNICIPALITY
BC, Kamloops; Vancouver (Mount Pleasant M3; 150 West Georgia)

SIZE (MW, ANNOUNCED PHASES)
85 initial; over 150 by 2032; 60,000-plus GPUs

CAPEX
Capex n/d; ~C$9 billion economic value claimed

POWER SOURCE
BC Hydro (98 to 99% renewable)

STATUS (AS OF)
Under development: Kamloops 2026, M3 end of 2026, 150 West Georgia 2029; protests May and June 2026

ANNOUNCED
Apr 15, 2025; cluster May 11, 2026

PARTNERS (INDIGENOUS PARTNERS NOTED)
NVIDIA, HPE; federal work under the sovereign AI data-centre initiative

SOURCE
[30], [31]

27. Moore Data Center

DEVELOPER / TENANT
Carpere Canada

PROVINCE, MUNICIPALITY
SK, Moose Jaw

SIZE (MW, ANNOUNCED PHASES)
150

CAPEX
~US$485 million

POWER SOURCE
n/d

STATUS (AS OF)
Proposed (planning, 2025 to 2030)

ANNOUNCED
2025

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[39]

28. Gryphon Pincher Creek

DEVELOPER / TENANT
Gryphon Digital Mining

SIZE (MW, ANNOUNCED PHASES)
130

POWER SOURCE
n/d

ANNOUNCED
2025

SOURCE
[39]

PROVINCE, MUNICIPALITY
AB, Pincher Creek area

CAPEX
~US$500 million

STATUS (AS OF)
Proposed (planning)

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

29. Bitdeer Fox Creek

DEVELOPER / TENANT
Bitdeer (tracker)

SIZE (MW, ANNOUNCED PHASES)
~100

POWER SOURCE
101 MW on-site gas; closed-loop dry cooling

ANNOUNCED
n/d

SOURCE
[15]

PROVINCE, MUNICIPALITY
AB, Fox Creek

CAPEX
n/d

STATUS (AS OF)
Under construction (tracker, Sept 2026)

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

30. Keel Sherbrooke (formerly Bitfarms)

DEVELOPER / TENANT
Keel Infrastructure; no tenant

SIZE (MW, ANNOUNCED PHASES)
96 (consolidating 48, 30 and 18 MW bitcoin sites)

POWER SOURCE
Hydro-Sherbrooke existing allocation

ANNOUNCED
Jul 15, 2026

SOURCE
[34]

PROVINCE, MUNICIPALITY
QC, Sherbrooke

CAPEX
n/d (part of a C$1.8 billion North American program)

STATUS (AS OF)
Approved by city July 13, 2026; MEIE recategorization needed; land closes Q1 2027

PARTNERS (INDIGENOUS PARTNERS NOTED)
Hydro-Sherbrooke

31. eStruxture CAL-3

DEVELOPER / TENANT
eStruxture

SIZE (MW, ANNOUNCED PHASES)
90

POWER SOURCE
Grid (FortisAlberta)

ANNOUNCED
2024

SOURCE
[14], [16]

PROVINCE, MUNICIPALITY
AB, Rocky View County (Balzac)

CAPEX
C$750 million

STATUS (AS OF)
Under construction; opening fall 2026

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

32. QScale Q01 Building B

DEVELOPER / TENANT
QScale (Infrastructure at Goldman Sachs Alternatives)

PROVINCE, MUNICIPALITY
QC, Lévis

SIZE (MW, ANNOUNCED PHASES)
60 IT (campus plan ~142)

CAPEX
C$700 million

POWER SOURCE
Hydro-Québec, waste-heat recovery

STATUS (AS OF)
Under construction (June 2026)

ANNOUNCED
Jun 4, 2026

PARTNERS (INDIGENOUS PARTNERS NOTED)
Goldman Sachs Alternatives

SOURCE
[34]

33. Vantage QC24

DEVELOPER / TENANT
Vantage Data Centers

PROVINCE, MUNICIPALITY
QC, Quebec City

SIZE (MW, ANNOUNCED PHASES)
32 (campus 86; Canada 178)

CAPEX
C$500 million

POWER SOURCE
Hydro-Québec

STATUS (AS OF)
Under construction; service early 2027

ANNOUNCED
Feb 27, 2025

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[34]

34. Yondr Toronto

DEVELOPER / TENANT
Yondr Group

PROVINCE, MUNICIPALITY
ON, Toronto area

SIZE (MW, ANNOUNCED PHASES)
27

CAPEX
n/d

POWER SOURCE
IESO grid

STATUS (AS OF)
Under construction; mid-2026 target

ANNOUNCED
2025

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[39]

35. Microsoft Canada East and Canada Central expansion

DEVELOPER / TENANT
Microsoft

PROVINCE, MUNICIPALITY
QC, Quebec City area (Lévis, Donnacona, L'Ancienne-Lorette, Saint-Augustin); ON, Toronto

SIZE (MW, ANNOUNCED PHASES)
n/d

CAPEX
C$7.5 billion over two years (Dec 2025) on top of C$680 million (Nov 2023)

POWER SOURCE
Hydro-Québec; IESO grid

STATUS (AS OF)
Under construction: Lévis civil works to autumn 2026; new capacity from H2 2026

ANNOUNCED
Dec 10, 2025

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[35]

36. CoreWeave Cambridge (Cohere anchor)

DEVELOPER / TENANT
CoreWeave; tenant Cohere

PROVINCE, MUNICIPALITY
ON, Cambridge

SIZE (MW, ANNOUNCED PHASES)
n/d

CAPEX
C$725 million project; up to C$240 million federal

POWER SOURCE
IESO grid

STATUS (AS OF)
Operating (opened 2025)

ANNOUNCED
Dec 6, 2024

PARTNERS (INDIGENOUS PARTNERS NOTED)
Government of Canada (Sovereign AI Compute Strategy)

SOURCE
[37]

37. QScale Ontario hyperscale

DEVELOPER / TENANT
QScale

PROVINCE, MUNICIPALITY
ON, Wilmot Township (shortlisted), Waterloo Region

SIZE (MW, ANNOUNCED PHASES)
n/d

CAPEX
C$2.5 to 4 billion (reported)

POWER SOURCE
IESO grid

STATUS (AS OF)
Proposed (site shortlist 2025)

ANNOUNCED
2025

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[39], [34]

38. Bell Rosser (CentrePort)

DEVELOPER / TENANT
Bell Canada

PROVINCE, MUNICIPALITY
MB, RM of Rosser

SIZE (MW, ANNOUNCED PHASES)
n/d (94,000 sq ft retrofit)

CAPEX
n/d

POWER SOURCE
Manitoba Hydro

STATUS (AS OF)
Under construction since early 2026; operation late 2026 or early 2027

ANNOUNCED
2026

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[26]

39. Ritchot hyperscale

DEVELOPER / TENANT
Jet.AI, Consensus Core, Convergence Compute

PROVINCE, MUNICIPALITY
MB, RM of Ritchot (Ile-des-Chenes)

SIZE (MW, ANNOUNCED PHASES)
n/d (six gas turbines; 350 acres)

CAPEX
n/d

POWER SOURCE
On-site gas

STATUS (AS OF)
Cancelled: premier said it is no longer on the table (June 2026); 4,200-signature petition

ANNOUNCED
Late 2025

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[28], [29]

40. Upper Nicola Band and Bell

DEVELOPER / TENANT
Bell Canada with Upper Nicola Band

SIZE (MW, ANNOUNCED PHASES)
n/d (candidate for Bell's 400-plus MW sites)

POWER SOURCE
BC Hydro

ANNOUNCED
2026

SOURCE
[24]

PROVINCE, MUNICIPALITY
BC, Upper Nicola lands near Merritt

CAPEX
C$500 million

STATUS (AS OF)
Proposed; band members voted yes (2026)

PARTNERS (INDIGENOUS PARTNERS NOTED)
Upper Nicola Band (Indigenous lessor)

41. Prophet River and ABCT Pacific

DEVELOPER / TENANT
Prophet River First Nation (majority) with ABCT Pacific (VCC) Ltd.

SIZE (MW, ANNOUNCED PHASES)
n/d

POWER SOURCE
BC Hydro (Site C)

ANNOUNCED
Mar 5, 2025

SOURCE
[24]

PROVINCE, MUNICIPALITY
BC, Fort St. John area

CAPEX
n/d

STATUS (AS OF)
Proposed; letter of intent and feasibility

PARTNERS (INDIGENOUS PARTNERS NOTED)
Prophet River First Nation (Indigenous majority owner)

42. IREN BC conversions

DEVELOPER / TENANT
IREN

SIZE (MW, ANNOUNCED PHASES)
n/d (existing bitcoin sites)

POWER SOURCE
BC Hydro

ANNOUNCED
2025

SOURCE
[32]

PROVINCE, MUNICIPALITY
BC, Prince George, Mackenzie, Canal Flats

CAPEX
n/d

STATUS (AS OF)
Converting to AI cloud workloads (2025 to 2026)

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

43. TELUS Rimouski Sovereign AI Factory

DEVELOPER / TENANT
TELUS

SIZE (MW, ANNOUNCED PHASES)
n/d

POWER SOURCE
Hydro-Québec (99% renewable)

ANNOUNCED
Apr 15, 2025

SOURCE
[30]

PROVINCE, MUNICIPALITY
QC, Rimouski

CAPEX
n/d

STATUS (AS OF)
Operating since Sept 24, 2025; sold out (May 2026)

PARTNERS (INDIGENOUS PARTNERS NOTED)
NVIDIA, HPE

44. Kineticor Rocky View Technology Park

DEVELOPER / TENANT
Kineticor

PROVINCE, MUNICIPALITY
AB, Rocky View County (northeast)

SIZE (MW, ANNOUNCED PHASES)
n/d (1,107 acres)

CAPEX
n/d

POWER SOURCE
On-site gas contemplated; county potable water

STATUS (AS OF)
Cancelled: council refused the area structure plan 6-1 on Sept 9, 2025

ANNOUNCED
2025

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[17]

45. Steelport hyperscale

DEVELOPER / TENANT
Not disclosed

PROVINCE, MUNICIPALITY
ON, Hamilton

SIZE (MW, ANNOUNCED PHASES)
n/d

CAPEX
n/d

POWER SOURCE
IESO grid

STATUS (AS OF)
Cancelled: Committee of Adjustment refused after public opposition (2025 to 2026)

ANNOUNCED
2025

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[29]

46. AWS Canada West and Canada Central

DEVELOPER / TENANT
Amazon Web Services

PROVINCE, MUNICIPALITY
AB, Calgary; QC, Montreal

SIZE (MW, ANNOUNCED PHASES)
n/d

CAPEX
C$4.3 billion by 2037 (Calgary); up to C$24.8 billion Canada by 2037

POWER SOURCE
Grid, 100% renewable-matched

STATUS (AS OF)
Operating (Calgary since Dec 2023; Montreal since 2016)

ANNOUNCED
Nov 2021 (Calgary); 2026 (commitment)

PARTNERS (INDIGENOUS PARTNERS NOTED)
n/d

SOURCE
[39], [14]

Roadblocks by province

PROVINCE	BINDING CONSTRAINT	EVIDENCE	SOURCE
Alberta	Grid connection capacity and queue (high)	19,565 MW requested vs 1,200 MW allocated (July 30, 2026); peak ~12,800 MW; Phase 1 closed with two projects; Phase 2 BYOG intakes roughly every nine months; 1,600 MW bridging pool	[4], [1], [5]
Alberta	Generation lead times and cost (high)	Large gas turbine backlogs over five years; gas capex doubled in two years; Greenlight (932 MW) costs ~C$4 billion, 2.6x a similar plant two years earlier, and arrives in H2 2030, after Meta needs power	[22], [21], [8]

PROVINCE	BINDING CONSTRAINT	EVIDENCE	SOURCE
Alberta	Municipal zoning and social licence (high)	Rocky View refusal 6-1 (Sept 2025) and moratorium 5-2 (July 2026); hundreds rallied in Morinville against Meta; 4 in 5 Albertans concerned about costs and environment	[17], [18], [20]
Alberta	Regulatory siting of on-site generation (high)	AUC denied Synapse's 1.4 GW plant at Olds (Aug 17, 2026) as too close to the community; ~1,500 parties applied to participate	[19]
Alberta	Water licensing (medium)	Water Act licences rank junior to existing holders; southern basins closed to new surface-water licences since 2006; Wonder Valley's 24 million cubic metres per year certificate held via the municipality; five projects publish 13.8 million litres per day	[4], [13], [15]
Alberta	Tenant and financing uncertainty (high)	Wonder Valley has no tenant and a late-2028 start; most tracker projects are applications; lenders shut to non-investment-grade tenants; land speculation reported	[12], [15], [40]
Alberta	Levy and rule uncertainty (medium)	AESO extended Phase 1 contract deadline (Aug to Oct 2025) for the levy; levy of 1 to 2 per cent on equipment from Dec 31, 2026; regulation only filed June 9, 2026	[2], [5], [6]
Alberta	Power price impacts (medium)	AESO acknowledges prices rise when load arrives before generation; Pembina Institute expects higher and more volatile rates	[20], [21]
British Columbia	Capped, competitive allocation (high)	400 MW per two years (300 MW AI, 100 MW conventional), 145 MW per project cap, bid security C$25,000 per MW; call closed March 2026; decisions fall 2026; crypto connections banned permanently; resource industries exempt	[40], [41], [42]
British Columbia	Community opposition (medium)	~750 marchers May 23, 2026 and a second march June 27; concerns on water during restrictions and consultation; petition reported at 15,000 signatures	[31]
Saskatchewan	Utility supply and ownership rules (high)	SaskPower could supply Bell's 300 MW but future projects must self-supply "behind the fence"; Canadian ownership required; 30-plus applications pending (Aug 27, 2026)	[27]
Manitoba	Utility capacity and political veto (high)	Manitoba Hydro says it cannot connect new energy-intensive users; legislation lets Hydro reject large loads; premier dropped the Ritchot hyperscale project (June 2026); 4,200-signature petition	[28], [29]
Ontario	Process length and full-cost rules (high)	Section 28.1 approval (in force Dec 11, 2025); system and connection impact assessments over 12 months for loads above 10 MW; OEB leave to construct 6 to 12-plus months; draft Playbook (Aug 13, 2026) requires full cost recovery, screening, and a Class C rate above 1 MW; final rules due fall 2026	[36]
Ontario	Local approvals (medium)	Steelport hyperscale campus in Hamilton refused by the Committee of Adjustment after opposition on power, water, noise and waterfront use	[29]
Quebec	Ministerial authorization and tariff (high)	Loads of 5 MW or more need MEIE authorization with comparative evaluation (Bill 69, June 2025); proposed data-centre rate ~13 cents per kWh (about double) from Nov 1, 2026, subject to Régie hearings in fall 2026; sector expected to grow from ~190 MW to ~1,000 MW by 2035	[33]
New Brunswick	Environmental assessment and emissions (high)	Lorneville gas plant would emit ~750,000 tonnes CO2 a year (~6.6% of provincial emissions), clear 27 ha of wetland and 3.5 ha of old-growth forest; EIA under way; moratorium motion blocked June 2026; provincial framework out for comment to Oct 2, 2026	[38]
Nova Scotia	Electricity supply (high)	Premier: "not a today thing"; support only if power can be supplied safely; no active file	[38]
Newfoundland and Labrador	Transmission and framework gap (medium)	About 17 MW of crypto load in Labrador; no AI-specific framework; Labrador transmission limits	[29]

PROVINCE	BINDING CONSTRAINT	EVIDENCE	SOURCE
Federal	Sovereignty screening and selection lag (medium)	100 MW-plus call closed Feb 15, 2026; MOU-based selection; no proponents named on the ISED page as of Sept 2, 2026; Cohere funding criticized because CoreWeave operates the site	[37]

Contested or uncertain figures

- Alberta queue size: 16 GW (AESO, June 2025), over 20,000 MW (AESO, September 2025), 20.7 GW in 2024 and about 21 GW in late 2025 (DeSmog and ConstructConnect), 19,565 MW (Government of Alberta, July 30, 2026), 13.1 GW "published maximum" (Alberta Data Centre Watch). The figures count different things (AESO project list versus active proposals) and some requests overlap or have been withdrawn.
- Alberta peak demand is cited as about 12,000 MW (Gowling, Reynar) and about 12,800 MW (Government of Alberta); the 2025 average was 10.3 GW (tracker). Use 12 to 12.8 GW for peak.
- Wonder Valley's 7.5 GW and C$70 billion are the proponent's long-run ambition; nothing beyond Phase 1 (1.4 GW) is specified, and even Phase 1 has no announced tenant, generation partner, financing or firm start date.
- Meta's campus is described as 1 GW (Meta) and as 1.8 GW or "scalable to 1.8 GW" (Pembina Institute, Capital Hill Group, EnergyNow); the 1,864 MW figure is the permitted expansion of the Greenlight plant, not committed data-centre load.
- Alberta's "C$100 billion" data-centre investment target appears in Global News and Capital Hill Group reporting but not on the province's own data-centre pages; a "5,000 MW" provincial target appears only in a secondary source (Reynar IT).
- Bell's Saskatchewan "C$12 billion" is projected economic value over time; the construction cost is about C$1.7 billion. Similar care applies to TELUS's "C$9 billion" economic-value claim.
- Beacon's capex: Alberta Major Projects lists C$4.0 billion for Foothills and also says "six data centres at an approximate cost of $4 billion"; DCD reporting attaches C$4 billion each to Indus and Chestermere. Treat per-campus capex as unconfirmed.
- Quebec block allocation: a search summary attributed a "300 MW AI plus 100 MW data centre" two-year block to Hydro-Québec; primary sources show those are British Columbia's caps. No verified Hydro-Québec MW block for data centres was found; what is verified is the 5 MW authorization rule, comparative evaluation, and the forecast of about 1,000 MW of data-centre load by 2035.
- No Nvidia agreement with the federal or Alberta government, no Capital Power and Nvidia project, and no Bell site in Thunder Bay were found in any source; treat those candidate items as unverified.
- Tracker-only Alberta projects (Travers, Wild Rose, Newell, Goldfinch, HubOne, Teton Digital, Bitdeer Fox Creek, Prairie Sky, AHI) have not been confirmed against AESO or municipal filings; developer identities and MW may change.
- Mihta Askiy capex (about US$1.5 billion), Carpere's Moose Jaw project, Gryphon's Pincher Creek project and Yondr's Toronto facility come from a single secondary list (BlackRidge Research).
- Google's 2021 Beauharnois announcement (US$600 million) has no verified 2026 status; it is excluded from the inventory.

- BC's call deadline is reported as March 9, 2026 (BLG, ConstructConnect) and March 18, 2026 (Canadian Press via CP24).
- Synapse's AUC history: ConstructConnect reports an AUC rejection on March 6, 2026 and CBC reports a re-application; the definitive denial is August 17, 2026.

Open questions students could investigate

1. How much of Alberta's 19.6 GW queue is "real"? Build a scoring model (tenant, generation, water licence, municipal approval, financing) and estimate MW likely to energize by 2030.
2. Who bears price risk when a 1 GW load arrives on the Alberta grid two years before its dedicated plant? Model the pool-price effect of Meta's 2028 to 2030 bridging period.
3. Does the bring-your-own-power model lock Alberta into gas? Compare levelized cost and delivery time of gas, wind plus storage, and small nuclear for a 400 MW campus given turbine backlogs.
4. What did Rocky View County's moratorium and the Olds denial teach developers about siting? Draft a community-benefit and siting checklist that would have passed both.
5. Is British Columbia's 400 MW per two years cap a rationing failure or sound industrial policy? Estimate the opportunity cost in GDP versus the ratepayer savings BC Hydro claims.
6. Will Quebec's 13 cents per kWh data-centre rate push AI workloads to Alberta or the United States? Compare all-in power cost per GPU-hour across Quebec, Alberta, Ontario and Texas.
7. What does "sovereign" mean when CoreWeave operates Cohere's site and Cerebras and CoreWeave anchor Bell's? Define measurable sovereignty criteria for the federal 100 MW-plus program.
8. Why did Saskatchewan get Bell's 300 MW and Manitoba get nothing? Compare utility capacity, politics and site readiness in the two Prairie provinces.
9. How should Indigenous equity be structured? Compare Woodland Cree's 51 per cent ownership, Upper Nicola's lease model and George Gordon's procurement agreement on risk, return and control.
10. What happens to bitcoin sites in BC and Quebec after crypto connection bans and rate hikes? Assess IREN's and Keel's conversion economics as a template for stranded-power reuse.

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07

CHAPTER 7

The rules: thirteen governments, thirteen different answers

There is no Canadian data-centre policy. There is a federal convening role with modest money, and provinces that have moved, within eighteen months, from courting these projects to rationing access to them. This chapter is the scorecard and the timeline.

1,200 MW All the firm grid capacity Alberta allocated for data centres to 2028, against requests near twenty thousand megawatts. Two projects took every megawatt of it.

WHAT THIS CHAPTER ANSWERS

- ? What is Ottawa actually funding, and what is it only convening?
- ? Why did Alberta, Ontario, Quebec and British Columbia end up with four different systems?
- ? Who decides, in each province, whether a project connects?
- ? What changed in 2026, and what is still being written?

KEY TAKEAWAYS

- Ottawa's money is modest and its main instrument is convening. The Canadian Sovereign AI Compute Strategy (announced in Budget 2024, launched December 2024) totals about $2 billion over five years: up to $700 million for commercial data centre capacity, up to $705 million for a public supercomputer through the AI Sovereign Compute Infrastructure Program (SCIP), up to $200 million to augment existing public compute and up to $300 million for the AI Compute Access Fund (Canada.ca, 7 March 2025; OECD.AI, updated 28 April 2026). Budget 2025 (4 November 2025) added $925.6 million over five years for a sovereign public AI infrastructure, of which $800 million came from the Budget 2024 envelope (Budget 2025 Chapter 1; CBC, November 2025).

- The federal call for sovereign AI data centres above 100 MW (15 January to 15 February 2026) offers non-binding memoranda of understanding (MOUs), not cash: an Innovation, Science and Economic Development Canada (ISED) spokesperson confirmed the $2 billion envelope will not fund those projects (BetaKit, 21 January 2026). The only publicly announced outcome by 2 September 2026 is the TELUS British Columbia cluster (Kamloops plus two Vancouver sites, 85 MW rising to 150 MW by 2032) announced 11 May 2026 (Canada.ca; CBC).
- The Canada Infrastructure Bank (CIB) is now the most concrete federal financing lever: its February 2026 Statement of Priorities directs it to prioritise AI data centres and digital infrastructure with a target of at least $5 billion at financial close, to use its clean-energy mandate for grid capacity and on-site generation, and to grow its capital envelope from $35 billion to $45 billion (Housing, Infrastructure and Communities Canada, February 2026; Budget 2025).
- The national strategy "AI for All" (4 June 2026) makes sovereign compute one of six pillars, commits to a "world-leading public AI supercomputer" and to government acting as an anchor customer, but publishes no binding megawatt target in the primary release (Canada.ca, 5 June 2026; Baker McKenzie, June 2026). Two secondary summaries cite a target of 850 MW of sovereign compute by 2030 scaling toward 2.3 GW (RBC Thought Leadership, 10 June 2026; Code To Cloud, June 2026); this could not be confirmed on the ISED strategy page and is flagged below.
- Alberta is the most welcoming province and the most grid-constrained. Its December 2024 strategy (Minister Nate Glubish, ambition of $100 billion of projects under construction within five years) rests on "bring your own power": the Alberta Electric System Operator (AESO) capped interim grid connections at 1,200 MW through 2028 on 4 June 2025 against 29 requests totalling more than 16 GW; requests reached roughly 19,565 MW against an all-time peak of 12,800 MW by mid-2026 (AESO; CBC, 4 June 2025; alberta.ca, 2026). The Data Centre Regulation (AR 117/2026, filed 9 June 2026) puts projects tethered to new generation or storage at the front of the queue and requires data centres to be curtailed before other customers (Osler, June 2026).
- Ontario has moved from first-come, first-served to ministerial gatekeeping. Bill 40 (Royal Assent 11 December 2025) lets the Minister of Energy and Mines decide which large loads connect; the draft Data Centre Playbook (13 August 2026, comments to 12 September 2026) requires data centres to pay the full cost of electricity, invest in communities and support digital sovereignty, and offers only non-financial support. Pending proposals could exceed 10,000 MW against a recent provincial peak of about 25,000 MW (Environmental Registry of Ontario 026-0853; Ontario Playbook backgrounder, 13 August 2026).
- Quebec has flipped from promoter to rationer. Projects above 5 MW need ministerial authorisation under Bill 69 (adopted June 2025), allocation is comparative rather than first-come, and Hydro-Québec asked the Régie de l'énergie on 19 February 2026 for a new data centre rate of about 13 cents per kWh, roughly double the large-power rate; data centre load is about 190 MW today and is expected to reach about 1,000 MW by 2035 (Hydro-Québec, 19 February 2026; BLG, July 2026).
- British Columbia rations by competition. Bill 31 (Royal Assent 27 November 2025) and B.C. Reg. 8/2026 (30 January 2026) cap new data centre capacity at 400 MW for two years (100 MW conventional, 300 MW AI, maximum 145 MW per project), allocated through BC Hydro's 2026 Call for Demand: 15 applications for about 800 MW were received by 9 March 2026, with winners due by end of September 2026 (bclaws; BC Hydro; BC Government, 30 January 2026).
- Smaller provinces are choosing conditions over volume. Saskatchewan's framework (27 August 2026) requires Canadian ownership and self-supplied power; Bell's $1.7 billion, 300 MW Regina-area centre with George Gordon First Nation is the last non-Crown project allowed to draw on SaskPower (BNN Bloomberg; Global News, 27 August 2026). Manitoba rejected a 100 MW hyperscale proposal in June 2026 and requires ministerial priority designation for loads above 5 MW (McCord Investments tracker). Nova Scotia's premier said in June 2026 the province is not actively pursuing data centres.

- Municipal and Indigenous positions now decide siting. Rocky View County (28 July 2026), Mississauga (29 July 2026) and Oakville (11 August 2026) paused new data centres, while Sturgeon County (Meta, $13 billion, announced 8 July 2026) and the Rural Municipality of Sherwood (Bell) approved them. Indigenous participation is an explicit criterion federally and in BC, and examples include George Gordon First Nation (Saskatchewan), Woodland Cree First Nation's 51 per cent stake in a planned 650 MW Alberta project and Prophet River First Nation in BC (Indigenous Energy Monitor, updated December 2025; paNOW, 17 March 2026).

Narrative

Canada's governments agree on the destination and disagree on the road. Every order of government now says AI data centres matter for sovereignty, but the federal government controls neither the electricity nor the land, so the real gatekeepers are provincial ministers, Crown utilities, system operators and municipal councils. That split explains why the same 18 months produced a federal call for gigawatt-scale "sovereign" data centres alongside caps, rate hikes, moratoria and rejections in most provinces.

Start with Ottawa. The Canadian Sovereign AI Compute Strategy, announced in Budget 2024 and launched in December 2024, is a $2 billion package: a public supercomputer through SCIP, a commercial stream originally called the AI Compute Challenge, and an access fund for small firms. The Carney government, elected 28 April 2025, created a dedicated Minister of Artificial Intelligence and Digital Innovation (Evan Solomon, 13 May 2025) and folded AI into its "build Canada" and "energy superpower" framing: Bill C-5's Building Canada Act promises two-year federal decisions on national-interest projects, and the Major Projects Office (Calgary, August 2025) coordinates approvals and financing. Budget 2025 (4 November 2025) put $925.6 million over five years toward a sovereign public AI infrastructure, largely re-labelling Budget 2024 money, enabled the CIB to invest in AI infrastructure, raised the CIB's envelope to $45 billion, doubled Indigenous loan guarantees to $10 billion, and extended accelerated write-offs through the Productivity Super-Deduction (up to $9 billion a year of output, per the April 2026 Spring Economic Update). It also confirmed the Clean Electricity investment tax credit without conditions on provinces, which matters for Crown utilities building supply for large loads.

The distinctive federal move on data centres came in January 2026: a call for Canadian firms and consortia to propose sovereign AI data centres above 100 MW, judged on seven factors (economic benefit, Indigenous participation, sovereignty, energy, performance, readiness, cost and ownership). The reward is an MOU that "explores mechanisms", and intake forms are shared with the CIB, Export Development Canada, Invest in Canada, the Major Projects Office and provinces. ISED was explicit that the $2 billion envelope would not fund these projects. The one visible result, TELUS's Kamloops and Vancouver cluster (May 2026), is a modest 85 to 150 MW. The June 2026 "AI for All" strategy elevates sovereign compute to a pillar, promises a "world-leading public AI supercomputer", positions the government as an anchor customer and expands the Global Talent Stream, but the primary release contains no megawatt target; secondary summaries cite 850 MW by 2030 and 2.3 GW later. Meanwhile the digital sovereignty debate (the US CLOUD Act's reach over US-controlled providers, and CUSMA Article 19.12, which restricts data localisation mandates except for federal procurement and national security) gives Ottawa a rationale for wanting Canadian-owned, Canadian-governed capacity, and critics such as Open Canada argue that funding a facility operated by a US provider does not deliver it.

Alberta wrote the most ambitious script and then hit physics. Its December 2024 strategy leans on deregulated power, gas, cold weather and a concierge program, with Minister Glubish talking about $100 billion of projects. Requests flooded in: 29 projects for more than 16 GW by June 2025, roughly 19.6 GW by 2026 against an all-time peak of 12.8 GW. AESO's answer was a 1,200 MW interim allocation through 2028, fully taken by two projects (Meta's 970 MW and Keephills 230 MW), and then a permanent "tethering" rule: the Data Centre Regulation (June 2026) prioritises projects paired with new dedicated generation or storage, allows a bridging period of up to three years, requires data centres to be curtailed first in emergencies, and the BYOG process opens 1,600 MW of bridging capacity in intakes roughly every nine months against a $15,000 per MW commitment. Alberta's four public commitments (no subsidies, grid first, water protected under the Water Act with new licences junior to existing ones, and a levy of up to 2 per cent on computing equipment) are meant to answer the affordability backlash seen in US states. Meta's $13 billion Sturgeon County campus, powered by a 932 MW gas plant built by Pembina, Morgan Stanley Infrastructure Partners and Kineticor, is the template; the province claims Meta's transmission fees could cut the transmission share of household bills by up to 6 per cent. The cost is carbon (about 150 million cubic feet of gas per day) and local friction: Rocky View County approved Beacon's 900-acre hub in 2025, rejected two other projects, and imposed a moratorium in July 2026.

Ontario is the clearest case of a province taking discretion away from its regulators. Bill 40 (December 2025) added an economic-growth mandate to the Independent Electricity System Operator (IESO) and the Ontario Energy Board (OEB) and created section 28.1 of the Electricity Act, under which large loads cannot connect without meeting prescribed requirements approved by the Minister. The August 2026 Data Centre Playbook fills that in: a System Impact Assessment (feasibility and full cost recovery, including on-site generation) and a Strategic Priority Assessment on three pillars (economic development, data security and digital sovereignty, community investment and environment). Ontario will "compete on value, not incentives", offering only non-financial help such as permitting facilitation, and proposes a separate rate class that keeps new data centres out of the Industrial Conservation Initiative. The scale of the queue, potentially more than 10,000 MW against a 25,000 MW peak, is why. Municipalities are moving faster than the province: Mississauga and Oakville paused approvals in July and August 2026.

Quebec's turn is the most striking because it once marketed cheap hydro to the industry. Since 2023 any project above 5 MW needs the Minister of Economy, Innovation and Energy's approval; Bill 69 (June 2025) made allocation comparative, judged on benefits per megawatt, and required an integrated resource plan (the PGIRE 2026-2050, launched June 2026). Hydro-Québec's Action Plan 2035 calls for 8,000 to 9,000 MW of new capacity and $155 to 185 billion of investment, so every megawatt to a data centre competes with electrification. The proposed Rate CD (about 13 cents per kWh, roughly double the large-power rate) and a 19.5-cent crypto rate go to Régie hearings in October 2026, and operators are already litigating the ramp-up underperformance charge. Yet Microsoft, Google, Vantage, QScale and OVHcloud keep building around Quebec City, Lévis and Beauharnois: the province is pricing, not closing the door.

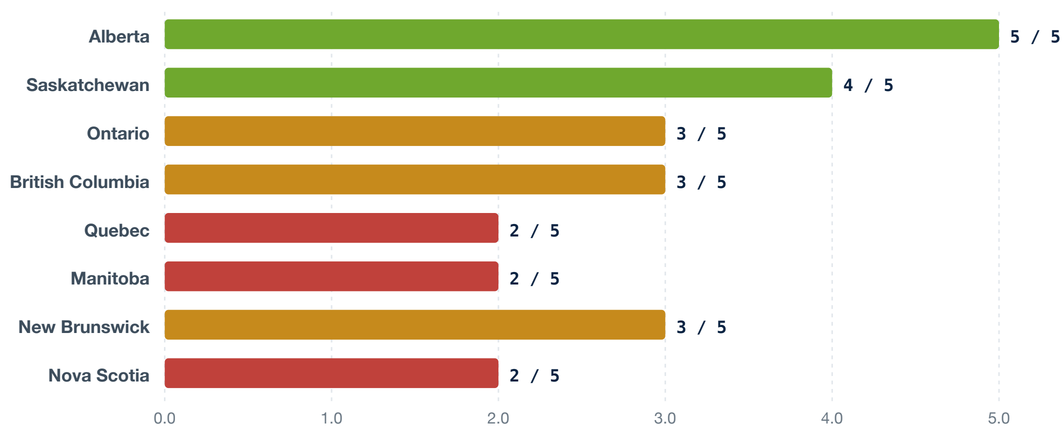
British Columbia sits between Alberta and Quebec. Faced with limited firm supply, it legislated an exit from first-come, first-served (Bill 31) and capped new data centre load at 400 MW for two years, allocated by a competitive Call for Demand that scores price, cost-effectiveness to BC Hydro, economic and community benefit, data sovereignty, First Nations benefit and environmental performance. Fifteen applications for about 800 MW compete for that tranche, with results due by the end of September 2026. In parallel, Bill 14 streamlines permitting for nine wind projects and the North Coast Transmission Line, and the 2025 Call for Power added more than 3,000 MW of wind and solar, so the constraint is timing rather than intent. Premier Eby's government pairs this with a "Look West" pitch for sovereign AI, visible in the TELUS cluster and Bell's six planned BC AI facilities.

The smaller provinces show the same pattern in miniature. Saskatchewan let SaskPower build 300 MW for Bell (partly by extending coal, which the opposition disputes) and then closed that door: from August 2026 new projects must be Canadian-owned and self-powered. Manitoba requires ministerial priority designation above 5 MW, levies data centres, and rejected a 100 MW hyperscale project on farmland. New Brunswick refused a moratorium but promised limits on a 390 MW gas-backed proposal at Saint John. Nova Scotia is not pursuing projects; Newfoundland and Labrador is absorbed by Churchill Falls; Yukon has nothing to offer a large load.

Two cross-cutting threads matter for students. First, Indigenous participation has become a formal screening criterion federally, in BC and in Alberta's strategy, backed by the $10 billion federal loan guarantee program, and the leading projects (Bell with George Gordon First Nation, Woodland Cree's majority-owned 650 MW plan, Prophet River's letter of intent) show equity or land partnerships as a path to social licence. Second, the binding constraint everywhere is firm electricity and who pays for it, which is why the policy vocabulary has converged on "full cost", "bring your own power", "curtailable" and "community benefit". Governments want the data centres; they no longer want to pay for the power.

FIGURE 7.1

How welcoming is each province? (5 is most welcoming)



Scores assigned in the policy research, with the reasoning recorded for each province. Note that the most welcoming province is also the one with the least clean grid, and the cleanest provinces are the most restrictive.

Source: Policy scorecard, this chapter.

FIGURE 7.2

The most welcoming province, making its own case. Five weeks after the Meta deal, the Government of Alberta published a video answering the six questions it was hearing most often, in which Premier Smith frames a data centre as a **digital refinery** turning natural gas into electricity, then compute, then intelligence, and argues that the projects are privately funded so a failure costs investors rather than taxpayers. It is the clearest statement of the Alberta thesis anyone has offered, and it is a government persuasion document. Read it as both. The useful question is which of the objections in the next chapter it does not address. In this file the still is a link; on screen it plays.

Source: Premier Danielle Smith, "Answering Your Questions on Alberta Data Centres", 1 August 2026.

`youtube.com/watch?v=qI-h2Zk-zEM`

Policy scorecard

Federal (Canada)

ATTITUDE
Pro-growth on sovereignty grounds; convenor more than funder

KEY INSTRUMENTS
$2B Sovereign AI Compute Strategy; $925.6M (Budget 2025) for public sovereign compute; SCIP $890M build layer; >100 MW call with MOUs; CIB $5B digital target and $45B envelope; Bill C-5 and Major Projects Office; Productivity Super-Deduction; Clean Electricity ITC; AI for All strategy

BINDING CONSTRAINT
Provincial control of electricity; small budgets relative to $80-110B capital need (BCG)

KEY DECISION-MAKER
PM Mark Carney; Minister Evan Solomon (AI and Digital Innovation); CIB

LATEST CHANGE (DATE)
AI for All strategy released 4 June 2026; SCIP applications closed 1 June 2026; TELUS MOU 11 May 2026

SOURCE
Canada.ca; ISED; HICC

Alberta

ATTITUDE
Most welcoming; "bring your own power", no subsidies

KEY INSTRUMENTS
AI Data Centre Strategy (Dec 2024); concierge program; AESO 1,200 MW interim cap (June 2025); Bill 8 (Dec 2025); Data Centre Regulation AR 117/2026 (June 2026); BYOG intakes (1,600 MW bridging, $15,000/MW); up to 2% equipment levy; Expedited 120-Day Approvals Act, 2026

BINDING CONSTRAINT
Grid: ~19.6 GW requested vs 12.8 GW peak; water licences junior to existing holders; AUC approval of on-site gas plants

KEY DECISION-MAKER
Minister Nate Glubish; Utilities Minister; AESO; Alberta Utilities Commission

LATEST CHANGE (DATE)
Meta $13B Sturgeon County (8 July 2026); AR 117/2026 in force June 2026

SOURCE
alberta.ca; AESO; Osler

Ontario

ATTITUDE
Selective; welcoming only with full cost recovery and community benefits

KEY INSTRUMENTS
Bill 40 (11 Dec 2025) s.28.1 connection approvals; Data Centre Playbook (13 Aug 2026); separate rate class and ICI exclusion; IESO Major Projects Identification Committee

BINDING CONSTRAINT
Ministerial approval; >10,000 MW of proposals vs ~25,000 MW peak; 3-5 year connection timelines

KEY DECISION-MAKER
Minister Stephen Lecce (Energy and Mines); IESO; OEB

LATEST CHANGE (DATE)
Playbook posted 13 Aug 2026, comments to 12 Sept 2026

SOURCE
ERO 026-0853; Torys

Quebec

ATTITUDE
Tightening; "economic value per megawatt"

KEY INSTRUMENTS
5 MW ministerial authorisation; Bill 69 (June 2025) comparative allocation; Rate CD ~13 c/kWh proposed (Feb 2026); ramp-up underperformance charge; PGIRE 2026-2050

BINDING CONSTRAINT
Scarce firm capacity; 8,000-9,000 MW of new supply needed by 2035 (Action Plan 2035)

KEY DECISION-MAKER
Premier Christine Fréchette; MEIE Minister Jean Boulet; Hydro-Québec; Régie de l'énergie

LATEST CHANGE (DATE)
Régie hearing on Rate CD scheduled 1-9 Oct 2026; PGIRE launched 30 June 2026

SOURCE
Hydro-Québec; BLG; McCord

British Columbia

ATTITUDE
Selective; competitive allocation favouring sovereign, clean, First Nations-linked projects

KEY INSTRUMENTS
Bill 31 (27 Nov 2025); B.C. Reg. 8/2026 400 MW cap; 2026 Call for Demand ($25,000/MW security); Bill 14 streamlined permitting for wind and North Coast Transmission Line

BINDING CONSTRAINT
400 MW over two years vs ~800 MW requested; new supply from 2025 Call for Power (>3,000 MW) still years away

KEY DECISION-MAKER
Premier David Eby; Minister Adrian Dix (Energy); BC Hydro

LATEST CHANGE (DATE)
Winners of Call for Demand due end Sept 2026; FortisBC area excluded (July 2026)

SOURCE
bclaws; BC Hydro; CBC

Saskatchewan

ATTITUDE
Welcoming with strict conditions (Canadian-owned, self-powered)

KEY INSTRUMENTS
Data Centre Framework (27 Aug 2026): six principles, central intake; SaskPower 300 MW build for Bell; coal life extension as bridge

BINDING CONSTRAINT
SaskPower capacity; no deregulated market for private PPAs

KEY DECISION-MAKER
Minister Jeremy Harrison (Crown Investments Corporation); SaskPower

LATEST CHANGE (DATE)
Framework released 27 Aug 2026; >30 applications pending

SOURCE
BNN Bloomberg; Global News

Manitoba

ATTITUDE
Cautious; case-by-case, small projects only

KEY INSTRUMENTS
M.R. 68/2025 ministerial priority designation for >5 MW; Bill 39 levy; Bill 20 curtailment (crypto); crypto connection ban

BINDING CONSTRAINT
Hydro surplus uncertain; farmland and environmental review

KEY DECISION-MAKER
Premier Wab Kinew; Finance Minister; Manitoba Hydro

LATEST CHANGE (DATE)
100 MW Jet.AI/Consensus Core project rejected June 2026

SOURCE
McCord; Capital Hill Group

New Brunswick

ATTITUDE
Managing; no ban but limits signalled

KEY INSTRUMENTS
Case-by-case; NB Power review action plan (May 2026)

BINDING CONSTRAINT
NB Power capacity and rates; 390 MW Lorneville proposal equals >10% of provincial demand

KEY DECISION-MAKER
Premier Susan Holt; NB Power

LATEST CHANGE (DATE)
Ban ruled out 13 July 2026; Miramichi council paused zoning July 2026

SOURCE
McCord NB

Nova Scotia

ATTITUDE
Not pursuing

KEY INSTRUMENTS
None; IRP base case assumes no large new loads

BINDING CONSTRAINT
Grid peak 2,459 MW (25 Jan 2026)

KEY DECISION-MAKER
Premier Tim Houston; Nova Scotia Power

LATEST CHANGE (DATE)
Premier statement June 2026

SOURCE
McCord NS

Newfoundland and Labrador

ATTITUDE
No data centre policy; focused on Churchill Falls and Gull Island

KEY INSTRUMENTS
Churchill Falls MOU (12 Dec 2024), revised agreement Aug 2026

BINDING CONSTRAINT
Transmission and firm supply

KEY DECISION-MAKER
Premier and NL Hydro

LATEST CHANGE (DATE)
Revised Churchill Falls agreement announced 17 Aug 2026

SOURCE
Wikipedia; Capital Hill Group

Yukon and territories

ATTITUDE No capacity to offer	KEY INSTRUMENTS 20-25 year PPAs for any large load
BINDING CONSTRAINT Small isolated grids	KEY DECISION-MAKER Yukon Energy
LATEST CHANGE (DATE) No projects (Jan 2025 status)	SOURCE McCord YT

Municipal (examples)

ATTITUDE Split: Sturgeon County and RM of Sherwood approve; Rocky View, Mississauga, Oakville, Miramichi pause	KEY INSTRUMENTS Land-use bylaws, interim control bylaws, moratoria, development permits
BINDING CONSTRAINT Water, noise, farmland, tax base	KEY DECISION-MAKER Councils and reeves
LATEST CHANGE (DATE) Rocky View moratorium 28 July 2026; Oakville ICBL 11 Aug 2026	SOURCE Global News; McCord ON

Timeline

- 16 April 2024: Budget 2024 commits about $2.4 billion to AI including $2 billion for compute (Gowling WLG primer, 13 February 2026; OECD.AI).
- December 2024: Canadian Sovereign AI Compute Strategy launched; Clean Electricity Regulations finalized (Canada.ca).
- 3 December 2024: Alberta publishes "Powering the Future of Artificial Intelligence", its AI Data Centre Strategy; Minister Glubish sets a $100 billion five-year ambition (open.alberta.ca; CBC).
- 28 April 2025: Federal election; Liberal minority under Mark Carney (Wikipedia).
- 13 May 2025: Evan Solomon appointed Canada's first Minister of Artificial Intelligence and Digital Innovation (Wikipedia).
- 27 May 2025: Speech from the Throne pledges to make Canada "the world's leading energy superpower in both clean and conventional energy" and a two-year federal approval timeline (Canada.ca).
- 29 May 2025: BC Bill 14, Renewable Energy Projects (Streamlined Permitting) Act, receives Royal Assent (bclaws, SBC 2025 c.12).
- 4 June 2025: AESO announces the 1,200 MW interim large-load limit through 2028; 29 projects sought more than 16 GW; the 1,200 MW was fully allocated by October 2025 to GLDC Load (970 MW, Meta) and Keephills Phase I (230 MW) (AESO; CBC).
- June 2025: Quebec adopts Bill 69 on responsible governance of energy resources (BLG).
- 26 June 2025: Bill C-5 (One Canadian Economy Act, including the Building Canada Act) receives Royal Assent (Davies).
- 29 August 2025: Major Projects Office opens in Calgary under CEO Dawn Farrell (Wikipedia).
- 1 to 31 October 2025: National AI strategy consultation, 11,300 respondents, 32-member Task Force (ISED).
- 4 November 2025: Budget 2025: $925.6 million for sovereign public AI infrastructure, CIB enabled for AI, Productivity Super-Deduction, Indigenous loan guarantees doubled to $10 billion (Budget 2025).

- 27 November 2025: BC Bill 31 Royal Assent; Canada-Alberta MOU signed (BLG; Wikipedia).
- 11 December 2025: Ontario Bill 40 (introduced 3 June 2025) and Alberta Bill 8 receive Royal Assent (OLA; McCord AB).
- 15 January to 15 February 2026: Federal call for proposals for sovereign AI data centres above 100 MW (ISED).
- 30 January 2026: BC Reg. 8/2026 caps data centre capacity at 400 MW for two years; competitive process launched (bclaws; BC Government).
- February 2026: CIB Statement of Priorities: at least $5 billion for AI data centres and digital infrastructure (HICC).
- 19 February 2026: Hydro-Québec proposes Rate CD (about 13 cents per kWh) for data centres above 5 MW (Hydro-Québec).
- 16 March 2026: Bell announces its $1.7 billion, 300 MW Regina-area AI data centre with George Gordon First Nation (paNOW; BNN Bloomberg).
- 15 April 2026: SCIP call for applications opens ($890 million build layer); closes 1 June 2026 (Canada.ca; ISED).
- 28 April 2026: Spring Economic Update publishes the six AI strategy pillars, including sovereign compute at scale (Finance Canada; CBC).
- 11 May 2026: Canada-TELUS MOU for a BC sovereign AI cluster, 85 MW to 150 MW (Canada.ca; CBC).
- 4 June 2026: "AI for All" national AI strategy released (Canada.ca).
- 9 June 2026: Alberta files Data Centre Regulation AR 117/2026; AESO BYOG process published 26 June (Osler; McCord AB).
- June 2026: Manitoba rejects the 100 MW Jet.AI/Consensus Core project; New Brunswick legislature declines a moratorium (17 June) (McCord).
- 8 July 2026: Meta's $13 billion Sturgeon County campus announced (alberta.ca).
- 28 to 29 July 2026: Rocky View County moratorium; Ontario's Lecce says data centres pay 100 per cent of costs; Mississauga pauses approvals (Global News; National Observer; McCord ON).
- 11 to 13 August 2026: Oakville passes an interim control bylaw on data centres; Ontario posts the Data Centre Playbook, comments to 12 September 2026 (McCord ON; ERO 026-0853).
- 27 August 2026: Saskatchewan releases its Data Centre Framework (BNN Bloomberg).

Contested or uncertain items

- Sovereign compute targets: the figures of 850 MW by 2030 and 2.3 GW appear in RBC Thought Leadership (10 June 2026) and Code To Cloud's summary of AI for All, but the ISED strategy page and the Canada.ca release accessed on 2 September 2026 contain no megawatt target. Treat as reported, not confirmed.
- The "$15 billion loan and investment program" mentioned in Gowling WLG's 2026 financing primer could not be matched to a Budget 2025 line item in this research; verify before citing.
- Whether the commercial $700 million stream (the AI Compute Challenge) still exists as a data centre subsidy: Baker McKenzie describes AI for All as a $700 million expansion of compute access for small and medium-sized enterprises, and ISED told BetaKit the $2 billion envelope will not fund the >100 MW call. The stream appears to have been repositioned; confirm with ISED.

- Federal selections under the >100 MW call: only TELUS has been announced publicly (11 May 2026). Other MOUs may exist but were not found.
- Quebec's Rate LG start date: McCord's Quebec page says the Rate L to Rate LG change took effect 1 April 2026 while the same tracker's dispatch lists April 2025. Check the Régie decision.
- Manitoba's Bill 39 levy: described as equal to 100 per cent of standard monthly energy and demand charges (McCord) and as a levy on total monthly charges (Capital Hill Group); read SM 2026 c.32 directly.
- BC's split of the 400 MW: bclaws (B.C. Reg. 8/2026) and BLG say 100 MW conventional plus 300 MW AI; McCord's dispatch reverses the numbers. The regulation text governs.
- Alberta's request totals: alberta.ca cites about 19,565 MW while McCord cites about 20 GW; both are mid-2026 and consistent in magnitude. The date of the Meta announcement is 8 July 2026 on alberta.ca; EnergyNow's feature says July 2025, which appears to be an error.
- Sovereign cloud procurement rules for the federal government (Shared Services Canada) and any 2026 amendments to the Clean Electricity Regulations were not located within this session's search budget; both are gaps rather than findings.
- Statements by Premier Eby specifically on AI data centres were not located; the BC positions cited are from Minister Dix and Minister Kahlon.

Open questions students could investigate

1. If Ottawa wants 100 MW-plus sovereign data centres but will not fund them, what mix of CIB debt, anchor-tenant procurement and provincial power allocation would make one bankable, and at what cost of capital?
2. Does Alberta's "bring your own gas plant" model survive the Clean Electricity Regulations after 2035, and what is the carbon price exposure under TIER for a 932 MW plant?
3. Is Ontario's ministerial approval regime (Bill 40 and the Playbook) more or less investable than IESO's old first-come queue? Model the risk premium a developer would demand.
4. At 13 cents per kWh, does Quebec still beat Virginia, Ohio or Texas for AI training workloads once cooling, latency and sovereignty are priced in?
5. How should BC Hydro score "data sovereignty" and "First Nations benefit" against price without inviting legal challenge, and what happens to the 400 MW losers?
6. What does a fair Indigenous equity structure look like for a data centre (land lease, minority equity, procurement, heat offtake), using George Gordon, Woodland Cree and Prophet River as cases?
7. Are municipal moratoria (Rocky View, Mississauga, Oakville) a temporary rulemaking pause or the start of durable resistance, and what community benefit package would change the outcome?
8. How much of Canada's data centre demand is domestic versus export (BCG: 1.3 GW domestic need by 2030 versus up to 6.7 GW export), and should provinces allocate scarce power differently for each?
9. Does the CLOUD Act make "sovereignty" achievable only with Canadian-owned operators, or is Canadian-located infrastructure with US software enough for most public-sector workloads?
10. Which province will announce the next 1 GW-plus project, and what does that reveal about where the binding constraint has actually moved: power, water, land or politics?

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08

CHAPTER 8

The ledger: who gains, who pays, and who has already said no

A data centre is a very large capital investment that creates very few permanent jobs, pays substantial tax, consumes a great deal of electricity and sometimes water, and lands in somebody's neighbourhood. Every disagreement in this file is about how to weigh those four facts against each other.

~30 jobs per 100 MW

Permanent employment once a campus is running. The construction crews are ten to a hundred times larger, and they leave.

WHAT THIS CHAPTER ANSWERS

- ? What does a project actually deliver to the community that hosts it?
- ? Who pays for the grid, and does anyone else's power bill rise?
- ? How much carbon and water, and how much does the province change that?
- ? Where have Canadians said no, and what did they object to?

KEY TAKEAWAYS

Narrative

The economics of an AI data centre are unusual. A hyperscale campus is a capital project of oil-sands scale that behaves, once built, like a very large and very quiet electricity customer. Meta's Sturgeon County project illustrates the shape: $13 billion of investment, 1,750 acres, a 932 MW gas plant next door, more than 3,000 construction workers at peak, and then about 300 permanent staff, with 30 more at the power plant. Virginia's independent legislative audit found the same pattern at a mature scale: the industry supports 74,000 jobs and USD 9.1 billion of GDP a year, but most of it comes from construction, and a typical building runs with about 50 people, half of them contractors. Brookings' county-level work confirms that a first large data centre lifts local data-processing employment by 56 per cent over a decade but produces only 100 to 200 jobs and no measurable wage gain. Industry-commissioned multipliers (PwC's 4.5 indirect jobs per direct job) are much larger because they count the whole supply chain nationally, which is a different question from what a host community gets. The "few permanent jobs" critique is therefore accurate, and 57 per cent of Canadians already believe it. The honest case for a data centre is not jobs per megawatt; it is capital, tax base, and strategic compute.

The tax base is real but shaped by policy. Alberta expects about $250 million a year from the Meta project across royalties on roughly 150 million cubic feet of gas a day, a levy, property taxes and transmission fees, and Sturgeon County expects around $40 million a year, which would make Meta one of its largest taxpayers. Two design choices limit the municipal share: computing equipment, the bulk of the capital cost, is exempt from municipal assessment, and the province's new 2 per cent levy on that equipment is fully offset against corporate income tax, so it raises nothing from a profitable operator. Quebec has gone the other way, proposing a 13 cents per kWh rate that roughly doubles what data centres pay, on the logic that the province's surplus of near-zero-carbon power (1.7 grams of CO_2 per kWh) is scarce and valuable. Hydro-Québec's own results show why: nine-month 2025 net income of $2.8 billion leaned heavily on $1.4 billion of external-market sales, and a captive industrial customer paying double the large-power rate is more attractive than volatile exports.

Electricity rates are where the argument is decided. The US evidence is now hard to dismiss. PJM's independent monitor attributes 40 per cent of the USD 16.4-billion December 2025 capacity auction to data centres, and 46 per cent of USD 63.6 billion across four auctions, with capacity prices up from USD 28.92 to USD 333.44 per MW-day in three years. Virginia's audit projects USD 14 to 37 a month more for Dominion households by 2040, and Henrico County has started asking teachers to switch off lights after a 25 per cent power-cost increase. The policy response has been rate classes and collateral: Dominion's new class requires 14-year contracts and USD 1.5 million per MW; Georgia certified 9,985 MW of new plants but made Georgia Power backstop the cost through 2031 if the data centres do not show up. Alberta's framework has the same instinct (a "cost causation" rule, mandatory own generation, transmission fees that the province says will cut the transmission line item by up to 6 per cent), but a gap in timing. Meta will draw up to 970 MW from the grid for two to three years before Greenlight runs, and the Pembina Institute, using the producers' own forecasts of pool prices near $100 per MWh, estimates $267 to $462 a year of extra cost per household in 2027 to 2031, dwarfing the transmission saving of under $20. The provincial government calls this fearmongering; the AESO acknowledges pool prices will rise while transmission costs fall. Students should treat the direction as contested and the mechanism as settled: bridging load on a tight grid raises prices until new supply arrives.

Environmentally, the province is the decision. Alberta's grid delivered 540 grams of CO_2 per kWh in 2023 to 2024 and Saskatchewan's 730, while Quebec, Manitoba, British Columbia and Ontario sit between 1.7 and 30. A 1 GW campus at 90 per cent utilization uses about 7.9 TWh a year, which on dedicated combined-cycle gas is roughly 3 Mt of CO_2, the figure Pembina attaches to Meta and about a tenth of Alberta's entire electricity sector. Blake Shaffer's estimate that 6.5 GW of gas-fed data centres would double Alberta's electricity emissions, and RBC's 16 Mt for 6 GW, point the same way. On Quebec hydro the same load would emit about 10,000 tonnes. Two policy moves lock in the high-carbon path: the November 2025 Canada-Alberta MOU suspended the Clean

Electricity Regulations, and the AESO's draft bring-your-own-generation rule treats only thermal plants as acceptable, which makes hybrid wind, solar and battery supply uneconomic even though TD Economics finds turbine backlogs of over five years and battery costs down 27 per cent in a year. Meta's promise to "match" its use with renewable certificates does not change the physical electrons.

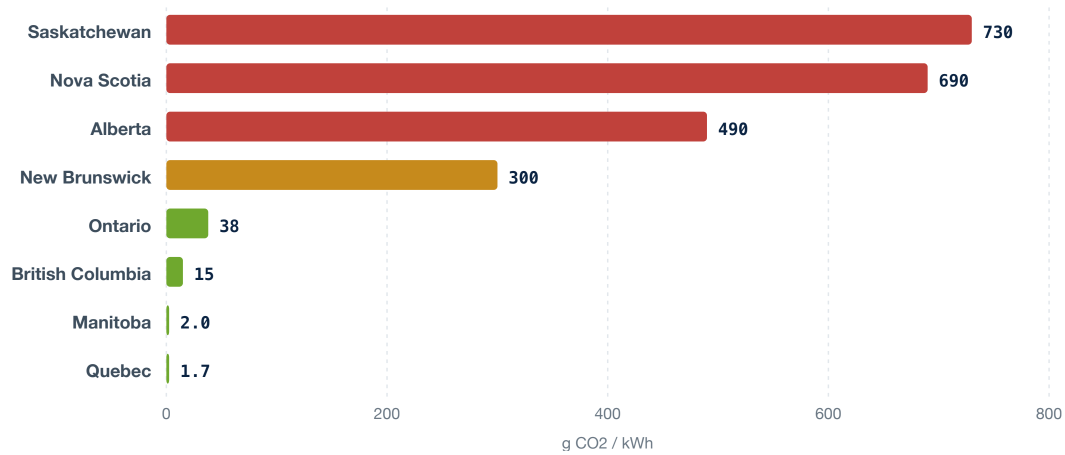
Water is the most emotional issue and the most fixable. Modern closed-loop dry cooling can eliminate operational cooling water, as Meta claims for Sturgeon and Lancaster's agreement enforces, and hyperscaler water usage effectiveness has fallen to 0.19 to 0.27 litres per kWh. The IEA's caution is that more than 60 per cent of a hyperscale site's water footprint is indirect, in thermal power generation and chip manufacturing; a gas-powered campus in Alberta moves water use from the server hall to the power plant. Land, noise and diesel backup are what neighbours actually experience, and the Olds decision, where the regulator rejected a 1.4 GW gas plant with 1.8 GW of diesel backup as too close to homes after about 1,500 people registered as intervenors, shows that siting can fail even in a pro-development province.

Social licence follows from all of the above. Polling is consistent across Abacus, Nanos, Leger and Angus Reid: Canadians are split on data centres nationally, opposed to subsidies (64 per cent), opposed to a site near home (68 per cent), and near-unanimous (81 to 82 per cent) that operators should pay their full costs and face strict regulation. Municipal politics has caught up: Rocky View County's 6 to 1 rejection and later moratorium, Oakville and Mississauga's one-year freezes, Hamilton's near-miss, Manitoba's cancelled rural project and three Vancouver marches all happened within twelve months. The complaints are less about AI than about process: NDAs signed by a Hamilton city-owned corporation and by the Town of Olds, two-week comment periods, and land-use notices that described a 26 MW AI facility as "bulk data storage". The models that seem to earn consent share three features: the developer pays full grid costs, benefits are written into enforceable agreements (Lancaster's USD 20.25 million and water cap; Meta's $60 million for local roads and water), and ownership is shared, as in Woodland Cree First Nation's majority-owned project or British Columbia's call that scores First Nations and community benefits. Ireland, where data centres now take 23 per cent of metered electricity and new connections must bring 80 per cent new renewables, and the Netherlands, which lost Meta's Zeewolde campus and then confined hyperscale sites to two locations, show what happens when governments regulate after the backlash rather than before it.

Finally, demand uncertainty cuts both ways. Alberta's 20.7 GW of requests exceed its entire peak load; PJM's monitor says USD 6.2 billion of one auction paid for data centres that do not yet exist; USD 64 billion of US projects were blocked or delayed by local opposition in a year; and Wonder Valley, once promised for 2027, now hopes to start construction in late 2028 with no tenant. A province that builds gas plants, pipelines and transmission for speculative load can strand them if AI demand disappoints, and a province that refuses to plan can lose the investment to Texas or Quebec. The management question for this session is which contracts, tariffs and ownership structures let Canada capture the capital and the compute without exporting the costs to households, farmland and the climate.

FIGURE 8.1

Grid carbon intensity by province (grams CO2 per kWh)

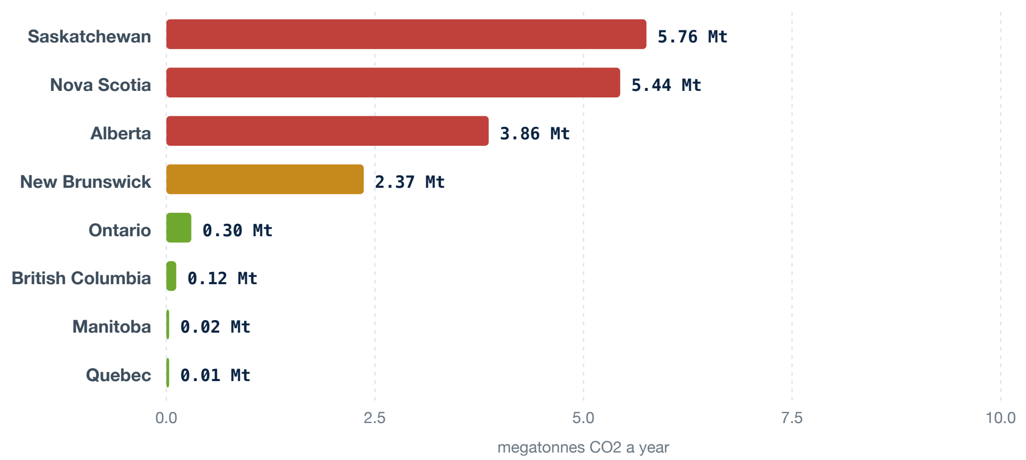


The spread between the top and the bottom of this chart is a factor of nearly three hundred.

Source: Environment and Climate Change Canada, output-based pricing standards; Canada Energy Regulator.

FIGURE 8.2

Emissions from one gigawatt of data centre, running a year



The same machine, in two provinces, is two entirely different climate policies. Alberta's answer is that new campuses must bring their own generation, which is why the Meta project arrives with a 932 megawatt gas plant attached.

Source: Calculated at 90 per cent average load from the intensities in Figure 8.1.

The picture in numbers

Economic metrics

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Meta Sturgeon County campus investment	13	CAD billion	2026	Alberta	Meta

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Meta construction jobs at peak / permanent jobs	3,000+ / ~300	jobs	2026	Alberta	Alberta.ca
Greenlight gas plant: capacity, cost, jobs	932 MW, $4.6B, ~1,000 construction, 30 permanent	mixed	2026	Alberta	Sturgeon County
Permanent jobs per 100 MW implied by Meta	~30	jobs per 100 MW	2026	Alberta	derived from Alberta.ca
Typical Virginia data centre staff (250,000 sq ft) / peak construction crew	~50 (half contractors) / ~1,500	workers	2024	Virginia	JLARC summary
Virginia industry: jobs, labour income, GDP	74,000 / USD 5.5B / USD 9.1B	per year	2024	Virginia	JLARC
Jobs in a typical US county after its first large data centre	100 to 200	jobs	2026	US	Brookings
Operations staffing intensity (as reported)	0.15 to 0.35	FTE per MW	2025	US	Hamm Institute
US employment multiplier (industry study)	4.5	indirect jobs per direct job	2024	US	PwC for Data Center Coalition
Subsidy cost per job in 11 US megadeals (as reported)	1.95	USD million per job	2016	US	Good Jobs First
Provincial benefit from Meta project	~250	CAD million per year	2026	Alberta	Alberta.ca
Sturgeon County property tax from Meta	~40	CAD million per year	2026	Alberta	Alberta.ca
Alberta computing-equipment levy	2 (offset against corporate tax)	per cent	2025	Alberta	RMA
Local data-centre revenue share in five mature Virginia localities	<1 to 31	per cent of local revenue	2024	Virginia	JLARC summary
PJM December 2025 auction cost / data-centre share	USD 16.4B / 40	billion / per cent	2026	PJM	Utility Dive
PJM capacity price, 2024/25 vs 2027/28	28.92 vs 333.44	USD per MW-day	2025	PJM	Utility Dive
Dominion residential impact by 2040	14 to 37	USD per month (real)	2024	Virginia	JLARC
Dominion GS-5 class: contract term / collateral	14 years / USD 1.5M per MW	mixed	2025	Virginia	Virginia Mercury
Georgia new generation certified (80% for data centres)	9,985	MW	2025	Georgia	Georgia PSC
Henrico County power-cost increase	25	per cent	2026	Virginia	Newsweek
Alberta household bill impact of Meta, 2027 to 2031	267 to 462	CAD per year	2026	Alberta	Pembina
Claimed transmission-charge reduction from Meta fees	up to 6 (under $20 a year)	per cent	2026	Alberta	Alberta.ca
Hydro-Québec proposed data-centre rate vs current	13 vs ~6.5	cents per kWh	2026	Quebec	Hydro-Québec

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Hydro-Québec nine-month net income / external-market sales	2,830 / 1,426	CAD million	2025	Quebec	Hydro-Québec Q3 bulletin
BC Hydro export revenue, first nine months (as reported)	2.05	CAD billion	2025	BC	Business in Vancouver
Gas use by Meta campus	~150	million cubic feet per day	2026	Alberta	Alberta.ca
Alberta grid requests vs peak load	20.7 vs ~12	GW	2025	Alberta	DeSmog
BC capacity offered vs requested, 2026 to 2028	400 vs ~800	MW	2026	BC	BLG
Potential Canadian capex if proposals proceed	100	CAD billion	2024	Canada	RBC
Canada active vs planned capacity (York University)	1.6 (194 sites) vs 22.2 (213 projects)	GW	2026	Canada	Canadian Press
US projects blocked or delayed by opposition	64	USD billion	2025	US	Data Center Watch

Environmental metrics

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Grid consumption intensity: AB / SK / ON / QC / MB / BC / NS / NB	540 / 730 / 30 / 1.7 / 2.0 / 15 / 690 / 300	g CO2e per kWh	2023 to 2024	prov-inces	ECCC
Projected intensity 2026: AB / ON / BC	438 / 59 / 18	g CO2e per kWh	2026	prov-inces	ECCC
Generation intensity: AB / SK / ON / QC / MB / BC / Canada	470 / 630 / 35 / 1.2 / 1.3 / 14 / 100	g CO2e per kWh	2022	prov-inces	CER profiles
Alberta electricity-sector emissions	19.4	Mt CO2e	2022	Alberta	CER Alberta
Electricity use of a 1 GW campus at 90% load	7.9	TWh per year	calc	any	this brief
Emissions of Meta campus on gas (Pembina)	~3 (about 10% of AB elec-tricity emissions)	Mt CO2 per year	2026	Alberta	Energy Mix
Load that would double Alberta electricity emissions	6,455	MW on gas	2024	Alberta	CBC (Shaffer)
6 GW of gas-powered data centres	+16 (3% of national)	Mt CO2e per year	2024	Canada	RBC
Wonder Valley (up to 9 GW) emissions	26 to 30	Mt CO2 per year	2026	Alberta	Energy Mix
US hyperscale fleet carbon intensity vs grid	545 vs 370	g CO2 per kWh	2025	US	arXiv (Harvard)
Water use, 100 MW US hyperscale site (60%+ indirect)	~2	million litres per day	2025	US	IEA
US direct / indirect data-centre water	66 / ~800	billion litres	2023	US	LBNL

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Global data-centre water consumption, 2023 to 2030	560 to 1,200	billion litres per year	2025	Global	IEA
Water usage effectiveness: industry avg / AWS / Meta / Microsoft	1.80 / 0.19 / 0.20 / 0.27	litres per kWh	2024 to 2025	Global	Dgtl Infra, Microsoft
Google water consumed / emissions	31 billion litres / 11.5 Mt (+51% vs 2019)	mixed	2024	Global	Google
Microsoft emissions change	+25	per cent year over year	FY2025	Global	Microsoft
Conventional large data centre water use (Conference Board)	~19	million litres per day	2025	Canada	VOCM
Wonder Valley preliminary water licence	24	million m3 per year	2026	Alberta	ELC
Land: Meta / Rocky View proposal / Zeewolde / Project Blue	1,750 acres / 448 ha / 166 ha / 290 acres	area	2022 to 2026	various	Meta, CBC
Noise: diesel generators / cooling towers at 400 ft	105 / 70	dB / dBA	2026	US	EESI
Diesel backup proposed at Olds	1.8	GW	2026	Alberta	Epoch Times
Generative-AI e-waste, cumulative 2020 to 2030	1.2 to 5.0	million tonnes	2024	Global	Nature Computational Science
QScale recoverable heat / households / CO2e saved	96 MW / 15,000+ / 146,576 t per year	mixed	2023	Quebec	SustainableBiz
Stockholm heat from data centres (target)	3.5 (10)	per cent of city heat	2026	Sweden	Eurelectric
US AI data-centre CO2 by 2030 (mitiga-tion potential)	24 to 44 (73%)	Mt per year	2025	US	Cornell / Nature Sustainability

Social metrics

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Support for a data centre in own community / oppose / depends	16 / 34 / 39	per cent	2026	Canada	Abacus
Say tech companies should pay full cost / want strict regulation	81 / 82	per cent	2026	Canada	Abacus
Say data centres do not create enough long-term jobs	57	per cent	2026	Canada	Benefits and Pensions Monitor (Abacus)
Oppose government incentives (Prairies fully opposed)	64 (49.9)	per cent	2026	Canada	Globe and Mail / Nanos
Worried about bills / environment; support vs oppose in own province	81 / 79; 44 vs 42	per cent	2026	Canada	Canadian Press / Leger
Oppose a large data centre within a few blocks	68	per cent	2026	Canada	CBC citing Angus Reid

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
US: oppose new data centre in neighbourhood (Gallup) / local development (Heatmap)	70 / 75	per cent	2026	US	Wikipedia summary, Energy Mix
Rocky View County vote / speakers against vs for	6 to 1 / 50+ vs 4	count	2025	Alberta	CBC
Rocky View moratorium vote	5 to 2	count	2026	Alberta	Medicine Hat News
Sturgeon County protest turnout	200+	people	2026	Alberta	Postmedia via Yahoo
Olds hearing intervenors (granted standing)	~1,500 (900+)	parties	2026	Alberta	Epoch Times
Vancouver rallies (May / June) and petition	500 to 700 / hundreds to 1,200; 15,000 to 17,000 signatures	people	2026	BC	CBC, Daily Hive
Hamilton moratorium vote	defeated 10 to 6	count	2026	Ontario	CHCH
Oakville / Mississauga moratoria	1 year each	duration	2026	Ontario	CBC, City of Mississauga
Manitoba petition against rural AI data centre	13,500+	signatures	2026	Manitoba	CBC
National day of action	14	cities	2026	Canada	National Observer
Ireland: data-centre share of metered electricity; estimated extra household cost 2015 to 2023	23; ~EUR 360	per cent; EUR	2025	Ireland	RTE / CSO
Zeewolde cancelled campus: power / land / jobs promised	200 MW / 166 ha / 400	mixed	2022	Netherlands	Silicon Republic
Lancaster CBA value / water cap	USD 20.25M / 20,000 gallons per day	mixed	2025	Pennsylvania	Columbia Climate Law
US community benefit agreements found / publicly posted	8 / 1	count	2026	US	FAS
Woodland Cree Mihta Askiy project (majority First Nation owned)	650	MW on-site gas	2025	Alberta	CBC

Impact ledger

BENEFIT (EVIDENCE; CONFIDENCE)	COST (EVIDENCE; CONFIDENCE)
Large private capital: $17.6 billion for the Meta campus plus Greenlight plant; RBC sees $100 billion nationally if proposals proceed (Alberta.ca 2026; RBC 2024). Confidence: high for announced projects, low for the $100 billion.	Few permanent jobs: ~300 per GW at Meta, 30 at a 932 MW plant, ~50 per Virginia building; 57 per cent of Canadians already think the jobs do not justify the resources (Alberta.ca 2026; JLARC 2024; Abacus 2026). Confidence: high.
Construction employment and supply chain: 3,000+ trades at peak in Sturgeon County; most Virginia construction spending stays in-state; TC Energy's Edmonton-area pipeline capacity sold out (Meta 2026; JLARC 2024; Global News 2026). Confidence: high.	Turbine and transformer bottlenecks inflate costs: gas plant capex doubled in two years, turbine backlogs over five years (TD Economics 2026; IEA 2026). Confidence: high.
Public revenue: ~$250 million a year to Alberta, ~$40 million a year to Sturgeon County; Virginia localities collect up to 31 per cent of local revenue from data centres (Alberta.ca 2026; JLARC 2024). Confidence: medium.	Revenue leakage by design: computing equipment exempt from municipal tax; 2 per cent levy fully offset against corporate income tax; US megadeals cost ~USD 1.95 million per job (Alberta Municipalities 2026; RMA 2025; Good Jobs First, as reported). Confidence: medium.

BENEFIT (EVIDENCE; CONFIDENCE)	COST (EVIDENCE; CONFIDENCE)
Premium utility revenue for surplus clean power: Hydro-Québec's 13 cents per kWh rate on ~190 MW today and ~1,000 MW by 2035; Hydro-Québec earned $1,426 million on external markets in nine months of 2025 (Hydro-Québec 2026, 2025). Confidence: high.	Higher wholesale prices during grid-bridging: $267 to $462 per Alberta household per year in 2027 to 2031; producers forecast pool prices up to $100/MWh (Pembina 2026). Confidence: medium; the province disputes it.
Spreading fixed grid costs: Meta's ~$200 million a year in transmission fees could cut the transmission line item up to 6 per cent; Georgia Power claims ~USD 102 a year for a typical customer (Alberta.ca 2026; WABE, as reported). Confidence: medium.	Cost shifting where rules lag: data centres were 40 per cent of PJM's USD 16.4-billion auction; Dominion customers face USD 14 to 37 more per month by 2040; Henrico County's power costs rose 25 per cent (Utility Dive 2026; JLARC 2024; Newsweek 2026). Confidence: high.
Heat reuse: QScale's 96 MW could heat 15,000 households and avoid 146,576 tonnes a year; Stockholm supplies 3.5 per cent of city heat from data centres (SustainableBiz 2023; Eurelectric 2026). Confidence: medium; Lévis greenhouses still ramping.	Emissions on gas: about 3 Mt CO_2 a year per GW; 6.5 GW would double Alberta's electricity emissions; US hyperscale fleet runs at 545 g/kWh (Pembina 2026; Shaffer 2024; arXiv 2026). Confidence: medium to high.
Water-light designs exist: Meta's closed-loop dry cooling claims no operational cooling water; Telus claims 90 per cent less water; Lancaster capped use at 20,000 gallons a day (Meta 2026; Telus via Vancouver Is Awesome 2026; Columbia 2026). Confidence: medium; claims are the developers'.	Indirect water and local conflict: 60 per cent of a hyperscale site's water is indirect; US indirect water ~800 billion litres; Project Blue wells up to 31 million gallons a year; Wonder Valley licence 24 million m3 (IEA 2025; LBNL 2024; KJZZ 2026; ELC 2026). Confidence: high.
Community benefit packages: Meta's $60 million for roads and water plus grants; Lancaster's USD 20.25 million CBA (Meta 2026; Columbia 2026). Confidence: high.	Opportunity cost of clean megawatts: 100 MW equals the annual use of ~350,000 EVs or 40,000 to 64,000 homes; BC could offer only 400 MW against ~800 MW requested (Climate Institute 2025; CBC citing York University 2026; BLG 2026). Confidence: medium.
Indigenous ownership: Woodland Cree's majority-owned 650 MW project; BC scores First Nations benefits in its call (CBC 2025; BLG 2026). Confidence: medium.	Stranded-asset risk: USD 6.2 billion of one PJM auction for unbuilt data centres; 20.7 GW requested against 12 GW peak in Alberta; Georgia forced a utility backstop; USD 64 billion of US projects blocked or delayed (Utility Dive 2026; DeSmog 2026; Georgia PSC 2025; Data Center Watch 2025). Confidence: medium.
Grid modernization and surplus generation: hyperscalers often build 1.5 times their need and sell surplus; Suncor's 800 MW cogeneration lowered early-2026 prices (The Hub 2026). Confidence: low to medium.	Noise, land and diesel: 105 dB generators, 70 dBA cooling towers; 448 ha of farmland at Rocky View; 1.8 GW of diesel backup at Olds (EESI 2026; CBC 2025; Epoch Times 2026). Confidence: high.
	Secrecy and trust: NDAs in Hamilton and Olds; only 1 of 8 US CBAs public; 68 per cent of Canadians oppose a nearby site (National Observer 2026; Narwhal 2026; FAS 2026; Angus Reid 2026). Confidence: high.

Contested or uncertain figures

- Direction of Alberta household bills. Pembina's $267 to $462 a year increase (2027 to 2031) rests on producer forecasts of $100/MWh pool prices; the government's up-to-6 per cent transmission saving (under $20 a year) is a line-item estimate that ignores energy prices. The AESO says both effects occur. Confidence in either single number is medium.
- Job counts. Announced figures (Meta 3,000 and 300; Wonder Valley "thousands" and "hundreds") are developer claims; Business Insider and TechRepublic reported in May 2026 that Wonder Valley's job estimates have shifted (headline only, not verified here). Hamm Institute's 0.15 to 0.35 FTE per MW and Good Jobs First's USD 1.95 million per job could not be opened directly and are cited as reported.
- Water. "No operational cooling water" (Meta) and "90 per cent less water" (Telus) are developer claims for closed-loop designs; the IEA and LBNL indirect-water figures depend on the electricity mix and are US-based. The government's "same as a golf course" comparison for Meta is unquantified.

- Demand forecasts. Alberta's 20.7 GW, Ontario's 6,500 MW and York University's 22.2 GW pipeline are requests, not commitments; PJM has said its own forecasts were overstated and is tightening vetting.
- Emissions accounting. Renewable energy certificates let a gas-fed campus report "100 per cent clean" matching; TechTimes cites peer-reviewed work finding such certificates unlikely to reduce emissions. The 1 GW = 3 Mt figure assumes combined-cycle efficiency and 90 per cent utilization; simple-cycle turbines or reciprocating engines would be higher.
- Grid intensities. ECCC consumption intensities (540 g for Alberta in 2023 to 2024) differ from CER generation intensities (470 g in 2022) and both differ from BC's own 22.8 t/GWh factor for 2025 and Hydro-Québec's 34.5 g life-cycle factor; use one basis consistently.
- Multipliers. PwC's US figures are industry-commissioned; JLARC and Brookings are independent and lower.
- Polls ask different questions: Abacus (community support), Nanos (incentives), Leger (bills), Angus Reid (within a few blocks). Do not average them.
- Heat reuse. QScale's 15,000-household figure is the design potential of 96 MW; the greenhouses were still being built in 2026. Telus's "150,000 homes" claim for Vancouver could not be verified, and no operating data-centre link to Vancouver's neighbourhood energy utility was found.
- Headline-only items not verified in this research: Upper Nicola Band's reported vote to welcome a $500-million data centre (2025), Saskatchewan's data-centre framework (August 2026), the Lorneville, New Brunswick dispute, Cumberland's moratorium (August 2026), TD Economics' March 2026 grid-constraint report, BIV's BC Hydro export figures, and Argus's 31 per cent Alberta gas-demand estimate.
- No dedicated Canadian data-centre economic impact study by Deloitte, PwC Canada, BMO, Scotiabank, the Business Council of Alberta or Calgary Economic Development was located; the Conference Board's October 2025 "AI on the Horizon" was seen only through a news summary.

Open questions students could investigate

1. Build a household-bill model for Alberta that combines Pembina's pool-price scenario with the province's transmission-fee argument: at what pool price does the 6 per cent saving break even, and how does the answer change if Meta's grid draw is 500 MW rather than 970 MW?
2. Compare the net present value to a province of 1 GW of clean power sold to a data centre at 13 cents per kWh (Quebec's proposal) versus exporting it or reserving it for industrial electrification and heat pumps; what social discount rate flips the answer?
3. Using ECCC intensities, estimate the carbon cost (at Alberta's $130 per tonne industrial price path) of siting a 1 GW campus in Alberta versus Quebec or Manitoba, and ask whether that gap explains why 92 per cent of planned Canadian capacity is still in Alberta.
4. Design a Canadian data-centre rate class: which elements of Dominion's GS-5 (14-year terms, 85 per cent minimum charges, USD 1.5 million per MW collateral) and Georgia's backstop would survive in a deregulated Alberta market versus a Crown utility?
5. Audit a community benefits agreement: what would a Lancaster-style contract (water cap, noise tied to ambient, clean-energy penalties, public records) cost Meta in Sturgeon County, and who should enforce it?
6. Test the "few jobs" critique against the tax base: at $40 million a year in property tax for 300 jobs, what is the fiscal value per job, and how does it compare with a petrochemical plant or a car assembly line in the same county?

7. Map the water footprint of a gas-fed versus hydro-fed campus using IEA's indirect shares; does dry cooling matter more or less than the power source?
8. Evaluate Indigenous equity models (Woodland Cree's majority ownership, BC's First Nations benefits criterion, Alberta Indigenous Opportunities Corporation loan guarantees) for a hypothetical 300 MW project: what revenue share and what governance rights would make a community say yes?
9. Stress-test stranded-asset exposure: if only 6 of Alberta's 30 proposed projects are built, which assets (pipelines, transmission, gas plants, municipal servicing) are stranded, and who holds the risk under current rules?
10. Examine the politics of process: compare the consultation records of Rocky View (rejected), Hamilton (reversed) and Sturgeon County (approved but protested) to identify which procedural choices changed the outcome.

Sources

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09

PART IV · THE STRATEGIC FRAME

The border: tariffs, sovereignty, and the value of not being American

Since January 2025 the Canada United States relationship has been rewritten. For data centres the effect is genuinely two sided: equipment is dearer and the trade rules less certain, while demand for compute that sits outside American jurisdiction has never been higher.

81% Share of all American electricity imports that come from Canada. Energy is the one lever in this relationship that points north.

WHAT THIS CHAPTER ANSWERS

- ? What do the tariffs actually do to the cost of building a campus in Canada?
- ? Does the sovereignty argument have a real customer, or is it rhetoric?
- ? Should Canada export electricity, or export the intelligence that electricity powers?
- ? What is the risk that the United States restricts Canadian-hosted compute?

KEY TAKEAWAYS

- The trade war has moved through three legal phases. Phase one (March 4, 2025 to February 24, 2026) used IEEPA: 25 percent on Canadian goods and 10 percent on energy, raised to 35 percent on non-CUSMA goods on August 1, 2025, but CUSMA-compliant goods (about 95 percent of exports, per Minister LeBlanc) were exempt from March 7, 2025. Phase two (February 24 to July 24, 2026) used a 10 percent Section 122 surcharge after the Supreme Court struck down the IEEPA tariffs on February 20, 2026, again exempting CUSMA goods and energy. Phase three (from August 22, 2026) uses Section 338: 50 percent on roughly $28 billion (US$20 billion) of Canadian goods, about 5 percent of exports, with no CUSMA exemption. [1][2][5][6][7][8][23]

- Sectoral Section 232 tariffs never went away: steel and aluminum 50 percent since June 4, 2025; autos 25 percent since April 3, 2025; copper 50 percent since August 1, 2025; softwood lumber an extra 10 percent since October 14, 2025; a narrow 25 percent semiconductor tariff since January 15, 2026; and, since April 6, 2026, duties on the full value of metal derivatives such as transformers, switchgear and racks (25 percent, with a temporary 15 percent band for large power equipment to December 31, 2027). None of these carve out Canada. [1][10][18][45]
- The August 2026 breakdown was about autos, trucks and sovereignty, not fentanyl. The rejected interim deal would have cut US auto tariffs to 15 percent (Canada wanted 10) and metals to 25 percent, but excluded medium and heavy trucks, constrained Canada's future trade deals and touched language and culture policy. Trump paused the 50 percent tariffs for three days on August 18, declared a deal, then Canada walked away on August 21. On August 24 Trump promised 50 percent on Canadian cars, trucks, parts and steel from January 1, 2027. Canada matches "dollar for dollar, rate for rate" from September 8, 2026 on $27.6 billion of US goods (15, 25 and 50 percent) with a $7.5 billion support package. [2][3][23][24][25][46]
- CUSMA is alive but unrenewed. On July 1, 2026 the US declined to confirm a 16-year extension; the deal now runs on annual reviews to July 1, 2036. USTR Greer wants interim arrangements by the end of 2026 and structural changes (50 percent US parts content, Chinese-input rules, dairy, alcohol, security linkage) in 2027. Chapter 19 still bans data-localisation mandates (Article 19.12) and restrictions on cross-border data flows (Article 19.11), which sits awkwardly with sovereign-cloud ambitions; US negotiators also pushed "digital trade alignment" in August 2026. [19][21][22][48][52]
- Energy is the asymmetry. In 2025 Canada sent $157.5 billion of crude, refined products, gas and natural gas liquids to the US (20.2 percent of all goods exports), supplied 63.4 percent of US crude imports, nearly 100 percent of gas imports and 81.3 percent of electricity imports (32.7 TWh, $3.3 billion). Ontario's 25 percent electricity surcharge lasted one day (March 10 to 11, 2025) before Trump's 50 percent steel threat forced its withdrawal; in August 2026 Ontario and Quebec again floated electricity leverage while Alberta, Saskatchewan and the Prime Minister rejected energy export taxes. [24][33][34][48][53]
- Ottawa is trying to do both: export electrons and host intelligence. The August 17, 2026 Churchill Falls and Gull Island agreement (2026 net present value $49 billion; 985 MW of guaranteed export access to New York and New England) sits beside a plan to double grid capacity by 2050, while the federal sovereign compute program ($2 billion, plus the Enabling Large-Scale Sovereign AI Data Centres call of January to February 2026) backs TELUS (60,000 GPUs, 150 MW by 2032 in BC), Bell and Cohere (US$220 million, 2,304 Grace Blackwell GPUs in BC) and CoreWeave-Cohere in Ontario. [29][30][32][37]
- US hyperscalers kept investing through the tension, but mostly with gas: Meta's $13 billion, 1 GW Sturgeon County, Alberta campus (announced July 8, 2026; powered by a 932 to 970 MW gas plant and a 250 MW Capital Power contract) is the largest, and Anthropic is hiring to bring "gigawatts of compute online in Canada" (August 20, 2026). We found no comparable new Canadian commitments from Amazon, Microsoft or Google in 2025 or 2026. [38][39]
- The US is competing hard for the same capital and chips: the July 23, 2025 AI Action Plan and Executive Orders 14318 and 14320 fast-track 100 MW-plus data centres, open federal land (Piketon 10 GW, Paducah US$100 billion) and export "full-stack" American AI to allies. Yet US grid politics now bite: Texas froze new data-centre grid connections on September 1, 2026 with a 474 GW request queue, and Executive Order 14420 (August 26, 2026) tightens foreign grid-equipment supply. [14][15][16][17][19][49][50]
- Chips are not the binding constraint for Canada today. The AI Diffusion Rule (January 2025) placed Canada in the top tier and was rescinded on May 13, 2025; since January 15, 2026 the US even licenses H200-class chips to China case by case. The risk is political: Canada is not a signatory of the US-led Pax Silica declaration (December 12, 2025), and the semiconductor proclamation reserves a "phase two" of broad chip tariffs after trade talks. [10][11][12][13][26]

- Public opinion pulls in two directions. Canadians overwhelmingly reject annexation (90 percent, Angus Reid, January 2025), travel to the US fell 25.4 percent in 2025 (29.1 million return trips) and 46 percent agree Canada needs domestic AI infrastructure, but 68 percent would oppose a large data centre a few blocks from home and 81 percent worry about electricity bills (Leger, July 2026). [35][40][41]

Narrative

Canada entered 2025 as the most integrated trading partner of the United States and enters the autumn of 2026 in an open tariff war with it. For anyone deciding where to put an AI data centre, the story matters less for the headline rates than for what it reveals about three things: which inputs are taxed, whether electrons or intelligence are the better export, and how much policy risk sits on top of a 20-year asset.

The first phase of the war, from February 2025, was built on IEEPA and framed around fentanyl. Executive Order 14193 set 25 percent on Canadian goods and 10 percent on energy from March 4, 2025, and Executive Order 14325 lifted the general rate to 35 percent on August 1, 2025. The critical fact for business was the March 7, 2025 carve-out for CUSMA-compliant goods, which covered roughly 95 percent of Canadian exports according to the trade minister. The fentanyl tariffs therefore hurt selectively, while the Section 232 measures on steel and aluminum (50 percent from June 4, 2025), autos (25 percent from April 3, 2025), copper and lumber did the real damage to specific industries. Canada retaliated in March 2025 on about $60 billion of US goods, then on September 1, 2025 removed most of those counter-tariffs to mirror the CUSMA exemption, keeping only steel, aluminum and autos. The digital services tax was sacrificed on June 29, 2025 to restart talks; Ontario's Reagan advertisement ended them again in October.

The legal ground then shifted twice. On February 20, 2026 the Supreme Court ruled 6-3 that IEEPA does not authorise tariffs. The administration replaced the fentanyl tariffs within days with a 10 percent Section 122 surcharge that again exempted CUSMA goods and energy, and used the 150-day window to prepare Section 301 findings. When that surcharge expired on July 24, 2026 the US turned to the untested Section 338 of the 1930 Tariff Act: three proclamations signed July 20, 2026 set 50 percent duties on listed Canadian goods, worth about $28 billion or 5 percent of exports, with no CUSMA exemption. A three-day pause on August 18 and a presidential announcement of a "DEAL" were followed by Canada's decision on August 21 to walk away. The interim terms on the table would have lowered US auto tariffs to 15 percent and metals to 25 percent, but excluded medium and heavy trucks, obliged Canada to drop its counter-tariffs and provincial alcohol bans, and constrained future Canadian trade deals and cultural policy. Canada's answer from September 8, 2026 is a rate-for-rate list of $27.6 billion.

Sitting under all of this is the July 1, 2026 CUSMA joint review, at which the US declined to renew. The agreement stays in force to 2036 but now lives year to year, and the US agenda for 2027 includes 50 percent US parts content in vehicles, tighter rules on Chinese inputs, dairy, alcohol and what the US Trade Representative called "digital trade alignment". That last item is the one that touches data centres directly. Chapter 19 of CUSMA already forbids data-localisation requirements (Article 19.12) and restrictions on cross-border data flows (Article 19.11) for commercial purposes. A federal sovereign-cloud strategy that mandates Canadian hosting for government or regulated data can be squared with those articles through the public-policy exception, but it invites exactly the kind of challenge the US is signalling.

For the data-centre builder, the tariff map is more favourable than the headlines suggest. Graphics processors and servers enter Canada from Taiwan, Mexico and Vietnam without touching US tariffs; the January 2026 US chip tariff is narrow and exempts chips destined for US data centres, and the AI Diffusion Rule that briefly rationed chips by country tier was rescinded in May 2025. The tariffs that do bite are on the power and cooling side. Since April 6, 2026 the US charges Section 232 duties on the full value of transformers, switchgear, racks and copper cabling, at 25 percent for most items and 50 percent for some copper goods, with a temporary 15 percent band for very large transformers. Those duties raise US project costs, not Canadian ones, and the August 26, 2026 grid-equipment emergency order tightens US supply further. On the Canadian side the costs come from Ottawa's own counter-tariffs: 25 percent on US steel and aluminum since March 2025, 25 percent on steel derivatives since December 2025, and from September 8, 2026 duties of up to 50 percent on US appliances and electronics. A project that sources switchgear from Wisconsin or racks from Ohio pays more; one that sources from Europe or Asia does not. The Buy Canadian rule for federally funded projects over $25 million pushes the same way.

Energy is where Canada's leverage and its temptation both lie. In 2025 Canada shipped 3.9 million barrels a day of crude, 8.6 billion cubic feet a day of gas and 32.7 terawatt-hours of electricity to the United States, supplying 63 percent of US crude imports, nearly all of its gas imports and 81 percent of its electricity imports. Ontario tested electricity as a weapon on March 10, 2025 and withdrew it within a day after Trump threatened 50 percent on steel; in August 2026 Ontario and Quebec floated the idea again while the Prime Minister, Alberta and Saskatchewan rejected export taxes. The federal answer is to expand rather than withhold. The Churchill Falls and Gull Island agreement of August 17, 2026 (net present value $49 billion) reserves 985 megawatts of transmission access into New York and New England, the Champlain Hudson line began delivering Quebec power to New York in January 2026, and Ottawa wants to double grid capacity by 2050 and triple LNG exports, with German buyers already signed. In parallel, the "export intelligence" thesis is being tested in Alberta, where Meta's $13 billion, 1 gigawatt campus will run on a purpose-built gas plant, and in British Columbia, where TELUS is scaling to 150 megawatts of hydro-powered sovereign compute. The honest summary is that Canada is trying to export both electrons and intelligence, and the binding constraint is local consent: 68 percent of Canadians would oppose a large data centre near their home and four in five Albertans worry about their power bills.

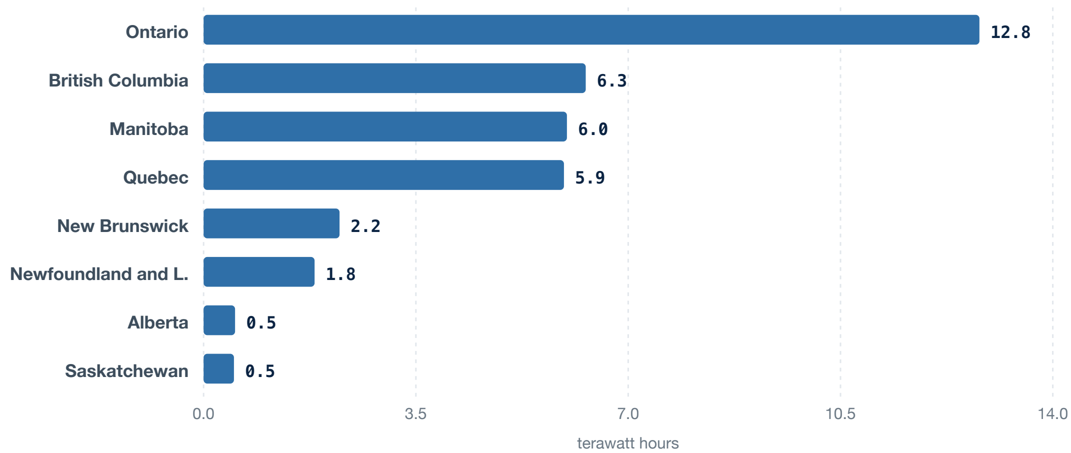
The sovereignty argument strengthened through the war. The CLOUD Act lets US authorities reach data held by US-controlled firms wherever it sits, and three US firms take about 85 percent of Canadian cloud spending. That is the addressable market for TELUS, Bell, Cohere and the federal program, and it explains why a Canadian government that once feared a US retaliation over "digital" policy still launched a large-scale sovereign data-centre call in January 2026. Public opinion supports the direction: 46 percent agree Canada needs domestic AI infrastructure, 90 percent reject annexation, and Canadians cut trips to the US by a quarter in 2025.

What could go wrong? The United States is competing for the same capital and chips with permitting waivers, federal land and Japanese-financed gas plants, and the hyperscalers plan to spend around US$760 billion in 2026, almost all of it at home. Canada is outside Pax Silica, the US-led technology alliance, and the semiconductor proclamation holds a "phase two" of broad chip tariffs in reserve. Section 338 itself may not survive the courts, which cuts both ways: relief for exporters, and more volatility. The macro cost of no deal is modest in aggregate (RBC estimates 0.4 percent of GDP) but concentrated in Ontario and Quebec manufacturing. For a data-centre investor the balance is a cost advantage on power equipment, strong and growing demand for

Canadian electricity and Canadian-controlled compute, and a policy environment in which the rules of North American trade will be renegotiated every year until 2036.

FIGURE 9.1

Electricity exported to the United States, by province (TWh, 2024)



Canada supplies about eighty-one per cent of all American electricity imports. This is the one lever in the relationship that points north, and it is also the electricity that could instead be sold at home as compute.

Source: Statistics Canada, Table 25-10-0021-01 (2024).

Timeline

Dates are the date of the action; where signing and effect differ, both are shown. Source numbers refer to the list at the end.

1. 2025-01-06 to 01-20: Trump repeatedly calls Canada the "51st state" and says he could use "economic force"; inaugurated January 20, 2025 with the "America First Trade Policy" memorandum. [51][1]
2. 2025-01-15: BIS publishes the Framework for Artificial Intelligence Diffusion (tiered controls on advanced chips and model weights; Canada in the top, uncapped tier). [12]
3. 2025-02-01: Executive Order 14193 imposes 25 percent on Canadian goods and 10 percent on energy and potash under IEEPA, effective February 4; Canada announces $155 billion of counter-tariffs, starting with $30 billion. [2][27]
4. 2025-02-03: 30-day pause after Canada commits to border measures and a fentanyl czar. [1][51]
5. 2025-03-04: US tariffs take effect; Canada's 25 percent on $30 billion of US goods takes effect; Phase 2 ($125 billion) consultation opens. [1][27]
6. 2025-03-06/07: Amendment exempts CUSMA-compliant goods and cuts potash to 10 percent. [3]
7. 2025-03-10 to 03-12: Ontario imposes a 25 percent surcharge on electricity exports to Michigan, Minnesota and New York (March 10); Trump threatens 50 percent on Canadian steel and aluminum (March 11); Ford suspends the surcharge the same day and Trump reverts to 25 percent; steel and aluminum tariffs take effect March 12; Canada retaliates on $29.8 billion (March 13). [51][53][27]

8. 2025-04-02/03: "Liberation Day" reciprocal tariffs exempt Canada; Section 232 autos 25 percent takes effect April 3 (CUSMA vehicles taxed on non-US content); Canada applies 25 percent to non-CUSMA US vehicles from April 9. [1][27]
9. 2025-04-28: Carney's Liberals win the election on a "Canada is not for sale" platform; Carney meets Trump on May 6. [51]
10. 2025-05-13: BIS announces rescission of the AI Diffusion Rule and new guidance on Huawei chips and diversion. [13]
11. 2025-06-04: Steel and aluminum tariffs rise to 50 percent. [1]
12. 2025-06-16: G7 Kananaskis: Carney and Trump set a 30-day target for a deal. [46]
13. 2025-06-23: Canada-EU summit: Security and Defence Partnership signed (Canada joins the EU SAFE procurement instrument in 2026). [54]
14. 2025-06-27 to 06-30: Trump ends talks over the DST; Canada rescinds the 3 percent, retroactive tax on June 29 and cancels the June 30 payment; talks resume June 30 with a July 21 target (repeal received royal assent March 26, 2026; $647 million refunded). [26][55]
15. 2025-06-30 (approx.): LNG Canada ships first cargo from Kitimat (the company marked one year of operations on June 30, 2026). [56]
16. 2025-07-23: America's AI Action Plan; Executive Order 14318 (data-centre permitting) and Executive Order 14320 (American AI Exports Program). [14][15][16]
17. 2025-07-31: Executive Order 14325 raises the non-CUSMA rate to 35 percent (40 percent for transshipment) from August 1; copper 50 percent also starts August 1. [4][1]
18. 2025-08-22 / 09-01: Carney announces removal of counter-tariffs on CUSMA-compliant US goods; $44.2 billion of counter-tariffs lifted September 1, steel, aluminum and autos kept. [27][1]
19. 2025-09: TELUS opens its first sovereign AI facility in Rimouski, Quebec (sold out). [30]
20. 2025-10-14: Section 232 lumber (extra 10 percent), furniture (25 percent) and cabinets (25 percent) take effect; no CUSMA exemption. [1]
21. 2025-10-23 to 10-25: Trump cancels talks over Ontario's Reagan advertisement and announces an extra 10 percent on Canadian goods; no implementing order appears in the Federal Register (see contested items). [51][57]
22. 2025-11-26: Canada cuts steel import quotas, adds 25 percent on $10 billion of steel derivatives (December 26) and launches a Buy Canadian procurement policy; November 2025 Canada-Alberta MOU on a new pipeline. [28][17]
23. 2025-12-12: Pax Silica declaration signed by the US and six allies; Canada is not a signatory. [26]
24. 2026-01-14/15: Proclamation 11002 imposes 25 percent on a narrow class of advanced chips (US data-centre use exempt); BIS moves H200-class exports to China to case-by-case review. [10][11]
25. 2026-01-15 to 02-15: Federal call for proposals under Enabling Large-Scale Sovereign AI Data Centres. [30]
26. 2026-02-20 / 02-24: Supreme Court (Learning Resources v. Trump, 6-3) voids IEEPA tariffs; Executive Order 14389 ends collection from February 24; a 10 percent Section 122 surcharge starts the same day (CUSMA goods and energy exempt) and expires July 24, 2026. [5][6][7][9]
27. 2026-04-06: Proclamation 11021 applies Section 232 metal duties to the full value of derivative products (10 to 50 percent). [18][45]

28. 2026-05-11: Canada-TELUS MOU: three BC facilities, more than 60,000 GPUs, 150 MW by 2032, about $9 billion in economic value; May 2026 SEFE (Germany) signs for 1 million tonnes a year of Ksi Lisims LNG. [30][16b]
29. 2026-06-01 to 06-18: Angus Reid finds 68 percent oppose a nearby data centre; "AI for All" strategy released June 4; Proclamation 11032 (June 8) sets a 15 percent band for power equipment and a CUSMA content rule; HIVE, Bell AI Fabric and Cohere sign the US$220 million, 2,304-GPU deal (June 18). [40][42][18][32]
30. 2026-06-30 / 07-01: Carney unveils an energy plan (double electricity capacity by 2050, triple LNG) and says no CUSMA renewal is expected; on July 1 USTR confirms the US did not agree to renew; annual reviews begin. [17][19][48]
31. 2026-07-08: Meta announces a $13 billion, 1 GW data centre in Sturgeon County, Alberta. [38]
32. 2026-07-14: BIS grants the UAE enhanced export treatment; Commerce has approved about US$10 billion of H200 licences for China with few shipments. [13][29]
33. 2026-07-20 / 07-22: Proclamations 11046, 11047 and 11048 (Section 338) set 50 percent on listed Canadian goods from August 19; Greer proposes interim USMCA arrangements by year-end. [8][48]
34. 2026-07-24: Section 122 surcharge expires; Section 301 forced-labour tariffs start (10 percent on non-CUSMA Canadian goods). [20]
35. 2026-07-29: Uniper signs for up to 2 million tonnes a year of Canadian LNG from 2032; Carney says Ottawa will not cut energy exports to the US. [16b][53]
36. 2026-08-17: Churchill Falls and Gull Island agreement (NPV $49 billion; 985 MW export access; federal $3.5 billion NPV plus loan guarantee). [37]
37. 2026-08-18 to 08-22: Proclamation 11056 pauses the 50 percent tariffs for three days as Trump announces a "DEAL"; Carney suspends talks on August 21; tariffs take effect August 22. [9][23][46]
38. 2026-08-24 to 08-26: Trump announces 50 percent on Canadian autos, parts and steel from January 1, 2027; Ford puts an electricity surcharge "on the table"; Quebec's premier will not rule out cutting electricity exports; Canada announces counter-tariffs (August 25); Executive Order 14420 declares a grid-equipment emergency (August 26). [46][48][25][17]
39. 2026-08-27 to 09-02: Greer says the US wants Canadian auto jobs moved south and no talks are under way (September 1); western premiers reject energy export taxes (August 31); Texas freezes data-centre grid connections (September 1); the Bank of Canada holds and warns that uncertainty has risen (September 2). [50][53][58]

The picture in numbers

Table 1: US tariff measures affecting Canada (rates by product and date)

Fentanyl tariff on Canadian goods

LEGAL BASIS IEEPA (EO 14193)	RATE 25% (10% energy, potash)
EFFECTIVE Mar 4, 2025	CUSMA-COMPLIANT GOODS Exempt from Mar 7, 2025
STATUS ON SEPT 2, 2026 Ended Feb 24, 2026 (Supreme Court)	SOURCE [2][3][5]

Fentanyl tariff increase

LEGAL BASIS IEEPA (EO 14325)	**RATE** 35% (40% transshipment)
EFFECTIVE Aug 1, 2025	**CUSMA-COMPLIANT GOODS** Exempt
STATUS ON SEPT 2, 2026 Ended Feb 24, 2026	**SOURCE** [4][5]

Steel and aluminum

LEGAL BASIS Section 232	**RATE** 25% then 50%
EFFECTIVE Mar 12, 2025; Jun 4, 2025	**CUSMA-COMPLIANT GOODS** No exemption
STATUS ON SEPT 2, 2026 In force; threatened 50% "on steel" restated for Jan 1, 2027	**SOURCE** [1][46]

Autos and parts

LEGAL BASIS Section 232	**RATE** 25% (CUSMA vehicles: non-US content only)
EFFECTIVE Apr 3, 2025 (parts May 3)	**CUSMA-COMPLIANT GOODS** Partial
STATUS ON SEPT 2, 2026 In force; 50% threatened from Jan 1, 2027	**SOURCE** [1][46]

Copper (semi-finished)

LEGAL BASIS Section 232	**RATE** 50%
EFFECTIVE Aug 1, 2025	**CUSMA-COMPLIANT GOODS** No exemption
STATUS ON SEPT 2, 2026 In force	**SOURCE** [1]

Softwood lumber, furniture, cabinets

LEGAL BASIS Section 232	**RATE** +10% lumber; 25% furniture (30% from Jan 1, 2026); 25% cabinets (50% from Jan 1, 2026)
EFFECTIVE Oct 14, 2025	**CUSMA-COMPLIANT GOODS** No exemption
STATUS ON SEPT 2, 2026 In force (plus existing AD/CVD on lumber)	**SOURCE** [1]

Advanced semiconductors (narrow class)

LEGAL BASIS Section 232 (Procl. 11002)	**RATE** 25%; US data-centre use exempt
EFFECTIVE Jan 15, 2026	**CUSMA-COMPLIANT GOODS** No exemption
STATUS ON SEPT 2, 2026 In force; "phase two" broad tariff pending	**SOURCE** [10]

Metal derivatives on full value (transformers, switchgear, racks, cable)

LEGAL BASIS Section 232 (Procl. 11021, 11032)	**RATE** 25% (10% if 85%+ US metal; 15% band for power equipment to Dec 31, 2027; below 15% metal content exempt); CUSMA goods 25% on non-US content, minimum 15%
EFFECTIVE Apr 6, 2026; Jun 8, 2026	**CUSMA-COMPLIANT GOODS** Partial
STATUS ON SEPT 2, 2026 In force	**SOURCE** [18][45]

Temporary import surcharge

LEGAL BASIS Section 122	**RATE** 10%
EFFECTIVE Feb 24 to Jul 24, 2026	**CUSMA-COMPLIANT GOODS** Exempt (also energy, 232 goods)
STATUS ON SEPT 2, 2026 Expired	**SOURCE** [7]

Forced-labour tariff

LEGAL BASIS Section 301	**RATE** 10% (Canada)
EFFECTIVE Jul 24, 2026	**CUSMA-COMPLIANT GOODS** Exempt
STATUS ON SEPT 2, 2026 In force	**SOURCE** [20]

Discrimination tariffs (alcohol, dairy, motor-vehicle annexes)

LEGAL BASIS Section 338 (Procl. 11046-11048)	**RATE** 50% on listed lines, about $28 billion of trade
EFFECTIVE Aug 22, 2026	**CUSMA-COMPLIANT GOODS** Not exempt
STATUS ON SEPT 2, 2026 In force; energy, potash, fish, critical minerals, 232 goods excluded	**SOURCE** [8][47]

Reagan-ad increase

LEGAL BASIS Announced only	RATE +10%
EFFECTIVE Announced Oct 25, 2025	CUSMA-COMPLIANT GOODS n/a
STATUS ON SEPT 2, 2026 No implementing order found	SOURCE [51][57]

Table 2: Canada's countermeasures

DATE	MEASURE	VALUE	STATUS	SOURCE
Mar 4, 2025	25% on US consumer goods (Phase 1)	$30 billion	Removed Sept 1, 2025	[27]
Mar 13, 2025	25% on US steel ($12.6 billion), aluminum ($3 billion), other ($14.2 billion)	$29.8 billion	Steel and aluminum kept; other removed Sept 1, 2025	[27]
Apr 9, 2025	25% on non-CUSMA US vehicles and non-North-American content	n/a	In force (cited by Proclamation 11048)	[27][8]
Apr 15, 2025	Remission for manufacturing inputs; Large Enterprise Tariff Loan Facility	six months, extended	Remission on US steel ended Jan 31, 2026	[1][28]
Dec 26, 2025	25% on steel derivatives; quota cuts for non-FTA (20% of 2024) and FTA (75%) steel	$10 billion	In force	[28]
Sept 8, 2026	15%, 25% and 50% "rate for rate" on 700-plus US products (steel, dairy, appliances, farm equipment, pulp and paper, electronics)	$27.6 billion (US$19.9 billion)	Announced Aug 25, 2026; seafood dropped Aug 26	[25][51]
Aug 25, 2026	Support: Regional Tariff Response Initiative $1.5 billion; BDC liquidity $500 million; Canada Strong Diversification Fund $2 billion; worker and employer supports $3.5 billion	$7.5 billion (on top of about $25 billion since 2025)	Announced	[25][23]

Table 3: Canada-US trade and energy flows (2025 unless noted)

INDICATOR	VALUE	AS OF	SOURCE
Share of Canadian merchandise exports going to the US	72% (87% in 2000)	2025	[46]
Share of Canadian exports to the US that are CUSMA compliant	about 95%	Feb 2026 (Minister LeBlanc)	[9]
Canadian exports covered by the Section 338 tariffs	about 5% to 5.5% of exports to the US (about $28 billion)	Aug 2026	[23][47][46]
Energy exports to the US (crude, refined, gas, NGLs)	$157.5 billion; 20.2% of all goods exports	2025 (CER, May 27, 2026)	[33]
Crude exports to the US	3.9 million b/d (90.1% of Canadian crude exports); $126.1 billion; 63.4% of US crude imports	2025	[33]
Natural gas exports to the US	8.6 Bcf/d; $12.5 billion; nearly 100% of US gas imports	2025	[33][34]
Electricity exports	32.7 TWh; $3.3 billion; 81.3% of US electricity imports; imports 22.1 TWh ($1.4 billion)	2025	[33]

INDICATOR	VALUE	AS OF	SOURCE
US-Canada total energy trade (US view)	US$137 billion (-11%); US imports from Canada US$111 billion; crude US$94.7 billion	2025 (EIA, Jul 29, 2026)	[34]
Prime Minister's dependence figures	Canada supplies 99% of US gas imports, 85% of electricity imports, 60% of crude	Aug 22, 2026	[24]
Canadian return trips from the US	29.1 million, -25.4%; overseas trips 14.2 million, +9.2%	2025 (StatCan, Feb 23, 2026)	[35]
Canadian travel spending in the US	$18.8 billion (leisure visits -21.5%, -3.2 million)	2025	[36]
Trans-border travel to the US	-8.7% year over year	Jul 2026	[36]
US spirits exports to Canada	-63% (about US$725 million lost)	2025 (DISCUS)	[51]
Foreign direct investment into Canada	$96.8 billion, highest since 2007	2025 (TD Economics via [57])	[57]
Macro cost of no deal	about 0.4% of GDP and employment (RBC); 87,000 jobs at risk (Tombe); Quebec -0.3% of GVA by 2028 (Oxford Economics)	Aug to Sept 2026	[46][58]

Table 4: Investment and sovereign-compute announcements made during the tension

DATE	ACTOR	ANNOUNCEMENT	SCALE	SOURCE
Budget 2024 (ongoing)	Government of Canada	Sovereign AI Compute Strategy	$2 billion: up to $700 million AI Compute Challenge, up to $1 billion public infrastructure, up to $300 million AI Compute Access Fund	[29]
Mar 20, 2025	ISED and Cohere	Federal investment in Cohere; CoreWeave facility in Cambridge, Ontario as anchor site	up to $240 million	[31]
Sept 2025	TELUS	Rimouski sovereign AI facility opens (sold out)	n/a	[30]
Jan 15 to Feb 15, 2026	ISED	Call for proposals: Enabling Large-Scale Sovereign AI Data Centres	no funding committed yet (May 2026)	[30]
May 11, 2026	TELUS and Canada	MOU for a BC AI factory cluster (Kamloops, two Vancouver sites)	60,000-plus GPUs; 150 MW by 2032 (85 MW initial); about $9 billion economic value	[30]
Jun 2, 2026	Bitdeer	Fox Creek, Alberta gas plant plus data centre	101 MW generation, about 100 MW compute	[59]
Jun 4 to 10, 2026	Government of Canada; RBC	"AI for All" strategy (equity stakes, sovereign foundation); RBC notes targets of 850 MW by 2030 scaling to 2.3 GW	n/a	[42]
Jun 18, 2026	HIVE (BUZZ HPC), Bell AI Fabric, Cohere	Three-year GPU contract in BC (Merritt)	US$220 million; 2,304 Grace Blackwell GPUs	[32]
Jul 8, 2026	Meta	First Canadian data centre, Sturgeon County, Alberta; Greenlight gas plant ($4.2 billion, 932 to 970 MW); Capital Power 250 MW from H2 2028	$13 billion; about 1 GW; 3,000 construction jobs; about $250 million a year to Alberta	[38]
Jul 14, 2026	HUMAIN (Saudi Arabia) and Cohere	Compute supply and Arabic models partnership	at least 50 MW from late 2027	[32]

DATE	ACTOR	ANNOUNCEMENT	SCALE	SOURCE
Aug 17, 2026	Canada, Quebec, Newfoundland and Labrador	Churchill Falls and Gull Island agreement	NPV $49 billion; Gull Island 2,700 MW; wind 2,000 MW; 985 MW export access; federal $3.5 billion NPV	[37]
Aug 20, 2026	Anthropic	Hiring a Canada compute lead and Alberta community manager	"gigawatts of compute" (aspiration)	[39]
Sept 14 to 15, 2026	Government of Canada, CPP Investments, PSP	Canada Investment Summit	target up to $1 trillion over five years	[60]
US comparators	Amazon, Alphabet, Microsoft, Meta	2026 capital spending plans; US data-centre equipment imports; federal-land campuses	about US$760 billion combined capex (2026); US$653.1 billion equipment imports (2025); Piketon 10 GW, Paducah US$100 billion	[45][49]

Risk and opportunity matrix

Direction is for Canada's AI data-centre opportunity. Magnitude and confidence are the analyst's judgment from the cited evidence.

FACTOR	DIRECTION FOR CANADA	MAGNITUDE	CONFIDENCE	EVIDENCE (AS OF SEPT 2, 2026)
US Section 232 duties on the full value of transformers, switchgear, racks and copper cabling (25% to 50%) raise US build costs but not Canadian ones	Positive (relative cost)	Medium	Medium	Proclamations 11021 and 11032; US power-infrastructure imports US$77 billion in 2025 (transformers US$35.4 billion). Illustrative arithmetic only: if tariff-exposed electrical and mechanical gear is 20 to 30 percent of a US project's capex and faces 25 percent, US capex rises roughly 5 to 7 percent. [18][45]
Canada's own counter-tariffs on US steel, aluminum, steel derivatives (25%) and, from Sept 8, 2026, US electronics and appliances (15% to 50%) raise Canadian project costs for US-sourced inputs	Negative	Medium	Medium-high	Finance Canada lists; Buy Canadian rules for federally funded projects over $25 million. [25][28]
GPU and server imports into Canada face no US tariff; the 25% US chip tariff is narrow and exempts US data-centre use; H200-class exports to China now licensed case by case	Neutral to positive	Low	Medium	Proclamation 11002; BIS rule of Jan 15, 2026. Watch the "phase two" broad chip tariff and Canada's absence from Pax Silica. [10][11][26]
CLOUD Act exposure drives demand for Canadian-owned, Canadian-operated compute	Positive	Medium	Medium-high	85 percent of Canadian cloud spend goes to three US firms; federal sovereign program; TELUS, Bell-Cohere, provincial sovereign-cloud procurements. [42][30][32][43]
CUSMA uncertainty: no renewal, annual reviews, US demands for "digital trade alignment"; Articles 19.11 and 19.12 limit localisation mandates	Negative (policy risk)	Medium-high	Medium	USTR statement Jul 1, 2026; Greer Jul 22, 2026; Chapter 19 text; Bloomberg Aug 20, 2026. [19][22][48][52]

FACTOR	DIRECTION FOR CANADA	MAGNITUDE	CONFIDENCE	EVIDENCE (AS OF SEPT 2, 2026)
Risk of US restrictions on Canadian-hosted compute or chip access	Negative (tail risk)	Low-medium	Low	No restriction found; AI Diffusion Rule (Canada top tier) rescinded May 13, 2025; American AI Exports Program targets allies; but Canada left out of Pax Silica and Trump said Canada will "no longer be treated like a State" (Aug 24, 2026). [12][13][16][26][51]
US demand for Canadian power (New England, New York, Midwest)	Positive	High	High	81.3 percent of US electricity imports; CHPE line live January 2026; Churchill Falls deal reserves 240 MW CHPE and 200 MW NECEC access; New York imports over US$20 billion of Canadian goods a year. [33][34][37][61]
Electricity as a bargaining chip (Ontario March 2025; Ontario and Quebec August 2026)	Negative (reliability perception)	Medium	Medium	Surcharge withdrawn within a day in 2025; Carney rejects energy leverage (Jul 29, 2026); western premiers oppose export taxes (Aug 31, 2026). [51][48][53]
Keeping power at home to host compute ("export intelligence")	Positive	High	Medium	Meta 1 GW in Alberta; TELUS 150 MW in BC; Alberta in talks with at least 60 proponents; grid-doubling plan; but 68 percent local opposition and 81 percent bill anxiety. [38][30][41][40][17]
US federal push (AI Action Plan, EO 14318 permitting, federal-land campuses, Japanese-financed gas plants) competes for capital and chips	Negative	High	High	13 GW-plus on DOE sites; about US$760 billion hyperscaler capex in 2026, overwhelmingly US-located. [14][15][49]
US grid and political constraints (Texas freeze, 474 GW queue, PJM curtailment rules, data-centre backlash in 21 midterm races) push developers to look north	Positive	Medium	Medium	Reuters Sept 1, 2026. [50]
Trade-war macro shock (0.4 percent of GDP; weaker dollar; Quebec hardest hit)	Mixed	Low-medium	Medium	Weaker Canadian dollar lowers Canadian operating costs in US dollar terms but raises imported equipment costs. [46][58]
Diversification partners (EU SAFE and LNG offtake, UK CPTPP accession Sept 1, 2026, India CEPA push, Gulf compute links)	Positive	Low-medium	Medium	German LNG deals; HUMAIN-Cohere; MGX's US$49 billion fund has no verified Canadian deal; Canada Investment Summit Sept 14 to 15, 2026. [16b][32][54][60]
Sovereignty sentiment (boycotts, 45 percent name Trump a top issue, defence procurement shifting to Europe) supports "made in Canada" compute procurement	Positive	Medium	Medium	Abacus Aug 30, 2026; $60 billion defence industrial strategy Aug 27, 2026; Buy Canadian policy. [28][58]

Contested or uncertain items

- The October 25, 2025 "additional 10 percent" on Canada was announced by the President and reported by the BBC and Reuters, but no implementing executive order appears in the Federal Register; treat it as announced, not verified as collected. [51][57]
- The value of trade covered by Section 338 is reported as about $28 billion (Prime Minister, August 21, 2026), US$20 billion (Reuters) and "5 percent" or "5.5 percent" of exports; the annexes were expanded be-

yond the alcohol, dairy and motor-vehicle headings, so estimates vary. [23][46][47]

- Whether Section 338 survives legal challenge is open; Slate (August 27, 2026) reports suits are expected, and the Court of International Trade reportedly found the Section 122 surcharge unlawful on July 14, 2026 (2-1) shortly before it expired. [9][62]
- The Churchill Falls federal contribution is reported as $3.5 billion (2026 NPV) in the provincial release and "up to $10 billion" in media reports that appear to include the loan guarantee; the "$70 billion package" figure comes from Inside Climate News and could not be reconciled with the primary release. [37]
- Reports that the 35 percent increase of August 1, 2025 was partly a response to Canada's plan to recognise a Palestinian state (Le Monde) are not reflected in the executive order, which cites fentanyl and Canadian retaliation. [4][57]
- The Boston Globe reports a Canadian aim to sell 55 percent of gas exports to non-US buyers "by mid-decade"; the target year is ambiguous in the report. [16b]
- No verified Gulf sovereign-fund investment in a Canadian data centre was found (MGX closed a US$49 billion AI fund on July 1, 2026 without a disclosed Canadian deal); HUMAIN's link is a supply agreement with Cohere, not Canadian capex. [32]
- Amazon, Microsoft and Google Canadian data-centre commitments in 2025 and 2026: none found in the news databases searched; absence of evidence, not evidence of absence.
- Polling on the "51st state" in 2026 is thinner than in 2025; the most recent figures are Leger's 56 percent for a hard line (August 2026) and Abacus's 45 percent naming Trump a top-three issue (August 30, 2026). [47][58]

Open questions students could investigate

1. Using Proclamations 11021 and 11032, price a 100 MW Canadian data centre's electrical and mechanical package sourced from the US versus Europe or Korea, and estimate the capex gap created by Canada's own counter-tariffs versus US Section 232 duties.
2. Does a federal requirement that government or health data be hosted on Canadian-controlled infrastructure comply with CUSMA Articles 19.11 and 19.12, and what would a US "digital trade alignment" chapter change?
3. What is the value of a firm 985 MW export portfolio into New York and New England versus selling the same Labrador power to a domestic AI campus at Alberta or BC industrial rates?
4. If the US "phase two" semiconductor tariff arrives with a tariff-offset program for US chip investment, does Canada become a more or less attractive place to install non-US-assembled servers?
5. Why did Ontario's electricity surcharge fail in 48 hours in March 2025, and what would a credible, WTO- and CUSMA-consistent energy lever look like?
6. Map the 2026 US federal-land data-centre program (Piketon, Paducah, Savannah River) against Canadian sites on cost of power, permitting time and community consent.
7. How should a Canadian pension fund weigh domestic sovereign-compute assets against US hyperscale leases given the Canada Investment Summit's $1 trillion target and the record $96.8 billion of inbound FDI in 2025?

8. What share of Canadian enterprise cloud spending (85 percent with three US firms) is realistically contestable by sovereign providers, and at what price premium?
9. How would a 50 percent US tariff on Canadian autos and steel from January 1, 2027 change the Ontario and Quebec electricity load forecast that data centres are competing for?
10. Compare the Meta Alberta gas-powered model with the TELUS BC hydro model on cost per megawatt, emissions and political durability under the 68 percent local-opposition finding.

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10

CHAPTER 10

The inheritance: nobel prizes, a compute gap, and the talent question

Canada did foundational work in deep learning and wrote the world's first national artificial intelligence strategy. It ranks in the global top ten on research and talent, and far lower on the infrastructure that turns research into industry. That gap is why data centres became a policy question at all.

8th, and 18th Canada's rank on the Global AI Index overall, and on that index's infrastructure pillar. The country is stronger at ideas than at machines.

WHAT THIS CHAPTER ANSWERS

- ? What does Canada actually own in the artificial intelligence stack?
- ? Where does its talent go, and why?
- ? How large is the compute gap, and is money the binding constraint?
- ? What have Canadian institutions recommended, and to whom?

KEY TAKEAWAYS

- Canada invented much of modern AI but ranks only 8th to 10th on composite AI indices: 10th of 36 countries in Stanford HAI's Global AI Vibrancy Tool (December 2025 release, score 15.56) and 8th of 83 in the Tortoise Global AI Index (September 2024 edition, down from 4th in 2021), with Tortoise placing Canada 18th on infrastructure and 16th on operating environment (Stanford HAI 2025; Tortoise 2024 via Logan Wealth 2025).
- The research legacy is real: Geoffrey Hinton (University of Toronto) shared the 2024 Nobel Prize in Physics; Richard Sutton (University of Alberta and Amii) shared the 2024 ACM Turing Award announced in March 2025; Yoshua Bengio founded Mila in 1993 and LawZero in 2025; and the 2017 Pan-Canadian AI Strategy was the world's first national AI strategy (CIFAR; ISED 2026).

- Talent is Canada's strongest card. Stanford's 2026 AI Index counts 31,450 top AI authors and inventors in Canada in 2025 (5th in the world) and 76.2 per 100,000 people (6th), and Canada leads the G7 in AI papers per capita (ISED 2024). But the same AI Index shows Canada's net flow of AI authors and inventors turned negative at minus 7.1 in 2025, and the federal AI for All strategy (June 2026) admits that nearly 70 percent of Canadian-led startups end up headquartered outside Canada.
- Compute is the weakest card. On the November 2023 TOP500 list Canada held 41 petaflops, about 0.7 percent of global supercomputing performance, last in the G7 and half the United Kingdom (The Dais, March 2024). The federal AI for All strategy estimates Canada's commercial players will need 5.5 gigawatts (GW) of AI compute by 2030, against partnerships proposing 850 megawatts (MW) by 2030 scaling to 2.3 GW (ISED, June 2026).
- Ottawa has now committed roughly $5 billion in AI-specific money in three steps: the $2.4 billion Budget 2024 package (including the $2 billion Sovereign AI Compute Strategy), $925.6 million for sovereign public AI infrastructure plus $1.7 billion for recruiting more than 1,000 international researchers in Budget 2025, and the $2.3 billion AI for All strategy of June 2026 (Department of Finance 2024; Budget 2025; BetaKit June 2026).
- Private capital is arriving in a lumpy way: Cohere reached a USD 7 billion valuation in September 2025 and announced a merger with Germany's Aleph Alpha in April 2026 at a reported combined value of about USD 20 billion; Waabi raised USD 750 million in January 2026 (the largest Canadian tech round on record); Clio hit a USD 5 billion valuation in November 2025; Xanadu listed on Nasdaq and the TSX in March 2026; but Tenstorrent moved its headquarters to California in 2024 and Untether AI shut down in June 2025 when AMD hired its team (BetaKit; CRN).
- Foreign hyperscalers are the biggest builders: Microsoft says it is spending $19 billion on AI infrastructure in Canada between 2023 and 2027 (December 2025), and Meta announced a $13 billion, 1 GW campus in Sturgeon County, Alberta in July 2026 with 3,000 construction jobs but only about 300 permanent jobs (Microsoft 2025; Invest Alberta 2026).
- Canadian institutional capital is going mostly abroad: CPP Investments committed about $225 million to a Cambridge, Ontario data centre loan (August 2025) but roughly $1.8 billion to Europe with Goodman (December 2025), USD 1.6 billion for atNorth in the Nordics (February 2026), up to $1 billion in India (June 2026) and $2.4 billion with EQT and EdgeConneX (July 2026); Brookfield's USD 100 billion AI infrastructure program has named projects in Sweden and France but none disclosed in Canada as of July 2026 (Investment Executive; ION Analytics; The Deep Dive).
- Venture funding for AI is now the Canadian venture market: AI companies took 54 cents of every venture dollar in 2025 (Osler, May 2026) in a $8.0 billion, 571-deal year that was down 6 percent (CVCA, February 2026); the first half of 2026 recovered 17 percent to $2.69 billion across 250 deals (CVCA via Financial Post, August 2026).
- Think tanks broadly agree on three asks: tie data-centre approvals to grid planning and cost transparency (C.D. Howe, Canadian Climate Institute, Pembina), make government the demanding first customer for Canadian AI (The Hub, MaRS, CCI, C.D. Howe), and build public compute with a refresh budget rather than one-off grants (C.D. Howe, Digital Research Alliance, IRPP).

Narrative

Canada's relationship with artificial intelligence is a story of an early lead that has been hard to bank. The technical foundations of the current boom were laid in Canadian universities: Geoffrey Hinton's deep-learning work at the University of Toronto earned a share of the 2024 Nobel Prize in Physics, Yoshua Bengio built Mila in

Montreal into what it describes as the largest concentration of deep-learning academic researchers in the world, and Richard Sutton's reinforcement-learning research at the University of Alberta and Amii was recognized with the 2024 ACM Turing Award announced in March 2025. The Canadian Institute for Advanced Research (CIFAR) funded these people for decades, and in 2017 Ottawa turned that bet into the world's first national AI strategy, the Pan-Canadian AI Strategy, with $125 million, followed by $443.8 million in 2021 and $174 million in late 2024. More than 150 Canada CIFAR AI Chairs have been funded across the three institutes (Vector in Toronto, Mila in Montreal, Amii in Edmonton), and the June 2026 federal strategy promises to grow the program to nearly 200 chairs.

The people are still here, at least in aggregate. Stanford's 2026 AI Index counts 31,450 top AI authors and inventors working in Canada in 2025, the fifth-largest pool in the world and the sixth-largest per capita. AI-related job postings were 3.0 percent of all Canadian postings in 2025, fifth globally, and Canada leads the G7 in AI research papers per person. Yet two numbers should worry students who plan to build careers here. The same AI Index shows that Canada's net flow of AI authors and inventors, which was strongly positive around 2020, fell to minus 7.1 in 2025. And the federal government's own AI for All strategy concedes that nearly 70 percent of Canadian-led startups end up headquartered outside the country. Tenstorrent, a chip designer founded in Toronto, moved its headquarters to California in 2024 to satisfy an investor's ownership caps and prepare for a US listing, while keeping 140 engineers in Toronto. Untether AI, another Toronto chip startup, shut down in June 2025 when AMD hired its engineering team and dropped its products. The counter-flow is real but small: the Global Impact+ initiative announced in August 2026 recruited 64 scholars, 48 of them from US universities, with $504 million over eight years drawn from Budget 2025's $1.7 billion talent envelope, and applications from US scientists to Canadian posts reportedly jumped after the US administration's research cuts. On immigration, the signals are mixed: a new Express Entry category for researchers and senior managers with Canadian experience opened in February 2026, but the Start-Up Visa program was suspended on January 1, 2026 after wait times passed ten years.

The compute picture is where the gap between reputation and capacity is widest. The last comprehensive comparison, by The Dais in March 2024 using the November 2023 TOP500 list, put Canada at 41 petaflops, about 0.7 percent of global supercomputing performance, last in the G7 and half of the United Kingdom, the next-lowest member. Canadian researchers largely train on foreign clouds; three US firms take roughly 85 percent of Canadian cloud infrastructure spending, and Cohere, the country's flagship model company, rents its Canadian capacity from a US operator, CoreWeave, in a Cambridge, Ontario facility that Ottawa backed with up to $240 million toward a $725 million project. The federal response has come in three waves: the $2 billion Canadian Sovereign AI Compute Strategy from Budget 2024 (a $700 million AI Compute Challenge, up to $1 billion for a public supercomputer, and a $300 million access fund), the $925.6 million for sovereign public AI infrastructure and $1.7 billion for researcher recruitment in Budget 2025, and the $2.3 billion AI for All strategy of June 2026, which adds $700 million to the Compute Access Fund and commits to a "world-leading" public supercomputer. The strategy also states the scale of the problem plainly: Canada's commercial players will need about 5.5 GW of AI compute by 2030, while the partnerships now being finalized propose 850 MW by 2030 with room to scale to 2.3 GW. In other words, even if every announced sovereign project lands, most Canadian AI workloads in 2030 will still run in facilities owned by foreign hyperscalers, which is exactly why Microsoft's $19 billion Canadian program (2023 to 2027) and Meta's $13 billion, 1 GW Alberta campus announced in July 2026 matter so much.

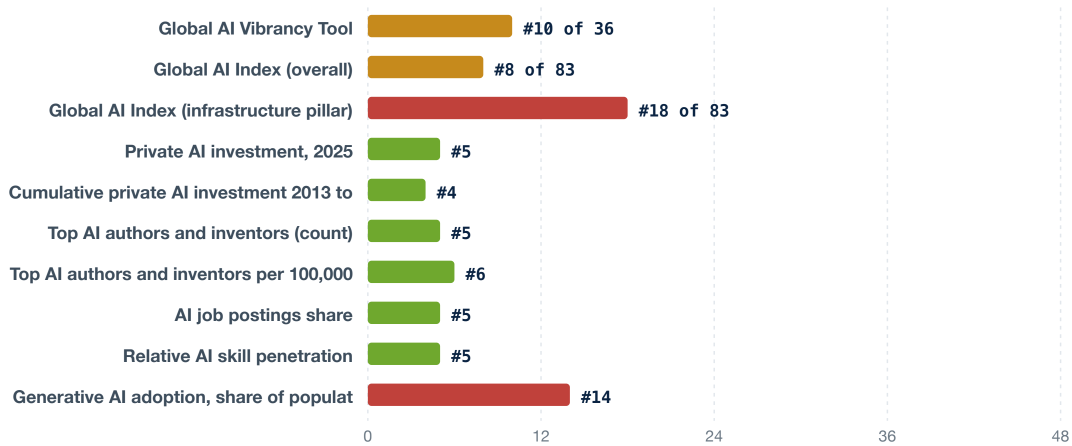
Capital tells a similar story of strength that leaks abroad. Canadian venture investment was $8.0 billion in 2025, down 6 percent, but AI took 54 cents of every dollar and drove the largest rounds: Cohere's climb to a USD 7 billion valuation in September 2025 (with Nvidia, AMD, PSP Investments, HOOPP and BDC among investors), Waabi's USD 750 million Series C in January 2026, and Clio's USD 500 million Series G at a USD 5 billion valuation alongside its USD 1 billion acquisition of vLex. Xanadu became the first new Canadian tech listing on the TSX since 2021 when it debuted in March 2026, and in August 2026 secured a $195 million federal loan for a photonics plant in Toronto. Cohere's April 2026 merger with Aleph Alpha, at a reported combined value of about USD 20 billion and with EUR 500 million from Germany's Schwarz Group, keeps the head office in Toronto but makes the company transatlantic. Meanwhile, Canada's largest pools of patient capital are financing the AI build-out mostly elsewhere. CPP Investments' data-centre commitments since mid-2025 add up to roughly $6 billion, of which $225 million is in Ontario and the rest in Europe, the Nordics, India and a global platform with EQT. Brookfield's USD 100 billion AI infrastructure program, anchored by Nvidia and Kuwait's sovereign fund, has named multi-billion projects in Sweden and France but, as of July 2026, none in Canada. Whether Canadian institutions treat domestic data centres as investable at scale is one of the open questions of the next two years.

What would a wave of data centres mean for jobs? The evidence is that construction is labour-intensive and operations are not. Meta's Alberta campus expects more than 3,000 construction workers at peak but about 300 permanent staff; Telus's three British Columbia facilities claim 1,000 construction jobs and 525 permanent roles for 151 MW of capacity. The larger employment effect is indirect: electrical trades, transmission and generation work, cooling and mechanical contractors, and the professional services (law, engineering, project finance, regulatory affairs) that each 100 MW project requires. Alberta's interconnection queue holds more than 10 GW of proposals against a 1,200 MW connection cap, and the Pembina Institute estimates that Meta's project alone could add $267 to $462 a year to household electricity bills between 2027 and 2031, which is why the policy fight is now about who pays for the grid.

The think-tank consensus that emerges from 2025 and 2026 is unusually coherent. On energy, C.D. Howe, the Canadian Climate Institute and Pembina all want data-centre approvals tied to honest electricity pricing, cost allocation to large users, and demand flexibility. On sovereignty, C.D. Howe, IRPP authors and the Digital Research Alliance want a public supercomputer with a refresh budget and public compute reserved for research, while RBC and the Council of Canadian Innovators want the government and the banks to act as anchor customers for Canadian providers. On competition, C.D. Howe proposes spot and forward markets for compute and rules against self-preferencing by infrastructure owners. On talent, Universities Canada, PPF and Mitacs want AI literacy across disciplines and structured pathways from research to company formation. For MBA, MM and MBAN students the practical lesson is that the coming Canadian AI economy will be built as much by people who can site, finance, power and staff a 100 MW facility, and by managers who can move a firm from a 12 percent adoption rate toward the 60 percent target, as by the researchers who started it.

FIGURE 10.1

Where Canada ranks (lower is better)



Read the pattern rather than any single line. Canada scores well wherever the measure is people or papers, and badly wherever the measure is machines.

Source: Stanford Institute for Human-Centered AI, *AI Index* (2025 and 2026); Tortoise Media; The Dais.

The picture in numbers

Rankings and indices

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Global AI Vibrancy Tool overall rank	10 of 36 (score 15.56; US 78.60, China 36.95, India 21.59)	rank	2025 release (data to 2024)	Canada	Stanford HAI via AffairsCloud, https://affairscloud.com/stanfords-global-ai-vibrancy-tool-2025-usa-tops-india-ranks-3rd/
Tortoise Global AI Index overall rank	8 of 83 (4th in 2021)	rank	Sept 2024 edition (latest found)	Canada	Tortoise Media, https://www.tortoisemedia.com/data/global-ai
Tortoise sub-pillar ranks	Government strategy 3rd; commercial 6th; operating environment 16th; infrastructure 18th	rank	2024	Canada	Logan Wealth citing Tortoise, https://www.loganwealth.com/resources/artificial-intelligence-can-canada-be-a-player
Private AI investment, single year	USD 2.89 billion (5th globally) in 2024; USD 4.28 billion (5th, behind US 285.9, China 12.4, UK 5.9, France 4.4) in 2025	USD billion	2024, 2025	Canada	Stanford AI Index 2025 and 2026, https://hai.stanford.edu/ai-index

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Private AI investment, cumulative	USD 15.31 billion 2013 to 2024 (4th); USD 19.59 billion 2013 to 2025 (4th, after US 757.3, China 131.8, UK 34.1)	USD billion	2024, 2025	Canada	Stanford AI Index 2025 and 2026
Newly funded AI companies	51 in 2024 (8th); 79 in 2025 (7th); 560 cumulative 2013 to 2025 (4th)	count	2024, 2025	Canada	Stanford AI Index 2025 and 2026
Notable AI models released	1 in 2024 and 1 in 2025 (US 59, China 35, South Korea 8 in 2025)	count	2025	Canada	Stanford AI Index 2026 (Epoch AI data)
Data centres counted	337 (5th: US 5,427; Germany 529; UK 523; China 449)	count	2025	Canada	Stanford AI Index 2026 (Cloudscene data)
Generative AI adoption, share of population	35.0 percent (rank 14)	percent	2025	Canada	Stanford AI Index 2026
Trust and literacy	44th of 47 on AI training and literacy; 42nd of 47 on trust in AI; 24 percent of Canadians have had any AI training	rank	2025 study cited 2026	Canada	KPMG and University of Melbourne cited in AI for All, https://ised-isde.canada.ca/site/ised/sites/default/files/documents/ai-strategy-en.pdf
Business AI adoption	12 percent of businesses used AI mid-2024 to mid-2025; 14.5 percent planning by mid-2026; SMEs about 8 percent versus Nordic 29 to 42 percent	percent	2025	Canada	Statistics Canada cited in AI for All (June 2026); C.D. Howe Commentary 712 (April 2026)
Organizations that have implemented AI	26 percent versus 34 percent globally	percent	2025	Canada	Deloitte Canada, https://www.deloitte.com/ca/en/about/press-room/canada-ai-future.html

Talent and people

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Top AI authors and inventors	31,450 (5th after US 220,520; India 50,460; Germany 48,520; UK 34,370)	people	2025	Canada	Stanford AI Index 2026 (Zeki data), https://hai.stanford.edu/ai-index/2026-ai-index-report
Top AI authors and inventors per 100,000 people	76.2 (6th; Switzerland 110.5; Singapore 109.5)	per 100,000	2025	Canada	Stanford AI Index 2026
Net flow of AI authors and inventors	minus 7.1 in 2025, after strong inflow around 2020	net count index	2025	Canada	Stanford AI Index 2026
Net AI talent migration (LinkedIn)	plus 1.23 per 10,000 LinkedIn members (US 1.22)	per 10,000	2025	Canada	Stanford AI Index 2026 (LinkedIn data)

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
AI talent concentration (LinkedIn)	0.93 percent of members in 2024 (up 166 percent since 2016); 1.01 percent in 2025	percent	2024, 2025	Canada	Stanford AI Index 2025 and 2026
AI job postings share	1.41 percent of all postings in 2024; 3.00 percent in 2025 (5th globally)	percent	2024, 2025	Canada	Stanford AI Index 2025 and 2026 (Lightcast data)
Relative AI skill penetration	1.30 (6th) 2015 to 2024; 1.54 (5th) 2015 to 2025	index	2024, 2025	Canada	Stanford AI Index 2025 and 2026
Top-tier AI researchers	6th globally, 3 percent of the world's total	rank, percent	2022 (cited 2024)	Canada	ISED What We Heard report, https://ised-isde.canada.ca/site/ised/en/what-we-heard-report-consultations-ai-compute
AI papers per capita	Leads the G7 since 2019	rank	2019 to 2024	Canada	ISED What We Heard report (Nov 2024)
New ICT graduates	Bachelor's 13,590; master's 3,342; PhD 324	graduates	2023	Canada	Stanford AI Index 2026 (OECD data)
New AI PhDs	Up 22 percent from 2022 to 2024, with the increase going to academia	percent	2024	US and Canada	Stanford AI Index 2026 (CRA Taulbee data)
Canadian-led startups headquartered outside Canada	Nearly 70 percent	percent	2026 statement	Canada	AI for All strategy, ISED, June 2026
Immigrants who leave Canada	1 in 5 within 25 years; doctorate holders nearly twice as likely to leave as bachelor's holders	share	2025 report	Canada	Institute for Canadian Citizenship and Conference Board "Leaky Bucket" via The Hub, https://thehub.ca/2026/04/22/canadas-brain-drain-is-only-half-the-story/
Researchers recruited from abroad	64 scholars, 48 from US universities (Cornell, Harvard, Yale, MIT); $504 million over eight years from the $1.7 billion Budget 2025 envelope	people, CAD	Aug 2026	Canada	BetaKit, https://betakit.com/canada-poaches-64-global-scholars-in-bid-to-bolster-domestic-talent-pipeline/
Canada CIFAR AI Chairs	More than 125 currently supported (CIFAR); over 150 funded to date; to grow from 130 to nearly 200	researchers	2026	Canada	CIFAR, https://cifar.ca/ai/ ; AI for All (June 2026)
AI institute scale	Vector: 950+ researchers and faculty, 30+ industry partnerships; Mila: 1,400+ community, 905 students and interns trained in 2022-23, about 120 industry partners; Amii: figures not published on site	people	2026 (site)	Toronto, Montreal, Edmonton	https://vectorinstitute.ai/about/ ; https://mila.quebec/en/mila ; https://www.amii.ca/about
Mitacs AI investment	$174.4 million directed to AI initiatives since 2018; 46,000 interns; 31 percent hired by partners	CAD million	2025	Canada	BetaKit, https://betakit.com/canadas-ai-edge-is-human/

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Data-centre jobs (examples)	Meta Alberta: 3,000+ construction, about 300 permanent; Telus BC: 1,000 construction, 525 permanent; Xanadu Toronto photonics plant: 275	jobs	2026	AB, BC, ON	Invest Alberta (July 2026); BetaKit (May 2026); BetaKit (Aug 2026)

Compute and infrastructure

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
TOP500 supercomputing performance	41.21 petaflops, about 0.7 percent of global; US 3,726; Japan 670; Germany 256; France 173; UK 82	petaflops	Nov 2023 list	Canada	The Dais "Can Canada Compute?", https://dais.ca/reports/can-canada-compute/
Per-capita compute gap	US 10.6 times Canada; Japan 7.6 times; France 2.4 times; Germany 1.9 times; UK 1.2 times	ratio	2024	G7	The Dais (March 2024)
Estimated AI compute need	5.5 GW for commercial players by 2030	gigawatts	2030	Canada	AI for All strategy (June 2026)
Sovereign compute pipeline	850 MW by 2030 scaling to 2.3 GW; large-scale data centres of at least 100 MW; 160 proposals received	MW	2026	Canada	AI for All (June 2026); BetaKit on Telus (May 2026)
Sovereign AI Compute Strategy	$2 billion over five years: up to $700 million AI Compute Challenge; up to $1 billion public supercomputing (about $890 million build layer under SCIP from 2026-27; $200 million near-term augmentation); $300 million AI Compute Access Fund	CAD	2024 to 2029	Canada	ISED, https://ised-isde.canada.ca/site/ised/en/canadian-sovereign-ai-compute-strategy
First compute grants	Cohere: up to $240 million toward a $725 million CoreWeave-operated facility in Cambridge, Ontario (operational August 2025); University of Toronto: $42.5 million to triple Trillium GPU capacity (Nov 2025)	CAD	2024 to 2025	Ontario	BetaKit; The Globe and Mail
Telus Sovereign AI Factory	Rimouski site opened Sept 2025; BC plan (May 2026): 75,500 Nvidia GPUs across Kamloops (25 MW), Vancouver Mount Pleasant (26 MW) and downtown Vancouver (100 MW, early 2029); $9 billion economic activity claimed	GPUs, MW	2025 to 2029	QC, BC	Telus; BetaKit, https://betakit.com/steel-concrete-and-code-feds-and-telus-announce-three-ai-data-centres-in-bc/
Bell AI Fabric	Six data centres, 459+ MW planned, Groq processors, first BC sites 2025	MW	2025	BC, MB, QC	BetaKit, https://betakit.com/bell-to-build-six-ai-data-centres-in-canada-as-telcos-compete-on-infrastructure/
Foreign ownership of cloud and data centres	Three US firms take about 85 percent of Canada's cloud infrastructure spending and about 88 percent of enterprise foundation-model usage; US firms own nearly one-third of Canada's 283 data centres; 7 US firms and 1 Canadian (ThinkOn) on the federal cloud shortlist	percent	2025 to 2026	Canada	RBC Thought Leadership (June 2026); BetaKit (Sept 2025)

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Alberta inter-connection queue	More than 10 GW of proposed data centres; AESO capped new large-load connections at 1,200 MW, fully allocated	GW	2025 to 2026	Alberta	Canadian Climate Institute (March 2025); The Hub (Aug 2026)

Capital

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Canadian venture capital, full year	$8.0 billion across 571 deals (dollars down 6 percent, deals down 12 percent); ICT $5.06 billion; zero IPOs; venture debt $1.40 billion	CAD	2025	Canada	CVCA Year-End 2025, https://www.cvca.ca/insights/market-reports/year-end-2025/
AI share of venture dollars	54 cents of every dollar; 23 percent of rounds; AI median pre-money valuations about 60 percent above the rest of market	percent	2025	Canada	Osler Deal Points via BetaKit, https://betakit.com/not-a-blip-ai-was-canadas-venture-market-mover-in-2025/
Venture capital, first half	$2.69 billion across 250 deals, up 17 percent; 16 mega-deals worth $1.57 billion; Beacon Software $313 million; US investors in 28 percent of deals	CAD	H1 2026	Canada	CVCA via Financial Post, https://finance.yahoo.com/news/venture-capital-investment-canada-jumps-100023869.html
Cohere	USD 7 billion valuation (Sept 2025); USD 240 million annualized revenue (Feb 2026); Aleph Alpha merger at reported USD 20 billion combined value with EUR 500 million from Schwarz Group (April 2026)	USD	2025 to 2026	Toronto	BetaKit, https://betakit.com/cohere-to-acquire-germanys-aleph-alpha-in-sovereign-ai-play/
Brookfield AI infrastructure	USD 100 billion program; BAIIF USD 10 billion target, USD 5 billion secured at launch with Nvidia and Kuwait Investment Authority; Sweden SEK 95 billion (June 2025); France EUR 20 billion rising to EUR 30 billion (2025); Bloom Energy USD 5 billion; no Canadian project disclosed	mixed	Nov 2025	Global	Brookfield; ION Analytics, https://ionanalytics.com/insights/infralogic/brookfields-wide-ranging-ai-infra-strategy/
CPP Investments data-centre commitments	$225 million Cambridge, Ontario (Aug 2025); about $1.8 billion Goodman Europe (Dec 2025); USD 1.6 billion atNorth (Feb 2026); up to $1 billion CtrlS India (June 2026); $2.4 billion EQT and EdgeConneX (July 2026)	CAD and USD	2025 to 2026	Global	Investment Executive, https://www.investmentexecutive.com/?s=CPP+Investments+data+centre
Hyperscaler commitments in Canada	Microsoft $19 billion 2023 to 2027 (new capacity from H2 2026); Meta $13 billion, 1 GW, Sturgeon County, Alberta	CAD	2025 to 2026	Canada	Microsoft (Dec 2025); Invest Alberta (July 2026)

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Federal AI funding, three steps	Budget 2024: $2.4 billion; Budget 2025: $925.6 million public AI infrastructure plus $1.7 billion for 1,000+ researchers; AI for All: $2.3 billion	CAD	2024 to 2026	Canada	Budget 2024 Chapter 4; Budget 2025 Chapter 1; BetaKit (June 2026)
Unit cost benchmarks	Hyperscale construction about $10 million per MW; compute hardware potentially more than $30 million per MW	CAD per MW	2026	Canada	Torys summarizing federal call, https://www.torys.com/our-latest-thinking/publications/2026/01/canada-promotes-investment-in-sovereign-large-scale-ai-data-centres

Canada's assets and gaps

DIMENSION	ASSET	GAP	EVIDENCE
Research legacy	Hinton (Nobel 2024), Bengio (Turing 2018, LawZero 2025), Sutton (Turing 2024); first national AI strategy (2017); three institutes with 150+ CIFAR chairs	Only one notable model a year originates in Canada; Canadian labs train on foreign clouds	Stanford AI Index 2026; ISED AI for All (2026)
Talent	5th in top AI authors and inventors; leads G7 in AI papers per capita; AI job postings 3.0 percent of all postings (5th)	Net flow of AI authors and inventors negative in 2025; 70 percent of Canadian-led startups end up headquartered abroad; Start-Up Visa suspended Jan 2026 after 10-year waits	Stanford AI Index 2026; AI for All; BetaKit (Dec 2025)
Compute	Clean grid (about 85 percent non-emitting), cool climate, 337 data centres; $2 billion sovereign strategy plus $925.6 million	0.7 percent of global supercomputing performance (2023), last in G7; 5.5 GW need vs 850 MW pipeline; Alberta queue capped at 1,200 MW	The Dais 2024; AI for All 2026; Climate Institute 2025
Companies	Cohere (USD 7 billion), Waabi (USD 750 million round), Clio (USD 5 billion), Xanadu (listed), Hypertec (Nvidia OEM), Ranovus (photonics)	Tenstorrent moved HQ to the US; Untether AI closed; Cohere rents compute from a US operator; no Canadian GPU fabrication	BetaKit; CRN; B2BNN (May 2026)
Capital	$8 billion venture market with AI at 54 percent; deep pension capital; BDC deployed $832 million in H1 2026	Pension data-centre money mostly deployed abroad; zero IPOs in 2025 and H1 2026; US investors in 28 percent of deals and 56 percent of later-stage rounds	CVCA 2026; Investment Executive 2026
Adoption	Individual generative AI use among the world's highest (35 percent of population, rank 14)	Business use 12 percent (target 60 percent by 2034); 44th of 47 on AI training and literacy	Stanford AI Index 2026; AI for All 2026
Energy and grid	Renewable-heavy provinces (BC, QC, MB) attract sovereign projects; Alberta offers bring-your-own-generation	Six-year grid connection waits; Meta could add $267 to $462 a year to Alberta bills 2027 to 2031; Ontario demand up 65 percent by 2050	RBC (Aug 2026); Pembina (Aug 2026); C.D. Howe (Aug 2026)

Recommendations by stakeholder

STAKEHOLDER	RECOMMENDATION	WHO MADE IT	DATE	SOURCE
Federal government	Expand sovereign compute beyond the $2 billion strategy; create spot and forward markets for compute; support open-weight models; remove regulatory barriers to data-centre buildout	C.D. Howe Institute (Daniel Schwanen, Commentary 713)	2026-04-15	https://cdhowe.org/publication/chipping-in-a-canadian-guide-for-maintaining-competition-in-ai/
Federal government	Update privacy law quickly; build open public data assets; fund StatCan's TechStat; keep SR&ED and accelerated capital cost allowance; mid-career skills strategy	C.D. Howe Institute (Rosalie Wyonch, Commentary 712)	2026-04-09	https://cdhowe.org/publication/from-hype-to-output-how-ai-investment-translates-to-real-productivity-gains/
Federal government	Pilot private-sector access to confidential StatCan data, synthetic datasets, regional AI sandboxes, and a Bill C-27 successor with de-identification standards	C.D. Howe Institute (Anindya Sen, Commentary 706)	2026-02-12	https://cdhowe.org/publication/the-missing-pillar-of-canadas-ai-strategy-data-supply-chains/
Federal government	Use anchor procurement to build domestic suppliers; convert AI for All into measurable milestones; give the public supercomputer a refresh cycle and budget	C.D. Howe Institute (Harvey Naglie)	2026-06-10	https://cdhowe.org/publication/executing-ai-for-all-how-to-get-a-capability-raising-result/
Federal government	Make infrastructure funding conditional on clean-supply matching and demand flexibility; enforce Clean Electricity Regulations and carbon pricing; national clean-AI reporting standard	Canadian Climate Institute (Dale Beugin, Kate Harland)	2026-05-26	https://climateinstitute.ca/canadas-ai-and-electricity-strategies-can-and-should-be-mutually-reinforcing/
Federal government	Create a Powering Canada Forward Fund with a national benefits test to expand grids while keeping delivery prices flat in real terms	Canadian Climate Institute (Beugin, Harland, Liebreich, Smith)	2026-07-22	https://climateinstitute.ca/policy-brief-powering-canada-forward-fund/
Federal government	Prioritize public compute for non-commercial AI, shift funding from private support to public infrastructure, coordinate with aligned countries	IRPP Policy Options (Guillaume Beaumier, Hubert Cadieux)	2026-05-06	https://policyoptions.irpp.org/2026/04/ai-public-infrastructure/
Federal government	Pursue small task-specific models, a Crown corporation for sovereign compute, and clean-powered data-centre parks with Indigenous governance	IRPP Policy Options (Anne Pasek and co-authors)	2025-10-20	https://policyoptions.irpp.org/2025/10/ai-made-in-canada/

STAKEHOLDER	RECOMMENDATION	WHO MADE IT	DATE	SOURCE
Federal government	Reform PIPEDA and the Privacy Act; use CUSMA carve-outs for data sovereignty; scale sovereign compute to 850 MW by 2030 and 2.3 GW; keep flexible procurement authority; retain AI graduates	RBC Thought Leadership	2026-06-10	https://www.rbc.com/en/thought-leadership/ai-technology-and-innovation/sovereign-ai-shaping-canadas-next-digital-chapter/
Federal government	Raise AI safety funding well above $50 million; put mandatory skilling and inclusion clauses in AI procurement; regular StatCan reporting on AI's labour effects; align with the EU AI Act	Public Policy Forum (Shingai Manjengwa)	2026-06-12	https://ppforum.ca/ppf-media/six-key-takeaways-from-canadas-ai-strategy/
Federal government	Give Canadian AI firms a clear roadmap to scale globally; act as an early customer; improve compute access and growth capital; crowd in domestic private investment	Council of Canadian Innovators (Laurent Carbonneau), MaRS (Grace Lee Reynolds), CVCA (Ben Bergen) via BetaKit	2026-06-04	https://betakit.com/canadas-ai-strategy-draws-mixed-reviews-from-across-the-tech-ecosystem/
Federal government	Pro-innovation regulation; targeted incentives; sector AI centres; expand compute providers; fund upskilling; build public trust	Canadian Chamber of Commerce	2026-02-10	https://chamber.ca/policy-matters-the-big-questions-about-ai-and-canadian-business/
Federal government	Invest in GPU-class high-performance computing and sustainable data centres; accelerate domestic semiconductor manufacturing; value-based procurement; multi-year partnerships with local vendors	Ontario Chamber of Commerce (letter to Minister Champagne)	2024-09-06	https://occ.ca/wp-content/uploads/ISED-AI-Compute-Consultation-Recommendations-from-the-OCC.pdf
Federal government	Consolidate the SCIP investment into one large GPU-intensive public supercomputer kept off foreign clouds	Digital Research Alliance of Canada	2025 to 2026	https://ai.alliancecan.ca/
Federal government	Combine centralized cloud subsidies, allied joint purchasing (EuroHPC model) and a $400 million to $1 billion domestic build	The Dais, Toronto Metropolitan University (Dobbs, Hirsch-Allen)	2024-03	https://dais.ca/reports/can-canada-compute/
Federal government	"Host extensively, control selectively, compete strategically, adopt aggressively"; be the demanding first customer for Canadian AI	The Hub (Pouya Daneshpajooh)	2026-08-14	https://thehub.ca/2026/08/14/canada-helped-build-modern-ai-data-centres-could-power-its-next-advantage/

STAKEHOLDER	RECOMMENDATION	WHO MADE IT	DATE	SOURCE
Federal government	Rewrite AI regulation to target frontier models rather than all "high-impact" uses; rely on existing consumer and privacy law for use-case harms	Macdonald-Laurier Institute (Ryan Khurana)	2025-01-02	https://macdonaldlaurier.ca/canada-has-a-nobel-prize-for-artificial-intelligence-but-our-ai-red-tape-will-strangle-us-ryan-khurana-in-the-globe-and-mail/
Federal government	Harmonized public investment aimed at competitive strengths; focus the AI Safety Institute on real-world risks; risk-based AI procurement; AI literacy in the national strategy	Deloitte Canada, "Building Canada's brightest AI future"	2025-03-25	https://www.deloitte.com/ca/en/about/press-room/canada-ai-future.html
Federal government	Expand the International Education Strategy into a talent, research and innovation strategy; align university research with AI, defence and sovereignty priorities	Universities Canada	2026-05-19	https://univcan.ca/news/universities-call-for-integrated-federal-action-to-strengthen-canadas-productivity-skills-and-sovereign-capability/
Provincial governments	Promote data-centre investment using regional advantages (Alberta power and cooling); manage environmental impacts; pool complementary AI resources across provinces	C.D. Howe Institute (Schwanen)	2026-04-15	as above
Provincial governments	Set clear frameworks for competing industrial loads; long-term energy plans; allocate more infrastructure cost to large users; enable direct power purchase agreements; prioritization frameworks for large connections	Canadian Climate Institute (Kate Harland)	2025-03-31	https://climateinstitute.ca/smart-way-integrate-artificial-intelligence-data-centres-canada-electricity-grids/
Provincial governments (Alberta)	Make large users pay the full cost of delivered energy; prioritize demand-side management; let data centres use wind, solar and storage alongside gas; redesign the bring-your-own-generation policy	Pembina Institute (David Pickup, Will Noel)	2026-08-26	https://www.pembina.org/pub/footing-bill
Provincial governments	Reserve dedicated energy blocks for public compute; manage expansion so electrification projects keep access	IRPP Policy Options (Beaumier, Cadieux)	2026-05-06	as above
Provincial governments (Alberta)	Accelerate project approvals and permitting for data centres, petrochemicals and carbon capture	Business Council of Alberta	2026-02-24	https://businesscouncilab.com/advocacy-category/alberta-budget-2026-three-things-were-looking-for/

STAKEHOLDER	RECOMMENDATION	WHO MADE IT	DATE	SOURCE
Provincial governments and utilities	Publish long-term cost forecasts; communicate capital needs; let rates rise gradually in real terms instead of shifting costs to taxpayers	C.D. Howe Institute (Cole Diepold)	2026-08-04	https://cdhowe.org/publication/canada-needs-a-bigger-grid-customers-need-an-honest-conversation/
Utilities and system operators	Design connection processes and rate structures that reward flexibility; use competitive allocation weighing alternative grid uses; build flexible grids rather than overbuilding	Canadian Climate Institute (Beugin, Harland)	2026-05-26	as above
Utilities and system operators	Approve only projects that let the grid absorb load without raising rates for surrounding communities	Kathleen Kauth (Mantle Climate) and Tyler Hamilton (MaRS) in The Globe and Mail	2026-08-27	https://www.theglobeandmail.com/business/commentary/article-canada-ai-data-centre-backlash-recommendations/
Municipalities	Negotiate grid upgrades, financial participation for residents, local startup and researcher access, apprenticeships, and noise mitigation	Kauth and Hamilton, The Globe and Mail	2026-08-27	as above
Municipalities	Pre-screen sites at the local or regional level for energy capacity and environmental assessment; run approvals in parallel	C.D. Howe Institute (Wyonch)	2026-04-09	as above
Municipalities and host communities	Negotiate local procurement, apprenticeships, waste-heat use; reserve compute capacity for local researchers and startups at predictable prices	The Hub (Daneshpajooh)	2026-08-14	as above
Indigenous communities	Federal preference for projects with Indigenous participation; equity partnerships in data centres	ISED (evaluation criteria for large-scale sovereign AI data centres); The Hub	2026-01-15; 2026-08-14	https://ised-isde.canada.ca/site/ised/en/enabling-large-scale-sovereign-ai-data-centres
Indigenous communities	Local Indigenous governance of clean-powered data-centre parks; procurement access for Indigenous-owned suppliers	IRPP Policy Options (Pasek et al.); Ontario Chamber of Commerce	2025-10-20; 2024-09-06	as above
Investors	Track Cohere, Bell AI Fabric, Telus and the Sovereign Cloud Consortium; treat the July 2026 CUSMA review and bank procurement decisions as market signals	RBC Thought Leadership	2026-06-10	as above

STAKEHOLDER	RECOMMENDATION	WHO MADE IT	DATE	SOURCE
Investors	Back proven Canadian firms committed to a long-term domestic presence rather than quick exits	RBC "Own the Stack" (John Stackhouse with Global Relay)	2026-06-30	https://www.rbc.com/en/thought-leadership/ai-technology-and-innovation/own-the-stack-canadas-data-sovereignty-test/
Investors and growth-capital providers	Condition capital on commercialization and Canadian scaling, but keep conditions light	C.D. Howe Institute (Naglie)	2026-06-10	as above
Investors	Close the research-to-company gap with dedicated funds such as the Mila and Inovia USD 100 million Venture Scientist Fund	Mila and Inovia (cited in AI for All)	2026-01	AI for All strategy
Operators and hyperscalers	Invest in renewables and storage; provide load flexibility at peak; locate on former industrial sites with existing grid capacity	Canadian Climate Institute (Beugin, Harland)	2026-05-26	as above
Operators and hyperscalers	Report annual water and energy use; manage water to local watersheds; create local jobs and procurement; support Canadian efficiency technologies	Kauth and Hamilton, The Globe and Mail	2026-08-27	as above
Operators and hyperscalers	Transparent pricing; access provisions for emerging competitors; no self-preferencing; documented interoperability	C.D. Howe Institute (Schwanen)	2026-04-15	as above
Operators and hyperscalers	Finance dedicated generation and transmission ("power comes first"); closed-loop cooling; transparent environmental standards	The Hub (Daneshpajooh)	2026-08-14	as above
Operators and hyperscalers	Projects over 100 MW judged on Canadian ownership and control, data residency, Canadian vendors, Indigenous participation and minimal environmental impact	ISED call for large-scale sovereign AI data centres	2026-01-15	as above
Universities	Host secure sovereign compute and data infrastructure; expand AI literacy; deliver the 90,000 student placements	Universities Canada	2026-06-04	https://univcan.ca/news/universities-canada-statement-on-release-of-the-national-ai-strategy/
Universities	Integrate AI across all disciplines, not just computer science	Public Policy Forum (Manjengwa)	2026-06-12	as above

STAKEHOLDER	RECOMMENDATION	WHO MADE IT	DATE	SOURCE
Universities and research institutions	Secure reasonable access to compute and data for academic and non-profit research; join public-private data infrastructure partnerships	C.D. Howe Institute (Wyonch)	2026-04-09	as above
Businesses that consume AI	Experiment despite pilot failures; redesign processes and business models around AI; invest in training and reorganization as complementary assets	C.D. Howe Institute (Wyonch)	2026-04-09	as above
Businesses that consume AI	Move from ambition to activation; redesign roles and workflows; cloud-native data platforms with privacy built in; broad workforce AI fluency	Deloitte Canada, State of AI in the Enterprise 2026 (175 Canadian executives)	2026	https://www.deloitte.com/ca/en/issues/generative-ai/state-of-ai-in-enterprise.html
Businesses that consume AI	Scenario-plan three CUSMA outcomes; split workloads between hyperscale and sovereign systems; treat model weights, datasets and AI talent as strategic assets; banks' procurement choices in the next 24 months decide the sovereign cloud market	RBC Thought Leadership	2026-06-10	as above
Businesses that consume AI	Adopt AI rather than protect legacy systems; invest in AI literacy to choose vendors confidently	C.D. Howe Institute (Schwanen)	2026-04-15	as above
Businesses and AI developers	Avoid partnerships that lock junior partners into proprietary APIs; judge partnerships by capability transferred, not deal size	C.D. Howe Institute (Schwanen; Naglie)	2026-04-15; 2026-06-10	as above

Contested or uncertain figures

- Canada's share of global compute. The 0.7 percent figure comes from the November 2023 TOP500 list (The Dais, March 2024), which counts publicly listed supercomputers and excludes most commercial cloud capacity. No official 2025 or 2026 update of Canada's share was found; ISED only states that Canada "lags all G7 nations" in high-performance computing. A search result attributed a "19 of the top 500 supercomputers" count to a June 2026 C.D. Howe piece, but that figure could not be verified in the memo retrieved.
- Composite rankings disagree. Canada is 10th in Stanford's 2025 Global AI Vibrancy Tool and 8th in Tortoise's September 2024 index (no 2025 Tortoise edition was found as of September 2026). Deloitte's "dropped from 4th to 8th" statement refers to the Tortoise index.
- Cohere's value. The USD 20 billion combined valuation reported for the Cohere and Aleph Alpha merger (April 2026) is a deal-announcement figure; the Schwarz-led Series E was described as expected to close

within months and no closing confirmation was found by September 2, 2026.

- Tenstorrent. The USD 8 billion to 10 billion Qualcomm acquisition talks (Reuters citing The Information, June 15, 2026) and the earlier Fidelity-led round talks (November 2025) are reports, not closed transactions.
- Global Impact+ funding. Nature and the New York Times reported "more than $364 million" for the recruitment of 64 scholars; BetaKit reported $504 million over eight years from the $1.7 billion Budget 2025 initiative. The difference likely reflects different scopes (chair funding alone versus chairs plus infrastructure), but this was not confirmed.
- Venture capital baselines. CVCA's own H1 2025 report said $2.9 billion across 254 deals; the August 2026 Financial Post summary of CVCA's H1 2026 data compared against a revised H1 2025 base of $2.3 billion across 274 deals. Growth rates depend on which base is used.
- The "nearly 70 percent of Canadian-led startups headquartered outside Canada" claim appears in the AI for All strategy without a cited methodology in the passage retrieved.
- Brain drain measures conflict. Stanford's Zeki-based net flow of AI authors and inventors is negative for Canada in 2025 (minus 7.1), while the LinkedIn-based net AI talent migration in the same report is slightly positive (plus 1.23 per 10,000 members). The two datasets track different populations.
- Data-centre counts range from 239 (Canada Energy Regulator, 2024) to 283 (BetaKit, 2025), 285 (Policy Options, 2026), about 300 (RBC, 2026) and 337 (Cloudscene in the 2026 AI Index). Definitions differ.
- Microsoft's $19 billion is a company statement covering broad 2023 to 2027 spending, not a verified capital-expenditure figure.
- Business AI adoption: the AI for All strategy uses 12 percent (mid-2024 to mid-2025); The Hub cites Statistics Canada at 19.2 percent for the second quarter of 2026. Both can be true because the survey question changed timing, but the 19.2 percent figure was not verified against the Statistics Canada release.
- Specific recommendations from the Business Council of Canada, the Fraser Institute, McKinsey Canada and the Conseil du patronat du Québec on data centres could not be located in 2025 to 2026 publications accessible during this research; their websites either returned no matching results or blocked automated access.

Open questions students could investigate

1. If Canada needs 5.5 GW of AI compute by 2030 and sovereign projects supply at most 2.3 GW, what ownership and contract structures (sovereign landing zones, Canadian-controlled tenancy, CLOUD Act carve-outs) would make hyperscaler capacity "sovereign enough" for banks, hospitals and governments?
2. Why do CPP Investments, Brookfield and other Canadian institutions deploy most of their data-centre capital abroad, and what would a Canadian project need (power, permits, tenant credit, returns) to compete for that capital?
3. Which Alberta, British Columbia, Quebec or Ontario grid policy (bring-your-own-generation, hydro allocation, connection caps, differentiated tariffs) produces the best trade-off between attracting investment and protecting ratepayers?
4. What is the true employment multiplier of a 100 MW AI data centre in Canada across construction, trades, operations and professional services, and how does it compare with a petrochemical or LNG project of similar capital cost?
5. Why do nearly 70 percent of Canadian-led startups end up headquartered abroad, and which levers (capital gains treatment such as a QSBS-style incentive, anchor procurement, growth funds like the $500 million

Tech Growth Fund) would change founder decisions?

6. Can Cohere remain a Canadian-headquartered frontier company after merging with Aleph Alpha, and what does its dependence on CoreWeave, Nvidia and now Schwarz Group imply for "sovereign AI" as a business model?
7. How should the public supercomputer under the AI Sovereign Compute Infrastructure Program be governed and refreshed so that it does not become obsolete within a GPU generation, as C.D. Howe warns?
8. What would it take to lift Canadian business AI adoption from 12 percent to the 60 percent target by 2034, and which sectors (finance, health, energy, manufacturing) offer the largest productivity gains per dollar of compute?
9. Is Canada's talent balance actually negative? Reconcile the Zeki-based outflow with LinkedIn's positive migration index and design a better indicator.
10. How should municipalities and Indigenous communities negotiate equity, waste heat, apprenticeships and compute access in host agreements, and what precedents exist in Canada or abroad?

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11

CHAPTER 11

The money: what a campus costs, who finances it, and who gets hired

A two hundred megawatt campus is roughly an eight billion dollar decision, and only about a third of that is the building. This chapter takes the decision apart: the capital stack, the operating economics, the financing, and the jobs it creates for people with a business degree rather than an engineering one.

US$14M + US$25M Capital cost per megawatt: the building and its power on one side, the chips inside on the other. The chips are two thirds of the money and depreciate four times faster.

WHAT THIS CHAPTER ANSWERS

- ? What does a campus actually cost, and where does the money go?
- ? How do the economics change between Quebec, Alberta and Virginia?
- ? Who is lending, and what happens if the demand does not arrive?
- ? Which roles does this build-out create for business graduates in Canada?

KEY TAKEAWAYS

- Building the shell, power and cooling of a data centre cost about US$10.7 million per megawatt (MW) of IT load in 2025 and is forecast at US$11.3 million per MW in 2026 (JLL, January 2026); Cushman & Wakefield's August 2026 cost guide puts the average modern greenfield build at US$17.6 million per MW, up 21% since its previous guide. Fitting the halls with AI servers adds up to US$25 million per MW (JLL 2026), so a fully equipped AI campus runs at roughly US$35-40 million per MW; Epoch AI's campus-level estimates work out to about US$37.9 million per MW (updated September 2026).

- Chips, not concrete, dominate the bill. The International Energy Agency (IEA, April 2025) expects accelerated servers to reach 45% of global data-centre investment by 2030 (from 10% in 2015), and Epoch AI (May 2026) estimates servers are about 60% of the total cost of ownership of a one-gigawatt AI data centre. IT equipment can be obsolete four to six years after installation, versus about 30 years for a transformer (IEA 2025).
- Capital is flowing at a scale with few precedents: the four largest hyperscalers plan about US$760 billion of capital spending in 2026 (Amazon US$220 billion, Alphabet US$195-205 billion, Microsoft about US$190 billion, Meta up to US$145 billion; Storyboard18, August 2026). JLL estimates US$3 trillion, including about US$870 billion of debt, is needed for 100 GW of new capacity by 2030, and the IEA projects US$4.2 trillion of cumulative data-centre investment over 2025-2030.
- Revenue benchmarks: retail colocation averaged US$184.06 per kW per month across North American primary markets in H2 2024, up 12.6% year on year (CBRE, February 2025); Northern Virginia pricing rose about 15% in the year to Q1 2025 (CBRE Global Data Center Trends, June 2025). A June 2026 take-or-pay hyperscale lease (Applied Digital, 210 MW, at least US$5.2 billion over 15 years) implies about US$138 per kW per month. AI cloud contracts signed by Nebius in Q2 2026 carry annual contract value above US$20 million per MW (Nebius, August 2026).
- GPU (graphics processing unit) rental prices fell and then firmed. AWS cut the list price of its eight-GPU H100 instance (p5.48xlarge, US East) by 44% on 5 June 2025, from US$98.32 to US$55.04 per hour (SkyPilot catalog); the market median for an H100 was about US$2.45-3.00 per GPU-hour in mid-2026 with lows near US$1.25 (computeprices.com, 2 September 2026). But Lambda raised its H100 list price from US$2.49 to US$3.29 per hour between February and April 2026, and Nebius reported a 15% price increase after a capacity auction (August 2026), as memory shortages tightened supply.
- Electricity is the largest operating line for a facility owner but a small share of an AI cloud's revenue. At Hydro-Québec's 2025 large-power average (5.83 cents CAD per kWh, about 4.1 US cents) a 200 MW AI campus pays about US$79 million a year for power; in Calgary (8.02 cents CAD, 5.6 US cents) about US$108 million; in Virginia (9.45 US cents industrial average, EIA 2025) about US$183 million. The Quebec-Virginia gap, about US$104 million a year, is worth roughly US$43 per kW per month, close to a third of a hyperscale rent.
- Financing has moved off corporate balance sheets into project structures. Meta's US$27 billion Hyperion campus in Louisiana is 80% owned by funds managed by Blue Owl, with Meta as a 20% partner and tenant that has provided US$28 billion of residual value guarantees (Meta 10-K, January 2026). Nvidia has enlisted Apollo, BlackRock, Blackstone, Brookfield, Goldman Sachs and KKR to mobilise over US$500 billion of third-party capital (August 2026). GPU-backed loans (CoreWeave US$3.1 billion, IREN US$3.65 billion, GMI Cloud US$947 million) and record convertible issuance (US$186.8 billion year to date by 1 September 2026, about 60% AI-related according to Barclays) have become routine.
- The risks are real and are starting to be priced. Nine technology companies carry about US$3 trillion of off-balance-sheet AI obligations (Wall Street Journal analysis, August 2026). Meta lengthened the useful lives of most servers to 5.5 years in January 2025, lifting nine-month 2025 net income by US$1.96 billion (Meta 10-Q, October 2025); this kind of accounting choice is at the centre of Michael Burry's late-2025 depreciation critique. CoreWeave drew 62% of 2024 revenue from Microsoft (S-1, March 2025). Texas froze new data-centre grid connections in September 2026 after its interconnection queue passed 474 GW.
- For Canada and for Sauder graduates: Alberta's grid operator had more than 16 GW of data-centre connection applications against a 12 GW peak load (AESO, June 2025); Meta is building a 1 GW, C$13 billion-plus campus in Sturgeon County with a 250 MW supply agreement from Capital Power (July 2026); Bell added C$1.3 billion of 2026 capex mainly for a 300 MW AI Fabric site in Saskatchewan; eStruxture, Vantage and QScale are expanding; and AI labs are hiring business-side roles in Canada (Anthropic's "Canadian Compute Lead" covers site selection, financing and government relations; OpenAI is hiring a power-trading lead). Uptime Institute's 2025 survey found 46% of operators struggle to find qualified candidates and 39% report a skills gap in operations management.

Narrative

A data centre is a power plant in reverse. The economics start from a single number, the megawatt of critical IT load, and almost every cost and revenue line is quoted per MW or per kW. In 2025 the shell, electrical and mechanical systems cost about US$10.7 million per MW on JLL's global measure, rising to US$11.3 million in 2026, while Cushman & Wakefield's 2026 cost guide, which reflects denser, liquid-cooled halls, puts the average modern greenfield build at US$17.6 million per MW, 21% above its previous guide. That is only the building. Filling the halls with AI servers adds up to US$25 million per MW (JLL), so the all-in cost of a frontier campus is about US$35-40 million per MW; Epoch AI's estimates for named campuses such as Meta's Prometheus (562 MW, US$21.3 billion) cluster near US$37.9 million per MW. The IEA's decomposition explains why: accelerated servers were 10% of global data-centre investment in 2015 and will be 45% by 2030, and IT equipment is written off over four to six years while a transformer lasts thirty.

Operating costs follow the same logic. Electricity is the largest line for whoever runs the building, and the sector's average PUE of 1.54 (Uptime 2025) means that for every kWh a server uses, another half is spent on cooling and distribution; Goldman Sachs estimates cooling alone is 35-40% of a hyperscaler's energy use. New Canadian builds can reach a PUE of 1.3 or better because of the climate. Staffing is the next line, and it is constrained: 46% of operators cannot find qualified candidates and the biggest skills gap has shifted to operations management (Uptime 2025). Maintenance and refresh of IT equipment is the third, and it is where the depreciation debate lives.

Revenue comes in three models. Retail colocation sells space and power by the kW; CBRE's North American average was US$184 per kW per month in H2 2024, up 12.6% in a year, with Northern Virginia up 15% by Q1 2025 and vacancy below 1%. Wholesale or hyperscale leasing sells whole halls on long take-or-pay leases; Applied Digital's June 2026 lease of 210 MW to an investment-grade hyperscaler for at least US$5.2 billion over 15 years works out to about US$138 per kW per month, and Digital Realty reported cash renewal spreads of 25% and stabilised yields above 10% in Q2 2026. GPU-as-a-service, the "neocloud" model of CoreWeave, Nebius and Lambda, sells compute by the GPU-hour or by contracted MW. Its prices fell hard in 2024-25, with AWS cutting its H100 instance list price by 44% in June 2025 and the market median settling near US$2.50-3.00 per H100-hour, but 2026 brought a rebound as memory shortages and Blackwell demand tightened supply: Lambda raised its H100 list price to US$3.29 in April 2026, Nebius reported a 15% increase after auctioning capacity, and new Nebius contracts carry annual value above US$20 million per MW. The sovereign-cloud variant, in which a national telecom or operator sells "Canadian-controlled" capacity to governments and regulated industries, is now visible in Bell's AI Fabric (a 300 MW Saskatchewan site, C$1.3 billion of extra 2026 capex, and a C$220 million three-year contract with BUZZ HPC to serve Cohere) and TELUS's Kamloops AI data centre.

Who pays for all this? Increasingly not the hyperscalers' balance sheets. The four largest plan about US$760 billion of capital spending in 2026, and they have pushed a further US$1.09 trillion of future lease commitments and roughly US$3 trillion of purchase commitments and unstarted leases off their balance sheets (Reuters and the Wall Street Journal, August 2026). The template is Meta's Hyperion campus: a US$27 billion joint venture in which Blue Owl funds own 80%, Meta owns 20%, leases the buildings from 2029 and backstops the lenders with US$28 billion of residual value guarantees. Around that core sits a market of specialist capital: the

Microsoft-BlackRock-GIP-MGX partnership that set out in 2024 to raise US$30 billion of equity and US$100 billion with debt, and that bought Aligned Data Centers for about US$40 billion in 2025; Nvidia's August 2026 alliance with Apollo, BlackRock, Blackstone, Brookfield, Goldman Sachs and KKR to mobilise over US$500 billion; KKR's Helix venture with the Kuwait Investment Authority, Nvidia and Vistra; Brookfield's record fundraising and its US$5 billion Bloom Energy commitment; and Canadian pension capital, with CPP Investments taking 51% of atNorth for US$1.3 billion in September 2026. Debt has followed: data-centre CMBS of about US$4.5 billion in Q1 2025 alone, GPU-backed loans from CoreWeave (US$3.1 billion) to GMI Cloud (US$947 million), Nebius's first secured facility and US$5.75 billion of converts, and a global convertible market that Barclays says is 60% AI-related. JLL's estimate that 100 GW of new capacity needs US$3 trillion, including US$870 billion of debt, is the scale to keep in mind.

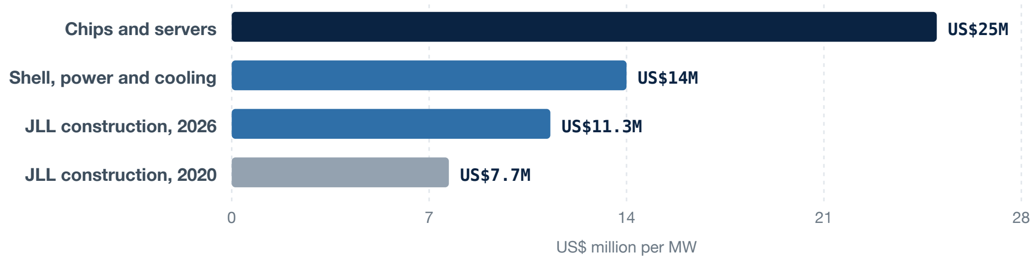
The risks are of four kinds, and each is now observable rather than hypothetical. Obsolescence: Meta extended the useful lives of most servers to 5.5 years from January 2025, which lowered nine-month 2025 depreciation by US$2.29 billion, and the IEA's four-to-six-year obsolescence window is the counterargument that Michael Burry made loudly in November 2025 before deregistering his fund and shorting Nvidia, Palantir, Oracle and Nebius. Utilisation and pricing: CoreWeave's Q2 2026 adjusted operating margin was 5% despite revenue doubling, and Meta's July 2026 plan to sell its surplus compute knocked neocloud shares. Concentration: Microsoft was 62% of CoreWeave's 2024 revenue, and neocloud backlogs (CoreWeave US$104 billion, Nebius up to US$27 billion from Meta alone) depend on a handful of counterparties. Circularity: Nvidia invests in OpenAI and Anthropic, guarantees up to US$108.5 billion of obligations and extends payment terms to customers who buy its chips; AMD issued OpenAI and Meta warrants for 160 million shares each tied to GPU purchases; Oracle's remaining performance obligations jumped from US$138 billion to US$638 billion in a year on contracts with OpenAI; and lenders have begun demanding wider spreads on data-centre bonds, as the CyrusOne and QTS CMBS deals showed in August 2026. Power-price and political risk complete the list: Alberta's all-in large-power price swung from 23.8 cents CAD in 2023 to 8.0 cents in 2025, Texas froze new data-centre grid connections in September 2026 after its queue reached 474 GW, and US midterm campaigns spent US$31 million on ads, 99% against data centres.

For Canada the numbers cut both ways. Montréal's large-power price of 5.83 cents CAD (about 4.1 US cents) is less than half Virginia's 9.45 US cents, worth about US$104 million a year on a 200 MW campus, and Alberta's 2025 price of 8.02 cents CAD is competitive too. But Alberta's queue of more than 16 GW of applications against a 12 GW peak, Hydro-Québec's rationing of large blocks, and the political questions raised at Alberta's August 2026 town halls show that speed to power and social licence, not tariffs, decide where the capital lands. Meta's 1 GW, C$13 billion-plus Sturgeon County campus with 250 MW from Capital Power, CoreWeave anchoring eStruxture's CAL-3 in Calgary, Goldman Sachs Alternatives buying QScale in Lévis, and Anthropic advertising a Canadian compute lead are the early evidence that Canada is on the map.

For a Sauder graduate the practical lesson is that this is an infrastructure business wrapped around a technology business. The roles that are opening are the ones that sit at the seams: financing structures that reconcile 30-year buildings with five-year chips; power procurement that turns a volatile pool price into a bankable contract; site selection and government relations that convert a queue position into a connection date; procurement that manages 18-month transformer lead times; and analytics that forecast load and utilisation. None of these require an engineering degree, but all of them require the ability to read a tariff sheet, a lease and a GPU spec sheet in the same afternoon, and to be honest about which numbers are contested.

FIGURE 11.1

Capital cost per megawatt (US$ million)

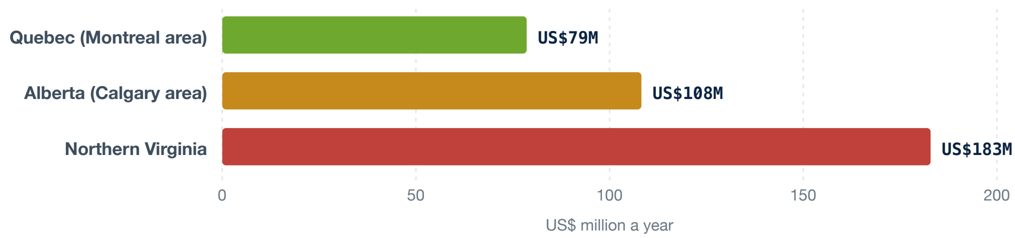


Nearly two thirds of the money is the computers, not the building. The chips depreciate over three to five years and the building lasts twenty. That mismatch is the largest open argument in artificial intelligence infrastructure finance.

Source: JLL *Global Data Center Outlook*; Cushman and Wakefield; Encor Advisors.

FIGURE 11.2

Annual electricity bill for the same 200 MW campus



Running the identical campus in Quebec rather than Northern Virginia saves about a hundred and four million United States dollars every year. Over a fifteen-year lease that is more than the cost of the building.

Source: Hydro-Québec price comparison (2025); United States Energy Information Administration, Table 5.6.A.

The picture in numbers

A. Capital and operating cost benchmarks

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Data-centre construction cost (shell, power, cooling)	10.7 (2025), 11.3 (2026 forecast), 7.7 (2020)	US$ million per MW	2025-2026	Global	JLL, 2026 Global Data Center Outlook, 5 Jan 2026, https://www.jll.com/en-us/insights/global-data-center-outlook
Technology fit-out for AI (servers, GPUs, networking)	up to 25	US$ million per MW	2026	Global	JLL, 2026 Global Data Center Outlook
Average greenfield development cost, modern facility	17.6 (up 21% versus prior guide)	US$ million per MW	2026	US-led global sample	Cushman & Wakefield, 2026 Data Center Development Cost Guide, Aug 2026, https://www.cushmanwakefield.com/en/united-states/insights/data-center-development-cost-guide

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Construction plus installations, non-IT	6,000 to over 10,000	US$ per kW of IT load	2024	Emerging markets to advanced economies	IEA, Energy and AI, Apr 2025 (citing Turner & Townsend 2024), https://www.iea.org/reports/energy-and-ai
All-in cost of large AI campuses (facility plus chips), for example Meta Prometheus 562 MW at US$21.3 billion	about 37.9	US$ million per MW	2025 dollars, updated 1 Sep 2026	US	Epoch AI, Frontier Data Centers hub, https://epoch.ai/data/data-centers
Share of servers in total cost of ownership of a 1 GW AI data centre	about 60	%	May 2026	Global	Epoch AI data insight, 14 May 2026, via https://epoch.ai/data/data-centers
Accelerated servers as share of global data-centre investment	10 (2015) rising to 45 (2030)	%	2015-2030	Global	IEA, Energy and AI, Apr 2025
Global annual data-centre investment	over 500 (2024), over 800 per year before 2030; 4,200 cumulative 2025-2030	US$ billion	2024-2030	Global	IEA, Energy and AI, Apr 2025
Neocloud capex intensity (Nebius 2026 plan)	20-25 billion for 800-1,000 MW, about 20-31	US$ million per MW	2026	Global	Nebius Q2 2026 results, 12 Aug 2026, via The Register, https://www.theregister.com/off-prem/2026/08/12/rent-a-gpu-outfit-nebius-promises-rapid-1-gw-powerup-plan-isnt-nebulous/5287086
Useful life of IT equipment versus transformer	4-6 years versus about 30 years	years	2025	Global	IEA, Energy and AI, Apr 2025
Meta's estimated useful life of most servers and network assets	5.5 (raised from prior estimate, effective 1 Jan 2025); nine-month 2025 depreciation lower by US$2.29 billion	years	2025	US	Meta 10-Q for Q3 2025, 30 Oct 2025, https://investor.atmeta.com
Weighted average power usage effectiveness (PUE)	1.54 overall; 1.44 for sites of 20 MW and above; 15% of respondents at 1.3 or better	ratio	2025	Global survey	Uptime Institute Global Data Center Survey 2025, https://uptimeinstitute.com/resources/research-and-reports/uptime-institute-global-data-center-survey-results-2025
Cooling share of a hyperscaler's energy use	35-40	%	2025	Global	Goldman Sachs Research, 4 Feb 2025, https://www.goldmansachs.com/insights/articles/ai-to-drive-165-increase-in-data-center-power-demand-by-2030
Data-centre power demand	55 GW (2025 estimate), 84 GW (2027), 122 GW (2030), a 165% rise versus 2023	GW	2025-2030	Global	Goldman Sachs Research, 4 Feb 2025

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Grid investment needed for data centres	about 720	US$ billion through 2030	2025	Global	Goldman Sachs Research, 4 Feb 2025
Hydro-Québec Rate L (large-power industrial, minimum 5,000 kW)	15.027 per kW of billing demand per month plus 3.821 cents per kWh	CAD	effective 1 Apr 2026	Quebec	Hydro-Québec, 2026 Electricity Rates, https://www.hydro-quebec.com/data/documents-donnees/pdf/electricity-rates.pdf
Average all-in price, large-power customer (5,000 kW, 3.06 GWh per month), excluding taxes	Montréal 5.83; Winnipeg 6.00; Calgary 8.02; Vancouver 8.42; Edmonton 10.17; Toronto 12.80; Seattle 13.31; Houston 14.35; New York 22.90; Boston 28.19	cents CAD per kWh	rates in effect 1 Apr 2025	North American cities	Hydro-Québec, Comparison of Electricity Prices in Major North American Cities 2025, https://www.hydroquebec.com/data/documents-donnees/pdf/comparison-electricity-prices.pdf
Calgary large-power price history	10.25 (2021), 13.16 (2022), 23.77 (2023), 10.46 (2024), 8.02 (2025)	cents CAD per kWh	2021-2025	Alberta	Hydro-Québec comparison 2025
Alberta average pool price	43.68 (2025), down 30.4% from 62.78 (2024), lowest in eight years	CAD per MWh	2025	Alberta	AESO, 2025 Annual Market Statistics, 13 Mar 2026, https://www.aeso.ca/market/market-and-system-reporting/annual-market-statistic-reports
Virginia industrial electricity price	9.45 (2025 average of monthly values); 10.09 (Jan-Jun 2026 average); 9.31 (Jun 2026)	US cents per kWh	2025-2026	Virginia	EIA Electric Power Monthly, Table 5.6.A, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a
US industrial electricity price	8.61 (2025 average); 9.17 (Jun 2026)	US cents per kWh	2025-2026	US	EIA Electric Power Monthly, Table 5.6.A

B. Pricing and revenue benchmarks

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Average asking colocation rate, 250-500 kW requirements	184.06, up 12.6% year on year	US$ per kW per month	H2 2024	North America primary markets	CBRE, North America Data Center Trends H2 2024, 26 Feb 2025, https://www.cbre.com/insights/reports/north-america-data-center-trends-h2-2024
Colocation pricing change	+2.5% for 250-500 kW; up to +19% for 10 MW-plus deals (Northern Virginia +13.8%, Silicon Valley +19%, Chicago +15.4%)	%	H1 2025	North America	CBRE, North America Data Center Trends H1 2025, 8 Sep 2025, https://www.cbre.com/insights/reports/north-america-data-center-trends-h1-2025
Vacancy and construction	vacancy 1.6%; 5,242.5 MW under construction, 74.3% preleased; supply 8,155 MW (+43.4% year on year)	MW, %	H1 2025	North America primary markets	CBRE H1 2025

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
Colocation pricing by market	Northern Virginia +15% year on year (vacancy 0.76%); Phoenix about 190; London 180-215; Singapore 310-470; Tokyo 190-355	US$ per kW per month	Q1 2025	Global	CBRE, Global Data Center Trends 2025, 24 Jun 2025, https://www.cbre.com/insights/reports/global-data-center-trends-2025
Hyperscale take-or-pay lease (Applied Digital, 210 MW, 15-year base term, investment-grade tenant)	at least 5.2 billion over 15 years, about 347 million a year, about 138 per kW per month; 12.7 billion if 30-year renewals exercised	US$	Jun 2026	US	Sherwood News, 9 Jun 2026, https://sherwood.news/markets/applied-digital-leaps-on-5-2-billion-deal-with-undisclosed-us-hyperscaler/
Digital Realty renewal rent growth	+25.4% cash, +32.0% GAAP; stabilised development yields 10%-plus; record bookings US$307 million annualised (129.8 MW)	%	Q2 2026	Global	Digital Realty Q2 2026 results, 23 Jul 2026, https://www.globenewswire.com/news-release/2026/07/23/3332571/0/en/digital-realty-reports-second-quarter-2026-results.html
AI cloud contract value (Nebius, contracts signed Q2 2026)	above 20 million per MW per year (20-25 million for medium-term leases; 40-50 million for short-term leases up to six months)	US$ per MW per year	Aug 2026	Global	Nebius Q2 2026 call, via The Register (12 Aug 2026) and Sina Finance (12 Aug 2026)
Nebius-Microsoft dedicated capacity contract	up to 17.4 billion over five years, with about 6.96 billion of upfront payments	US$	Sep 2025	New Jersey, US	Nebius 20-F for 2025, 30 Apr 2026, https://nebius.com/newsroom
Nebius-Meta contracts	2.9 billion (Nov 2025); up to about 27 billion (Mar 2026: 12 billion of dedicated clusters plus up to 15 billion for unsold capacity)	US$	2025-2026	Global	Nebius 20-F for 2025
AWS on-demand list price, p5.48xlarge (8 x H100), US East	98.32 to 55.04 per instance-hour (about 12.29 to 6.88 per GPU-hour), a 44% cut	US$ per hour	5 Jun 2025	US	SkyPilot catalog price history, https://github.com/skypilot-org/skypilot-catalog
Lambda on-demand list price, 1 x H100 PCIe	1.99 (2023-24); 2.49 (Feb 2024 to Feb 2026); 2.86 (Feb 2026); 3.29 (Apr 2026 onward)	US$ per GPU-hour	2023-2026	US	SkyPilot catalog price history
Market H100 rental price, 51 providers	lowest 1.25; median about 2.45-2.50; Google Cloud 4.86; Azure 11.06	US$ per GPU-hour	2 Sep 2026	Global	computeprices.com, https://computeprices.com/gpus/h100
Market median on-demand price, single GPU	H100 2.69 (May 2026) to 2.99 (Aug-Sep 2026); H200 3.49 to 3.99; B200 5.83 to 6.23	US$ per GPU-hour	May-Sep 2026	Global	computeprices daily offers (97,155 observations from 25 May 2026), via Drillr data tables
Neocloud price change after capacity auction	+15%	%	Aug 2026	Global	Nebius, via Benzinga, 13 Aug 2026

METRIC	VALUE	UNIT	YEAR	REGION	SOURCE
CoreWeave revenue and backlog	Q2 2026 revenue 2.575 billion (versus 1.212 billion a year earlier); remaining performance obligations 103.7 billion at 30 Jun 2026; 2026 revenue guidance 12.4-13.2 billion; 2026 capex 35-39 billion; power in use above 1.85 GW by year-end	US$	Aug 2026	Global	CoreWeave 10-Q and 8-K, 11-12 Aug 2026, https://investors.coreweave.com
CoreWeave cash payback on GPU investments (company claim)	about 2.5 years including customer prepayments	years	Mar 2025	Global	CoreWeave S-1/A, 20 Mar 2025

C. Financing volumes and structures

DEAL OR METRIC	VALUE	UNIT	DATE	SOURCE
Global AI Infrastructure Investment Partnership (BlackRock, GIP, Microsoft, MGX; Nvidia supporting)	30 billion of equity sought; up to 100 billion with debt	US$	17 Sep 2024	Microsoft news release, https://news.microsoft.com/2024/09/17/blackrock-global-infrastructure-partners-microsoft-and-mgx-launch-new-ai-partnership-to-invest-in-data-centers-and-supporting-power-infrastructure/
Acquisition of Aligned Data Centers by GIP, the AI Infrastructure Partnership and MGX	about 40 billion; completed July 2026 with a further 5 billion of growth capital	US$	Oct 2025	Wikipedia, Global Infrastructure Partners, https://en.wikipedia.org/wiki/Global_Infrastructure_Partners
Blackstone acquisition of AirTrunk (3 GW-plus platform, Asia-Pacific)	24 billion AUD (about 16 billion USD)	AUD	2024	Wikipedia, AirTrunk, https://en.wikipedia.org/wiki/AirTrunk
CPP Investments and Equinix acquisition of atNorth (Nordics)	4 billion; CPP Investments 51% (1.3 billion), Equinix 34% (895 million), Partners Group 10%	US$	2 Sep 2026	PR Newswire, https://www.prnewswire.com/news-releases/cpp-investments-and-equinix-complete-atnorth-acquisition-to-support-growth-of-leading-nordic-data-center-platform-302867672.html
Digital Realty purchase of Blackstone's interest in three Northern Virginia data centres	3.5 billion (plus a 2.346 billion secondary share sale by Blackstone)	US$	29 Jun 2026	GlobeNewswire, https://www.globenewswire.com/news-release/2026/06/29/3319286/0/en/Digital-Realty-Announces-Purchase-of-Blackstone-Interest-in-Three-Northern-Virginia-Data-Centers.html
Meta Hyperion joint venture (Louisiana)	about 27 billion of development cost; Meta 20% and Blue Owl funds 80%; Meta lease commitment 12.31 billion from 2029; residual value guarantees up to 28 billion; Meta maximum exposure 45.95 billion	US$	Oct 2025 (10-K of 29 Jan 2026)	Meta 10-K FY2025, https://investor.atmeta.com

DEAL OR METRIC	VALUE	UNIT	DATE	SOURCE
Meta data-centre project debt	12.5 billion priced at a higher rate than a similar 2025 deal; BlackRock-led financing of about 12-14 billion	US$	24-28 Jul 2026	Wall Street Journal, https://www.wsj.com/finance/the-price-to-finance-the-ai-data-center-boom-is-rising-just-ask-meta-7894d503 ; Financial Times, 24 Jul 2026
Nvidia financing platforms with Apollo, BlackRock, Blackstone, Brookfield, Goldman Sachs and KKR	target of over 500 billion of third-party capital	US$	10 Aug 2026	PYMNTS, https://www.pymnts.com/news/artificial-intelligence/2026/goldman-sachs-mobilizes-investors-for-nvidias-500-billion-ai-infrastructure-push/
Nvidia agreements with AI cloud providers and guarantees	36 billion of agreements; guarantees of up to 108.5 billion; equity holdings 95.6 billion	US$	26 Aug 2026	Nvidia disclosures via AOL/Bloomberg summary, https://www.aol.com/articles/nvidia-looking-more-central-bank-213156000.html
Apollo and Blackstone debt package for Anthropic's chip capacity (Broadcom-backed)	35 billion	US$	5 Jun 2026	Bloomberg, https://www.bloomberg.com/news/articles/2026-06-05/apollo-wraps-up-35-billion-debt-to-buy-ai-chips-for-anthropic
KKR, Kuwait Investment Authority, Nvidia and Vistra launch Helix Digital Infrastructure	over 10 billion committed	US$	11 Jun 2026	Company release via news index
Brookfield commitments	up to 5 billion for Bloom Energy fuel cells at AI data centres (3 Jun 2026); 605 million debt led by Brookfield for 5C Group AI campuses (10 Aug 2026); record fundraising year driven by AI and infrastructure (5 Aug 2026)	US$	2026	Bloomberg, PR Newswire, https://www.prnewswire.com/news-releases/5c-secures-more-than-usd-1-4-billion-to-power-north-americas-ai-infrastructure-302847289.html
GPU-backed and neocloud debt	CoreWeave 3.1 billion GPU-backed loan (Jul 2026) and over 20 billion of 2026 financing; IREN 3.65 billion investment-grade GPU facility and 2.4 billion Blue Owl-led loan (Aug 2026); Lambda 1 billion (Aug 2026); GMI Cloud 947 million (Sep 2026); Nebius 775 million first secured facility (Jul 2026) and 5.75 billion convertible notes (Aug 2026)	US$	2026	Company releases via news index; Nebius newsroom
Big Tech future lease commitments for data centres (Microsoft, Meta, Oracle, Amazon, Alphabet)	about 1.09 trillion	US$	4 Aug 2026	Reuters, https://www.reuters.com/business/retail-consumer/ai-data-centre-race-builds-1-trillion-lease-burden-big-tech-2026-08-04/

DEAL OR METRIC	VALUE	UNIT	DATE	SOURCE
Off-balance-sheet AI obligations of nine tech companies	about 3 trillion (1.9 trillion purchase commitments plus 1.2 trillion of unstarted leases)	US$	filings to Jun 2026	Wall Street Journal analysis via Yahoo Finance, https://finance.yahoo.com/markets/stocks/articles/alphabet-meta-microsoft-hiding-3-135343885.html
Oracle remaining performance obligations	638 billion at 31 May 2026 versus 138 billion a year earlier	US$	Jun 2026	Oracle 10-K FY2026, 22 Jun 2026
AMD warrants to OpenAI and Meta (up to 160 million shares each at US$0.01, vesting with up to 6 GW of GPU deployments)	none vested as of 27 Jun 2026	shares	Oct 2025 and Feb 2026	AMD 10-K FY2025 and 10-Q Q2 2026
Data-centre CMBS issuance	about 4.5 billion in Q1 2025; in Aug 2026 CyrusOne and QTS deals had to widen pricing as risk premiums rose	US$	2025-2026	CBRE H1 2025; Bloomberg Law, 6 Aug 2026, https://news.bloomberglaw.com/capital-markets/cmbs-investors-push-back-against-ai-as-luddite-trade-spreads
Debt required for 100 GW of new capacity by 2030	about 870 billion of a 3 trillion total	US$	Jan 2026	JLL 2026 Global Data Center Outlook
Global convertible bond issuance	186.8 billion year to date (362 deals), about 60% AI-related	US$	1 Sep 2026	Dealogic and Barclays via Axios, https://www.axios.com/2026/09/02/ai-nvidia-zero-bonds
Green financing example	AirTrunk JPY 191.6 billion (US$1.24 billion) green loan for TOK1	JPY	Mar 2026	Wikipedia, AirTrunk
Canadian bank syndicate on Brookfield Infrastructure preferred units (Scotiabank, BMO, CIBC, National Bank, RBC, TD)	100 million	CAD	20 Aug 2026	GlobeNewswire, https://www.globenewswire.com/news-release/2026/08/20/3348425/0/en/brookfield-infrastructure-to-issue-100-million-of-preferred-units.html

D. Valuations (market data as of 2 September 2026 unless noted)

Equinix (EQIX)

MARKET CAP (US$ BILLION)	ENTERPRISE VALUE (US$ BILLION)
99.2	120.3
EV/EBITDA TRAILING	**EV/EBITDA FORWARD**
26.8x	23.7x
NOTE	**SOURCE**
Q2 2026 MRR +11%, AFFO per share +18%; 282 data centres; 2026 revenue growth guided 11-12%	Drillr company snapshot; Equinix IR, https://investor.equinix.com

Digital Realty (DLR)

MARKET CAP (US$ BILLION)	ENTERPRISE VALUE (US$ BILLION)
62.2	81.4
EV/EBITDA TRAILING	EV/EBITDA FORWARD
23.9x	23.1x
NOTE	SOURCE
Q2 2026 revenue US$1.9 billion (+29%), adjusted EBITDA US$978 million	Drillr snapshot; Digital Realty Q2 2026

CoreWeave (CRWV)

MARKET CAP (US$ BILLION)	ENTERPRISE VALUE (US$ BILLION)
44.2	89.4
EV/EBITDA TRAILING	EV/EBITDA FORWARD
35.1x	16.7x
NOTE	SOURCE
net debt to EBITDA 17.7x; share price down 10.8% over one year	Drillr snapshot

Nebius (NBIS)

MARKET CAP (US$ BILLION)	ENTERPRISE VALUE (US$ BILLION)
54.4	56.4
EV/EBITDA TRAILING	EV/EBITDA FORWARD
59.0x	60.1x
NOTE	SOURCE
revenue growth 461% trailing; shares +204% over one year	Drillr snapshot

Vertiv (VRT, power and cooling equipment)

MARKET CAP (US$ BILLION)	ENTERPRISE VALUE (US$ BILLION)
98.9	99.1
EV/EBITDA TRAILING	EV/EBITDA FORWARD
39.3x	20.7x
NOTE	SOURCE
shares +106% over one year	Drillr snapshot

Nvidia (NVDA)

MARKET CAP (US$ BILLION)	ENTERPRISE VALUE (US$ BILLION)
5,481	5,420
EV/EBITDA TRAILING	EV/EBITDA FORWARD
23.2x	16.7x
NOTE	SOURCE
Q2 FY2027 data-centre revenue US$89 billion	Drillr snapshot; Nvidia results, 26 Aug 2026

Oracle (ORCL)

MARKET CAP (US$ BILLION) 416	**ENTERPRISE VALUE (US$ BILLION)** 546
EV/EBITDA TRAILING 17.0x	**EV/EBITDA FORWARD** 11.6x
NOTE RPO US$638 billion	**SOURCE** Drillr snapshot; Oracle 10-K

Private benchmarks

MARKET CAP (US$ BILLION) AirTrunk A$24 billion (2024); Aligned about US$40 billion (Oct 2025); atNorth US$4 billion (Sep 2026); QScale acquired by Goldman Sachs Alternatives (13 May 2026, price undisclosed)	**SOURCE** Sources as in table C and QScale site, https://www.qscale.com

Worked example: a 200 MW campus

Purpose: show, transparently, how capex, power cost and revenue interact, and why location changes the answer. All figures are order-of-magnitude estimates from the sources above; they are not a business plan.

Assumptions

ITEM	ASSUMPTION	BASIS
Critical IT load	200 MW	Comparable to Meta Prometheus (562 MW), CoreWeave Denton (262 MW) or Bell's 300 MW Saskatchewan site
Power usage effectiveness (PUE)	1.30	New high-latitude builds reach 1.3 or better (Uptime 2025); fleet average is 1.54
Average IT utilisation	85% of nameplate	Assumption; AI training and inference clusters run near-continuously
Average facility draw	200 x 1.30 x 0.85 = 221 MW	Derived
Annual energy	221 MW x 8,760 h = 1,936 GWh	Derived
Peak billing demand	260 MW (200 x 1.30)	Derived, used for demand charges
Facility capex (shell, electrical, mechanical)	US$14 million per MW (range 11.3-17.6) = US$2.8 billion (range US$2.3-3.5 billion)	JLL 2026 (11.3) and Cushman 2026 (17.6)
IT fit-out (GPUs, servers, networking, storage)	US$25 million per MW = US$5.0 billion	JLL 2026 (up to 25); consistent with Epoch's about 37.9 all-in and Nebius's 20-31 per MW
Total all-in capex	about US$7.8 billion (about US$39 million per MW)	Derived
Electricity price, Montréal	5.83 cents CAD = 4.06 US cents per kWh	Hydro-Québec 2025 comparison (large-power profile), C$1 = US$0.697
Electricity price, Calgary	8.02 cents CAD = 5.59 US cents per kWh	Hydro-Québec 2025 comparison; consistent with the 2025 pool price of C$43.68 per MWh plus transmission and other charges
Electricity price, Northern Virginia	9.45 US cents per kWh (2025 industrial average); 10.09 cents in H1 2026	EIA Table 5.6.A

ITEM	ASSUMPTION	BASIS
Exchange rate	C$1 = US$0.697	Rate used in the Hydro-Québec 2025 comparison (1 Apr 2025)

Step 1: annual electricity cost = 1,936 GWh x price

SCENARIO	PRICE (US CENTS PER KWH)	ANNUAL POWER COST (US$ MILLION)	VERSUS VIRGINIA
Quebec (Montréal area)	4.06	79	saves 104 per year
Alberta (Calgary area)	5.59	108	saves 75 per year
Northern Virginia	9.45 (2025)	183	baseline
Northern Virginia at H1 2026 prices	10.09	195	

Cross-check for Quebec using the actual 2026 Rate L tariff (C$15.027 per kW per month on 260,000 kW plus 3.821 cents per kWh on 1,936 GWh): C$46.9 million plus C$74.0 million = C$120.9 million, which is 6.24 cents CAD per kWh all-in, or about US$84 million. The published comparison figure (5.83 cents) is for a smaller 5 MW profile, so the 2026 tariff-based number is the better estimate for a large campus. Either way Quebec power is roughly half the Virginia cost. The catch is availability: Hydro-Québec allocates blocks of capacity to large loads and Quebec has been rationing supply to data centres, so price is not the binding constraint.

Alberta caution: the same Hydro-Québec comparison shows Calgary's large-power price at 23.77 cents CAD in 2023 and 10.46 cents in 2024, so an Alberta campus must budget for price volatility and hedge (a power purchase agreement, or PPA, with a generator such as Capital Power's 250 MW, ten-year-plus supply deal with Meta is one answer). Alberta's 2025 pool price was the lowest in eight years.

Step 2: revenue under two business models

Model A, wholesale landlord (the developer builds the powered shell and turnkey halls; a hyperscaler or neocloud brings its own IT and pays for power). Rent benchmark: about US$138 per kW per month (Applied Digital's 15-year take-or-pay lease, June 2026). Revenue = 200,000 kW x US$138 x 12 = US$331 million a year. If landlord operating costs (staff, maintenance, insurance, property taxes) absorb about 15% of rent, net operating income is about US$281 million, a 10.0% yield on US$2.8 billion of facility capex, which matches the "10%-plus" stabilised yields Digital Realty reported for Q2 2026. Simple payback on the facility is about ten years. For the tenant, power (US$79-183 million) equals 24-55% of rent, so the tenant's total occupancy cost is 30-36% lower in Quebec than in Virginia; that is why hyperscalers and their site-selection teams treat the power price as a first-order variable.

Model B, AI cloud operator (the same company owns the halls and the GPUs and sells compute). Revenue benchmark: US$20 million per MW per year of contracted capacity (Nebius, Q2 2026; the range was 20-25 million). Revenue = 200 MW x US$20 million = US$4.0 billion a year. If the operator achieves an adjusted EBITDA margin near the 60% that CoreWeave reported in 2025, EBITDA is about US$2.4 billion, giving a simple payback on US$7.8 billion of about 3.3 years; CoreWeave's own S-1 claimed about 2.5 years including customer prepayments. In this model electricity is only 2-5% of revenue (US$79-195 million against US$4.0 billion); the dominant cost is depreciation of US$5.0 billion of IT over five years (US$1.0 billion a year) plus interest on debt. Sensitivity: if contract pricing at renewal falls to about US$12 million per MW (roughly what H100-era pricing of US$2.50-3.00 per GPU-hour implies at 80% utilisation), revenue drops to US$2.4 billion and EBITDA to about US$1.4 billion, barely covering depreciation and interest. The 44% AWS price cut of June 2025 and the 2026 price rebound show that both directions are plausible.

What the example teaches: (1) chips are two-thirds of the capital and wear out in four to six years, so the return depends on utilisation and on pricing at renewal, not on the building; (2) cheap Canadian power is worth about US$40-50 per kW per month to a tenant, a real but second-order edge for an AI cloud and a first-order edge for a landlord; (3) speed to power and certainty of supply, not price alone, decide where campuses land, which is why Alberta's queue (over 16 GW of applications) and Quebec's allocation rules matter as much as tariffs.

Career map for business graduates

ROLE FAMILY	WHAT THE WORK IS	EXAMPLE EMPLOYERS IN CANADA	SKILLS THAT MATTER	EVIDENCE OR POSTING SOURCE
Infrastructure and project finance	Structuring construction loans, take-or-pay leases, asset-backed securities (ABS), GPU-backed loans and equity for campuses; underwriting tenant credit	RBC Capital Markets, TD Securities, BMO, Scotiabank, CIBC, National Bank (all in the Aug 2026 Brookfield Infrastructure syndicate); Brookfield; CPP Investments (atNorth, 51% for US$1.3 billion, Sep 2026); pension and infrastructure funds	Project-finance modelling, credit analysis, lease and PPA structuring, understanding residual-value guarantees	Meta 10-K (Hyperion structure); Nvidia's US$500 billion platforms with six financiers (Aug 2026); Vantage's global CFO Scott Beasley (Kellogg MBA) oversaw asset-backed securitisations (Vantage leadership page)
Energy trading and power procurement	Buying power for campuses, hedging price risk, negotiating PPAs and large-load tariffs, managing demand-response and on-site generation	Capital Power, TransAlta, Emera, Fortis, ENMAX, hyperscalers' energy teams; OpenAI is hiring a power-trading lead (Bloomberg, 11 Aug 2026)	Electricity market literacy (pool prices, transmission tariffs, capacity), derivatives, contract negotiation	Capital Power 250 MW agreement with Meta (8 Jul 2026); AESO 2025 statistics (pool price volatility)
Real-estate development and site selection	Finding powered land, securing grid connections and permits, structuring land and lease deals	Vantage (Montreal I-III, Quebec City), eStruxture (15 sites, 130 MW-plus), QScale (Lévis, 142 MW), Digital Realty and Equinix (Toronto), Anthropic's "Canadian Compute Lead"	Real-estate finance, zoning and utility processes, negotiation with municipalities and utilities	BetaKit, 20 Aug 2026 (Anthropic postings); Cushman 2026 ranking (Toronto 8th primary Americas market, Montreal 6th secondary)
Construction and programme management	Delivering multi-hundred-million-dollar builds on time; managing contractors, commissioning, budgets	PCL, EllisDon, Ledcor (attended AESO's 2025 large-load session), Bird, engineering firms; operators' construction teams	Scheduling, cost control, risk management, contracts; enough technical fluency to speak with electrical and mechanical engineers	Cushman 2026 (costs up 21% per MW; labour shortages a key driver); Uptime 2025 (electrical and mechanical skills gaps above 30%)
Supply chain and procurement	Sourcing transformers, switchgear, generators, chillers, chips and servers with long lead times; managing tariffs and logistics	Operators, hyperscalers, Hypertec (hardware for Bell AI Fabric), Vertiv, Schneider Electric, ABB, Eaton	Category management, supplier finance, inventory and lead-time analytics	Cushman 2026 ("long equipment lead times"); Nvidia disclosed US$279 billion of future supply commitments (Aug 2026); memory price increases of 13-18% quarter on quarter (TrendForce, Aug 2026)
Sustainability and ESG reporting	Power sourcing, carbon and water reporting, green loans and bonds, community benefit agreements	Operators, utilities, pension funds; Anthropic's "Data Centre Community Engagement Manager" (Alberta)	Carbon accounting, green-finance frameworks, stakeholder engagement	AirTrunk US$1.24 billion green loan (Mar 2026); Alberta's four commitments and town halls (Aug 2026); Bell's Regina coal controversy (Aug 2026)

ROLE FAMILY	WHAT THE WORK IS	EXAMPLE EMPLOYERS IN CANADA	SKILLS THAT MATTER	EVIDENCE OR POSTING SOURCE
Policy and government relations	Working with provinces, utilities and regulators on tariffs, allocation of capacity, incentives and community consent	Provincial ministries, AESO, IESO, BC Hydro, Hydro-Québec, industry associations, operators' public-affairs teams	Regulatory literacy, policy analysis, coalition building	AESO large-load framework (16 GW-plus queue, Jun 2025); Alberta town halls (Aug 2026); Texas grid-connection freeze (Sep 2026)
Management consulting focused on data centres and energy	Market sizing, site strategy, cost modelling, due diligence for investors and utilities	McKinsey, BCG, Bain, Deloitte, PwC (Strategy& bought AI consultancy Datasparq, Aug 2026), Accenture, engineering consultancies	Financial modelling, structured problem solving, energy-system knowledge	JLL, CBRE and Cushman outlooks are consultancy-style products; IEA Energy and AI
Cloud and AI product management	Pricing and packaging GPU capacity, capacity planning, customer onboarding, service-level design	AWS, Microsoft, Google Cloud (Canadian regions), Nvidia, CoreWeave (anchor tenant at eStruxture CAL-3, May 2026), Nebius, Lambda, Cohere	Unit economics of compute, pricing strategy, technical literacy	Nebius asset-light partner model (Jul 2026); Nebius price increase after auction (Aug 2026)
Sales, partnerships and business development	Selling colocation, AI capacity and connectivity; structuring anchor-tenant and channel deals	TELUS (Kamloops AI data centre, C$15 billion BC plan to 2030), Bell AI Fabric (300 MW Saskatchewan; Cohere and BUZZ HPC C$220 million three-year contract), eStruxture, Vantage, Equinix, Digital Realty	Enterprise sales, contract structuring, ecosystem knowledge	Cointelegraph, 18 Jun 2026 (HIVE/BUZZ HPC-Bell-Cohere); Castanet, 15 Aug 2026 (TELUS Kamloops)
Utilities and system operators	Large-load interconnection, tariff design, demand forecasting, rate cases	Hydro-Québec, BC Hydro (C$90 million Vancouver substation, Aug 2026), IESO, AESO, SaskPower, Capital Power, TransAlta, Emera, Fortis	Load forecasting, regulatory economics, stakeholder management	AESO Phase 1 large-load integration session (Jun 2025); federal C$70 billion hydro, wind and transmission package (17 Aug 2026)
Data-centre operators: commercial, finance and operations management	Leasing, revenue management, FP&A, capital raising, operations leadership	eStruxture (new CFO David Schwartz, 31 Aug 2026), Vantage Canada (VP and GM Maxime Guévin, MBA HEC Montréal), QScale, Equinix, Digital Realty, Beacon AI Centers, Bitdeer (Fox Creek, Alberta)	Real-estate and infrastructure finance, operations, people leadership	Uptime 2025: operations management is the largest skills gap (39%); eStruxture and Vantage leadership pages
Analytics (capacity planning, demand forecasting, energy optimisation, GPU utilisation)	Forecasting load and demand, optimising cooling and power, tracking GPU utilisation and pricing	Utilities, operators, neoclouds, hyperscalers, consultancies; Robert Half 2026 Canada guide: data scientist C$104,250-156,750, AI engineer C$89,000-140,000	Statistics, forecasting, optimisation, cloud and data tooling, domain knowledge of power systems	Uptime 2025 (PUE and energy use are the most tracked metrics; fewer than half track others); AESO and IESO planning outlooks
Investment and asset management	Sourcing and managing data-centre and digital-infrastructure investments in pension, sovereign and private funds	CPP Investments, La Caisse, OMERS, BCI, Brookfield, Blackstone, KKR, Apollo (Canadian offices), Goldman Sachs Alternatives (owner of QScale since May 2026)	Valuation, deal execution, portfolio and asset management	Table C deals; Brookfield record fundraising year (Aug 2026)

Compensation and workforce indications (Canada unless noted): electricians average C$38.62 per hour (4,700 salaries, Indeed Canada, 17 Aug 2026; journeyperson about C$79,071 a year; Wood Buffalo, Alberta C$50.49 per hour); data-centre technicians average C$30.52 per hour (Toronto C$35.95; Indeed Canada, 12 Aug 2026); Robert Half's 2026 Canada Salary Guide lists data scientists at C$104,250-156,750, machine-learning developers C$85,000-165,000, AI architects C$109,250-164,500 and controllers C$114,750-172,500. In the US, specialised data-centre construction commands pay premiums of about 32%, with electricians in Texas and Virginia earning US$114,000-280,000 including overtime (IBTimes, 31 Jul 2026, citing OpenAI's White House submission that its build-out could require about one-fifth of America's skilled-trades workforce within five years). Uptime Institute (2025): 46% of operators cannot find qualified candidates, 37% struggle to retain staff, 25% lose staff to competitors, and 75% of operators have workforces that are 10% women or less. Meta funded a US$115 million construction "Workforce Academy" with Associated Builders and Contractors (Jun 2026) and a building-trades partnership (Aug 2026); Associated Builders and Contractors said construction job openings hit a near two-year high in July 2026 on data-centre and power demand.

Career stories (named individuals, from company biographies and reference sources; none are Sauder-specific)

1. Maxime Guévin, Vice-President and General Manager, Canada, Vantage Data Centers: telecommunications engineer with an MBA from HEC Montréal; grew 4Degrees Colocation from a start-up to C$20 million of revenue after 19 years at Vidéotron (Vantage leadership page).
2. Scott Beasley, Global CFO, Vantage: Kellogg MBA; former CFO of Frontier Communications, where he led a US$12 billion fibre programme and asset-backed securitisations (Vantage leadership page).
3. Sureel Choksi, CEO, Vantage: Wharton economics graduate; former CFO and president of wholesale markets at Level 3 Communications and operating executive at Silver Lake (Vantage leadership page).
4. Andrew Power, CEO, Digital Realty: analytical-finance graduate who spent his early career in real-estate investment banking at Citi and Bank of America Merrill Lynch, executing over US$30 billion of capital raises, before joining the company he had advised on its 2004 IPO (Digital Realty leadership page). His CFO, COO and chief investment officer all hold MBAs (Berkeley, Bentley, Michigan).
5. David Schwartz, CFO, eStruxture (appointed 31 Aug 2026): Bachelor of Commerce in finance, CPA and CFA; former CFO of Nuvei, where he led the 2020 TSX listing, after roles at Aldo, Optimal Payments, BCE Emergis and PwC (eStruxture leadership page).
6. Todd Coleman, founder and CEO, eStruxture: law degree plus computer information systems; co-founded Cologix and ran data centres at Level 3 before building Canada's largest platform (15 sites, 130 MW-plus, about 800 customers; eStruxture site).
7. Michael Intrator, Brian Venturo and Brannin McBee, co-founders of CoreWeave: former commodities traders who started a crypto-mining firm in 2017, pivoted to GPU cloud after 2018, pioneered GPU-collateralised lending (US$2.3 billion in 2023) and listed the company in March 2025 in the largest AI listing by proceeds (Wikipedia, CoreWeave).
8. Kevin O'Leary (Ivey MBA, 1980): the investor behind the 9 GW "Stratos" data-centre proposal in Utah (2026), and publicly associated with a large Alberta proposal ("Wonder Valley") that this session could not verify from a primary source (Wikipedia, Kevin O'Leary; Stratos coverage Aug-Sep 2026).
9. Role examples rather than people: Anthropic's "Canadian Compute Lead" (site selection, leasing, financing, logistics and government relations to bring "gigawatts of compute online in Canada") and "Data Centre Community Engagement Manager" in Alberta (BetaKit, 20 Aug 2026); OpenAI's power-trading lead running commodity hedging across its power portfolio (Bloomberg via Techmeme, 11 Aug 2026).

Skills a business graduate needs to be useful in this sector: (1) infrastructure financial modelling (project cash flows, debt sizing, lease and take-or-pay structures, ABS and residual-value guarantees); (2) energy-market literacy (pool prices and capacity, transmission tariffs, PPAs, PUE and load factors, interconnection queues); (3) regulatory literacy (large-load rules at AESO, IESO, BC Hydro and Hydro-Québec, municipal permitting, tax incentives, community consent); (4) AI and compute literacy sufficient to talk to engineers (what a GPU-hour is, why memory and networking matter, why utilisation drives returns); (5) negotiation of PPAs, leases and supply contracts; (6) analytics for forecasting demand, utilisation and prices.

Contested or uncertain figures

- Michael Burry's depreciation critique (November 2025): his estimate of roughly US$176 billion of understated depreciation over 2026-2028 and the implied earnings overstatement at Meta and Oracle is widely reported but the original post and paywalled coverage could not be retrieved in this session. Cite Meta's own 10-Q (5.5-year lives; US$2.29 billion lower nine-month depreciation) and the IEA's four-to-six-year obsolescence estimate instead; treat Burry's dollar figures as "reported, unverified".
- McKinsey's "cost of compute" estimate (about US$6.7 trillion of data-centre capital by 2030, April 2025) could not be retrieved (site timed out four times). JLL (US$3 trillion for 100 GW) and the IEA (US$4.2 trillion cumulative 2025-2030) cover the same ground with different scopes; the gap reflects whether chips and energy capex are included.
- Cost per MW ranges from US$11.3 million (JLL 2026) to US$17.6 million (Cushman 2026) because of scope (density, cooling type, land, market). The worked example uses US$14 million and shows the range.
- CBRE's Global Data Center Trends 2025 extract reports a figure of US$217.30 per kW per month described as a weighted average alongside Northern Virginia's 15% rise; the exact definition should be checked against the report before quoting.
- The Hydro-Québec comparison prices are for a 5,000 kW, 3.06 GWh-per-month profile, not a 200 MW campus; the Rate L tariff cross-check (6.24 cents CAD all-in) is more representative for large loads, and neither guarantees that capacity is available.
- The Alberta all-in price (8.02 cents CAD, 2025) sits on the lowest pool price in eight years; the 2023 figure (23.77 cents) shows the volatility. Virginia's EIA industrial average is not a hyperscale tariff; large-load contract rates may differ.
- Epoch AI's US$37.9 million per MW is a model constant applied across campuses, not a project-by-project cost audit.
- The Aligned Data Centers consortium composition and the CPP Investments role in AirTrunk are taken from reference pages rather than the deal press releases (which could not be fetched).
- Bell AI Fabric's total planned capacity (widely described as 500 MW) was not confirmed from a Bell document; the verified figures are the 300 MW Saskatchewan site and the Merritt, BC expansion.
- Kevin O'Leary's Alberta "Wonder Valley" project could not be verified from a primary source in this session; the Utah Stratos project is documented.
- Nvidia's reported US$250 billion financing guarantee and US$350 billion chip-purchase financing for OpenAI (July 2026) come from a single Taiwanese business outlet in the news index; the verified Nvidia disclosures are the letter of intent (10-Q, Nov 2025) and up to US$108.5 billion of guarantees (Aug 2026).
- Indeed's "Center Manager" salary page (average C$76,250) is not specific to data-centre managers; Robert Half's 2026 Canada guide does not list a data-centre manager role.

Open questions students could investigate

1. At what electricity price and utilisation does a 200 MW AI cloud in Alberta break even on a five-year GPU life, and how much of the answer changes if GPU-hour prices fall by half at renewal?
2. Is Quebec's power-price advantage (about US$104 million a year on 200 MW) large enough to offset the delay and uncertainty of Hydro-Québec's capacity allocation process compared with a faster connection elsewhere?
3. Who should bear the residual-value risk in a Hyperion-style structure: the tenant (through guarantees), the lender (through spreads) or the equity? What does the widening of CMBS spreads in August 2026 say about how that risk is being priced?
4. How concentrated are Canadian data-centre revenues by tenant, and what happens to a Calgary or Lévis campus if a single anchor such as CoreWeave or a hyperscaler reduces its commitments?
5. What is the true cost of a "sovereign" Canadian cloud (Bell AI Fabric, TELUS) versus renting from a US hyperscaler's Canadian region, and who will pay the premium?
6. Do Alberta's four commitments (including that Albertans will not pay for projects and that the grid comes first) hold up under a 16 GW queue, and what tariff design would make large loads pay their way?
7. How should a Canadian pension fund weigh a 10% stabilised yield on a leased shell against a 26x EBITDA multiple for Equinix or a 59x multiple for Nebius?
8. What share of the 35,000 construction jobs and 2,500 permanent jobs quoted for OpenAI's 8 GW Ohio campus would translate to Canadian projects, and where will the electricians come from given Uptime's skills-gap data?
9. Can the circular deals (Nvidia to OpenAI to Oracle to CoreWeave) be mapped as a network, and what fraction of announced backlog is backed by investment-grade counterparties?
10. Which Canadian employers actually posted business-side data-centre roles in the past 12 months, and what did they pay? (A scrape of Indeed, LinkedIn and company career pages would extend the salary evidence in this brief.)

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12

PART V · THE PEOPLE

The people: who decides this, and why so many of them are Canadian

It is easy to describe the build-out as weather. It is not. It is a small number of named people making capital and regulatory decisions, and a striking number of them were trained in, live in, or answer to Canada.

52 people Everyone in this chapter is named, sourced and current as of September 2026. Thirty-five have a freely licensed portrait. Seven of the fifty-two are women.

WHAT THIS CHAPTER ANSWERS

- ? Who actually signs the decisions in this story?
- ? Why does the Canadian research inheritance keep showing up in other countries' companies?
- ? Which ministers and utility executives hold the megawatts?
- ? Who is arguing against, and on what grounds?

KEY TAKEAWAYS

- Canada invented a large share of this technology and owns almost none of the resulting compute. Geoffrey Hinton, Yoshua Bengio and Richard Sutton hold a Nobel Prize and two Turing Awards between them, all earned in Toronto, Montreal and Edmonton. Ilya Sutskever took three University of Toronto degrees and now runs a company that Nvidia put $5 billion into in July 2026. The inheritance is real; the ownership is not.
- The decisive people are not the famous ones. The Meta campus in Sturgeon County will be shaped less by Mark Zuckerberg than by Aaron Engen of the AESO, who controls the 1,200 MW of Alberta large-load capacity available to 2028 against more than 20,000 MW of proposals. Grid operators and utility chief executives are the real gatekeepers, and almost none of them have a public profile.
- Canada has three visibly different provincial models, each with a named owner. Alberta under Danielle Smith and Nate Glubish runs bring-your-own-power and an open door. British Columbia under David Eby, Adrian Dix and Ravi Kahlon rations a public utility's output, capping data centres at about 400 MW over two years.

Ontario under Stephen Lecce demands community benefits and full cost recovery before connection. Students can compare three live policy experiments running at once.

- One premier has already said no. Wab Kinew rejected a hyperscale project near Ile des Chenes on 4 June 2026 on a clean hydro grid, saying the environmental threat outweighed the economic benefit. Manitoba is the counterfactual that shows refusal is a real option, not a hypothetical one.
- The politics have turned local and hostile faster than the politics of any comparable Canadian industrial build-out. Nate Glubish was booed, jeered and sworn at across four Alberta town halls in August 2026. Rocky View County council voted six to one against a data-centre plan in September 2025 after a ten-hour hearing where more than 50 residents spoke against and four spoke in favour. The opposition is agricultural and municipal, not environmentalist.
- The most consequential Canadian analysis of 2026 came from a think tank, not a government. Pembina Institute's Footing the Bill, published on 26 August 2026 by David Pickup, put the Meta campus at $270 to $460 a year on a typical Alberta household bill. Danielle Smith responded at a town hall the next day by advising Albertans to lock in a fixed rate, which was read by many as confirming the risk.
- The biggest builders are actively planning to leave the planet. Jeff Bezos forecast gigawatt data centres in orbit at Italian Tech Week in October 2025; Sundar Pichai announced Project Suncatcher with prototype TPU satellites planned for early 2027; SpaceX absorbed xAI on 2 February 2026 and filed for up to one million solar-powered satellites. Every one of those bets, if it pays off, devalues Canada's cold climate and clean firm power.
- Canada's counter-strategy has one named owner and one named champion company. Evan Solomon, the world's first national AI minister, has been in post since May 2025 and is attached to nearly every Canadian compute announcement. Cohere, led by Aidan Gomez, is the company federal policy is effectively built around, and Microsoft agreed in December 2025 to integrate Cohere's models as part of its Canadian sovereignty commitments.
- Telecommunications companies, not technology companies, are Canada's domestic builders, and both just changed or nearly changed leadership. TELUS opened Canada's first sovereign AI factory in Rimouski in September 2025 under Darren Entwistle, who retired on 30 June 2026; Victor Dodig, a banker, took over on 1 July 2026. Bell under Mirko Bibic is building six facilities plus the 300 MW Saskatchewan project. Continuity of strategy across a leadership change is now a live risk.
- Indigenous participation is moving from consultation to equity, and it can be named. Chief Shawn Longman of George Gordon First Nation is a partner in the 300 MW Bell facility near Regina; Woodland Cree First Nation under Chief Isaac Laboucan-Avirom holds a 51 per cent stake in an Alberta project. At the same time Sturgeon Lake Cree Nation has objected to Wonder Valley, so the record is not uniform.
- The visual record is lopsided, and that is itself a finding. Every global technology chief executive in this list has a freely licensed portrait. Fourteen of the seventeen people with no free portrait are Canadian officials, utility executives, Indigenous leaders and analysts. The people making the decisions that will land on Canadian electricity bills are literally harder to picture than the people flying in to make the announcements.
- Almost everyone in this story is male. Of 52 people, seven are women: Raquel Urtasun, Doina Precup, Lisa Su, Danielle Smith, Christine Frechette, Claudine Bouchard and Charlotte Mitha. Three of the seven run electricity utilities or provinces rather than technology companies.

The cast

Everyone named in this chapter, in the order they appear. Portraits are freely licensed; initials mean no free portrait exists. Attribution for every photograph is in the portrait credits at the end of the chapter.

Geoffrey Hinton
University Professor Emeritus, Department of Computer Scienc

Yoshua Bengio
Professor, Universite de Montreal; founder and scientific ad

Richard S. Sutton
Professor of Computing Science, University of Alberta; chief

Yann LeCun
Co-founder, Advanced Machine Intelligence (AMI) Labs; profes

Ilya Sutskever
Chief executive officer

Alex Krizhevsky
Current role not verified as of September 2026

Aidan Gomez
Co-founder and chief executive officer

Raquel Urtasun
Founder and chief executive officer, Waabi; pro-fessor, Depar

Doina Precup
Associate dean of research (faculty of science) and Canada R

Jensen Huang
Founder, president and chief executive officer

Sam Altman
Chief executive officer

Mark Zuckerberg
Chairman and chief executive officer

Satya Nadella
Chairman and chief executive officer

Brad Smith
Vice chair and president

Andy Jassy
President and chief executive officer

Sundar Pichai
Chief executive officer

Elon Musk
Chief executive officer, SpaceX (which absorbed xAI in Febru

Lisa Su
Chair and chief executive officer

Jeff Bezos
Executive chairman, Amazon; founder, Blue Origin

Mark Carney
Prime Minister of Canada

Evan Solomon
Minister of Artificial Intelligence and Digital Innovation,

TH

Tim Hodgson
Minister of Energy and Natural Resources; MP for Markham-Tho

MS

Michael Sabia
Clerk of the Privy Council and Secretary to the Cabinet

Danielle Smith
Premier of Alberta

Nate Glubish
Minister of Technology and Innovation; MLA for Strathcona-Sh

Stephen Lecce
Minister of Energy and Mines; MPP for King-Vaughan

David Eby
Premier of British Columbia

Adrian Dix
Minister of Energy and Climate Solutions

Ravi Kahlon
Minister of Jobs and Economic Growth

Christine Frechette
Premier of Quebec; leader of the Coalition Avenir Quebec

Bernard Drainville
Minister of Economy, Innovation and Energy, and Minister res

Scott Moe
Premier of Saskatchewan

Wab Kinew
Premier of Manitoba

Claudine Bouchard
President and chief executive officer

CM

Charlotte Mitha
President and chief executive officer

AE

Aaron Engen
President and chief executive officer

JF

Jason Fitzsimmons
President and chief executive officer

Kevin O'Leary
Founder and chairman, O'Leary Ventures; pro-moter of the Wond

VD

Victor Dodig
President and chief executive officer

DE

Darren Entwistle
Chief executive officer emeritus and adviser to the chief ex

MB

Mirko Bibic
President and chief executive officer

Bruce Flatt
Chief executive officer, Brookfield Corporation; chair, Broo

AD

Avik Dey
President and chief executive officer

JH

Joel Hunter
President and chief executive officer

TC

Todd Coleman
Founder, president, chief executive officer and chairman of

SL

Shawn Longman
Chief

IL

Isaac Laboucan-Avirom
Chief

Tobi Lutke
Chief executive officer

CK

Crystal Kissel
Former Reeve, Rocky View County (defeated in the October 202

DP

David Pickup
Director of Electricity

BS

Blake Shaffer
Associate professor of economics and public policy; co-lead,

Rick Smith
President

The picture in numbers

NAME	ROLE	ORGANISATION	WHY THEY MATTER HERE	SOURCE
Geoffrey Hinton	University Professor Emeritus	University of Toronto	AlexNet and the Toronto claim; Nobel Physics 2024; argues profit motive is not enough	cs.toronto.edu
Yoshua Bengio	Professor; co-president, LawZero; chair, International AI Safety Report	Universite de Montreal, Mila, LawZero	Made Montreal an AI city; his risk framing enters the rooms where Canadian rules are set	yoshuabengio.org
Richard S. Sutton	Professor; chief scientific advisor, Amii	University of Alberta, Amii	The Bitter Lesson is the intellectual case for ever-larger compute; anchors Alberta research	amii.ca
Yann LeCun	Co-founder, AMI Labs	Advanced Machine Intelligence Labs	Public dissenter from scaling; AMI has a Montreal office; left Meta November 2025	Wikipedia
Ilya Sutskever	Chief executive officer	Safe Superintelligence	Three U of T degrees, AlexNet, then all the value created elsewhere	Wikipedia
Alex Krizhevsky	Current role not verified	Formerly Google, Dessa	Wrote the code that started the GPU era, then went quiet	Wikipedia
Aidan Gomez	Co-founder and chief executive	Cohere	The Canadian company federal sovereign compute policy is built around	Wikipedia

NAME	ROLE	ORGANISATION	WHY THEY MATTER HERE	SOURCE
Raquel Urtasun	Founder and chief executive; professor	Waabi, University of Toronto	Largest venture raise in Canadian history; argues algorithms substitute for brute force	BetaKit
Doina Precup	Associate dean; head of Montreal office	McGill University, Google DeepMind, Mila	Shows what Canada actually gets from big tech: a research lab, not a data centre	Wikipedia
Jensen Huang	Founder, president and chief executive	Nvidia	Every Canadian project depends on his chip allocation; first $5 trillion company	Wikipedia
Sam Altman	Chief executive officer	OpenAI	Stargate set the 10 GW benchmark against which Canada's 5.5 GW is measured	OpenAI
Mark Zuckerberg	Chairman and chief executive	Meta Platforms	The C$13 billion, 1 GW Sturgeon County campus, gas-fired, and the bill fight it started	Meta
Satya Nadella	Chairman and chief executive	Microsoft	Sets the capital envelope behind C$19 billion of Canadian spending, 2023 to 2027	Microsoft
Brad Smith	Vice chair and president	Microsoft	Signed the five-point Canadian digital sovereignty plan, including a litigation pledge	Microsoft
Andy Jassy	President and chief executive	Amazon	Built AWS; runs the incumbent Canadian cloud that sovereignty arguments target	Wikipedia
Sundar Pichai	Chief executive officer	Alphabet and Google	Owns the Canadian inheritance commercially; Project Suncatcher moves compute to orbit	Wikipedia
Elon Musk	Chief executive officer	SpaceX (absorbed xAI), Tesla	Colossus at 150 MW as a yardstick; declared terrestrial data centres a dead end	Wikipedia
Lisa Su	Chair and chief executive	AMD	The only credible second source of AI accelerators for Canadian sovereign compute	Wikipedia
Jeff Bezos	Executive chairman; founder	Amazon, Blue Origin	Forecast gigawatt orbital data centres, directly challenging Canada's physical pitch	GeekWire
Mark Carney	Prime Minister of Canada	Government of Canada	Energy superpower framing; AI for All strategy, 4 June 2026, about 5.5 GW projected	pm.gc.ca
Evan Solomon	Minister of AI and Digital Innovation	Government of Canada	The world's first national AI minister, in post since May 2025, owns sovereign compute	House of Commons
Tim Hodgson	Minister of Energy and Natural Resources	Government of Canada	Holds the power half of the file; grid doubling by 2050 with gas as a bridge	Wikipedia
Michael Sabia	Clerk of the Privy Council	Government of Canada	Ran Hydro-Quebec until July 2025, then took over the federal public service	Wikipedia

NAME	ROLE	ORGANISATION	WHY THEY MATTER HERE	SOURCE
Danielle Smith	Premier of Alberta	Government of Alberta	Bring-your-own-power model; the digital refinery framing; delivered the Meta campus	alberta.ca
Nate Glubish	Minister of Technology and Innovation	Government of Alberta	The $100 billion target, and the minister who took it to four hostile town halls	alberta.ca
Stephen Lecce	Minister of Energy and Mines	Government of Ontario	Community benefits plus 100 per cent cost recovery before grid connection; Bill 40	ontario.ca
David Eby	Premier of British Columbia	Government of BC	Public utility as an allocation tool rather than an open door	BC Gov News
Adrian Dix	Minister of Energy and Climate Solutions	Government of BC	Operates the 400 MW competitive allocation process launched 30 January 2026	BC Gov News
Ravi Kahlon	Minister of Jobs and Economic Growth	Government of BC	Look West criteria decide which projects win scarce clean power	BC Gov News
Christine Frechette	Premier of Quebec	Government of Quebec	Ran the energy and economy file before becoming premier on 15 April 2026	quebec.ca
Bernard Drainville	Minister of Economy, Innovation and Energy	Government of Quebec	Now decides how much Hydro-Quebec power goes to data centres, and to whom	quebec.ca
Scott Moe	Premier of Saskatchewan	Government of Saskatchewan	A small grid taking a 300 MW load, partly gas-fired, with an Indigenous partner	saskatchewan.ca
Wab Kinew	Premier of Manitoba	Government of Manitoba	The first Canadian first minister to refuse a hyperscale project, 4 June 2026	Global News
Claudine Bouchard	President and chief executive	Hydro-Quebec	Controls the largest pool of clean firm power in Canada	Hydro-Quebec
Charlotte Mitha	President and chief executive	BC Hydro	Runs the only Canadian utility formally rationing power to data centres	BC Hydro
Aaron Engen	President and chief executive	AESO	1,200 MW available to 2028 against more than 20,000 MW proposed	AESO
Jason Fitzsimmons	President and chief executive	IESO	Must turn Ontario's new conditions into an actual connection queue	IESO
Kevin O'Leary	Founder and chairman	O'Leary Ventures	Wonder Valley: $70 billion, 7.5 GW announced, construction not before late 2028	Wikipedia
Victor Dodig	President and chief executive	TELUS	Took over 1 July 2026; a banker now running a national compute strategy	TELUS
Darren Entwistle	Chief executive officer emeritus	TELUS	Built the sovereign AI factory strategy; retired 30 June 2026 after 26 years	TELUS
Mirko Bibic	President and chief executive	BCE and Bell Canada	Six announced AI data centres plus the 300 MW Saskatchewan project	BCE

NAME	ROLE	ORGANISATION	WHY THEY MATTER HERE	SOURCE
Bruce Flatt	Chief executive, Brookfield Corporation	Brookfield	Where Canadian capital meets global AI infrastructure as an owner, not a host	Wikipedia
Avik Dey	President and chief executive	Capital Power	Genesee is one of the few Alberta sites that can actually host a hyperscale load	Capital Power
Joel Hunter	President and chief executive	TransAlta	Holds part of the scarce Alberta large-load capacity to 2028	TransAlta
Todd Coleman	Founder, president and chief executive	eStruxture Data Centers	The largest Canadian-owned operator, and the domestic sovereignty alternative	eStruxture
Shawn Longman	Chief	George Gordon First Nation	Named Indigenous partner in Canada's largest purpose-built AI data centre	paNOW
Isaac Laboucan-Avirom	Chief	Woodland Cree First Nation	51 per cent Indigenous equity, not benefit sharing, in an Alberta project	Indigenous Energy Monitor
Tobi Lutke	Chief executive officer	Shopify	Demand side: whether Canada will consume the compute it wants to host	Wikipedia
Crystal Kissel	Former Reeve, Rocky View County	Rocky View County	Presided over the first significant municipal refusal, 9 September 2025	Rocky View County
David Pickup	Director of Electricity	Pembina Institute	Footing the Bill: $270 to $460 a year on a typical Alberta household	Pembina
Blake Shaffer	Associate professor; co-lead, Electricity Centre	University of Calgary	20,000 MW proposed, and the claim it would double Alberta power emissions	blakeshaffer.ca
Rick Smith	President	Canadian Climate Institute	Occupies the middle ground: integrate data centres, do not just refuse them	climateinstitute.ca

Group 1: the Canadian AI inheritance

Geoffrey Hinton is University Professor Emeritus at the University of Toronto, where he has held an appointment since 1987. He is British-Canadian, shared the 2018 Turing Award with Yoshua Bengio and Yann LeCun, and won the 2024 Nobel Prize in Physics with John Hopfield. The 2012 AlexNet result that started the GPU era came out of his lab, and the three-person company he formed with Alex Krizhevsky and Ilya Sutskever was bought by Google in 2013. Since resigning from Google in May 2023 to speak freely about AI risk, he has argued that leaving the field to the profit motive of large companies will not be sufficient, which is the precise tension Canada faces as it courts hyperscaler capital.

Yoshua Bengio is a professor at the Universite de Montreal, founder and scientific advisor of Mila, co-president and scientific director of LawZero, and chair of the International AI Safety Report. He is the reason Montreal is an AI city and, indirectly, the reason Quebec's cheap hydro power became an AI story. The second International AI Safety Report, published on 6 February 2026, drew on more than 100 experts with 29 nations plus the UN, OECD and EU nominating panel members, so his framing of risk travels straight into the policy rooms where data-centre rules get written. LawZero, launched in Montreal in June 2025 with funding that includes the Canadian government, puts a safety institution physically inside the country that is trying to sell compute.

Richard S. Sutton is a professor of computing science at the University of Alberta, chief scientific advisor and fellow at Amii, a Canada CIFAR AI Chair, and a research scientist at Keen Technologies. He became a Canadian citizen in 2015 and renounced his US citizenship in 2017. He and Andrew Barto were named 2024 Turing Award recipients in March 2025 for the foundations of reinforcement learning. His 2019 essay The Bitter Lesson, arguing that general methods leveraging computation win by a large margin, is the single most-quoted intellectual justification for building ever-larger compute, which puts him in an awkward relationship to the Alberta build-out happening around him.

Yann LeCun left Meta in November 2025 after twelve years as chief AI scientist and co-founded Advanced Machine Intelligence (AMI) Labs with Alexandre LeBrun. AMI announced a $1.03 billion seed round at a $3.5 billion pre-money valuation on 10 March 2026, with a Paris headquarters and offices in New York, Montreal and Singapore. He matters to Canada twice: he is the most senior public dissenter from the view that scaling language models leads to real intelligence, which directly challenges the demand forecasts behind gigawatt campuses, and his new company is recruiting from the Montreal talent pool while making that argument.

Ilya Sutskever is chief executive of Safe Superintelligence Inc., a role he took after co-founder Daniel Gross left for Meta in mid 2025. He holds Israeli and Canadian citizenship and took a BSc, MSc and PhD at the University of Toronto between 2005 and 2013, receiving an honorary doctorate there in 2025. He is the clearest single illustration of Canada's export problem: AlexNet, then OpenAI, then a company valued at $32 billion in March 2025 with Nvidia announcing a $5 billion investment in July 2026, none of it in Canada.

Alex Krizhevsky is the first author of the AlexNet paper, the result that made GPU training standard and set this entire build-out in motion. He completed his PhD at the University of Toronto under Hinton, sold DNNresearch to Google in 2013, and left Google in September 2017 to join the Toronto startup Dessa. His current role could not be verified from any source, and no freely licensed portrait of him exists. For teaching purposes that is the point: the person whose code triggered hundreds of billions of dollars of capital spending is invisible in every announcement.

Aidan Gomez is co-founder and chief executive of Cohere, and co-authored Attention Is All You Need in 2017 as a 20-year-old Google Brain intern. He is British-Canadian, with a University of Toronto bachelor's degree and an Oxford PhD completed in 2024. Cohere is the company federal sovereign compute policy is effectively built around: it received federal backing for a multibillion-dollar Canadian data centre, Microsoft agreed in December 2025 to integrate Cohere's models into its services as part of its Canadian sovereignty plan, and Bell partnered with it on infrastructure. Cohere's acquisition of Germany's Aleph Alpha in April 2026 created a combined entity valued at around $20 billion.

Raquel Urtasun is founder and chief executive of Waabi and a professor at the University of Toronto. She is Spanish-Canadian, born in Pamplona and resident in Canada since 2014, and was elected a Fellow of the Royal Society in 2026. Waabi's January 2026 round of $750 million US, plus up to $250 million more from Uber, was described by Urtasun as the largest fundraise in Canadian history. Her technical argument, that simulation and better algorithms substitute for brute-force data collection, is a live counterweight to the assumption that AI progress requires all the gigawatts being planned.

Doina Precup is associate dean of research in McGill's faculty of science, a Canada Research Chair in machine learning, head of Google DeepMind's Montreal office since 2017, and a core academic member of Mila. She is the working example of what Canada actually gets from a hyperscaler that is not building here: a research lab employing researchers rather than a facility consuming gigawatts. She is also the most senior woman in the Canadian AI research establishment, which is worth noticing against the composition of the rest of this list.

Group 2: the global builders whose decisions land in Canada

Jensen Huang is founder, president and chief executive of Nvidia, which he incorporated on 5 April 1993 and which became the first company to exceed a $5 trillion market capitalisation in October 2025. Nothing in the Canadian build-out happens without his chips: Telus's Rimouski AI factory, Bell's projects and Cohere's compute all depend on Nvidia allocation and Nvidia pricing. His sovereign AI pitch, that every country should own its own compute, is now repeated almost verbatim by Canadian ministers.

Sam Altman runs OpenAI and promotes Stargate, announced at the White House on 21 January 2025 with SoftBank and Oracle and targeting 10 gigawatts in the United States by 2029. That is the benchmark against which Canada's own AI for All strategy, projecting about 5.5 gigawatts for the whole country, has to be read. In February 2026 OpenAI launched OpenAI for Countries, offering governments an equity stake in national Stargate projects in exchange for permitting, grid access and co-investment, which is exactly the kind of deal Canadian governments will be asked to weigh.

Mark Zuckerberg is behind the single largest private capital commitment in Canadian data-centre history. Meta broke ground in July 2026 on a campus in Sturgeon County, Alberta, worth more than C$13 billion and roughly one gigawatt, its first in Canada, its largest outside the United States, and powered by a new natural gas plant. Meta has promised $60 million of local infrastructure spending and at least $250 million a year for Alberta. Against Meta's 2026 capital-expenditure budget of roughly $145 billion the project is modest; against Alberta's grid it is transformative.

Satya Nadella sets Microsoft's capital envelope. Microsoft already runs Azure Canada Central and Canada East, and in December 2025 committed C$7.5 billion over two years inside a C$19 billion total for 2023 to 2027, including new capacity near Quebec City, with capacity coming online from the second half of 2026. Microsoft chose to compete in Canada on sovereignty guarantees rather than on price, which is the more interesting strategic fact.

Brad Smith, Microsoft's vice chair and president, is the executive who actually wrote and signed those commitments. His 9 December 2025 post called the announcement the most important commitment in Microsoft Canada's history and set out a five-point digital sovereignty plan: an Ottawa threat intelligence hub, in-country Copilot data processing from 2026, confidential computing and Azure Key Vault in Canadian regions, integration of Cohere's Canadian models, and a pledge to pursue every available legal and diplomatic avenue including litigation if Microsoft were ordered to suspend Canadian cloud services. That last item is the most concrete corporate answer yet to Canadian fears of US extraterritorial reach.

Andy Jassy is president and chief executive of Amazon and the person who built AWS before taking the top job in July 2021. AWS runs Canadian regions in Montreal and Calgary and is the incumbent against which every sovereign-cloud argument is made. Whether Amazon matches Microsoft's Canadian sovereignty commitments is an open question and a good one for students to track.

Sundar Pichai runs Alphabet and Google, which owns the Canadian AI inheritance commercially: it bought Hinton's DNNresearch in 2013 and runs the DeepMind Montreal office Doina Precup leads. Project Suncatcher, announced in late 2025, plans solar-powered satellite constellations carrying TPUs, with two prototype satellites to launch with Planet Labs by early 2027. If orbital compute works even partially, the value of Canadian cold air and clean firm power falls.

Elon Musk built Colossus in Memphis, fully operational from December 2024 at about 150 megawatts peak, then moved decisively off-planet. SpaceX acquired xAI on 2 February 2026 in an all-stock deal valuing xAI at $250 billion and SpaceX at $1 trillion, folded it in as SpaceXAI by July 2026, and filed with the FCC for a constellation of up to one million solar-powered satellites. He also holds Canadian citizenship through his mother and briefly attended Queen's University, which makes him an uncomfortable footnote in any Canadian talent-retention argument.

Lisa Su is chair and chief executive of AMD, and the answer to the question of whether there is a second source. Every Canadian sovereign compute plan is exposed to Nvidia allocation and pricing, and AMD's Instinct accelerators are the main hedge. With Huang she is a reminder that the physical layer of the AI economy is controlled by a handful of firms, none of them Canadian.

Jeff Bezos gave the orbital thesis its highest-profile endorsement at Italian Tech Week in Turin in October 2025, forecasting gigawatt data centres in orbit within ten to twenty years and arguing that constant solar power and no weather will let space beat the cost of terrestrial data centres within a couple of decades. That is a direct challenge to the Canadian pitch, which rests on physical geography.

Group 3: the Canadian decision makers

Mark Carney has been Prime Minister since March 2025. His government launched AI for All, the national AI strategy, on 4 June 2026, built on trust, opportunity and sovereignty, and projecting around 5.5 gigawatts of Canadian AI compute demand. His energy superpower framing is what allows gas-fired data centres in Alberta to be presented as nation building, and reporting through 2026 traced federal permissiveness on gas-powered data centres in part to Alberta industry lobbying. He is the person who has to reconcile the emissions target with the compute pitch, and that reconciliation has not yet been made in public.

Evan Solomon is Minister of Artificial Intelligence and Digital Innovation and Minister responsible for the Federal Economic Development Agency for Southern Ontario, sworn in on 13 May 2025 as the world's first national AI minister and confirmed still in post through mid 2026. He owns the sovereign compute file: the Canadian Sovereign AI Compute Strategy, the AI Sovereign Compute Infrastructure Program, federal money behind Cohere's data centre, and the May 2026 Telus announcement of three British Columbia sites. He is also a first-time MP running a new department, which is itself a governance risk.

Tim Hodgson is Minister of Energy and Natural Resources, elected in April 2025 and sworn in that May. He holds the half of the file Solomon does not: Canada's AI ambitions are a power problem before they are a chip problem, and he is the minister arguing Canada must roughly double its grid by 2050 with natural gas as a bridging fuel. The Canada-Alberta memorandum of understanding explicitly includes AI data-centre infrastructure, which is where federal climate policy and provincial gas generation meet. No freely licensed portrait of him exists.

Michael Sabia became the 26th Clerk of the Privy Council on 7 July 2025, three days after leaving Hydro-Quebec, where he had been chief executive since May 2023. He is the hinge between Canada's electricity system and its federal government: he ran the largest clean-power utility in the country exactly when Quebec was deciding how much power to sell to data centres, then moved to run the federal public service. There is no free portrait of him, which is a small illustration of how invisible senior officials are next to the executives they negotiate with.

Danielle Smith has been Premier of Alberta since October 2022 and is the most aggressive provincial promoter of AI data centres in Canada. Her bring-your-own-power model, under which developers build their own generation and can sell surplus into the grid, is what made Alberta the front-runner and delivered the Meta campus. She has framed a data centre as a digital refinery converting natural gas into electricity, then compute, then intelligence. At an August 2026 virtual town hall, responding to the Pembina analysis, she said Albertans who want certainty on their bills can lock in at a price, which critics read as an admission that bills are at risk.

Nate Glubish has been Alberta's Minister of Technology and Innovation since 24 October 2022 and is the author of the ambition to see $100 billion of AI data centre construction under way within five years. In August 2026 he took that pitch to four town halls in Lacombe, Sturgeon County, Redwater and Ponoka, and was booed, jeered and sworn at. His response, that all he can offer is to do the best of his ability to ensure development is done responsibly, is markedly thinner than the strategy he is defending, and that gap is the story.

Stephen Lecce has been Ontario's Minister of Energy and Mines since 6 June 2024. Ontario has taken the opposite posture to Alberta: in July 2026 Lecce announced that AI data centres seeking a grid connection must demonstrate community benefits, pay 100 per cent of their energy costs, and satisfy broader provincial priorities, with Bill 40 giving the government power to set those prerequisites. The rules did not yet exist when he announced them, which is the gap critics point to, and observers note that even full cost recovery may not stop prices rising for everyone.

David Eby has been Premier of British Columbia since November 2022. He told the Vancouver Web Summit in May 2026 that he is an optimist about AI having seen both the opportunity and the threat, and that BC Hydro being a public utility gives the province a huge advantage. British Columbia is the test of whether a public utility can allocate scarce clean power deliberately rather than first come, first served.

Adrian Dix, Minister of Energy and Climate Solutions, is the official who actually operates that model. The 30 January 2026 release he fronted launched a competitive process capped at 100 MW for conventional data centres and 300 MW for AI data centres over the two years from 1 February 2026, with successful applicants to be notified in September 2026, and exempted traditional industries such as mining, forestry and LNG. **Ravi Kahlon**, Minister of Jobs and Economic Growth, supplies the selection criteria through the Look West strategy, which prioritises projects delivering the greatest economic and environmental benefits. Between them, Dix and Kahlon run the most explicit rationing scheme in the country.

Christine Frechette became the 33rd Premier of Quebec on 15 April 2026, after winning the Coalition Avenir Quebec leadership on 12 April with 57.9 per cent of the vote against Bernard Drainville. She is the second woman to lead Quebec. Uniquely among Canadian first ministers she ran the data-centre file directly before taking the top job, as Minister of Economy, Innovation and Energy from 5 September 2024 to 26 January 2026, the period when Hydro-Quebec set a data-centre rate and Quebec debated how much of its power to sell and to whom. Her open question, whether Quebec should host foreign-owned data centres or insist on Quebec ownership, is the sovereignty debate in its sharpest provincial form.

Bernard Drainville was appointed Minister of Economy, Innovation and Energy and Minister responsible for the Maritime Strategy in Frechette's 29-member cabinet on 21 April 2026, making him the superminister who inherited exactly the file she left. Quebec has the cheapest large-scale clean firm power in North America and the most explicit political anxiety about selling it to foreign technology companies, so his allocation and pricing decisions set the ceiling on Quebec's participation.

Scott Moe has been Premier of Saskatchewan since February 2018. Saskatchewan is the quiet case: the Bell facility in the RM of Sherwood near Regina is roughly $1.7 billion and 300 megawatts, about five per cent of the province's current generating capacity, will run partly on natural gas through SaskPower and TransGas, and carries an Indigenous partnership with George Gordon First Nation. It shows that a small grid can attract a very large load, and that the Indigenous participation question arrives with it.

Wab Kinew has been Premier of Manitoba since October 2023 and is the first Canadian first minister to publicly refuse a hyperscale AI data centre. On 4 June 2026 he rejected a project on 142 hectares near Ile des Chenes southeast of Winnipeg, proposed by the US company Jet.AI and British Columbia's Consensus Core Technologies and powered largely by gas turbines. He said there was a big threat to the environment and not much benefit to the economy, and that Manitobans want AI to serve them rather than the reverse. Manitoba has clean hydro power and said no anyway, which is the most important fact in the Canadian debate.

Claudine Bouchard became president and chief executive of Hydro-Quebec on 5 July 2025, after 25 years at the utility and two years as chief operating and infrastructure officer. She controls the largest pool of clean firm power in Canada and therefore the most sought-after grid connection in the country, and must balance data-centre sales against domestic electrification and a very large capital plan. She succeeded Michael Sabia, who left to run the federal public service, which shows how tightly this utility is tied to national policy.

Charlotte Mitha is president and chief executive of BC Hydro, having been named in May 2025 as Chris O'Riley retired after 35 years. Anyone still citing O'Riley as BC Hydro's chief executive is working from stale information. Mitha operates the mechanism that makes British Columbia different, and her January 2026 comments stressed that clarity for customers already in the interconnection queue is essential for maintaining confidence, which is the practical problem every Canadian utility now faces.

Aaron Engen has been president and chief executive of the Alberta Electric System Operator since 1 August 2024, after 25 years in investment banking, most recently as vice chair of investment and corporate banking at BMO Capital Markets. His organisation issues the numbers that decide whether Alberta's ambitions are physically possible: 1,200 MW of large-load capacity allowed to 2028, already claimed by TransAlta and a Pembina Pipeline and Kineticor joint venture, against more than 20,000 MW of proposed projects. That gap is the single most important fact in the Alberta story.

Jason Fitzsimmons is listed as president and chief executive of the Independent Electricity System Operator as of September 2026. Lesley Gallinger led the IESO from 2021, oversaw the largest resource procurement in Canadian history, and the board chair announced on 11 June 2026 that she would step down effective 1 August 2026, with a transition plan under way but no successor named at that time. The IESO now has to turn Lecce's community-benefit and full-cost conditions into a working connection queue for the largest electricity market in Canada.

Group 4: the Canadian industry and capital

Kevin O'Leary is promoting Wonder Valley, a proposed $70 billion, 7.5 gigawatt campus in the Greenview Industrial Gateway about 40 kilometres south of Grande Prairie, in partnership with the Municipal District of Greenview. Announced in December 2024 for a 2027 first phase, it has slipped: 2026 is the permitting year and construction is now hoped for late 2028. Alberta confirmed in April 2026 that no provincial environmental impact assessment would be required, Sturgeon Lake Cree Nation has objected, and on 2 September 2026 reporting alleged Greenview did not disclose an agreement during public hearings. In April 2026 he announced a separate 40,000 acre project in Box Elder County, Utah, which raises a reasonable question about focus. Wonder Valley is the best available case study in the distance between an announcement and a building.

Victor Dodig became TELUS president and chief executive on 1 July 2026, having been named chief executive designate on 12 February 2026 and joining full time on 1 May. He inherits a genuinely distinctive Canadian strategy. **Darren Entwistle**, who ran TELUS for 26 years and retired on 30 June 2026 with the title chief executive officer emeritus and an advisory role to Dodig until 30 April 2027, decided that a Canadian telecommunications company should own AI compute rather than rent it. TELUS opened Canada's first fully sovereign AI factory in Rimouski, Quebec in September 2025, reported as the country's fastest supercomputer on the TOP500 list and fully sold out; Kamloops follows in 2026, Vancouver's Mount Pleasant at the end of 2026, scaling past 150 MW by 2032. Whether a banker sustains a telecoms infrastructure bet is now a live question.

Mirko Bibic has been president and chief executive of BCE and Bell Canada since January 2020 and is confirmed in post on BCE's own leadership page in 2026. Bell announced six Canadian AI data centres in May 2025, partnered with Cohere in July 2025, and in March 2026 announced the roughly $1.7 billion, 300 MW Saskatchewan facility with George Gordon First Nation. Bell and TELUS competing directly on AI infrastructure is a structural change in how Canadian telecommunications capital gets deployed. No free portrait of Bibic exists on Wikimedia Commons.

Bruce Flatt is chief executive of Brookfield Corporation and chair of Brookfield Asset Management. He was born in Winnipeg in 1965, joined Brookfield in 1990, and became chief executive of the whole organisation in 2002. In February 2026 he handed the BAM chief executive role to Connor Teskey while keeping the chair and the Brookfield Corporation role, so anyone describing him as BAM's chief executive is out of date. Brookfield is where Canadian capital meets the global data-centre boom as an owner rather than a host, through renewable power agreements, data-centre platforms and AI infrastructure vehicles.

Avik Dey is president and chief executive of Capital Power and **Joel Hunter** is president and chief executive of TransAlta, and between them they control much of the Alberta generation that any hyperscale project needs. Dey has described the Genesee station west of Edmonton as probably one of the most attractive generation sites anywhere in North America, and told analysts in March 2026 that the pace of announcements has not matched market expectations, which is the most candid public statement any Canadian generator has made about how slowly these deals close. Hunter succeeded John Kousinioris, who retired effective 30 April 2026, so TransAlta changed leadership in the middle of the most consequential capacity allocation in its history.

Todd Coleman is founder, president, chief executive and board chair of eStruxture Data Centers, the largest Canadian-owned data-centre operator, founded in Montreal in 2017. He is the most direct test of whether sovereign compute can be supplied by a Canadian company rather than through commitments extracted from Microsoft or Amazon.

Shawn Longman is Chief of George Gordon First Nation, which signed a partnership with Bell covering Indigenous procurement participation and workforce development on the 300 MW facility near Regina, announced at the University of Regina on 16 March 2026. The project is projected to generate $12 billion of economic value for Saskatchewan, 80 full-time jobs, around 750 spinoff jobs and about 800 construction jobs, with construction starting in spring 2026 and operations in the first half of 2027. **Isaac Laboucan-Avirom** is Chief of Woodland Cree First Nation, which holds a 51 per cent stake in the Mihta Askiy data centre in northwestern Alberta with Sovereign Digital Infrastructure. That is equity ownership rather than benefit sharing, and it is a different and more consequential model. Neither leader has a freely licensed portrait.

Tobi Lutke is included on the demand side rather than the supply side. Shopify does not build data centres, but his 2025 internal memo requiring teams to justify why AI cannot do a job before hiring for it made Shopify the most-cited Canadian example of AI-first operations. Whether Canadian firms actually consume the compute Canada wants to host is a real question, and he is the closest thing to a national indicator of it.

Group 5: the critics and the civil society voices

Crystal Kissel was Reeve of Rocky View County when its council voted six to one on 9 September 2025 against the Kineticor Area Structure Plan, a roughly 448 hectare data-centre campus in the county's northeast quadrant with potential on-site natural gas generation. The public hearing ran more than ten hours, with over 50 residents speaking against and four in favour. She said the proposed plan did not align with the community's vision or with that of future generations who want to continue farming. She then lost her Division 3 seat to Alison Whiting in the October 2025 municipal election, and Sunny Samra is now reeve, so she is a historical rather than a current actor. The refusal stands as the template for local opposition across Alberta, and the fact that the reeve who led it was defeated weeks later is itself worth discussing.

David Pickup, director of electricity at the Pembina Institute, produced the most consequential piece of Canadian civil society analysis in this debate. Footing the Bill, published on 26 August 2026, estimated that Meta's Sturgeon County data centre could add $270 to $460 a year to a typical Albertan's electricity bill from 2027 to 2031, a 15 to 25 per cent increase over five years against average household electricity spending of about $1,700 in 2025, even after a possible 6 per cent reduction on the transmission portion. He noted that Albertans already pay some of the highest and most volatile electricity rates in the country. Danielle Smith responded to the report directly at a town hall the following day.

Blake Shaffer is an associate professor at the University of Calgary and co-lead, with Sara Hastings-Simon, of the new UCalgary Electricity Centre. He supplied the two numbers that govern the Alberta debate: 33 proposed provincial projects drawing more than 20,000 megawatts in total, and the estimate that building all of them would roughly double Alberta's electricity greenhouse gas emissions. He is not a straightforward opponent. He frames the cost question as a numerator and denominator problem, arguing that a data centre adds system costs but also adds demand across which fixed costs are spread, and that flexible data centres able to shift when they draw power could actually lower average costs. That nuance makes him the most useful single voice for a teaching case.

Rick Smith has been president of the Canadian Climate Institute since 2021. The Institute has produced the most sustained Canadian policy work on integrating AI data centres into electricity grids, including its March 2025 analysis of how to do it well and its May 2026 argument that Canada's AI and electricity strategies can and should be mutually reinforcing. Smith leads the organisation trying to occupy the middle ground between build-at-any-cost and outright refusal, which is where most Canadian policy will probably end up.

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People with no freely licensed portrait

No acceptable free portrait exists on Wikimedia Commons for the following 17 people, and their image fields are set to null in the data file. Do not substitute a press photograph, corporate headshot or LinkedIn image for any of them.

Alex Krizhevsky, Tim Hodgson, Michael Sabia, Charlotte Mitha, Aaron Engen, Jason Fitzsimmons, Victor Dodig, Darren Entwistle, Mirko Bibic, Avik Dey, Joel Hunter, Todd Coleman, Shawn Longman, Isaac Laboucan-Avirom, Crystal Kissel, David Pickup, Blake Shaffer.

Two additional people who appear in the narrative also have no free portrait and no full record: Sara Hastings-Simon of the University of Calgary and Andrew Leach of the University of Alberta.

Contested or uncertain items

- **Jason Fitzsimmons at the IESO.** He is listed as president and chief executive on the IESO executive team page as of September 2026, but no dated press release naming him as Lesley Gallinger's successor was found. The 11 June 2026 board chair message confirmed only that Gallinger would leave on 1 August 2026 and that a transition plan was under way. Treat the appointment date as unconfirmed.

- **Richard Sutton and Oak Lab.** One trade outlet reported in 2026 that Sutton and Khurram Javed left Keen Technologies to found a Canadian-incorporated company called Oak Lab. Neither the Amii profile nor his Wikipedia entry mentions it, and both still list Keen Technologies. The Oak Lab claim is not verified here.
- **Yann LeCun's exact title at AMI Labs.** He is consistently described as a co-founder with Alexandre LeBrun. Whether he holds the chief executive or chief scientist title was not confirmable from a primary source.
- **Alex Krizhevsky's current role.** Nothing after his 2017 move to Dessa could be verified. He is included because his historical role is essential, but his present position is genuinely unknown.
- **Isaac Laboucan-Avirom's current term as chief.** The Woodland Cree First Nation data-centre project is documented by sector publications, and his role as chief appears in reference sources, but no dated primary source confirming his current term was found.
- **QScale leadership.** QScale operates the Q01 campus in Levis, Quebec, with 142 MW secured and a second 60 MW building under construction as of June 2026, but the company website returned no named executives and no reliable primary source for its chief executive was found. QScale is therefore represented in this brief by its facility, not by a person.
- **Danielle Smith's portrait is from 2014.** It is the most recent freely licensed image on Commons and predates her premiership by eight years. Nate Glubish's file is dated 2017 despite being titled August 2019. Both are legally usable but visually dated; flag this if the teaching document places them next to 2026 photographs of the technology executives.
- **Doina Precup's portrait is a two-person photograph** taken with the late Ian Kerr in 2018. It is the only free image available. It may need cropping, and CC BY-SA 4.0 requires that any cropped version be released under the same licence.
- **Three portraits are studio images released by their subject or employer under a free licence.** Claudine Bouchard's file was uploaded by Hydro Quebec under CC BY-SA 4.0, Bruce Flatt's is a Brookfield executive portrait by Todd France released under CC BY-SA 4.0, and Raquel Urtasun's was released by her under CC BY-SA 4.0. These look like corporate headshots, and they are, but the copyright holder has licensed them freely on Wikimedia Commons, so they are legal to reproduce with attribution. That is different from taking a headshot off a company website, which is not.
- **Chris O'Riley and Lesley Gallinger are no longer in post.** O'Riley retired from BC Hydro in 2025 and Gallinger left the IESO on 1 August 2026. Any earlier research listing them as current should be corrected.
- **Crystal Kissel is no longer Reeve of Rocky View County.** She lost her seat in October 2025 and Sunny Samra is the current reeve. The September 2025 refusal she presided over still stands.
- **Bruce Flatt is no longer chief executive of Brookfield Asset Management.** Connor Teskey took that role in February 2026. Flatt remains chief executive of Brookfield Corporation and chair of BAM.
- **Meta's Alberta location.** Some early coverage placed the campus in Beaver County. The confirmed location is Sturgeon County, northeast of Edmonton.
- **Web search limits.** This dimension used 22 web searches before the session's shared search budget was exhausted, after which all remaining verification was done through direct page fetches of primary sources, roughly 30 of them. Every current role in this brief traces to a primary or official page, not to a search snippet.

Open questions students could investigate

- Alberta's AESO allows 1,200 MW of large-load connections to 2028 against more than 20,000 MW of proposals. Which projects actually connect, and what does the queue design say about who captures the value?
- Manitoba refused a hyperscale project on clean hydro power while Alberta approved one on gas. What does that pairing tell you about whether the binding constraint is emissions, land, water, politics or price?
- Ontario says data centres must pay 100 per cent of their energy costs, yet analysts still expect prices to rise for everyone. Model why full cost recovery for a new load can still raise average bills.
- Pembina puts the Meta campus at $270 to $460 a year per Alberta household; Blake Shaffer argues flexible data centres could lower average costs. Reconcile the two using the numerator and denominator framing.
- Microsoft has promised to litigate rather than suspend Canadian cloud services. Is that a credible commitment, what would enforce it, and would AWS or Google match it?
- If Project Suncatcher or SpaceX orbital compute works even partially by 2030, what happens to the value of Canadian cold climate, fresh water and clean firm power?
- Canada produced Hinton, Bengio, Sutton, Sutskever, Krizhevsky and Gomez. Trace where the economic value from each went, and identify the specific policy or capital-market failure at each departure point.
- Compare the George Gordon procurement and workforce model with the Woodland Cree 51 per cent equity model. Which delivers more durable value to the community, and why is equity still rare?
- Fourteen of the seventeen people here with no free portrait are Canadian officials, utility executives, Indigenous leaders and analysts. What does that asymmetry in the public visual record do to democratic accountability for infrastructure decisions?
- Both TELUS and TransAlta changed chief executives in mid 2026, and the IESO changed leadership on 1 August 2026. How exposed is a multi-decade infrastructure strategy to leadership turnover, and what institutional design would reduce that exposure?

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A

APPENDIX A

Method, and what this book is not

The research behind this book was produced on 2 September 2026 by fourteen artificial intelligence research agents working in parallel, one per dimension of the question. Each was given the same instructions: prefer primary sources, record a date and a link for every figure, cross-check headline numbers against at least two sources where possible, distinguish announced from under construction from operating, flag anything that could not be verified rather than dropping it, and write for a graduate business reader who does not have an engineering background.

Each agent produced three artifacts. A written brief of roughly seven thousand words, with key takeaways, tables, a narrative, a contested-figures section, open questions and a numbered source list. A machine-readable dataset in which every number carries its unit, year, region and source link. And a folder of downloaded primary documents with a manifest recording the file, the source, the publisher, the date and why it matters. Between them the agents ran roughly five hundred searches and saved 884 files totalling 716 megabytes. All twelve datasets validate as JSON, and every downloaded PDF was checked to confirm it is a real document rather than a saved error page.

This book is those 12 briefs, reordered into a single argument, with the front matter, chapter openers, figures and appendices added. The charts were generated from the datasets rather than redrawn by hand, so a figure and the table beside it cannot disagree. Nothing in the briefs was rewritten to make the argument tidier.

What was checked, and what was not

Every figure that appears in the executive summary, on a chapter opener or in a chart was reconciled against its source during preparation. Four unit errors were found and corrected in the companion software during that pass, all of them factors of a thousand in energy and emissions arithmetic. The figures used in the classroom materials were independently re-verified, and five of six needed rewording for precision.

The full body text of each brief has not been line-by-line fact checked. That is the honest limit of this document. Several claims were found to be unverifiable and are marked in each chapter's contested section. One research agent was interrupted by a usage limit before it could write its download manifest, which was afterwards reconstructed from the files on disk and is labelled as such.

What this book is not

It is not investment advice, and it is not a consulting deliverable. It was written to give graduate business students a shared, sourced foundation for an argument they were asked to make themselves, and to demonstrate what a person working with artificial intelligence tools can now assemble in a day. Where it expresses a view, in the executive summary and in the chapter openers, that view is the author's.

Judgement, where it appears

Two scores in the companion software are explicitly the author's judgement rather than published data: how much realistic spare room each province has, and how strong its social licence is. Both are shown with their reasoning. The per-province ceilings on project size in the siting tool are also judgement, with one exception: British Columbia's 145 megawatt limit per project, which is written into B.C. Reg. 8/2026.

Reproducing it

The book is generated by `research/book/build_book.py`, which reads the briefs and datasets and writes the HTML that becomes this PDF. The datasets are in `research/data/`, the briefs in `research/briefs/`, the primary documents in `research/downloads/`, and the interactive companion in `research/app/`. Re-running the build after editing any dataset regenerates every chart.

B

APPENDIX B

The project inventory

Every large Canadian data-centre project found in the research, ordered by announced size. Rows marked *tracker* come from an independent tracker and are not confirmed against filings. "Announced" is not "built": read the status field before using any of these figures.

Wonder Valley AI Data Centre Industrial Park

DEVELOPER OR TENANT
O'Leary Ventures with the Municipal District of Greenview

WHERE
MD of Greenview (Greenview Industrial Gateway, about 40 km south of Grande Prairie), AB

ANNOUNCED
7,500 MW · phase 1 1,400 MW

CAPITAL
C$70.0 billion

POWER
off-grid natural gas, possible geothermal

STATUS
Proposed

ANNOUNCED DATE
2024-12-09

PARTNERS
['Municipal District of Greenview', 'HPC and AI Data Centres']

NOTE
Phase 1 about US$2 billion. Land purchase agreement March 2026; no provincial EIA required (April 2026); no tenant or gas-plant partner announced; construction now expected about late 2028 (The Walrus, May 2026). Sturgeon Lake Cree Nation objects on water and consultation. Confidence: primary announcement, status secondary.

Travers AI Data Centre tracker

DEVELOPER OR TENANT
not disclosed

WHERE
Vulcan County, AB

ANNOUNCED
2,000 MW

CAPITAL
not disclosed

POWER
grid, new 500 kV substation

STATUS
Proposed

ANNOUNCED DATE
not disclosed

PARTNERS
none disclosed

NOTE
Planning target up to 2,000 MW per tracker; developer not verified.

Genesee Data Centre

DEVELOPER OR TENANT
Capital Power with an unnamed data-centre developer

ANNOUNCED
1,500 MW

POWER
grid at Genesee generating station (1,857 MW gas on site)

ANNOUNCED DATE
2024-06

NOTE
AESO application June 2024; did not receive a high enough Phase 1 allocation; deferred to Phase 2 (December 2025 newsletter). Separately, Capital Power will sell 250 MW to Meta's Sturgeon County campus from H2 2028.

WHERE
Leduc County (Genesee mine permit area), AB

CAPITAL
not disclosed

STATUS
Proposed

PARTNERS
none disclosed

Wild Rose Power Hub tracker

DEVELOPER OR TENANT
not disclosed

ANNOUNCED
1,300 MW

POWER
grid; dry cooling

ANNOUNCED DATE
not disclosed

NOTE
1.3 GW grid request per tracker; halted by Rocky View County moratorium (5-2 vote, late July 2026). Developer not verified.

WHERE
Rocky View County, AB

CAPITAL
not disclosed

STATUS
Paused

PARTNERS
none disclosed

Beacon Indus AI Hub

DEVELOPER OR TENANT
Beacon AI Centers

ANNOUNCED
1,200 MW · phase 1 400 MW

POWER
on-site natural gas (1,494 MW) plus solar

ANNOUNCED DATE
2025

NOTE
946 acres; first phase 400 MW at about C$4 billion with December 2026 energization target (DCD); 1.2 GW load and 1.5 million litres per day water per tracker. Under Rocky View County moratorium since late July 2026.

WHERE
Rocky View County (near Indus and Langdon), AB

CAPITAL
C$4.0 billion

STATUS
Paused

PARTNERS
none disclosed

Newell Data Center tracker

DEVELOPER OR TENANT
not disclosed

WHERE
County of Newell, AB

ANNOUNCED
1,200 MW

CAPITAL
not disclosed

POWER
grid

STATUS
Proposed

ANNOUNCED DATE
not disclosed

PARTNERS
none disclosed

NOTE
1.2 GW grid connection request per tracker; developer not verified.

Meta Sturgeon Data Centre

DEVELOPER OR TENANT
Meta Platforms · Meta (owner-operator)

WHERE
Sturgeon County (Alberta Industrial Heartland), AB

ANNOUNCED
1,000 MW · phase 1 970 MW

CAPITAL
C$13.0 billion

POWER
grid 970 MW (AESO P2936 GLDC Load); Capital Power 250 MW from H2 2028; Greenlight Electricity Centre 932 MW combined-cycle gas from H2 2030 (permitted to 1,864 MW)

STATUS
Under construction

ANNOUNCED DATE
2026-07-08

PARTNERS
['Greenlight Limited Partnership (Pembina 47.5%, Morgan Stanley Infrastructure Partners 47.5%, Kineticor 5%)', 'Capital Power', 'AltaLink', 'AESO']

NOTE
C$13 billion-plus; Greenlight plant about C$4 billion gross, FID July 2, 2026. About 3,000 construction and 300-plus permanent jobs; C$60 million local infrastructure; province estimates about C$250 million a year in revenues. Closed-loop dry cooling, no operational cooling water. Some sources describe the campus as scalable to 1.8 GW. Meta expects operation in 2 to 3 years.

Malachite One

DEVELOPER OR TENANT
Tourmaline and Emerald (per EnergyNow)

WHERE
Yellowhead County, AB

ANNOUNCED
1,000 MW

CAPITAL
C$20.0 billion

POWER
on-site gas (930 MW), carbon capture considered; 74.9 MW grid request

STATUS
Proposed

ANNOUNCED DATE
2026

PARTNERS
none disclosed

NOTE
About C$15 billion data centre plus C$5 billion power per EnergyNow (August 25, 2026); tracker lists 930 MW on-site generation and a 74.9 MW grid request, just under the 75 MW large-load threshold.

Synapse Olds AI Data Centre Campus

DEVELOPER OR TENANT
Synapse Real Estate Corp.

WHERE
Town of Olds, AB

ANNOUNCED
1,000 MW · phase 1 100 MW

CAPITAL
C$10.0 billion

POWER
on-site gas 1,400 MW with 1,800 MW diesel backup

STATUS
Cancelled

ANNOUNCED DATE
2026-01

PARTNERS
none disclosed

NOTE
Ten 100 MW data centres. Alberta Utilities Commission denied the power plant on August 17, 2026 (too close to the community); about 1,500 parties sought standing. Proponent says the project will not proceed as proposed but remains committed to Alberta.

Keephills Data Centre

DEVELOPER OR TENANT
TransAlta (site and power provider) with CPP Investments and Brookfield

WHERE
Parkland County (Keephills), AB

ANNOUNCED
1,000 MW · phase 1 230 MW

CAPITAL
not disclosed

POWER
Keephills on-site gas plus grid (AESO P3083, 230 MW Phase 1 allocation)

STATUS
Proposed

ANNOUNCED DATE
2026-02-27

PARTNERS
['CPP Investments', 'Brookfield']

NOTE
MOU for an initial 230 MW PPA with evaluation of up to 1 GW; subject to regulatory approvals and definitive agreements. Holds one of the two AESO Phase 1 grid contracts.

Beacon Heartland AI Data Centre Hub

DEVELOPER OR TENANT
Beacon AI Centers

WHERE
Sturgeon County, AB

ANNOUNCED
960 MW

CAPITAL
not disclosed

POWER
on-site natural gas (920 to 960 MW)

STATUS
Proposed

ANNOUNCED DATE
2025

PARTNERS
none disclosed

NOTE
Alberta Major Projects lists 960 MWe with 2027 completion; tracker lists 800 MW load and 920 MW gas.

Goldfinch Technology Park tracker

DEVELOPER OR TENANT
not disclosed

WHERE
Wheatland County, AB

ANNOUNCED
950 MW

CAPITAL
not disclosed

POWER
grid

STATUS
Proposed

ANNOUNCED DATE
not disclosed

PARTNERS
none disclosed

NOTE
950 MW grid connection request per tracker; developer not verified.

HubOne AI and BTC tracker

DEVELOPER OR TENANT
not disclosed

WHERE
Wheatland County, AB

ANNOUNCED
750 MW

CAPITAL
not disclosed

POWER
on-site gas, up to 3,000 MW generation

STATUS
Proposed

ANNOUNCED DATE
not disclosed

PARTNERS
none disclosed

NOTE
750 MW-plus AI load per tracker; developer not verified.

Mihta Askiy Data Centre

DEVELOPER OR TENANT
Mihta Askiy Datacenter LP (51% Woodland Cree First Nation) with Sovereign Digital Infrastructure

WHERE
Northern Sunrise County (about 40 km northeast of Peace River), AB

ANNOUNCED
650 MW · phase 1 400 MW

CAPITAL
C$2.1 billion

POWER
on-site natural gas; two 200 MW Siemens turbines procured; re-purposed Carmon Creek power plant

STATUS
Proposed

ANNOUNCED DATE
2025

PARTNERS
['Sovereign Digital Infrastructure', 'Siemens Energy Canada', 'Eastdil Secured']

INDIGENOUS PARTNER
Woodland Cree First Nation (51% owner)

NOTE
Capex about US$1.5 billion per BlackRidge Research (converted at 1.37), unconfirmed. First power targeted mid-2027. Tracker lists 5 million litres per day water. mw_phase1 reflects the two procured turbines.

Crusoe and Kalina energy parks (Alsike, Myers, Crossfield)

DEVELOPER OR TENANT
Crusoe with Kalina Distributed Power

WHERE
Alsike (Red Deer County per tracker), Myers (Brazeau County), Crossfield (Rocky View County, withdrawn), AB

ANNOUNCED
510 MW · phase 1 170 MW

CAPITAL
not disclosed

POWER
three 170 MW on-site gas plants

STATUS
Proposed

ANNOUNCED DATE
2025

PARTNERS
['Kalina Distributed Power']

NOTE
Multi-year framework agreement for colocated AI data centres at three Kalina-owned 170 MW gas plants; Crossfield (Lone Pine) proposal withdrawn per tracker.

Bell AI Fabric British Columbia cluster

DEVELOPER OR TENANT
Bell Canada · Bell (sovereign AI compute for enterprise and research customers)

WHERE
Kamloops, Merritt, Thompson Rivers University, two sites to be confirmed, BC

ANNOUNCED
500 MW · phase 1 7 MW

CAPITAL
not disclosed

POWER
BC Hydro (hydro)

STATUS
Under construction

ANNOUNCED DATE
2025-05-28

PARTNERS
['Groq', 'Thompson Rivers University']

INDIGENOUS PARTNER
Upper Nicola Band (candidate host for a C$500 million facility)

NOTE
Six facilities: Kamloops 7 MW (June 2025, operating), Merritt 7 MW (2025), Kamloops 26 MW (2026), TRU 26 MW (within two years), two high-density sites 400 MW-plus combined. Investment described as nine figures.

Teton Digital Black Bear tracker

DEVELOPER OR TENANT
Teton Digital

WHERE
Swan Hills region, AB

ANNOUNCED
466 MW

CAPITAL
not disclosed

POWER
on-site natural gas generation

STATUS
Proposed

ANNOUNCED DATE
not disclosed

PARTNERS
none disclosed

NOTE
466 MW is generation capacity per tracker.

Beacon Foothills AI Data Centre Hub

DEVELOPER OR TENANT
Beacon AI Centers

WHERE
Foothills County (near High River), AB

ANNOUNCED
400 MW

CAPITAL
C$4.0 billion

POWER
400 MW on-site generation plus solar; grid connection expected late 2026

STATUS
Proposed

ANNOUNCED DATE
2025

PARTNERS
none disclosed

NOTE
Two five-storey buildings, 300 operational jobs; approvals being sought.

Beacon Chestermere

DEVELOPER OR TENANT
Beacon AI Centers

WHERE
City of Chestermere, AB

ANNOUNCED
400 MW

CAPITAL
C$4.0 billion

POWER
on-site generation

STATUS
Proposed

ANNOUNCED DATE
2025

PARTNERS
none disclosed

NOTE
310 acres of greenfield land in southern Chestermere per DCD; capex per campus unconfirmed.

Beacon Harry Smith tracker

DEVELOPER OR TENANT
Beacon AI Centers

WHERE
Parkland County, AB

ANNOUNCED
400 MW

CAPITAL
not disclosed

POWER
grid

STATUS
Proposed

ANNOUNCED DATE
not disclosed

PARTNERS
none disclosed

NOTE
400 MW grid connection per tracker.

Beacon Saunders Lake tracker

DEVELOPER OR TENANT
Beacon AI Centers

WHERE
Leduc County, AB

ANNOUNCED
400 MW

CAPITAL
not disclosed

POWER
grid

STATUS
Proposed

ANNOUNCED DATE
not disclosed

PARTNERS
none disclosed

NOTE
400 MW grid connection per tracker.

Spruce Lake AI Hub (Lorneville)

DEVELOPER OR TENANT
Beacon Data Centers and VoltaGrid

WHERE
Saint John (Spruce Lake Industrial Park, Lorneville), NB

ANNOUNCED
390 MW

CAPITAL
C$2.0 billion

POWER
190 MW on-site natural gas (VoltaGrid) plus about 200 MW from NB Power

STATUS
Proposed

ANNOUNCED DATE
2025-10

PARTNERS
['VoltaGrid']

NOTE
Environmental impact assessment under review; gas plant would emit about 750,000 tonnes CO_2 a year; 27 ha wetland and 3.5 ha old-growth forest affected; 1,200 construction and 210 permanent jobs claimed; construction planned 2026, operation 2028; 'Save Lorneville' opposition; provincial framework consultation to October 2, 2026.

Bell AI Fabric Sherwood (Regina)

DEVELOPER OR TENANT
Bell Canada · Cerebras and CoreWeave

WHERE
Rural Municipality of Sherwood (outside Regina), SK

ANNOUNCED
300 MW · phase 1 300 MW

CAPITAL
C$1.7 billion

POWER
SaskPower grid; first transmission interconnection phase due end of 2026

STATUS
Under construction

ANNOUNCED DATE
2026-03-16

PARTNERS
['Government of Saskatchewan', 'SaskTel', 'Bird Construction', 'Hipperson Construction', 'George Gordon Developments Ltd.']

INDIGENOUS PARTNER
George Gordon First Nation (procurement and workforce agreement)

NOTE
About C$1.7 billion capex with C$1.3 billion in 2026; early site works began April 21, 2026; two data halls in H1 2027 and two in H2 2027; at least 800 construction jobs and 80 permanent; up to C$12 billion economic value and C$720 million provincial revenue projected.

Technologies New Energy and Data District Phase 1

DEVELOPER OR TENANT
Technologies New Energy (TNE) and Data District Inc.

WHERE
Olds, Bonnyville, Calgary, Edmonton, AB

ANNOUNCED
240 MW

CAPITAL
C$1.3 billion

POWER
not disclosed

STATUS
Proposed

ANNOUNCED DATE
2025

PARTNERS
['unnamed European partners']

NOTE
Four facilities; Olds construction from 2026 and Bonnyville 2027 per Alberta Major Projects.

Teton Digital Northern Forge tracker

DEVELOPER OR TENANT
Teton Digital

WHERE
MD of Greenview, AB

ANNOUNCED
200 MW

CAPITAL
not disclosed

POWER
on-site natural gas generation

STATUS
Proposed

ANNOUNCED DATE
not disclosed

PARTNERS
none disclosed

NOTE
200 MW is generation capacity per tracker.

TELUS Vancouver and Kamloops Sovereign AI cluster

DEVELOPER OR TENANT
TELUS · TELUS (sovereign AI cloud)

WHERE
Kamloops; Vancouver (Mount Pleasant M3; 150 West Georgia), BC

ANNOUNCED
150 MW · phase 1 85 MW

CAPITAL
not disclosed

POWER
BC Hydro (98 to 99% renewable)

STATUS
Under construction

ANNOUNCED DATE
2025-04-15

PARTNERS
['NVIDIA', 'HPE', 'Government of Canada (Enabling Large-Scale Sovereign AI Data Centres initiative)']

NOTE
85 MW initial supply secured from BC Hydro scaling to over 150 MW by 2032 with 60,000-plus GPUs; Kamloops online 2026, M3 end of 2026, 150 West Georgia 2029; about C$9 billion economic value claimed; protests of about 750 people on May 23, 2026 and again June 27, 2026.

Moore Data Center tracker

DEVELOPER OR TENANT
Carpere Canada

WHERE
Moose Jaw, SK

ANNOUNCED
150 MW

CAPITAL
C$0.7 billion

POWER
not disclosed

STATUS
Proposed

ANNOUNCED DATE
2025

PARTNERS
none disclosed

NOTE
US$485 million converted at 1.37; single secondary source.

Gryphon Digital Mining Pincher Creek tracker

DEVELOPER OR TENANT
Gryphon Digital Mining

WHERE
Pincher Creek area, AB

ANNOUNCED
130 MW

CAPITAL
C$0.7 billion

POWER
not disclosed

STATUS
Proposed

ANNOUNCED DATE
2025

PARTNERS
none disclosed

NOTE
US$500 million converted at 1.37; single secondary source.

Bitdeer Fox Creek tracker

DEVELOPER OR TENANT
Bitdeer

WHERE
Fox Creek, AB

ANNOUNCED
100 MW · phase 1 100 MW

CAPITAL
not disclosed

POWER
101 MW on-site natural gas plant; closed-loop dry cooling

STATUS
Under construction

ANNOUNCED DATE
not disclosed

PARTNERS
none disclosed

NOTE
Tracker lists as under construction; workload type (bitcoin versus AI) not confirmed.

Keel Infrastructure Sherbrooke AI and HPC campus

DEVELOPER OR TENANT
Keel Infrastructure (formerly Bitfarms)

WHERE
Sherbrooke, QC

ANNOUNCED
96 MW · phase 1 96 MW

CAPITAL
not disclosed

POWER
Hydro-Sherbrooke existing 96 MW allocation (consolidating Bunker 48 MW, Leger 30 MW, Garlock 18 MW)

STATUS
approved

ANNOUNCED DATE
2026-07-15

PARTNERS
['Hydro-Sherbrooke', 'City of Sherbrooke']

NOTE
City conditionally approved land sale July 13, 2026; MEIE approval needed to recategorize bitcoin capacity to HPC; land closes Q1 2027; part of a C$1.8 billion North American program (2.2 GW pipeline).

eStruxture CAL-3

DEVELOPER OR TENANT
eStruxture Data Centers

WHERE
Rocky View County (Balzac), AB

ANNOUNCED
90 MW · phase 1 90 MW

CAPITAL
C$0.8 billion

POWER
grid (FortisAlberta)

STATUS
Under construction

ANNOUNCED DATE
2024

PARTNERS
none disclosed

NOTE
205,000 sq ft Tier III, up to 125 kW per rack; opening fall 2026; will be Alberta's largest data centre. CAL-2 (26 to 30 MW) operating since 2023.

QScale Q01 Building B

DEVELOPER OR TENANT
QScale (Infrastructure at Goldman Sachs Alternatives)

WHERE
Lévis, QC

ANNOUNCED
60 MW · phase 1 60 MW

CAPITAL
C$0.7 billion

POWER
Hydro-Québec with waste-heat recovery

STATUS
Under construction

ANNOUNCED DATE
2026-06-04

PARTNERS
['Goldman Sachs Alternatives']

NOTE
60 MW of IT capacity; about 300 workers at peak; campus long-term plan reported at 142 MW.

Vantage QC24

DEVELOPER OR TENANT
Vantage Data Centers

WHERE
Quebec City, QC

ANNOUNCED
32 MW · phase 1 32 MW

CAPITAL
C$0.5 billion

POWER
Hydro-Québec

STATUS
Under construction

ANNOUNCED DATE
2025-02-27

PARTNERS
none disclosed

NOTE
Completes an 86 MW four-building campus in early 2027; Vantage Canada totals 178 MW and about C$2.5 billion.

Yondr Toronto tracker

DEVELOPER OR TENANT
Yondr Group

WHERE
Toronto area, ON

ANNOUNCED
27 MW · phase 1 27 MW

CAPITAL
not disclosed

POWER
IESO grid

STATUS
Under construction

ANNOUNCED DATE
2025

PARTNERS
none disclosed

NOTE
Mid-2026 ready-for-service target; single secondary source.

Microsoft Canada East and Canada Central expansion

DEVELOPER OR TENANT
Microsoft · Microsoft Azure

WHERE
Quebec City area (Lévis, Donnacona, L'Ancienne-Lorette, Saint-Augustin-de-Desmaures); Toronto, QC

ANNOUNCED
not disclosed

CAPITAL
C$7.5 billion

POWER
Hydro-Québec; IESO grid

STATUS
Under construction

ANNOUNCED DATE
2025-12-10

PARTNERS
none disclosed

NOTE
C$7.5 billion over two years announced December 10, 2025, on top of C$680 million announced November 2023; Lévis (Charny) construction began April 15, 2024 with civil works continuing to autumn 2026; new capacity from H2 2026. MW not disclosed.

CoreWeave Cambridge (Cohere anchor tenant)

DEVELOPER OR TENANT
CoreWeave · Cohere

WHERE
Cambridge, ON

ANNOUNCED
not disclosed

CAPITAL
C$0.7 billion

POWER
IESO grid

STATUS
Operating

ANNOUNCED DATE
2024-12-06

PARTNERS
['Government of Canada (up to C$240 million under the Sovereign AI Compute Strategy)']

NOTE
C$725 million project; opened in 2025 per The Globe and Mail; MW not disclosed; criticized because a US operator runs the facility.

QScale Ontario hyperscale campus

DEVELOPER OR TENANT
QScale

WHERE
Wilmot Township (shortlisted), Waterloo Region, ON

ANNOUNCED
not disclosed

CAPITAL
C$3.2 billion

POWER
IESO grid

STATUS
Proposed

ANNOUNCED DATE
2025

PARTNERS
none disclosed

NOTE
Reported at C$2.5 to 4 billion (midpoint used); MW not disclosed.

Bell Rosser (CentrePort) AI data centre

DEVELOPER OR TENANT
Bell Canada · Bell

WHERE
Rural Municipality of Rosser (CentrePort Canada), MB

ANNOUNCED
not disclosed

CAPITAL
not disclosed

POWER
Manitoba Hydro

STATUS
Under construction

ANNOUNCED DATE
2026

PARTNERS
none disclosed

NOTE
Retrofit of the former Merit Functional Foods plant (about 94,000 sq ft); construction began early 2026; operation late 2026 or early 2027; MW not disclosed.

Ritchot hyperscale campus (Jet.AI, Consensus Core, Convergence Compute)

DEVELOPER OR TENANT
Jet.AI, Consensus Core, Convergence Compute

WHERE
Rural Municipality of Ritchot (Ile-des-Chenes), MB

ANNOUNCED
not disclosed

CAPITAL
not disclosed

POWER
on-site natural gas (six turbines proposed)

STATUS
Cancelled

ANNOUNCED DATE
2025

PARTNERS
none disclosed

NOTE
350 acres (141 ha) of farmland; more than 4,200 petition signatures; Premier Wab Kinew said in June 2026 the project is no longer on the table (Capital Hill Group, CBC).

Upper Nicola Band and Bell AI data centre

DEVELOPER OR TENANT
Bell Canada with Upper Nicola Band · Bell

WHERE
Upper Nicola Band lands near Merritt, BC

ANNOUNCED
not disclosed

CAPITAL
C$0.5 billion

POWER
BC Hydro

STATUS
Proposed

ANNOUNCED DATE
2026

PARTNERS
['Bell Canada']

INDIGENOUS PARTNER
Upper Nicola Band (lessor)

NOTE
Band members voted yes; about 2,000 construction jobs and 200 direct jobs claimed; likely one of Bell's two 400 MW-plus high-density sites but MW not confirmed.

Prophet River First Nation and ABCT Pacific data centre

DEVELOPER OR TENANT
Prophet River First Nation (majority owner) with ABCT Pacific (VCC) Ltd.

WHERE
Fort St. John area, BC

ANNOUNCED
not disclosed

CAPITAL
not disclosed

POWER
BC Hydro (Site C hydro)

STATUS
Proposed

ANNOUNCED DATE
2025-03-05

PARTNERS
['ABCT Pacific (VCC) Ltd.']

INDIGENOUS PARTNER
Prophet River First Nation (majority owner)

NOTE
Letter of intent; feasibility study stage; size and capex to be determined.

IREN British Columbia AI conversions

DEVELOPER OR TENANT
IREN · IREN AI cloud

WHERE
Prince George, Mackenzie, Canal Flats, BC

ANNOUNCED
not disclosed

CAPITAL
not disclosed

POWER
BC Hydro

STATUS
Under construction

ANNOUNCED DATE
2025

PARTNERS
none disclosed

NOTE
Existing bitcoin sites being upgraded for AI workloads; site MW not verified in sources reviewed.

TELUS Rimouski Sovereign AI Factory

DEVELOPER OR TENANT
TELUS · TELUS (sold out)

WHERE
Rimouski, QC

ANNOUNCED
not disclosed

CAPITAL
not disclosed

POWER
Hydro-Québec (99% renewable)

STATUS
Operating

ANNOUNCED DATE
2025-04-15

PARTNERS
['NVIDIA', 'HPE']

NOTE
Opened September 24, 2025; fully sold out and Canada's fastest TOP500 system per TELUS (May 2026); MW not disclosed.

Kineticor Rocky View Technology Park

DEVELOPER OR TENANT
Kineticor

WHERE
Rocky View County (northeast quadrant), AB

ANNOUNCED
not disclosed

CAPITAL
not disclosed

POWER
on-site natural gas contemplated; county potable water

STATUS
Cancelled

ANNOUNCED DATE
2025

PARTNERS
none disclosed

NOTE
1,107-acre area structure plan refused 6-1 on September 9, 2025 after a 10-hour hearing with over 50 opposing speakers; may be resubmitted elsewhere.

Steelport hyperscale campus

DEVELOPER OR TENANT
not disclosed

WHERE
Hamilton (Steelport lands), ON

ANNOUNCED
not disclosed

CAPITAL
not disclosed

POWER
IESO grid

STATUS
Cancelled

ANNOUNCED DATE
2025

PARTNERS
none disclosed

NOTE
Refused by Hamilton's Committee of Adjustment after opposition on electricity, water, noise and waterfront use; developer not named in source.

AWS Canada West (Calgary) and Canada Central (Montreal)

DEVELOPER OR TENANT
Amazon Web Services · AWS

WHERE
Calgary; Montreal, AB

ANNOUNCED
not disclosed

CAPITAL
C$24.8 billion

POWER
grid, 100% renewable-matched (2025)

STATUS
Operating

ANNOUNCED DATE
2021-11

PARTNERS
none disclosed

NOTE
Calgary region live December 2023 (C$4.3 billion by 2037, 950-plus jobs); 2026 quick facts commit up to C$24.8 billion in Canadian infrastructure by 2037; MW not disclosed.

APPENDIX C

The provinces at a glance

Price is the large-power industrial rate for a 50,000 kilowatt customer at 85 per cent load factor, rates in effect 1 April 2025. Carbon intensity is the latest year available. Announced megawatts is the sum of every project found in the inventory, at every stage.

PROVINCE	PRICE ¢/KWH	NON-EMITTING	GCO2/KWH	ANNOUNCED MW	SUPPLY OUTLOOK	THE RULE ON LARGE LOADS
British Columbia BC Hydro	6.72	90.6%	15	650	deficit in dry years	Bill 31 (Royal Assent 27 Nov 2025): competitive call for demand; 300 MW AI + 100 MW data centres for Feb 2026 to Feb 2028 (150 + 50 MW in 2028–29); projects 10 to 145 MW; $25,000/MW bid security; applications closed 9 Mar 2026, results Sept 2026; about 800 MW
Alberta AESO (system operator), deregulated market	7.99	21.6%	490	25,346	surplus energy, deficit firm connection capacity	AESO interim limit 1,200 MW allocated to GLDC (970 MW) and Keephills (230 MW); Phase 2 framework under development; Data Centre Regulation AR 117/2026 defines large data centre at 75 MW and prioritizes tethered projects with their own generation or storage. Pr
Saskatchewan SaskPower	8.05	18.5%	730	450	constrained by dispatchable baseload	No cap or formal allocation process; Bell AI Fabric 300 MW near Regina ($1.7 billion initial, $12 billion total) with 300 MW gas backup, construction from spring 2026.
Manitoba Manitoba Hydro	5.09	99.6%	2.0	0	surplus largely committed; tight by 2029	Manitoba Hydro Act changes in force 1 Sept 2025: every request above 5 MW screened for eligibility and feasibility; cryptocurrency mining ineligible; 100 MW Jet.AI proposal rejected June 2026 (secondary source).
Ontario IESO, Hydro One, OPG	12.66	82.5%	38	27	growing deficit from early 2030s	Electricity Act s.28.1 in force Dec 2025 (secondary source): connection of specified load facilities subject to regulatory requirements; Energy for Generations (July 2025) prioritizes data centres with local benefits; data centres 13% of new demand by 2035; IC

PROVINCE	PRICE ¢/KWH	NON-EMITTING	GCO2/KWH	ANNOUNCED MW	SUPPLY OUTLOOK	THE RULE ON LARGE LOADS
Quebec Hydro-Quebec	5.52	98.7%	1.7	188	deficit emerging; surplus era over	Ministerial authorization required for any data centre load of 5 MW or more (since 2025); Bill 69 comparative allocation; proposed Rate CD about 13 cents/kWh for data centres (double current large-power rates), effective late 2026 subject to Regie; underuse ch
New Brunswick NB Power	10.63	47.0%	300	390	deficit forecast by 2028	No framework; NB Power seeks flexible, interruptible data centre loads; Lorneville (Saint John) proposal 190 MW (CBC Nov 2025) to 390 MW (secondary, Aug 2026).
Nova Scotia Nova Scotia Power; IESO Nova Scotia	13.43	26.4%	690	0	deficit; coal exit by 2030	No data centre framework; premier (June 2026): no active proposal, supply security first.
Newfoundland and Labrador NL Hydro	7.66	97.4%	n/a	0	large surplus committed to Quebec	No data centre framework.
Prince Edward Island Maritime Electric	11.27	99.0%	n/a	0	import dependent	None.

APPENDIX D

Policy timeline, 2024 to 2026

Dated policy events from January 2024 to August 2026, federal, provincial and municipal.

2024-04-16 FEDERAL
Budget 2024 commits about $2.4B to AI including $2B for the Sovereign AI Compute Strategy

2024-06-28 BRITISH COLUMBIA
Cryptocurrency Power Regulation (B.C. Reg. 163/2024) deposited

2024-12-03 ALBERTA
AI Data Centre Strategy 'Powering the Future of Artificial Intelligence' published; Minister Glubish sets $100B five-year ambition

2024-12-12 NEWFOUNDLAND AND LABRADOR / QUEBEC
Churchill Falls MOU signed (Gull Island 2,250 MW; 51-year PPA to 2075)

2024-12-31 FEDERAL
Canadian Sovereign AI Compute Strategy launched and Clean Electricity Regulations finalized (December 2024)

2025-03-07 FEDERAL
AI Compute Access Fund (up to $300M) launched; first call closed 31 July 2025

2025-04-28 FEDERAL
Federal election returns a Liberal minority under Mark Carney

2025-05-13 FEDERAL
Evan Solomon appointed first Minister of Artificial Intelligence and Digital Innovation

2025-05-27 FEDERAL
Speech from the Throne: Canada to become the world's leading energy superpower; two-year federal approvals

2025-05-29 BRITISH COLUMBIA
Bill 14 Renewable Energy Projects (Streamlined Permitting) Act receives Royal Assent (SBC 2025 c.12)

2025-06-03 ONTARIO
Bill 40 introduced by Minister Lecce

2025-06-04 ALBERTA
AESO announces 1,200 MW interim large-load limit through 2028; 29 projects sought more than 16 GW

2025-06-17 ROCKY VIEW COUNTY
Council approves the 900-acre Beacon AI Hub area structure plan at Indus

2025-06-26 FEDERAL
Bill C-5 (Building Canada Act) receives Royal Assent

2025-06-30 QUEBEC
Bill 69 on responsible governance of energy resources adopted (June 2025)

2025-08-29 FEDERAL
Major Projects Office established in Calgary under CEO Dawn Farrell

2025-09-01 MANITOBA
Requests for Service Regulation M.R. 68/2025 in force: ministerial priority designation for loads above 5 MW

2025-10-01 FEDERAL
National AI strategy consultation (1 to 31 Oct 2025): 11,300 respondents, 32-member Task Force

2025-10-31 ALBERTA
AESO's 1,200 MW interim capacity fully allocated to GLDC Load (970 MW) and Keephills Phase I (230 MW)

2025-11-04 FEDERAL
Budget 2025: $925.6M for sovereign public AI infrastructure; CIB enabled for AI; Productivity Super-Deduction; Indigenous loan guarantees to $10B

2025-11-27 BRITISH COLUMBIA
Bill 31 Energy Statutes Amendment Act receives Royal Assent, ending first-come, first-served for data centres

2025-11-27 FEDERAL / ALBERTA
Canada-Alberta memorandum of understanding signed (energy and pipeline focus; references AI development)

2025-12-11 ONTARIO
Bill 40 receives Royal Assent (Electricity Act s.28.1 connection approvals)

2025-12-11 ALBERTA
Bill 8 Utilities Statutes Amendment Act, 2025 receives Royal Assent

2026-01-15 FEDERAL
Call for proposals for sovereign AI data centres above 100 MW opens (closes 15 Feb 2026)

2026-01-30 BRITISH COLUMBIA
B.C. Reg. 8/2026 caps new data centre capacity at 400 MW over two years; competitive process launched

2026-02-01 FEDERAL
CIB Statement of Priorities: prioritise AI data centres, at least $5B in digital infrastructure, envelope to $45B

2026-02-19 QUEBEC
Hydro-Québec proposes Rate CD (about 13 cents per kWh) for data centres above 5 MW and Rate CB (19.5 cents) for blockchain

2026-03-09 BRITISH COLUMBIA
BC Hydro 2026 Call for Demand closes: 15 applications for about 800 MW

2026-03-16 SASKATCHEWAN
Bell announces $1.7B, 300 MW AI data centre near Regina on George Gordon First Nation land

2026-04-15 FEDERAL
AI Sovereign Compute Infrastructure Program call opens ($890M build layer); closes 1 June 2026

2026-04-28 FEDERAL
Spring Economic Update publishes six AI strategy pillars including sovereign compute at scale

2026-05-11 FEDERAL / BRITISH COLUMBIA
Canada-TELUS MOU for sovereign AI cluster in Kamloops and Vancouver (85 MW to 150 MW by 2032)

2026-06-04 FEDERAL
AI for All national AI strategy released

2026-06-09 ALBERTA
Data Centre Regulation AR 117/2026 filed; AESO BYOG process published 26 June

2026-06-17 NEW BRUNSWICK
Legislature declines a data centre moratorium motion; province rules out a ban on 13 July

2026-06-30 MANITOBA
Premier Kinew rejects the 100 MW Jet.AI/Consensus Core hyperscale project near Île-des-Chênes (June 2026)

2026-06-30 QUEBEC
Hydro-Québec launches first integrated energy resource management plan (PGIRE 2026-2050)

2026-07-08 ALBERTA
Meta's $13B Sturgeon County campus announced: 970 MW grid connection plus 932 MW Greenlight gas plant

2026-07-28 ROCKY VIEW COUNTY
Council votes a temporary moratorium on new data centre proposals

2026-07-29 ONTARIO
Minister Lecce says data centres must pay 100 per cent of energy costs; Mississauga pauses approvals

2026-08-11 OAKVILLE
Interim control bylaw restricts new data centres for one year

2026-08-13 ONTARIO
Data Centre Playbook posted (ERO 026-0853), comments to 12 September 2026

2026-08-17 NEWFOUNDLAND AND LABRADOR
Revised Churchill Falls agreement announced ($49B 2026 NPV to NL)

2026-08-27 SASKATCHEWAN
Data Centre Framework released: Canadian ownership, self-supplied power, central intake; more than 30 applications pending

APPENDIX E

Trade timeline, 2025 to 2026

Trade and technology-control events from January 2025 to August 2026, with the rate or value where one applies.

2025-01-15 US BUREAU OF INDUSTRY AND SECURITY
Framework for Artificial Intelligence Diffusion published; tiered controls on advanced chips and model weights; Canada in the uncapped top tier **tiered licence caps**

2025-02-01 UNITED STATES (EXECUTIVE ORDER 14193)
IEEPA tariffs on Canadian goods announced, effective Feb 4 then paused to Mar 4 **25% goods; 10% energy and potash**

2025-02-01 CANADA
Retaliation package announced: C$30 billion immediately, C$155 billion in total **25% on C$30B (phase 1)**

2025-03-04 UNITED STATES AND CANADA
US IEEPA tariffs and Canada's phase-1 counter-tariffs take effect **25% / 10% energy; 25% on C$30B**

2025-03-06 UNITED STATES
Amendment exempts CUSMA-compliant goods; potash cut to 10% **0% for CUSMA-compliant goods**

2025-03-10 ONTARIO
25% surcharge on electricity exports to Michigan, Minnesota and New York; withdrawn Mar 11 after Trump threatens 50% on Canadian steel and aluminum **25% surcharge (one day)**

2025-03-12 UNITED STATES
Section 232 steel and aluminum tariffs take effect on all countries **25%**

2025-03-13 CANADA
Counter-tariffs on US steel, aluminum and other goods **25% on C$29.8B**

2025-04-03 UNITED STATES
Section 232 tariffs on automobiles take effect (parts May 3); CUSMA vehicles taxed on non-US content **25%**

2025-04-09 CANADA
Counter-tariff on non-CUSMA US vehicles and non-North-American content in CUSMA vehicles **25%**

2025-05-13 US BUREAU OF INDUSTRY AND SECURITY
Announces rescission of the AI Diffusion Rule with new guidance on Huawei chips and diversion **rule rescinded**

2025-06-04 UNITED STATES
Steel and aluminum tariffs doubled **50%**

2025-06-23 CANADA AND EUROPEAN UNION
Canada-EU summit: Security and Defence Partnership signed; path to SAFE procurement participation (2026) **partnership**

2025-06-29 CANADA
Digital services tax rescinded to restart talks (US had ended talks Jun 27); talks resume Jun 30 with Jul 21 target **3% DST cancelled; C$647M later refunded**

2025-07-23 UNITED STATES
America's AI Action Plan; EO 14318 on data-centre permitting and federal land; EO 14320 American AI Exports Program **projects over 100 MW or USD 500M prioritised**

2025-07-31 UNITED STATES (EXECUTIVE ORDER 14325)
Non-CUSMA tariff on Canada raised, effective Aug 1; copper 50% also from Aug 1 **35% (40% transshipment)**

2025-09-01 CANADA
Counter-tariffs on CUSMA-compliant US goods removed (announced Aug 22); steel, aluminum and autos kept **C$44.2B of counter-tariffs lifted**

2025-10-14 UNITED STATES
Section 232 tariffs on softwood lumber, furniture and cabinets take effect; no CUSMA exemption **+10% lumber; 25% furniture and cabinets (30% and 50% from Jan 1, 2026)**

2025-10-23 UNITED STATES
Trump cancels talks over Ontario's Reagan advertisement; on Oct 25 announces an extra 10% on Canada (no implementing order found in the Federal Register) **+10% announced**

2025-11-26 CANADA
Steel quota cuts, 25% on steel derivatives from Dec 26, Buy Canadian procurement policy; November 2025 Canada-Alberta pipeline MOU **25% on C$10B of steel derivatives**

2025-12-12 UNITED STATES AND ALLIES
Pax Silica declaration signed by seven countries; Canada not a signatory (observer) **24 countries plus EU by mid-2026**

2026-01-14 UNITED STATES (PROCLAMATION 11002)
Section 232 tariff on a narrow class of advanced semiconductors, effective Jan 15; chips for US data centres exempt; phase-two broad tariff reserved **25%**

2026-01-15 US BUREAU OF INDUSTRY AND SECURITY
Licence policy for H200-class chips to China and Macau changed to case-by-case with conditions **case-by-case**

2026-01-15 ISED
Call for proposals under Enabling Large-Scale Sovereign AI Data Centres (to Feb 15, 2026) **no funding committed as of May 2026**

2026-02-20 US SUPREME COURT
Learning Resources v. Trump: IEEPA does not authorise tariffs (6-3); EO 14389 ends collection Feb 24 **IEEPA tariffs voided**

2026-02-24 UNITED STATES
Section 122 temporary import surcharge for 150 days; CUSMA-compliant goods, energy and Section 232 goods exempt; expires Jul 24, 2026 **10%**

2026-04-06 UNITED STATES (PROCLAMATION 11021)
Section 232 duties applied to the full value of steel, aluminum and copper derivatives such as transformers, switchgear, racks and cable **10% to 50% on full value**

2026-05-11 CANADA AND TELUS
MOU for a BC sovereign AI factory cluster (Kamloops and two Vancouver sites) **60,000+ GPUs; 150 MW by 2032; about C$9B economic value**

2026-06-01 ANGUS REID INSTITUTE
Poll: 68% would oppose a large AI data centre a few blocks from home; 46% agree Canada needs domestic AI infrastructure **68% oppose**

2026-06-08 UNITED STATES (PROCLAMATION 11032)
Metals regime adjusted: 15% band for fixed industrial machinery and power equipment to Dec 31, 2027; CUSMA goods 25% on non-US content with 15% minimum; US-content threshold cut to 85% **25% standard; 15% band**

2026-06-18 HIVE (BUZZ HPC), BELL AI FABRIC, COHERE
Three-year GPU contract in a Bell data centre in British Columbia **USD 220M; 2,304 Grace Blackwell GPUs**

2026-06-30 PRIME MINISTER CARNEY
Energy plan: double electricity capacity by 2050, triple LNG within a decade, second pipeline; says no CUSMA renewal expected **2x grid by 2050**

2026-07-01 UNITED STATES TRADE REPRESENTATIVE
First CUSMA joint review: US does not agree to renew; agreement continues to 2036 under annual reviews **no 16-year extension**

2026-07-08 META
First Canadian data centre announced in Sturgeon County, Alberta, powered by the Greenlight gas plant and a 250 MW Capital Power contract **C$13B; about 1 GW**

2026-07-20 UNITED STATES (PROCLAMATIONS 11046, 11047, 11048)
Section 338 duties on listed Canadian goods (alcohol, dairy and motor-vehicle annexes), originally effective Aug 19; no CUSMA exemption **50% on about C$28B (USD 20B)**

2026-07-22 UNITED STATES TRADE REPRESENTATIVE
Greer proposes interim USMCA arrangements by end-2026 and structural changes in 2027 (50% US parts content, Chinese inputs, dairy, alcohol) **interim deals**

2026-07-24 UNITED STATES
Section 122 surcharge expires; Section 301 forced-labour tariffs begin (CUSMA-compliant Canadian goods excluded) **10% (Canada)**

2026-07-29 CANADA AND UNIPER
Second German LNG offtake deal (Uniper, up to 2 million tonnes a year from 2032) after SEFE (1 million tonnes, May 2026); Carney says Ottawa will not cut energy exports to the US **2 Mt/yr**

2026-08-17 CANADA, QUEBEC, NEWFOUNDLAND AND LABRADOR
Churchill Falls and Gull Island agreement replacing the 1969 contract; 985 MW export access to New York and New England **NPV C$49B; federal C$3.5B NPV plus loan guarantee**

2026-08-18 UNITED STATES (PROCLAMATION 11056)
Section 338 duties suspended for three days as Trump announces a deal subject to documents **3-day pause**

2026-08-21 PRIME MINISTER CARNEY
Canada suspends negotiations citing unfair last-minute US terms; pledges dollar-for-dollar retaliation **50% on about C$28B takes effect Aug 22**

2026-08-24 UNITED STATES (TRUTH SOCIAL)
Trump announces 50% on Canadian cars, trucks, parts and steel from Jan 1, 2027; Ontario and Quebec float electricity leverage **50% from 2027-01-01 (threat)**

2026-08-25 DEPARTMENT OF FINANCE CANADA
Counter-tariffs on 700-plus US products from Sept 8 plus C$7.5B support package **15%, 25%, 50% on C$27.6B**

2026-08-26 UNITED STATES (EXECUTIVE ORDER 14420)
National emergency over foreign-supplied bulk-power system equipment (transformers, switchgear, inverters, batteries); Canada not named **rules within 120 days**

2026-09-01 TEXAS PUBLIC UTILITY COMMISSION
Freeze on new data-centre grid connections and audit of a 474 GW interconnection queue; USTR says no talks with Canada under way **474 GW queue**

F

APPENDIX F

Glossary

Terms used in this book, in plain language.

Baseload

Electricity generation that runs continuously rather than following demand. Data centres are close to a baseload customer, which is why utilities value them and why they crowd the grid.

Behind the meter

Generation built on the customer's own site and connected directly to the load, bypassing the public grid. Alberta's policy pushes large data centres toward this arrangement.

Capacity factor

The share of a year a generator actually produces at full output. Wind and solar have low capacity factors, which is why they cannot on their own serve a load that runs constantly.

Colocation

Renting space, power and cooling in someone else's data centre. Contrast with hyperscale, where the operator owns the building and the machines.

CUSMA

The Canada United States Mexico Agreement, the successor to NAFTA. Its treatment of compliant goods has determined which Canadian exports escape American tariffs since 2025.

Curtailment

Being ordered to reduce consumption, usually at times of system stress. Several Canadian frameworks now require data centres to accept curtailment as a condition of connection.

Demand response

A contractual promise by a large customer to reduce load on request, in exchange for cheaper power or faster connection.

Free cooling

Using outside air rather than mechanical refrigeration to cool a building. Canadian winters supply it for much of the year, which lowers both energy and water use.

Gigawatt (GW)

One thousand megawatts. A gigawatt campus running for a year consumes roughly 7,900 gigawatt hours, about 1.3 per cent of everything Canada generates.

HBM

High-bandwidth memory, the specialised memory stacked beside an artificial intelligence processor. Its supply has been sold out and is a real constraint on how fast servers can be built.

Hyperscaler

One of the very large cloud operators, principally Amazon, Microsoft, Google and Meta, which build and own data centres at enormous scale.

Inference

Running a trained model to answer a request. Inference is latency sensitive, so it prefers to sit near users, unlike training.

Interconnection queue

The list of projects waiting for permission and physical connection to the grid. Position in the queue, not price, is often the binding constraint.

Large load

A grid customer above a defined size threshold, commonly 75 megawatts in Alberta or five megawatts in Quebec and Manitoba, which triggers a separate approval process.

Latency

The delay between a request and its answer, driven largely by distance. It is why inference capacity is built near cities and training capacity can be remote.

Megawatt (MW)

A unit of power, meaning a rate of energy use. One megawatt running for a year is about 8,760 megawatt hours, roughly the annual electricity of 750 average Canadian homes.

Neocloud

A newer specialist provider renting artificial intelligence compute, such as CoreWeave, Nebius or Lambda, as distinct from the established hyperscalers.

Non-emitting

Generation that does not burn fossil fuel: hydro, nuclear, wind, solar and biomass. Seventy-eight per cent of Canadian generation qualifies.

PPA

Power purchase agreement. A long-term contract to buy electricity at an agreed price, and the usual instrument for financing new generation dedicated to a campus.

PUE

Power usage effectiveness, total facility power divided by the power reaching the computers. A perfect building would be 1.0; the world average has been stuck near 1.5 for six years, and the best operators run at 1.1.

Rack density

Electrical power drawn by one rack of equipment. Traditional racks draw about nine kilowatts; a current artificial intelligence rack draws about 120, which forces liquid cooling.

Rate class

The tariff category a customer falls into. Creating a separate data-centre rate class, as Quebec has proposed, is how a utility charges these customers differently.

SMR

Small modular reactor. Ontario's Darlington project is the first in a Group of Seven country, and is often cited as future firm clean supply for large loads.

Social licence

Informal community acceptance of a project, distinct from legal permission. In several Canadian provinces it has become the binding constraint.

Sovereign compute

Computing capacity located in a country and operated under its law, so that data is not exposed to foreign jurisdiction such as the United States CLOUD Act.

Stranded asset

Infrastructure built for demand that does not arrive, leaving the cost to be recovered from someone. The central risk in building transmission for announced data centres.

Terawatt hour (TWh)

A million megawatt hours. Canada generates roughly 640 terawatt hours a year; the world's data centres used about 485 in 2025.

Tethered

Alberta's term for a data centre that brings its own dedicated generation rather than drawing firm capacity from the shared grid. Tethered projects are prioritised.

Time to power

How long before a site can actually draw the electricity it needs. In most markets this now matters more to a developer than the price of that electricity.

Training

Building a model by processing very large amounts of data. Training is compute-intensive but tolerant of distance, so it can be sited remotely.

Transformer

The equipment that steps voltage up or down between the grid and a site. Lead times of 128 to 160 weeks have made it one of the hardest bottlenecks to solve.

WUE

Water usage effectiveness, litres of water per kilowatt hour. Closed-loop designs approach zero; evaporative cooling can reach 1.9 to 2.5 litres.

APPENDIX G

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APPENDIX H

Terrestrial power options, a supplementary note

What this is, and how it differs from the other briefs. During the hardware research (brief 09) a sub-agent produced this separate body of findings on the terrestrial alternatives to grid power: small modular reactors, gas with and without carbon capture, geothermal, hydro uprating, flexible and curtailable load, and waste-heat reuse. It did not pass through the editing that the numbered briefs received, so it is filed here as a raw research note rather than as a chapter of the book.

Treat it accordingly. Every figure carries the URL it came from, and the note is explicit about which numbers are company claims, which are regulator or laboratory figures, and which sources could not be opened because of anti-scraping walls. Read those caveats before quoting anything.

Why it is worth keeping. Three findings in here are not covered anywhere else in this research set: the Duke University flexible-load study, which is the cheapest and fastest of all the options; the fact that almost none of the announced gas-for-AI projects actually commit to carbon capture; and the honest gaps in Canada, which has no confirmed reactor-to-data-centre agreement, no Canadian equivalent of the Duke study, and outside one Quebec greenhouse project no data-centre district heating with published figures.

The one-line summary

The cheapest and fastest of the seven options is not a technology at all. It is agreeing to switch off occasionally. Duke University found that 76 to 98 gigawatts of new load could join the United States grid today if it accepted curtailment for 85 to 177 hours a year. Google has already contracted a gigawatt of exactly that. Compare it with Darlington: C$20.9 billion and more than five years for 1.2 gigawatts.

1. Small modular reactors

Darlington New Nuclear Project, Ontario. The only one of these actually being built.

ITEM	FIGURE
Capacity per unit, GE Vernova Hitachi BWRX-300	300 MWe
Total for four units	1,200 MW
Total capital cost, four units	C$20.9 billion (2024 dollars)
First unit, including shared infrastructure	C$7.7 billion

ITEM	FIGURE
Fourth unit projected	C$4.1 billion, about 33% cheaper than the first
Licence to construct issued	4 April 2025, valid to 31 March 2035
Operating licence application	25 March 2026
Target in service, unit 1	end of 2030; remaining units mid-2030s

Announced economics, from the province and the federal Major Projects Office, are claims rather than outcomes: up to 18,000 annual construction jobs, 2,500 operating jobs, C$38.5 billion added to GDP over 65 years, more than 80% of spending to Canadian firms.

Sources: CNSC, World Nuclear News on the budget, Major Projects Office.

Reactor deals signed for data centres, all outside Canada and all pre-construction.

BUYER AND PARTNER	CAPACITY	ANNOUNCED	STATUS
Google with Kairos Power	up to 500 MW	14 Oct 2024	announced, first online target 2030
Amazon with X-energy and Energy Northwest	320 MW initial, up to 960 MW	Oct 2024	pre-permit, operations in the 2030s
Meta, following its Dec 2024 request for proposals	up to 6.6 GW by 2035	9 Jan 2026	announced: TerraPower 2.8 GW, Oklo 1.2 GW, Vistra 2.1 GW plus 433 MW of uprates
Microsoft with Constellation, Three Mile Island unit 1 restart	835 to 837 MW	20 Sep 2024	US$1.6 billion, US DOE loan of US$1.0 billion closed Nov 2025

The Canadian finding is a negative one. No confirmed, signed Canadian reactor-to-data-centre power agreement exists in any primary source. SaskPower's own pages still state that no technology and no site have been selected. New Brunswick's utility news feed carries no reactor items to 31 August 2026. Darlington is utility generation for the grid, not contracted to any named data centre.

2. Natural gas, with and without carbon capture

The framing point worth teaching: almost none of the announced gas-for-AI projects commit to carbon capture. It is repeatedly described as flexibility to add later.

- **Chevron with Engine No. 1 and GE Vernova**, 28 January 2025: up to 4 GW of co-located gas for United States data centres, seven GE Vernova 7HA turbines, first power targeted end of 2027. Carbon capture appears only as design "flexibility to integrate" later. Chevron
- **Project Kilby**, 22 June 2026: a Chevron subsidiary signed a 20-year power purchase agreement with Microsoft for about 2.67 GW in West Texas. Final investment decision expected by end of 2026, first power 2028. Emissions control listed is selective catalytic reduction for nitrogen oxides only. **No carbon capture is mentioned.** Uses brackish groundwater, not fresh water. Chevron
- **NET Power**, the purest carbon-capture play, publicly recalibrated on 13 August 2026 toward fast-deployment unabated gas, deferring capture to later phases pending better economics. No project financing or named data-centre customers as at that release. NET Power

- **Calpine and Constellation** have signed a series of unabated gas powered-land deals in Texas: 190 MW and then 400 MW with CyrusOne at Thad Hill, 380 MW at Freestone, and the 460 MW Pin Oak peaker which opened 5 May 2026. Calpine

Alberta. AESO's own June 2025 figure is 29 proposed projects and more than 16 GW seeking connection, against an interim limit of 1,200 MW to 2028, fully allocated to two projects: GLDC Load at 970 MW and Keephills Phase I at 230 MW. The widely quoted 20.7 GW figure appears in commentary, not on any AESO page, so cite it as reported. Phase 2 work ran from November 2025 to April 2026 and covers tethering agreements, with no curtailable-load provisions detailed. AESO newsroom, AESO large load projects.

A correction worth carrying. The C$100 billion figure attached to Alberta's AI Data Centres Strategy does **not** appear in the strategy document itself, which also contains no megawatt or gigawatt targets. It comes from ministerial statements reported in the press. Strategy PDF

Wonder Valley is registered in Alberta's major projects registry with status "proposed": phase 1 of 1.4 GW at C$12.0 billion, 7.5 GW and more than $70 billion at full build, natural gas with possible geothermal, no construction start recorded. Registry

3. Geothermal

Fervo Energy is the reference case for engineered geothermal.

ITEM	FIGURE
Project Red, Nevada, demonstration	3.5 MW, online 2023
Drilling cost per well, first four Cape wells	US$9.4M falling to US$4.8M
Fastest Cape well	21 days, a 70% reduction against 2022
Cape Station, Utah	Phase I about 100 MW, Phase II 400 MW, total 500 MW
Status as at Q2 2026	under construction; first power targeted Q4 2026
Phase II target all-in cost	US$5,500 per kW
Google power purchase agreements	115 MW Nevada (Jun 2024) plus 396 MW Cape Station (1 Sep 2026), option for about 600 MW more
Long-term target	1.1 GW by 2030

Fervo newsroom.

Eavor, a Calgary company, achieved first electricity at Geretsried in Germany on 5 December 2025, rated 8.2 MW electric, about a year behind its original target, supported by a EUR 91.6 million European Innovation Fund grant. Eavor

The Canadian reality check, and the best single number in this note. Canada's total installed geothermal electricity capacity in 2024 was **6 megawatts**, out of 156,388 MW nationally. Statistics Canada Table 25-10-0022-01

4. Hydro uprating

United States Department of Energy and Oak Ridge National Laboratory found that of a net 2.1 GW added to the American hydro fleet between 2010 and 2022, **1.4 GW came from upgrading existing plants**, and that across the 155 plants with additions the **median capacity increase was 15%**, achievable through runner replacement and generator rewinds. The pace has since slowed from 193 MW a year to 66 MW a year. US Hydropower Market Report 2023

Hydro-Québec's 2035 Action Plan commits C$155 to 185 billion by 2035 for 8,000 to 9,000 MW of additional capacity, of which **3,800 to 4,200 MW is hydropower**, plus 1,500 to 1,700 MW of wind and 1,600 to 1,800 MW from energy savings. Action Plan 2035

Canada's installed hydro capacity in 2024 was 83.05 GW, 53.1% of the national total, led by Quebec at 40.70 GW, British Columbia at 16.39 GW and Newfoundland and Labrador at 7.59 GW.

5. Flexible and curtailable load, the cheapest option

Norris, Profeta, Patino-Echeverri and Cowie-Haskell (2025), *Rethinking Load Growth*, Nicholas Institute, Duke University, NI R 25-01, published 13 February 2025. Nine years of hourly data across 22 balancing authorities serving 95% of United States peak load.

CURTAILMENT ACCEPTED	NEW LOAD THAT COULD BE INTEGRATED	CURTAILMENT HOURS A YEAR	AVERAGE EVENT
0.25% of uptime	76 GW, about 10% of US peak demand	85	1.7 hours
0.5%	98 GW	177	2.1 hours
1.0%	126 GW	366	2.5 hours
5.0%	215 GW	1,848	4.5 hours

United States systems run at a 53% average load factor, which is why the headroom exists. At the 0.5% limit, PJM alone offers 18 GW. Note that 88% of curtailment hours still retain at least half the new load.

Landing page. The institute's site blocks automated retrieval; the full text is also filed in an Illinois Commerce Commission docket at icc.illinois.gov, and the authors' own slide deck is at ISO New England.

Google has contracted a gigawatt of it. On 19 March 2026 Google said it had integrated 1 GW of demand response into long-term energy contracts with Indiana Michigan Power, the Tennessee Valley Authority, Entergy Arkansas, Minnesota Power and DTE Energy, by limiting or shifting machine-learning workloads. Its own caveat is that flexibility is limited and location-specific. Google

Emerald AI reports demonstrated pilots including a 25% load reduction sustained over three hours in Phoenix with Salt River Project, and a 96 MW power-flexible reference architecture in Virginia with Nvidia, Digital Realty and Dominion. These are company claims. Emerald AI

The Canadian gap. There is no published Canadian equivalent of the Duke study and no Canadian curtailable-load programme for data centres with verifiable megawatt figures. AESO's Phase 2 work is about connection sequencing and tethering, not curtailment. Ontario's system operator treats data centres as an uncertain step load rather than a flexibility resource. This is a genuine gap and a good student question.

6. Waste heat reuse

QScale Q01, Lévis, Quebec, is the Canadian example. The campus is 142 MW with 114 MW of protected customer load, claims a power usage effectiveness below 1.2 and free cooling up to 80% of the year, and says **up to 96 MW of waste heat could be distributed**, enough to heat more than 15,000 Quebec households, with agricultural targets of 2,800 tonnes of small fruit and more than 80,000 tonnes of tomatoes a year. Every one of those is a projection or a potential, not a delivered figure. No primary source gives greenhouse hectares built, produce actually delivered, or carbon dioxide actually avoided. QScale Q01, Énergir partnership

Meta Odense, Denmark projects 165,000 MWh a year recovered, described as enough to warm 11,000 homes. Again a design projection; Meta does not publish delivered megawatt hours. Meta

Stockholm Exergi supplies the most useful commercial number in this section: it pays about **2 million Swedish krona a year for heat deliveries of 1 MW**, which turns a cooling cost into a revenue line. Its network runs 3,000 km of heating pipe and 300 km of cooling pipe. Stockholm Exergi

Outside QScale, no other Canadian data-centre district heating project with published figures was found.

7. Canadian context numbers gathered along the way

Generation mix, 2025, Statistics Canada Table 25-10-0015-01, total 625.2 TWh: hydro 343.37 TWh (54.92%), combustible fuels 143.43 (22.94%, of which non-renewable 134.14), nuclear 81.57 (13.05%), wind 50.49 (8.08%), solar 5.96 (0.95%). Provincial 2025 shares: Quebec 92.8% hydro, British Columbia 88.7% hydro, Ontario 46.1% nuclear, Alberta 76.0% combustible.

Canada Energy Regulator, Canada's Energy Future 2026, published 9 April 2026. Electricity demand grows 30% to 120% by 2050 depending on scenario. **In the higher scenario, data centres are about a quarter of all demand growth, roughly 100 TWh.** Total capacity reaches 310 GW by 2050. CER

Ontario system operator, 2026 Annual Planning Outlook, published 20 March 2026. Commercial data-centre demand grows from 4.5 TWh in 2027 to 22.6 TWh in 2050 in the reference case, 28.4 TWh in the high case and 14 TWh in the low case, which counts only projects with a completed system impact assessment. For contrast Ontario's entire commercial sector excluding data centres grows 41% over the same period. IESO

Hydro-Québec puts current data-centre peak at about 200 MW, growing to nearly 1,000 MW by 2035, with blockchain at about 115 MW and no growth expected.

Caveats to carry into the classroom

1. Gas plus carbon capture for data centres is mostly gas without carbon capture.
2. Darlington is the only project in this note that is genuinely under construction.

3. Canada has no confirmed reactor-to-data-centre agreement, no equivalent of the Duke flexible-load study, and outside QScale no data-centre district heating with published figures.
4. Canada's structural advantage sits in the price table, not the technology table. Montreal large-power at 5.83 cents against Boston at 28.19 cents is a 4.8 times spread, and Quebec's response has been to raise the data-centre rate to about 13 cents and ration access above 5 MW.
5. Flexible load is the cheapest and fastest option, and Canada has not started on it.

Sources that could not be opened

The Nicholas Institute, Constellation, the Nuclear Regulatory Commission, Ontario Power Generation and Equinix all block automated retrieval. Figures attributed to them here came from mirrors, regulatory dockets or partner releases, and are labelled as such above. Open them in a browser before quoting.

APPENDIX I

What data centres pay, and what they must agree to

Provenance, which is unusual and worth reading

This note went through an alarming episode. The research agent that produced it first delivered a long, heavily cited report. It then **retracted the report and claimed it had fabricated the citations**. It then **withdrew that retraction** and said the material was genuine after all.

Rather than take any of those three claims on faith, the underlying files were located on disk, and one high-stakes claim was checked against the primary source.

The result: the research is genuine and, on the test applied, accurate. The three source reports exist, run to 1,009 lines and carry 131 source URLs between them. The PJM capacity-price table, the most consequential set of numbers here, was verified line by line against PJM's own auction report. Every figure matched exactly, including the clearing prices, the cleared unforced capacity of 138,317.8 megawatts, and the price cap and floor. That report is saved alongside the note.

The lesson for a classroom is worth stating plainly. An AI research agent asserted twice without checking: once that its work was complete, and once that its work was invented. Both assertions were wrong, and the second would have destroyed good work. The fix in each case was to go and look at the artifact. That is the habit this whole project is trying to teach.

Everything below carries a source. The sections on Japan, Korea, Maharashtra and Uttar Pradesh remain genuinely unresearched, because several government sites blocked automated access. Those gaps are marked, and the agent's own "do not assert" list at the end is real and is the most useful part of the note.

Full source reports and the verification PDF: `research/downloads/13-tariffs-and-large-load-rules/`.

Canada

Quebec. Hydro-Québec has proposed a data-centre rate of **13 cents per kWh** for loads above 5 MW, and **19.5 cents** for cryptocurrency, announced **19 February 2026**. It is **proposed, not approved**: it sits with the Régie de l'énergie as docket **R-4333-2026**, status open, with procedural decisions D-2026-025, D-2026-045 and D-2026-077. Quebec's data centres currently draw about **190 MW** and blockchain about **115 MW**.

The detail that news coverage misses: **data centres do not take Rate L**, which is reserved for subscriptions linked primarily to an industrial activity. They take **Rate LG**. From 1 April 2026 the two differ:

	DEMAND CHARGE	ENERGY CHARGE
Rate L, industrial	$15.027 per kW	3.821 cents per kWh
Rate LG, what a data centre pays	**$16.571 per kW**	**4.324 cents per kWh**

Rate LG also carries an **unused available capacity charge of $38.502 per kW**, which applies when demand falls below 60% of contracted capacity. Several operators are challenging its validity in the Québec Superior Court.

Bill 69 is in force. It requires ministerial authorisation for any request of **5 MW or more**, or **50 kW or more** for cryptographic use, with a 15 working day decision deadline for requests up to 50 MW at a site already served.

Sources: Hydro-Québec press release of 19 February 2026; the Régie docket page for R-4333-2026; Hydro-Québec's own tariff PDF; the official Bill 69 statute PDF.

Ontario. The Data Centre Playbook is a **draft**, out for comment under **ERO notice 026-0853** until **12 September 2026**. It proposes a separate Global Adjustment class for new data centres above about 1 MW, which would be **ineligible for the Industrial Conservation Initiative**. No special data-centre rate is in force in Ontario today. The IESO's 2026 Annual Planning Outlook forecasts Ontario demand growing **65% by 2050**, with data centres **8.6% of demand in 2050** and an **8 TWh need emerging in 2032**.

Alberta. The **1,200 MW** interim limit announced **4 June 2025** applies at a **75 MW** threshold. It was set against **29 projects and more than 16 GW** of requests, and went entirely to two projects: **GLDC Load at 970 MW** and **Keephills Phase I at 230 MW**.

The bring-your-own-power route narrowed on **3 June 2025**, when the Alberta Utilities Commission **rejected the Coaldale project**, ruling that self-supply generation cannot span multiple properties separated by roads and railways. Alberta's Bill 8 is referenced in commentary but **could not be verified** and should not be cited.

British Columbia, the finding worth knowing. BC gives qualifying data centres a **discount**, not a penalty. Rate Schedule **1894**, the Clean BC Industrial Electrification Rate, treats a data centre as an "Innovation Customer" if contract demand exceeds **10,000 kVA**, annual consumption exceeds **70 GWh**, and the plant is **not** mining cryptocurrency. The rate is a multiplier on standard transmission service: **0.80 in years 1 to 5**, 0.87 in year 6, 0.93 in year 7.

Standard rates from 1 April 2026: Rate Schedule 1830, transmission service, **$12.178 per kVA and 4.914 cents per kWh**. Rate Schedule 1600, large general service, $13.83 per kW and 6.79 cents per kWh. Rate Schedule 1823 was cancelled on 1 April 2026.

BC's allocation is the **100 MW conventional plus 300 MW AI** split over two years, capped at **145 MW per project**, with **$25,000 per MW** of bid security. **This split belongs to British Columbia. It has been misattributed to Quebec in circulating summaries.** Quebec allocates case by case and publishes no aggregate cap.

Source: BC Hydro's own Electric Tariff PDF; BLG for the allocation process.

Two jurisdictions Canada is bidding against

Ireland. The Commission for Regulation of Utilities published its Large Energy User Connection Policy, **CRU2025236**, on **12 December 2025**, and it is in force. Above **10 MVA** a data centre must provide onsite or proximate dispatchable generation or storage matching its import capacity. Everything at or above **1 MVA** must source at least **80% of annual demand from additional renewable generation in Ireland**, phased over six years. System operators had to publish a connection process by **31 March 2026**.

Ireland's data centres used **7,663 GWh in 2025, 23% of metered electricity**, up 10% on the year against 2% for all other users. The 2024 figure was **22%**. Residential dwellings together are 28%. Source: the Central Statistics Office release.

The commonly cited **2028 end date for the Dublin connection moratorium could not be verified**. The 2021 pause itself is well established.

Virginia. The State Corporation Commission approved a new **GS-5 rate class for customers at or above 25 MW**, effective **1 January 2027**. Large load customers must take and pay for service for **at least 14 years**, pay at least **85% of transmission and distribution costs monthly regardless of use**, and post collateral of up to **60%** of minimum charges. Customers served before **1 January 2016** are exempt.

The useful nuance: independent modelling by Arcadia found GS-5 can be **cheaper** than the existing GS-4 for a high-load-factor data centre. What GS-5 unambiguously does is **transfer risk**, through the 14-year term and the 85% floor. The popular framing that it simply makes data centres pay more is contested.

Source: the SCC's own fact sheet; Dominion's filed GS-4 tariff.

Texas, the verified part only

Senate Bill 6 became law in **June 2025** and is being implemented through **five separate PUCT projects**, numbered 58479, 58480, 58481, 58482 and 58484. The interconnection standard, **16 TAC 25.194**, was published for comment on **12 March 2026** with comments due **17 April 2026**, and is **proposed, not adopted**. It applies at **75 MW**. Large loads interconnected after **31 December 2025** must be curtailable during firm load shed. ERCOT's Batch Zero process groups projects of 75 MW and above.

As of a PUCT presentation in **October 2025**, large-load interconnection requests totalled **189 GW, nearly 69% of it data centres**.

By June 2026 ERCOT reported **more than 438 GW** of large-load requests, nearly 89% of it data centres. That figure is an **upper bound on speculative interest, not a forecast**. ERCOT's own adjusted 2030 peak forecast is **139 GW**, because it discounts data-centre requests to **49.8%** of requested megawatts based on what actually energised at sites commissioned in 2022 to 2024, and officer-letter loads to 55.4%. From summer 2027 ERCOT models data centres as **100% curtailable**. Proposed fees would be **$50,000 per MW** of financial security plus a **$50,000 per MW** non-refundable interconnection fee, so roughly $30 million for a 300 MW project before construction. Note that the same March 2026 document states $100,000 per MW in its preamble and $50,000 in the rule text; use the rule text.

Germany, the statute only

The Energy Efficiency Act defines a data centre at **300 kW** of non-redundant nominal connected load and sets binding limits:

REQUIREMENT	THRESHOLD
Power usage effectiveness, existing sites	1.5 or below from 1 July 2027; 1.3 or below from 1 July 2030
Power usage effectiveness, sites starting from 1 July 2026	1.2 or below
Waste heat reuse	10% from July 2026, 15% from 2027, 20% from 2028
Renewable electricity, balance-sheet basis	50% from 1 January 2024, 100% from 1 January 2027

Germany's new industrial electricity price floor of **50 euros per megawatt hour** was approved as state aid in April 2026 under case SA.120495, running 2026 to 2028 with a budget of 3.8 billion euros. Data centres almost certainly **do not qualify**, because eligibility follows a list of manufacturing and mining activities, and data processing and hosting is neither. Treat that last point as a strong inference rather than a verified fact. A 2026 amendment to the Act is in draft and its numbers are **not verified**.

The two price sets that are verified

Hydro-Québec's North American comparison, at 50,000 kW and 85% load factor, rates in effect 1 April 2025, Canadian cents per kWh excluding taxes. This is the single best exhibit in the note.

CITY	¢/KWH	CITY	¢/KWH
Winnipeg	5.09	Chicago	9.25
Montréal	5.52	Toronto	12.66
Vancouver	6.72	Houston	12.90
Calgary	7.99	New York	22.88
Edmonton	8.05	Boston	24.58
		21-city average	**11.61**

Quebec's proposed 13 cents would sit **above** that 21-city average, above Toronto and above Houston.

United States Energy Information Administration, industrial, US cents per kWh: Texas 6.58 in June 2026 and 6.65 year to date; Virginia 9.31 and 10.08; Pennsylvania 8.87 rising to 10.91 year to date; United States average 9.17 and 8.89.

Eurostat, industrial, euro cents per kWh, second half of 2025. Band ID is 2,000 to 19,999 MWh a year, band IG is 150,000 MWh and above, which is the hyperscale band. Prices excluding all taxes:

COUNTRY	BAND ID	BAND IG
Norway	6.38	4.08

COUNTRY	BAND ID	BAND IG
Sweden	8.46	6.39
Netherlands	14.25	9.19
Germany	16.13	11.90
Ireland	21.18	15.62
European Union average	15.96	10.96

Ireland is the most expensive non-household market in the Union. Note how far apart the two bands are: a hyperscale campus pays roughly a third less than a mid-sized industrial user in the same country, which is why quoting the wrong band is the commonest error in cross-country price comparison.

PJM, the number that should concentrate a Canadian mind

These figures were independently verified against PJM's own 2028/2029 Base Residual Auction Report, saved in the downloads folder.

DELIVERY YEAR	CLEARING PRICE, $/MW-DAY	CLEARED UCAP, MW	TOTAL COST
2024/25	28.92	147,478.9	$2.2bn
2025/26	269.92	135,684.0	$14.7bn
2026/27	329.17	134,205.3	$16.1bn
2027/28	333.44	134,478.1	$16.4bn
2028/29	325.00	138,317.8	$16.4bn

Prices are held down only by a temporary cap and floor of **$256.75 and $138.25 per MW-ICAP**, which are **$325.00 and $175.00** on an unforced capacity basis. PJM's own no-collar simulation says 2027/28 would otherwise have cleared at **$529.80**, about $9.9 billion higher. The last two auctions both cleared at a **14.4% installed reserve margin**, well below the 20% target.

For a 100 MW data centre in 2027/28, applying the forecast pool requirement, that is roughly **$11 million a year in capacity charges alone**, against about $1 million three years earlier. PJM attributes **30 GW of 32 GW** of forecast demand growth to 2030 to data centres.

PJM's **Interim Resource Adequacy Service**, filed with FERC on **13 August 2026** and pending, would require new large loads above 50 MW to bring their own generation, curtail them at the first emergency level **ahead of residential customers**, and from the 2029/2030 auction stop new large loads that bring no new supply from counting toward the capacity everyone else pays for.

This is the single best argument for siting in Canada, and the single best warning about what happens when a grid operator runs out of room.