EHRC

Powering Intelligence

AI-Driven Change in Canada's Electricity Workforce

NOVEMBER 2025

IN COLLABORATION WITH

Future Skills Centre
Centre des Compétences futures

ABOUT

Electricity Human Resources Canada

Electricity Human Resources Canada (EHRC) is the leading provider of research and analysis on human resources issues impacting Canada's electricity and renewable energy sector. We empower the sector to meet its evolving workforce needs by delivering strategies and programs that help employers recruit, retain and develop the skilled workers essential for operating an efficient and reliable electricity system.

We deliver critical business intelligence that informs labour market decision-making, forge partnerships that enable the industry to adapt and upskill and lead initiatives that strengthen and sustain a safety-focused, innovative and inclusive workforce. We are dedicated to build-ing a world-class electricity workforce that supports Canada's transition to a low-carbon economy.

For more information, visit ehrc.ca.

ABOUT THE

Future Skills Centre

The Future Skills Centre (FSC) is a forward-thinking centre for research and collaboration dedicated to driving innovation in skills development so that everyone in Canada can be prepared for the future of work. We partner with policymakers, researchers, practitioners, employers and labour, and post-secondary institutions to solve pressing labour market challenges and ensure that everyone can benefit from relevant lifelong learning opportunities. We are founded by a consortium whose members are Toronto Metropolitan University, Blueprint, and The Conference Board of Canada, and are funded by the **Government of Canada's Future Skills Program**.

For more information, visit fsc-ccf.ca.

About this Report

Artificial intelligence is transforming Canada's electricity workforce—reshaping roles, skill requirements and organizational strategies. This report offers data-driven insights and forward-looking guidance, highlighting how human talent, inclusive training and ethical innovation can shape a resilient, equitable and sustainable energy future.

For more information about this project, visit **ehrc.ca/artificial-intelligence**

This project has been funded by the Government of Canada's Future Skills Program.

The opinions and interpretations in this publication are those of the author and do not necessarily reflect those of the Future Skills Centre or the Government of Canada.

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This report is also available in French.
Ce rapport est également disponible en français : L'intelligence en action : évolution de la main-d'œuvre du secteur canadien de l'électricité par l'IA

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A Message from EHRC and FSC

On behalf of EHRC and the Future Skills Centre, we are proud to present this landmark report on the transformative role of artificial intelligence (AI) in Canada's electricity sector.

AI is no longer a distant possibility. It is a present force reshaping how electricity is generated, distributed and governed. From predictive maintenance and outage forecasting to smart grid coordination and customer engagement, AI is driving innovation across the sector. But with this transformation comes a responsibility to ensure that technological progress is matched by workforce readiness, ethical governance and inclusive opportunity.

This report offers a comprehensive analysis of how AI is being adopted across Canada's electricity industry, and what it means for the people who power it. It highlights the strategic imperatives facing utilities, regulators, educators and policymakers: to modernize infrastructure, upskill workers and build trust in intelligent systems. It also underscores the urgency of preparing for rising electricity demand, particularly from AI-intensive data centres, and the need for coordinated planning to ensure sustainability and resilience.

At the heart of this report is a commitment to people. AI will not replace human judgment, but it will redefine how decisions are made and who makes them. We must ensure that all communities—urban, rural, Indigenous and remote—benefit from the opportunities AI presents. That means investing in lifelong learning, supporting inclusive hiring and designing systems that reflect Canada's values of equity, transparency and environmental stewardship.

We are grateful to the many stakeholders who contributed to this study, including employers, unions, educators and community leaders. Their insights have shaped a report that is not only rich in data but grounded in lived experience and practical foresight.

Together, we can harness AI as a catalyst for a more adaptive, inclusive and sustainable electricity sector. We invite you to explore the findings, reflect on the recommendations and join us in shaping a future where technology and talent work hand in hand.

Michelle Branigan
CEO
EHRC

Noel Baldwin
Executive Director
Future Skills Centre

Executive Summary

POWERING INTELLIGENCE · 2025

Artificial Intelligence (AI) is transforming Canada's electricity sector, offering new opportunities for **efficiency, resilience and climate action** while introducing complex challenges for utilities, regulators and workers.

This report explores how AI is reshaping operations, redefining job roles and skill requirements, and accelerating demand for electricity, particularly from AI-intensive data centres.

Key Findings:

AI is already transforming operations: used for load forecasting, outage prediction, customer engagement and distributed energy resource management.

New demand drivers are reshaping the grid: data centres are driving new electricity demand, while integrating renewables and Small Modular Reactors (SMRs) are adding operational complexity.

Policy adoption lags behind usage: only 34% of organizations have implemented AI policies, 40% are developing one and 24% have not started. Yet 60% of employers say their employees are actively using AI in the workplace.

Canada faces an AI literacy gap: just 24% of respondents have received formal training, highlighting a major workforce readiness gap.

AI adoption is uneven: regional disparities and slower uptake in frontline and field-based roles highlight integration challenges, mostly related to upskilling rather than workforce displacement.

Equity and inclusion are critical: Indigenous participation, hybrid skill development and regional planning must be prioritized to ensure fair access to AI-driven energy innovation.

Training programs aligned to new AI deployments will be critical to realize the benefit of productivity gains in the workplace: partnerships between industry and post-secondary institutions will be important to maximize training efficiencies.

Strategic Imperatives

To harness AI responsibly and effectively, the sector must:

1. **Adapt operations to AI-driven disruption and rising electricity demand.**
2. **Strengthen governance to ensure ethical, transparent and inclusive deployment.**
3. **Transform education and workforce training to build a digitally fluent, future-ready workforce.**
4. **Embed equity, sustainability and public trust into every stage of AI adoption.**

AI will not replace human judgment, but it will reshape how decisions are made, who makes them and how the sector prepares for the future. Human resources leaders and workforce strategists are pivotal in guiding this transformation—ensuring that skills development, productivity and ethical practices support long-term sector resilience.

With coordinated leadership and sustained investment, Canada can position its electricity workforce to thrive in a low-carbon, intelligent electricity system.

1

AI Technologies Reshaping Electricity Operations

Canada's electricity sector is undergoing rapid digital transformation, driven by technologies that enhance **grid stability, operational efficiency and customer experience.** While smart meters, SCADA systems and renewable integration laid the foundation, **artificial intelligence (AI)** is now emerging as a transformative force—helping utilities manage complexity, streamline decision-making and automate energy systems.

AI Platforms for Grid and Operational Intelligence

One of the most promising developments is the rise of **energy-specific AI platforms.** These systems ingest live data from sensors, weather feeds, billing systems and grid telemetry to deliver real-time insights on **consumption, emissions and cost performance.** Natural language interfaces allow staff to ask simple questions and receive instant, actionable answers, reducing the need for specialized analytic support.

Common capabilities include:

- **Automated reporting on energy use, emissions and operational performance**
- **Smart alerts for anomalies and inefficiencies across assets**
- **Optimized scheduling based on predictive data and instantaneous conditions**
- **Integration with grid programs like Demand Response and Distributed Energy Resource (DER) markets**

Generative AI tools are also expanding how frontline staff interact with energy systems. Instead of navigating complex dashboards, personnel can ask questions like: *"What time yesterday did our compressor spike in load ?"* or *"How can we reduce emissions during peak hours?"*—and receive immediate, data-driven answers.

Looking ahead, organizations are testing platforms that enable AI to control assets, coordinate DER integration and facilitate cross-departmental communication. These systems could autonomously manage heating, ventilation and air conditioning (HVAC), battery storage or solar generation with minimal human input, transforming both facility operations and strategic planning.

Implications for the Sector

These innovations signal a **shift toward intelligent, data-driven energy ecosystems** where AI not only improves operations but can support greater agility, cost control and sustainability. As these technologies scale beyond pilot projects, they will have major implications for:

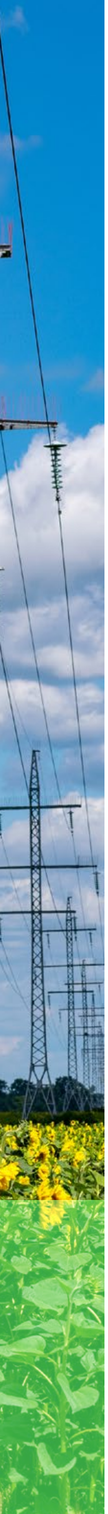
- **Workforce capabilities:** Roles are evolving from manual oversight and routine data entry to strategic planning, digital coordination and real-time decision support.
- **Infrastructure readiness:** AI adoption is influencing how facilities are designed, maintained and integrated with broader grid systems.
- **System design and policy:** Regulatory considerations, especially around data hosting and privacy, are shaping infrastructure planning and investment decisions.

AI is positioned as a strategic enabler of Canada's long-term energy goals, including grid modernization, renewable integration and 2050 decarbonization targets. Its adoption is also expected to drive electricity demand, particularly from hyperscale data centres, while reinforcing the role of nuclear energy as a clean, reliable source.

> The shift towards AI-driven systems presents opportunities to **advocate for upskilling, job redesign and inclusive workforce planning,** ensuring that the transition benefits workers across all levels of the sector.

2

Understanding AI: Concepts and Global Trends



Artificial intelligence (AI) refers to a system's ability to interpret external data accurately, learn from patterns and apply this knowledge to achieve defined objectives. AI systems are typically built using components like neural networks and rely on software tools to train models using large datasets. Once trained, their performance is validated using independent data to ensure reliability. Importantly, AI is not a single technology but a suite of capabilities that mimic aspects of human cognition—such as reasoning, decision-making and problem-solving—across a wide range of applications.

Core AI Approaches

AI development spans several key domains:

- **Computer Vision:** Enables machines to interpret and analyze images.
- **Natural Language Processing (NLP):** Supports text generation, translation and speech interpretation.
- **Generative Models:** Includes large language models (LLMs) that produce dynamic outputs such as text, code and simulations.

These systems may remain static or evolve continuously as they incorporate new data. AI exists on a continuum, from **assisted intelligence,** which supports human activity, to **autonomous intelligence,** where systems make decisions independently.

Agentic AI: Autonomous Decision-Making in Energy Systems

An emerging category within autonomous intelligence is **Agentic AI.** These systems set goals, make context-aware decisions and adapt their behaviour over time. Unlike reactive automation, Agentic AI demonstrates initiative, persistence and strategic reasoning. It can reschedule tasks, optimize energy use and coordinate assets without direct human input. In Canada's electricity sector, Agentic AI is increasingly applied to **microgrid management, predictive maintenance and smart dispatch,** where autonomous coordination enhances reliability and efficiency.[1]

Global Adoption Trends

AI adoption is accelerating worldwide. According to Stanford's 2025 AI Index, organizational use of AI has grown from **55% to 78% globally.**[2]

Focusing on country-level enterprise use, IBM's 2023 AI Adoption Index finds that **42% of large enterprises** (1,000+ employees) were using AI in some capacity. China leads the world with 85% adoption, followed by India (74%) and the United Arab Emirates (72%). In contrast, uptake remains lower in countries such as the UK (40%), Australia (38%) and Canada (35%).[3]

AI use is most prevalent in financial services, telecommunications and heavy industry, driven by objectives such as alleviating skill shortages, automating repetitive tasks and improving customer service. However, **20% of organizations already using AI report a lack of trained staff**, underscoring a key workforce challenge that could limit the technology's full potential.

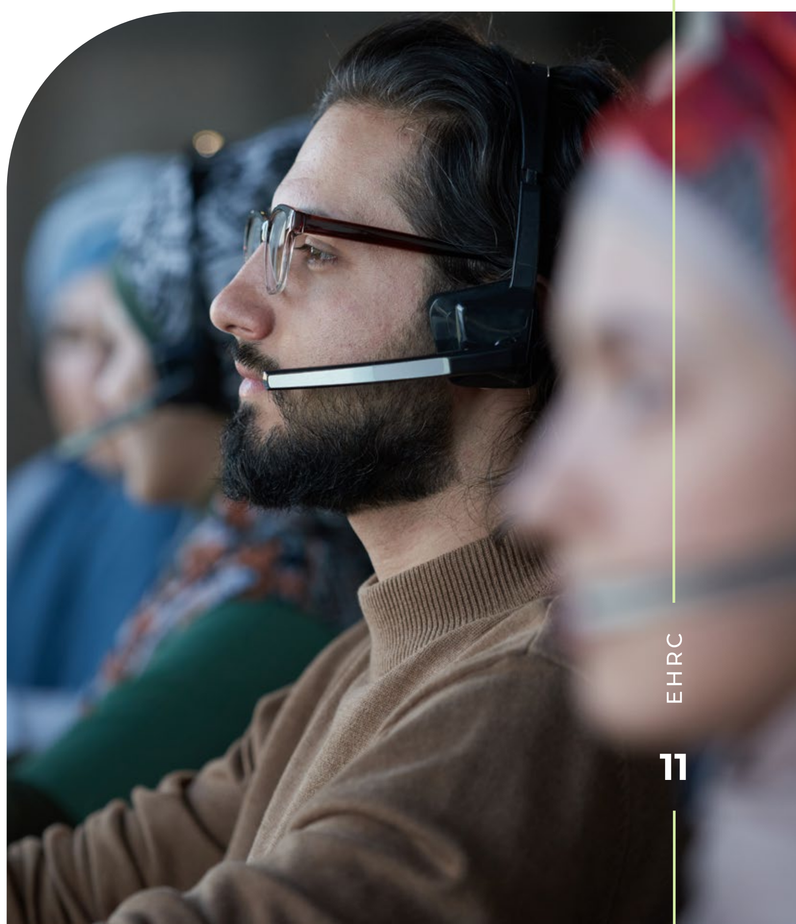
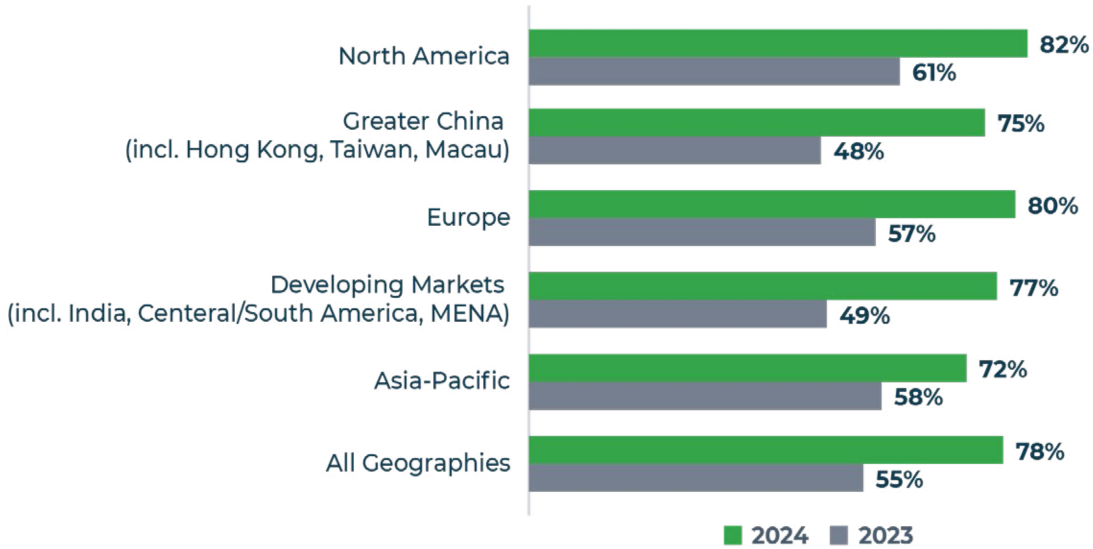


FIGURE 1

Global Organizational AI Adoption by Region (2023 vs 2024)



Source: McKinsey & Company Survey, 2024.
2025 Stanford AI index report.

AI adoption within organizations increased across all regions, with North America leading at 82% in 2024.

Canada's AI Landscape

Canada is widely recognized for its leadership in foundational AI research. In 2017, it launched the **Pan-Canadian AI Strategy**, becoming the first country with a national AI plan.[4] Major investments have supported centers of excellence such as the Alberta Machine Intelligence Institute (AMII), Montreal Institute for Learning Algorithms (MILA) and Vector Institute (Toronto). Today, **Canada ranks third among G7 nations in per capita AI funding**[5] and hosts over 670 AI-focused startups. Its talent pool reached 140,000 AI professionals in 2024, a 29% year-over-year increase, signalling momentum but underscoring the need for broader workforce training.[6, 7]

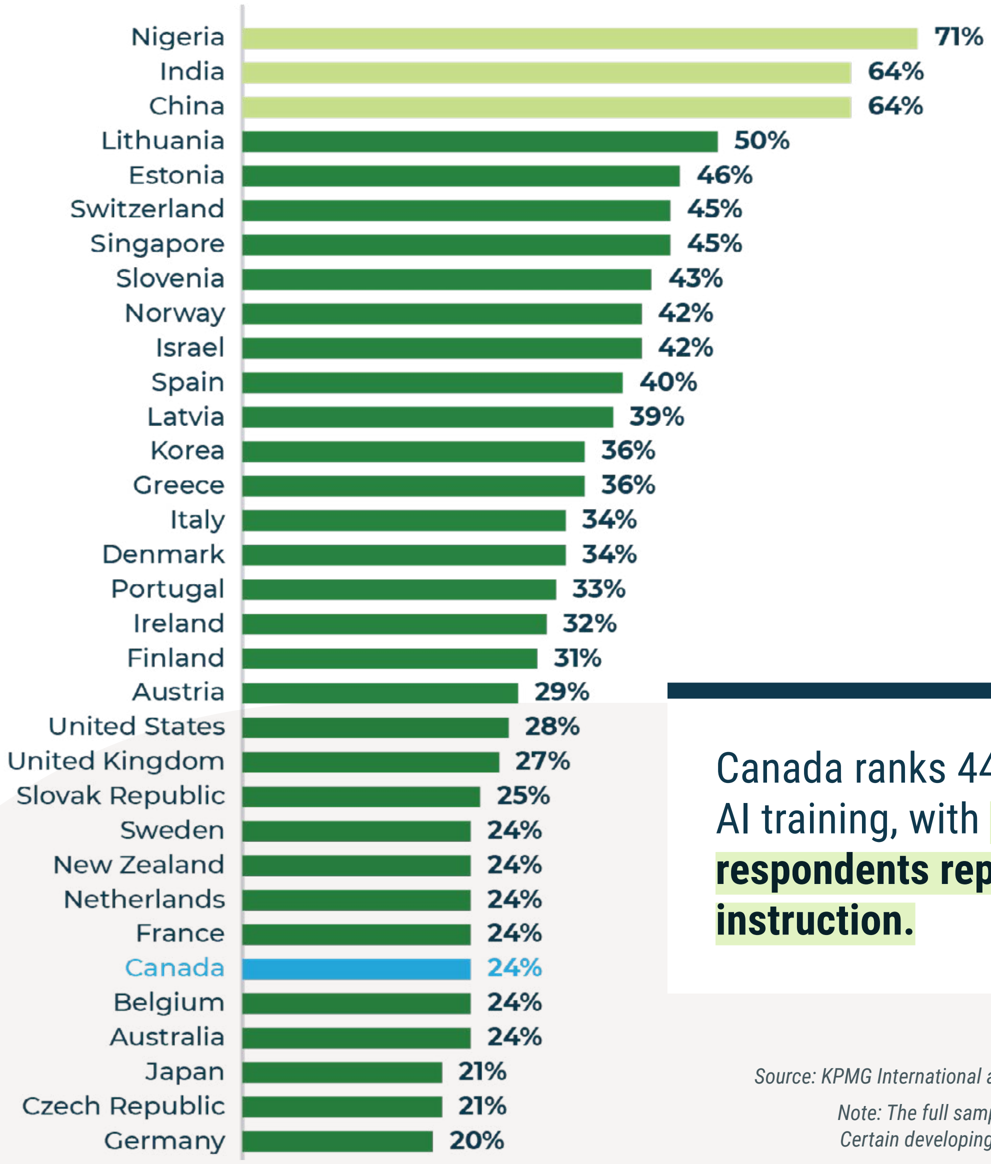
International Collaboration

On Nov. 3, 2025, Canada and its G7 partners endorsed a **G7 Energy and AI Work Plan**, developed in with international and industry partners including the International Energy Agency (IEA), the International Renewable Energy Agency (IRENA) and the Canadian Chamber of Commerce. Canada also announced a **$10-million AI for Canadian Energy Innovation Call for Proposals** to fund high-impact R&D projects that grow national expertise and stimulate novel, Canadian-made AI solutions that accelerate the pace of domestic energy innovation and lower the associated costs.

Beyond these initiatives, Canada participates in global projects such as AIxpertise, led by the OECD Nuclear Energy Agency, which integrates AI into nuclear research, engineering and education through data curation, algorithm benchmarking and professional training.[8] AIxpertise provides a secure platform for experts to share datasets, test models and develop tools that enhance reactor safety, improve performance and accelerate innovation—emphasizing transparency and regulatory readiness.

FIGURE 2

AI Training Rates by Country



Canada ranks 44th globally in AI training, with **only 24% of respondents reporting formal instruction.**

Source: KPMG International and University of Melbourne, 2025

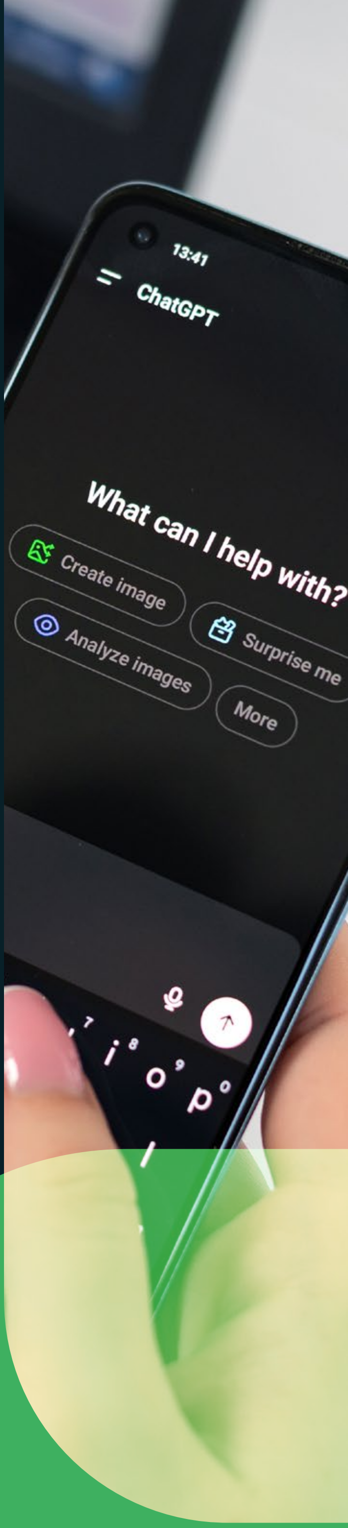
Note: The full sample of countries was not included. Certain developing markets were included for scale.

Public Perception

Canadian attitudes toward AI remain cautious. An IPSOS survey of 28 countries ranked Canada among the most skeptical—just ahead of France.[9] A 2025 survey of 47 countries **ranked Canada 44th in AI training** and **42nd in public trust,**[10] with only **24% of Canadians reporting formal AI instruction** compared to 39% globally. Closing this skills gap and fostering a climate receptive to technical change will be critical for Canada to maximize its AI investment and maintain global competitiveness. Public education efforts must emphasize AI's potential to enhance productivity and streamline tasks while addressing concerns about job displacement and building confidence in responsible integration.

3

AI Adoption in Canada: Cost, Trends and Barriers



While Canada is a global leader in AI research, adoption across its business and utility sectors remains modest.

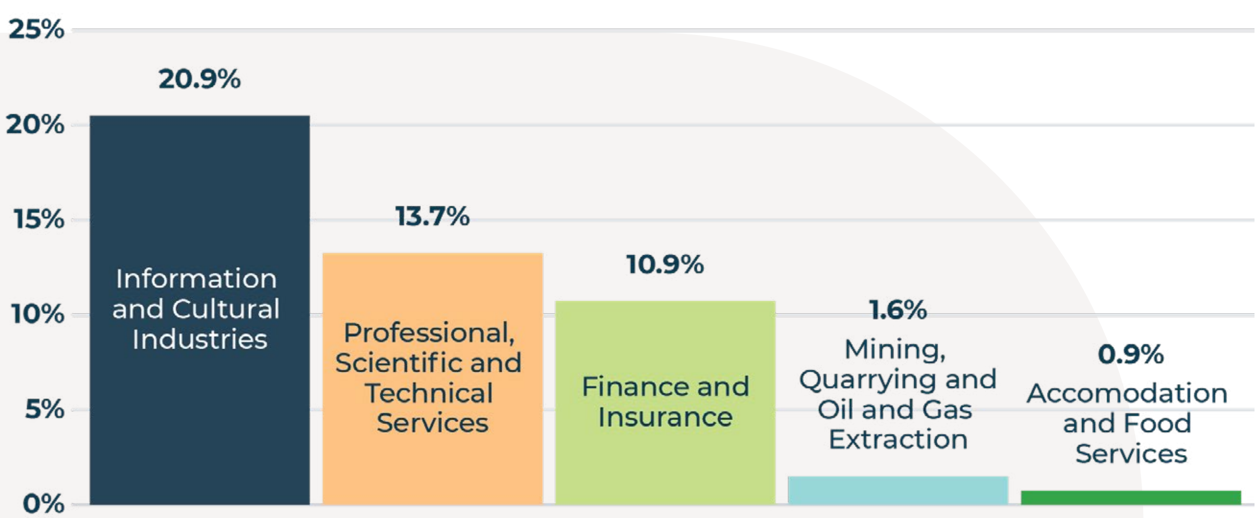
While Canada is a global leader in AI research, adoption across its business and utility sectors remains modest. Recent data shows that only **35% of Canadian firms use AI,** compared to **72% in the United States.**[11] According to Statistics Canada, AI adoption among Canadian businesses grew from **6.1% in Q2 2024 to 12.2% a year later.**[12] Similarly, KPMG's Generative AI Adoption Index rose to 31.6 out of 100, a 17-point increase from 14.6 in 2023.[13] This upward trend signals growing enterprise integration of generative AI tools, especially in workplaces where daily use is becoming common. Notably, 48% of organizations are exploring AI deployment but remain cautious due to costs, technical challenges and uncertain returns on investment.[14]

Nearly 25% of Canadian workers use generative AI tools such as ChatGPT and Microsoft Copilot, often informally and without structured training.[15] A Canadian Chamber of Commerce report highlights that while AI use is widespread, it is uneven with persistent **gaps in literacy, integration and understanding**.[16]

FIGURE 3

AI Adoption by Industry in Canada (Q2 2024)[17]

Source: Statistics Canada. Table 33-10-0825-01



Information and cultural industries lead AI adoption at 20.9%, while accommodation and food services remains low at under 1%.

AI applications span multiple sectors. In healthcare, AI early diagnosis systems are being refined; in banking, it powers fraud detection and investment forecasting; and in retail, recommendation engines personalize shopping experiences. AI is also gaining ground in Canada's legal sector, automating tasks such as legal research, document review and contract analysis—improving efficiency and reducing costs so lawyers can focus on strategic work.[18] In contrast, industries with lower profit margins, such as agriculture, food services and transportation, face barriers to adoption due to high costs, technical limitations and risk aversion.[19] The electricity sector typically falls into a moderate- to high-margin category, with returns varying by location, regulation and business model.[20]

To accelerate adoption among smaller firms, Canada is investing heavily in AI development and workforce support. The federal government's Budget 2025 proposes over $1 billion in new funding for AI and quantum computing, with a strong focus on building sovereign AI infrastructure and embedding AI across federal operations. This builds on Budget 2024's commitment to AI, which allocated $2.4 billion over five years for AI initiatives and targeted workforce support through the Sectoral Workforce Solutions Program to assist workers affected by AI-driven disruption.[21] Additional funding will strengthen regional innovation hubs, including AMII (Alberta), MILA (Quebec) and the Vector Institute (Toronto).

Implementing AI in the electricity sector involves significant cost considerations. Experts estimate that **custom AI solutions range from CAD $400,000 to over $9.5 million over three to five years**, depending on complexity and scope.[22] Off-the-shelf systems typically cost $70,000 to $700,000 annually, including licensing, customization and support. Cloud-based infrastructure expenses generally fall between $27,500 and $275,000 per year, while on-premises systems can exceed $1.35 million.

Ongoing maintenance and monitoring are essential for sustained performance. Employers should expect to spend **15–25% of initial development costs annually** for updates, cloud inference, retraining and bug fixes.[23]

Specialized talent is also critical: in-house AI professionals earn $130,000–$220,000 per year, while consultants charge $275–$480 per hour. Training and change management costs range from $70,000 to $350,000, depending on workforce size and adoption scale. For energy providers, integrating AI into grid operations, forecasting and infrastructure analytics may require substantial upfront investment—but promises long-term gains in efficiency, reliability and customer service over time.[24]

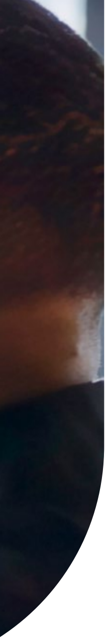


TABLE 1

Estimated AI Deployment Costs

Cost Category	Estimated Range (CAD)	Comments
Off-the-shelf AI systems	$70,000 – $700,000 annually	Includes licensing, customization and support
Customized AI solutions	$400,000 – $9.5 million (3–5 years)	Varies by scope, complexity and integration level
Cloud-based infrastructure	$27,500 – $275,000 annually	Scalable; depends on usage and compute intensity
On-premises infrastructure	$1.35M+	Includes hardware, cooling and installation
Ongoing maintenance and updates	15–25% of initial cost annually	Covers retraining, bug fixes and cloud inference costs
AI talent (in-house)	$130,0000 – $220,000 per year	Salaries for AI engineers and data scientists
AI consultants	$275 – $480 per hour	Specialized expertise for short-term engagements
Training and change management	$70,000 – $350,000	Varies by workforce size and adoption scale

4

How AI Is Being Used In Canada’s Electricity Sector

Adoption Challenges and Strategic Constraints

EHRC conducted a comprehensive review of AI applications in Canada's electricity sector, drawing on industry research and a nationwide employer survey (see Appendix 1). This analysis explores adoption trends, organizational readiness, workforce planning and perceptions of AI integration.

Current Adoption and Industry Insights

AI is gaining traction across the electricity sector, supported by both global research and Canadian survey data. Nearly 90% of surveyed organizations reported implementing AI tools in at least one operational area, reflecting a broader industry shift toward digital transformation.

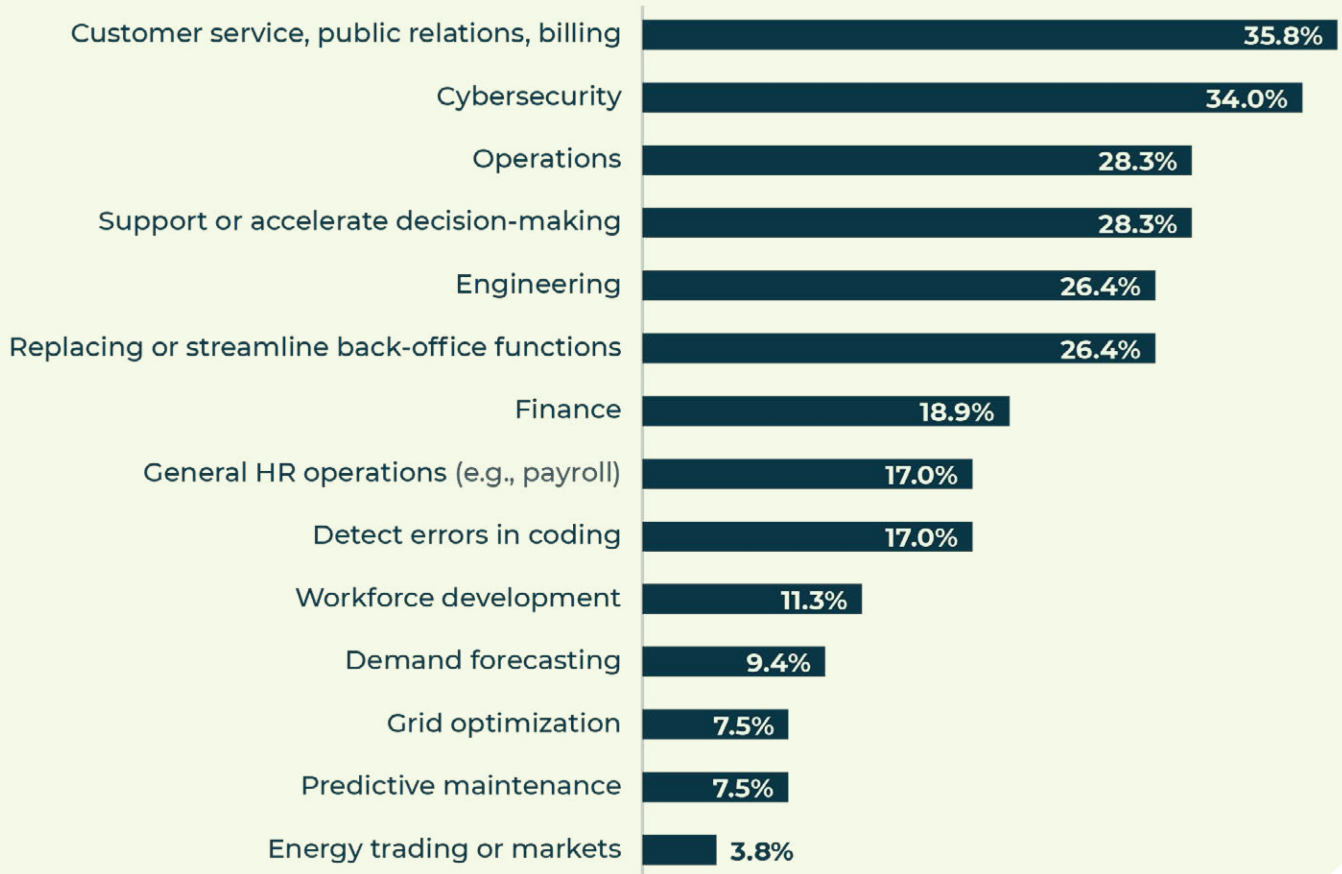
Adoption is most common in operational and customer-facing functions:

- **Customer service, public relations and billing (36%)**
- **Cybersecurity (34%)**
- **Decision support (28%)**
- **General operations (28%)**

Other areas include office functions, engineering and finance. However, sector-specific applications—such as predictive maintenance, grid optimization and demand forecasting—are in introductory implementation, with strong evidence from industry research that these areas offer significant efficiency gains.

FIGURE 4

AI Adoption by Operational Area in Canada's Electricity Sector



Source: EHRC AI Survey, 2025

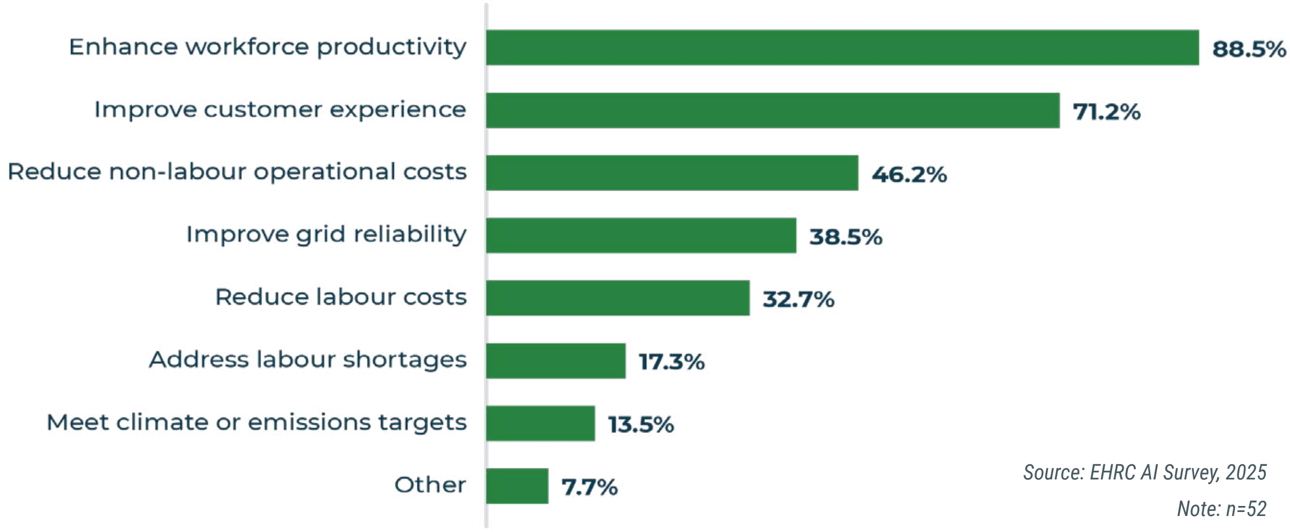
Note: n=53

Customer service and cyber-security lead AI adoption in Canada's electricity sector, while predictive maintenance and grid optimization remain underutilized.

The primary reported goal of AI initiatives is **enhancing workforce productivity (88%),** followed by **improving customer experience (71%)**. Cost-saving measures rank lower, with fewer than half of respondents citing them as a major objective. This aligns with global trends emphasizing resilience, flexibility and customer-centric innovation over short-term cost reductions.

FIGURE 5

Primary Objectives of AI Initiatives in the Electricity Sector



Source: EHRC AI Survey, 2025

Note: n=52

Workforce productivity and customer experience dominate AI objectives, with cost reduction ranking lower.

While current adoption focuses on broadly applicable tools, research highlights emerging opportunities for sector-specific innovation, such as AI for grid resilience, energy planning and climate targets, that can transform system performance and sustainability.

4.1
AI as a Strategic Tool for Grid Modernization

Industry studies and Canadian utility practices confirm AI's strategic role in managing growing system complexity. By balancing technical, economic and environmental factors, AI enables efficient decision-making—essential for Canada's decarbonization and electrification goals.

Key applications include:

- **Real-time forecasting and grid coordination**
- **Predictive asset management**
- **Integration of renewables and distributed resources**[25]

These capabilities increase system flexibility, reduce reliance on carbon-heavy generation and optimize storage and load management. Companies such as BluWave-ai, AutoGrid and Opus One help utilities forecast demand, integrate renewables and manage distributed energy resources like EVs and battery storage—reducing infrastructure needs and supporting Canada's clean tech sector.[26]

For utilities engaged in cross-border trade (e.g., OPG, Hydro-Québec), **AI enhances energy procurement by forecasting price changes, optimizing contracts and reducing risk.** Automation of routine tasks further improves operational agility and frees staff for strategic work.

4.2
AI for Climate Resilience and Disaster Response

As climate disruptions intensify, research and practice show AI is emerging as a critical tool for resilience in Canada's electricity sector.[27] It can predict extreme weather events, optimize grid recovery and support emergency response coordination—functions increasingly vital amid wildfires, floods and storms.

Predictive analytics analyze satellite imagery, weather data and outage patterns to identify vulnerable assets and guide timely interventions, reducing restoration costs and service interruptions.[28] [29]

Emergency coordination integrates AI with management systems for real-time collaboration among utilities, first responders and government agencies.[30] [31]

Infrastructure hardening uses continuous monitoring to inform investments in grid modernization and climate resilience, especially in regions with aging infrastructure or severe weather risks.[32]

4.3
Load Forecasting and Demand Optimization

One of the most promising applications of AI is in load forecasting, an essential function for system operators who must balance supply and demand in real time. AI-driven asset management is transforming utility operations by extending equipment lifecycles, improving maintenance and optimizing grid performance. Smart sensors deployed across Canada's electricity networks collect real-time data on temperature, vibration, voltage and load conditions. AI algorithms analyze this data to detect anomalies, predict equipment failures and proactively schedule maintenance—reducing downtime and improving cost efficiency.[33]

Beyond asset management, AI is reshaping customer engagement and operational planning. A key informant from a major Eastern Canadian utility reported that their organization has implemented **AI-powered customer tools** to deliver personalized energy insights and support **load forecasting**. These tools help consumers understand usage patterns while enabling utilities to anticipate demand fluctuations more accurately. According to the informant, such innovations are not only improving customer satisfaction but also informing **future governance models** for AI integration.

Industry research reinforces these findings, highlighting how predictive maintenance and demand optimization allow utilities to allocate resources more effectively, focus on high-risk areas and enhance infrastructure resilience.[34] Pilot projects across Canada demonstrate that AI-driven forecasting is critical for managing peak loads, integrating distributed energy resources and supporting long-term electrification goals.

4.4 Emissions Monitoring and Environmental Performance

Utilities are already using AI to monitor emissions and improve environmental performance—showing how sustainability principles can be operationalized. AI supports Canada's decarbonization goals by:

- Enhancing emissions tracking and compliance.
- Improving energy efficiency.
- Informing investment decisions through granular analysis.

Examples include:

- **Hydro-Québec** is deploying predictive modelling to assess greenhouse gas outputs and mitigation strategies.[35]
- **Newfoundland Power** is adopting digital tools to optimize operational footprints and meet evolving environmental targets.[36]

AI systems analyze fuel consumption, temperature profiles and geographic dispersion to identify high-emission areas and recommend corrective actions. These capabilities are critical for providers managing mixed-generation fleets or transitioning to renewables.

However, risks persist. **Model drift**—the decline in accuracy as conditions change—requires ongoing retraining. Neglecting this can lead to poor decisions and increased risk. For instance:

- Grid operators using machine learning for solar and wind forecasting saw performance degrade during climate anomalies.[37]
- Demand forecasting models trained on pre-pandemic data failed to adjust during COVID-19, causing inaccurate load projections.

A key informant in the nuclear sector stressed that **unmanaged AI deployment can compromise work quality, introduce bias and erode public trust.**

Safeguards ensuring **transparency, auditability and responsible use are essential**—especially in high-stakes environments where operational integrity and brand credibility matter.

4.5 Building Trust and Security in AI-Enabled Energy Services

AI is reshaping customer interactions through smart billing, outage prediction and personalized energy insights.[38] Utilities must prioritize **transparent communication and accessibility** to build public trust and ensure equitable participation in AI-enabled services.

Special attention is needed for low-income households, rural communities and older adults—groups often facing barriers such as limited connectivity and lower tech literacy. Outreach programs, user-friendly interfaces and subsidized access can help prevent energy inequities and foster inclusion.[39]

Cybersecurity is equally critical as utilities digitize. AI enables real-time threat detection, anomaly identification and adaptive defence strategies. Companies like CGI Canada provide AI-powered monitoring to detect intrusion patterns, ransomware and unauthorized access, activating protective protocols instantly. AI also supports infrastructure security by simulating attack scenarios and reinforcing digital defences, especially vital for operators of critical assets such as substations and nuclear facilities, where breaches carry severe consequences. As cyber-physical systems proliferate, AI's role in anticipating and neutralizing digital threats is becoming more central to grid reliability and national security.

4.6 Examples Across Canadian Utilities

Canadian utilities are leveraging AI for grid optimization, customer engagement and asset management:

Nova Scotia Power	MyEnergy Insights platform delivers appliance-level consumption insights and personalized recommendations. AI also supports real-time grid stability and predictive maintenance.[40 41]
Hydro One	Uses AI to improve customer service and operational efficiency, and has introduced an AI knowledge assistant for frontline staff.[42]
Alectra Utilities	Tests AI tools for outage response, customer forecasting and distributed energy integration.[43]
Hydro-Québec	Applies AI for demand forecasting, dispatch planning and peak demand management.[44 45]
NB Power	Uses AI, drones and satellite imagery to detect vegetation encroachment and pole wear.[46]
TransAlta and BC Hydro	Employ AI for load forecasting, renewable integration and peak demand management.[47 48]
Saint John Energy	Smart grid pilot uses AI for 35-day demand forecasts and smart home coordination.[49]
Hydro Ottawa and Enbridge	Deploy AI for outage prediction, personalized insights and employee support tools like Microsoft Copilot.[50]

5

Global Lessons for Canada's Electricity Sector

Canada is recognized globally for its leadership in AI policy, yet **implementation in the electricity sector remains modest compared to international peers.** Examining how other nations integrate AI into energy systems offers valuable insights for accelerating adoption in Canada.

Global Best Practices

- **Denmark:** AI-driven demand response systems balance wind generation with consumer usage, reducing curtailment and improving grid efficiency.[51]
- **South Korea:** The Smart Grid Initiative uses AI to coordinate distributed energy resources and electric vehicle (EV) charging.[52]
- **Germany:** The Fraunhofer Institute has developed AI tools for proactive maintenance and renewable integration among regional providers.[53]

Countries with cohesive national strategies, streamlined regulations and strong public-private partnerships are advancing AI more rapidly. In contrast, Canada's fragmented jurisdictional landscape and slower regulatory processes can hinder innovation. Adopting international models—such as regulatory sandboxes, workforce transition planning and ethical oversight—could help Canadian energy providers scale AI effectively.[54]

Key Insights for Canada

Leading Canadian practitioners emphasize: [55]

- Addressing real business challenges rather than pursuing technology for its own sake
- Integrating AI into supply chains and supporting SMEs
- Investing in upskilling and hybrid skills
- Aligning academic research with industry needs for ethical, scalable adoption

Public Trust and Digital Literacy

Global benchmarking underscores the significance of public trust and digital literacy. Nations with higher AI adoption rates invest heavily in education and community engagement. Canada's low trust rankings indicate that technical excellence alone is inadequate; cultural readiness and inclusive governance are equally vital.

Lessons from the U.S.

The U.S. Department of Energy's 2024 report on Powering AI and Data Center Infrastructure offers relevant guidance as Canada faces rising demand from AI-intensive data centres.[56]

These challenges mirror Canada's own load forecasts and infrastructure constraints. The report underscores priorities such as data sovereignty and cybersecurity, reinforcing Canada's commitment to AI-ready data centres powered domestically and designed to protect privacy and system integrity.

Adoption Challenges and Strategic Constraints

Despite its promise, AI deployment faces significant barriers. **Many energy providers rely on legacy systems lacking digital connectivity,** limiting real-time data access and model training. Older infrastructure complicates adoption, meaning benefits will emerge unevenly across the sector. Regulatory approvals for AI applications in pricing, dispatch or emissions remain slow and inconsistent.

A key informant from an Ontario academic institution identified critical challenges: certifying and validating AI technologies in regulated environments, developing highly qualified personnel (HQP), building smart infrastructure and ensuring system resiliency to prevent operational failures. Addressing these barriers is essential to unlock AI's full potential.

Most Canadian utilities are still formulating comprehensive AI strategies. While some have launched pilots, few have frameworks addressing governance, ethics, workforce adaptation and long-term integration. Awareness of responsible AI use is growing—especially around reliability, cybersecurity and compliance—but formal strategies remain inconsistent.[57] Larger utilities and system operators are beginning to integrate AI into planning and operations, yet sector-wide adoption is still emerging.

6

Data Centres and Infrastructure Impacts

Attracting investment in AI data centres has become a strategic priority for federal and provincial governments, reflecting a commitment to digital infrastructure, economic diversification and sustainable energy planning.[58] Budget 2024 allocates $2 billion over five years to strengthen Canada's AI ecosystem by providing advanced tools and support for researchers and companies. In December 2024, the federal government launched the Canadian Sovereign AI Compute Strategy, committing up to $700 million for new and expanded data centre infrastructure through the AI Compute Challenge.[59]

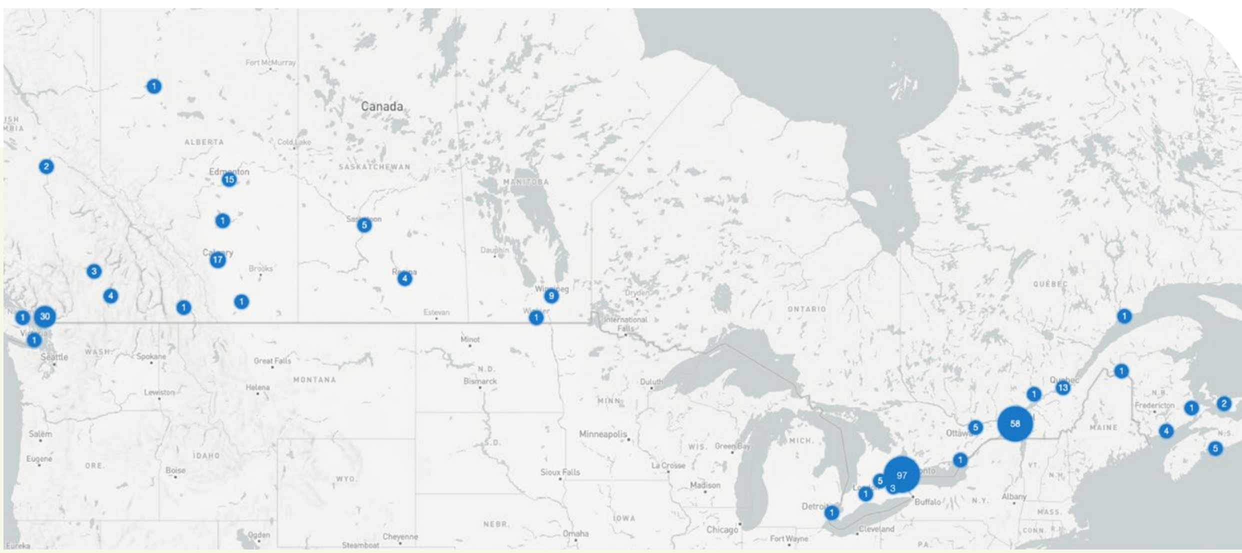
6.1
The Role of Data Centres in AI Growth

Globally, data centres consume 1.5% of total electricity, and their footprint is expanding rapidly.[60] Canada operates about 290 data centres, including hyperscale facilities from Google and Microsoft that support large-scale digital services. Ontario leads with 110 centres, followed by Quebec (72) and British Columbia (42), leveraging hydroelectric power and fibre connectivity.

Projections indicate that data centre electricity consumption could reach 14% of Canada's total power demand by 2030.[61] Ontario's Independent Electricity System Operator (IESO) expects provincial electricity demand to grow 75% by 2050, driven largely by data centre expansion.[62] By 2035, data centres are forecast to account for 13% of new electricity demand and 4% of Canada's total grid load.[63]

FIGURE 6

Map of Data Centres in Canada



Source: DataCenterMap.com as of Nov. 17, 2025.

Strategic Investment in AI Infrastructure

Data centres are now among Canada's fastest-growing electricity loads, supporting AI as well as cloud computing, IoT, big data analytics, blockchain and government services.

Their constant power needs, specialized cooling systems and reliability requirements are reshaping grid planning and infrastructure investment nationwide.

6.2
Canada's Data Centre Landscape

Canada's data centre market is evolving rapidly, reshaping electricity demand and introducing new operational challenges.

Data centres are now among Canada's fastest-growing electricity loads. Their constant power needs, specialized cooling systems and reliability requirements are reshaping grid planning and infrastructure investment nationwide.

Originally concentrated in hydro-rich Quebec, the industry now spans at least 30 service providers and is expanding aggressively to meet demand for cloud services, IoT and big data analytics, blockchain and government services. From 2023 to 2029, **the sector is projected to grow at a compound annual growth rate (CAGR) of about 10%**, reaching a market value of $9.04 billion by 2029.[64] This growth reflects the accelerating digitalization of industries and the critical role of data infrastructure in supporting Canada's AI ambitions.

The North American Electric Reliability Corporation (NERC) identifies data centres as a major source of rising electricity demand, with implications for transmission capacity and system resilience.[65] NERC is developing formal reliability guidelines, expected by 2026, to address cybersecurity, governance and human-machine coordination as smart systems integrate with grid operations.

Reliability and Regulatory Oversight

Design requirements for next-generation AI infrastructure are escalating. By 2027, server racks for AI workloads may require up to 600 kilowatts each—50 times more than current internet servers.[66] These demands will place immense pressure on transmission networks, cooling systems and generation capacity. Alberta has already received applications for 29 data centre projects totalling over 16,000 megawatts, exceeding the province's peak load of 12,000 MW. This surge underscores the urgency of regulatory frameworks and infrastructure planning.[67]

Infrastructure Demands and Design Challenges

Alberta is responding with a phased connection strategy: [68]

- **Phase 1:** Temporary cap of 1,200 megawatts through 2028 for large-load facilities that do not require major grid upgrades.
- **Phase 2:** Development of a long-term framework for future applications and connection requests.

To ease pressure on the grid and accelerate approvals, the Alberta Electric System Operator (AESO) encourages off-grid and self-generation options, particularly those using natural gas and geothermal energy. This approach aligns with Alberta's Data Centre Plan, which promotes energy autonomy, grid reliability and economic diversification through digital innovation.

Off-Grid Power Solutions and Energy Autonomy

This trend reflects a broader movement across Canada: data centres are increasingly generating their own power to overcome grid limitations and accelerate development timelines.

Alberta's "bring your own power" model exemplifies this approach, attracting interest in off-grid solutions. A notable example is the Wonder Valley project, which plans to invest $70 billion to supply 7.5 gigawatts of low-cost power to up to 58 data centres, operating independently of the provincial grid.[69] In Ontario, ThinkOn is transitioning its Ottawa facility off-grid using natural gas cogeneration, reinforcing a national push for energy independence and operational resilience.[70]

These developments mark a strategic transformation in Canada's data infrastructure, where self-generation is emerging as a competitive advantage. This shift is not only altering electricity demand patterns but also reshaping regulatory frameworks, infrastructure planning and investment priorities. It also has the potential to open new work opportunities for traditional electricity workers.

Sovereign AI Infrastructure

Sovereign AI infrastructure enables a nation to develop and manage AI systems and data independently, keeping sensitive information local and investing in domestic computing power.

This approach strengthens data security, regulatory alignment and long-term resilience, and can support Canada's ability to advance AI innovation without external dependencies.[71]

Bell Canada's AI Fabric Initiative is one demonstration of Canada's commitment to sovereign AI infrastructure. The project will establish a 500-megawatt hydro-powered AI compute supercluster across six data centres in British Columbia, starting in Kamloops and Merritt.[72] Thompson Rivers University will add two 26-megawatt facilities featuring waste heat recovery systems integrated with campus energy. These investments reinforce data sovereignty, security and regulatory compliance, reducing reliance on foreign technologies and enhancing Canada's strategic autonomy.[73]

The U.S. CLOUD Act permits American authorities to access data from Canadian entities that are hosted on U.S.-owned servers, prompting many Canadian firms to choose domestic providers to safeguard sensitive information and reduce cross-border legal risks.[74] A key informant from a major data centre operator noted that site selection is critical.

Employment Impacts

Data centres create distinct employment opportunities throughout their lifecycle. During construction, they generate significant short-term jobs, often requiring 1,000 to 1,500 workers for site preparation and installation—particularly in regions with active infrastructure projects.[75] Once operational, staffing levels decline sharply, typically employing 50 to 200 personnel focused on IT systems, cooling management and security. While these roles are specialized and stable, they offer limited opportunities for broader workforce engagement.[76] This contrast underscores the need for targeted training and regional planning to ensure communities benefit from both construction and operational phases.

Urban vs. Rural Siting Considerations

Canada's data centre industry is geographically concentrated. Toronto leads due to its financial and tech ecosystems, Montreal offers low-cost renewable power, and Vancouver and Calgary are emerging as strategic secondary hubs.[77] The federal government has proposed up to $15 billion in incentives for green data centres powered by AI, reinforcing Canada's ambition to become a global leader in AI infrastructure.[78]

Infrastructure upgrades are underway, but risks persist. Transmission projects face supply chain delays, particularly for transformers and cooling systems. Building a data centre in Canada averages 18 months, while connecting it to the grid can take four years or more.[79] These timelines complicate planning and could hinder growth.

Many Canadian data centres can operate off-grid using onsite power sources such as natural gas cogeneration, renewables or diesel generators. These arrangements provide energy independence and sustainability benefits but require careful planning around regulations, infrastructure and reliability. While technically feasible, going off-grid involves complex engineering and legal considerations, making it a strategic option for organizations seeking energy control.[80]

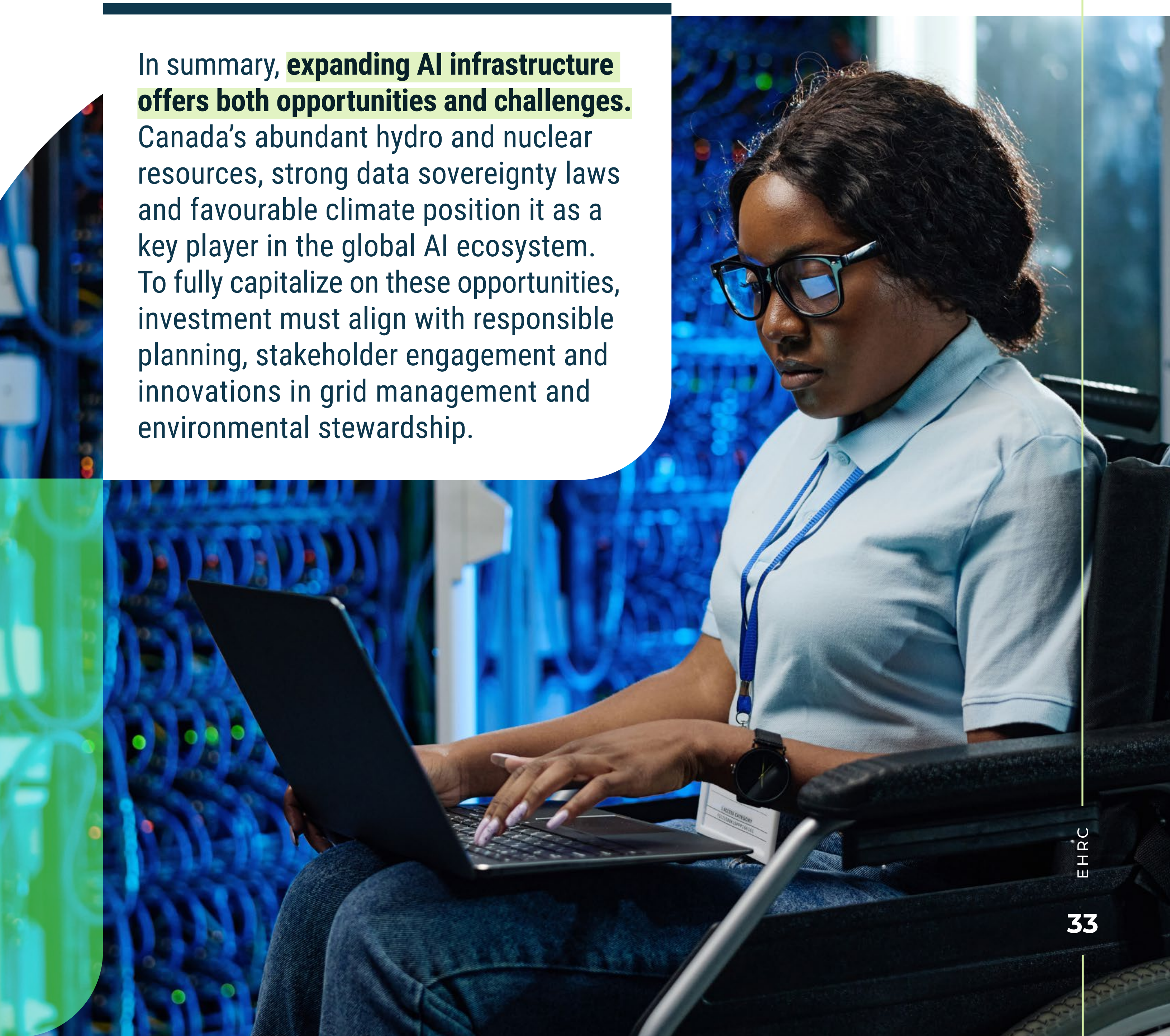
Choosing data centre locations requires balancing urban advantages against rural efficiencies. Urban sites offer proximity to users and businesses, reducing latency for real-time applications like streaming and gaming.[81] However, higher costs for land, energy and cooling, along with stricter zoning and environmental regulations, offset these benefits. Rural locations typically provide lower land costs, better access to renewable energy and more space for expansion, but face challenges such as increased latency, limited network infrastructure and difficulty attracting skilled labour.

Environmental Impacts and Sustainability Concerns

AI-intensive data centres raise significant sustainability issues. For example, a single ChatGPT query may consume up to ten times more electricity than a typical Google search, illustrating the energy demands of generative AI and its greenhouse gas implications.[82] As Canada expands its capacity, policymakers must weigh environmental trade-offs and prioritize clean energy sources.

Fortunately, AI is also modernizing energy networks. The U.S. Department of Energy estimates that grid-enhancing technologies, including AI, could free up 100 gigawatts of transmission and distribution capacity within three to five years, reducing the need for new power lines.[83] These advancements could help Canada manage growing data centre demands while improving grid efficiency and affordability.

In summary, **expanding AI infrastructure offers both opportunities and challenges.** Canada's abundant hydro and nuclear resources, strong data sovereignty laws and favourable climate position it as a key player in the global AI ecosystem. To fully capitalize on these opportunities, investment must align with responsible planning, stakeholder engagement and innovations in grid management and environmental stewardship.



6.3
Data Centres and Labour Implications for Canada's Electricity Sector

The rapid expansion of data centres is placing new pressures on Canada's electricity system.

Operators must balance rising power requirements with local grid constraints, while ensuring sufficient skilled labour to address technical and logistical challenges. Short-term employment impacts are modest, but long-term effects—especially as AI adoption accelerates—could be more significant.

Data centre growth is expected to drive higher electricity demand, affecting transmission and distribution networks and increasing the need for additional generation capacity. These changes have direct implications for labour requirements across the sector.

To assess these impacts, we applied the Canada Energy Regulator's Canada Energy Future 2023 (CEF2023) framework under two scenarios:

- **Current Measures:** A business-as-usual policy trajectory.
- **Canada Net-Zero:** a pathway featuring aggressive electrification and greenhouse gas reductions, supported by major investments in renewable and low-carbon technologies.

We incorporated forecasted IT load capacity for data centre projects expected by 2031 into both scenarios as a proxy for additional electricity demand and its potential labour impacts.[84] These modified scenarios were then compared to their original baselines (see Appendix 2).

Forecasted Capacity Growth and Uncertainty

The data centre industry is evolving rapidly, with uncertainty around project timelines, grid integration and the pace of AI adoption. Estimates from Mordor Intelligence suggest **IT load capacity will rise from about 1,300 MW in 2019 to nearly 4,500 MW by 2031,** representing a substantial increase in computing power.[85]

While these projections are useful for planning, they should be interpreted cautiously, as methodologies for estimating data centre energy consumption vary.

Labour Force Impacts (2025–2031)

Current Measures: Additional installed capacity requirements from data centres result in a minimal change in employment levels, averaging 122 additional jobs per year over the outlook period. Labour demand—which captures the change in industry needs for labour—remains close to baseline levels, with a **cumulative increase of 166 jobs relative to the baseline.**

Canada Net-Zero: Combined data centre growth and economy-wide electrification lead to an average uptick of 1,695 jobs per year (about 1.3% above the baseline average), totalling 11,863 cumulative jobs over the outlook period.

Labour market demand rises primarily due to expansion of demand, adding a cumulative 2,574 jobs, while replacement demand contributes 355 jobs, for **a total change of 2,929 jobs above the baseline**.

The figure illustrates that under Current Measures, cumulative labour demand change is negligible (167 jobs), while Canada Net-Zero shows a more pronounced effect (2,929 jobs), driven mainly by expansion demand.

TABLE 2

Total Employment in the Electricity Sector (Canada Net-Zero vs Net-Zero with Data Centres)

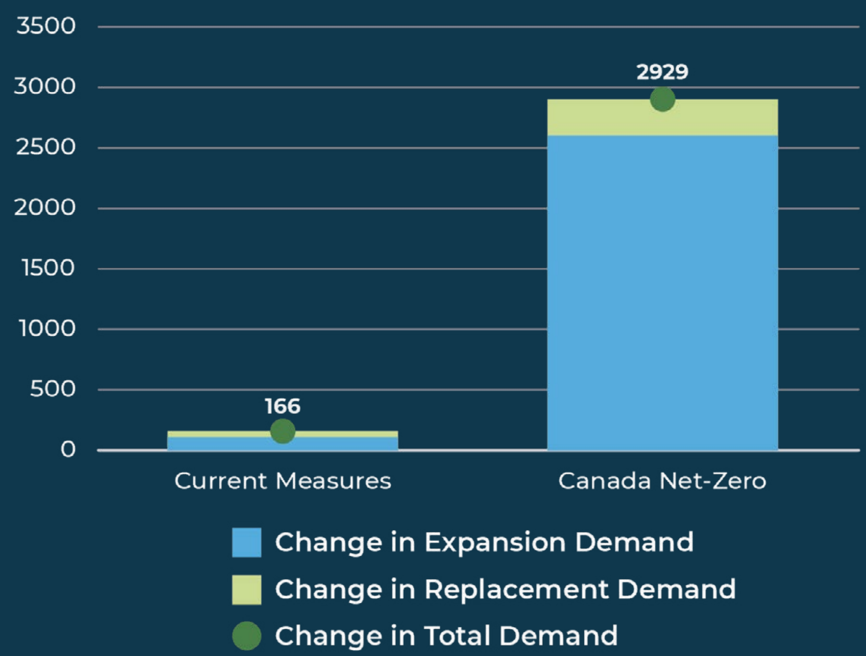
Year	2024	2025	2026	2027	2028	2029	2030	2031
Canada Net-Zero	120,215	121,311	123,872	126,801	129,831	134,642	145,757	147,034
Canada Net-Zero + Data Centres	120,215	122,423	125,175	128,271	131,239	136,393	148,000	149,609

Source: EHRC Labour Market Model

Employment projections under Canada Net-Zero scenarios with and without additional electricity demand from data centres (2024–2031).

FIGURE 7

Cumulative Change in Labour Demand Relative to Baseline (2025–2031)



Labour demand impacts under Current Measures and Canada Net-Zero scenarios, showing changes in expansion and replacement demand due to data centre growth.

Occupational Structure and Labour Market Imbalances

Employment growth alone does not fully capture the impact of data centre expansion on the electricity sector workforce. A more comprehensive measure is labour market imbalances—the gap between projected labour demand and supply. These imbalances reflect multiple factors, including school leavers, occupational mobility, immigration and transitions from unemployment, all relative to the industry's labour needs.

Under Current Measures, persistent shortages remain across critical roles: Trades, Engineers, Technicians, Operations and Maintenance, and ICT specialists. Data centre growth introduces only marginal changes to these dynamics. Shortages in trades increase slightly, while ICT roles see a minor improvement. However, these shifts fall within the margin of error and do not materially alter overall labour market pressures.

Similar patterns emerge under **Canada Net-Zero.** Despite higher electricity demand and broader electrification, occupational imbalances remain largely unchanged. This suggests that while data centre-driven growth adds incremental pressure in certain trades, **systemic workforce challenges—particularly in engineering and technical roles—persist regardless of additional electricity demand.**

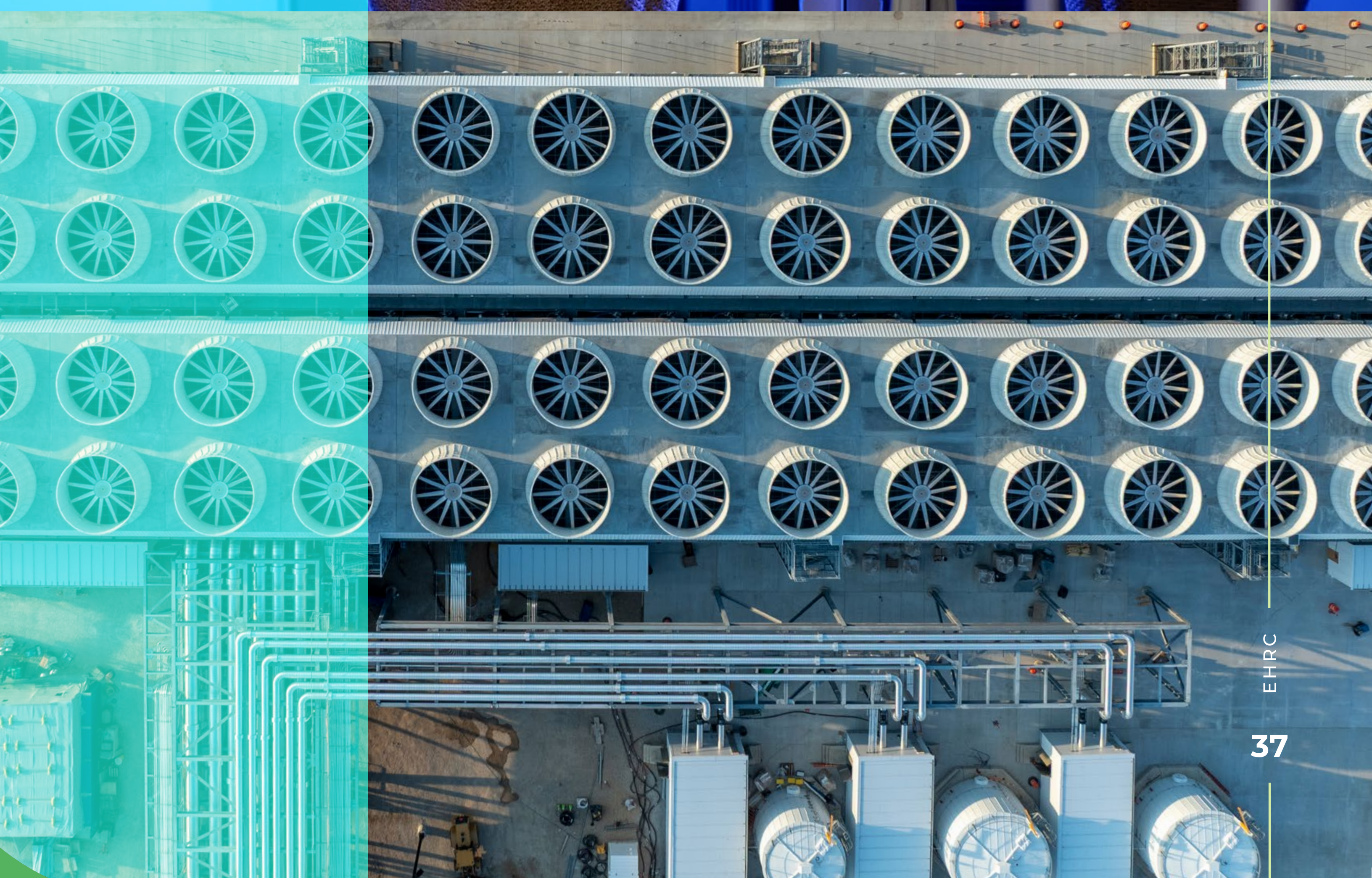
Provinces Leading the Way: Ontario and Quebec

Ontario and Quebec dominate Canada's anticipated data centre capacity expansion. Ontario's IT load capacity is projected to double by 2031, driven by high-density developments in the Greater Toronto Area. Labour market impacts in Ontario under Current Measures, even when adjusted for data centre electricity demand, remain modest and consistent with national trends.

Quebec's outlook is more pronounced. IT load capacity is forecasted to more than double by 2031, supported by major investments such as Vantage Data Centres' expansion in Quebec City and Microsoft's hyperscale infrastructure development. These projects require close coordination with Hydro-Québec to ensure grid reliability and timely integration.

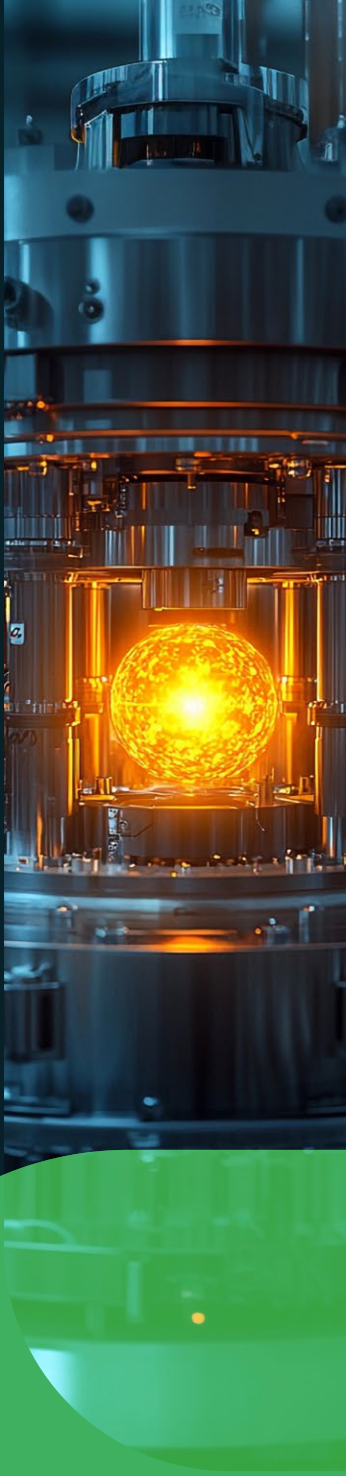
Under Current Measures, Quebec sees a cumulative increase of 2,103 jobs over the outlook period, averaging 300 additional jobs annually relative to baseline. This is driven by higher labour demand of approximately 280 jobs in total compared to the baseline during this period. While modest in the context of the overall electricity workforce, these figures signal heightened regional labour requirements for construction, grid integration and technical support.

Key Insight: The anticipated impacts of data centre buildouts on the electricity sector's labour force remain muted in the medium term. However, given the uncertainty surrounding AI adoption and future capacity growth, stronger electricity demand could amplify occupational imbalances—particularly in skilled trades and technical roles—requiring proactive workforce planning and regional coordination to ensure there are sufficient workers with the right balance of skills for these roles down the line.



7

AI and Nuclear Energy: The Role of SMRs in Canada’s Power Landscape



Artificial intelligence is becoming central to Canada's nuclear energy evolution, particularly as Small Modular Reactors (SMRs) move from concept to deployment. With capacities ranging from 5 to 300 MW, SMRs offer a flexible, low-carbon solution for rising electricity demand.

They are especially suited for AI-driven data centres, which require consistent baseload power to support high-performance computing.

The scale of this demand is striking. Gartner projects global data centre electricity consumption will reach 500 terawatt-hours annually by 2027, up from 190 TWh in 2023—roughly equivalent to powering Canada for approximately four months based on 2023 figures.[86] **This surge is driving interest in dedicated nuclear generation for AI infrastructure**, positioning SMRs as a strategic enabler of digital growth.

Canada's SMR Strategy spans three streams: **grid-scale reactors** like the 300 MW BWRX-300 at Ontario Power Generation (OPG)'s Darlington site, **advanced reactors** (fourth generation) such as the ARC and Moltex projects in New Brunswick, and **micro modular reactors (MMRs)** such as the 5 MW demonstration reactor by Global First Power in development at the Chalk River Laboratories in Ontario.

AI enhances nuclear operations in many ways, as plants rely on rigorous, real-time monitoring to maintain safety during routine and unexpected conditions. AI can improve these systems through:

- **Predictive Analytics –** Machine learning models simulate reactor physics, predict component wear and optimize maintenance schedules to reduce downtime and operational costs.
- **Digital Twins –** AI-driven virtual replicas of reactor systems enable real-time scenario testing, allowing engineers to improve safety without physical intervention.
- **Smart Plant Operations –** Integration of AI with IoT and mobile platforms improves reliability, decision-making and operational efficiency.

A key informant emphasized **AI's pivotal role in optimizing SMR deployment,** particularly in reactor sizing, site selection and lifecycle cost analysis. AI-driven simulation tools allow stakeholders to evaluate multiple transition scenarios, supporting data-driven decisions for investors and municipalities—especially important given high capital costs and lengthy licensing processes for nuclear projects.

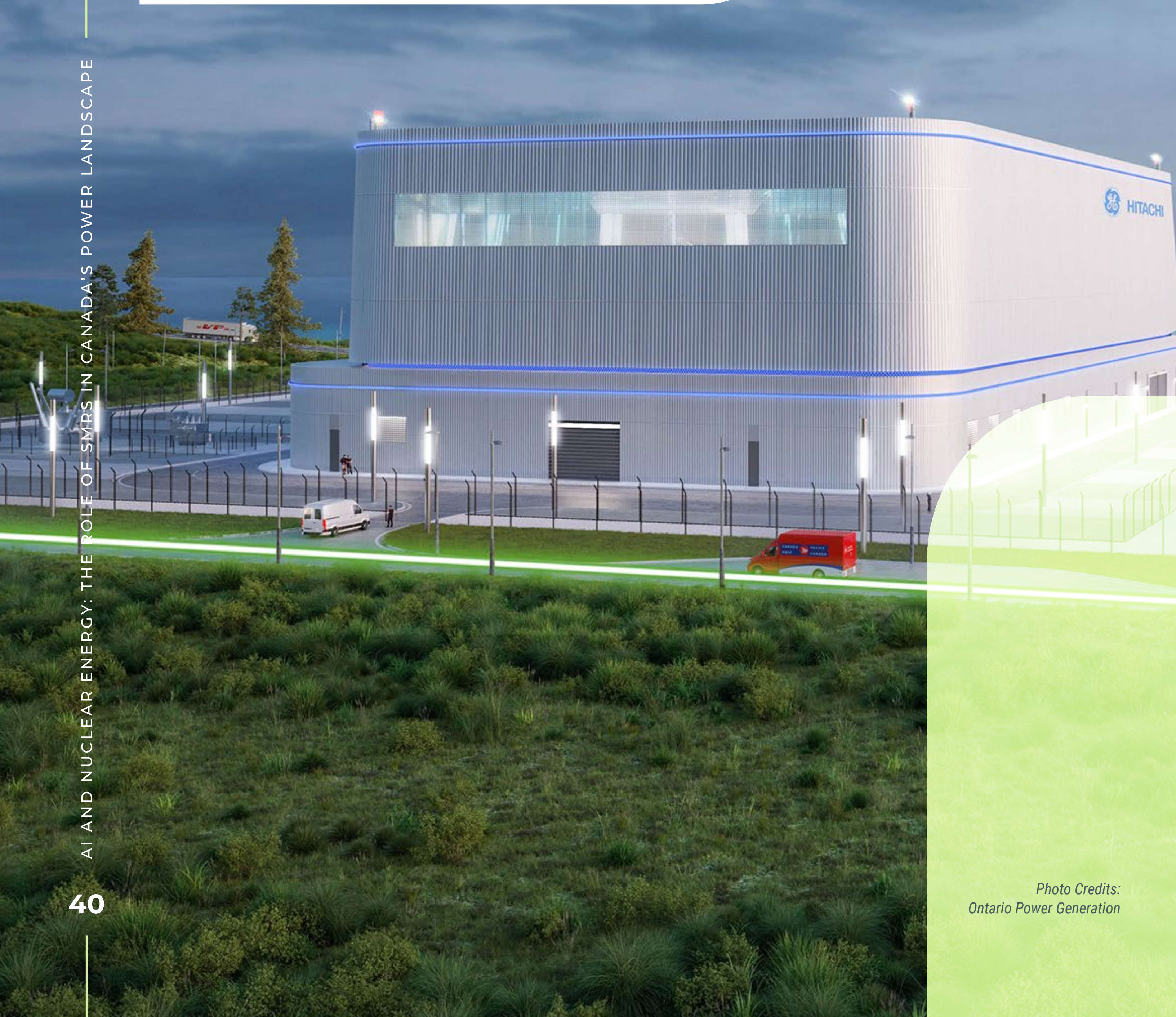


Photo Credits: Ontario Power Generation

These capabilities are critical for SMRs, given their modularity and remote siting, where autonomous monitoring may be essential. Future advancements in algorithms, sensor networks and human-machine interfaces will deepen these benefits,[87] though challenges remain—**cybersecurity, regulatory compliance and workforce readiness are top priorities.**

The Canadian Nuclear Safety Commission has invested $50.7 million in its SMR Readiness Project to strengthen regulatory oversight and internal AI capabilities for risk modelling, real-time data analysis and licensing decisions.[88] Industry leaders such as Terrestrial Energy and Westinghouse Electric are leveraging AI for fuel cycle management and thermal efficiency optimization in next-generation reactors.[89]

In the U.S., major tech firms such as Microsoft, Google and Meta are investing in American SMR developers to secure long-term clean energy for large-scale data centres.[90] This signals a growing market for nuclear-backed AI compute environments—a trend Canada is well positioned to exploit given its nuclear expertise, strong safety culture and skilled workforce.

Workforce Implications

AI-linked nuclear projects require hybrid expertise spanning nuclear engineering, data science, cybersecurity and ethical governance. OPG estimates that construction of the Darlington SMR alone will create 1,600 jobs annually during peak build-out,[91] generating $1.9 billion in labour income.[92] As AI becomes embedded in plant operations, demand will rise for hybrid-skilled professionals who can interpret complex data outputs and manage smart infrastructure safely and effectively. It is essential to understand how the nuclear workforce is evolving, identify new competencies required to design, build, operate and maintain advanced nuclear technologies, and account for the lead time needed to train and certify these professionals.

SMRs represent a pivotal intersection of AI innovation, energy resilience and low-carbon growth. Their success depends not only on technical deployment but also on workforce readiness and government systems that ensure safety, accountability and sustainability.

8

Workforce Transformation in the Age of AI

Workforce transformation is increasingly recognized as essential to unlocking digital innovation in Canada's electricity sector.

Success in automated, data-driven environments requires more than technical proficiency—it demands cohesive teams, clearly defined roles and shared strategic goals. As mobile and distributed energy systems evolve, organizations are prioritizing the human element, ensuring workers to not only adopt new tools but apply them effectively and with confidence.

Standalone AI platforms such as ChatGPT and Copilot are already supporting HR professionals, engineers, tradespeople and administrative staff. These tools streamline recruitment, automate reporting, enhance safety and inform decision-making—fundamentally reshaping operations.

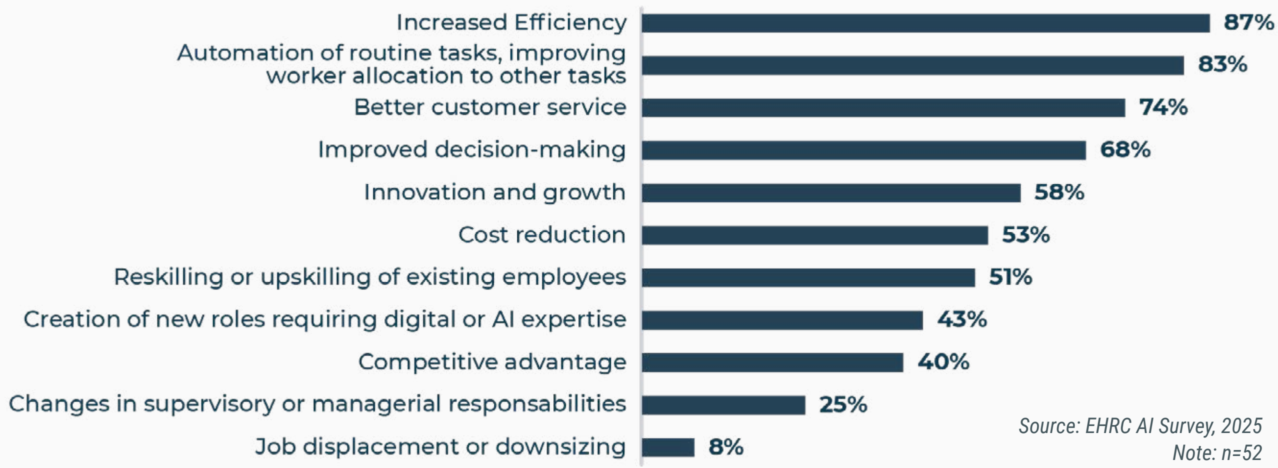
This transformation calls for inclusive leadership pathways, mentoring programs for skills development and workplace cultures that value equity, adaptability and resilience.

Survey data reveals strong optimism about AI's potential:

- **87% of respondents expect increased efficiency.**
- Many anticipate improvements in customer service, decision-making and innovation.
- A significant proportion foresee the creation of new roles focused on digital and data expertise.

FIGURE 8

Anticipated Impacts of AI Adoption in the Electricity Sector



Source: EHRC AI Survey, 2025
Note: n=52

Survey results showing expected outcomes of AI integration, including **efficiency gains, innovation and workforce transformation.**

8.1 Shifting Roles and Operational Realignment

AI is reshaping work across Canada's electricity sector, moving tasks such as pattern recognition, fault detection, scheduling and customer service from manual processes to intelligent systems. This shift **reduces routine workloads and enables proactive, data-driven operations.**

For example, in vegetation management, aerial image analysts now replace traditional line-clearance crews, while predictive diagnostics help reliability engineers prioritize interventions based on real-time risk. Nova Scotia Power exemplifies this transformation: vegetation encroachment, the leading cause of outages, once required costly manual inspections across vast networks. Today, satellite-based AI monitors transmission corridors, improving risk prediction, reducing outages and enhancing crew safety. This approach reflects a strategic move toward climate-resilient infrastructure.

At OPG, AI supports energy trading, grid optimization and internal operations. Its ChatOPG assistant, developed with Microsoft, streamlines HR and IT access, reducing administrative burden and freeing staff for higher-value tasks. While AI has not caused widespread job displacement, it is redefining roles and skill requirements. OPG is responding with targeted upskilling and workforce adaptation programs.

The rise of energy-specific AI platforms allows employees across departments to access advanced energy insights simply by typing natural language prompts—asking, for example, *'How can we reduce peak demand tomorrow?'*—and receiving instant, actionable responses. This capability is democratizing analytics and reshaping decision-making authority, enabling more roles to participate directly in strategy and operational planning.

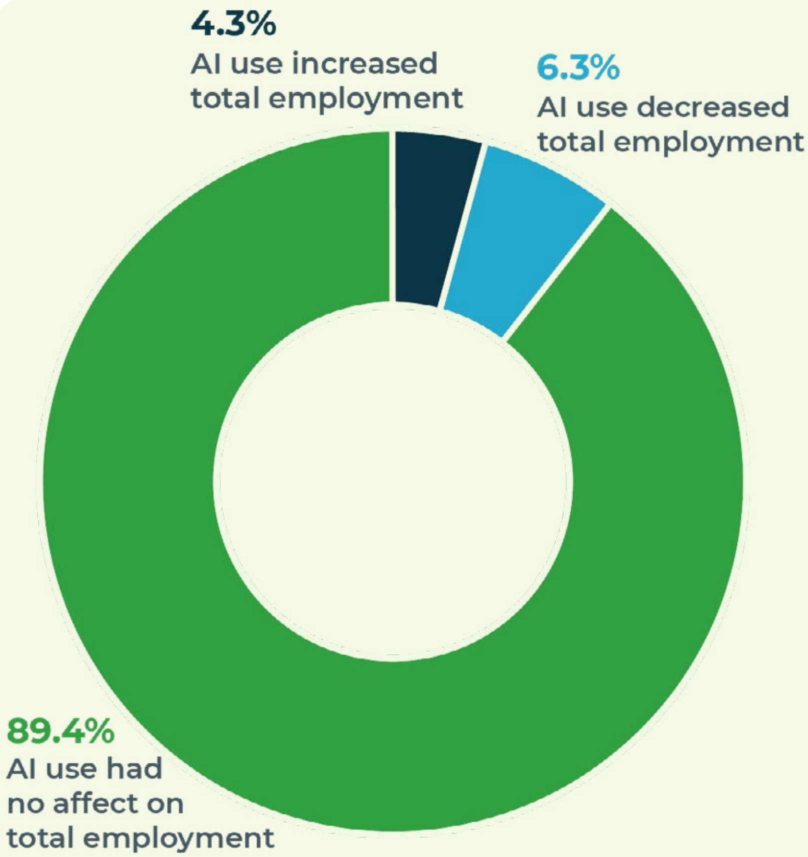
8.2 Quantitative Labour Trends

Labour market data shows that AI adoption in Canada is driving transformation without widespread job loss. Statistics Canada estimates that 31% of Canadian workers are in occupations with high exposure and low complementarity to AI—meaning their tasks are more vulnerable to automation and workers have limited ability to adapt through complementary skills.[93] Despite this risk, real-world impacts remain modest. Among firms adopting AI, 79% report stable employment and 18% report job growth.[94]

Most Canadian businesses report little change in workforce size following AI adoption. About 89.4% maintained stable employment, while 6.3% saw a decrease and 4.3% saw an increase. This indicates that AI integration has had minimal impact overall.

FIGURE 9

Impact of AI Use on Employment within Canadian Businesses (Q2 2025)



Most firms report no change in employment following AI adoption, reinforcing that **AI integration enhances operations rather than displaces workers.**

Source: Canadian Survey on Business Conditions, second quarter of 2025 (Table 33-10-1006-01).

At present, **AI adoption in Canada is reshaping jobs rather than eliminating them**, supporting a model of operational enhancement. Instead of mass displacement, AI is more likely to augment existing roles–freeing time and improving decision-making–than replace them outright. Positions most at risk remain concentrated in repetitive administrative and monitoring tasks, while strategic and technical roles are expanding.

Survey data reinforces this trend: 50.9% of organizations expect moderate changes within specific departments, and 22.6% anticipate significant impacts across many roles. Few expect no impact, underscoring **AI's broad influence on job design and the need for adaptability.**

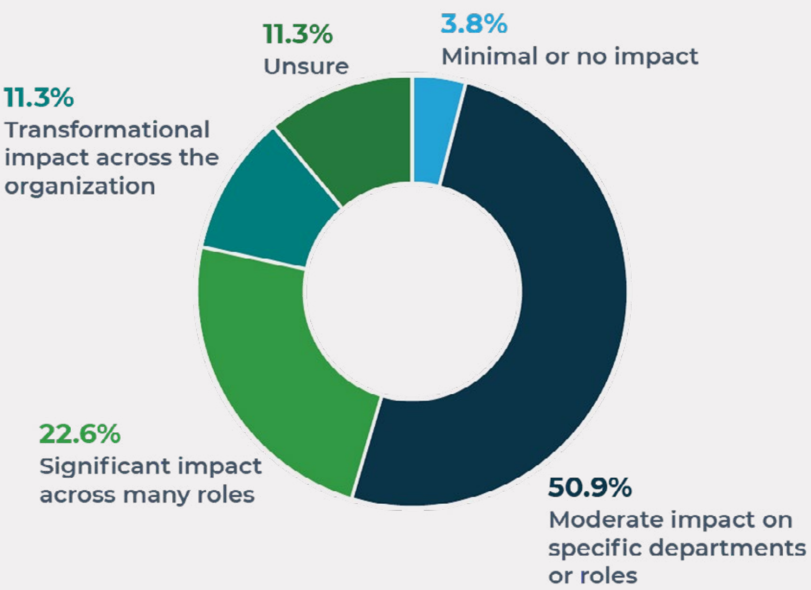
Talent acquisition now emphasizes strategic planning and future skill needs. Employers can tap into the fresh talent pipeline by hiring co-op students, interns or recent graduates through work-integrated learning programs, bringing in individuals with strong digital skills and fluency in emerging technologies. This approach not only supports AI innovation but also builds a future-ready workforce.

A key informant from a leading Ontario electricity company described plans to align talent with new AI skills through learning frameworks and diversity initiatives. **AI and other technologies are reshaping operations and workforce strategies.**

Leadership development is evolving in parallel, with targeted upskilling and AI literacy programs focused on governance, data stewardship and responsible data use. Experts agree that as AI adoption grows, **success depends on training, adaptability and trust**—requiring organizations to balance innovation with operational stability.

FIGURE 10

Perceived Impact of AI on Workforce Roles



Source: EHRC AI Survey, 2025
Note: n=53

Survey results show about one third of companies anticipate significant or transformational changes, while just over half expect only moderate to shifts changes in job functions across the electricity sector.

Key insights from informants in EHRC's study

AI is transforming Canada's electricity sector by **boosting productivity, changing job roles** and **improving efficiency.**

Rather than replacing workers, AI **automates repetitive tasks**, freeing employees for strategic and creative work.

Utilities are investing in **upskilling and hiring digitally fluent talent,** while academic institutions align curricula with industry needs.

Most organizations expect **moderate changes** in specific roles (50.9%), while fewer anticipate major, workforce-wide impacts (22.6%). Very few forsee no impact. These figures highlight a wide variation across organizations and suggest that some are better prepared for change than others.

Workforce planning now considers **recruitment, training and mobility** alongside ethical issues like **bias, privacy and cybersecurity.**

AI optimizes **grid operations, predictive maintenance and customer engagement.** Rising electricity demand from data centres is driving future workforce modelling.

Inclusion challenges persist, especially in Indigenous communities, where barriers include low literacy and concerns about data sovereignty.

Collaboration with academia and tech firms helps utilities stay ahead. AI-driven change requires **careful planning, inclusive strategies and continuous learning.**

8.3 Emerging Occupations and Skill Pathways

New roles in **energy analytics, system integration, cybersecurity and machine learning** are becoming more important. While these positions often require STEM backgrounds, they increasingly demand blended skills like **critical thinking, collaboration and digital fluency.** Technicians who previously calibrated meters or monitored substations are now expected to synthesize predictive data, validate system performance and interpret AI-generated recommendations.[95]

An academic leader in engineering stressed the need for hybrid skill development that combines engineering expertise with AI literacy. Engineering education has shifted to train students in using AI for design optimization, predictive maintenance and energy dispatch. This evolution underscores the need for professionals who can operate in complex, data-driven environments.

As conversational interfaces become more common, demand for hybrid skills is growing. Examples include prompt designers, who guide team interactions with AI platforms; energy data translators, who bridge gaps between machine outputs and operational decisions; and AI system coordinators, who manage usage, customization and user support across teams.

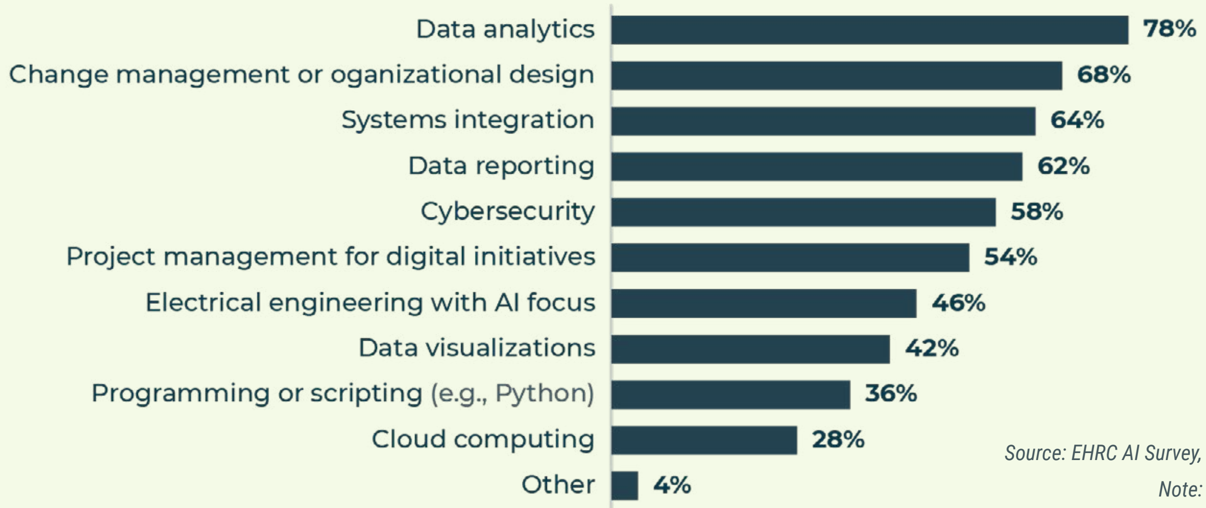
Respondents noted that IT and data analytics, customer service and administrative functions such as HR, finance and legal will be most affected, as these roles involve tasks that AI tools can partially automate. Engineering and operational departments may also see changes as AI-enabled tools become more prevalent.

Data analytics ranks as the top skill for effective AI implementation at 78%, followed by change management at 68%, systems integration at 64% and cybersecurity at 58%. This mix of technical and soft skills shows that employees need a comprehensive approach to technology adoption. To prepare for evolving skill needs, half of respondents plan internal training or upskilling, while 42% expect to hire new talent with digital or AI expertise. Demand for these skills is clear: 63% of organizations plan to use both in-house and external expertise to integrate AI into operations, while 27.8% plan to rely primarily on internal resources.

There is a significant opportunity for employers and educators to collaborate on programs that support immediate technology integration needs and emphasize human oversight of AI tools. One key informant noted that **current students are eager to bring innovative technology skills learned in school into the workplace, and organizations could do more to adapt quickly.**

FIGURE 11

Top Skills for Effective AI Implementation



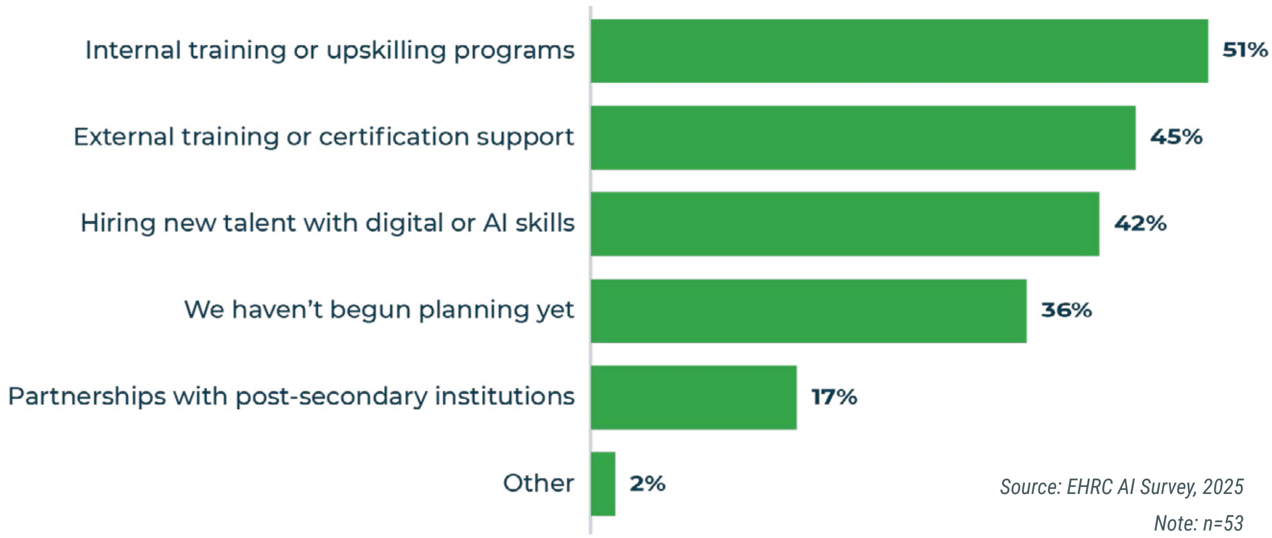
Source: EHRC AI Survey, 2025

Note: n=50

Survey results highlight data analytics, change management and systems integration as key competencies.

FIGURE 12

Organizational Strategies for AI Workforce Readiness



Source: EHRC AI Survey, 2025

Note: n=53

Survey responses on internal training, external certification and hiring plans to support AI integration.

Applied Career Narratives

AI is not eliminating jobs in the electricity sector—it's transforming them and creating dynamic new career paths. As companies embrace modernization, AI plays an increasingly central role in **optimizing operations, increasing efficiency and driving sustainable innovation.** This shift has created demand for professionals who can bend technical expertise with strategic insight, whether by engineering smarter grid systems, building predicative models to anticipate demand, or developing intelligent platforms that support energy management. These opportunities demonstrate that AI is no longer an add-on to the electricity industry, but is becoming a **core driver of transformation.**

A growing number of career opportunities are emerging for those inspired by the growing intersection of technology and energy.[96] Concerns about job loss were the least mentioned in research discussions; workforce displacement ranked lowest among AI-related concerns, reflecting a belief that **AI will augment rather than replace workers** over the next three to five years.

Career stories illustrate how jobs are evolving through smart systems, predictive analytics and automation:

Predictive and Analytical Roles

These roles focus on interpreting data, forecasting system behaviour and optimizing performance:

Reliability Engineers use predictive diagnostics to monitor asset health and prioritize interventions based on real-time risk. AI tools simulate failure scenarios and recommend maintenance schedules to improve uptime and safety.

Energy Data Scientists build models to forecast load, detect anomalies and support strategic planning. Their insights guide decisions across generation, transmission and customer engagement.

Energy Traders leverage AI analytics to enhance market participation, automate pricing strategies and manage risk in dynamic regulatory environments.

Field and Infrastructure Roles

Remote sensing, automation and AI-assisted diagnostics are reshaping these roles:

Vegetation Analysts use aerial and satellite imagery to identify encroachment risks, replacing manual line-clearance inspections. Their work supports outage prevention and climate resilience.

Field Technicians rely on AI-powered mobile tools for inspections, issue reporting and alerts, reducing downtime and improving crew safety.

Strategic and Planning Roles

These roles are expanding as AI enables broader participation in system design and operational strategy.

System Planners work with AI platforms to model grid behaviour under varying load conditions and incorporate renewables and distributed energy resources.

Smart Grid Architects design and connect smart systems, ensuring interoperability and scalability.

AI Product Managers lead the development and deployment of user tools, aligning technical capabilities with operational needs.

Sustainability Analysts apply smart modelling to optimize renewable portfolios, monitor emissions and support climate goals.

HR and Workforce Strategists link talent development to emerging AI skills, ensuring training programs meet operational and equity objectives.

A union representative noted that **AI is influencing many areas of the electricity workforce, but its impact on trades and field-based utility jobs will remain limited in the short to medium term.** Roles such as lineworker, heavy-duty mechanics and wind turbine technicians are unlikely to be replaced in the next three to five years because they require complex skills, physical presence and specialized training. AI is seen as a tool to improve planning and coordination rather than a threat to these jobs. This perspective highlights a key point: not all roles face equal risk from AI disruption. For trades and utility workers, the near future appears stable, though ongoing dialogue, monitoring and inclusive planning will be essential as technology evolves.

Demographic and Equity Gaps in AI Readiness

Research from Toronto Metropolitan University's Diversity Institute shows that **immigrants, Indigenous Peoples and racialized Canadians have a greater familiarity with AI tools than the broader population.**[97] Yet these groups remain underrepresented in energy-sector hiring pipelines. Barriers such as credential recognition and biased recruitment practices limit fair access to AI-related roles, even for those with strong technical capabilities.

If left unaddressed, these challenges could reinforce existing inequities within the energy workforce. Closing these gaps requires **targeted training programs, inclusive outreach and equity-focused hiring practices** to ensure all qualified candidates can participate in the sector's transition.

Regional and Generational Implications

AI adoption will affect regions and generations differently. Younger workers tend to be more digitally fluent but may lack domain-specific expertise and knowledge, while older professionals bring operational experience yet often need support adapting to AI tools and interfaces. Rural and northern communities that depend heavily on energy infrastructure jobs may see fewer field roles as smart systems enable more centralized oversight.[98] Urban centres, by contrast, are positioned to benefit from growth in clean technology, AI innovation and digital operations.

Generational turnover adds complexity: the rapid retirement of skilled tradespeople and engineers threatens institutional knowledge unless addressed through strong documentation, mentorship and knowledge-sharing tools.[99] AI offers new ways to capture and transfer expertise across the ecosystem, but success depends on careful transition planning aligned with workforce priorities and system reliability.

Interest in AI is growing across Canada's electricity sector, but utilities in the Yukon, Northwest Territories and Nunavut—such as Yukon Energy, Northwest Territories Power Corporation and Qulliq Energy Corporation—have yet to launch major public initiatives or formal AI strategies. Their focus remains on reliability, diesel reduction and renewable integration.[100] While some internal assessments or pilot projects exist, they lack transparency, limiting visibility into AI engagement. Current use is mostly informal, centred on HR and productivity tools, signalling early experimentation rather than strategic deployment.[101, 102]

> Key informants expect broader adoption of metering, grid control and automation, but progress depends on upskilling, technical hiring and strong governance around **cybersecurity, privacy and bias.**

Tailored support and local expertise are essential for northern and remote regions to fully participate in Canada's AI-enabled energy transition. Emerging technologies such as agentic AI could help preserve institutional knowledge by learning from historical data and mimicking expert decisions. One territorial utility manager anticipates expanded AI use in metering and grid control, emphasizing that AI will transform jobs rather than eliminate them—and that success requires local technical capacity and robust cybersecurity frameworks.

Indigenous Perspectives and Energy Sovereignty

Indigenous communities are critical partners in Canada's energy transition, yet their perspectives on AI often remain underrepresented in mainstream planning. AI has the potential to **strengthen Indigenous energy sovereignty, support environmental stewardship and enable community-led innovation**—provided its use is inclusive and culturally respectful.

Community-led projects, such as the Tŝilhqot'in Nation's solar microgrid, already integrate AI-based forecasting to manage energy storage and optimize local generation.[103] These initiatives demonstrate how AI can enhance autonomy and sustainability when aligned with Indigenous governance and cultural values.

However, significant barriers remain. Many remote communities lack the digital infrastructure needed for AI, and training programs may not reflect Indigenous learning styles or priorities. **Inclusive outreach, tailored support and co-created solutions** are essential for meaningful engagement in AI-driven energy innovation.

Indigenous organizations such as Indigenous Clean Energy (ICE) are working to close these gaps by promoting digital tools for community energy planning and advocating for culturally relevant training. While AI adoption in Indigenous electricity projects is still limited, its potential to optimize microgrids and improve operational efficiency is clear. Key challenges include fragmented contractor networks and low AI literacy. Addressing these requires workforce development strategies that respect cultural context and ensure community participation.

Many Indigenous communities are also focused on reducing diesel reliance through renewable energy and battery storage systems. These projects advance energy sovereignty but often involve multiple contractors, creating integration challenges. AI can help streamline operations and improve forecasting, but unlocking its benefits will require innovative **strategies that reflect community priorities and governance frameworks.**

Labour Union Perspectives and Regulatory Oversight

Labour unions across North America are responding to AI-driven changes with proactive strategies. In the U.S., trade unions are influencing not only workplace integration but also upstream decisions on AI design, testing and governance through collaboration with industry, academia and policymakers.[104]

In Canada, unions such as the Canadian Union of Public Employees (CUPE), International Brotherhood of Electrical Workers (IBEW) and the Canadian Labour Congress are actively negotiating AI-related workplace protections, including clear rules on algorithmic decision-making and limits on electronic surveillance.[105] [106] [107] The Power Workers' Union (PWU) supports collaborative workforce strategies in Ontario's energy sector, focusing on upskilling, worker participation in technology adoption and safeguards against job displacement.[108]

Key informants note **growing concerns among Ontario trades about over-reliance on AI**, erosion of soft skills and governance gaps, even as they recognize AI's potential to improve curriculum design.

Regulatory bodies are also adjusting their scope, though sector-wide enforcement remains inconsistent. Canada's voluntary AI codes and international frameworks (such as OECD principles) provide a foundation, but sector-specific standards are needed to address the electricity sector's unique risks. Academic experts highlight that Canada's regulatory approach lags behind AI innovation, particularly in nuclear energy.[109] AI could help streamline licensing and certification processes, improving efficiency and responsiveness.

Job Quality, Well-being and Organizational Culture

AI can improve job quality by reducing repetitive tasks and supporting better decision-making. However, it also introduces new pressures. Algorithmic scheduling can limit worker autonomy, while intelligently managed performance metrics may create unrealistic expectations and affect morale. Organizations should prioritize responsible design, involve employees in deployment and maintain open dialogue to balance efficiency with dignity and mental health. **Trust, transparency and cultural alignment** will be critical as digital systems become embedded in utility operations.

Best Practice Models and Collaborative Training

Utilities are adopting innovative training models to build AI readiness while retain talent. AltaML's Applied AI Lab offers 12-week residencies that provide hands-on experience solving real-world energy challenges.[110] Enova Power delivers AI-focused webinars for commercial and industrial clients, highlighting operational benefits and workforce impacts.[111] These initiatives extend beyond internal teams, engaging external stakeholders to promote sector-wide understanding of AI's role in energy transformation.

Such models underscore the value of **partnerships among energy providers, academic institutions, unions and technology firms.** Training programs must evolve to build conversational AI fluency, data literacy and cross sector adaptability–not just technical mastery.

National Workforce Readiness and Training Programs

As AI becomes increasingly embedded in electricity operations, workforce readiness is a strategic priority. **National AI literacy remains**

low, underscoring the need for inclusive, future-focused training initiatives.[112] Canadian public institutions, private colleges and industry-led programs are responding with targeted offerings designed **to support displaced workers, enhance digital competencies and build interdisciplinary expertise** across technical, operational and strategic domains:

- **EDGE UP 2.0 in Calgary** helps oil and gas professionals transition to digital and energy related fields through short duration, job specific training. [113]
- **Careers in Energy and Lighthouse Labs** offer fully funded programs in cybersecurity, data analytics and web development, tailored for energy workers transitioning into tech roles.[114]
- Leading institutions such as the **Universities of Toronto, Waterloo and Alberta** embed AI into energy-relevant curricula, while Ontario colleges like Mohawk, Cambrian and Humber integrate smart grid optimization and renewable forecasting into capstone projects.[115]

Access remains uneven. Smaller providers face financial and technical challenges, and Indigenous and rural communities require tailored support.[116] Ontario Tech University stands out for interdisciplinary programs in nuclear, hydrogen, renewables and smart grid systems. The University of British Columbia and Camosun College emphasize sustainability and Indigenous perspectives, while Quebec's MILA and IVADO advance AI-energy integration. Indigenous-led initiatives, such as UBC's Abundant Intelligences Project, aim to decolonize AI design and promote community-driven energy solutions.[117]

Both the University of Saskatchewan and the University of Regina include AI-related content in their engineering programs.[118] [119] Students gain practical experience through research assistantships and co-op placements with utilities and technology companies, ensuring exposure to real-world applications of AI in energy systems.

Other notable efforts include Dalhousie University's AI2Market program,[120] the College of the North Atlantic's applied IT degree in AI and machine learning, and Newfoundland and Lab rador's micro-credential funding for SMEs.[121] International programs like Gridmatic[122] and IEEE's "AI for Energy" vertical provide global benchmarking and practical case studies.[123]

To support broader AI proficiency, industry partners such as Microsoft and Google offer foundational training in AI literacy and ethics.[124] Programs like ADaPT, developed by the Diversity Institute and Future Skills Centre, focus on workforce agility, helping jobseekers to adapt to digital demands.[125]

These initiatives highlight the need for **expanded digital training, demographic inclusion and ethical awareness** in technical courses. Upskilling and cross-training are critical for improving digital fluency and fostering collaboration between AI specialists and domain experts.

To build an AI-ready electricity workforce, **Canada needs sustained investment, regional planning and lifelong learning systems.** Human oversight remains essential for technical accuracy, ethical governance and public trust. Canada's leadership in AI-powered energy innovation depends on its ability to train, adapt and include all stakeholders.

TABLE 3

AI and Clean Energy Integration in Canadian Universities

Institution	Province/ Territory	Program/ Credential	AI Integration
University of British Columbia	**British Columbia**	Renewable Energy Research Initiatives	AI primarily through research projects, not formal degrees
BC Institute of Technology	**British Columbia**	B.Sc. in Renewable Energy Engineering	No dedicated AI component
University of Alberta	**Alberta**	B.Sc. in Renewable Energy Engineering	AI via electives and research opportunities
University of Waterloo	**Ontario**	Sustainable Energy Programs and AI Institute	Integrated research opportunities combining AI and energy
Carleton University	**Ontario**	M.A.Sc. in Sustainable Energy	AI elements possible through electives and thesis work
York University	**Ontario**	Certificate in Sustainable Energy	Graduate-level AI specialization options available
University of Toronto	**Ontario**	Energy and AI Research via Vector Institute	Applied AI through electives and research collaborations
Ontario Tech University	**Ontario**	Energy Systems Research Centre	AI-enabled projects in smart grid and informatics
Université de Montréal and Polytechnique Montréal	**Quebec**	Graduate Research Programs	AI integration through MILA partnerships
Dalhousie University	**Nova Scotia**	CFREF-funded Climate and Energy Transformation Programs	AI-related research paths available
McGill, Victoria, Calgary, Memorial, Concordia, York	**Multiple Provinces**	CFREF-funded Energy and Decarbonization Projects	AI-integrated research initiatives

Overview of post-secondary institutions offering energy programs with AI-related components.

TABLE 4

Community and Private College Programs with AI-Relevant Energy Components

Institution	Province/ Territory	Program/ Credential	AI-Relevant Features
Vancouver Community College	**British Columbia**	Clean Energy Technology Diploma (2 years)	Energy modelling, system control, data-based diagnostics
Ace Community College	**British Columbia**	Green Energy Installer training and workshops	EV charging, system installation, basic tech training
Conestoga College	**Ontario**	Renewable Energy Techniques Certificate (1 year)	Grid integration, battery systems, simulation tools
Centennial College	**Ontario**	Research and Innovation in Sustainable Energy Systems	Smart microgrids, EV charging, energy optimization using data
Bay River College	**Alberta**	Applied Environmental Technology Diploma	General environmental tech; limited AI-energy content
ABM College	**Alberta/ Ontario**	Tech Diplomas (IT, UX, Development)	No renewable energy-AI programming
Nova Scotia Community College	**Nova Scotia**	Applied Energy Research (via R&D labs)	Smart grid tech, data analytics, EV charging/storage systems

Comparison of college-level programs integrating renewable energy and AI technologies.

9

Governance, Equity and Sustainability in AI Deployment

As artificial intelligence becomes integral to decision-making in Canada's electricity sector, ethical considerations are no longer optional—**they are essential.**

AI now functions as a strategic force, shaping operational priorities and influencing organizational culture. Its impact extends beyond technical performance to **critical issues of fairness, transparency and accountability.** Utilities must ensure AI systems uphold public trust, protect workforce integrity and align with societal values while driving innovation.

AI introduces both opportunities and challenges within the Environmental, Social and Governance (ESG) framework as its use expands in the electricity sector. Algorithms influencing pricing models, outage prioritization, hiring practices and performance evaluations, raising concerns about bias and opacity. Utilities must actively prevent algorithms from perpetuating historical inequities or making decisions that lack transparency.

Environmental Impacts

The rapid growth of AI systems, particularly in data centres, raises concerns about energy consumption and emissions. Hydro-Québec projects that data centres will increase demand by 4.1 terawatt-hours by 2032, enough to power more than 340,000 Canadian homes annually.[126] Ontario forecasts that data centres will account for 13% of new demand and 4% of total grid load by 2035.[127]

In Alberta, building all proposed data centres could significantly increase provincial greenhouse gas emissions. This has sparked debate about clean energy deployment, off-grid solutions and reliability trade-offs. Critics argue that decarbonization is often sidelined in favour of speed, uptime and rapid deployment.[128] First Nations communities have raised concerns about environmental impacts, inadequate consultation and Treaty 8 rights violations in projects such as "Wonder Valley."[129]

Data centers also require massive computing power, generating heat and consuming large volumes of water for cooling. Their sitings, another contentious issue, can strain local water supplies and land resources. Canadians may face direct competition for these resources, while government and businesses may encounter challenges in site decisions.

Globally, emissions from AI-intensive data centres are rising. In the U.S., such facilities emitted around 105 million tonnes of CO2 over the past year, nearly equivalent to the aviation sector's footprint. Proximity to coal-powered plants remains common due to their accessibility.[130] These trends underscore the need for AI tools that support renewable integration, optimize grid operations and minimize waste. Predictive maintenance, demand forecasting and dynamic resource management are among the most promising applications in this regard.

Governance Challenges

International bodies such as the OECD and European Union are advancing ethical frameworks for AI, emphasizing transparency, human oversight and sustainability. In 2024, the EU enacted Delegated Regulation (EU) 2024/1364, requiring data centres with IT power demand above 500 kW to report sustainability metrics under a unified rating system.[131] According to California's Electric Power Research Institute (EPRI), reliability, affordability, resilience and clean energy have become a focus for the industry.[132] In Canada, Natural Resources Canada published a Best Practice Guide for Canadian Data Centres (2024), which benchmarks for energy use and cooling efficiency.[133]

Canada has adopted voluntary codes and public service guidelines for AI implementation across government agencies and regulated industries. However, enforcement remains uneven and public trust is low. A 2025 global survey found that only 24% of Canadians reported receiving formal AI training, and Canada ranked 42nd out of 47 countries for trust in AI—highlighting widespread perception of risk and skepticism.[134]

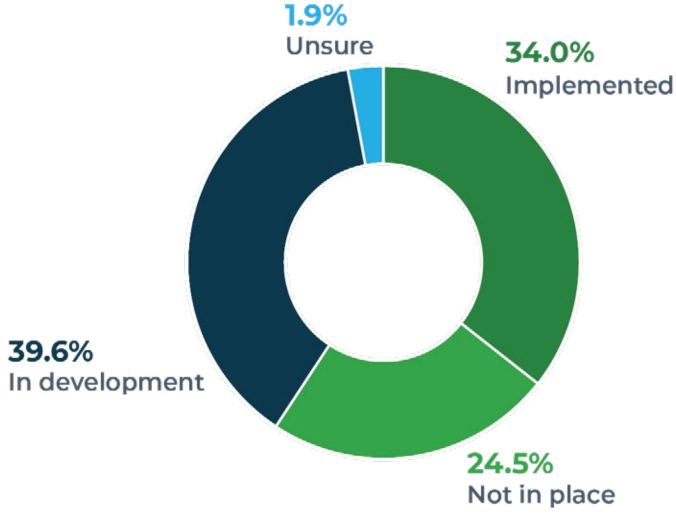
Explainable AI frameworks are essential for auditing and challenging machine learning outputs, particularly in regulated environments where pricing and service delivery must align with public interest standards. **Best practices include ethical oversight boards, algorithmic audits and human-in-the-loop systems** to mitigate unintended consequences and maintain accountability.[135]

Organizations also face internal risks from unmanaged AI use. Over-reliance on automated outputs without clear policies or human oversight can compromise work quality, erode stakeholder trust and damage reputations. **Employees need guidance on appropriate use, ethical boundaries and accountability structures.** Without these safeguards, tools designed to enhance productivity may inadvertently harm brand integrity.

Within the electricity sector, governance gaps pose risks to organizational integrity and employee safety. When surveyed, **only 34% of organizations have implemented AI policies,** 40% are developing one and 24% have not started. Regardless of policy status, over 60% of respondents believe employees are already using AI tools to a moderate extent. This underscores the urgency of cohesive strategies to safeguard staff and sensitive information.

FIGURE 13

Status of AI Governance Policies in the Electricity Sector

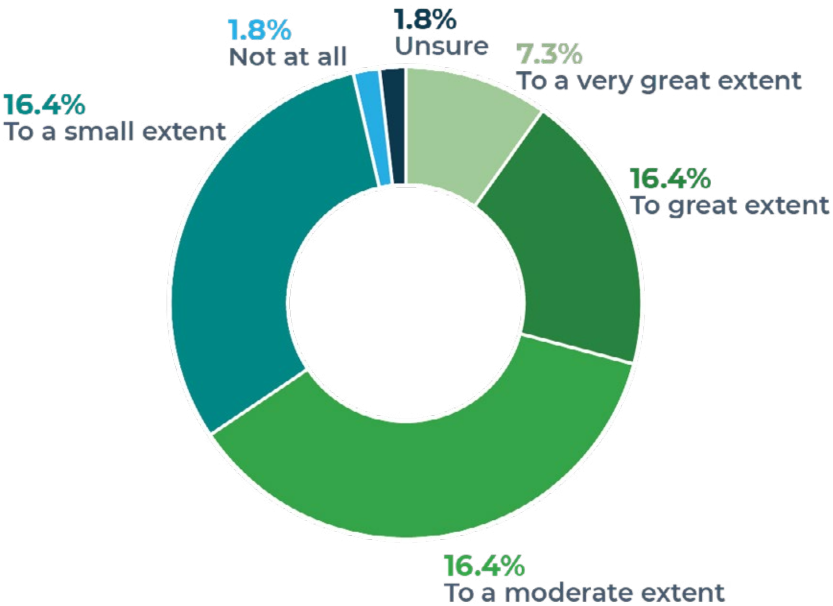


Source: EHRC AI Survey, 2025
Note: n=55

Survey results show that **only 34% of organizations have implemented formal AI policies**, while 40% are still developing them. Nearly one-quarter have not started, highlighting a significant governance gap as AI adoption accelerates.

FIGURE 14

Extent of Employee Use of AI Tools Without Formal Policy



Despite limited policy coverage, over 60% of respondents believe employees are using AI tools to at least a moderate extent. This underscores the urgency for **clear guidelines to manage risks and ensure responsible use.**

Source: EHRC AI Survey, 2025
Note: n=55

Social Considerations

AI is reshaping workforce planning, recruitment and organizational culture. For example, TransAlta uses AI to identify diversity gaps, detect hiring biases and improve team composition.[136] These tools analyze patterns across departments and levels, providing insights that inform targeted interventions.

Generative AI platforms streamline candidate screening, onboarding and performance assessments. When applied responsibly, they reduce administrative burdens and promote equitable advancement. However, **employers must ensure algorithmic fairness and transparency** to avoid discriminatory outcomes. Algorithmic opacity and biased training data can perpetuate discrimination.

Beyond HR applications, technologies such as facial recognition, predictive policing and surveillance raise civil society concerns and regulatory challenges. In Canada, AI use in defence and public safety has drawn scrutiny, with experts calling for stronger oversight and ethical review.[137]

A key informant from a major eastern Canadian utility emphasized the need for human oversight and robust privacy protections to maintain fairness and safeguard employee data. These applications reflect a broader movement toward **aligning technological progress with human values and organizational transparency.**

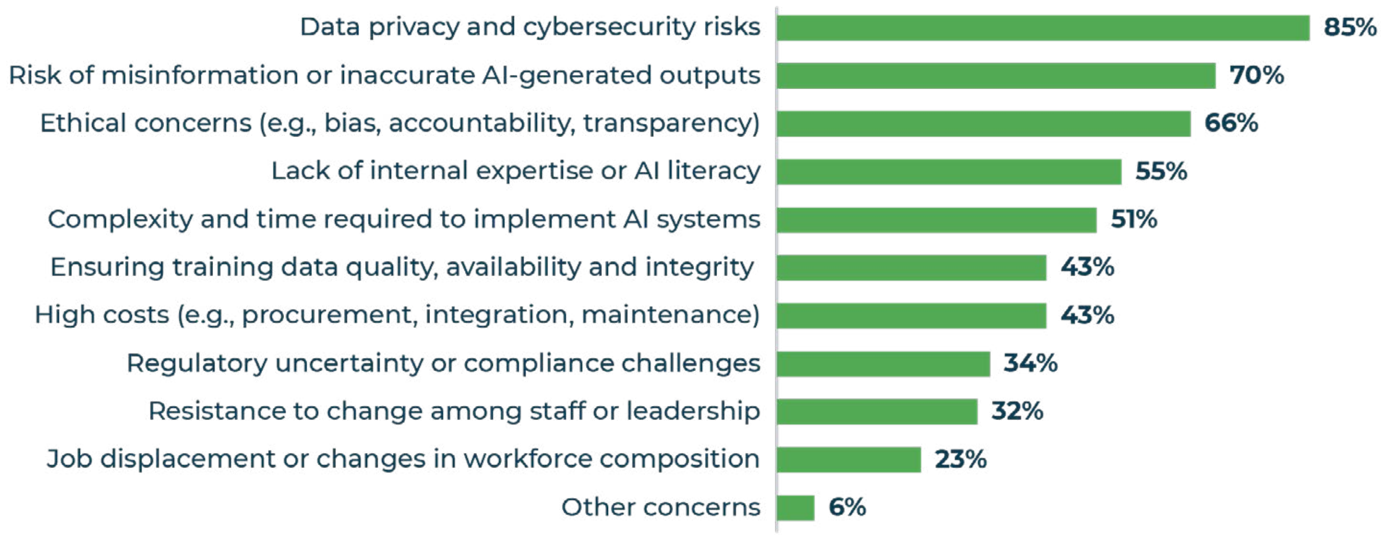
Cybersecurity Risks

AI enhances threat detection and incident response but also enables malicious actors to scale attacks. Between 2023 and 2024, cyberattacks on U.S. energy providers rose 70%, highlighting vulnerabilities.[138] Canadian utilities must integrate AI with layered security protocols, cross-sector coordination and training to maintain resilience. Cybersecurity and data privacy risks are the most cited challenges among survey respondents (85%), followed by misinformation (70%) and ethical concerns (66%).

FIGURE 15

Top Organizational Concerns About AI Deployment

What potential challenges or issues is your organization concerned about in relation to deploying AI?



Source: EHRC AI Survey, 2025
Note: n=53

Cybersecurity and data privacy risks dominate organizational concerns (85%), followed by misinformation (70%) and ethical issues (66%). These findings reflect the need for robust security measures and ethical governance frameworks.

ESG governance will determine whether AI's benefits are realized responsibly. Stakeholders—including energy providers, regulators, unions and consumers—must collaborate to align technological progress with environmental stewardship, social inclusion and transparent leadership. Without robust safeguards, AI could exacerbate inequities, strain energy systems and erode public confidence.

9.1
AI Lifecycle and Sustainability

As AI becomes integral to electricity operations, sustainability must be considered across the entire lifecycle—not just deployment and use, but also model maintenance, hardware upgrades and eventual decommissioning. Without careful planning, AI infrastructure can increase environmental impacts and operational inefficiencies.

Designing AI systems with lifecycle stewardship in mind ensures that digital transformation aligns with environmental responsibility.

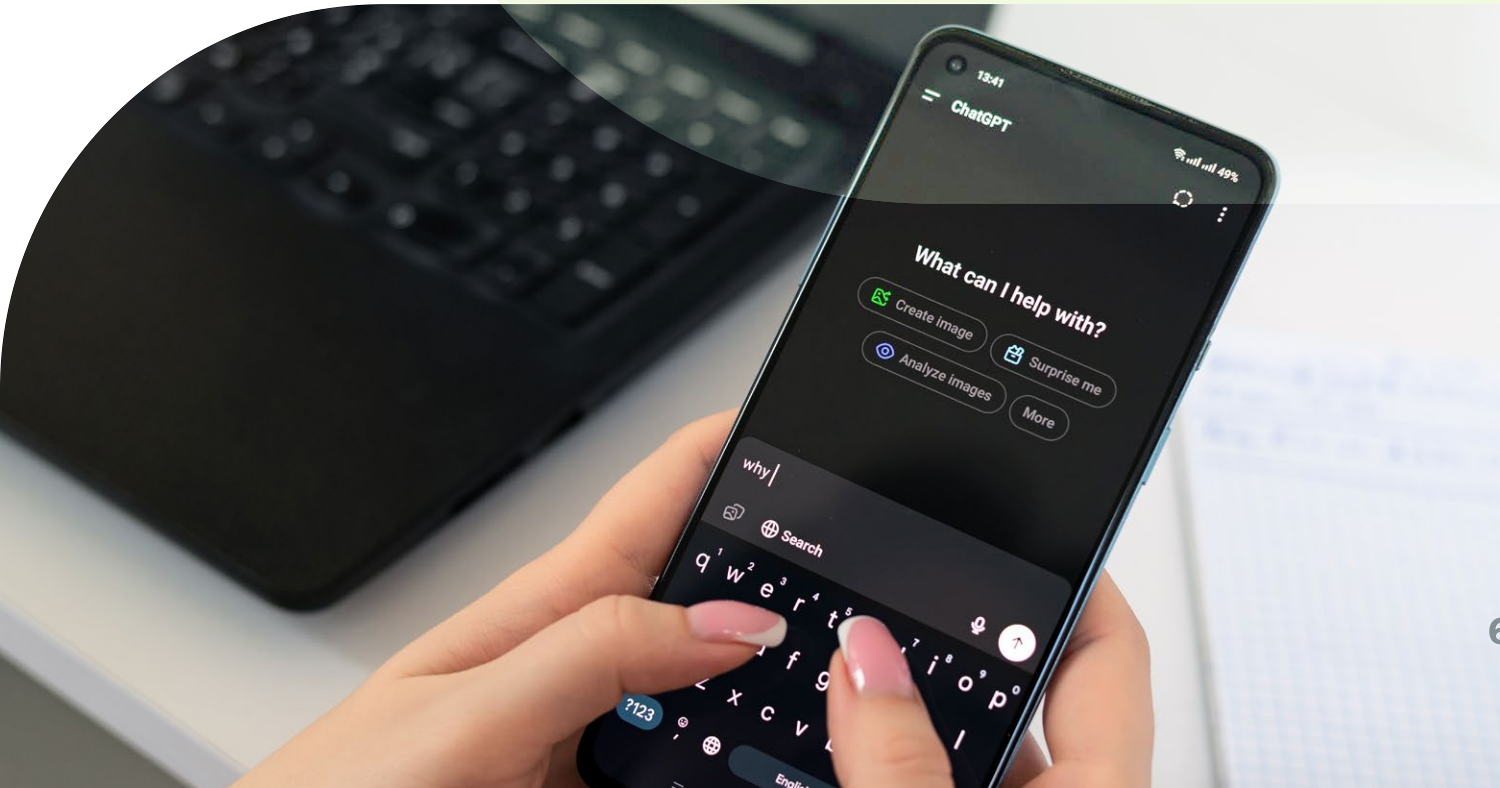
Lifecycle stewardship includes:

Model drift: Regular retraining and validation to prevent performance decline as data patterns change.

Hardware sustainability: High-density servers and specialized chips consume significant energy and generate electronic waste. Server racks are projected to reach 600 kW each by 2027, raising environmental concerns about procurement, cooling and disposal.[139]

Responsible retirement: Secure data erasure, ethical system phase-out and adherence to environmental guidelines. Wherever possible, equipment should be refurbished, recycled or repurposed in line with circular economy principles.[140]

Software efficiency: Open-source models, modular architectures and cloud optimisation can reduce resource consumption and improve adaptability.



9.2
Pathways to an Equitable and Adaptive Future

One of the most pressing challenges is the surge in electricity demand driven by AI-powered data centres.

Ontario's Independent Electricity System Operator (IESO) projects a 75% increase in demand by 2050, with 60% of that growth expected by 2035.[141] Alberta's AESO reports over 16,000 MW of pending large-load applications, surpassing the province's current peak demand.[142] If realized, this rapid shift will strain transmission capacity, system flexibility and emissions targets.

Although the IESO does not yet have a formal AI policy, it has begun exploring implications through its Innovation Roadmap and whitepaper series launched in 2022. AI is positioned as a strategic enabler, particularly for forecasting, automation and decision support, rather than a disruptive force. These efforts align with Ontario's public sector directives on responsible AI use, which emphasize transparency, accountability and ethical deployment.

Alberta's AI and Data Strategy outlines a roadmap to position the province as a global AI hub.[143] It prioritizes attracting private-sector investment in AI infrastructure, especially data centres, by leveraging Alberta's competitive electricity costs, technical talent and innovation ecosystem. The strategy calls for alignment between AI deployment and clean energy priorities, including emissions reduction and grid reliability. Alberta aims to use AI as a tool for long-term economic diversification, projecting up to $100 billion in private investment over the next decade.

However, the cost and complexity of AI deployment create barriers for small and mid-sized energy providers. Expenses include development, licensing, hardware, cloud infrastructure, staffing and maintenance. Without dedicated funding and coordinated support, these organizations risk falling behind. Regulatory processes also lag innovation, often requiring years for approvals and creating deployment bottlenecks.

Despite these challenges, AI offers pathways to optimize existing grid infrastructure, reducing the need for costly new transmission development. The U.S. Department of Energy estimates that grid-enhancing technologies, including AI, could unlock up to 100 GW of additional transmission and distribution capacity, improving system performance and sustainability without extensive physical expansion.[144] This could directly impact electricity rates for customers in affected jurisdictions.

Canada’s position in the global AI ecosystem is strong. Its hydroelectric resources, cool climate, robust privacy laws and research networks make it **well-suited for ethical, scalable digital infrastructure.** Success, however, depends on adaptive leadership, public engagement and long-term vision.

Several initiatives are advancing responsible governance. The Canadian Standards Association (CSA) supports AI integration through its Artificial Intelligence and Data Governance (AIDG) Standardization Hub, which promotes ethical AI use, Indigenous inclusion and alignment with international frameworks.[145] Internationally, the European Commission’s Artificial Intelligence Act mandates transparency and human oversight for high-risk AI systems, offering a model for Canadian regulators. Domestically, energy providers like TransAlta are deploying ethical tools to detect bias and improve team composition—underscoring that **ethical AI is a governance imperative, not just a technical concern.**

10 Recommendations for Harnessing AI in Canada's Electricity Workforce

Artificial intelligence is accelerating change across Canada's electricity sector, from grid optimization to predictive maintenance. But its most significant impact will be on people. Job roles are shifting, tasks are being redefined and new skills are becoming essential. This transformation brings opportunity and risk if workforce readiness is not prioritized.

To ensure AI strengthens resilience and equity rather than creating disruption, stakeholders must lead with a people-first approach. Lifelong learning, inclusive hiring, mental health supports and ethical governance will be critical to building trust and adaptability. The following recommendations—organized by utilities, HR leaders, governments and academic institutions—place workforce considerations at the centre of AI integration, ensuring technology uplifts the people who power Canada's energy future.

Utilities

Prepare and support the workforce for AI adoption

- Implement governance to oversee AI adoption, training and risk management.
- Conduct AI usage audits to identify tools is use and their associated tasks.
- Develop comprehensive workforce transition plans alongside AI strategies, including reskilling programs, job redesign and clear communication, to reduce uncertainty and build trust.
- Establish policies that provide workers with clear guardrails on how and when to use AI.
- Engage unions and frontline employees early in planning to ensure job quality and equitable participation.

Adopt enterprise-wide AI strategies

- Move beyond isolated pilots to integrated strategies that balance efficiency with ethical considerations, risk analysis, transparency and community trust.

Strengthen operations and resilience

- Expand AI for predictive maintenance, outage forecasting, vegetation management and disaster response to improve reliability and reduce costs.

Prioritize cybersecurity

- Invest in AI-driven monitoring and adaptive defence systems to protect critical assets and maintain public confidence.

Advance lifecycle stewardship

- Plan for AI systems lifecycle management, including model retraining, hardware upgrades and responsible decommissioning, and leverage AI for emissions monitoring and environmental compliance.

Human Resources Leaders

Lead workforce transformation

- Support critical thinking and empower employees through training that equips employees to responsibly use AI tools, understand data privacy regulations such as PIPEDA, and adapt confidently to evolving technologies.
- Train leaders to evaluate AI deployment decisions against productivity benchmarks, asking "will this tool improve productivity or reduce it?"
- Create training programs that build technical and cross-functional skills, enabling employees to adapt confidently to AI-driven changes.

Ensure responsible use of AI in HR practices

- Implement safeguards for fairness, bias prevention, privacy and monitoring when using AI for recruitment, training and performance evaluation. Maintain human oversight as essential.

Support culture and well-being

- Invest in leadership development, mentorship and mental health supports to help employees navigate change while sustaining engagement and morale.

Collaborate with unions and staff

Foster transparent dialogue and joint planning to ensure adoption enhances job quality rather than creating division.

Governments and Regulators

Invest in workforce readiness and inclusion

Canada lags in AI training and literacy compared to global peers. Expanding education and retraining programs—in partnership with Indigenous and local communities—will be key to building an inclusive workforce for the future.

Modernize regulatory frameworks

Governments should establish clear and consistent guidelines for AI deployment in the electricity sector. This includes certification, validation and oversight processes—particularly for safety-critical systems such as nuclear operations and grid reliability.

Support innovation and adoption

Financial incentives and regulatory "sandboxes" can help utilities and smaller firms overcome cost and risk barriers, while encouraging innovation and experimentation.

Align AI policy with climate and equity goals

AI adoption should advance Canada's environmental and social priorities. Policies should ensure that new infrastructure supports decarbonization, community consultation and equitable participation.

Academic Institutions

Scale workforce-focused programs

Expand interdisciplinary curricula combining AI, energy systems and sustainability, with strong emphasis on ethics, governance and Indigenous perspectives.

Strengthen industry partnerships for experiential learning

Increase internships, co-op placements and applied labs to prepare students for evolving careers in the electricity sector.

Build programs in partnership with industry to accelerate AI adoption leveraging skills learned in school.

Address regional and accessibility needs

Offer micro-credentials and remote delivery to reach rural and underserved communities, tailored to regional energy strengths.

Advance research in responsible AI

Lead development of explainable, transparent AI systems for energy applications to set Canadian standards for responsible deployment.

Cross-Sector Strategic Imperatives

Coordinate national workforce development

Align AI investments with lifelong learning and accessible credentials to build absorptive capacity across the sector.

Adapt regulatory frameworks for agility

Implement sandbox models and iterative governance to keep pace with technological change while safeguarding public interest and trust.

Expand partnerships for inclusive innovation

Foster collaboration among technology providers, academia and labour organizations to scale workforce solutions.

Ensure environmental stewardship

Integrate sustainability goals into infrastructure planning to prioritize clean energy sources, efficient cooling systems and prevent ecological overreach.

11

Conclusion

Artificial intelligence is not just a technological shift; it's a workforce revolution. As Canada's electricity sector evolves, success will depend on how well we prepare people to lead, adapt and thrive in intelligent systems. This report shows that AI can enhance productivity, resilience and sustainability—but only if we invest in inclusive training, ethical governance and strategic workforce planning.

The path forward demands bold leadership. Utilities, educators, policymakers and communities must work together to ensure that AI strengthens, not sidelines, human talent.

The opportunity is here. By placing human talent at the centre of digital transformation, Canada can build an electricity workforce that reflects our values, meets rising demand and leads the transition to a low-carbon, digitally enabled future.

Appendices

Appendix 1: Survey Results

EHRC conducted the survey AI Adoption and Workforce Impacts in Canada's Electricity Sector to examine how artificial intelligence is influencing workforce dynamics in the electricity and renewables sector. The survey was distributed online via QuestionPro between July 14 and Aug. 11, 2025, targeting senior professionals and decision-makers, including CEOs, executives, senior managers, HR leaders and digital transformation specialists.

A total of 59 respondents participated, representing a broad cross-section of the industry—generation, transmission, distribution, engineering, policy and occupational health and safety. Purposive sampling ensured participants had relevant expertise within key organizations across Canada.

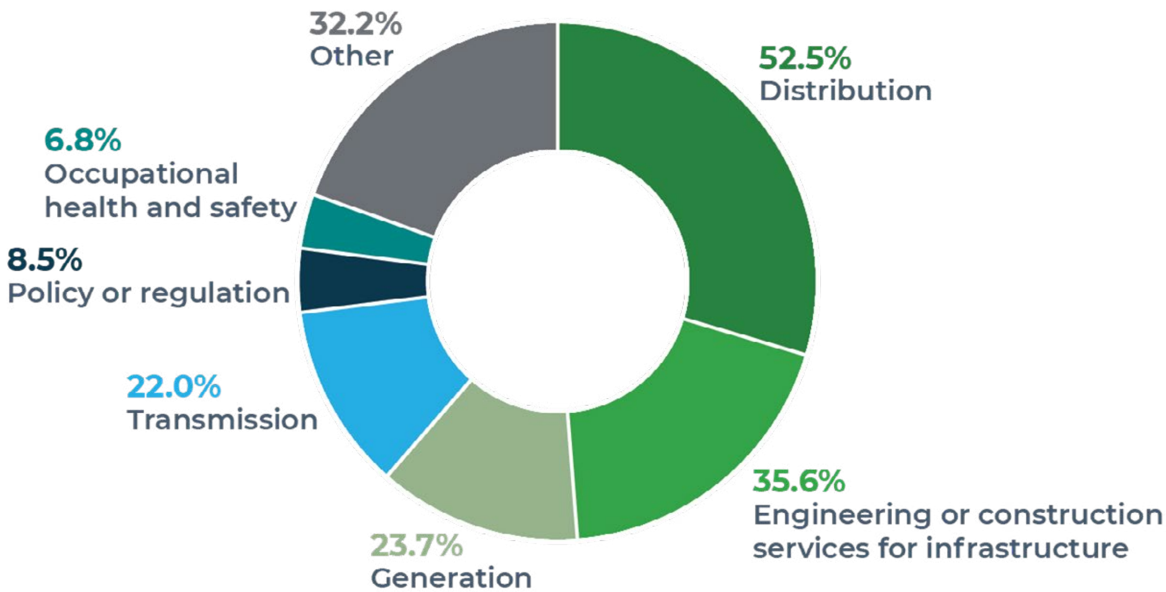
The survey included 26 questions, primarily multiple choice, with some open-ended items to capture qualitative insights. Topics covered:

- Organizational readiness for AI adoption.
- Current implementation practices.
- Future outlooks on workforce skills and deployment strategies.

To maintain confidentiality, responses were anonymized and analyzed in aggregate form. Data cleaning involved removing duplicates and excluding low-quality responses. Limitations include geographic concentration and potential bias due to higher response rates from Ontario-based organizations. Despite these constraints, the findings provide valuable insights into how AI is shaping workforce strategies in Canada's electricity sector.

FIGURE A1

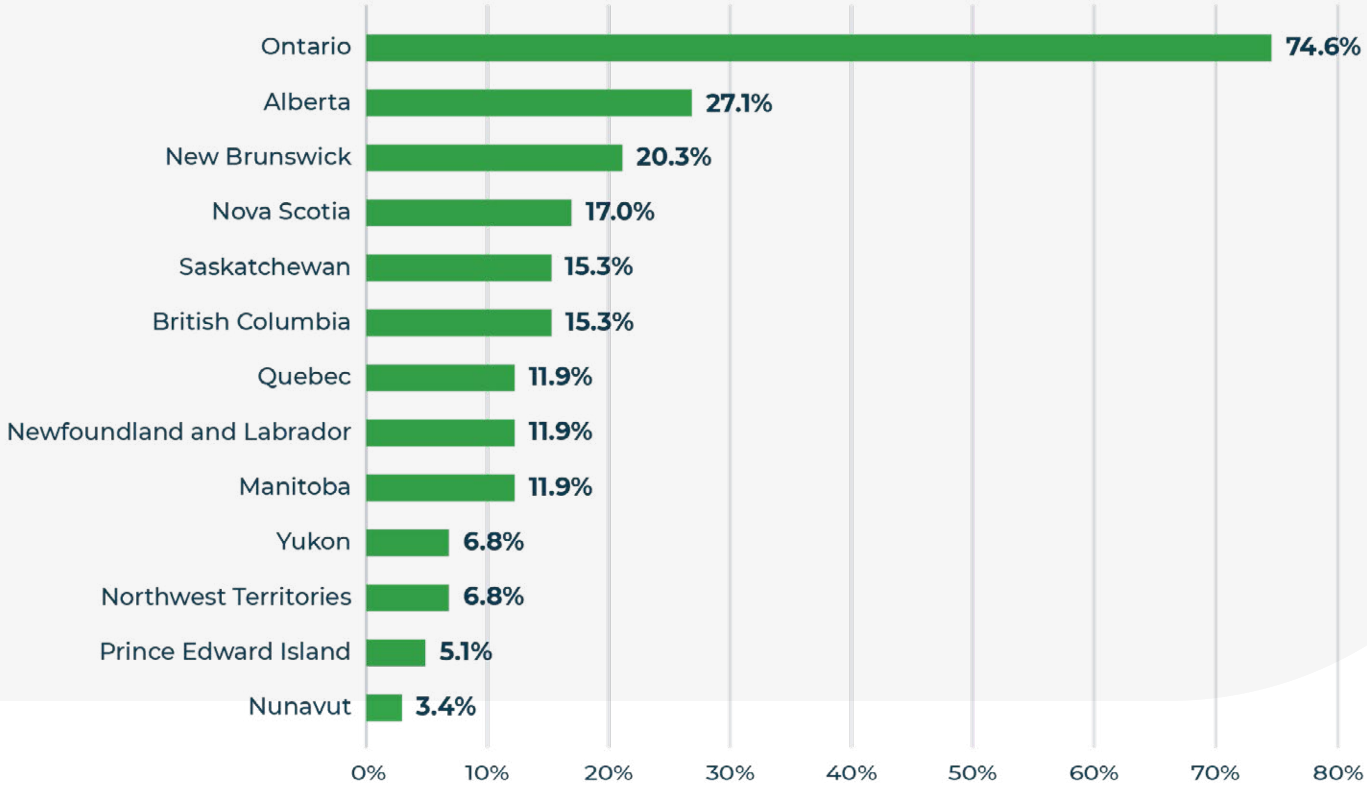
Organizational Activity Areas of Respondents



Source: EHRC AI Survey, 2025
Note: n=59

FIGURE A2

Geographic Distribution of Respondents



Source: EHRC AI Survey, 2025
Note: n=59

Appendix 2: Forecast Method

This report uses EHRC's proprietary projection model to forecast labour market conditions in Canada's electricity sector at the occupation level. The model produces sector-specific outlooks similar to the Canadian Occupation Projections System (COPS), focusing on power generation, transmission and distribution sub-sectors. The model integrates:

- Historical labour market data
- Demographic trends
- Electricity-sector variables
- Macroeconomic scenarios

Key data sources:
Labour Force Survey, Canadian Census, COPS and population projections from Statistics Canada.

Forecasting Scenarios and Assumptions

Electricity sector scenarios are based on Canada's Energy Future 2023 (CEF2023) from the Canada Energy Regulator. Two scenarios were applied:

- **Current Measures:** Assumes no change to existing environmental policies and fixes renewable generation share at June 2023 levels.
- **Canada Net-Zero:** Models a pathway to net-zero emissions by 2050.

Both scenarios anticipate significant growth in installed electrical capacity. Net-zero grows more slowly initially but surpasses Current Measures later in the outlook period. These serve as baselines for modified scenarios that incorporate additional electricity demand from data centres.

AI Impact and Data Centre Demand

To estimate AI's effect on labour demand, the model uses the increase in data centre electricity consumption as the primary transmission mechanism.[146] While AI adoption also influences productivity and processes through adoption, our approach is focuses on the anticipated rise in electricity consumption from data centres, driven by AI-related workloads, as a proxy for AI's broader impact on labour market dynamics in the sector.

Because of the rapid pace of development in the data centre industry and the high uncertainty surrounding forecasted energy use, a series of assumptions were made to help approximate its impact.

Key Assumptions

Installed IT Load Capacity: The model incorporates estimated installed IT load capacity, commissioned from Mordor Intelligence, including historical data starting in 2019 and forecasts for 2025–2031. This measure refers to the capacity required for operating servers, storage and networking devices, measured in megawatts.[147] Note: Not all new data centre builds are dedicated to the installation of servers specifically for the use of AI; installations vary based on customer demand.

Pipeline Realization: Projections assume that data centres currently under development or in the pipeline will materialize without significant deviation.

Total Electrical Capacity: The Installed IT load capacity does not capture total installed electrical capacity requirements for data centres. Auxiliary systems, such as cooling and other infrastructure, are also significant sources of electricity consumption.

Power Usage Effectiveness (PUE): PUE measures energy efficiency of data centres, focusing on minimizing infrastructure electricity consumption. It is the ratio of total facility electricity consumption to IT equipment consumption.

- Industry average PUE: 1.56
- Highly efficient data centre PUE: Near 1.[148]

We adopt the industry average to approximate the total installed capacity of a data centre, and assume no major efficiency improvements over the outlook period.[149] [150]

Redundancy: To minimize downtime, data centres incorporate redundant infrastructure—duplicate components that allow operations to continue if one fails. Various redundancy configurations exist, and some facilities combine multiple approaches. We assume N+1 redundancy in our outlook.

Electricity Source: Data centres are assumed to source electricity from the grid rather than on-site generation.

Integration into Model: Our estimated measure adjusts energy use within the model, which in turn recalibrates electricity capacity at both national and provincial levels. This update reflects recent data centre developments not captured in the CER2023 scenarios, with our total installed capacity estimate serving as a data centre-specific update.

Limitations

- **Data Constraints:** Limited observations for data centre measures restrict robust incorporation of this demand shock into our model.
- **Forecast Variability:** Estimates of data centre electricity consumption vary widely across methodologies and sources.[151]
- **Assumption Sensitivity:** Alternative assumptions for PUE, utilization rates and redundancy were tested to validate consistency. While absolute values varied, overall trends remained stable.
- **Uncertainty:** Rapid evolution of AI workloads and data centre technology introduces inherent uncertainty into projections.

Endnotes

1 Johnston, K. (2025, August 8). Schneider Electric Canada's agentic AI ecosystem to redefine sustainability and energy management. Mechatronics Canada. https://www.mechatronicscanada.ca/latest-articles/schneider-electric-canadas-agentic-ai-ecosystem-to-redefine-sustainability-and-energy-management/

2 Stanford Institute for Human-Centered Artificial Intelligence. (2025). The 2025 AI Index Report. Stanford University. https://hai.stanford.edu/ai-index/2025-ai-index-report

3 IBM. (2024, January 10). Data suggests growth in enterprise adoption of AI is due to widespread deployment by early adopters. IBM Newsroom. https://newsroom.ibm.com/2024-01-10-Data-Suggests-Growth-in-Enterprise-Adoption-of-AI-is-Due-to-Widespread-Deployment-by-Early-Adopters

4 Government of Canada. (2024, April 7). Securing Canada's AI advantage. Prime Minister of Canada. https://www.pm.gc.ca/en/news/news-releases/2024/04/07/securing-canadas-ai

5 Innovation, Science and Economic Development Canada. (2024, December 5). Canada to drive billions in investments to build domestic AI compute capacity at home. Government of Canada. https://www.canada.ca/en/innovation-science-economic-development/news/2024/12/canada-to-drive-billions-in-investments-to-build-domestic-ai-compute-capacity-at-home.html

6 Innovation, Science and Economic Development Canada. (2025, March 7). Government of Canada introduces AI Compute Access Fund to support Canadian innovators. https://www.canada.ca/en/innovation-science-economic-development/news/2025/03/government-of-canada-introduces-ai-compute-access-fund-to-support-canadian-innovators.html

7 Innovation, Science and Economic Development Canada. (2025, March 7). Government of Canada introduces AI Compute Access Fund to support Canadian innovators. https://www.canada.ca/en/innovation-science-economic-development/news/2025/03/government-of-canada-introduces-ai-compute-access-fund-to-support-canadian-innovators.html

8 Euratom National Contact Point in Ukraine. (2025). OECD-NEA launches AIxpertise: Artificial intelligence for nuclear research and education. https://uaineuratom.com.ua/en/oecd-nea-launches-aixpertise-artificial-intelligence-for-nuclear-research-and-education

9 Ipsos. (2024, June). The Ipsos AI Monitor 2024: A 32-country Ipsos Global Advisor Survey. https://resources.ipsos.com/rs/297-CXJ-795/images/Ipsos-AI-Monitor-2024.pdf

10 Gillespie, N., Lockey, S., Ward, T., Macdade, A., & Hassed, G. (2025). Trust, attitudes and use of artificial intelligence: A global study 2025. The University of Melbourne & KPMG International. https://figshare.unimelb.edu.au/articles/report/Trust_attitudes_and_use_of_artificial_intelligence_A_global_study_2025/28822919

11 Cukier, W. (2024, May 15). New report shows AI adoption strategy for Canadian business is essential. Innovating Canada. https://www.innovatingcanada.ca/technology/future-of-ai-2024/new-report-shows-ai-adoption-strategy-for-canadian-business-is-essential

12 Statistics Canada. (2025, June 16). Analysis on artificial intelligence use by businesses in Canada, second quarter of 2025. https://www150.statcan.gc.ca/n1/pub/11-621-m/11-621-m2025008-eng.htm

13 KPMG in Canada. (2024, August). Generative AI Adoption Index. https://kpmg.com/ca/en/home/services/digital/ai-services/generative-ai-adoption-index.html

14 Stryker, C. (2025). AI adoption challenges. IBM Think. https://www.ibm.com/think/insights/ai-adoption-challenges

15 ChatGPT is the most well-known chatbot. Besides answering questions like a human, it can create text, new images, videos and audio. Microsoft's Copilot, launched in 2023, is another AI tool with a chatbot function. It is included in Microsoft programs like Office, PowerPoint, Excel, Microsoft's search engine Bing and the Windows operating system.

16 Canadian Chamber of Commerce Business Data Lab. (2024, May). Prompting productivity: Generative AI adoption by Canadian businesses. https://businessdatalab.ca/wp-content/uploads/2024/05/Prompting_Productivity_Report_May_2024.pdf

17 Statistics Canada. (2025, May 27). Table 33-10-1006-01: Employment by industry and class of worker, monthly, unadjusted for seasonality. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3310100601

18 LexisNexis Canada. (2025, March 31). 9 reasons why Canadian law firms should embrace legal AI in 2025. LexisNexis Blogs. https://www.lexisnexis.com/blogs/en-ca/b/legal-ai/posts/canadian-law-firms-embrace-legal-ai

19 Bryan, V., Sood, S., & Johnston, C. (2025, June 16). Analysis on artificial intelligence use by businesses in Canada, second quarter of 2025. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/11-621-m/11-621-m2025008-eng.htm

20 CSIMarket. (2025). Electric utilities industry profitability ratios. https://csimarket.com/Industry/industry_Profitability_Ratios.php?ind=1201

21 Government of Canada. (2024, April 7). Securing Canada's AI advantage. Prime Minister of Canada. https://www.pm.gc.ca/en/news/news-releases/2024/04/07/securing-canadas-ai

22 These figures are based on converting US dollar prices at the exchange rate prevailing on September 18, 2025 (1 USD = 1.3796 CAD)

23 Johnson, L. (2025, April 24). How much does it cost to maintain AI? BytePlus. https://www.byteplus.com/en/topic/415183?title=how-much-does-it-cost-to-maintain-ai

24 Tuot, C., Do Thi Tam, H., Klose, F., Levin, A., Lee, V., & Oh, A. (2025, June 18). AI in energy: A new strategic playbook. Boston Consulting Group. https://www.bcg.com/publications/2025/ai-in-energy-new-strategic-playbook

25 Majkut, J., & Abrahams, L. (2025, September 22). AI for the grid: Opportunities, risks, and safeguards. Center for Strategic and International Studies. https://www.csis.org/analysis/ai-grid-opportunities-risks-and-safeguards

26 Hydro-Québec. (n.d.). Hydro-Québec: The power of clean and renewable energy. https://www.hydroquebec.com/clean-energy-provider/markets/

27 Leadvent Group. (2025, August 22). Enhancing grid resilience against extreme weather events with AI. https://www.leadventgrp.com/blog/enhancing-grid-resilience-against-extreme-weather-events-with-ai

28 Jachno, M. (2025, April 2). AI can help utilities predict grid outages. EY. https://www.ey.com/en_us/insights/power-utilities/ai-can-help-utilities-predict-grid-outages

29 Argonne National Laboratory. (n.d.). Outage prediction and grid vulnerability identification using machine learning on utility outage. https://www.anl.gov/esia/outage-prediction-and-grid-vulnerability-identification-using-machine-learning-on-utility-outage

30 New Energy Nexus. (2024, November 10). How does AI contribute to emergency response and restoration in energy systems? https://nenpower.com/blog/how-does-ai-contribute-to-emergency-response-and-restoration-in-energy-systems/

31 Zaa, J., Gidwani, S., & Rozenberg, N. H. (2025, August 22). How AI emergency preparedness helps the energy industry. IBM. https://www.ibm.com/new/product-blog/how-ai-emergency-preparedness-helps-the-energy-industry

32 Londagin, S. (2025, June 25). Unlocking AI's grid modernization potential. Federation of American Scientists. Federation of American Scientists. https://fas.org/publication/unlocking-ai-grid-modernization-potential/

33 McLean, S.-R., Wadhera, A., Wong, S., & Roy, M. (2022). Smart grid in Canada 2020–21 (Report No. 2022-001 RP-TEC DER-REN2). Natural Resources Canada. https://natural-resources.canada.ca/sites/www.nrcan.gc.ca/files/canmetenergy/pdf/Smart%20Grid%20in%20Canada%20Report%20Web%20FINAL%20EN.pdf

34 Hafez, S., Alkhedher, M., Ramadan, M., Gad, A., Alhalabi, M., Yaghi, M., Jama, M., & Ghazal, M. (2025). Advancements in grid resilience: Recent innovations in AI-driven solutions. Results in Engineering, 26, 105042. https://doi.org/10.1016/j.rineng.2025.105042

35 Hydro-Québec. (n.d.). Greenhouse gas emissions and reservoirs. https://www.hydroquebec.com/sustainable-development/specialized-documentation/ghg-reservoir.html

36 Electricity Canada. (2024). Leveraging AI and satellite technology to enhance service delivery and sustainability. https://www.electricity.ca/programs/centre-of-excellence/leveraging-ai-and-satellite-technology-to-enhance-service-delivery-and-sustainability/

37 Specht, M. (2022, April 25). Grid modeling overview: Four types of models guiding the transition to clean electricity. Union of Concerned Scientists. https://blog.ucs.org/mark-specht/grid-modeling-overview-four-types-of-models-guiding-the-transition-to-clean-electricity/

38 International Energy Agency. (2025, April 10). AI is set to drive surging electricity demand from data centres while offering the potential to transform how the energy sector works. https://www.iea.org/news/ai-is-set-to-drive-surging-electricity-demand-from-data-centres-while-offering-the-potential-to-transform-how-the-energy-sector-works

39 Raihan, M. M. H., Subroto, S., Chowdhury, N., Koch, K., Ruttan, E., & Turin, T. C. (2025, May 6). Dimensions and barriers for digital (in)equity and digital divide: A systematic integrative review. Digital Transformation and Society, 4(2), 111–127. https://www.emerald.com/dts/article/4/2/111/1246345/Dimensions-and-barriers-for-digital-in-equity-and

40 Nova Scotia Power. (n.d.). MyEnergy Insights. https://www.nspower.ca/my-energy-insights

41 Net Zero Atlantic. (2025, October 16). Enhanced grid stability and power management in Nova Scotia through AI-driven autonomous voltage control. https://netzeroatlantic.ca/research/enhanced-grid-stability-and-power-management-nova-scotia-through-ai-driven-autonomous

42 Hydro One Limited. (2025, May). Annual report 2024. https://www.hydroone.com/investorrelations/Reports/Hydro%20One%20Limited%20Annual%20Report%202024.pdf

43 Alectra Utilities. (2025, June 13). GRE&T Centre report 2024. https://www.alectra.com/sites/default/files/assets/pdf/2024-great-centre-report.pdf

44 Hydro-Québec. (n.d.). Forecasting demand. https://www.hydroquebec.com/projects/planning/forecasting-demand.html

45 Hydro-Québec. (n.d.). Corporate peak demand management Hydro Lab.https://www.hydroquebec.com/collab-space/hydro-lab/projects/corporate-peak-demand-management.html

46 NBPower. (n.d.). How. https://www.nbpower.com/en/products-services/tree-maintenance/how

47 BC Hydro. (n.d.). Balancing authority load data. https://www.bchydro.com/energy-in-bc/operations/transmission/transmission-system/balancing-authority-load-data.html

48 BC Hydro. (n.d.). Long-term electricity planning. https://www.bchydro.com/toolbar/about/strategies-plans-regulatory/supply-operations/long-term-electricity-planning.html

49 Saint John Energy. (2025, July 11). Saint John Energy receives $5.25M for digital grid. https://sjenergy.ca/about/news/saint-john-energy-ai-grid-funding

50 Enbridge Inc. (2024, October 7). Enbridge collaborates with Microsoft to use AI for enhanced safety, emissions reduction, and asset optimization. https://www.enbridge.com/media-center/news/details?id=123831&lang=en

51 Siemens Energy. (2021). AI-driven demand response for wind energy: Wind power forecasting in Denmark. Scientific Research Publishing. https://www.scirp.org/reference/referencespapers?referenceid=3884101

52 Korea Institute of Energy Technology Evaluation & Planning (KETEP). (2022). Smart grid strategy and vision in Korea. https://www.esmap.org/sites/default/files/2022/Presentations/Smart%20Energy%20S%20Korea/-Day1_Oct.30-S2-Dr-Lee_Smart-Grid-Strategy-and-Vision.pdf

53 Klobasa, M., Plötz, P., Pelka, S., & Vogel, L. (2018). Artificial intelligence for the integrated energy transition. Fraunhofer ISI & dena. https://publica-rest.fraunhofer.de/server/api/core/bitstreams/c66a2385-0eab-4f14-b614-e4c6676a18b3/content

54 Sandbox regulation a allows businesses or innovators to test new products, services, or technologies under relaxed regulatory conditions—but with oversight from government regulators.

55 Scale AI. (2020, May). Strategic Plan. https://cdn.scaleai.ca/uploads/2020/05/scale-ai_strategic-plan_en.pdf

56 U.S. Department of Energy. (2024, July 30). Powering AI and data center infrastructure: Recommendations. https://www.energy.gov/sites/default/files/2024-08/Powering%20AI%20and%20Data%20Center%20Infrastructure%20Recommendations%20July%202024.pdf

57 Slate, D. D., Parisot, A., Min, L., Panciatici, P., & Van Hentenryck, P. (2024). Adoption of artificial intelligence by electric utilities. Energy Bar Association. https://www.eba-net.org/wp-content/uploads/2024/05/6-Slate-et-al1-23.pdf

58 Coban, D., Gralnick, D., Thomson, I. (2025, July). Connecting data centres in Ontario. Torys LLP. https://www.torys.com/our-latest-thinking/publications/2025/07/connecting-data-centres-in-ontario

59 Innovation, Science and Economic Development Canada (ISED). (n.d.). AI compute challenge: Canadian sovereign AI compute strategy. https://ised-isde.canada.ca/site/ised/en/canadian-sovereign-ai-compute-strategy/ai-compute-challenge

60 International Energy Agency. (2025, April 10). Energy and AI. https://iea.blob.core.windows.net/assets/601eaec9-ba91-4623-819b-4ded331ec9e8/EnergyandAI.pdf

61 Canada Energy Regulator. (2024, October 2). Market Snapshot: Energy demand from data centers is steadily increasing, and AI development is a significant factor. https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/market-snapshots/2024/market-snapshot-energy-demand-from-data-centers-is-steadily-increasing-and-ai-development-is-a-significant-factor.html

62 Hale, A. S. (2024, October 16). AI-powered data centres to push Ontario's energy demand to new heights. The Trillium. https://www.thetrillium.ca/news/energy-and-the-environment/ai-powered-data-centres-to-push-ontarios-energy-demand-to-new-heights-9665828

63 Research and Markets. (2024, March 1). Canada data center market investment analysis report 2024: Investments of $9.04 billion by 2029, growing at a CAGR of 10.26% during 2023–2029. Business Wire. https://www.businesswire.com/news/home/20240301958781/en/Canada-Data-Center-Market-Investment-Analysis-Report-2024-Investments-of-%249.04-Billion-by-2029-Growing-at-a-CAGR-of-10.26-during-2023-2029---ResearchAndMarkets.com

64 Howell, J. (2024, October 25). The state of data centres in Canada. ENCOR Advisors. https://encoradvisors.com/data-centres-canada/

65 North American Electric Reliability Corporation. (2024, December). 2024 long-term reliability assessment. https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_Long%20Term%20Reliability%20Assessment_2024.pdf

66 Robb, D. (2025, October 20). Data Centers Look to Old Airplane Engines for Power. IEEE Spectrum. https://spectrum.ieee.org/ai-data-centers

67 Alberta Electric System Operator. (2025, June 4). AESO announces interim approach to large load connections. https://www.aeso.ca/aeso/newsroom/aeso-announces-interim-approach-to-large-load-connections

68 Alberta Electric System Operator. (2025, June 4). Phase I: Large load integration information session presentation. https://www.aeso.ca/assets/Phase-I-Large-Load-Intergration-Information-Session-Presentation-posted-June-4-2025.pdf

69 CTV News. (2025). Largest AI data centre in the world to be built in northwest Alberta. https://www.ctvnews.ca/edmonton/article/largest-ai-data-centre-in-the-world-to-be-built-in-northwest-alberta/

70 CBC News. (2024, March 4). Canadian companies racing to build sovereign, energy-efficient data centres. https://www.cbc.ca/news/canada/ottawa/canadian-companies-racing-to-build-sovereign-energy-efficient-data-centres-1.7597092

71 Politico EuropeKraley, A., Kantor, I., Gutiérrez, R.. (2024, September 1516). Sovereign AI ecosystems: Navigating Global AI Infrastructure & Data Governance Sovereign AI ecosystems. Politico Europe. https://www.politico.eu/wp-content/uploads/2024/09/15/Sovereign-AI-Ecosystems.pdf

72 Bell Canada. (2025, May 28). Bell Canada increases sovereign AI capacity with Bell AI Fabric. BCE Inc. https://www.bce.ca/news-and-media/releases/show/Bell-Canada-Increases-Sovereign-AI-Capacity-with-Bell-AI-Fabric?page=1&month=&year=&perpage=25

73 CBC News. (2024, March 4). Canadian companies racing to build sovereign, energy-efficient data centres. https://www.cbc.ca/news/canada/ottawa/canadian-companies-racing-to-build-sovereign-energy-efficient-data-centres-1.7597092

74 Server Cloud Canada. (2025, April). Canadian cloud, American control: Why your data needs a sovereign home. https://www.servercloudcanada.com/2025/04/canadian-cloud-american-control-why-your-data-needs-a-sovereign-home/

75 Broadstaff. (2025, October 6). Data center staffing levels: How many people does a facility need? https://broadstaff-global.com/data-center-staffing-levels-how-many-people-does-a-facility-need

76 Uptime Institute. (2023). Global data center survey: Staffing, sustainability, and AI readiness. Uptime Institute Intelligence. https://uptimeinstitute.com/resources/research-reports/global-data-center-survey-2023

77 Howell, J. (2024, October 25). The state of data centres in Canada. ENCOR Advisors. https://encoradvisors.com/data-centres-canada/Encor Advisors. (n.d.). Data centres

in Canada. https://encoradvisors.com/data-centres-canada/

78 Benefits and Pensions Monitor. (2025, October 24). Ottawa considers $15bn for pension funds to invest in green AI. https://www.benefitsandpensionsmonitor.com/news/industry-news/ottawa-considers-15bn-for-pension-funds-to-invest-in-green-ai/390357

79 Calgary.Tech. (2025, April 25). Alberta emerges as Canada's data centre powerhouse. https://calgary.tech/2025/04/25/alberta-emerges-as-canadas-data-centre-powerhouse

80 Salem, A., Bullen, J., Barretto, J., Parizeau, T. L., Rotman, T., Hammer, M., & Rath, S. (2025, January 17). Power surge: Legal landscape of data centre development in Canada. Cassels. https://cassels.com/insights/power-surge-legal-landscape-of-data-centre-development-in-canada/

81 Vasuez, M., Khym, E. (2025, April 23). Small towns, big impact: Rural leadership in the clean energy era. Clean Energy Forum.https://cleanenergyforum.yale.edu/2025/04/23/small-towns-big-impact-rural-leadership-in-the-clean-energy-era

82 Tremayne-Pengelly, A. (2024, December 17). A.I. data centers are emitting as much greenhouse gases as commercial airlines. Observer. https://observer.com/2024/12/ai-data-center-carbon-emission/

83 U.S. Department of Energy. (2024, April). AI for energy: Opportunities for a modern grid and clean energy economy. https://www.energy.gov/sites/default/files/2024-04/AI%20EO%20Report%20Section%205.2g%28i%29_043024.pdf

84 Mordor Intelligence. (2025). Assessment of data center power consumption in Canada (2025–2031). [Custom Report for EHRC]

85 International Energy Agency. (2025, MayMarch). Data centre energy use: Critical review of models and results. https://www.iea-4e.org/wp-content/uploads/2025/05/Data-Centre-Energy-Use-Critical-Review-of-Models-and-Results.pdf

86 Gartner. (2024, November 12). Gartner predicts power shortages will restrict 40% of AI data centers by 2027. https://www.gartner.com/en/newsroom/press-releases/2024-11-12-gartner-predicts-power-shortages-will-restrict-40-percent-of-ai-data-centers-by-20270

87 Jendoubi, C., & Asad, A. (2024). A survey of artificial intelligence applications in nuclear power plants. IoT, 5(4), 666–691. https://doi.org/10.3390/iot5040030

88 Canadian Nuclear Safety Commission. (n.d.). Small Modular Reactor Readiness project overview. https://www.cnsc-ccsn.gc.ca/eng/reactors/smr/smr-readiness/

89 Westinghouse Electric Company. (2025, July 15). Westinghouse to accelerate US nuclear reactor construction and enhance operations with Google Cloud AI. https://info.westinghousenuclear.com/news/westinghouse-to-accelerate-us-nuclear-reactor-construction-and-enhance-operations-with-google-cloud-ai

90 Jackson, A. (2025, March 13). Data centre giants Amazon, Google & Meta back nuclear power. Data Centre Magazine. https://datacentremagazine.com/hyperscale/why-are-amazon-google-meta-backing-nuclear

91 Ontario Power Generation. (2025, May 13). OPG reports 2025 first quarter financial results. https://www.opg.com/reporting/financial-reports/release/opg-reports-2025-first-quarter-financial-results/

92 Ontario Power Generation. (2023, October 20). OPG's SMRs will generate jobs and lasting economic benefits for Ontario. https://www.opg.com/releases/opgs-smrs-will-generate-jobs-and-lasting-economic-benefits-for-ontario/

93 Statistics CanadaMehdi, T., Morissette, R. (2024, September 3). The impact of artificial intelligence on the labour market: Evidence from Canadian businesses (Catalogue No. 11F0019M2024005). Statistics Canada. https://www150.statcan.gc.ca/n1/pub/11f0019m/11f0019m2024005-eng.htm

94 Cukier, W., Saiphoo, A., & Parkin, A. (2024, October). Artificial intelligence at work: The shifting landscape of future skills and the future of work. Future Skills Centre, Diversity Institute at Toronto Metropolitan University, & Environics Institute for Survey Research. https://www.torontomu.ca/content/dam/diversity/reports/environics-ai-report/Artificial%20Intelligence%20at%20Work.pdf

95 Careers in Energy. (2023, March 24). Digital skills training programs. https://careersinenergy.ca/resources/digital-skills-training-programs/

96 International Energy Agency. (2025, March). World Energy Employment 2024 (2nd rev. ed.). https://iea.blob.core.windows.net/assets/d2b4b054-4a55-4c6f-893f-fc2c8b77e9a1/WorldEnergyEmployment2024.pdf

97 Cukier, W., Saiphoo, A., & Parkin, A. (2024, October). Artificial intelligence at work: The shifting landscape of future skills and the future of work. Future Skills Centre, Diversity Institute at Toronto Metropolitan University, & Environics Institute for Survey Research. https://www.torontomu.ca/content/dam/diversity/reports/environics-ai-report/Artificial%20Intelligence%20at%20Work.pdf

98 Pinchin, G. (2024, July 25). Rural and remote communities are essential, and entitled, to a net-zero energy transition. QUEST Canada. https://questcanada.org/project/rural-remote-communities-essential-and-entitled-to-a-net-zero-transition/

99 Newton, R. S. (2025, September 9). Rescuing institutional knowledge from the generational shift. Synergis Software. https://www.synergissoftware.com/blog/rescuing-institutional-knowledge-from-the-generational-shift

100 Government of Northwest Territories. (2024, October). 2023–-2024 eEnergy iInitiatives Rreport. https://www.inf.gov.nt.ca/en/services/energy/2023-2024-energy-initiatives-report

101 Government of Yukon. (2023, November 9). Innovation Yukon: Bringing northern ingenuity to the world. https://yukon.ca/en/innovation-yukon-bringing-northern-ingenuity-world

102 Natural Resources Canada. (2024). Iqaluit smart grid project overview. https://natural-resources.canada.ca/funding-partnerships/iqaluit-smart-grid

103 Lavoie, J. (2019, November 4). Tsilhqot'in First Nation opens B.C.'s largest solar farm. The Narwhal. https://thenarwhal.ca/tsilhqotin-first-nation-opens-b-c-s-largest-solar-farm/

104 Blanchet, A. (2024, July 4). Trade union strategies on artificial intelligence and collective bargaining on algorithms.

Equal Times. https://www.equaltimes.org/trade-union-strategies-on

105 Canadian Union of Public Employees. (2024, July 11). Understanding artificial intelligence: A guide for CUPE members. https://cupe.ca/understanding-artificial-intelligence-guide-cupe-members

106 Tulloch Consulting. (2024, May 2). The knowledge crisis: How HR can ensure expertise survives retirement and technological change. https://www.tullochconsulting.ca/post/the-knowledge-crisis-how-hr-can-ensure-expertise-survives-retirement-and-technological-change

107 IBEW Local 457Crow. A. (2025, February 26n.d.). How AI is infiltrating labor union contracts, strategies. Pittsburgh's Public Source. https://www.publicsource.org/ai-labor-union-contracts-pittsburgh-work/https://ibew457.org/content/how-ai-infiltrating-labor-union-contracts-strategies

108 Power Workers' Union. (2025, January 16). Submission to the Ministry of Energy and Electrification Consultation on Long Term Role of Natural Gas (ERO 019-9501). https://www.pwu.ca/pwu-submission-to-the-moe-on-the-future-role-of-natural-gas/

109 Innovation, Science and Economic Development Canada. (2023, September). Voluntary Code of Conduct on the Responsible Development and Management of Advanced Generative AI Systems. Government of Canada. https://ised-isde.canada.ca/site/ised/en/voluntary-code-conduct-responsible-development-and-management-advanced-generative-ai-systems

110 Calgary Economic Development. (2021, April 13). OCIF-funded AltaML makes a crucial difference for Calgary companies. https://www.calgaryeconomicdevelopment.com/newsroom/ocif-funded-altaml-makes-a-crucial-difference-for-calgary-companies/

111 Enova Power Corp., & Edgecom EnergyBahrami, B., Conway, C. (2025, March 19). Unlock the future of energy management with AI [Webinar presentation]. Enova Power Corp., & Edgecom Energy. https://enovapower.com/wp-content/uploads/2025/04/Enova-Webinar-Edgecom-Webinar-.pdf

112 KPMG International, & University of Melbourne. (2025, June 23). Study shows Canada among least AI literate nations. KPMG Canada. https://kpmg.com/ca/en/home/media/press-releases/2025/06/study-shows-canada-among-least-ai-literate-nations.html

113 EDGE is an acronym that stands for "energy to digital growth education and upskilling project". Led by Calgary Economic Development, the program featured a mix of technical training, workplace readiness support and work-integrated learning.

114 Careers in Energy. (2023, November 1). Training program gives energy workers digital skills for evolving workplace. https://careersinenergy.ca/resources/training-program-gives-energy-workers-digital-skills-for-evolving-workplace/

115 Humber College. (2023, March 30). Humber College and Siemens Canada open the Sustainable Microgrid and Renewable Technology Lab (SMART Lab). Humber Today. https://humber.ca/today/media-releases/humber-college-and-siemens-canada-open-sustainable-microgrid-and-renewable-technology

116 Independent Electricity System Operator. (2024). Indigenous participation in the energy transition. https://www.ieso.ca/-/media/Files/IESO/Document-Library/sac/2024/sac-20241211-Indigenous-chapter.pdf

117 Wale, J. (2021, Augustn.d.). Assessing opportunities to embed energy management curriculum in Indigenous post-secondary education and training. BC HydroUniversity of British Columbia. https://sustain.ubc.ca/sites/default/files/2021-037_Assessing%20Opportunities%20to%20Embed%20Energy_Wale.pdf

118 University of Regina. (n.d.). Artificial intelligence in engineering. Faculty of Engineering and Applied Science. Retrieved September 4, 2025, from https://www.uregina.ca/academics/programs/engineering/master-cert-artificial-intelligence-engineering.html

119 University of Saskatchewan. (n.d.). Artificial intelligence at USask. https://ai.usask.ca

120 Dalhousie UniversityTrainor, T. (2025, August 15). Dal launches new entrepreneurial AI program for startups in Atlantic Canada. Dal News. https://www.dal.ca/news/2025/08/15/ai2market-launch.html

121 Government of Newfoundland and Labrador. (2025, May 7). Provincial government invests nearly $2 million in AI training for small and medium-sized businesses. https://www.gov.nl.ca/releases/2025/ipgs/0507n03/

122 Gridmatic. (2023, November 15). Gridmatic closes $50 million energy storage fund, underscoring importance of AI to optimizing batteries. https://www.gridmatic.com/gridmatic-closes-50-million-energy-storage-fund-underscoring-importance-of-ai-to-optimizing-batteries

123 IEEE. (2025). AI for energy – IEEE CAI 2025. IEEE Conference on Artificial Intelligence. https://cai.ieee.org/2025/ai-for-energy/

124 Everett, L. (2025, October 2). Elevating skills and communities: Helping Canadians thrive in the age of AI. Microsoft Source Canada. https://news.microsoft.com/source/canada/2025/10/02/elevating-skills-and-communities-helping-canadians-thrive-in-the-age-of-ai/Future Skills Centre. (n.d.). Elevating skills and communities: Helping Canadians thrive in the age of AI. Source Canada.

125 Future Skills Centre. (2024, November). AI and the shifting landscape of future skills and the future of work. https://fsc-ccf.ca/research/ai-and-future-skills/

126 Hydro-Québec. (2022, Novembre 1). Plan d'approvisionnement 2023–2032. https://www.hydroquebec.com/data/achats-electricite-quebec/pdf/plan-dapprovisionnement-2023-2032.pdf

127 The TrilliumHale, A. S. (2024, October 16). AI-powered data centres to push Ontario's energy demand to new heights. The Trillium. https://www.thetrillium.ca/news/energy-and-the-environment/ai-powered-data-centres-to-push-ontarios-energy-demand-to-new-heights-9665828

128 Data Center Dynamics. (2025, January 17.). Alberta's First Nation opposes Mr. Wonderful's data center project. Data Center Dynamics. https://www.datacenterdynamics.com/en/news/albertas-first-nation-opposes-mr-wonderfuls-data-center-project/

129 CTV News. (2025, August 7). First Nation says it wasn't consulted on Wonder Valley AI data centre proposed for thousands of hectares of land. https://www.ctvnews.ca/edmonton/article/first-nation-says-it-wasnt-consulted-on-wonder-valley-ai-data-centre-proposed-for-thousands-of-hectares-of-land

130 Guidi, G., Dominici, F., Gilmour, J., Butler, K., Bell, E., Delaney, S., & Bargagli-Stofi, F. J. (2024). Environmental burden of United States data centers in the artificial intelligence era. Harvard T.H. Chan School of Public Health. https://arxiv.org/pdf/2411.09786

131 European Commission. (2024, March 14). Commission Delegated Regulation (EU) 2024/1364 of 14 March 2024 on the first phase of the establishment of a common Union rating scheme for data centres. EUR-Lex. https://eur-lex.europa.eu/eli/reg_del/2024/1364/oj/eng

132 The Economist Impact. (2025, July 27n.d.). The AI factory transforming your neighbourhood. https://impact.economist.com/projects/the-solutionist/the-ai-factory-transforming-your-neighbourhood

133 Natural Resources Canada. (2024). Appendix 3: Data centre energy use. https://oee.nrcan.gc.ca/publications/statistics/dac/2024/appendices.cfm?targetid=appendix_3

134 TransAlta Corporation. (2021, May 3). TransAlta certified by Diversio for its Equity, Diversity and Inclusion Program [Press release]. CNW Group. https://www.newswire.ca/news-releases/transalta-certified-by-diversio-for-its-equity-diversity-and-inclusion-program-868679423.htmlFrenette, J. (2023). Ensuring human oversight in high-performance AI systems: A framework for control and accountability. World Journal of Advanced Research and Reviews, 20(2), 1507–1516. https://doi.org/10.30574/wjarr.2023.20.2.2194

135 145 Frenette, J. (2023). Ensuring human oversight in high-performance AI systems: A framework for control and accountability. World Journal of Advanced Research and Reviews, 20(2), 1507–1516. https://doi.org/10.30574/wjarr.2023.20.2.2194TransAlta Corporation. (2021, May 3). TransAlta certified by Diversio for its Equity, Diversity and Inclusion Program [Press release]. CNW Group. https://www.newswire.ca/news-releases/transalta-certified-by-diversio-for-its-equity-diversity-and-inclusion-program-868679423.html

149 National Security Transparency Advisory Group. (2024, August 23). National security agencies should explain how they're using AI. CBC News. https://www.cbc.ca/news/politics/artificial-intelligence-csis-rcmp-1.7303086

136 Reuters. (2024, September 11). Cyberattacks on U.S. utilities are up 70% this year. Fast Company. https://www.fastcompany.com/91189181/cyberattacks-utilities-surge-70-percent-check-point

137 Moss, S. (2025, March 18). Nvidia's Rubin Ultra NVL576 rack expected to be 600kW, coming second half of 2027. Data Center Dynamics. https://www.datacenterdynamics.com/en/news/nvidias-rubin-ultra-nvl576-rack-expected-to-be-600kw-coming-second-half-of-2027/

138 Suboyin, A., Eldred, M., Sonne-Schmidt, C., & Rahman, S. (2023, October 2). AI enabled offshore circular economy: Tracking, tracing and optimizing asset decommissioning. Society of Petroleum Engineers. https://doi.org/10.2118/217051-MS

139 Hydro-Québec. (n.d.). Greenhouse gas emissions and reservoirs. https://www.hydroquebec.com/sustainable-development/specialized-documentation/ghg-reservoir.html

140 Electricity Canada. (2024). Leveraging AI and satellite technology to enhance service delivery and sustainability. https://www.electricity.ca/programs/centre-of-excellence/leveraging-ai-and-satellite-technology-to-enhance-service-delivery-and-sustainability/

141 Independent Electricity System Operator. (2024, October 16). Electricity demand in Ontario to grow by 75 per cent by 2050. https://www.ieso.ca/Corporate-IESO/Media/News-Releases/2024/10/Electricity-Demand-in-Ontario-to-Grow-by-75-per-cent-by-2050

142 Alberta Electric System Operator. (2025, June 4). AESO announces interim approach to large load connections. https://www.aeso.ca/aeso/media/aeso-announces-interim-approach-to-large-load-connections

143 Government of Alberta. (2024, December 4). Alberta's AI data centre strategy: Powering the future of artificial intelligence. https://open.alberta.ca/publications/albertas-ai-data-centre-strategy

144 U.S. Department of Energy. (2025, July). Resource adequacy and grid-enhancing technologies: Strengthening U.S. grid reliability. https://www.energy.gov/sites/default/files/2025-07/DOE_Fact_Sheet_Grid_Report_July_2025.pdf

145 Innovation, Science and Economic Development Canada. (n.d.). The Artificial Intelligence and Data Act (AIDA) – Companion document. Government of Canada. https://ised-isde.canada.ca/site/innovation-better-canada/en/artificial-intelligence-and-data-act-aida-companion-document

146 International Energy Agency159. (2025, April). Energy and AI. https://iea.blob.core.windows.net/assets/40a4db21-2225-42f0-8a07-addcc2ea86b3/EnergyandAI.pdf

147 International Energy Agency159. (2025, April). Energy and AI. https://iea.blob.core.windows.net/assets/40a4db21-2225-42f0-8a07-addcc2ea86b3/EnergyandAI.pdf

148 Google. (n.d.). Efficiency at Google data centers. https://datacenters.google/efficiency/ California Energy Commission. (2024, October 21). CEC data center energy use report. https://www.energy.ca.gov/filebrowser/download/6686?fid=6686#:~:text=%E2%80%A2%20Annual%20Load%20Factor%20%E2%80%A2,to%20new%20and%20existing%20customers

149 California Energy Commission. (2024, October 21). CEC data center energy use report. https://www.energy.ca.gov/filebrowser/download/6686?fid=6686#:~:text=%E2%80%A2%20Annual%20Load%20Factor%20%E2%80%A2,to%20new%20and%20existing%20customers

150 Lawrence Berkeley National Laboratory. (2012). PUE: A comprehensive examination of the metric (WP49). https://datacenters.lbl.gov/sites/default/files/WP49-PUE%20A%20Comprehensive%20Examination%20of%20the%20Metric_v6.pdf#:~:text=II,due%20to%20the%20need%20voiced

151 International Energy Agency. (2025, May). Data centre energy use: Critical review of models and results. https://www.iea-4e.org/wp-content/uploads/2025/05/Data-Centre-Energy-Use-Critical-Review-of-Models-and-Results.pdf

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