Canadian Renewable Energy Association
WIND. SOLAR. STORAGE.

Association canadienne de l'énergie renouvelable
ÉOLIEN. SOLAIRE. STOCKAGE.

Unveiling the Environmental Footprint of AI

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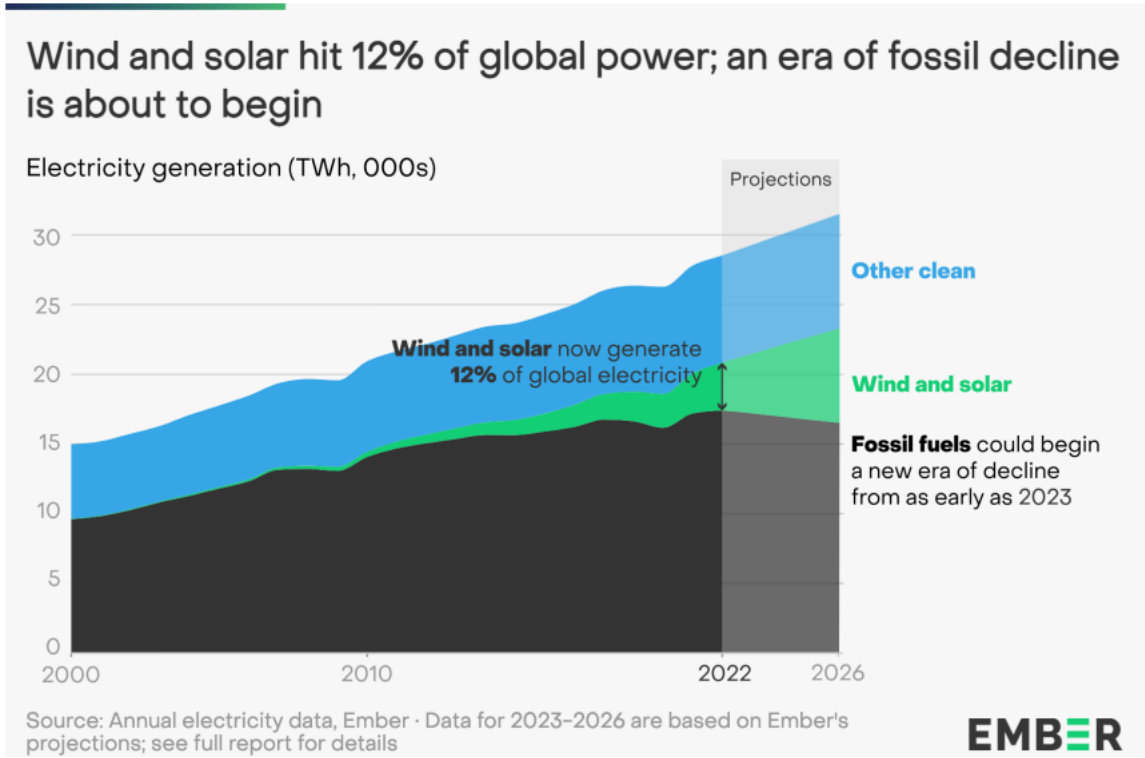
Director Québec et Atlantic Canada

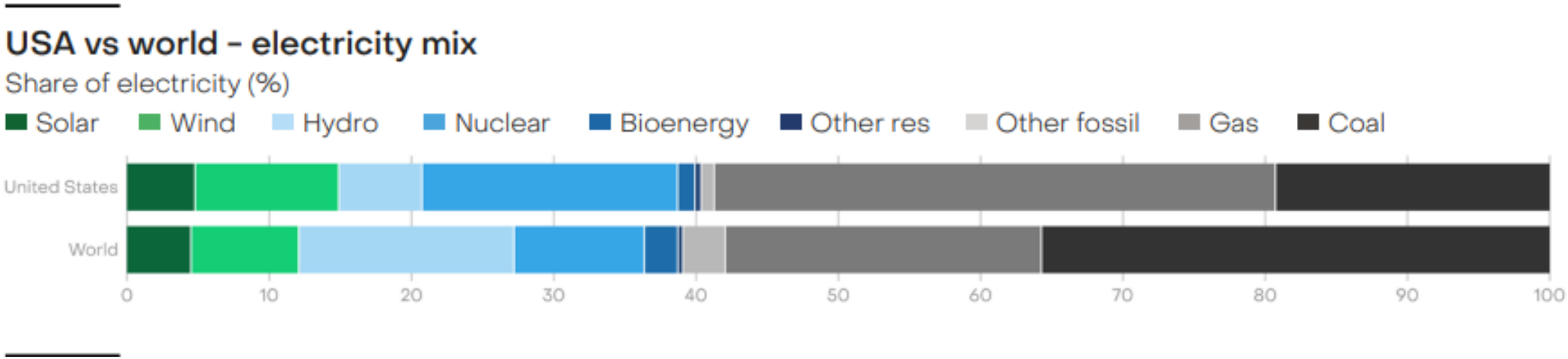
May 17, 2024

Energy Mix in the World

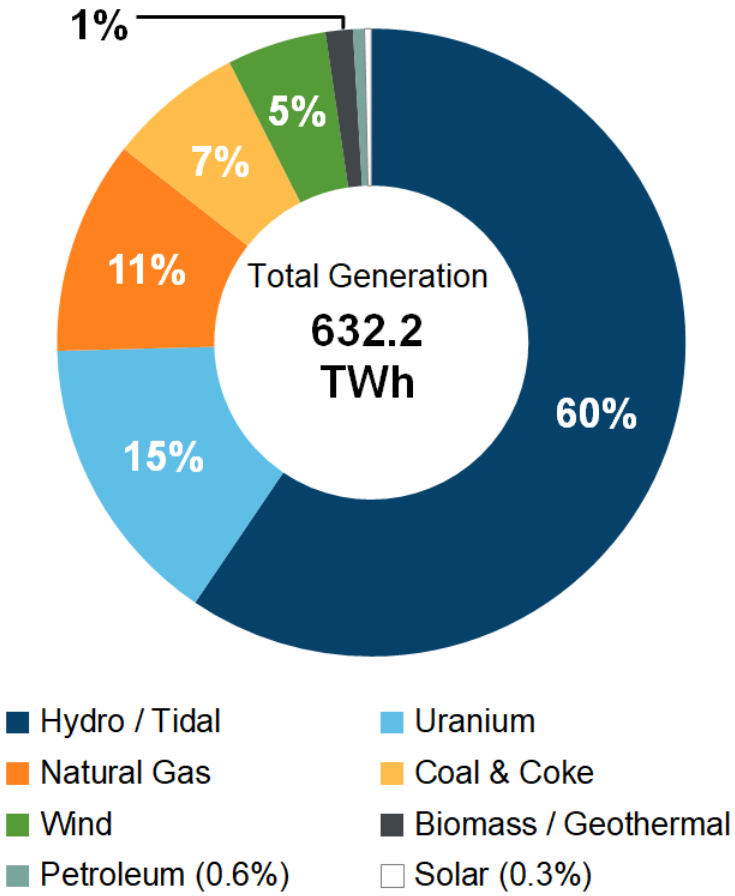
- The majority of the eletricity mix in the world isn't decarbonized yet
- More countries have a net-zero commitment by 2050
- The deployment of renewables technologies will increase substantially over the next few years, and we need to consider:
  - Supply chain
  - Workers
  - Host Communities
  - Sustainable development



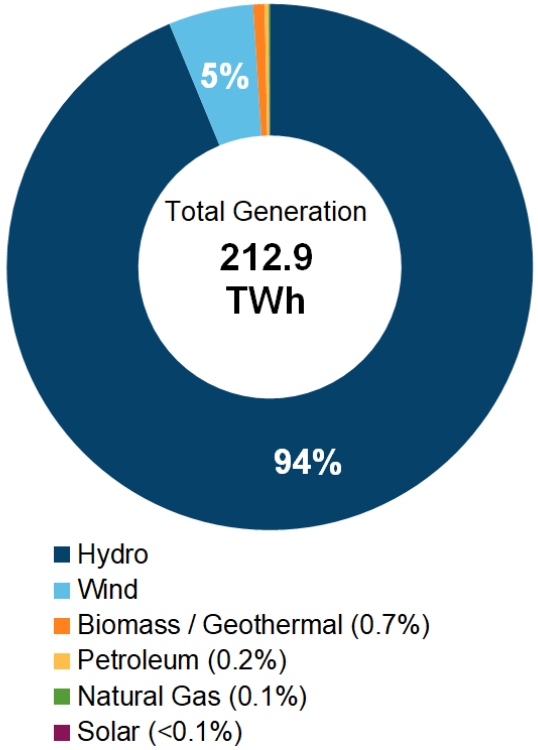
Energy Mix in the USA VS the Energy Mix in the world

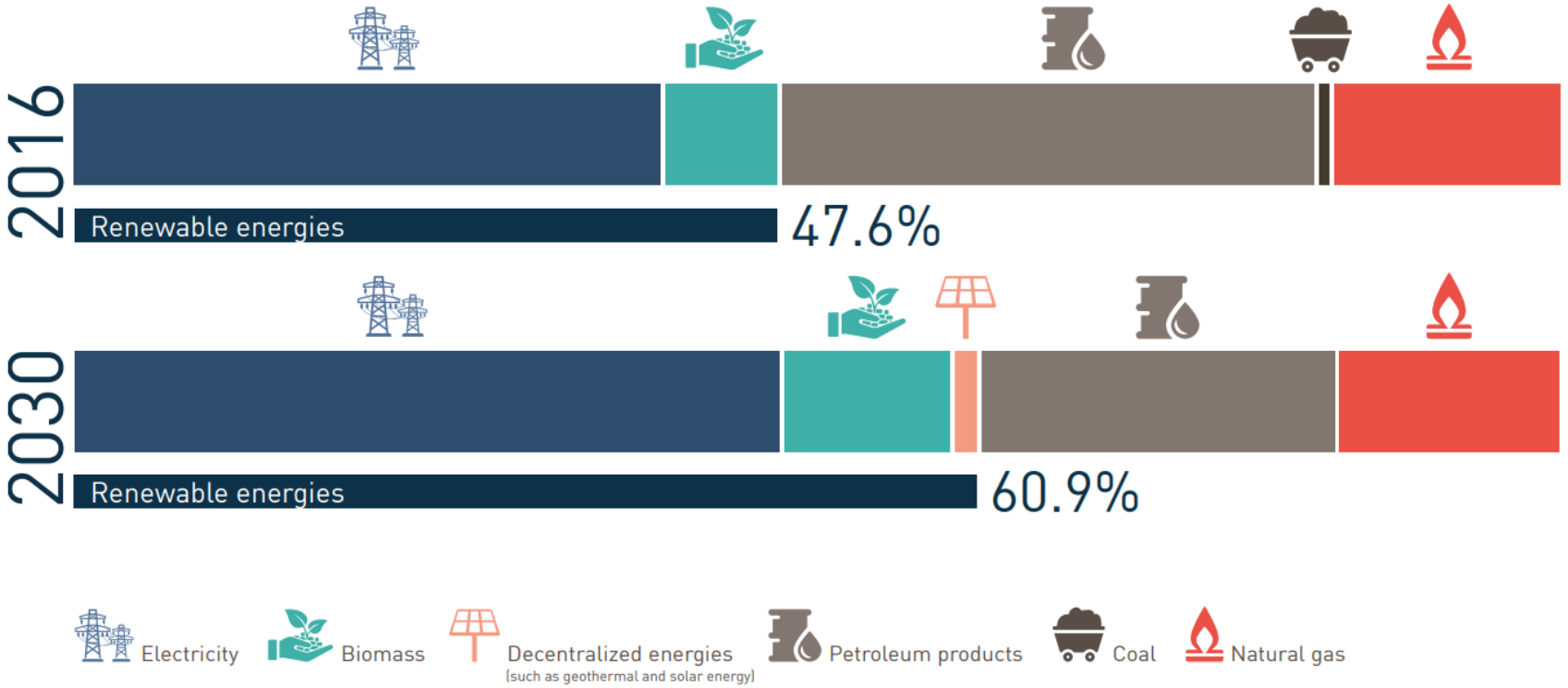


Energy Mix in Canada



Energy Mix in Quebec – Electricity Mix Vs Energy use





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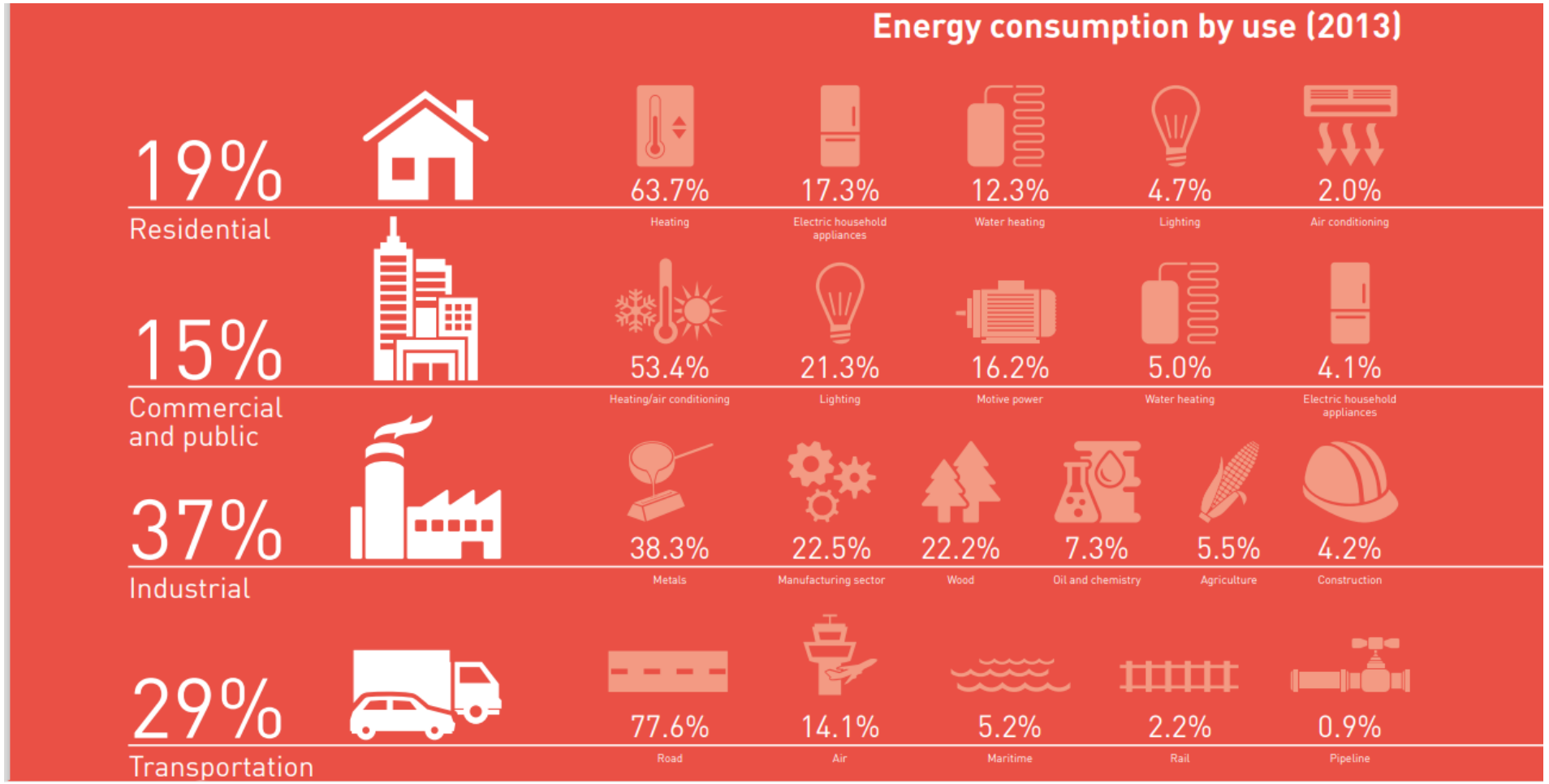


The Long-Term Strategy of the United States: Pathways to Net-Zero Greenhouse Gas Emissions by 2050.

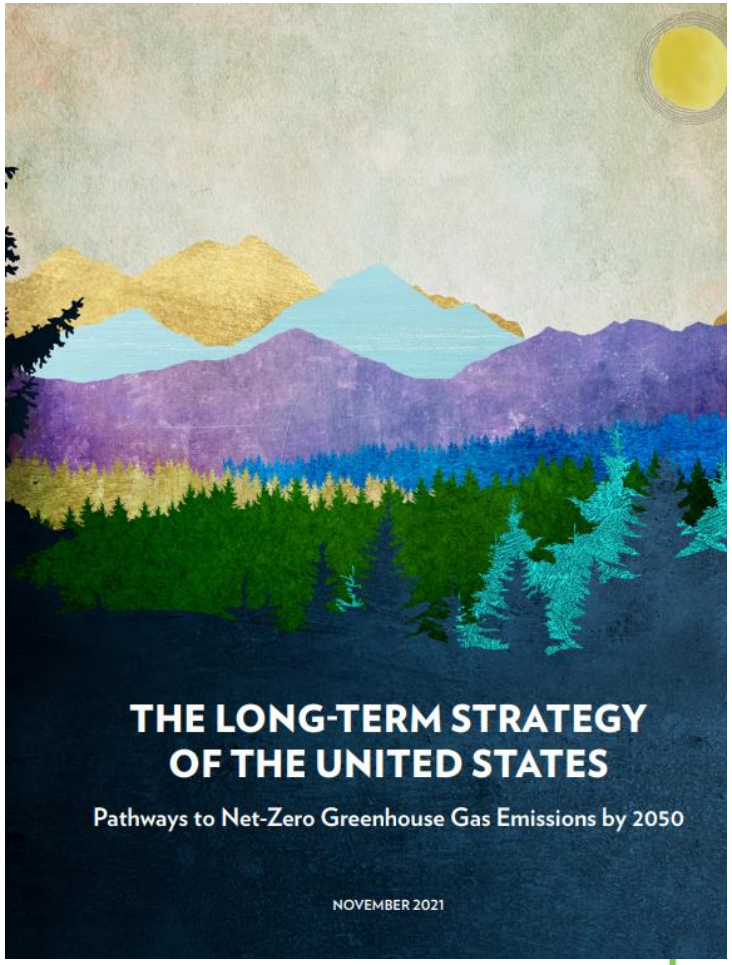
1- Decarbonize Electricty

2- Electricy end uses and switch to other clean fuels

3- Cut energy waste

4- Reduce Non-CO2 gases such as methane, and others

5- Scale up CO2 removal from the atmosphere



CanREA's 2050 Vision

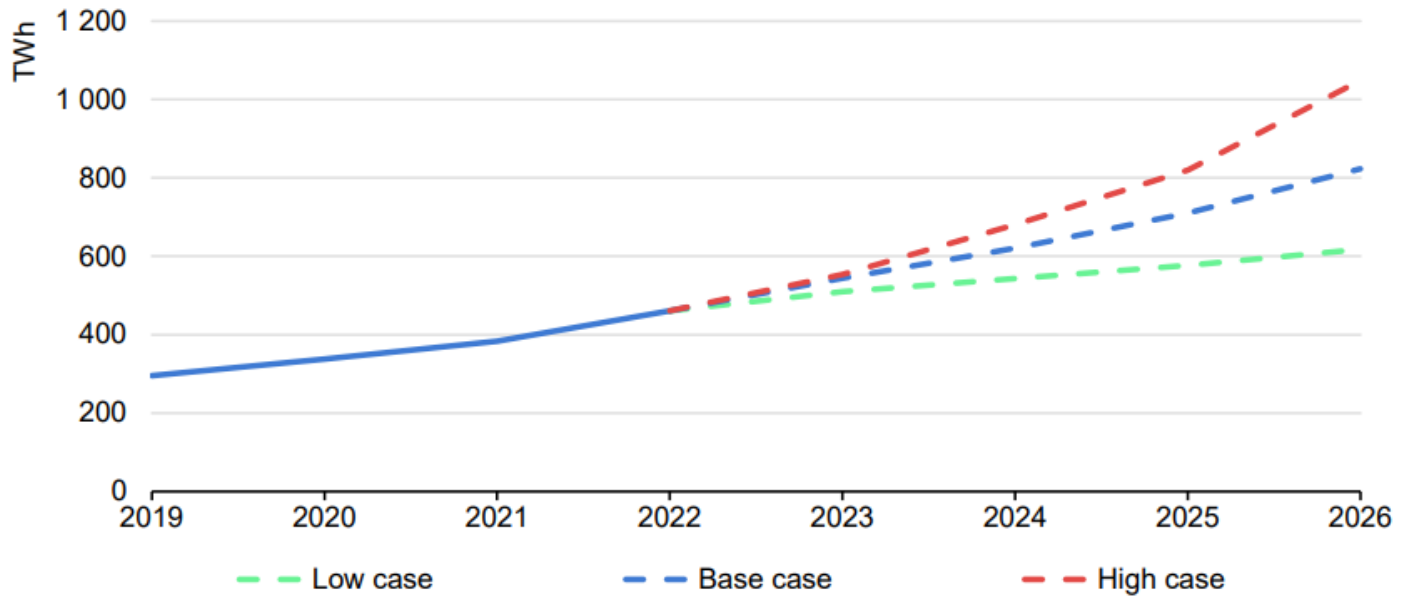
- **Task 1:** Decarbonize Canada's electricity production by 2035
- **Task 2:** Modernize Canada's electricity markets and regulatory structures to enable the lowest-cost pathway to grid decarbonization and expansion
- **Task 3:** Build new wind, solar and energy storage in Canada, ensuring cost-effective outcomes from procurement processes for new, decarbonized electricity generation
- **Task 4:** Rethink Canada's electricity infrastructure investments and seek to minimize the cost of new transmission and distribution infrastructure needed to expand electricity production
- **Task 5:** Use decarbonized electricity to reduce greenhouse gas emissions in Canada's transportation, buildings, and industry sectors

Electricity consumption from data centres, artificial intelligence (AI) and the cryptocurrency sector

- The International Energy Agency published in a 2024 report that electricity consumption from data centres, artificial intelligence (AI) and the cryptocurrency sector could double by 2026.
- Data centres are significant drivers of growth in electricity demand in many regions. After globally consuming an estimated 460 terawatt-hours (TWh) in 2022, data centres' total electricity consumption could reach more than 1 000 TWh in 2026. This demand is roughly equivalent to the electricity consumption of Japan.
- US data centre electricity consumption is expected to grow from 4 per cent to 6 per cent of total demand by 2026, while the AI industry is forecast to expand "exponentially" and consume at least 10 times its 2023 demand by 2026, said the IEA. (FT-2024)
- Updated regulations and technological improvements, including on efficiency, will be crucial to moderate the surge in energy consumption from data centres.

Electricity consumption from data centres, artificial intelligence (AI) and the cryptocurrency sector

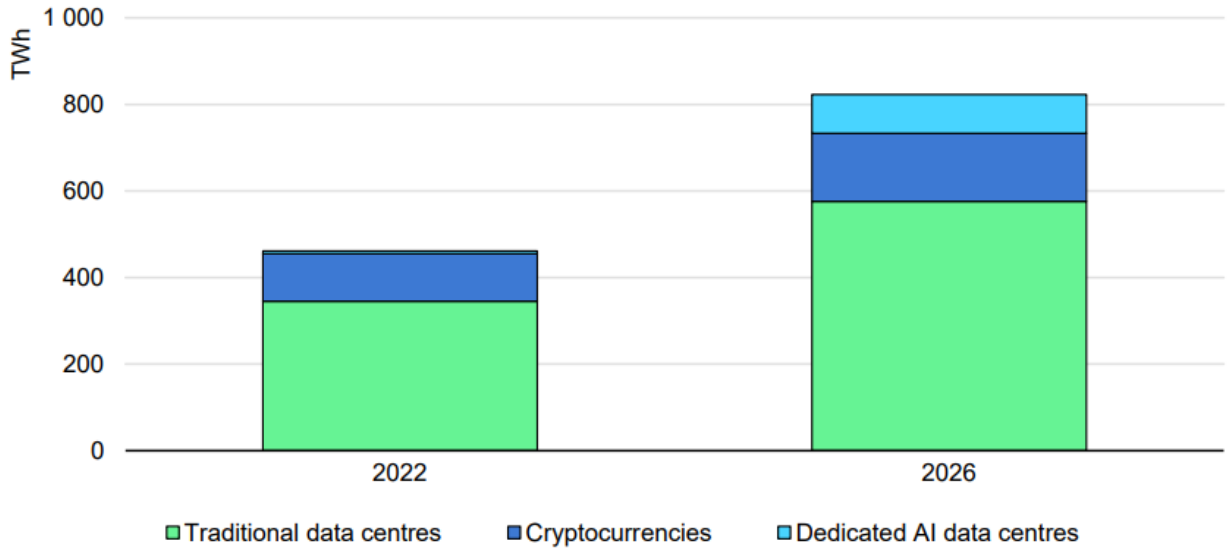
Global electricity demand from data centres, AI, and cryptocurrencies, 2019-2026



Notes: Includes traditional data centres, dedicated AI data centres, and cryptocurrency consumption; excludes demand from data transmission networks. The base case scenario has been used in the overall forecast in this report. Low and high case scenarios reflect the uncertainties in the pace of deployment and efficiency gains amid future technological developments.

Electricity consumption from data centres, artificial intelligence (AI) and the cryptocurrency sector

Estimated electricity demand from traditional data centres, dedicated AI data centres and cryptocurrencies, 2022 and 2026, base case



Note: Data centre electricity demand excludes consumption from data network centres.

Sources: IEA forecast based on data and projections from Data Centres and Data Transmission Networks; Joule (2023), Alex de Vries, The growing energy footprint of artificial intelligence; Crypto Carbon Ratings Institute, Indices; Ireland Central Statistics Office, Data Centres Metered Electricity Consumption 2022; and Danish Energy Agency, Denmark's Energy and Climate Outlook 2018.

How to Mitigate the Electricity Consumption from Data Centres, AI and the Cryptocurrency Sector

- Optimization of Algorithms & Hardware: Develop and optimize AI algorithms to be more energy-efficient, reducing the computational resources required for training and inference tasks & hardware architectures
  - Google reported using its DeepMind AI to reduce the electricity demand of their data centre cooling systems by 40%.
  - More efficient semiconductors reduce cooling requirements.
  - In the long term, IEA wrote that replacing supercomputers with quantum computers could reduce electricity demand of the sector if the transition is supported by efficient cooling systems.
- Renewable Energy Usage: Power the electricity Consumption from Data Centres, AI and the Cryptocurrency Sector with renewable energy sources such as solar, wind, and hydroelectric power.
  - The Inflation Reduction Act is giving incentives to produce renewables energy.

How to Mitigate the Electricity Consumption from Data Centres, AI and the Cryptocurrency Sector

- Lifecycle Management: Implement sustainable practices for hardware lifecycle management, including responsible disposal and recycling of electronic components to minimize e-waste generation.
- Policy Interventions: Implement regulations and incentives to promote sustainable development.
  - The USA Energy Act of 2020 requires the federal government to conduct studies on the energy and water use of data centres, to create applicable energy efficiency metrics and good practices that promote efficiency, along with public reporting of historical data centre energy and water usage.
  - At a state level, regulators in Oregon have already imposed requirements for better sustainability practices and carbon emissions reductions.

How AI can help achieve our 2050 Vision

- AI will consume a lot of electricity in the future but is an essential asset to the decarbonization of our economy, energy efficiency, the optimization of our infrastructure, integrating intermittent technologies & EVs, and mitigate peak period :
  - Demand Response Programs: Incentivize consumers to reduce electricity usage during peak periods through rebates or incentives.
  - Energy Efficiency Measures: Companies like BrainBox AI provide a game-changing HVAC (heating, ventilation, and air conditioning) technology leverages AI to make buildings smarter and greener.

    -Lower HVAC related carbon emissions by up to 40%

    -Reduce HVAC energy costs by up to 25%
- Deploy Distributed Energy Resource (DER): : Encourage the deployment of distributed generation sources, such as Behind-the-meter energy generation like rooftop solar panels with energy storage to offset peak demand and reduce the pressure on the grid.

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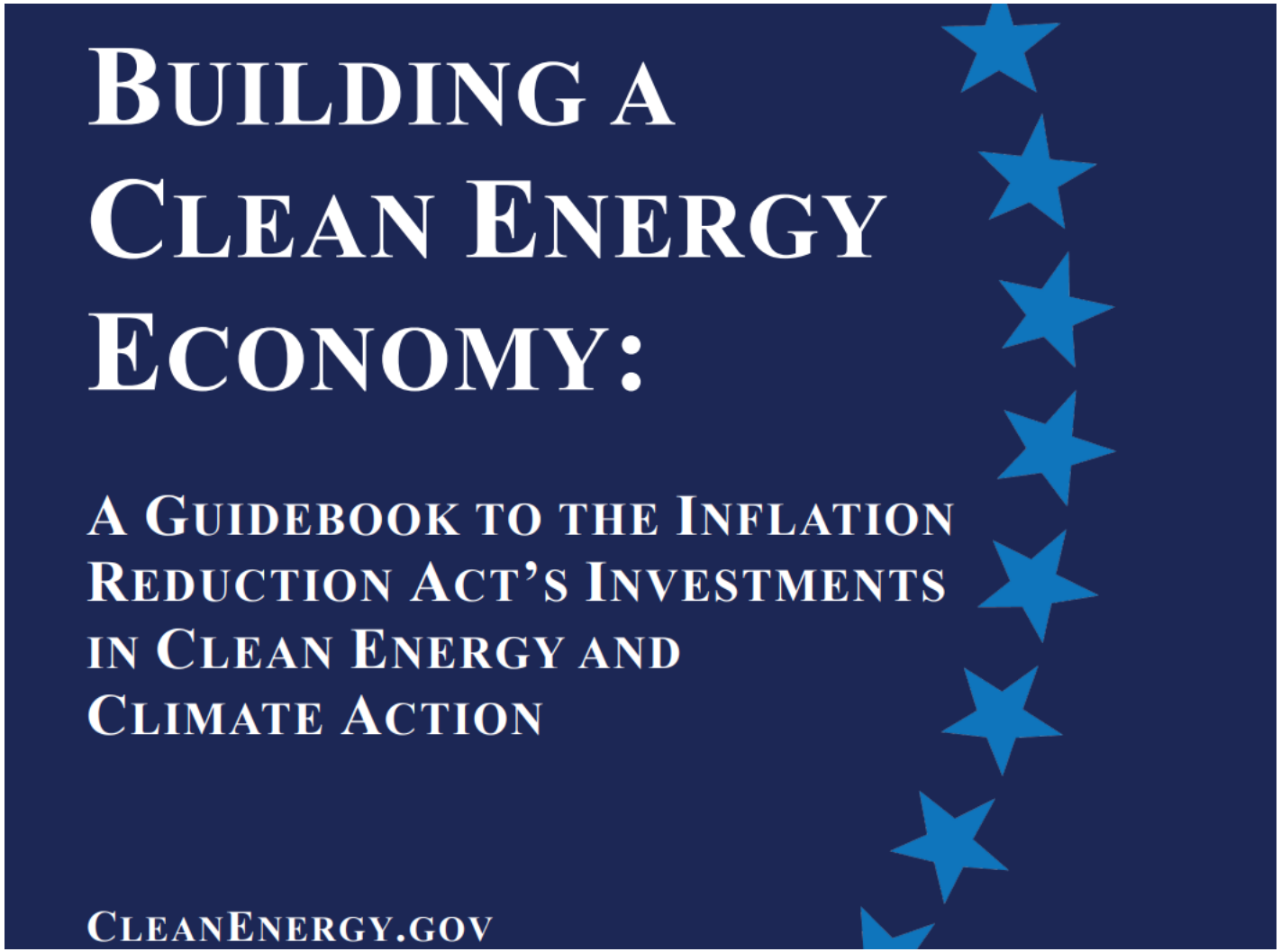
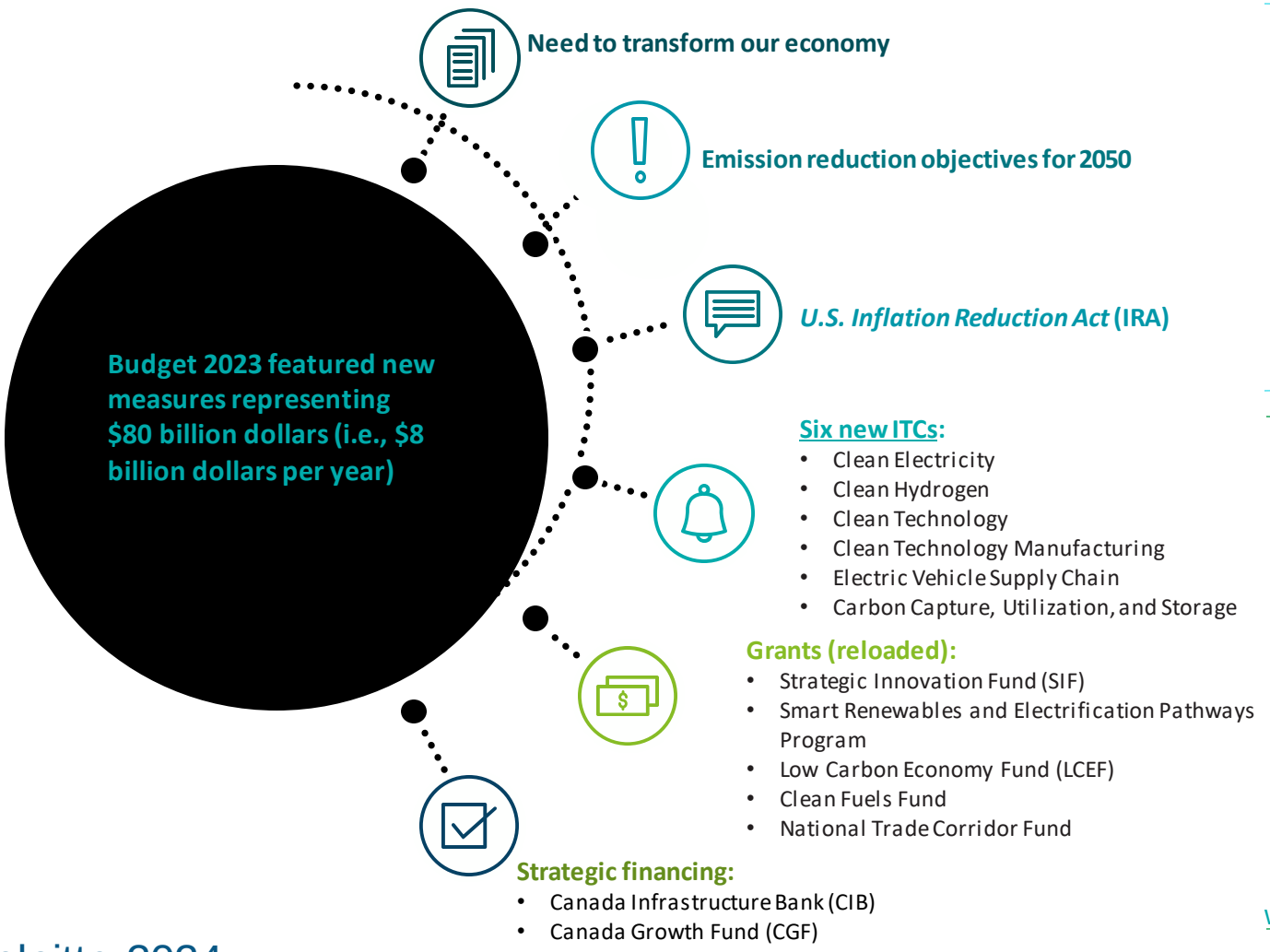
Inflation Reduction Act



The Canadian Federal Budget



The context

The proposals

Deloitte-2024

Deloitte Summary table of the six refundable federal investment tax credits for clean technologies (as of April 17, 2024)

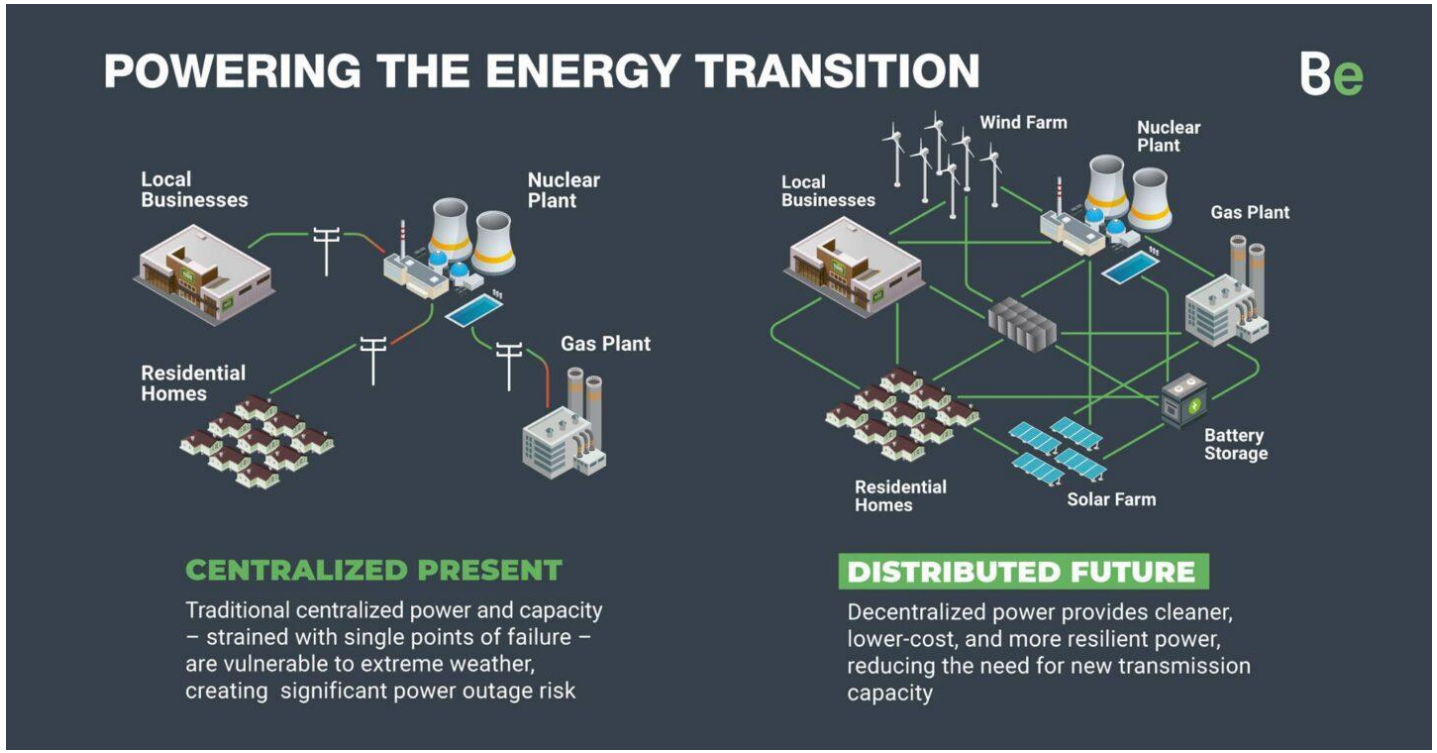
Name of credit	Acronym	Eligible entities	Eligible assets	Rate	Budget estimate	Effective date	End date	Status of legislation
Clean Technology Investment Tax Credit	CTITC	Taxable Canadian corporations**	Certain Class 43.1, Class 43.2 properties, and Class 56 properties	30%*	$6.9 billion by 2028	March 28, 2023	15% in 2034 0% in 2035	Bill C-59 introduced Nov. 28, 2023 (s. 127.45)
Clean Electricity Investment Tax Credit	CEITC	Canadian taxable corporations (taxable + some non-taxable ones)	New equipment and renovation of former installations	15%*	$25.7 billion by 2035	April 16, 2024	2034 (incl.)	Possible draft legislation - 2024
Clean Hydrogen Investment Tax Credit	CHITC	Taxable Canadian corporations	New dedicated equipment for hydrogen/ammonia productions	40%*, 25%* or 15%*	$17.7 billion by 2035	March 28, 2023	Reduced in 2034, 0% in 2035	Proposed legislation – December 20, 2023 (s.127.48)
Clean Technology Manufacturing Investment Tax Credit	CTMITC	Taxable Canadian corporations	Machinery and equipment for manufacturing of clean tech, extraction/processing of critical minerals	30%	$11.1 billion by 2035	January 1, 2024	20% in 2032 10% in 2033 5% in 2034	Proposed legislation – December 20, 2023 (s. 127.49)
Electrical vehicles Supply Chain Investment Tax Credit	EVSCITC	Taxable Canadian corporations	Buildings used for electric EV, EV battery production and cathode active material production	10%	$1.82 billion by 2035	January 1, 2024	5% in 2033-2034 0% in 2035	Possible draft legislation - 2024
Carbon Capture, Utilization and Storage Investment Tax Credit	CCUS	Taxable Canadian corporations	Assets used to capture, store and reuse CO_2	37.5% to 60%*	$9.1 billion by 2030	January 1, 2022	2040 (incl.)	Bill C-59 introduced Nov. 28, 2023 (s. 127.44)

* *This rate will be reduced by 10% if the company does not comply with the labour requirements (i.e., the compensation level meets or exceeds the relevant wage, and at least 10% of total labour hours are performed by apprentices (section 127.46)). Effective as of November 28, 2023 (s.127.46).*

** *Including certain REITs (November 28, 2023 Bill C-59).*

How AI can help achieve our 2050 Vision

- Electricity generation is shifting from a centralized perspective to a distributed perspective including, and AI will contribute to improve DER, V2G, V2H, developing solutions to reduce-mitigate peak period and improve the interconnection possibility.



Interconnection can help achieve our 2050 Vision

- AI could play an enhance role in interconnection
- Consider more interconnection to improve reliability when new transmission investment is required, from a regional perspective, and not solely from a provincial/state perspective.
- Quebec is part of the NPCC, one of six Regional Entities which, together with the North American Electric Reliability Corporation (NERC), make up the Electric Reliability Organization Enterprise.
- NPCC is committed to the collective vision of a highly reliable and secure North American bulk power system and shares the joint mission of assuring the effective and efficient reduction of risks to the reliability and security of the grid.