

Annual Report 2024

Canada

Photo: *Neweg Energy Project, Kings County, New Brunswick. (Photo credit: ENERCON Canada Inc.)*

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Canada added 1435 MW of new wind energy capacity in 2024, a slight reduction from the 1671 MW of capacity added in 2024.

The province of Alberta has accounted for 82% of Canadian wind deployment over the last five years, however there is increasing uncertainty about future deployment given recent regulatory and market reforms. In other parts of the country there were signs of government interest and indications of future deployments of wind energy.

Procurement announcements were made in 2024 in the provinces of British Columbia, Saskatchewan, Manitoba, Ontario, Quebec, and New Brunswick and frameworks were created to facilitate private power-purchase agreements for wind (in Nova Scotia) as well as direct development by provincial governments (in Quebec and Prince Edward Island).

Enhancements to regulatory frameworks were made to facilitate the development of an Offshore Wind and/or Green Hydrogen market by the collective action of the governments of Canada, Nova Scotia, and Newfoundland and Labrador.

Total (net) installed wind power capacity	18.5 GW
Total offshore capacity	0 GW
New wind power capacity installed	1.44 GW
Decommissioned capacity (in 2024)	0 GW
Total electrical energy output from wind	45.84 TWh
Wind-generated electricity as percentage of national electricity demand	7.7%
Average national capacity factor	29.5 %
Target (Offshore Project Formation)	N/A
National wind energy R&D budget	EUR 9.847 million

Table 1. *Key Statistics 2024: Canada*

Highlights

- Alberta (1234 MW) accounted for the majority of Canadian wind power deployment (1435 MW) in 2024 due to previously approved projects being constructed

- Procurements, developments, and deployments have been announced or are underway in all nine other provinces. As such, it is anticipated that 2026 and beyond will see significant wind deployment in Canada. [2]

Market Development

Targets and Policy

The Canada Electricity Advisory Council (CEAC), convened by the Federal Minister of Natural Resources in May 2023, delivered its final report in May 2024 [3], which presents 28 key policy recommendations. These include harmonizing electrical codes and standards between provinces, leveraging investment tax credits, building out inter-regional transmission capacity, and increasing the involvement of First Nations. Canada's size and geographic diversity of natural resources present challenges for decarbonization. Figure 1 illustrates the current share of non-emitting electricity generation at the provincial level.

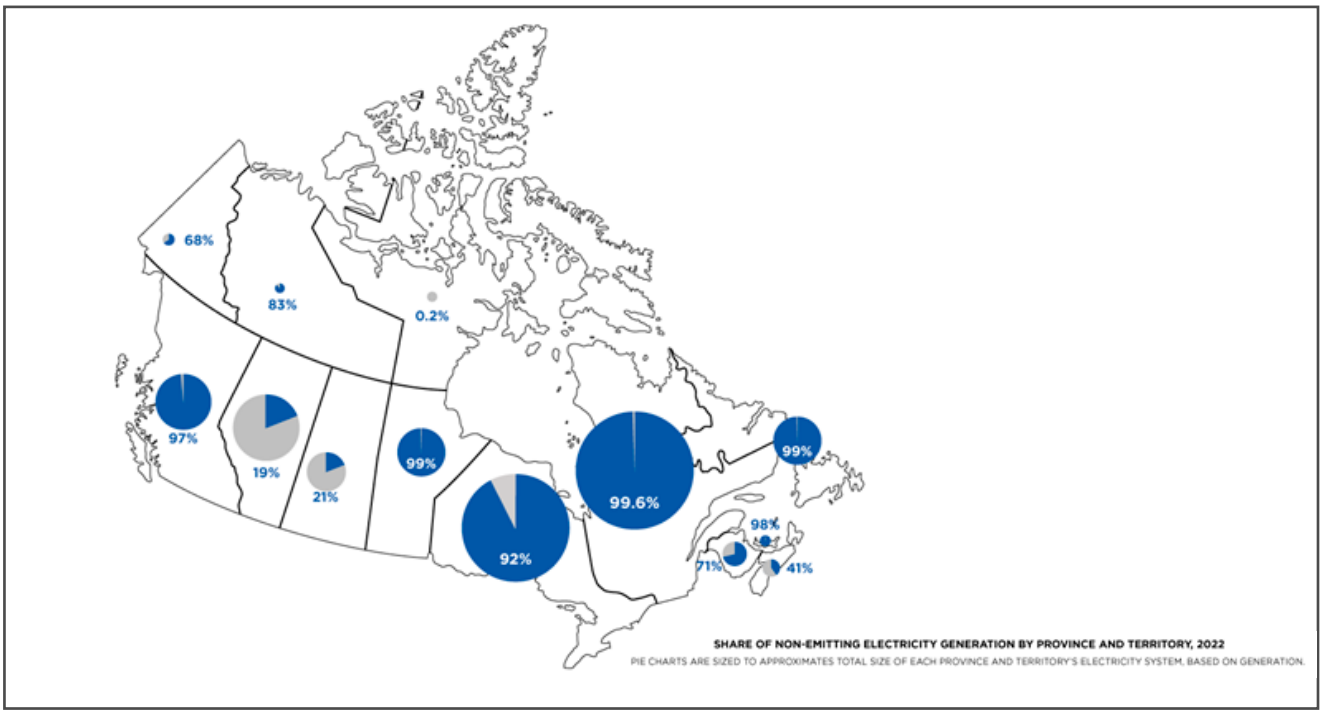

Figure 1: *Share of non-emitting electricity generation by Canadian province and territory, 2022* (Source: CanREA)

The most significant federal policy developments are as follows:

The federal government launched the Clean Economy Investment Tax Credits (ITCs) initiative to attract investment, create jobs, and help Canada reach its net-zero goal by 2050. The ITCs represent USD 64.57 billion in federal incentives by 2034-35 [4].

The federal government established the Clean Electricity Regulations to limit CO_2 fossil fuel emissions used to generate electricity and protect human health and the environment from the effects of climate change [5].

Bill C-49, amending the offshore accords between governments of Canada, Nova Scotia, and Newfoundland and Labrador, was signed into law [6].

The most significant provincial policy developments are as follows:

Nova Scotia passed legislation to modernize its electricity system, streamline regulations, and drive towards a target of 80% clean electricity generation by 2030 [7], [8].

Hydro-Québec published a plan to develop over 10,000 MW of wind power by 2035 as part of its Action Plan 2035 [9], [10].

Prince Edward Island has a plan to reach net zero by 2040 [11].

New Brunswick published its 2035 energy and climate goals as part of a plan to achieve net-zero by 2050 [12].

Alberta published a plan aspiring to a carbon neutral economy by 2050 [13].

Progress and Operational Details

Several provinces made progress on procurement of wind energy, notably:

British Columbia Hydro awarded nine wind energy projects (eight of which have 51% equity ownership held by First Nations) in 2024, totaling 1531 MW to be built before 2031 [14], [15].

Procurement under Nova Scotia's Green Choice program resulted in the development of six projects comprising 625 MW of wind power – exceeding the 350 MW target [16].

Manitoba Hydro announced their Notice of Intended Procurement for up to 600 MW of wind energy in their upcoming RFP process in Spring 2025. These projects will require majority Indigenous ownership [17].

The Ontario Government has announced that it will be increasing its procurement target from 5000 MW to about 6500 MW of energy-producing resources, including wind [18].

Wind turbine hub heights for new projects have remained relatively consistent over the last five years at around 135 m, while rotor diameters and turbine capacities have continued to increase, reaching 170 m and 6.2 MW respectively in 2024, shown in Figure 2.

The average size of new wind farms installed in Canada is now 200 MW, twice the size of new installations in 2019 [25]. Hydro-Québec is planning gigawatt-scale windfarms [26].

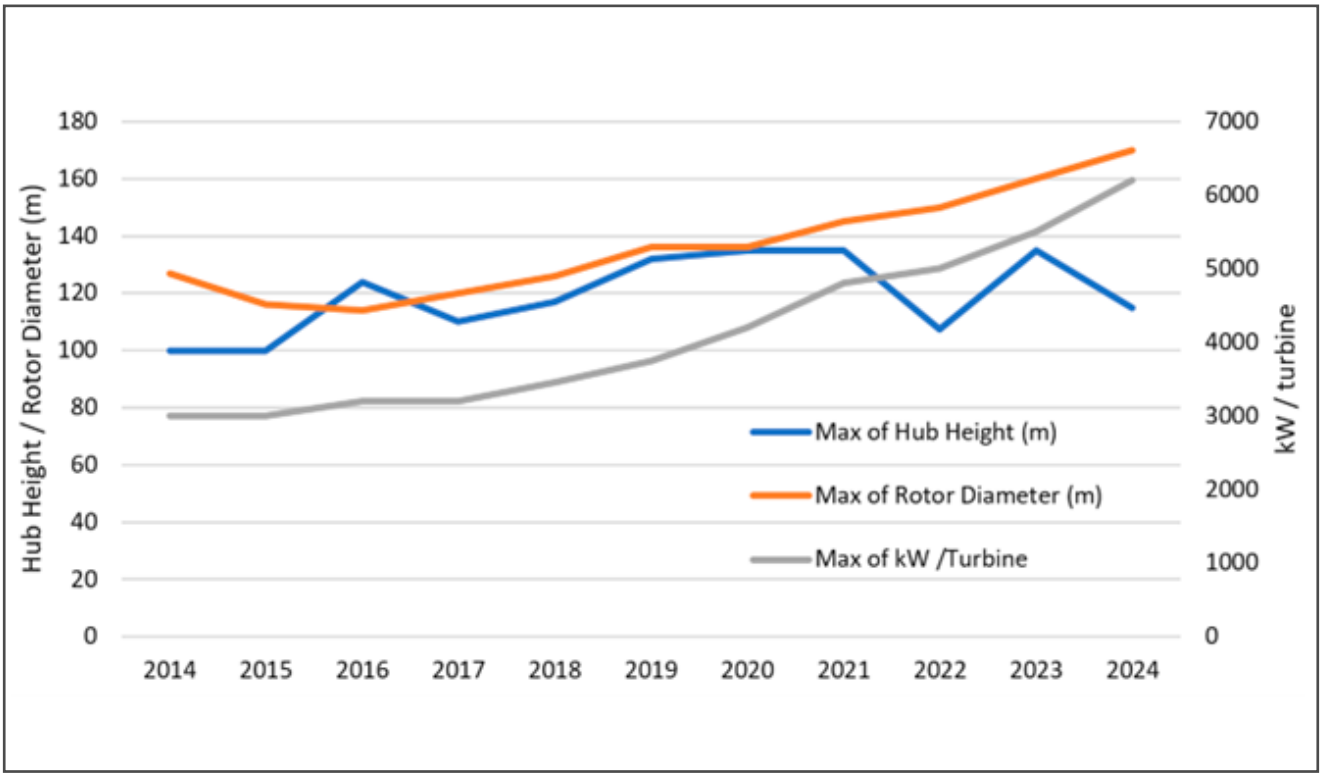

Figure 2: *Comparative growth of hub height, rotor diameter, and turbine output.* (Source: CanREA)

Matters Affecting Growth and Work to Remove Barriers

The province of Alberta is redesigning its electricity market as well as making changes to how its electricity transmission infrastructure is planned and built [19], at least partially in response to congestion issues due to a lack of transmission buildout to high-wind areas. The Alberta Market Surveillance Administrator (MSA) 4th Quarter Report states:

"In 2024, 40% of curtailed intermittent generation occurred during supply surplus events compared to 6% in 2023. This trend reflects the increase in supply surplus events as well as the increase in intermittent capacity" [20]. Figure 3 shows the trend of increased transmission congestion in Alberta over the past two years.

RD&D Activities

National R, D&D Priorities and Budget

Significant RD&D priorities are as follows:

- Canada's Federal Budget 2024 allocated USD 538.8 million towards a retooled Clean Fuels Fund to "de-risk the capital investment required to build new or expand existing clean fuel production facilities" [27], [28].

- The 2024-2029 Strategic Plan released by the National Research Council (NRC) focuses on climate change and sustainability, emphasizing decarbonization of Canada's transportation and construction industries [29].

- The Smart Renewables and Electrifications Pathways (SREPs) and Electricity Predevelopment programs disbursed USD 52 million funding for new wind projects in Nova Scotia [30].

- The Office of Energy Research and Development (OERD) issued a Renewable Energy Demonstrations Call under the Energy Innovation Program, which received 69 eligible submissions under Stream 1, amounting to an overall request of USD 127.3 million Stream 2 received 86 eligible submissions, amounting to an overall request of USD 223.4 million [31].

National Research Initiatives and Results

The Canadian Wind Energy Research Network (CWERN) delivered its first hybrid (in person & virtual) meeting in 2024. This included 62 attendees representing five provinces as well as guests from Australia and Finland. Topics covered included: Aerodynamics, asset management, social and environmental integration, and curriculum development.

Test Facilities and Demonstration Projects

The Wind Energy Institute of Canada (WEICan) features a variety of facilities designed to advance wind energy research and development, including a 10 MW R&D wind park, a climate station, a 111.5 kW/223 kWh Tesla Energy battery storage system, a 109 kW solar photovoltaic array, and a 35-acre small wind test bed:

Work is ongoing at the Wind Energy Institute of Canada (WEICan) with the following priorities:

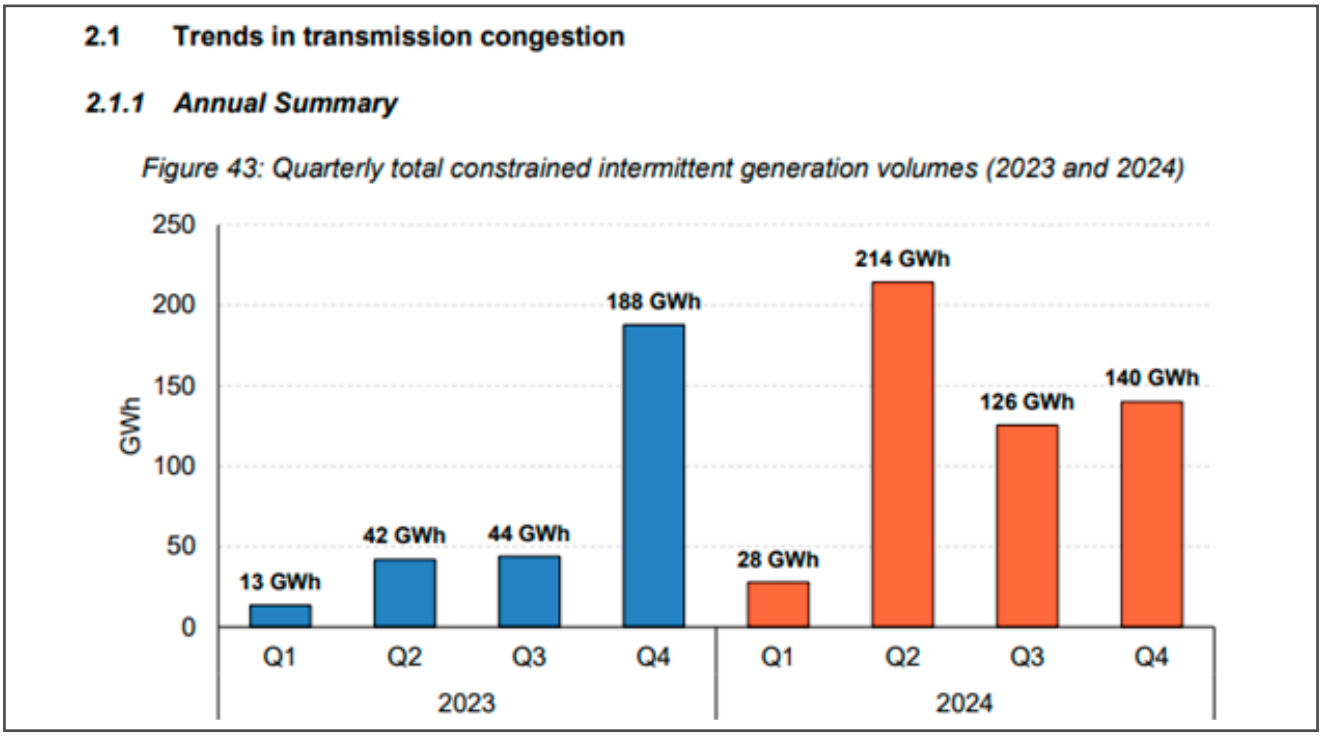

Figure 3: *Transmission congestion in Alberta, as reported by the Alberta Market Surveillance Administrator (Source: Alberta Market Surveillance Administrator)*

- Asset retirement/end of life options for wind turbines
- Structural health monitoring of wind turbine drive trains and blades
- Lubrication of wind turbine components
- Resource adequacy stress from rapid electrification

Nergica owns and operates a full-scale research site that comprises wind turbines, a solar array, met masts, lidars, a wind/solar/diesel microgrid, storage technologies, and a real-time simulation platform. Installed in Rivière-au-Renard (Quebec, Canada) at an elevation of 330 m, these cutting-edge infrastructures constitute a research site that offers real-world conditions and allows for a multitude of research, development, and technology transfer projects to be carried out in cold climate conditions and complex terrain.

Collaborative Research

WEICan represents Canada in IEA Task 46, Wind Turbine Blade Erosion. They are participating in Work Package 2 by providing data for key meteorological parameters and Work Package 3 by contributing to a model to predict annual energy production loss, standardization of damage reports, potential for erosion safe-mode operation, and accuracy of leading-edge erosion performance loss model based on field observations. This work resulted in a joint international publication in 2024 [21].

Nergica is a centre of applied research that stimulates innovation in the renewable energy industry through research, technical assistance, technology transfer and technical support for businesses and communities. Nergica is involved in four IEA Wind Tasks on behalf of NRCAN [33]:

Task 41 - Distributed Wind

Task 50 - Hybrid Systems

Task 52 - Large scale deployment of wind lidar

Task 54 - Cold Climate Wind Power.

This participation allows Nergica to share results from the Canadian RD&D ecosystem at the international level as well as sharing best practices and latest research results with the Canadian ecosystem through participation in national conferences like Electricity Transformation Canada, CanREA's Operators Summit, and CWERN.

Impact of Wind Energy

Environmental Impact

In 2024, the hoary bat, eastern red bat, and silver-haired bat were assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Endangered [22]. This will lead to legislation and may lead to the imposition of operational requirements such as increased cut-in speeds to protect these species at both existing wind facilities as well as new developments.

Regulations to protect bats from wind turbines are currently being implemented in Alberta and Ontario, and there are active discussions regarding similar implementation in British Columbia and Quebec. NRCan published a paper in 2024 regarding the risks presented to vulnerable bat populations by wind turbine operation, titled 'Review of Bat Fatality Mitigation Studies and Recommendations for Canada' [32].

Economic Benefits and Industry Development

There has been a trend of increased Indigenous participation in wind projects over the last several years in Canada [23]. An example of this is Nova Scotia's Green choice program, where all six approved wind energy projects were developed in partnership with local First Nations [16]. In British Columbia's recent call for power, eight of the nine successful projects were more than 51% First Nation owned [14]. Likewise, in Manitoba Hydro's upcoming RFP Process, all projects will require majority indigenous ownership [17].

Electricity Human Resources Canada (EHRC) released a Labour Market Intelligence report focusing on Renewable Energy in March 2025 entitled "Winds of Change" [24]. This report states:

"Over 300 firms participate in Canada's wind, solar, bioenergy and energy storage markets. Employment in these firms rose from 4,700 twelve years ago to 23,000 in 2024. Due to growth in the renewables sector, EHRC anticipates an additional 6,000 to 8,000 workers by 2030." Further, the report states "The Canada Net Zero scenario involves the most aggressive climate action. Under this scenario, employment growth in the renewables sector is projected to be 25.8% from 2024 to 2030."

Next Term

A great deal of uncertainty has come into the Canadian market due to the implementation of tariffs by the newly elected US Administration. The scope, level, and severity of these tariffs have changed dramatically in the first months of 2025, leading to a high-risk and uncertain market due to potentially higher investment, material, and component costs, as well as uncertainty pertaining to future electricity exports to the United States. In spite of this, regional electrical authorities have announced or are in the process of procuring over 18 GW between 2025 and 2035.

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