



Report 2021

Canada

Picture: 102 MW wind farm in Bear Mountain, BC. Wind Turbine Model E-82, Source: ENERCON Canada Inc.

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During 2021, 677 MW of new wind capacity was installed in Canada.

THIS is a significant increase from last year's installed capacity (175 MW), partially because many projects are ramping up due to the post-pandemic economic recovery. Wind production reached over 36 TWh of electricity generated, representing a 0.2% decrease from production in 2020.

Highlight(s)

- 677 MW of new capacity online in 2021 – a high increase from 2020, almost reaching the record level of 2016
- Stricter GHG targets and support to reach net zero announced in 2021
- At least 2,000 MW of wind energy capacity are anticipated this year

Table 1. Key National Statistics 2021: Canada

Total (net) installed wind power capacity*	14,3 GW
Total offshore capacity	0 GW
New wind power capacity installed	0.677 GW
Decommissioned capacity (in 2021)	0 GW
Total electrical energy output from wind	36.19 TWh
Wind-generated electricity as percent of national electricity demand	6.2%
Average national capacity factor	29.6%
Target	
National wind energy R&D budget	

*Installed wind power capacity: Calculated using nameplate power ratings of the installed wind turbines

Market Development

Targets and Policy

- In April 2021, the Government of Canada announced a national GHG emission reduction target of 40% to 45% below 2005 levels by 2030, an increase in stringency compared to the previous target of a 30% reduction by 2030.
- In June 2021, the Government of Canada announced the 965 million CAD (665 million EUR; 762 million USD) Smart Renewables and Electrification Pathways Program (SREPs) in support of Canada's ongoing effort to reach net-zero emissions by 2050 by encouraging the replacement of fossil-fuel generated electricity with cleaner energy technologies. The program provides funding support for eligible projects under three streams: established renewables, emerging technologies, and grid modernization [2].
- Hydro-Québec's Strategic Plan for 2022–2026 included a commitment to developing a portfolio of wind energy projects totaling 3,000 MW that will be implement-

ed as demand grows. In 2021, the province launched two renewable-energy procurement processes, including a proposal request (RFP) for 300 MW of new wind energy capacity [3].

- The province also moved forward with the anticipated large-scale 200 MW Apuiat wind farm project, which is projected to produce the most cost-competitive electricity of all wind farms in Quebec. Construction is scheduled to begin in summer 2022 and commissioning in December 2024 [4].
- Nova Scotia (NS) launched the Green Choice Program, allowing large energy customers in the Province to procure up to 100% of their energy needs from new local renewable energy sources. As part of this initiative, NS also announced that an RFP would be issued to attract low-cost and innovative solutions to supply 10% of the province's electricity from renewables [5].
- The province of Saskatchewan and SaskPower, the provincial

utility, announced a 200 MW wind energy project owned by Cowessess First Nation due to the province's 2020 RFP for new wind power [6].

Progress and Operational Details

- Projects announced in 2021 had an average installed cost of 1.8 million CAD/MW (1.27 million EUR/MW; 1.46 million USD/MW), a moderate decrease from the 2020 average of 2.3 million CAD/MW (1.59 million EUR/MW; 1.82 million USD/MW).
- There was a significant increase from 2020 (175 MW) in terms of new wind installations in Canada, with 677 MW of new capacity coming online in 2021.
- Total wind energy capacity in Canada (as of Dec 31, 2021) was 14,304 MW, up from 13,627 MW in 2020. Nearly half of the capacity growth occurred in Alberta (358 MW), with additional development in Saskatchewan, Ontario, and British Columbia [1].
- In 2021, 36.19 GWh of electric-



Nergica research site, Quebec, 2 Senvion MM92 CCV, 4.1 MW installed capacity, plus a 230 kW Diesel, Wind, and Solar microgrid.
Source: Nergica.

ity was generated from wind, representing 6.2% of Canada's national energy demand. The total electricity generated from wind decreased slightly (0.2%) relative to 2020. Electrical demand was 0.4% higher than in 2020.

- The national wind power capacity factor reached 29.6%, a slight decrease from 2020 (30.6%), which was the highest reported value over the past five years.

Matters Affecting Growth and Work to Remove Barriers

- Public acceptance continues to be a challenge for the wind energy industry. An assessment of the M'Chigeeng's First Nation in Ontario examined the lived experience of the community that owns and operates two wind turbines. Researchers found various essential requirements for enhanced social acceptance, including intra-community communication, community ownership, precise and up-to-date communication on projects, and attending to Indigenous models and choices of societal development [7].

R,D&D Activities

National Research Initiatives and Results

- CanmetENERGY-Ottawa released an assessment of existing offshore wind technologies and their potential applicability in Atlantic Canada. The analysis provided high-level information on five aspects of offshore wind: construction methods, foundation, technologies, environmental protection, operational considerations, and a summary of Canada's offshore setting [8].

Test Facilities and Demonstration Projects

- Two Tasks were performed as part of NRCan and WEICan's Utility Forum, a multi-year initiative to convene Canadian utilities to address issues with operating electric grids with high levels of Non-Synchronous Generation (NSG) and Inverter-Based Resources (IBR):
 - Task 1 - Wind Farm Enhanced Capability Demonstration Project: Nova Scotia Power Inc. (NSPI) examined the technical ability of the provinces' wind

generator fleet in providing various grid ancillary services – fast-frequency response, power-frequency response (similar to droop-frequency control), and automatic generation control (AGC) [9].

- Task 2 - Canadian Provincial Grid Code Study: GE was contracted to recommend opportunities to harmonize grid codes across Canada as a means to lower the barriers to entry for further renewables deployment [10].

Collaborative Research

- The IEA Task 25 final report was released, and brings together experience and study results from 17 countries participating countries, pertaining to the design and operation of energy systems with large amounts of variable generation. Key topics include how to increase the value of wind energy in future power and energy systems, avoid unnecessary curtailments, provide system support from wind power plants (WPPs), and improve operational practices and flexibility [11].



Picture: 100 MW wind farm in Nation Rise, ON. Wind Turbine Model E-138 EP3,
Source: ENERCON Canada Inc.

Impact of Wind Energy

Environmental Impact

- Repowering is an option for wind energy projects near the end of operational life. CanREA, in collaboration with Canadian entrepreneurs and researchers, are developing new concepts for blade construction to facilitate recycling or re-use after decommissioning. [12].

Economic Benefits and Industry Development

- In July 2021, the Government of Canada committed up to \$25 million for a joint partnership with the Quebec government and plant owner LM Wind Power, a Danish subsidiary of General Electric, to produce 107-meter-long blades that would be the largest in the world [13].

- While currently behind provinces like B.C. and Quebec, Alberta is set to see 71,700 jobs in its clean energy sector by 2030, a 164% increase over 2020—the greatest increase of any Canadian province [14].
- In total, Canada's new wind and solar energy capacity installed in 2021 created approximately 2,400 person-years of employment, primarily in the construction of new facilities, but also in the ongoing operations and maintenance of these sites [15].

Next Term

- At least 2,000 MW of wind energy capacity is anticipated in growth this year. It is expected that 23 new wind farms should launch in 2022: one in Saskatchewan, one in

New Brunswick, with the remainder in Alberta [16].

- In April 2022, the Government of Newfoundland and Canada agreed to work toward modernizing the Canada–Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) that would expand its mandate to include the regulation of offshore renewable energy development in the Canada–Newfoundland and Labrador offshore areas, such as offshore wind and clean hydrogen [17].

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