



Report 2022

# Canada

Riverhurst Wind Farm has an installed generation capacity of 10 MW, and is comprised of three Enercon E-138 EP3 EP1 turbines with a generation capacity of 3.5 MW each. The facility has a 20-year Power Purchase Agreement (PPA) with SaksPower under their Green Options Partner Program. Source: ENERCON Canada Inc./ Captstone Infrastructure Corporation.

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**In 2022, Canada increased its installed wind energy capacity by just over one gigawatt to a total of 15.31 GW. Wind-generated electricity reached 39.06 TWh, a record for the country, representing 6.6% of national electricity demand.**

The majority of growth in new capacity was located in the western provinces of Alberta and Saskatchewan.

There were several significant announcements related to offshore wind, including the initiation of regional assessments to support decision-making on offshore wind in the provinces of Nova Scotia and Newfoundland and Labrador, and an announcement by the province of

Nova Scotia for a target of 5 GW of offshore wind energy leases by 2030.

## Highlight(s)

- Canada installed 1,006 MW of new wind power capacity in 2022, the highest annual increase since 2015.

**Table 1. Key National Statistics 2022: Canada**

|  |                 |
|--|-----------------|
| Total (net) installed wind power capacity                            | 15.31 GW        |
| Total offshore capacity  | 0 GW            |
| New wind power capacity installed                                    | 1.006 GW        |
| Decommissioned capacity (in 2022)                                    | 0 GW            |
| Total electrical energy output from wind                             | 36.06 TWh       |
| Wind-generated electricity as percent of national electricity demand | 6.6%            |
| Average national capacity factor                                     | 30.1%           |
| Target   |                 |
| National wind energy R&D budget                                      | CAD \$9,678,000 |

- Wind-generated electricity set a new record of 39 TWh, reaching a share of national electricity demand of 6.6%.
  - Wind turbines with a nominal capacity of over 5 MW were deployed for the first time in Alberta and Saskatchewan.
  - The province of Nova Scotia announced a target to offer leases for 5 GW of offshore wind by 2030.
- Market Development**
- Targets and Policy**
- Canada's national decarbonisation target is to achieve net-zero emissions by 2050, which was brought into legislation in 2021 through the Canadian Net-Zero Emissions Accountability Act.
  - In March 2022, the Government of Canada released the 2030 Emissions Reduction Plan, which outlines a roadmap on how Canada will meet its enhanced Paris Agreement target to reduce emissions by 40-45% from 2005 levels by 2030 [1].
- Progress and Operational Details**
- The province of Nova Scotia announced a target to offer leases for 5 GW of offshore wind by 2030, with the first call for bids slated for 2025. The province has indicated an interest in the use of offshore wind-generated renewable electricity to produce green hydrogen for use in the province and for export and announced that it is developing a green hydrogen action plan to be released in 2023 [2].
  - The Government of Canada announced that the Impact Assessment Agency of Canada should undertake Regional Assessments to inform future federal impact assessment decisions on offshore wind development in the provinces of Nova Scotia and Newfoundland and Labrador [3].
  - Seven onshore wind projects became operational in 2022, comprising 221 turbines and totalling 1,006 MW of new capacity. Six of the seven projects had installed capacities greater than 100 MW. Most of the growth in new capacity was located in Alberta (four projects equal to 604.9 MW) and Saskatchewan (two projects, 377 MW), with the remaining 24 MW project located in Quebec. The average cost of new projects in 2022 was roughly 1,775 CAD/kWh (1,207 EUR/kWh; 1,312 USD/kWh).
  - The average turbine capacity across all projects installed in 2022 was 4.55 MW. The first projects in Canada with turbines greater than 5 MW each were installed in 2022. This occurred at three sites – the 177 MW Blue Hill Wind Project in Saskatchewan, the 130 MW Rattlesnake Ridge Wind Project in Alberta, and the 122.4 MW Wheatland Wind Project in Alberta. Each of these projects featured the Siemens Gamesa SG 5.0-145 turbines with a nominal power of 5 MW.
- Matters Affecting Growth and Work to Remove Barriers**
- In April 2022, the governments

of Canada, Newfoundland and Labrador and Nova Scotia committed to expanding and modernising the mandates of the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) and the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) to include the regulation of

offshore renewable energy development, such as offshore wind. To reflect the expanded mandates of the Boards, the Minister also introduced amendments to the Acts that will rename the Canada-Nova Scotia and Canada Newfoundland and Labrador Offshore Petroleum Boards as the Canada-Nova

Scotia Offshore Energy Regulator and the Canada Newfoundland and Labrador Offshore Energy Regulator, respectively [4].

- The provincial government of Newfoundland and Labrador lifted its 15-year moratorium on the development of wind

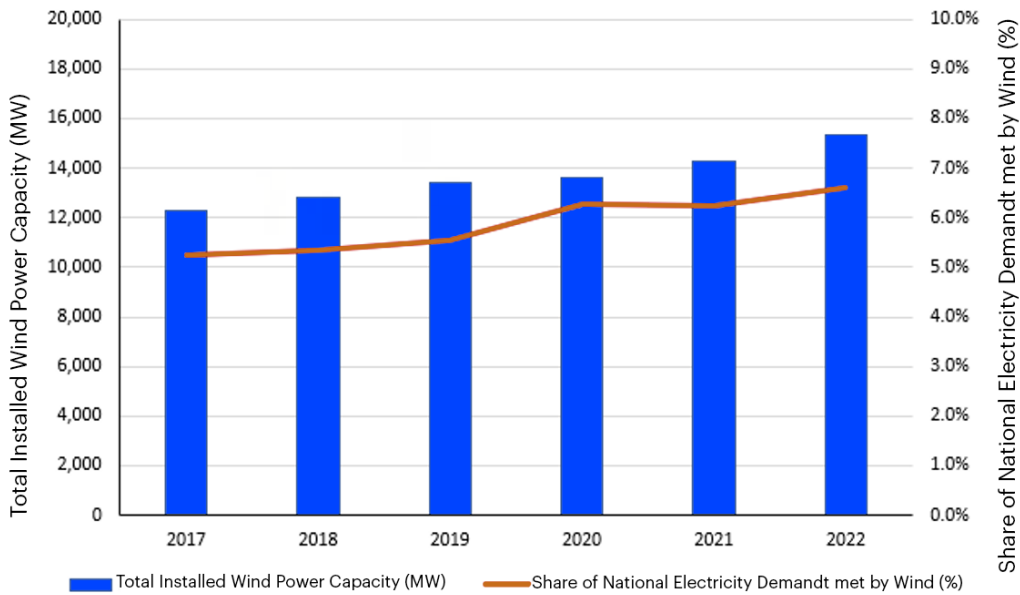


Figure 1: Wind power installed capacity and share of national electricity demand in Canada. Credit: National Resources Canada.

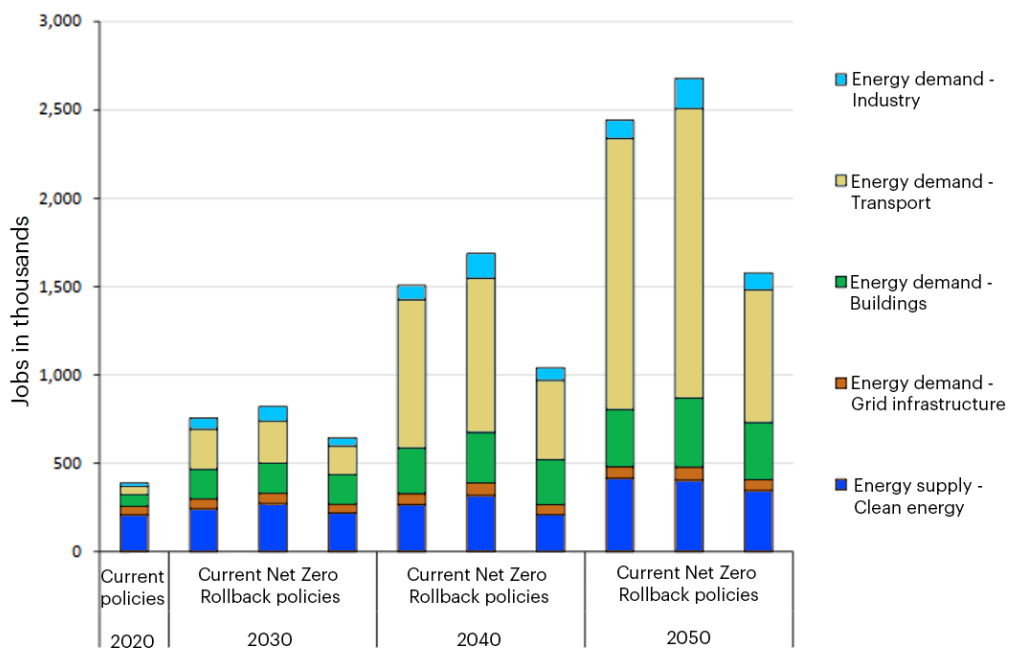


Figure 2: Projection of clean jobs in Canada between 2020 and 2050 under four scenarios. Credit: Navius Research / Clean Energy Canada.

power, allowing it to capitalise on its strong wind resource through both on- and offshore wind energy projects. The province also announced a new green technology tax credit for companies that invest in equipment for energy conservation and clean energy generation [5].

- Retention of workers in the electricity sector continues to be a challenge, which was exacerbated by the COVID-19 pandemic. A paper by Electricity Human Resources Canada (EHRC) explored these challenges and discussed possible solutions involving structure, processes, leadership strategies and the role of human resources departments [6].

## RD&D Activities

### National RD&D Priorities and Budget

- Developing new technologies and enhancing existing infrastructure to support electrification continues to be an active area of research. The Government of Canada's Budget 2022 proposed 600 million CAD (412.8 million EUR; 443.4 million USD) over seven years starting in 2022-2023 to Natural Resources Canada for the Smart Renewables and Electrification Pathways Program to support additional renewable electricity and grid modernisation projects [7].
- The Canadian Renewable Energy Association (CanREA) launched the Electricity Transformation Hub, supported by funding from Natural Resources Canada. The Hub is intended to be a knowledge-transfer tool to support electricity utilities and system operators in accelerating their decarbonisation efforts, facilitating the integration of the larger amounts of wind energy, solar energy and energy

storage needed to support electrification and Canada's net-zero GHG-emission targets [8].

- Reducing the use of fossil fuels for heating and electricity in remote communities by increasing the use of local renewable energy sources and energy efficiency remains a priority. On April 25, 2022, an additional 300 million CAD (206.4 million EUR; 221.7 million USD) was announced, available through 2027, to further support clean energy projects in Indigenous, rural and remote communities [9].

### National Research Initiatives and Results

- The Geological Survey of Canada (GSC) completed a study that reviews the current offshore wind geotechnical characterisation of methods and provides context for Atlantic Canada-specific soil conditions [10].
- The University of New Brunswick, in collaboration with Natural Resources Canada, Emera and NB Power, published a study on emerging short-term wind power forecasting techniques that aimed to improve the accuracy of icing and ramp forecasting algorithms compared to existing models [11].
- The Canadian Wind Energy Research Network held its second annual forum in Spring 2022. The Research Network serves as a national forum for technical wind energy R&D specifically focused on the needs of Canadian stakeholders and aims to accelerate the uptake and impact of research products and ensure that industry and government have an active role in shaping research direction [12].

## Test Facilities and Demonstration Projects

- Nergica, in collaboration with Pacific Northwest National Laboratory (PNNL) under IEA Wind Task 41, published a study characterising the risk of ice throw from small wind turbines. Focusing on turbines up to 100 kW in size, the study used a data-driven approach to quantify the potential risk from icing on small wind turbines and discussed means of mitigating risk to nearby communities [13].
- The Wind Energy Institute of Canada (WEICan), in collaboration with Nova Scotia Power Inc. and Enercon, completed a study on the provision of ancillary services, including power-frequency response and automatic generation control (AGC) from IEC Type 4 turbines. Empirical data gathered at the 50.6 MW Nuttby Mountain wind farm in Nova Scotia was used to inform the analysis [14].

## Collaborative Research

- In June, Nergica announced a new joint research project with Tarquti Energy and Hydro-Québec. Funded by the Natural Sciences and Engineering Research Council of Canada (NSERC) and partners, this project seeks to optimise the integration of renewables in off-grid networks in Nunavik, a region of northern Quebec where several remote communities rely on petroleum-based fuels for the majority of their energy needs [15].
- Through collaboration under Task 46, WEICan contributed to a study on wind turbine blade leading edge erosion. Operational data from WEICan's full-scale wind research park in North Cape, PEI, along with five other sites, was used to inform the analysis [16].



**Photo 1:** The three-phase 409 MW Jenner Wind Project, under construction in Alberta, features 55 Enercon E-160 EP5 E3 turbines. Credit: ENERCON Canada Inc.

## Impact of Wind Energy

### Environmental Impact

- Modelling results continue to show wind as a major contributor to a significant portion of future growth in the generation of electrical capacity required to meet Canada's climate and energy targets. A report issued by the Canadian Climate Institute suggested that Canada's electricity generation capacity will need to be 2.2 to 3.4 times bigger in 2050 than today and that the share of wind and solar energy in Canada's electricity supply will need to increase from 6% today to between 31% and 75% of total generation to meet net-zero targets [17].
- Nova Scotia announced it is

moving ahead with a request for proposals (RFP) for wind and solar energy projects that will supply 10% of the province's electricity. These projects will generate 350 megawatts of low-cost renewable energy and reduce Nova Scotia's greenhouse gas emissions by more than one million tonnes annually. The province has committed to having 80% of its electricity needs supplied by renewable energy by 2030 [18].

- The City of Edmonton announced a 78 MW Renewable Attributes Purchase Agreement ("RAPA") with Capstone Infrastructure to purchase renewable electricity over 20 years from Capstone's 192 MW Wild Rose 2 Wind Farm, currently in development. This represents the

largest long-term procurement of renewable energy attributes by a Canadian city to date and is part of the City's Community Energy Transition Strategy, which set targets to be carbon neutral in its corporate operations by 2040 and for the City as a whole to achieve net zero GHG emissions by 2050 [19].

### Economic Benefits and Industry Development

- CanREA estimated that employment in the Canadian wind energy industry amounted to approximately 4,462 person-years by the end of 2022.

- A study by Clean Energy Canada and Navius Research projects that the number of clean energy jobs in Canada will grow from about 388,000 in 2020 to between 1.6 and 2.7 million in 2050, depending on which policies are enacted. Renewable electricity jobs are projected to grow from 132,000 in 2020 to 193,000 – 198,000 in 2050, most of which are associated with wind and solar [20].

## Next Term

- In March 2023, the Minister of Environment and Climate Change Canada announced the start of Regional Assessments in Nova Scotia, Newfoundland, and Labrador under the federal Impact Assessment Act. Independent committees will engage with Indigenous groups, non-government organisations, public stakeholders, and federal and provincial authorities to inform future project-specific impact assessments and decisions for offshore wind projects.
- In May 2023, the Minister of Natural Resources introduced amendments to the Atlantic Accord Acts in Parliament, which will expand the mandates of the Offshore Boards in Newfoundland and Labrador and Nova Scotia to include offshore renewable energy development.
- According to CanREA, up to 3.1 GW of new wind capacity could be installed in 2023, primarily in Alberta and Saskatchewan.

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