ENERGY SERIES: Part 2

Hydro-Wind Evolution

Summary

This report is the second installment of a two-part series exploring key trends and emerging technologies in the energy sector. *Part 1: Powering Up on Nuclear* was published earlier in January. Part 2 delves into hydro and wind power.

- Global and Canadian wind power capacity to grow at an accelerated pace
- Churchill Falls: long-term energy security for Quebec, game-changer for Newfoundland and Labrador's public finances
- Expanding onshore wind power: a key component of Hydro-Quebec's 2035 Action Plan
- Hydro-wind power mix: at the centre of Quebec, British Columbia and Manitoba energy plans
- Wind-powered hydrogen gaining ground in Nova Scotia and Newfoundland and Labrador
- Offshore wind: the next step for Nova Scotia

Wind Power—In the Midst of the Global Energy Transition

The global energy transition, led by the electrification of the transport sector, is driving a significant increase in energy demand. McKinsey's latest report predicts global energy demand will grow by 11% to 18% by 2050, driven by emerging economies. ExxonMobil has the same view, projecting a 15% rise in global energy demand by 2050. U.S. electricity consumption is poised to jump by 15% to 20% over the next decade, according to the U.S. Department of Energy.

Amid this surge in demand, Bloomberg NEF reports double-digit pace growth in clean energy investment. Global energy investment likely exceeded US$3 trillion in 2024, according to the International Energy Agency (IEA). The IEA says clean energy investments exceed those in fossil fuels, nine years after the Paris Agreement of 2015.

By 2030, renewables are projected to account for nearly half of the global energy mix. With solar, wind energy is becoming an imperative source of renewable power. The World Economic Forum (WEF) reported a staggering 50% increase in installed global wind capacity in 2023. China leads the world, leading many to believe that the country may have already reached a peak in greenhouse gas emissions. In the U.S., wind has become the second largest source of clean energy, behind nuclear power, as discussed in our report *Powering Up on Nuclear*.

Advancing Technologies, Falling Costs

The Levelized Cost of Electricity (LCOE) of wind power, which measures the cost per unit of energy, factoring in capital and operating expenses, has been steadily decreasing globally, thanks mostly to China. According to Bloomberg NEF, wind power—along with solar—is now the cheapest form of new electricity in most countries. The biggest progress has come from technology advancements, such as replacing older turbine blades with more efficient ones and reducing operating and maintenance expenses. The lifespan of a wind farm has increased from 20 years to 25-30 years, also contributing to lower the LCOE. Wood Mackenzie reports that the LCOE for renewable technologies, including wind and solar, fell by 4.6% in 2024 due to a drop in capital costs reversing part of the pandemic-driven inflation period. According to Wood Mackenzie, continued technological progress could lead to a double-digit reduction in wind power's LCOE by 2060. Additionally, decommissioning wind farms is less complex than decommissioning nuclear plants.

Canada—Opportunities for Further Progress in the Energy Transition

Where does Canada stand in the global energy transition? According to a recent United Nations report, Canada's current policies and investments are not enough to limit global temperature rise by 2050. The WEF's Energy Transition Index ranks Canada 27th, behind most developed countries. Scandinavian nations top the list, driven by their strong electric vehicle market. Despite this relatively low 27th ranking, the WEF praised Canada for making the energy transition more equitable, with private companies and crown hydro corporations working closely with First Nations to ensure their involvement in the transition. Additionally, according to data compiled by the Institut de l'énergie Trottier, Canada's per capita energy consumption is twice the OECD average due to the presence of energy-intensive industries.

Hydropower— Quebec Secures Long-Term Stability with Churchill Falls Deal

Canada ranks among the top three countries for the percentage share of electricity generated by low-carbon sources—80%, according to the 2023 Statistical Review of World Energy. This figure has likely improved since the closure of Alberta's last coal-fired power plant in the summer of 2024.

The abundance of hydropower notably drives the low carbon footprint of electricity generation in several provinces, particularly Quebec. However, about half of Quebec's total energy consumption still comes from fossil fuels, meaning further investments in renewable energy by Hydro-Québec (HQ) are needed to support decarbonization.

In May 2024, HQ unveiled its ambitious Action Plan 2035. The plan aims to add 8,000 to 9,000 MW of capacity by 2035—up from the current 37.2 GW—to meet the expected doubling of electricity demand by 2050. Three-quarters of this new capacity will be dedicated to decarbonizing economic activities, while the rest will support economic and population growth, including new data centers.

HQ plans to invest between $155 billion and $185 billion by 2035, or roughly $17 billion per year. In 2023, HQ's investments totaled $4.9 billion, up from $4.3 billion in 2022. This major ramp-up in investment is attracting attention in the Canadian bond market. To support Action Plan 2035, HQ also launched an economic reconciliation strategy with First Nations and Inuit in late 2024.

The new economic strategy will also facilitate the next phase of the Quebec-Newfoundland & Labrador hydro agreement. In December 2024, the two provinces reached a major deal in principle to secure long-term energy security in Quebec. The 50-year Churchill Falls agreement includes 7,200 MW of energy, with two key segments. The first involves expanding the generation capacity at Churchill Falls by 5,000 MW, while the second will develop a large facility at Gull Island with a capacity of 2,200 MW.

Expanding Onshore Wind—A Cornerstone of Quebec's Energy Strategy

The Churchill Falls deal reflects a simple reality: there are few remaining options for building new dams in Quebec in the Côte-Nord region or Northern Quebec.

At the same time, Quebec has significant untapped wind power potential. As a result, tripling the province's wind power capacity by adding 10,000 MW has become an important goal in HQ's 2035 plan. HQ currently estimates its wind capacity utilization at around 35%, similar to the U.S. average (at 37%), according to the Center for Sustainable Systems at the University of Michigan. Action Plan 2035 assumes a conservative capacity utilization rate of 15%, which should be achievable. New wind farms from HQ are expected to have a lifespan of about 30 years.

In summer 2024, HQ announced a major $9 billion wind farm project in the Saguenay-Lac-Saint-Jean region, with 400 new turbines, making it one of the largest in North America. Another large wind project was announced in Quebec's Lower St. Lawrence region in fall 2024. Unlike nuclear, new wind farms require significant land; however, this is less of a challenge in Quebec compared to places like Japan and New Zealand, where land availability is a bigger constraint.

Expanding wind power capacity will also reduce the concentration risk. Currently, 80% of Quebec's hydropower comes from just two regions, according to the HEC 2024 energy report. In late 2024, reservoirs were at a 10-year low, due in part to the 2023 wildfires and a lack of rain in 2024. This impacted the crown corporation's financial performance. 70% of Quebec's current wind power production is also concentrated in just two regions, though this share is expected to decrease with upcoming developments.

Furthermore, wind power and hydropower are complementary energy sources. Hydropower's flexibility allows to adjust energy output based on weather conditions or peak demand, an ideal backup for the intermittent nature of wind power. This combination helps ensure a reliable and stable energy supply for the province.

Here Comes the Sun

The U.S. is a global leader in solar photovoltaic technology, driven in large part by the U.S. President Biden's Inflation Reduction Act. According to the Solar Energy Industries Association, in the first quarter of 2024, the U.S. added a record 11.8 GW of solar capacity, making it the second-best quarter on record after the last quarter of 2023. Solar power accounted for three-quarters of all new electricity generation, thanks to its low cost and quick installation time. Texas has even surpassed California in total solar capacity.

According to a HQ's renewable energy report, most of Quebec receives more sunlight than Germany, which generates 82 GW of solar power, one of the highest in the world. Currently, two small solar generating stations in the Montérégie region are producing 9.5 MW. However, this is set to change. HQ plans to launch calls for tenders for a total block of 300 MW of solar capacity, with the goal of connecting it to the grid by 2029. The first call for tender—for at least 150 MW—is expected by the end of 2024, with a second round of bidding planned for 2026.

British Columbia—Wind Projects Set to Follow After Site C Hydro Completion

Like Quebec, British Columbia is increasingly relying on a complementary mix of wind and hydropower. BC Hydro is gearing up for a very busy period, with a $36 billion capital plan for 2024–2034 that represents a 50% increase from the previous plan. In Fort St. John, the reservoir for the Site C hydro project has been completed, and the first of six generating units began operations in October 2024. All units are expected to be in service by fall 2025. Once completed, Site C will produce about 5.1 TWh of electricity annually, increasing BC Hydro's supply by 8%.

In December 2024, the BC government approved nine wind power projects, which together will generate nearly the same amount of electricity annually as Site C (5 TWh). These projects will cost between $5 billion and $6 billion, and are the result of a competitive clean power call by BC Hydro, the first of its kind in 15 years. This 8% addition to BC Hydro's power capacity surpasses the 5% target set last spring, driven by an impressive response from the private sector. Indeed, private companies submitted proposals three times higher than originally anticipated. The wind projects are set to begin in 2028, with full completion by 2031. Eight of the nine projects will have 51% Indigenous equity ownership.

The combination of Site C and the nine wind farms should provide enough power to meet BC's medium-term electricity demand. BC Hydro's mid-2023 projection incorporates a 15% cumulative jump in demand by 2030, driven by residential, industrial, and commercial sectors.

Altogether, wind power is projected to increase over time its current 4% share of BC's electricity capacity, according to the Canada Energy Regulator. With long-term energy demand poised to expand beyond 2030, BC Hydro plans to issue additional calls for wind projects to meet future needs. This approach will reinforce energy sustainability and improve diversification. Solar energy is another potential source of diversification, as 30% of the private sector proposals in last spring's call were for solar projects.

Manitoba's Next Step: Expanding Wind Power

Manitoba Hydro currently has a generating capacity of 6.1 GW. Last fall, the NDP government introduced its Affordable Energy Plan, which includes plans to develop wind power in partnership with First Nations. It is still unclear whether Manitoba Hydro will open the market to independent producers through a call for proposals, or if it will fully own and develop future projects itself. The province aims to at least double electricity output over the next two decades, primarily by adding 600 MW of wind power. Currently, two wind projects are in operation. Northern Manitoba is particularly well-suited for wind energy. New hydro projects appear less likely given the high debt burden tied to past developments.

Newfoundland & Labrador: Wind-Powered Hydrogen—Progress and Challenges

Newfoundland & Labrador's Plan for Development of the Renewable Energy Industry emphasizes the province's substantial wind energy potential. Alongside this, the province has introduced a Hydrogen Development Action Plan. The province's energy initiatives, particularly the export of hydrogen-ammonia, could play a critical role in assisting Europe—especially Germany—meet its decarbonization goals and reduce geopolitical risks. While commercialization is still a work in progress, there has been notable advancement. According to the Department of Industry, Energy and Technology, in 2023, four wind hydrogen projects were selected following the province's call for bids. Furthermore, Canada and Germany signed a memorandum of understanding in spring 2024 to further support these efforts.

The Burin Peninsula wind project could begin construction in 2025. However, the most advanced wind-to-hydrogen project is Project Nujio'quonik, which includes export facilities at the Port of Stephenville. Initial exports to Europe could begin after 2025, as long as the European hydrogen market works through its challenges. In the meantime, the hydrogen produced in N&L could meet growing domestic energy demands.

The European Commission set a target of producing 20 million tonnes of renewable hydrogen annually by 2030, with half of that expected to come from imports. However, Bloomberg NEF warns that global policy targets are likely to be missed. One challenge relates to the development of hydrogen pipelines, according to the World Economic Forum. On a positive note, Germany has recently added hundreds of kilometers of pipelines, with hydrogen expected to flow through them for the first time this year.

Transportation costs present another challenge to exporting North American hydrogen to Europe. According to an article in the International Journal of Hydrogen Energy, there is no consensus on the most efficient method for transporting hydrogen over long distances, which is more complex than shipping oil. Estimates of transportation costs for hydrogen and its derivatives vary widely due to differing technological and economic assumptions. Lower transportation costs would support the transition, according to a post by the World Economic Forum. Additionally, Germany's preference for "friendshoring" could make it harder for North American hydrogen suppliers, including Newfoundland & Labrador, to compete.

While the future of wind-powered hydrogen remains uncertain, Newfoundland & Labrador stands to gain significantly from the new Memorandum of Understanding (MOU) on Churchill Falls. The draft deal, passed by the province's legislature in January, will provide more energy capacity, supporting business growth. The addition of an escalator clause in the deal will also better align future revenues with energy market conditions.

The MOU includes approximately $227 billion in revenue over 50 years, with most of it coming from rates Hydro-Québec will pay for new power contracts and hydro developments. Newfoundland & Labrador will receive an extra $1 billion annually until 2041, with that amount increasing to nearly $4 billion per year after 2056. This is a notable change for the province, which had a net debt of $17.7 billion and market borrowings of $19.3 billion at the end of FY 2023–24.

Nova Scotia—New Onshore Wind Capacity on the Horizon

According to Canadian Renewable Energy Association, wind power currently accounts for about 7% of Canada's total electricity supply, with all existing projects consisting of onshore wind farms. Nova Scotia is a leader in this field, operating more than 300 commercial wind turbines.

The province is actively advancing its efforts to reduce domestic carbon emissions and—like Newfoundland & Labrador—is working toward exporting green hydrogen to Europe through ammonia conversion. Nova Scotia introduced its Green Hydrogen Action Plan over a year ago, setting the stage for significant progress in renewable energy.

Since the fall of 2023, the province has approved three new onshore wind projects, with a total capacity of 527 MW. In addition, the Canada Infrastructure Bank announced a $224 million loan in January 2025 to support a 168 MW onshore wind farm. This project will supply power to the industrial sector and includes a 10% equity stake for First Nations. Commercial operations are expected to begin in 2026.

Offshore Wind: the Next Big Step for Nova Scotia

In addition to expanding onshore wind, offshore wind is a key part of Nova Scotia's energy strategy. Offshore wind is generally stronger and more consistent than onshore wind, leading to a higher capacity factor. Offshore wind also allows for the construction of larger, taller turbines, increasing power density. According to Bloomberg NEF, the cost of electricity from offshore wind is now competitive with coal, though it remains more expensive than onshore wind.

Currently, there are no offshore wind projects in operation or under construction in Canada. However, federal legislation passed the Senate in Ottawa last fall, establishing a solid legal framework for future projects. Nova Scotia is well-positioned to become a leader in the offshore wind industry, with wind speeds off its coast comparable to those in parts of Europe near the North Sea.

The most promising project is the Nova East Wind project, which aims to generate 300–400 MW of power from a location 20–30 km off Goldboro, pending regulatory approval. The Nova Scotia government plans to open a call for bids for a 5 MW offshore wind project in 2025, with a goal of generating offshore wind energy by 2030.

Nova Scotia's upcoming push for offshore wind energy is likely to attract positive attention and traction from financial markets, especially considering the success of offshore wind in Europe. The UK, Denmark and the Netherlands are among global leaders. In Denmark, for example, offshore wind provides about a quarter of the country's electricity. The first offshore wind farm was built there in the 1990s. However, Denmark's recent auction for new offshore projects didn't attract any bids, prompting some to suggest that the government should revise its auction rules and adjust market incentives.

Nonetheless, several European countries with access to the North Sea plan to more than triple their offshore wind capacity by 2050. In tandem, there has been strong demand in bond markets for offshore wind projects. For instance, Iberdrola, a Spanish energy company, successfully issued a €600 million green bond in the fall of 2024, marking its largest bond issue in 15 years. Similarly, Polish power company Polenergia raised €174 million through a 5-year bond last fall to finance offshore wind projects in the Baltic Sea, with the deal being oversubscribed two times.

Takeaway

The wind energy's global footprint is accelerating with recent investments. Technological innovations and sizeable cost reductions will contribute to add further wind capacity across various locations in Canada. The versatile nature of wind makes it a good match with the reliable hydropower benefiting notably from a large storage capacity. Quebec, British Columbia and Manitoba are among Canadian provinces pushing for the hydro-wind power mix, to match future energy demand and to push decarbonization. In the Atlantic Region, Nova Scotia and Newfoundland and Labrador are making progress toward commercializing of wind-powered hydrogen, although challenges remain particularly around the cost and logistics of transporting hydrogen to the European market.

We want to hear from you

Sales & Trading

Robert Sforza, CFA
Head of Distribution, Money Market & Repo
SforzaR@vmbl.ca | 514 350 2905

Etienne Bisaillon, CFA
Vice President, Trader
BisaillonE@vmbl.ca | 514 350 2905

Kacper Jurga, MS
Vice President, Trader
JurgaK@vmbl.ca | 514 350 2905

Benoit Martineau, MS
Vice President, Trader
MartineauB@vmbl.ca | 514 350 2907

Jean-Philippe St-Laurent, CFA
Vice President, Sales
StLaurentJP@vmbl.ca | 514 350 2904

Laura Chelaru, CFA
Vice President, Sales
ChelaruL@lb-securities.ca | 416 865 5811

Debt Capital Markets

Benoit Lalonde, CFA
Vice President & Head DCM
LalondeB@vmbl.ca | 514 350 2904

Massimo Morabito, CFA, FRM
Director, Debt Capital Markets
MorabitoM@vmbl.ca | 514 350 2904

Zakaria Hammama
Associate, Debt Capital Markets
HammamaZ@vmbl.ca | 514 350-2904

LBS Economics

Sébastien Lavoie
Chief Economist
LavoieS@vmbl.ca | 514 213 4571

Alexandre Larose
Economic Analyst
LaroseA@vmbl.ca | 514 350-2800

Visit us on the web

Fixed Income

Economic Research & Strategy