



Minds, Molecules and Electrons:

**A Report on Energy, the Energy
Transition and Innovation in
Newfoundland and Labrador**

Scott McKnight, PhD

Innovation in Extractive Industries,
Memorial University of Newfoundland

May 2025

This project is supported by the Hebron and Hibernia Projects with project management and delivery support from Energy Research & Innovation Newfoundland & Labrador.

Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author and do not necessarily reflect the views of Energy Research & Innovation Newfoundland and Labrador or its members.

Table of Contents

1. Executive Summary.....	1
2. Overview: Minds, Molecules and Electrons.....	2
3. NL as an Energy Warehouse	3
3.1 More Wealth but Less Emissions.....	3
3.2 The Power Sector: Clean and Abundant.....	4
3.3 Oil, Oil Fired Plants and an Idle Refinery	5
3.4 Big Consumers: Industry and Transport.....	9
4. Where to go from Here?	10
4.1 Emissions and Pledges to Cut Emissions	10
4.2 NL as Energy Exporter – But Possibly Very Different This Time	10
4.3 Carbon Capture and Storage: A Lucrative Niche for NL?	11
4.4 Still So Much Oil, but what to do with it?.....	12
4.5 What to do with Natural Gas?	14
4.6 Joining the Wind and Hydrogen Rush	15
4.7 Mining and ‘Critical Minerals’: New Growth Engine but to what extent?	17
5. Big Factors, Big Risks, and Some Old Habits	21
6. Closing Thoughts: Doing What and To What Ends	22
Glossary.....	24

Figures & Tables

Figure 1: Operational oilfields, basins and refinery in Newfoundland and Labrador	6
Table 1: Offshore oilfields in Newfoundland and Labrador (by production).....	7
Table 2: Government-approved wind-hydrogen projects in NL	16
Table 3: Major producing mines in Newfoundland and Labrador	19

1. Executive Summary

The province of Newfoundland and Labrador (NL) on Canada's northeast Atlantic coast punches above its weight in energy—in producing carbon-intensive sources like petroleum and low-carbon ones like hydroelectricity; in exporting energy to neighbouring provinces, the United States, and the global economy; as well as by consuming energy at disproportionately high rates for a province of roughly 546,000 people.

Few places face higher stakes than Newfoundland and Labrador when it comes to the low-carbon energy transition. Opportunities, threats and hard choices are already making their presence felt, with big questions yet to be fully answered:

- Should the province continue or even expand oil operations, including developing valuable reserves further offshore, at the expense of swiftly reducing carbon emissions and possibly sacrificing NL's commitments to 'net zero' by 2050?
- Alternatively, should the province hold oil production steady, thereby preventing the development of valuable reserves with severe consequences for the province's fragile finances and attractiveness as a hub for investment?
- How can the province prioritize core activities of the low-carbon economy, such as wind, hydrogen and mining 'critical minerals', without neglecting an oil and gas industry that has for several decades provided significant rents and generated high-paying jobs in the province?
- What will be the sources of advantage of NL's companies, workforce and public institutions in a global economy that is both attempting to decarbonize while also fragmenting and restructuring from trade tensions and disruptive policy changes?

There is nothing inevitable or straightforward about the future trajectory of the province's energy system; the political economy built around it; and areas of innovation that NL's government, its companies, and public institutions will prioritize. Regardless where a future innovation strategy may focus and on which activities it commits resources, clarity and sustained commitment will be needed for that strategy to succeed.

This report emerged from a two-day seminar in December 2024 in St. John's entitled 'Innovation and the State of the Energy Transition', which was led by presenter and author [Scott McKnight](#). The seminar brought together various energy-focused stakeholders in industry, provincial and federal government, as well as from academic institutions like Memorial University and College of the North Atlantic. The seminar provided a global overview of sectors and trends in energy, such as recent shifts in industrial policy, mining in the energy transition, the oil and gas markets, the wind and solar photovoltaics (PV) markets, as well as China's emergence as leader in deploying and manufacturing low-carbon technologies. Most importantly, the seminar provided a forum for participants to interact and share ideas on energy- and innovation-related matters relevant to the province. This seminar and discussions with these stakeholders informed the contents and conclusions of this report.

This project is supported by the Hebron and Hibernia Projects with project management and delivery support from Energy Research & Innovation Newfoundland & Labrador.

Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author and do not necessarily reflect the views of Energy Research & Innovation Newfoundland and Labrador or its members.

2. Overview: Minds, Molecules and Electrons

There are few places where the low-carbon energy transition presents as many risks and opportunities as it does for Newfoundland and Labrador (NL). The province produces significant amounts of carbon-intensive energy like petroleum, which it largely exports to foreign countries, as well as low-carbon energy like hydroelectricity, which it exports to neighbouring provinces. The province's overall energy consumption is among the lowest of Canadian provinces and territory, but among the highest on a per capita basis.

On the one hand, NL features several advantages that could facilitate innovation in the low-carbon economy. Most famously, NL possesses an abundance of natural resources—aboveground in the form of hydroelectric power and wind; subsoil with minerals like iron ore and nickel, which will be needed for low-carbon technologies; as well as subsea in the form of petroleum, fisheries, and sedimentary basins to store carbon. For another, the province's roughly 546,000 people are legendarily resourceful, with pockets of expertise in various energy-focused industries and connected through close-knit networks.¹ Moreover, the government of NL regularly spends significant sums on public goods like healthcare, education, and infrastructure, which could expedite innovation in low-carbon activities and industries.² The province is also home to several important post-secondary institutions like Memorial University (MUN) and College of the North Atlantic (CNA), both of which consistently contribute by training workers and conducting research across fields that are relevant to the province, including in both fossil-fuel based and renewable industries.³

¹ Alvin Simms and Robert Greenwood, 'Newfoundland and Labrador,' State of Rural Canada Report (2015), <https://sorc.crrf.ca/nl/>.

² Dan Breznitz, a leading scholar on innovation, defines innovation as 'the complete process of taking new ideas and devising new or improved products and services ... from the first vision, design, development, production, sale, and usage, to the after-sale aspects of products and services.' Breznitz, *Innovation in Real Places* (Oxford: Oxford University Press, 2021), p. 3.

³ Scott McKnight, 'The state of innovation in Newfoundland & Labrador and the role of Memorial University with the regional innovation system: Background report for the OECD's Entrepreneurial, Education, Collaboration and Engagement network,' St. John's, NL: Harris Centre, June 2022, <https://www.mun.ca/harriscentre/media/production/memorial/administrative/the-harris-centre/media-library/reports/reports/OECD%20Background%20Report%20McKnight.pdf>.

NL is a significant oil producer as well, with ample reserves that have yet to be developed.⁴ Since commercial oil production began in the late 1990s, the oil and gas (O&G) industry has become a major pillar of public finances, employer, funder of research and training, and across-the-board contributor to the local economy. Similarly on this carbon-intensive side of the ledger, the province's large and varied transport sector functions almost entirely by combusting fossil fuels like gasoline and diesel, with minimal uptick in battery-powered vehicle sales. Likewise, a sustained increase in mining activity—which the government and certain mining companies have long promoted and whose products will be in much greater demand by metal-intensive low-carbon technologies—would very likely increase fossil fuel use given the high energy demands of mining operations, and therefore slow further reductions in the province's carbon footprint.

The challenges are many, but so too are the opportunities. NL's abundance of carbon-emitting resources, as well as the legacy assets, innovation networks and political economy built around fossil fuels could be harnessed to make it so NL's companies, workers and supporting academic institutions are active contributors in the energy transition. However, there is nothing inevitable or straightforward about the future orientation of the province's energy system. Nor is it clear how innovation will be pursued, tested or ignored in years to come. However, through collaboration, strategic planning and sustained commitments, these myriad challenges could be converted into long-term growth and prosperity for the province and its people.

3. NL as an Energy Warehouse

3.1 More Wealth but Less Emissions

We start with several basic energy-related facts about Newfoundland and Labrador (NL).

To start, burning fossil fuels accounts for about 90% of the province's GHG emissions, with industry and transport sectors as the major users thereof, as we'll see [below](#).⁵ Likewise, NL's real gross domestic product (GDP) has experienced impressive growth during this period, being nearly 75% greater than it was in 1990. For example, during the twenty-year period from 1998 to 2017, average wages in NL went from being 13% *below* the Canadian average to 6% *above* it. In another example of gains in material standards of living, wages for those in professional

⁴ C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) estimates NL's remaining offshore reserves and resource potential total 2.5 billion barrels of oil, about the same as the United Kingdom and Indonesia, as well 12.6 trillion cubic feet of natural gas. Canada's Oil and Natural Gas Producers (CAPP), 'Canada's offshore oil and natural gas industry in Newfoundland and Labrador' (May 2018), https://www.capp.ca/wp-content/uploads/2024/01/Canada_s_Offshore_Oil_and_Natural_Gas_Industry_in_Newfoundland_and_Labrador-320561.pdf.

⁴ The author would like to thank one of the seminar's participants for this catchy description.

⁵ GNL, *Climate Change Action Plan 2019-2024* (St. John's), https://www.gov.nl.ca/ecc/files/ClimateChangeActionPlan_MidtermUpdate.pdf, p. 1.

services grew even sharper, rising 46% within the province faster than those of their counterparts in Canada between 2001 and 2017.⁶ Furthermore, the province's population has returned to its historic highs of about 560,000 inhabitants, a level not seen since about 1990-91, without *also* increasing the province's carbon footprint.

Despite these gains in living standards and a return to population growth, NL's total greenhouse gas (GHG) emissions have decreased in recent decades, with levels in 2022 about 10% lower than levels in 1990.⁷ Put simply, the province of NL now has more people enjoying higher incomes and producing more but is emitting less carbon than it did several decades before. We now turn to the sources of this energy consumption and production.

3.2 The Power Sector: Clean and Abundant

The decrease in NL's greenhouse gas emissions can be explained by several things.

For one, NL famously boasts a very low-emitting power sector. For example, NL's power sector has an impressive 8.68 gigawatts (GW) of electricity-generating capacity, which accounts for about 6% of Canada's total capacity, yet emits barely 1% of the country's GHGs from power generation.⁸ This admirable discrepancy is because some 97% of NL's electricity now comes from 'clean' or low-carbon power sources. Virtually all of this is generated by large and small-scale hydro projects, with by far the largest of this fleet being the Churchill Falls station in Labrador.⁹ In fact, NL is one of the largest producers of hydroelectricity in Canada, third only to much more populous provinces like British Columbia and Québec that have over ten and 15 times more people respectively than NL.

NL has also added hydroelectric capacity in recent years, with no recent project larger or more controversial than the 824-megawatt (MW) hydroelectric power station at Muskrat Falls. These

⁶ Jupia Consultants, *Newfoundland and Labrador Offshore Oil and Gas Industry: Economic Impact Report—Current Impact and Future Potential* (St. John's: NOIA, 2018), https://energy.nl.ca/wp-content/uploads/2020/07/ITP_EconomistReport_FINALweb.pdf

⁷ Put differently, NL emitted 8,606 kilotonne (kt) CO₂e in 2022 compared with 9,470 kt CO₂e in 1990. Government of Newfoundland and Labrador (GNL), 'Greenhouse Gas Information—Environment and Climate Change', <https://www.gov.nl.ca/ecc/occ/greenhouse-gas-data/> (accessed December 2024).

⁸ Canada Energy Regulator (CER), 'Provincial and Territorial Energy Profiles—Newfoundland and Labrador', <https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-newfoundland-labrador>.

⁹ The Churchill Falls hydroelectric generating station, with capacity of 5,428 MW and the second-largest hydropower plant in Canada, accounts for about 75% of the province's hydroelectric generation capacity. Smaller though still large generating stations include Muskrat Falls (824 MW) and Bay d'Espoir 729 MW). All three are owned and operated by NL Hydro. NL Hydro, 'Our Generation Assets', <https://nlhydro.com/about-us/our-electricity-system/our-generation-assets/>.

additions have reduced the GHG intensity ([Glossary](#)) of NL's power sector to well below *one-fifth* the national average.¹⁰ NL has even greater potential to generate renewable energy on top of what has already been installed, including dozens of sites for small-scale hydroelectric plants on the island of Newfoundland alone.

The province also boasts vast but almost entirely untapped wind resources, a fact that has sparked serious interest in recent years ([more below](#)). Although some 97% of NL's electricity comes from hydropower, wind and bioenergy also contribute to this clean energy mix, generating less than 1% and 0.2% of power in the province respectively.

NL's power-generating capacity greatly exceeds the province's demands, which has enabled NL to be a significant net exporter of electricity to neighbouring provinces, notably Québec, Canada's largest electricity-consuming province. In 2023, NL's net exports of electricity amounted to 34.5 terrawatt hours (TWh).¹¹ A near-term challenge and opportunity is to build transmission and distribution lines to move surplus power from Muskrat Falls and potentially Gull Island ([Glossary](#)) to maritime Canada and even to the United States, enhancing stability on the grid and adding to the province's revenues. In late 2024, the original Churchill Falls deal reached in 1969, long seen as lopsided within NL for the extremely low prices that Québec paid, was replaced with better terms in a memorandum of understanding signed between the premiers of the two provinces. The agreement has helped stabilize the relationship, while also capturing significantly more revenue to NL.¹²

3.3 Oil, Oil Fired Plants and an Idle Refinery

Apart from hydropower's significant contribution in the province, NL burns oil to generate electricity as well. Given the province's relatively small population spread over a territory that is larger than the size of Japan, NL is also home to nearly two dozen small-scale isolated diesel-

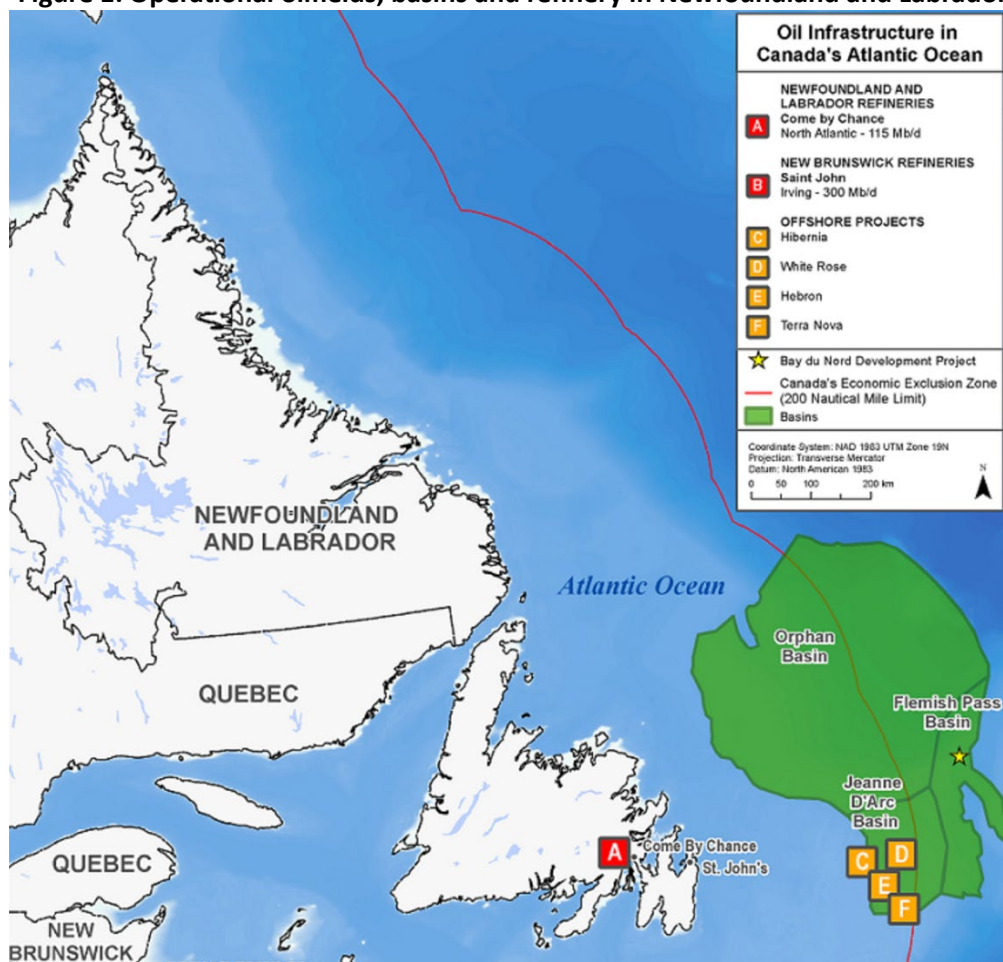
¹⁰ The GHG intensity of NL's electricity grid was 17 grams of CO₂e per kWh electricity generated in 2022, 15% less than the province's 2005 levels of 20g of CO₂e per kWh. The national average in 2022 was 100 g of CO₂e per kWh. CER, 'Provincial and Territorial Energy Profiles—Newfoundland and Labrador', <https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-newfoundland-labrador>. On the Muskrat Falls project, cost overruns, delays, governance issues and questions over transparency were among the many parts of this controversy. Though initially estimated at CAD\$7.4 billion in 2012, the project's cost ballooned to some \$12.7 billion by 2020. Terry Roberts, 'Scathing Muskrat Falls inquiry report lays blame on executives', *CBC News* (10 March 2020), <https://www.cbc.ca/news/canada/newfoundland-labrador/muskrat-falls-inquiry-misguided-project-1.5492169>.

¹¹ CER, 'Provincial and Territorial Energy Profiles—Newfoundland and Labrador', <https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-newfoundland-labrador>.

¹² Benjamin Shingler, 'Why Quebec struck a new hydro deal with Newfoundland and Labrador', *CBC News* (13 December 2024), <https://www.cbc.ca/news/canada/montreal/hydro-quebec-newfoundland-churchill-deal-1.7409673>.

powered systems. The number of these plants has been growing at faster rates than residential and commercial sectors despite these plants serving only about 2% of the utilities' customers.¹³

Figure 1: Operational oilfields, basins and refinery in Newfoundland and Labrador



Source: Canada Energy Regulator (CER), 'Market Snapshot: Atlantic offshore oil production and the Law of the Sea', (updated 2019-03-06), <https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/market-snapshots/2019/market-snapshot-atlantic-offshore-oil-production-law-sea.html>.

The largest and most notable of these is the 490 MW oil-fired generating station at Holyrood, about 40 kms southwest of St. John's. Prior to the Muskrat Falls power station coming online, the 35-year-old thermal power station at Holyrood provided somewhere between one-fifth to

¹³ GNL, 'Review of the Newfoundland and Labrador Electricity System', <https://www.gov.nl.ca/iet/files/publications-energy-review-of-nl-electricity-system.pdf>; Department of Industry, Energy and Technology (IET), 'Electricity', <https://www.gov.nl.ca/iet/energy/electricity/>.

one-sixth of NL’s electricity annually.¹⁴ These oil-fired plants are perennial topics of discussion due to their environmental and health impacts. Despite plans to close the Holyrood plant and to deploy more renewable energy to replace some of these diesel systems¹⁵ as part of the province’s ‘net zero’ by 2050 commitment ([below](#)), the Holyrood power station will stay in operation till at least 2030, serving as an important—though carbon-emitting—backup source for years to come.¹⁶

Table 1: Offshore oilfields in Newfoundland and Labrador (by production)

Name	Year discovered (start of production)	Production (bpd)	Rec. reserves (m. barrels of oil)	Operators (lead operator first)
Hebron	1980 (2017)	115,011	707	ExxonMobil, Chevron, Suncor, Equinor, Nalcor
Hibernia	1979 (1997)	65,519	1,812	ExxonMobil, Chevron, Suncor, CHHC, Murphy Oil, Equinor, Nalcor
Terra Nova	1984 (2002)	6,656	506	Suncor, Cenovus, Murphy Oil
White Rose	1984 (2005)	6,544	436	Cenovus, Suncor, Nalcor
North Amethyst	2006 (2010)	3,012	70	Cenovus, Suncor, Nalcor

Source: Canada-Newfoundland & Labrador Offshore Petroleum Board (C-NLOPB), *Canada—Newfoundland and Labrador C-NLOPB Annual Report 2023-2024* (St. John’s: C-NLOPB, 2024), <https://www.cnlopb.ca/wp-content/uploads/ar2024e.pdf>, p. 32.

All of this is not to forget the ubiquitous importance of oil and oil production in the province. NL boasts five operational fields—Hebron, Hibernia, Terra Nova, White Rose, and North Amethyst—which are all located offshore in the Jeanne d’Arc Basin ([Figure 1](#)). These fields together have produced some 2 billion barrels of oil since commercial extraction first began in 1997.¹⁷

¹⁴ CER, ‘Canada’s Renewable Power - Newfoundland and Labrador’, <https://www.cer-rec.gc.ca/en/data-analysis/energy-commodities/electricity/report/canadas-renewable-power/provinces/renewable-power-canada-newfoundland-labrador.html>.

¹⁵ GNL, *Maximizing Our Future: A Plan for Development of the Renewable Energy Industry in Newfoundland and Labrador* (St. John’s: Government of NL, 2021), <https://www.gov.nl.ca/iet/files/Renewable-Energy-Plan-Final.pdf>.

¹⁶ Newfoundland Power, ‘NL Hydro say province can’t turn its back on thermal energy’, *CBC* (7 June 2024), <https://www.cbc.ca/news/canada/newfoundland-labrador/diesel-backup-newfoundland-power-1.7226437>; NL Hydro, ‘Hydro Files 2024 Resource Adequacy Plan’ (11 July 2024), <https://nlhydro.com/hydro-files-2024-resource-adequacy-plan/>.

¹⁷ GNL, ‘Oil and Gas Development: Field Summary Brochure’, <https://www.gov.nl.ca/iet/files/GovNLFieldSummaryBrochure.pdf>.

The province produced nearly 213,000 barrels per day (bpd) in September 2024, which accounted for almost 5% of Canada's overall oil production.¹⁸ The fields of Hebron and Hibernia are the workhorses of this offshore endowment, with the former averaging 115,000 bpd of production and the latter 66,000 bpd in 2023. By contrast, production from Terra Nova and White Rose each amounted to about one-tenth the production of Hibernia and one-twentieth that of Hebron, though both in recent years experienced shut-ins due to technical reasons. Meanwhile, the 3,000 bpd from North Amethyst makes it the smallest producing field by far ([Table 1](#)).

NL's offshore petroleum industry, as is the case worldwide, is a very exclusive realm of highly specialized companies with extremely deep pockets, supported by various lesser known but also very capable suppliers and service-providers. Hebron and Hibernia, as NL's two most prolific fields, are majority-owned and operated by Houston-based ExxonMobil, though other global giants like Chevron, Suncor, and Equinor hold significant minority stakes in the projects.

NL is also home to an oil refinery in Come By Chance on the isthmus of the Avalon peninsula.¹⁹ This refinery, with a capacity of 130,000 barrels per day, underwent significant change in the years 2021-23 after Braya, a company held by a private equity firm based in Dallas, invested several hundred million dollars to transform the refinery to process biofuels.²⁰ In early 2024, the facility and its workforce of 230 people started commercial operations devoted to converting animal fats and vegetable oils into 'green' diesel. However, barely a year after the restart, the company has ceased operations, citing economic difficulties and the expiration of fuel-blending tax credits.²¹

¹⁸ This volume was slightly less than Gabon's oil production in 2024, the second-smallest producer within the Organization of Petroleum Exporting Countries (OPEC). OPEC, 'OPEC Monthly Oil Market Report' (15 January 2025), file:///Users/scottmcknight/Downloads/OPEC_MOMR_January_2025.pdf, p. 53; Canada-Newfoundland & Labrador Offshore Petroleum Board (C-NLOPB), *Canada—Newfoundland and Labrador C-NLOPB Annual Report 2023-2024* (St. John's: C-NLOPB, 2024), <https://www.cnlopb.ca/wp-content/uploads/ar2024e.pdf>, p. 32.

¹⁹ This is one of Canada's 17 refineries. The Come By Chance refinery accounts for about 1% of Canada's refining capacity. CER, CER, 'Refined Petroleum Products', <https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-canada.html#s3>.

²⁰ Terry Roberts, 'The Come By Chance refinery is producing fuel again. This time, it's a different type of oil.' *CBC News* (22 February 2024), <https://www.cbc.ca/news/canada/newfoundland-labrador/braya-production-start-1.7122162>.

²¹ Terry Roberts, 'Come By Chance refinery considering "economic shutdown" less than one year after reboot', *CBC News* (9 December 2024), <https://www.cbc.ca/news/canada/newfoundland-labrador/refinery-idle-struggles-1.7405072>.

3.4 Big Consumers: Industry and Transport

Within the province, industry and transport are the most energy-consuming and carbon-emitting sectors. Industry, which includes mining, oil refining and offshore petroleum production, together accounts for about two-fourths of NL's overall energy demand. The large presence of energy-intensive extractive industries in NL also explains why the province has the fourth largest energy demand per capita of Canada's provinces, though ranks ninth in overall energy consumption.²²

Transport is another major energy consumer and carbon-emitter in NL, as this sector functions almost entirely by combusting fossil fuels like gasoline and diesel. Transport regularly accounts for about one-third of the province's overall energy demand. In fact, transport is the sector whose GHG footprint has increased the most in absolute terms since 1990, growing about 37% to about 3.7 Mt CO₂e. Electrifying the province's transport fleet has been very limited, as there were an estimated 1,240 electric vehicles on NL roads by 2023, or about 0.3% of the entire transport fleet in the province.²³ Meager sales of plug-in electric vehicles, despite federal and provincial government incentives but without readily available charging infrastructure, mean that even passenger transport will remain oil-dependent in the province for many years to come. Unlike the carbon footprint from transport, emissions from agriculture have stayed basically the same since 1990, while those from heavy industry, buildings and especially power generation have experienced significant declines.

In attempting to diversify the economy, the provincial government has prioritized industries like wind-hydrogen projects ([more below](#)) and mining ([more below](#)). For the latter, having more electricity available could facilitate a boom in onshore mining, especially in mineral-rich and sparsely populated Labrador. Iron Ore Company (IOC), which is majority-owned by London-based mining giant Rio Tinto with a significant minority stake by Mitsubishi, has long sought to expand iron ore output at its expansive west Labrador operations. Likewise, Vale, a formerly Brazil-based mining giant, has also been eager to expand nickel output from its Voisey's Bay operations as this abundant supply of high-grade nickel is ideal for nickel-based battery chemistries in electric vehicles, a fast-growing source of end-use demand.

Greater electricity demands from mining, electrifying parts of the transport fleet and others have naturally raised questions about transmission and distribution capacity in the province as

²² CER, 'Provincial and Territorial Energy Profiles—Newfoundland and Labrador', <https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-newfoundland-labrador>.

²³ Take Charge NL, <https://takechargenl.ca/evs/>; Lukas Wall, 'More than 500 new electric vehicles hit NL roads in 2023', *CBC News* (27 January 2024) <https://www.cbc.ca/amp/1.7089326>

well as questions about the continued viability of exporting electricity.²⁴ These are just several of many examples in the energy transition where both technical and political matters intertwine and require sorting out.

4. Where to go from Here?

4.1 Emissions and Pledges to Cut Emissions

In 2020, the government of Newfoundland and Labrador announced its pledge to carbon neutrality or ‘net zero’ emissions by 2050 (see [Glossary](#)). Although there is no binding legislation and few details on how to make this happen, the commitment nevertheless spurs all sectors of the economy to find ways to reduce their respective carbon footprints. Considering the far-reaching importance of NL’s carbon-emitting resources, which are anchored in legacy assets and knowledge networks, and which enable a significant portion of government spending, meeting these climate commitments will require some hard choices be made.

4.2 NL as Energy Exporter – But Possibly Very Different This Time

A mix of technological, geopolitical and economic trends has again thrust NL’s varied resource endowment, skilled workforce and innovation networks back into the spotlight.

For one, increasingly stringent standards on carbon emissions and ambitious targets like ‘net zero’ announced by virtually every major country and corporation will require deploying renewable energies and low-carbon technologies on an unprecedented scale. For another, the ‘deep decarbonization’ needed to fulfill these ambitious pledges inevitably means finding less carbon-intensive solutions for the much more challenging ‘hard-to-abate’ industries like heavy industry, shipping, and aviation ([Glossary](#)). Geopolitical changes have also raised NL’s global profile as energy exporter as Europe has rushed to secure energy supplies following Russia’s invasion of Ukraine.

However, there is no guarantee that these trends will translate into tangible gains for NL—for its companies, workers and supporting institutions. The global energy crisis of 2022-23 returned NL’s oil exports to the forefront, while also reviving proposals of NL liquefying and shipping natural gas in the form of LNG ([more below](#)). However, no topic has gained more attention and debate in the province than aspirations around the possibility of ‘green’ hydrogen (see

²⁴ Elizabeth Whitten and John Gushue, ‘Hundreds of billions at stake as NL, Quebec draft new Churchill Falls deal’, *CBC News* (12 December 2024), <https://www.cbc.ca/news/canada/newfoundland-labrador/nl-quebec-new-churchill-falls-agreement-1.7408663>.

[Glossary](#)) being produced from NL's abundant wind resources ([more below](#)). Let's turn to oil and carbon management first.

4.3 Carbon Capture and Storage: A Lucrative Niche for NL?

Carbon capture, utilization, and storage (CCUS) is both an established and new practice, which is experiencing rapid growth as it is increasingly applied to other sectors beyond traditional use in the oil and gas industry.

Carbon capture has been recognized as vital in the 'net zero' by 2050 scenario of the International Energy Agency (IEA), the energy-focused body of the Organization of Economic Cooperation and Development (OECD).²⁵ Carbon capture is also one of the four areas of focus as part of the province's Hydrogen Development Action Plan.²⁶

Although experts raise valid questions about the practical application of CCUS to NL's offshore operations, there are nevertheless several reasons for more to be done on this front within the province. For one, NL's oil and gas sector emitted 1.29 MT CO₂e of GHGs in 2022, virtually all of which were due to offshore oil production.²⁷ This makes the O&G sector the cause of about 16% of NL's overall GHG emissions, well behind transportation as we've seen [above](#) and marginally less than industry's contribution.

Oil production from Hebron emitted less carbon than that from Hibernia, despite the former producing 75% more oil output. In the five-year period from 2018-2022, Hebron and Hibernia experienced GHG declines of about 11% and 21% respectively, according to C-NLOPB.²⁸ Put differently, offshore oil production—all of which occurs off the coast of NL—has never accounted for more than 15% of Canada's emissions from oil production, compared to roughly half that comes from the oilsands production.

There is still opportunity for CCUS to aid in these emission reductions. For decades, CCUS was almost exclusively a practice confined to natural gas processing. Only since 2020 have large-

²⁵ International Energy Agency (IEA), *Net Zero by 2050: A Roadmap for the Global Energy Sector* (Paris: OECD, 2021), https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroBy2050-ARoadmapfortheGlobalEnergySector_CORR.pdf.

²⁶ GNL, *Hydrogen Development Action Plan* (St. John's: Government of Newfoundland and Labrador, 2024), <https://www.gov.nl.ca/iet/files/Hydrogen-Development-Action-Plan.pdf>.

²⁷ Another 0.03 MT CO₂e of GHGs were attributable to petroleum refining.

²⁸ Hebron: from about 481.4 in 2018 to 431.6 t in 2022; Hibernia: from 552 t to 455.8 in 2022

scale facilities to capture carbon from a range of other industries like steel production, hydrogen, power generation, synfuel and fertilizer been announced or come online. The range of CCUS projects worldwide spans the gamut, including projects in early development, advanced development, under construction, and those already in operation. There are estimates that global CCUS deployments may be ten times greater in 2030 than levels in 2020. Similarly, the IEA estimates that by 2030, global CCUS projects would need to have the capacity to capture about 1,000 metric tonnes (MT) CO₂, which was about 100 times more operational capture capacity than in 2022 and about 2.5 times more than announced capture capacity.²⁹

Canada has been an early leader in managing and storing carbon, and currently trails only the US in the number of carbon capture projects announced and operational.³⁰ Likewise, Canada is home to several world-class research and testing facilities, including eight publicly funded laboratories and test beds spread across British Columbia, Alberta, Saskatchewan, Ontario and Québec, where efforts are being made to develop and scale up carbon management technologies.

This brings us to another reason for further research and policy support on CCUS in NL: the rapid growth and increasing importance of this specialization globally. Developing capacity to understand and deploy CCUS technologies could become a significant business niche for NL firms, researchers, and specially trained workers *outside* the province where practically all growth of the CCUS market will take place. To this, NL has some potential and suitable geology for conventional seabed CO₂ storage, as well as offshore expertise and infrastructure that could be leveraged to support CO₂ storage and learning. However, more research, engagement and policy support will be needed if NL-based companies and researchers are to fill this emerging global demand and contribute to further innovation in this area.

4.4 Still So Much Oil, but what to do with it?

Any realistic discussion of the fate of NL's offshore highly lucrative petroleum industry must consider economic, political and even social factors as well. Oil production has become crucial to the province's economic health, accounting for about one-fourth of the province's gross domestic output (GDP) and about two-fifths of its exports.³¹ Moreover, a 2020 estimate found

²⁹ IEA, *Energy Technology Perspectives 2020: CCUS in Clean Energy Transitions: Special Report on Carbon Capture Utilization and Storage* (Paris: IEA, 2020), p. 27.

³⁰ The Inflation Reduction Act, passed in 2022, offers a tax credit of US\$35-50 per tonne of CO₂ captured, depending on how the carbon is reused or storage. Clean Air Task Force, 'Carbon Capture and the Inflation Reduction Act', <https://cdn.catf.us/wp-content/uploads/2023/02/16093309/ira-carbon-capture-fact-sheet.pdf>.

³¹ GNL, *The Way Forward—on oil and gas* (St. John's: GNL, 2018), <https://www.gov.nl.ca/iet/files/advance30-pdf-oil-gas-sector-final-online.pdf>, p. 3.

that the offshore oil industry supports about 23,500 jobs, which includes direct, indirect and induced jobs in the province.³²

Despite the significant upfront costs as well as expertise needed to operate in the fierce unforgiving environment of the offshore, NL's favourable geology, high-quality oil as well as good production rates and recovery factors continue to attract commercial interest from offshore oil operators worldwide. With one recent government estimate of 4.4 billion barrels of commercially recoverable barrels of oil in NL's offshore, there is still plenty of oil that could be produced.³³ While the Jeanne d'Arc Basin has thus far been home to all of NL's commercially producing oilfields ([Table 1](#)), no potential 'deepwater' oilfield (e.g. those at depths greater than 400m—see [Glossary](#) for more) in the Flemish Pass or Orphan Basin has yet entered production.

Equinor, the Norwegian offshore oil giant, leads a partnership that is assessing developing oil in Bay du Nord. Some 500km east of St. John's and in water depths of some 1,200m, the estimated 407 million barrels of recoverable oil could justify the enormous costs and technical challenges to bring the project online. It would also be a boon for the province's finances, local suppliers and service-providers as well as innovation network for decades to come.³⁴ The Bay du Nord oilfield alone could produce 200,000 barrels per day as early as 2028, which would nearly double NL's 2024 production figures.³⁵ Revenues from Bay du Nord production could amount to some CAD\$3.5bn³⁶, as well as CAD\$75 million of investment over 10 years in research and development in engineering, technology and other relevant disciplines. Innovation, which has consistently characterized offshore oil operations for decades, may yield even greater gains in productivity, efficiency, and safety, while potentially further decreasing the GHG intensity of NL's offshore oil production.

The provincial government made clear its priority to continue to facilitate development of the province's O&G industry, most notably by streamlining permitting processes to achieve its larger vision of multiple basins producing over 650,000 barrels of oil equivalent per day from

³² Newfoundland and Labrador Offshore Oil and Gas Industry: Economic Impact Report - Current Impact and Future Potential https://energynl.ca/wp-content/uploads/2020/07/ITP_EconomistReport_FINALweb.pdf; Newfoundland Offshore Industry Association (NOIA), 'Offshore Oil & Gas Industry Facts', <https://energynl.ca/wp-content/uploads/2020/05/Offshore-Industry-Facts-Official-2020-05-07.pdf>.

³³ GNL, 'Oil and Gas Development: Field Summary Brochure', <https://www.gov.nl.ca/iet/files/GovNLFieldSummaryBrochure.pdf>.

³⁴ GNL, 'Oil and Gas Development: Field Summary Brochure', <https://www.gov.nl.ca/iet/files/GovNLFieldSummaryBrochure.pdf>.

³⁵ 'As political diversions emerge over Bay du Nord, N.L. pcs lash out at federal liberals', *CBC News* (10 February 2022), <https://www.cbc.ca/news/canada/newfoundland-labrador/bay-du-nord-divisions-politics-1.6346794>.

³⁶ Equinor, 'The Bay du Nord project', <https://www.equinor.com/en/where-we-are/canada-bay-du-nord.html>.

new and existing projects by 2030.³⁷ These ambitious projections have understandably raised questions about how these production increases would fit with plans of both provincial and federal governments to curb emissions and to achieve carbon-neutrality. These questions also touch on deeper existential struggles regarding the role of fossil fuels and which sectors will drive growth and prosperity in NL and Canada more broadly, something we'll attempt to address [below](#).

4.5 What to do with Natural Gas?

In contrast to oil that is produced, shipped and traded globally, none of the natural gas produced at offshore oil facilities makes it to market. Instead, natural gas is used to power offshore oil facilities, reinjected to maintain reservoir pressure, or flared.

Several problems have prevented this gas from becoming a commercial product. For one, bringing gas onshore for use in industry or homes would inevitably compete with hydroelectric power, something which NL has installed in abundance as we saw [above](#). Likewise, proposals to turn natural gas into an exportable product in the form of liquefied natural gas (LNG) faces several challenging business prospects.

First, NL has neither significant gas production nor abundant gas reserves compared to even the world's mid-sized LNG exporters.³⁸ Therefore, to muster adequate gas volumes would require building a centralizing gas hub from the five oil-producing fields in the Jeanne d'Arc Basin. Furthermore, any LNG project would require facilities to transport and then to liquefy the gas for maritime transport. The most prominent proposal for an LNG facility at Placentia Bay, an ice-free port that already has transshipment facilities, would require building an expensive subsea pipeline some 600km in length.³⁹

These business challenges must also take into account the fundamentally different nature of the gas market, which generally requires a secure long-term relationship between supplier and buyer to help shoulder the hefty infrastructure costs and to spread them over many decades. This comes at a time when the viability of the LNG business in the low-carbon energy transition remains unclear.

³⁷ GNL, *Advance 2030* (St. John's: GNL, 2018), <https://www.gov.nl.ca/iet/files/advance30-pdf-oil-gas-sector-final-online.pdf>.

³⁸ NL's offshore gas reserves are estimated at 12.6 trillion cubic feet (TcF), which would make it about the 38th largest in the world if NL were a country.

³⁹ Environment and Climate Change, GNL, 'Placentia Bay Liquefied Natural Gas (LNG) Facility and Marine Terminal – Proponent: LNG Newfoundland and Labrador Limited', <https://www.gov.nl.ca/ecc/projects/project-2177/>.

4.6 Joining the Wind and Hydrogen Rush

Hydrogen created from renewable sources like wind power has generated excitement and grabbed headlines in recent years. In April 2022, the NL government lifted the fifteen-year-old moratorium on wind development.⁴⁰ A flurry of project announcements followed ([Table 2](#)).

To start, vast amounts of power are needed to isolate the ‘magic molecule’ of hydrogen from other elements like oxygen. This has sparked a global rush to build renewable energy capacity to power hydrogen processing facilities, and to fill this potentially large market demand, with localities and companies seeking an early advantage in the promising but undefined market of clean hydrogen.

In November 2023, the city of St. John’s hosted the Canada-European Union (EU) Summit, from which a broad agreement to jointly develop a trans-Atlantic hydrogen market was reached. This came barely weeks after NL’s Department of Industry, Energy and Technology (IET) accepted four proposals for wind-hydrogen projects in different parts of the province ([Table 2](#)).

NL’s appeal in the fiercely competitive global hydrogen race stems from an appealing combination of factors, which include not only enormous wind resource potential and vast amounts of unused land under Crown control—a necessity for these massively land-intensive projects—but also a workforce familiar with executing big construction projects, robust port infrastructure and a ‘clean’ grid to provide additional electricity. We can also add the positive role of a government that is interested in seeing these wind-hydrogen projects come to fruition.⁴¹

This willingness to develop high-risk low-carbon projects with unproven business models reflects what one seminar participant called a ‘changed mindset’ amid the Covid-19 pandemic, with certain international investors and renewable energy developers leading the way. From this, the provincial government has taken on an ‘enabling role’ to these proposals.

In this same vein, the province released a Hydrogen Development Action Plan, which covers the years 2024-27, and seeks to establish a ‘green hydrogen network’, among targeted sectors like [mining](#) and [CCUS](#).⁴² This plan complements policy supports from the Canadian government,

⁴⁰ IET, ‘Ministerial Statement—Minister Parsons announces end of moratorium on wind development’, (5 April 2022), <https://www.gov.nl.ca/releases/2022/iet/0405n07/>.

⁴¹ Maddie Ryan, ‘Stephenville mayor, businesses still hopeful as World Energy GH2 revises plans for wind project’, *CBC News* (4 February 2025), <https://www.cbc.ca/news/canada/newfoundland-labrador/world-energy-wind-pivot-1.7446984>.

⁴² This network is envisioned to be made of Energy NL, techNL, econext, with the IET serving as ‘lead for the network’.

which includes a clean hydrogen tax credit that may cover up to 40% of investment costs for clean hydrogen and ammonia projects, as well as priority financing from the Canada Infrastructure Bank. For its part, the NL government has introduced a tax credit of 20% for the capital costs of eligible ‘green’ investments, which include green hydrogen among them. The province has also released a fiscal framework specifically for wind-hydrogen projects in the hopes of conveying transparency and predictability to an otherwise new business sector.

Table 2: Government-approved wind-hydrogen projects in NL

Project lead company	Location	Approved size (in hectares)	Plan
Toqlukuti’k Wind and Hydrogen (ABO)	Isthmus region	108,000	Three-phase project to produce and export hydrogen/ammonia to jointly develop green hydrogen production with Braya at the Come By Chance refinery whose closure complicates the project (see above)
EverWind NL	Burin peninsula	270,000	Multi-phase wind energy project to build wind farm, storage and production facilities to produce and export hydrogen-ammonia
Exploits Valley Renewable Energy Corporation (EVREC)	Botwood, central Newfoundland	30,000	Multi-phase wind energy project and hydrogen/ammonia production facility to produce and export green hydrogen/ammonia
World Energy GH2	Stephenville	107,000	The project of onshore wind farms shifted from building a hydrogen/ammonia production facility, to becoming a ‘renewable energy campus’, producing e-fuels and powering data centres
Argentia Renewables LP	Port of Argentia	2,500	300 MW wind-hydrogen project and ammonia production and export facility on lands owned by the Port of Argentia, originally with target construction date of 2025 and a target project operations date of 2027

Sources: Industry, Energy and Technology (IET), ‘Wind Hydrogen Projects’, <https://www.gov.nl.ca/iet/wind-hydrogen-projects/#projectsselectedthroughthecallforbids>;

Reuters, ‘Canadian province Newfoundland picks 4 wind farm projects to power hydrogen plants’ (30 August 2023), <https://www.reuters.com/business/energy/canadian-province-newfoundland-picks-4-wind-farm-projects-power-hydrogen-plants-2023-08-30/>; Sarah Smellie, ‘Newfoundland wind-to-hydrogen company eyes data centre as international market lags’, *CBC* (19 November 2024), <https://www.cbc.ca/news/canada/newfoundland-labrador/newfoundland-wind-to-hydrogen-company-eyes-data-centre-as-international-market-lags-1.7387847>.

Despite these favourable conditions and incentives, it’s been a rough ride in the global hydrogen market in recent years. Committed buyers of clean hydrogen have been hard to find.

This phenomenon of suppliers greatly outnumbering purchasers is global and industry-wide, and certainly not exclusive to NL's several proposed wind-hydrogen projects. For example, BloombergNEF, an energy-focused research body, found that in early 2024 a mere 12% of hydrogen deals had identified its offtaker, which meant that nearly 54 million metric tonnes (MMt) of green hydrogen had no identified buyer. In a similarly challenging vein for suppliers, only 11% of clean hydrogen offtake agreement volumes were binding.⁴³ Overall, the pipeline of announced projects has grown rapidly, but very few of these projects have resulted in purchase agreements or hydrogen deliveries.

Some of this could be put on the usual growing pains of a new market and industry finding its footing. There is no shortage of challenges to quicker and more widespread growth of the global hydrogen market. One major reason is cost. Green hydrogen—which includes that produced by wind power—is still three to *eight* times *more* expensive than hydrogen produced from fossil fuels. That steep price gap raises the pressing question: who will pay this green premium?

There are also serious questions about looming trade restrictions, especially for electrolyzers (see [Glossary](#)). The global electrolyzer market is expected to expand very rapidly, from its value of US\$489 million in 2023 with expectations to grow at a compound annual growth rate (CAGR) of 95% from 2024 to 2030.⁴⁴

To date, the most cost-competitive electrolyzers are manufactured in China, a fact that has revived fears among various governments that are determined not to allow Chinese companies to gobble up significant chunks of the global value chain for electrolyzers, as has occurred in other renewable energies like solar photovoltaics (PV) and electric-vehicle battery industries. Conversely, the global hydrogen market cannot grow swiftly without a significant supply of this equipment. As yet, no other country has achieved the cost reductions and quality improvements that China's electrolyzer manufacturers have.

4.7 Mining and 'Critical Minerals': New Growth Engine but to what extent?

Mining is also one of the four areas of focus in the provincial government's hydrogen strategy. Prioritizing the mining industry has coincided with greater interest in so-called 'critical minerals' and some other base metals since certain defense technologies as well as low-carbon technologies like solar PV modules, wind turbines, batteries for EV and stationary storage, and

⁴³ Author's correspondence with BloombergNEF hydrogen expert (November 2024).

⁴⁴ Grand View Research, 'Electrolyzer Market Size & Trends', <https://www.grandviewresearch.com/industry-analysis/electrolyzer-market-report>.

the like require certain metals to function. The province also released a critical minerals plan, which echoes the federal government's strategy released in 2022.⁴⁵

Mining in NL is already a well-established industry, with some 8,200 people employed in the sector in 2024 and with many mines operational in the province (Table 3).⁴⁶ In 2024, the value of mineral production in NL totaled CAD\$4.56 billion, which is a sharp increase from the CAD\$2.96 billion mined in NL in 2020, but roughly the same value of CAD\$4.58bn that was mined in the province in 2010.⁴⁷ These figures may grow in years to come, whether due to price rebounds—always unpredictable and ephemeral—or due to longer term fundamentals like increased investment in 'brownfield' operations or from opening new 'greenfield' mines. To this, CAD\$223.2 million was spent in the province on mining exploration in 2024, a significant figure that will likely translate to increased mineral reserves and potentially new discoveries, but whose effects may take many years to fully unfold.

The province famously produces significant volumes of iron ore and nickel (Table 3). NL, as Canada's second-largest iron ore-producing province after Québec, boasts many iron ore projects and commercially attractive deposits, notably in Labrador.⁴⁸ There is significant buzz around these deposits being ideal to produce so-called 'green steel', which, like CCUS (above), could become a competitive advantage for the province, its companies and researchers, though this too would require significant commitment and focus.

NL's nickel production was also significant, with 35.4 thousand tonnes produced in the province in 2021 at a value of CAD\$789 million, or about one-fourth of Canada's nickel production that year, though NL's nickel fetched about 30% of the total value of production.⁴⁹ The higher quality of this production is largely due to the coveted ore body at Voisey's Bay. This mine in northeast Labrador is one of the world's largest high-grade nickel mines and has been a significant source of nickel since it began operations in 2005. Likewise, recent completion of the underground nickel-copper-cobalt mine will extend the life of the mine and will tie Vale (now Toronto-based Vale Base Metals) to a long-term commitment to the province. Further

⁴⁵ GNL, *Critical Minerals Plan: Our Critical Mineral Advantage* (St. John's: GNL, 2023), <https://www.gov.nl.ca/iet/files/Critical-Minerals-Plan-Our-Critical-Minerals-Advantage.pdf>; Government of Canada, *The Canadian Critical Minerals Strategy* (Ottawa: NRCAN, 2022), <https://www.canada.ca/en/campaign/critical-minerals-in-canada/canadian-critical-minerals-strategy.html>.

⁴⁶ GNL, 'Mining in Newfoundland and Labrador', (Fall 2024), <https://www.gov.nl.ca/iet/files/Mining-in-NL-Fall-2024.pdf>, p. 1.

⁴⁷ Ibid, p. 1; MAC, *The Canadian Mining Story: Economic Impacts and Drivers for the Global Energy Transition*.

⁴⁸ These iron ore projects include Carol Lake, Scully Mine and Mill, DSO Project, Kamistiatasset (Kami), Joyce Lake DSO Project, and the Houston Project, among others.

⁴⁹ MAC, *The Canadian Mining Story*, p. 79.

downstream, the only mineral-processing facility in the province is at Long Harbour, an asset under the ownership of Vale.

Table 3: Major producing mines in Newfoundland and Labrador

Company	Mine site	Location	Mineral(s)	Stage of activity
Beaver Brook Antimony Mine	Beaver Brook	Glenwood	Sb	U., C.
AuTECO (previously owned by Rambler Metals)	Nugget Pond	Snook's Arm	Cu	C.
FireFly Metals (previously owned by Rambler Metals)	Ming	Baie Verte	Cu, Au, Ag	U.
Anaconda Mining	Point Rousse (Pine Cove)	Baie Verte	Au	P., C.
Vale NL	Voisey's Bay	Voisey's Bay	Ni, Cu, Co	P., C.
Tacora Resources	Scully	Wabush	Fe	P., C.
Iron Ore Company (IOC)	Carol Lake	Wabush	Fe	P., C.
Tata Steel Minerals Canada	DSO (Timmins)	Menihek	Fe	P., C.
Canada Fluorspar	DSO (Timmins)	St. Lawrence	Fluorspar	P., U., C.
Barite Mud Services	Buchans	Buchans	Barite	P.
Trinity Resources	Conception Bay South	Conception Bay South	Pryophyllite	P.

Source: Mining Association of Canada (MAC), *The Canadian Mining Story: Economic Impacts and Drivers for the Global Energy Transition* (Ottawa, ON: Mining Association of Canada: 2023), p. 72; 'Ming Copper-Gold-Silver Mine, Canada', *NS Energy* (19 October 2023), <https://www.nsenergybusiness.com/projects/ning-copper-gold-silver-project-canada/>.

Nickel production from Voisey's Bay, iron ore production from various mines in Labrador, as well as smaller amounts of copper, cobalt and the like, make NL an integral part of Canada's 'critical mineral' strategy and to any 'friend-shoring' efforts in critical minerals with the United States and allies. Although mining projects throughout Canada received a boost with the passing of the Inflation Reduction Act in the US in 2022, which put forth a tax credit for critical minerals and battery parts sourced from 'any country with the US has a free trade agreement' for which Canada qualifies, recent efforts by the Trump administration to roll back these credits and to implement tariffs of Canadian exports to the US may hinder further mining investments.⁵⁰ As with hydrogen, the mining of 'critical minerals' may be another example of NL facilitating the energy transitions of other Canadian provinces and countries.

⁵⁰ IEA, 'Inflation Reduction Act 2022: Sec. 13401 Clean Vehicle Credit', <https://www.iea.org/policies/16277-inflation-reduction-act-2022-sec-13401-clean-vehicle-credit>.

The province also produces modest amounts of copper and cobalt. The former is a crucial input to a range of low-carbon technologies as ‘the metal of electrification’, while the latter remains a challenging but necessary input for lithium-ion batteries in EVs for its significant cost and lopsided supply chain.⁵¹

The province also boasts a robust gold mining industry. Gold production in NL was valued at just under CAD\$54 million in 2021.⁵² Though gold is generally not considered a ‘critical mineral’ and isn’t used in any low-carbon technologies, gold mining serves as an anchor of sorts for the rest of the industry—as an innovation testing ground by some of Canada’s ambitious ‘junior’ companies, as a significant employer in rural areas of the province, and as a magnet for foreign investment.

Beyond these minerals and metals already in production, the province also boasts rich geological potential for a whole host of other minerals, like lithium, scandium, antimony, and rare earth elements.⁵³ NL’s favourable geology of lithium in particular has been a source of intense exploration activity, though questions remain around financing, company capacity, community relations, lithium price volatility, negotiations with multi-billion-dollar EV battery plants in Ontario and Québec, labour constraints, among others. On this issue of labour, the mining industry continues to struggle to attract sufficient numbers of women, ethnic minorities and young people to the industry. Despite significant improvements in diversifying the workforce in recent years, this problem is felt throughout the global mining industry, and presents no easy solutions.

Overall, NL’s abundant resource endowment bodes well for a greater focus on mining projects and mineral production, however there are challenges to making this happen. As with O&G, mining projects are very capital-intensive with lead times measured in years but more accurately decades. For example, the global average lead time for a nickel sulfide mine—which is similar in mineral makeup to the Voisey’s Bay deposit—averages 13 years. Much of this time is spent on exploration, discovery, and feasibility planning—in other words, activities that are

⁵¹ Canada produced 4,300 tonnes of cobalt, or about 2.5% of global production in 2021. Copper production mined in NL was 28,440 tonnes in 2021, or just over 5% of Canada’s overall mined copper production that year. MAC, *The Canadian Mining Story*, pp. 81-2. Daniel Matthews, ‘Global Value Chains: Cobalt in Lithium-Ion Batteries for Electric Vehicles’, Office of Industries Working Paper ID-067 (May 2020), https://www.usitc.gov/publications/332/working_papers/id_wp_cobalt_final_052120-compliant.pdf.

⁵² MAC, *The Canadian Mining Story*, p. 79.

⁵³ GNL, ‘Mining in Newfoundland and Labrador’, (Fall 2024), <https://www.gov.nl.ca/iet/files/Mining-in-NL-Fall-2024.pdf>, p. 1.

vital to any successful mining operation but do not generate revenue on their own and therefore make it challenging for even deep-pocketed mining companies.⁵⁴

There is another uncomfortable truth to this. Any increase in mining, an inevitably carbon-intensive sector, would almost certainly increase the province's GHG emissions. To this, NL's established innovation networks, major operators and service-providers as well as academic institutions like Memorial University and College of the North Atlantic can play a part. There are significant opportunities to find ways to improve energy efficiency, logistical planning, productivity, digital twinning, as well as to automate certain processes and to implement artificial intelligence (AI)—some of which can be transferred from impressive gains and practices recently adopted in the offshore oil industry. Likewise, workers and certain small- and medium-sized enterprises (SMEs) in NL's robust and innovative supply and service sector, which emerged as part of the offshore O&G industry, may also bring over skills and lessons to mining onshore.

5. Big Factors, Big Risks, and Some Old Habits

Any planning for a realistic mid- and long-term innovation strategy that is sustainable and prosperity-sharing in the province should take account several big factors that are already making an impact on NL's energy system and its transition toward a less carbon-intensive economy.

For one, price uncertainty is a fact-of-life in extractive industries. Since the start of commercial oil production in the late 1990s, NL's workforce and government have become painfully familiar with the whiplashing effects of oil prices. Price downturns, the harshest in recent memory came at the onset of the Covid-19 pandemic in 2020, are cruel reminders of the price-taker roles that NL and Canada more broadly play in global commodity markets. By contrast, the surge in natural gas prices from December 2024 to March 2025 may spur investment interest but may not be sufficient or long-lasting enough to bring companies to undertake building the extremely expensive and technically sophisticated LNG infrastructure.

Mineral prices show some variation in recent years, though in no case do we see sustained bullishness. There are no shortage of factors applying downward pressure on prices, including continued economic uncertainty; 'strategic decoupling' and trade protectionism under the latest Trump administration; and for nickel in particular, breakneck growth in production in far-off places like Indonesia. Any innovation and investment strategy needs to acknowledge these various pressure points and be responsive to sometimes jarring changes ahead.

⁵⁴ Of course, there is considerable variation in bringing a promising geological site into actual production, as it depends on the nature of the resource as well as the political jurisdiction it is located.

Moving away from global markets, we should also acknowledge the underlying political difficulties around these energy decisions, a theme that was repeatedly stressed during discussions at the December 2024 seminar that inspired this report. For one, debates between St. John's and Ottawa about natural resource development remain unresolved. NL's decision-making autonomy is significant but not comprehensive when it comes to decisions on climate agreements, immigration, among other relevant issues for the province.⁵⁵ Similarly, we simply don't yet know how sudden trade tensions with the United States will impact NL's position in the Canadian and global economy.

6. Closing Thoughts: Doing What and To What Ends

The province's transition to a low-carbon economy requires planning, commitment and vision, including making several hard choices in years to come—on whether to expand or to hold oil production steady; whether to take serious measures to fulfill its commitments to 'net zero' by 2050, and which measures those entail; on how much to prioritize renewable energy activities, including wind, hydrogen projects and mining 'critical minerals', though without sacrificing an O&G sector that continues to contribute to the province's economy and finances.

These are only a few of the very largest, energy-related matters that will need to be addressed now and in years ahead. Adding to these are deeper fundamental questions about labour, debt and productivity that may only peripherally relate to energy but to which the province must also commit resources and find solutions.

This brings us to a consistent theme from the seminar and surrounding discussions: What is being attempted in NL and toward what ends? In other words, what is the bigger vision, and are the means available and prioritized to achieve that vision? Innovation is not the inevitable result of continuous and disparate efforts.

In NL, this has traditionally meant exploiting natural resources, but only secondarily using that natural endowment as a training ground or test bed to develop viable, globally competitive companies and workers. The O&G industry has been an important and largely successful exception, where commitments in research and development and education and training that operating companies have to the province has resulted in a more knowledgeable and better-remunerated workforce, funding research that is important to the province, as well as to the emergence of some globally competitive SMEs in offshore operations.

This type of focused but reasonably flexible engagement may be replicated to some extent in the mining industry and large-scale renewable energy projects, where largely foreign-based multinational companies with the financial resources and expertise are granted access to the

⁵⁵ 'NL isn't a sovereign country', as one participant said during a discussion period.

province's natural resources in return for jobs, investment and royalties for the province. During the seminar, several astute attendees noted how this reflex toward job-creation no longer fits with NL's tight labour market. Instead, greater emphasis should be placed on productivity, which has stagnated in recent years in NL and Canada-wide. Furthermore, unlike an O&G industry that is exceptionally rent-generating, the importance of harnessing non-fiscal elements of this engagement with mining, wind and hydrogen are at a premium. This requires emphasizing mining and renewable projects like wind-hydrogen to yield new sources of advantages—in skills, advanced research, exportable knowledge and competitive SMEs.

How NL's workers, companies and public institutions will contribute and benefit from this energy transition are questions without clear answers. This will require more clearly specifying the goals of innovation and sustaining that focus—two vital elements of a successful innovation strategy and its execution. Given the impressive and talented group of individuals who gathered for the seminar and engaged in robust and informed discussions, the province has many reasons to be hopeful.

Glossary

Renewable ('green') diesel: a synthetic fuel made from vegetable oils and animals that is chemically similar to petroleum diesel. There has been tremendous growth in new plants in recent years, many of which are located in midwestern US states and were converted from existing petroleum refineries.

Carbon dioxide equivalent (CO₂e): a unit of measurement that compares the impact of different greenhouse gases (GHGs) on the climate.

Carbon neutrality ('net zero'): a balance between emitting carbon and absorbing carbon from the atmosphere in carbon sinks. To achieve this, all worldwide greenhouse gas (GHG) emissions will have to be counterbalanced by carbon sequestration; that is, removing carbon oxide from the atmosphere and then storing it.

Carbon capture, utilization, and storage (CCUS): a practice that involves capturing CO₂, generally from a large point source like a power plant or industrial facility that use either fossil fuels or biomass as fuel. If not used onsite, the captured CO₂ is compressed and transported by pipeline, ship, rail or truck for use in other applications, or injected into deep geological formations such as depleted oil and gas reservoirs or saline aquifers.

Critical minerals: minerals and metals that are necessary for modern technologies such as electronics, defense applications, solar PV, electric vehicles, medical devices, and so on. Examples include lithium, nickel, cobalt, rare earth elements, and many others.

Deep decarbonization: the gradual elimination of carbon-emitting fuels, including in 'hard-to-abate' sectors such as aviation, steelmaking and long-haul shipping that are difficult to make carbon-neutral with current technologies.

Depth: Although there is no clear consensus on how global O&G industry distinguishes between depths, in NL shallow water projects are fields/discoveries in water depths up to 400m, though all existing projects are in depths less than 150m, while deepwater projects are fields/discoveries in water depths greater than 400m. In NL, only shallow water projects have become commercially operational, such as Hebron/Ben Nevis, Hibernia, Hibernia South (AA Blocks), Hibernia South Extension, Kings Cove, Mara, Terra Nova, West Bonne Bay, White Rose and White Rose Satellites. Deepwater projects consist of Bay du Nord, Harpoon and Mizzen North.

Electrolyzer: technically complex equipment that uses electricity to separate hydrogen and oxygen (the process of electrolysis), and serves as a critical technology for producing low-emission hydrogen from renewable ('green') or nuclear ('pink') electricity.

'Green' steel: the manufacturing of steel without the use of fossil fuels, such as by using hydrogen via electrolysis and renewable energy; steel manufacturing presently produces more CO₂ than any other heavy industry, comprising around 8% of total global emissions.

Greenhouse gases (GHGs): Gases that trap heat in the atmosphere. Examples include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gases like hydrofluorocarbons and chlorofluorocarbons.

Greenhouse gas (GHG) intensity: A measure of efficiency, as it measures the amount of GHG emissions released for a specific output or activity, as opposed to absolute GHG emissions.

Gull Island: located about 225 km downstream from Churchill Falls; the planned facility has a target date of 2035 and will have a capacity of 2,000 MW.

Hydrogen (fuel): a clean fuel that can be produced from a variety of sources, including natural gas ('gray'), nuclear power ('pink'), wind and solar ('green'), among others; the most common methods currently in use are natural gas reforming (a thermal process) and electrolysis; when consumed in a fuel cell, produces only water; it is an appealing option for transportation and electricity generation applications.

About the Author

Scott McKnight (smcknight@mun.ca), Ph.D., leads the Innovation in Extractive Industries research project at Memorial University of Newfoundland and serves as adjunct professor in the Munk School of Global Affairs & Public Policy at the University of Toronto.

He has extensive knowledge of the political economy of extractive industries. His pending book on China's role in the energy transition, to be published by Oxford University Press in late 2025, makes him intimately familiar with the major technologies and challenges surrounding the transition to a low-carbon economy.

He is fluent in several languages (Mandarin Chinese, Spanish, Portuguese and French), which he harnessed to conduct fieldwork for his doctoral work on national oil companies in their respective political economies.