FIRST NATIONS MAJOR PROJECTS COALITION

TECHNICAL REPORT

The Critical Minerals Value Chain:

What First Nations in Canada Need to Know

WITH SUPPORT FROM

The Transition Accelerator | L'Accélérateur de transition

NATIONS ROYALTY

First Nations Major Project Coalition

The First Nations Major Project Coalition (FNMPC) is a national 180+ collective group of First Nations made up of elected councils, hereditary Chiefs, Tribal Councils and Development Corporations, who have made the decision to come together to advance our shared interests of participating, and where appropriate gaining equity positions in the major projects taking place in our territories.

At the Coalition, we believe that economic opportunities must go hand in hand with environmental stewardship, which is why we also provide technical support to First Nations in conducting impact assessments and environmental reviews in accordance with their laws and values. We are paving the way for a brighter future in this country – one that will bring about positive outcomes in terms of Indigenous peoples having a greater role in the economy and in terms of the environmental legacies we will leave for the enjoyment of our future generations.

WITH SUPPORT FROM:

The Transition Accelerator / L'Accélérateur de transition

The Transition Accelerator drives projects, partnerships, and strategies to ensure Canada is competitive in a carbon-neutral world, working with 300+ partner organizations to build out pathways to a prosperous low-carbon economy and avoid costly dead-ends along the way. By connecting systems-level thinking with real-world analysis, it is enabling a more affordable, competitive, and resilient future for all Canadians.

NATIONS ROYALTY

Nations Royalty unlocks shareholder value as first movers focused on the new and untapped Indigenous-owned royalty market. Its growth strategy creates value for Indigenous and non-Indigenous shareholders alike by offering diversification and metal price exposure through a growing portfolio of royalty payments.

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Executive Summary

Introduction and purpose

Growing interest and momentum in developing Canada's critical minerals sector present a range of new resource development opportunities for First Nation governments and communities. The rising economic and national security importance of critical minerals also brings new and changing dynamics to the mining sector and related minerals and metals processing sectors.

Given this context, FNMPC Members have identified that there is a need to support First Nations in two ways:

1. Developing a more comprehensive understanding of the opportunities for economic and commercial participation in the entire critical minerals value chain.
2. Providing an overview and gateway to existing tools and practical frameworks to support First Nation economic and commercial participation in projects.

This report provides a basis for understanding the critical minerals sector and its associated value chains. It is intended to support First Nations in better understanding the context and forces driving increased interest in developing Canada's critical minerals resources. This understanding is useful when considering the opportunities presented by critical minerals in greater detail.

Mining has always involved a variety of costs, benefits, and impacts to First Nations. As interest in developing critical minerals grows, governments and industry must learn from past experiences. The drawbacks must not be placed on First Nations, while others benefit from new wealth creation.

What is a "critical mineral?"

To be defined as a critical mineral, a substance must be:

(a) essential to Canada's national or economic security,
(b) necessary for the transition to a low-carbon and digital economy, or
(c) position Canada as a strategic and sustainable partner within global supply chains.

In addition, its supply chain is threatened, and there's a reasonable likelihood that it could be produced in Canada. Critical minerals are key inputs to energy production, generation, storage, and electrical equipment, clean technologies, defence production, and fertilizers, among others.

Global demand is increasing dramatically

There is a rapidly increasing global demand for critical minerals, driven by the accelerating energy transition, advancements in artificial intelligence and robotics, and escalating requirements for defence materials. This surge in demand has underscored a critical imperative for Canada and its allies: it must reduce dependence on current processing hubs, particularly in China, by developing domestic supply chains for these essential minerals.

In the face of global competition, Canada has the following advantages for developing critical mineral value chains further:

- Developed expertise.
- Market position in key critical minerals.
- Skilled workforce.

- Favourable regulations.
- Market access.
- Strong environmental, social, and governance standards.
- Clean and affordable electricity.
- Stock exchange access.
- Water security.

The critical minerals market structure

While they are captured under the broad term *critical minerals*, their processing, international trade, and markets can differ significantly. For example, there is an established base metals market for minerals such as nickel, copper, and zinc, which are traded as standardized commodities on exchanges such as the London Metal Exchange. This is quite different from the less transparent contract agreements for rare earths or gallium. Similarly, a definition of critical minerals that focuses solely on the mineral and mining sectors would risk leaving out the value-added midstream and downstream segments of the value chain.

The structure of the Canadian mining and metallurgy industry has evolved over the past decades as global multinationals have acquired many formerly Canadian mining champions, although several influential Canadian firms remain active. In downstream and advanced materials manufacturing, the sector includes Canadian startups, specialized mid-sized firms, and large foreign multinationals setting up manufacturing facilities in Canada.

The hollowing out of mid-tier mining companies has also created a structural financing gap in the Canadian mining ecosystem. Market conditions, consolidation and mergers, and limited access to capital have reduced the number of companies able to advance projects that remain too small for the majors. As a result, many deposits stall after discovery. While public and private funding mechanisms often support early-stage exploration and drilling in Canada, they rarely cover this intermediate development phase. This means that technically viable projects struggle to progress. It also means a greater likelihood of engaging with a company as a project proponent that may have less understanding of the Canadian context surrounding First Nation engagement, consultation, and consent.

Assessment and Permitting

Moving a mine from discovery to production typically takes nearly twenty years in Canada. Developers also face substantial structural risks, including price fluctuations, reliance on imported equipment, and limited domestic refining and advanced manufacturing capabilities. At the project level, companies encounter significant obstacles, including remote infrastructure deficits, labour shortages, permitting delays, and environmental obligations that extend through closure and reclamation.

In Canada, security laws require mining companies to comply with the National Instrument 43-101 Standard when disclosing information about mineral projects, particularly in public reporting of exploration results, resources, and reserves, to maintain consistency and build investor confidence. Consequently, this requirement applies to any material mineral project, whether greenfield (new) or brownfield (existing mine, expansion, or restart), if the company is publicly listed on a Canadian stock exchange such as the TSX or TSXV.

Opportunities for First Nation Participation in the Critical Minerals Industry

Generally, the opportunities for First Nation participation in the critical minerals industry do not vary considerably from the opportunities available in mineral development. However, critical minerals differ from other mining in terms of the level of government focus and the expediency required, given the importance of the energy transition, defence, and the development of new supply chains. Depending on where the claim is, companies must negotiate access

agreements and compensate landowners. However, the claim does not allow mining or production, which requires a separate mining lease, additional regulatory approvals, and potentially an impact assessment.

Roles in permitting are dependent on where the project takes place and its size:

- **Crown land:** the government owns both surface and mineral rights;
- **Private surface land:** minerals are crown property, but in specific cases, a freehold landowner may own both minerals and surface rights.
- **Settlement lands:** surface rights may be held either fully or jointly by an Indigenous government, requiring their permission for access and co-management.
- **On Reserve**: the Government of Canada retains ownership of the minerals, but under the *First Nations Land Management Act*, participating First Nations can make rules governing access to minerals on reserve.

First Nations are participating economically in critical minerals in the following ways:

- **Proponent:** In October 2024, the Norway House Cree Nation (NHCN) acquired full ownership of the Minago magnesium, nickel and Platinum Group Metals mining project in northern Manitoba via an $8 million cash deal with Flying Nickel Mining Corp.
- **Equity Investor:** The Taykwa Tagamou Nation (TTN) finalized a $20 million convertible note investment in Canada Nickel Company Inc.'s flagship Crawford Nickel Sulphide Mining Project in Ontario in May 2025. This investment represented 7.9% of the company's shares at that time and secured TTN a seat on the board. It is one of the most significant direct equity investments by a First Nation in Canada's critical mineral sector.
- **Impact Benefit Agreements:** Employment targets and training commitments, business development and procurement opportunities; revenue, royalty, or profit-sharing arrangements; support for cultural programming and language initiatives; environmental monitoring, data-sharing, and mitigation measures; community health and wellness initiatives; and dispute-resolution mechanisms and joint implementation committees. For example, the Raglan Mine agreement with Innu and Labrador Inuit (which is publicly available).
- **Consent Agreements:** B.C. and Tahltan signed a Consent Agreement for the Red Chris Gold and Copper mine in 2023. This mine was already fully operational as an open pit mine, but the Block Cave Project proposed transitioning to underground mining to extend its lifespan, making this an amendment to an already existing approval.
- **Revenue Sharing Agreements:** Selkirk First Nation has a 22.3% equity interest in Selkirk Copper Mines Incorporated, alongside a 1.5% net smelter royalty on the Minto project. Selkirk First Nation also receives mining royalties through Chapter 23 of its Final Agreement.

Loan Guarantees support First Nations in becoming equity participants by reducing their borrowing risk and enabling purchases to be financially viable. The federal government specifically tailored the *Critical Mineral Infrastructure Fund (CMIF)* Indigenous Grants to support engagement activities, capacity building and knowledge gathering and sharing.

There is a keen interest from governments and investors in greater First Nation involvement in the critical minerals industry. The pros and cons depend on the specifics of the project. However, this paper seeks to support First Nation participation in those discussions.

1 Introduction

Questions this section answers

1. What is this report about?
2. Why should you care about critical minerals?
3. How can you use this report?

Top three takeaways

1. Canada has abundant critical minerals and there is growing demand for those minerals.
2. There are a range of ways that First Nations can be involved in the critical minerals beyond extraction.
3. There are supporting tools and resources for First Nations that the First Nations Major Projects Coalition can provide to help inform decision-making about participating in the critical minerals sector.

1.1 What this report is about

Growing interest and momentum in developing Canada's critical minerals sector present a range of new resource development opportunities for Indigenous communities. The rise in the economic and security importance of critical minerals brings new dynamics to the mining and related metals processing sectors.

Given this context, FNMPC Members have identified that there is a need to support First Nations in two ways:

- Developing a more comprehensive understanding of the opportunities for economic or commercial participation in the critical minerals sector.
- Providing an overview and gateway to existing tools and practical frameworks to support FN participation in projects.

This report provides a basis for understanding the critical minerals sector and its associated value chains. The information presented here is intended to support First Nations in better understanding the context and forces driving increased interest in developing Canada's critical minerals resources. This understanding is useful when considering the opportunities presented by critical minerals in greater detail.

Then the discussion proceeds to an overview of the opportunities related to critical minerals and the mechanisms for assessing business partnerships, funding, employment, and infrastructure. This report offers a gateway, not a complete handbook. It offers a range of resources that could support informed decision-making.

1.2 How to use this report

This report was designed primarily for a First Nations audience interested in better understanding and potentially engaging with the rapidly evolving critical minerals sector in Canada. It begins by explaining what critical minerals are, why they matter for clean energy and advanced technologies, and how geology, resource base, and Crown government strategies seek to position Canada as a global supplier. The guide also provides an overview of the critical minerals value chain—from exploration and extraction to processing, manufacturing, recycling, and reclamation—to show where critical mineral opportunities extend beyond the mine site. It is FNMPC's hope that this tool will support First Nations in their own decision-making processes related to critical minerals.

The report outlines key opportunities for First Nations in critical minerals development:

1. setting social and environmental standards;
2. seeking community funding; promoting contracting and procurement to Indigenous partnerships;
3. securing employment and training opportunities; exploring infrastructure partnerships;
4. developing partnerships or wholly owned corporations to service the industry; and
5. developing equity ownership.

Mechanisms that First Nations can use to advance these outcomes include:

1. readiness;
2. consultation and consent;
3. community and impact benefit agreements; and
4. federal and other financing support.

Each section of this report highlights key considerations for First Nations, supported by examples from across Canada and insights from existing research.

How to Read this Report

Each core section will begin with a navigation window at the top to help guide the reader through the report and provide quick access to the most relevant section. The questions the section answers and the "top three takeaways" are also highlighted. Each section will also begin with **a summary of the most important content** in the *"what you need to know"* section. Case studies focus on opportunities and risks for First Nations. **Infoboxes** focus on specific concepts and give essential definitions.

How to Use this Report

The primary audience for this report is technical staff within First Nations (such as economic development managers, lands and resources teams, or negotiation teams). This report can serve as a reference when First Nations are preparing for engagement with companies or governments and as a resource when developing governance tools, policies, or economic strategies. It supports informed, community-driven decision-making, long-term planning, and direct participation in projects.

Additional Support

The First Nations Major Projects Coalition offers its members supporting tools to use alongside this report, such as briefing materials for Chief and Council. Please contact members@fnmpc.ca to gain access to Member-only materials.

1.3 Why critical minerals matter now

There is a rapidly increasing global demand for critical minerals, driven by the accelerating energy transition, advancements in artificial intelligence and robotics, and escalating requirements for defence materials. This surge in demand has underscored a critical imperative for Canada and its allies: it must reduce dependence on current processing hubs, particularly in China, by developing domestic supply chains for these essential minerals.

1.4 Why critical minerals matter for First Nations

Minerals development continues to present both opportunities and potential risks for First Nations. There is an increase in the range of minerals deposits of economic and strategic interest. By understanding the critical minerals industry and supply chain, First Nation governments can plan and take actions that can best serve their communities.

Table 1: Conventional versus "New" Minerals

Conventional	New Minerals
• High-purity iron ore • Copper • Nickel	• Graphite • Lithium • Rare earth elements

Mineral development has always involved a variety of costs and benefits, impacting Indigenous rights-holders differently. Increasing demand for conventional minerals, such as high-purity iron ore, copper, and nickel, and relatively new minerals (or metals and materials), such as graphite, lithium, and rare earth elements, brings with it new players in domestic and international supply chains and new market dynamics. As interest in developing these critical minerals grows, industry and government must learn from past experiences. The drawbacks must not be placed on First Nations, while others benefit from the wealth created.

1.5 Respecting and incorporating First Nation rights and interests

Indigenous peoples in what today is called Canada used minerals well before contact with Europeans. For example, the Yellowknives Dene (Tetsǫ́t'ıné or T'atsaot'ine in Dene) are known by their anglicized name because they used copper from the Coppermine River to make knives. Some First Nations assert an aboriginal right to the use of mineral resources.

Aboriginal rights related to natural resource development are rooted in Section 35 of the Constitution Act, 1982, and further articulated in the common law and in treaties. Canadian common law requires the Crown to engage in meaningful consultation with potentially affected Indigenous groups whenever proposed projects may impact their Aboriginal or treaty rights (the "duty to consult").

Consultation must be conducted in good faith, involve early notice, provide funding for participation, and enable First Nation input on project decision-making. The degree of consultation and accommodation required depends on the

strength of the claim and the impact of development that cannot be mitigated. Inadequate consultation risks delay, higher costs, reputational damage, a drop in share price, or reversal of project approval by courts.

While the duty to consult is a legal requirement, simply meeting the procedural and narrow obligations of the legal duty has not -and will not - achieve social license to operate, nor will it facilitate efficient assessment and regulatory processes. It is the minimum standard and the beginning of a positive relationship with Indigenous Rights-holders, not the end of the process. Rather, First Nations in Canada expect adherence to the principle of free, prior, and informed consent, as set out in the *United Nations Declaration on the Rights of Indigenous Peoples* (UNDRIP). Canada also acknowledges UNDRIP in federal legislation.

The current state of industry understanding in Canada is partially reflected in the Mining Association of Canada's *Towards Sustainable Mining (TSM) Protocols*, particularly the Indigenous and Community Relationships Protocol. *This protocol represents agreed-upon industry good practice,* and can also serve as a guide for communities on key mechanisms for involvement, influence, and benefit-sharing with mining projects.

Predictable and efficient processes are of mutual interest to project developers and First Nations. While there tends to be greater focus and debate on what "consent" means in free, prior, and informed consent, this report is meant to contribute to "prior and informed" by providing background on the full value chain for critical minerals. The support and confidence of impacted Indigenous Rights-holders is a foundation to build on, not a barrier that needs to be overcome.

2 What are Critical Minerals?

Questions this section answers

1. What are critical minerals?
2. How are critical minerals used?
3. Why is demand for critical minerals increasing?

Top three takeaways

1. To be defined as a critical mineral, a substance must be either: essential to national or economic security, necessary for the transition to a low-carbon and digital economy, or position Canada as a strategic and sustainable partner within global supply chains. In addition, its supply chain is threated and there's a reasonable likelihood of producing it in Canada.
2. Critical minerals are key inputs to energy production, generation, storage, and electrical equipment, clean technologies, defence production, and fertilizers, among others.
3. Demand is growing rapidly. For example, demand is expected to grow 1,337% for lithium by 2050 compared to 2019.

What you need to know:

Critical minerals form the backbone of modern economies. Critical minerals power clean energy systems, digital infrastructure, and national defence. Yet, their supply chains remain fragile, which is why governments are focusing on how to develop and support domestic projects.

Countries define what a critical mineral is differently. Canada identifies 34 minerals. Canada's definition of critical minerals ranges from common metals like copper and nickel to highly specialized materials such as rare earths and gallium. These minerals support essential technologies, including batteries, semiconductors, fertilizers, hydrogen systems, and solar power, each of which requires critical minerals and advanced materials for performance and reliability.

Global demand is rising rapidly as electrification accelerates, with **lithium, graphite, nickel, copper, cobalt, and rare earths** projected to grow sharply through 2050. Despite variations in forecasts, analysts agree that supply will struggle to keep pace with demand, which increases the urgency of new projects, investment, recycling, and more efficient use of materials.

Understanding these minerals across the entire value chain from extraction to advanced manufacturing is critical for effective planning and decision-making for if and how First Nations may want to get involved. Existing mines are being depleted faster than they are replaced by new discoveries. Therefore, increased development is necessary to meet future demand.

2.1 Definitions and key minerals

Critical minerals are natural resources that play a crucial role in modern economies. Critical minerals are considered *critical* because of their vulnerability to global supply chain risks. Disruptions in the supply of critical minerals can threaten key industries and even national security.

While definitions and specific lists differ across countries and jurisdictions (e.g., critical materials, critical raw materials, strategic and critical minerals, transition minerals), the term generally refers to **non-fossil-fuel minerals** that are essential to sectors such as energy, technology, and defence and are not easily substitutable.

For example:

- **Lithium** is central to lithium-ion batteries for energy storage.
- **Copper** is indispensable for electrification and wiring.
- **Gallium** is used in semiconductors for lasers and radars.
- **Neodymium** is vital for the production of strong, permanent magnets in electric motors and wind turbines.

While captured under the broad term critical minerals, processing, international trade, and markets can differ significantly. For example, there is an established base metals market for minerals such as **nickel, copper, and zinc**, which are traded as standardized commodities on exchanges such as the London Metal Exchange. This is quite different from the less transparent contract agreements for rare earths or gallium.

According to the International Energy Agency's *Policy Tracker*, more than 20 countries or regional blocs have compiled their own lists of critical minerals. Government and agencies regularly update these lists. They reflect different classification methods, strategies, and contexts. The European Union refers to "Critical Raw Materials" and currently lists 34 minerals or groups of minerals.

The United States maintains three lists:

- The **Defense Logistics Agency** (Department of Defense) identifies 62 minerals and materials essential for defence readiness.
- The **Department of Energy** highlights 18 minerals critical for the energy sector.
- The **Department of the Interior** maintains a list of 60 minerals based on economic impact.

In Canada, 9 of 13 provinces and territories have released critical mineral strategies or priorities, and several have also published their own lists. The federal government launched its Critical Minerals Strategy in 2022 and updated it in 2024, expanding it to include **34 minerals**.

Under the federal definition, Canada considers a mineral as *critical* if it meets **one** of the following three conditions:

1. It is essential to national or economic security.
2. It is necessary for the transition to a low-carbon and digital economy.
3. It positions Canada as a strategic and sustainable partner within global supply chains.

In addition, it must meet **both** requirements:

- The mineral's supply chain is threatened.
- There is a reasonable likelihood of producing it in Canada.

One important distinction is the broad use of the term "mineral" in the context of critical minerals, which can lead to confusion.

To be classified as a mineral, a substance must:

- be naturally occurring in a homogeneous solid,
- have a definite chemical composition,
- have a highly ordered atomic arrangement, and
- be (usually) formed by inorganic processes.

However, this is often not the case for critical minerals. For instance, nickel itself is not a mineral per se; it is an element and a metal. Two true minerals containing nickel are **pentlandite** and **millerite**. Pure nickel metal, however, does not occur naturally. Pure nickel is produced only after these minerals are mined, smelted, and refined. Further along the value chain, pure nickel can be converted into **stainless steel** or **nickel sulphate**, a key chemical for batteries. In contrast, some minerals do exist as single elements, such as gold, which occurs principally as a native metal, or diamond, which is pure carbon.

A definition that focuses solely on the mineral and mining sectors would risk leaving out the value-added midstream and downstream segments of the value chain. This is why it is essential to consider critical minerals across their **entire value chain**: from mining the mineral to processing into metals or chemical intermediates, and finally to manufacturing advanced materials and products for specific applications.

Infobox 1: Grouping of Critical Minerals & Families of Metals

Some metals with **similar properties, uses, or values** are grouped together into families of several chemical elements. Critical Minerals Lists from many jurisdictions often recognizes specific families such as Rare Earth Elements rather than listing each metal individually. Here are a few common families and categories of metals:

Rare Earth Elements (REE): a group of **17 metals**, including 15 lanthanides, along with yttrium (Y) and scandium (Sc), which are often considered separately, as seen in the Canadian Critical Minerals Strategy. Industry use lathandides in electronics, optics, glass, magnets, and catalysts. These lanthanides include:

- lanthanum (La),
- cerium (Ce),
- praseodymium (Pr),
- neodymium (Nd),
- promethium (Pm),
- samarium (Sm),
- europium (Eu),
- gadolinium (Gd),
- terbium (Tb),
- dysprosium (Dy),
- holmium (Ho),
- erbium (Er),
- thulium (Tm),
- ytterbium (Yb),
- lutetium (Lu).

Platinum Group Metals/Elements (PGM/PGE): six metals including ruthenium (Ru), rhodium (Rh), palladium (Pd), osmium (Os), iridium (Ir), and platinum (Pt). They are rare, valuable, and used as catalysts.

Precious Metals: Can be defined as Platinum Group Metals along with gold (Au) and silver (Ag).

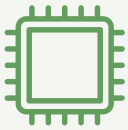
Base metals: They are commonly occurring metals that are inexpensive compared to precious metals and are mined on a large scale. Definitions vary, but they usually include lead (Pb), copper (Cu), nickel (Ni), aluminum (Al), zinc (Zn), and tin (Sn). For mining and economics, ferrous metals are not usually included.

Ferrous metals: All the alloys containing the element iron (Fe), such as steel, wrought iron, cast iron, stainless steel, etc.

2.2 Importance of critical minerals to the energy transition and efficiency, AI and data infrastructure, defence and security, and autonomy

Critical minerals are highly valuable because they are essential to several key sectors, including the energy transition, the digital economy, and national security. Their applications are extensive, and the table below illustrates which critical minerals are used in a selection of seven vital application value chains.

Table 2: Seven Key Application Value Chains for Critical

End-Use Application Value	Details
Defence 	**Elements & Minerals Included** Al, Be, Co, Ga, Ge, Graphite, Li, Mn, Pt, REE, Ti, W1 **Details** Aluminum lightens aircraft and missiles, graphite strengthens tanks and quiets submarines, and cobalt enables superalloys that withstand the extreme heat and stress of jet engines and missile systems.
Semiconductors 	**Elements & Minerals Included** Sb, As, Ga, Ge, In, Si **Details** Semiconductors are vital to the digital economy and advanced electronics: from smartphones to AI, connectivity, and computing, as recognized by the Government of Canada. While silicon is the most common material, high-performance semiconductors also depend on critical minerals such as gallium, germanium, indium, and antimony, which must be refined to ultra-high purity or specific compounds for use in chips and devices.
Fertilizer 	**Elements & Minerals Included** Phosphate, Potash **Details** Fertilizers are indispensable to agriculture, with phosphate rock and potash providing two of the most critical nutrients for crops, alongside nitrogen. Because these resources are geographical-ly concentrated and irreplaceable in large-scale farming, securing access to phosphate and potash is essential for food production and food security.
Permanent Magnets 	**Elements & Minerals Included** Rare Earth Elements: Dy, Nd, Pr, Tb **Details** Rare-earth-based permanent magnets, particularly NdFeB (“Neo”) magnets, enable strong magnetic fields in compact sizes and are essential for technologies such as EV traction motors, wind turbines, robotics, and precision electronics. Canada identifies Rare Earth Elements, such as neodymium, praseodymium, dysprosium, and terbium, as a priority value chain.

[1] NATO’s list of 12 essential raw materials for Allied defence

Hydrogen Fuel Cells & Electrolyzers

Elements & Minerals Included

Al, Co, Cu, Graphite, Ni, PGE (Ir, Pd, Pt), REE (La, Y), Zr

Details

Hydrogen technologies rely on critical minerals for key components, such as electrolyzers that split water into hydrogen and fuel cells that convert hydrogen into electricity. Canada also identifies Platinum-group metals (PGMs) such as platinum, iridium, and ruthenium, which act as catalysts for these reactions, as well as several other critical minerals for this value chain.

Solar

Elements & Minerals Included

Al, Bi, Cd, Cu, Ga, In, Pb, Mo, Se, Si, Ag, Te

Details

Solar photovoltaic (PV) modules depend on critical materials to efficiently convert sunlight into electricity, and they've also been identified as a priority application value chain for Canada. Technologies such as crystalline silicon, CIGS (copper indium gallium selenide), CdTe (cadmium tellu-ride), and amorphous silicon re-quire specific minerals and met-als, including copper, indium, gal-lium, tellurium, and high-purity silicon.

Battery and Energy Storage Technology

Elements & Minerals Included

Al, Cu, Co, Graphite, Fe, Li, Mn, Ni, Phosphate, Ti, Si, V

Details

Energy storage also depends on several critical minerals. Lithium-ion batteries use lithium for electricity storage, along with nickel, cobalt, manganese, or phosphate and iron for the cathode, and graphite for the anode, powering both electric vehicles and the growing market for stationary storage.

PGE: Platinum Group Elements; REE: Rare Earth

On top of those seven application value chains, other critical elements have distinct roles:

- **Helium**, a scarce noble gas extracted from natural gas, is vital for medical imaging, superconducting magnets, and semiconductor manufacturing.
- **Uranium** fuels nuclear power plants and is the most energy-dense commercial fuel, producing electricity without greenhouse gas emissions.
- **Iron** is incorporated into the battery value chain, particularly for LFP technology. **High-purity iron ore** is also listed as a critical mineral in Canada, which is key to the further development of the Labrador Trough between Labrador and Quebec, as well as to the production of green steel.

Infobox 2: Dual Use Critical Minerals

One term gaining significant traction is 'dual use'. This describes critical minerals that have **both civilian and military applications**. This diversity in applications allows for a diversity of off-takers and capital pools. Export Development Canada has highlighted some of the capital pools where Canada could hold a strategic position.

For example, aluminum is used in automotive and construction, but also in aircraft and ammunition. Platinum is used in car catalytic converters and in fuel reforming technologies for military purposes. **Tungsten** is found in cellphones, as well as in munitions and rockets.

2.3 Rising demand for critical minerals

The demand for critical minerals is projected to increase significantly as the global energy transition accelerates. Electrification, the deployment of renewable energy, and the growth of electric vehicles (EVs) are driving a fundamental shift in material requirements, calling for large quantities of lithium, nickel, cobalt, graphite, and copper.

Accurately forecasting clean energy deployment, however, remains challenging. For instance, the IEA has underestimated the pace of solar PV growth and, at times, the market share of EV sales. The reliability of forecasts depends on the assumptions behind them, so they should be considered informed guesses made using the evidence and experience available to the forecaster. Despite these uncertainties, forecasts and scenario comparisons remain valuable tools for understanding potential trends.

Infobox 3: What goes into a demand forecast for critical minerals?

Forecasters shape their projections for critical minerals demand based on:

- **Demand trends**
- **Market dynamics**
- **Technological progress**
- **Production capacity**
- **The level of government support**

A 2023 report by the International Energy Forum and the Payne Institute for Public Policy compared 11 global demand projections and scenarios for eight metals from major international organizations, universities, government agencies, and companies. While the 11 scenarios varied widely in scope and assumptions, they all agreed that demand for critical minerals will grow substantially.

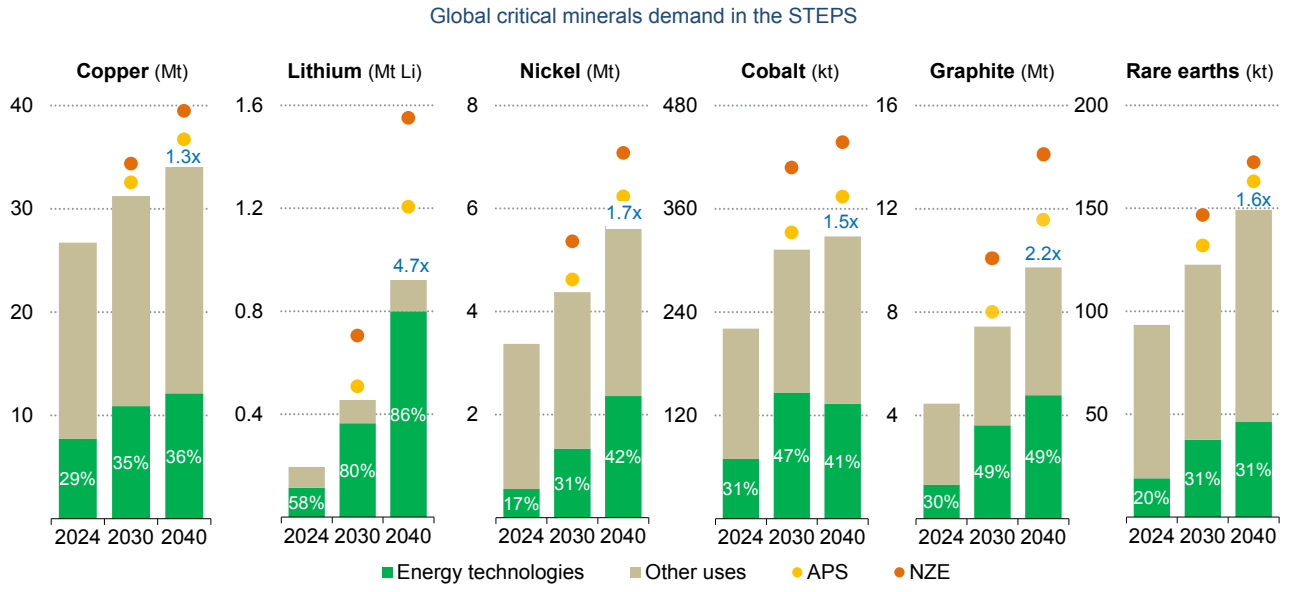
Table 3: Increase in Demand for Critical Minerals

Critical Mineral	2019-2022 Demand	2050 Demand	Demand & Growth
Aluminum	12 Mt	24 Mt	+100%
Cobalt	68 kt	258 kt	+279%
Copper	6 Mt	17 Mt	+183%
Graphite	0.6 Mt	3.5 Mt	+483%
Lithium	73 kt	1,049 kt	+1,337%
Neodymium	10 kt	96 kt	+860%
Nickel	0.5 Mt	2.0 Mt	+300%
Silver	5 kt	13 kt	+160%

Demands represent the median value across 11 different projection scenarios; kt = kilotonnes; Mt = mega-tonnes

The most recent 2025 IEA Critical Minerals Outlook also forecasts consistent growth in demand for critical minerals. This was true even under its most conservative scenario, known as the "Stated Policies Scenario" (STEPS). The STEPS scenario assumes governments follow only their existing policies, serving as a cautious, business-as-usual benchmark for the energy system. Between 2024 and 2040, the IEA projects that copper demand will increase by about 30%, while lithium demand is expected to multiply fivefold. Nickel, cobalt, graphite, and rare earth elements are projected to increase significantly, from 1.3x for copper to 1.7x for nickel.

Image 1: Critical Mineral Demand Forecast from 2025 IEA Outlook



IEA. CC BY 4.0.

Notes: STEPS = Stated Policies Scenario; Mt = million tonnes; kt = kilotonnes; APS = Announced Pledges Scenario; NZE = Net Zero Emissions by 2050 Scenario. The figures for copper are based on refined copper (excluding direct-use scrap). Those for rare earth elements are for magnet rare earth elements only. Growth rates (in blue) are between 2024 and 2040.

Most projections also emphasize that these rising demands are unlikely to be met. This is true even when accounting for new mining projects expected to come online, projected supply falls short of projected demand. This imbalance is spurring a sense of urgency to accelerate investment and development in critical mineral projects and to advance material efficiency and recycling.

3 The Global Critical Minerals Landscape

Questions this section answers

1. Which countries control critical mineral supply?
2. Why are there concerns about how certain countries are controlling supply?
3. What are Canada's advantages in the global critical minerals market?

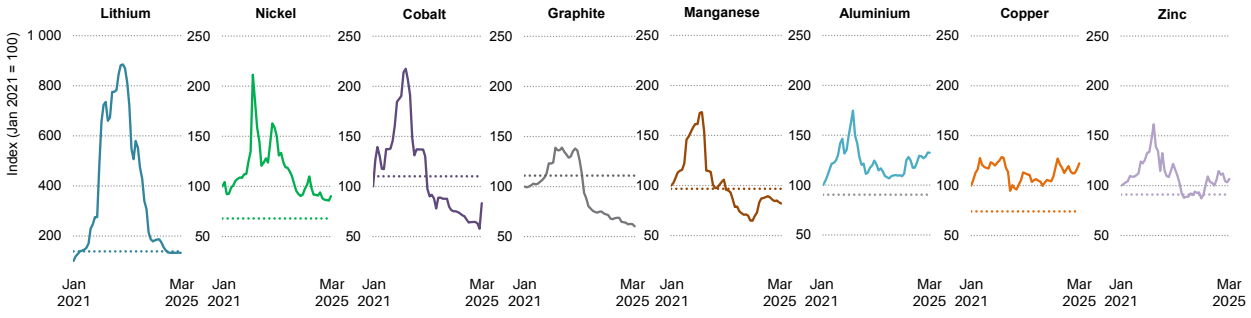
Top three takeaways

1. China dominates the critical mineral market at most stages and uses policies to maintain this control.
2. The concentration of supply in a few countries has the effect of making prices quite volatile, which can impact the competitiveness of new projects into the market.
3. Canada's comparative advantage as a desirable host for critical minerals projects is rooted in its developed expertise, skilled workforce, strong standards, access to global markets, and relative security of water supply.

What you need to know:

Critical mineral supply chains are fragile because mining and processing are heavily concentrated in a few countries, giving them outsized control over global markets. China dominates many of the most strategic stages, including refining lithium and cobalt, processing nearly all-natural graphite, and producing most battery components, rare earth magnets, and solar and wind technologies. These concentrations make governments and industries vulnerable to export restrictions, trade disputes, and price swings, as shown by the rare-earth crisis and volatility in the nickel and lithium markets.

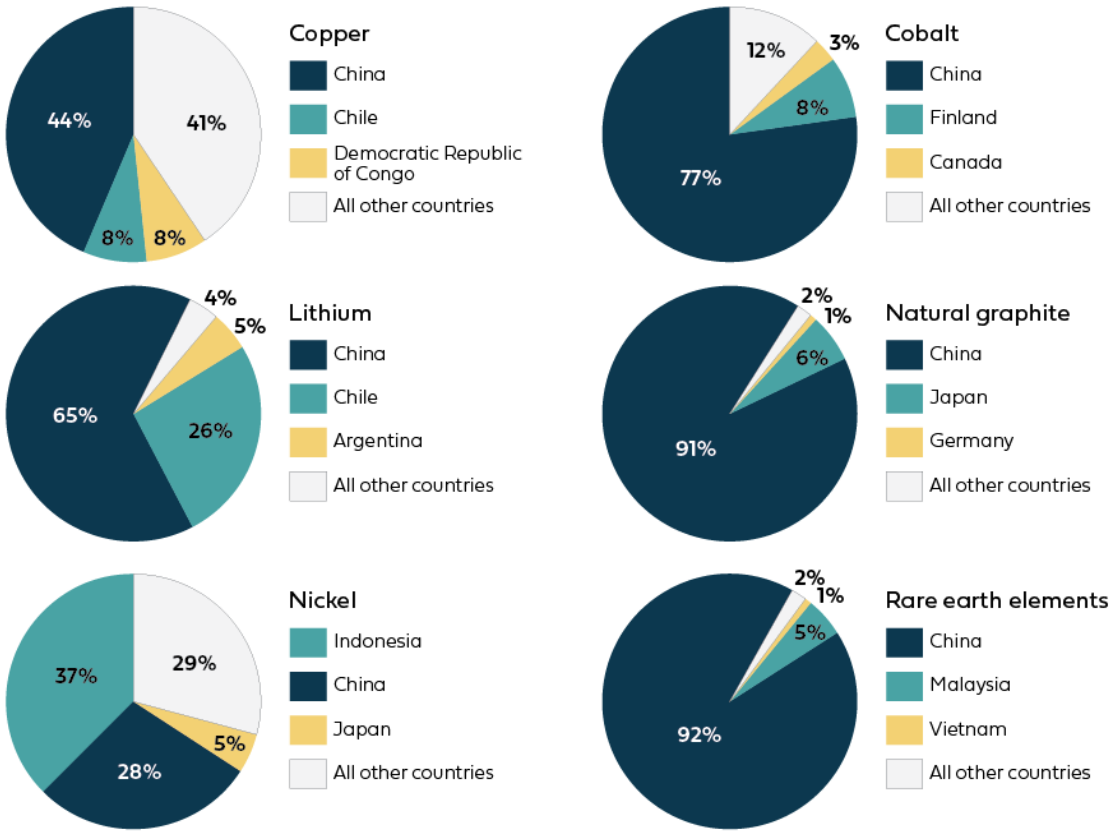
Image 2: Price Volatility for Eight Selected Critical Minerals from 2021-2025[2]



[2] https://www.iea.org/reports/global-critical-minerals-outlook-2025.

Canada holds a strong position with world-leading uranium and potash production, a skilled workforce, clean electricity, and mining. These strengths provide a strategic opportunity to build more secure and sustainable supply chains that reduce dependence on concentrated foreign sources.

Image 3: Percentage of refined material production for critical minerals (2023)



3.1 Who produces, processes, and controls supply

The vulnerability of the critical minerals value chain often stems from market concentration among a small number of actors and countries. These differences can vary widely across commodities. For example, copper mining involves a diverse group of producing countries, with Chile leading at 24% of global output in 2022. Chile is followed by Peru (11%), the Democratic Republic of China (11%), China (9%), and the U.S. (6%). Other critical minerals are much more concentrated in one producing country.

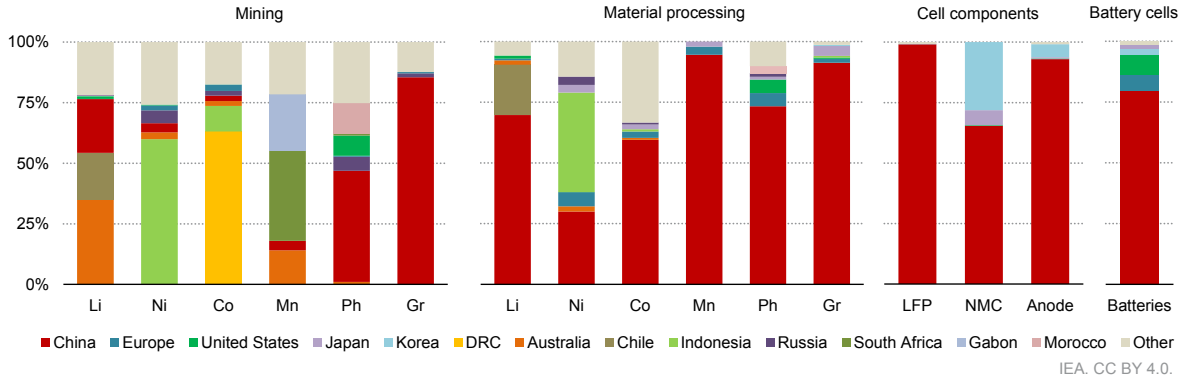
For example, according to the U.S. Geological Survey, in 2023:

- Brazil made up 93% of global niobium mining.
- The U.S. and Qatar accounted for 84% of the global helium production.
- South Africa accounted for 70% of the global platinum production.
- Russia produced 42% of palladium globally.
- China produced around 99% of low-purity gallium in 2023.

[3] https://www.iea.org/reports/global-critical-minerals-outlook-2025.

As highlighted in the figure below from the International Energy Agency 2025 Critical Minerals Outlook, China maintains a particularly dominant position in the **global battery supply chain**. While it only clearly monopolizes natural graphite mining, China especially leads in the mid- and downstream segments of battery chemicals and manufacturing.

Image 4: Geographical Distribution of the Global EV and Storage Lithium-Ion Battery Supply Chain (2024).



Notes: Li = lithium; Ni = nickel; Co = cobalt; Mn = manganese; Ph = phosphate; Gr = graphite; Refining: Li = battery-grade lithium chemicals; Ni = nickel final products including nickel sulphate; cobalt = final refined cobalt products including cobalt sulphate; Mn = battery-grade manganese sulphate; Ph = battery-grade phosphoric acid. LFP = lithium iron phosphate; NMC = lithium nickel manganese oxide. LFP and NMC refer to cathode material production and NMC includes all nickel-based cathode material such as nickel cobalt aluminium oxide (NCA). DRC = Democratic Republic of the Congo. Geographical breakdown refers to the country where the production occurs. All stages of the supply chain are based on data for production in 2024 except for cell components, which is based on production capacity in 2024. Graphite refining refers to all battery-grade graphite production.
Source: IEA analysis based on USGS (2025), Mineral commodity summaries, BloombergNEF, EV Volumes and Benchmark Mineral Intelligence.

Indeed, in metallurgy and chemicals, China processes over half of the lithium and cobalt, produces nearly two-thirds of the world's purified phosphoric acid in 2022, and controls almost all natural graphite processing. In battery materials, China accounts for over 90% of anode production and 98% of LFP battery cathode production, while manufacturing roughly 80% of all battery cells.

Batteries are not the only high-tech application in which China has a global production lead over the value chain:

- **Permanent magnets:** Around two-thirds of global rare-earth mining production comes from China, which also exclusively produces the extremely valuable heavy rare-earth elements. In the midstream, China accounts for 92% of rare-earth refining and around 80–90% of global neodymium magnet production.
- **Solar:** China represented around 80% of polysilicon, 97% of wafers, 85% of solar cells, and 75% of solar cell modules global manufacturing capacity in 2021.
- **Wind:** China produces 70–80% of global turbine blades, 45–50% of tower manufacturing, and about 70% of nacelle assembly capacity in 2024, according to the IEA.
- **Defence:** China is the leading producer of 4 of NATO's 12 Defence Critical Raw Materials. In 2023, it supplied 79% of the world's natural graphite, 67% of vanadium, 68% of rare earth elements, 34% of titanium concentrate, and 83% of tungsten. Beyond extraction, China also leads globally in the processing and refining of key materials, such as rare earths, manganese, cobalt, graphite, and lithium, and dominates global aluminum production. It accounts for 98% of gallium, 74% of germanium, and 69% of titanium sponge output. China has further consolidated its position in vanadium mining (67% of global production) and tellurium refining (77%), both metals being strategically important in aerospace and defence applications.

[3] https://www.iea.org/reports/global-critical-minerals-outlook-2025.

3.2 Why the security of supply is a big deal

As mentioned above, a few entities control most global critical mineral production and processing, and the rise of resource nationalism and export restrictions now poses significant supply risks to economies and communities. Given their essential applications, disruptions in critical mineral supply can threaten multiple dimensions of state sovereignty, including national security, defence, food supply, and energy independence. This, in turn, can dramatically affect a community's quality of life.

A key example is the **rare earth crisis**. Rare earth elements, vital for permanent magnets in electric motors and wind turbines, were at the centre of a major supply chain shock in the early 2010s, as noted by the IRENA. After leading production until the 1990s, the U.S. ceded dominance to China, which by the early 2000s produced roughly 95% of global rare earth elements. Citing pollution and resource depletion, China introduced export quotas, taxes, and investment restrictions starting in 2006, cutting exports by 37% in 2010 and triggering a global price surge. A brief halt in exports to Japan during a maritime dispute further demonstrated the fragility of the supply for these minerals. The resulting 2010–2011 price spike spurred recycling, substitution, and new mining efforts, especially in Western countries, before prices stabilized by 2012. In 2014, the World Trade Organization ruled China's export restrictions violated trade rules, forcing their removal. The ensuing price drop, however, led to the cancellation of several Western rare earth projects, reinforcing China's dominance in the value chain.

Similarly, global **production overcapacity** and **low prices** for key commodities like nickel and lithium have slowed the development of promising critical mineral projects. Indonesia, home to many Chinese-owned operations, and China dominate global nickel mining and processing, while China itself handles over two-thirds of lithium refining. This imbalance hinders project development and economic growth in other countries. Despite significant lithium deposits in Canada, several projects have been delayed or halted due to depressed international prices.

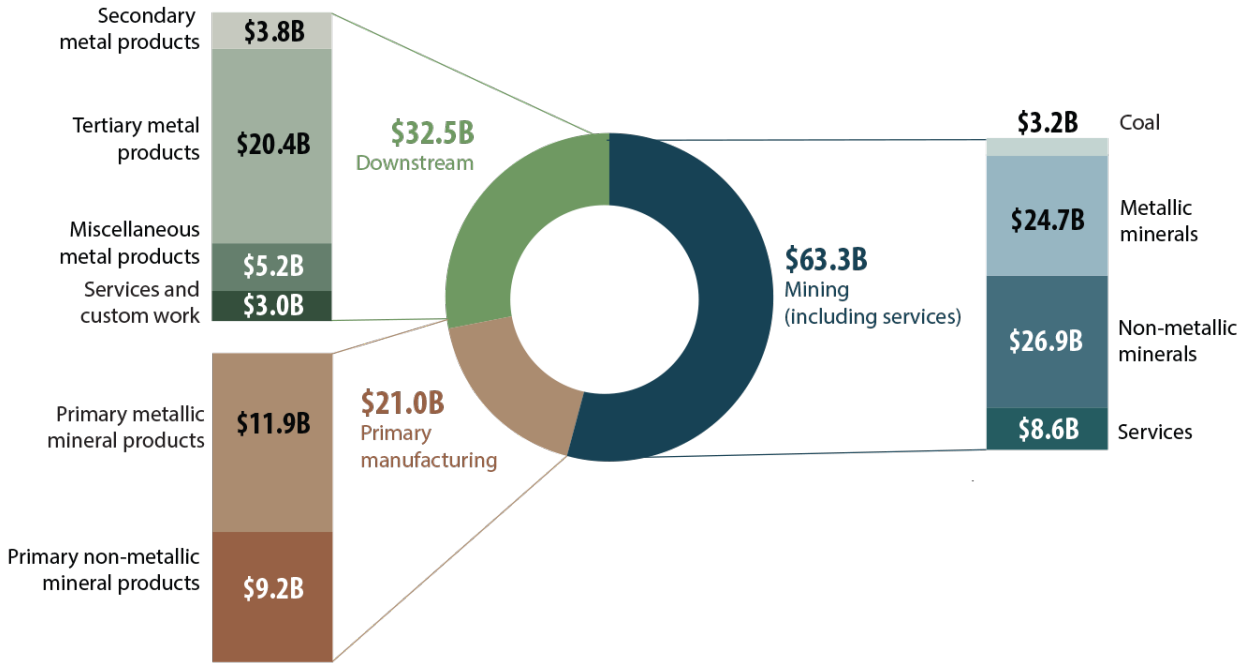
With these strategic materials under its control and export policies designed to maintain control, China dominates many clean technologies critical to the energy transition, as well as key inputs for defence and the digital economy. Beyond supply security, the stability of **off-take agreements** is also fragile. In 2025 and early 2026, tariff fluctuations and ongoing negotiations with the U.S. on free trade have notably affected Canada's aluminum and steel sectors, which depend heavily on the U.S. market. Perceived threats to state sovereignty have reinforced the importance of domestic supply.

The COVID-19 pandemic exposed the vulnerability of global supply chains, impacting electronics, automotive, transportation, medical, and food industries alike, resulting in **slower growth** and **higher inflation**. This highlights the urgent need for more diversified, resilient, and locally anchored supply chains, supported by a broader base of suppliers and off-takers.

3.3 How Canada fits into the global picture

In Canada, approximately 54,775 jobs were linked to the extraction and production of critical minerals in 2023, representing 1.1% of the total Canadian economy, according to StatsCan. When considering a broader framework that includes the overall mineral sector, its services, primary, and downstream manufacturing, this totals 430,000 people employed in the mining industry that same year. The direct contribution of the minerals and metals sector to the country's gross domestic product is $117 billion, or 4% of GDP.

Image 5: Minerals sector nominal gross domestic product, by subsector and product group, 2023[4]



According to NRCan, more than 17,300 Indigenous Peoples are employed in the minerals and metals sector and represent 11% of the upstream mining industry's labour force, which is more than double the all-industry average in every sector. In 2022, Indigenous gross domestic income grew by 21.1% in the mining, quarrying, and oil and gas extraction sectors, contributing significantly to overall Indigenous economic activity.

In the face of global competition, Canada has the following advantages for developing critical mineral value chains further:

Developed Expertise – Canada has a long history of mining and metallurgy, especially in iron/steel, nickel, and copper, with over a hundred years of operation in some areas.

Market Position in Key Critical Minerals - World-class market position in uranium, producing nearly a quarter of global output in 2024, and potash, accounting for almost a third of global production in 2023. In fact, Saskatchewan is home to 45% of the world's known potash reserves. In early 2026, Saskatchewan also has two new uranium mines in the final stages of regulatory approval, with both projects prioritizing Indigenous partnership. Canada ranked first in Bloomberg NEF's 2024 Global Lithium-Ion Battery Supply Chain Ranking, and second in the 2025 edition, reflecting its strong performance in resource availability, environmental standards, and domestic manufacturing potential.

[4] https://natural-resources.canada.ca/minerals-mining/mining-data-statistics-analysis/minerals-economy.

Skilled Workforce - Combined with a skilled mining workforce, domestic technology, and homegrown innovation.

Favourable Regulations- This includes, for example, a 30% Critical Mineral Exploration Tax Credit. In 2024, the Fraser Institute ranked Saskatchewan, Newfoundland and Labrador, and Alberta in the top 10 most attractive global jurisdictions for mining policy.

Market Access - Canada has access to the North American market through the Canada-United States-Mexico Agreement (CUSMA) and other multilateral and bilateral trade agreements *(the Comprehensive and Progressive Agreement for Trans-Pacific Partnership, the Comprehensive Economic and Trade Agreement, etc.)*. However, agreements such as CUSMA can be at risk at the whim of the US administration.

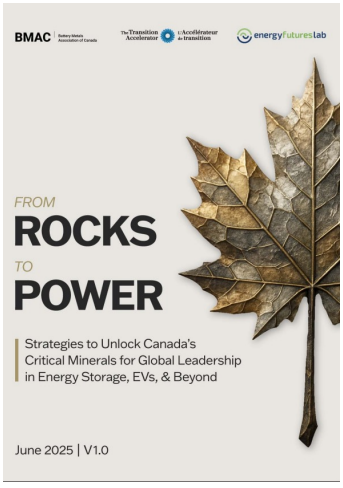
Strong Environmental, Social, and Governance (ESG) Standards - ESG Standards in Canada's mining sector include *Towards Sustainable Mining (TSM)* by the Mining Association of Canada (MAC). Current Canadian metallurgical processes emit considerably less greenhouse gas than those in Asia, largely due to a cleaner electricity grid and better environmental regulations.

Clean and Affordable Electricity - A clean and affordable electricity grid, with 81% of its electricity generation relying on non-carbon-emitting sources such as hydropower, nuclear, wind, and solar in 2021.

Stock Exchange Access - Canada holds a leading position in mining equity and stock exchanges, with the TSX and TSX-V. They account for $45B or 36% of total mining equity capital raised worldwide, more than any other exchange.

Water Security - Unlike other mineral-rich countries such as Chile, Peru, South Africa or Australia, Canada is not a water-stressed mining jurisdiction. Additionally, Canadian case law recognized an Aboriginal right to water, which is further defined and codified in agreements between the Crown and First Nation governments, such as modern treaties.

Infobox 4 - Additional Resources: *From Rocks to Power*



Published by the Battery Metals Association of Canada and authored by the Transition Accelerator, based on over a year of collaboration with industry, government, and academic partners across the country, this report identifies clear, investable priorities in eight minerals, each critical to building resilient EV and energy storage value chains.

By looking at specific opportunities and providing detailed justifications for its recommendations, From *Rocks to Power* offers a way out of our perpetual planning cycle and towards a new momentum for Canada's critical minerals sector—and our future economic prosperity.

https://transitionaccelerator.ca/reports/from-rocks-to-power/

The following table illustrates the current state and global rank of the Canadian mining and metallurgical industry in 2022 for 9 selected critical minerals. It was updated from the From Rocks to Power report published by the Battery Metals Association of Canada.

Table 4: Summary of Canada's Rank in Reserve, Mining, and Processing for Selected Critical Minerals

Critical Mineral	Cobalt	Copper	Graphite	Iron	Lithium	Nickel	Phosphate	REE	Vanadium
Role and Canada's Rank in 2022	NMC cathode	Current, transformer, wire	NMC, LFP Anode	LFP cathode	NMC, LFP cathode, electrolyte	NMC cathode	LFP Cathode	Permanent Magnet	Flow battery
Global Reserve Rank	7th	13th	9th	7th	6th	7th	18th	10th	/
Global Mining Rank	7th	12th	7th	7th	7th	6th	None	None	None
Global Processing Rank	3rd	16th	None	15th (steel)	None	4th	None	SRC in SK*	1 plant**
Canadian Mining in tonnes (% world)	3,060 (1.6%)	520,000 (2.4%)	13,000 (0.8%)	41,400,000 (2.7%)	520 (0.4%)	143,000 (4.4%)	0	0	0

Data from the U.S. Geological Survey, Yearly Mineral Commodity Summary, 2024; NRCan, 2024; IEA, 2024.
* Saskatchewan Research Council's Rare Earth Processing Facility in Saskatoon
** Val-des-Sources electrolyte pilot plant operated by VanadiumCorp

Table 4 shows that Canada ranks highly **globally for its mineral reserves**, thanks to its vast landmass and favourable geology. However, Canada lacks processing for phosphate, rare earth elements, and vanadium. Copper production has also declined.

This strength in extraction does not extend to processing: Canada has **limited smelting and refining capacity**, with no midstream industry for graphite, lithium, or phosphate. The country hosts a pilot electrolyte plant for vanadium battery in Quebec, and Saskatchewan recently opened a small-scale rare-earth processing centre. The Canadian steelmaking sector lacks the scale to compete globally. While Canada is the world's third-largest cobalt refiner (four refineries) and fourth-largest nickel refiner (three refineries), each only accounts for 1–4% of global output.

4 Critical Minerals in Canada

Questions this section answers

1. Where are critical minerals being produced in Canada?
2. What is the Government of Canada, as well as provinces and territories doing to encourage the development of critical minerals?
3. Who are the major players in the Canadian critical minerals market?

Top three takeaways

1. The Government of Canada has developed a critical mineral strategy and is creating agencies, undertaking research, and providing funding to support the development of the critical minerals. Provinces and territories are adapting strategies to regional conditions.
2. The structure of the Canadian mining and metallurgy industry has evolved over the past decades as global multinationals have acquired many formerly Canadian mining champions, although several influential Canadian firms remain active.
3. In downstream and advanced materials manufacturing, the sector includes Canadian startups, specialized mid-sized firms, and large foreign multinationals setting up manufacturing facilities in Canada.

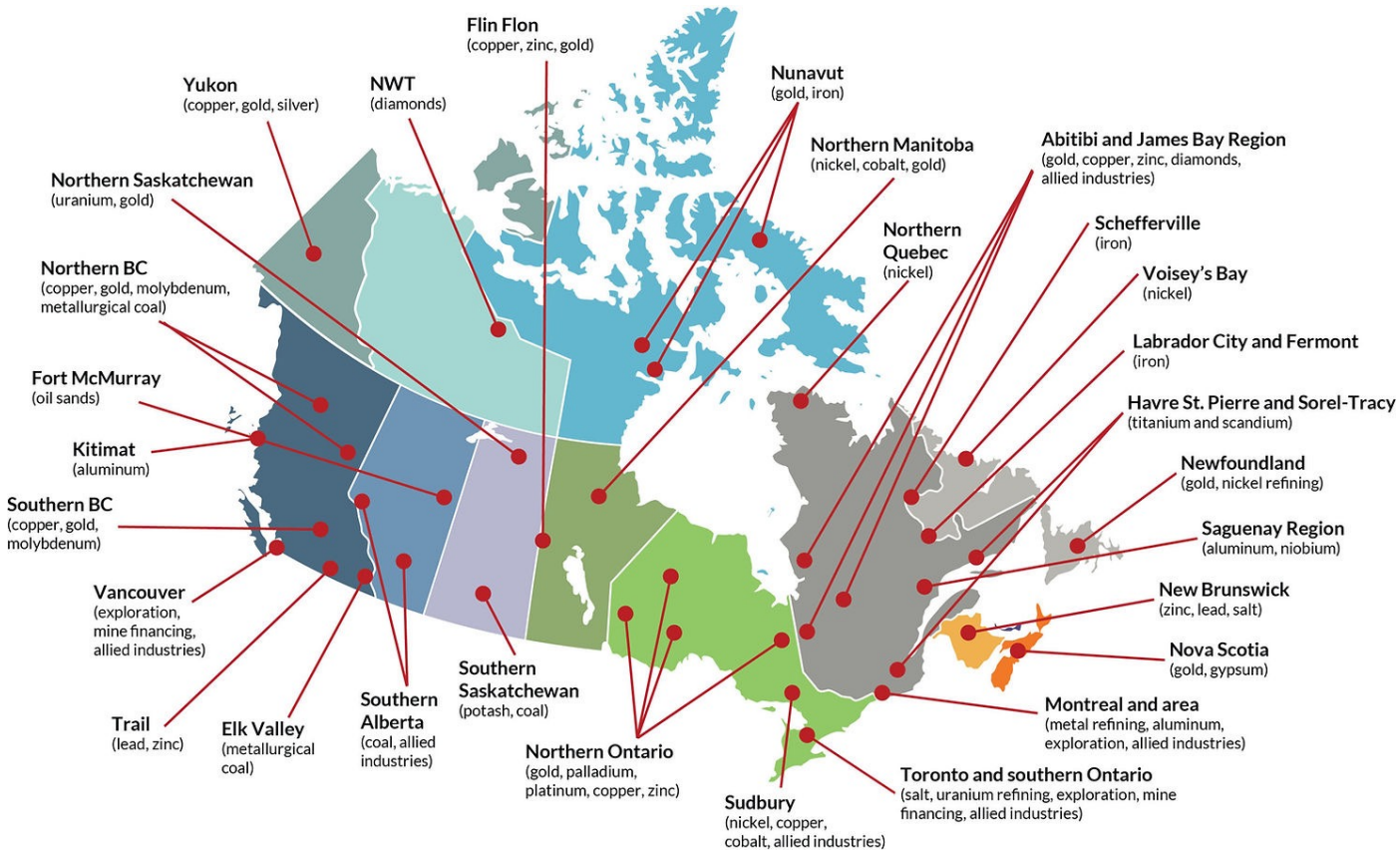
What you need to know:

Canada possesses a wealth of critical minerals, supported by 56 operating mines, 26 processing facilities, including smelters and refineries, and over 150 advanced projects across every province and territory. Key regions like British Columbia, Saskatchewan, Quebec, and Ontario form major production corridors, while emerging opportunities are broadening Canada's midstream capacity in processing, refining, and advanced material manufacturing. This resource base is underpinned by a layered policy framework that includes a federal strategy, new permitting tools, and nine provincial and territorial strategies tailored to distinct geological and economic priorities.

The structure of the Canadian mining and metallurgy industry has evolved over the past decades as global multinationals have acquired many formerly Canadian mining champions, although several influential Canadian firms remain active. In downstream and advanced materials manufacturing, the sector includes Canadian startups, specialized mid-sized firms, and large foreign multinationals setting up manufacturing facilities in Canada.

4.1 Key regions, projects, and minerals

Image 6: Map of the mining and processing regions in Canada by the Mining Association of Canada



Due to its vast surface area and rich geology, Canada has significant critical mineral resources. In June 2024, NRCan reported that there were:

- 56 operating critical minerals mines.
- 26 critical minerals processing facilities.
- 151 active advanced-stage critical minerals projects.[5]

For example, the table below presents several regions involved in critical minerals extraction, including active or upcoming mines, the critical minerals they contain, and brief descriptions. This table provides only a partial account of Canada's mining potential.

[5] Refer to section 10.2 of this report for more information on Critical Minerals maps.

Table 5: Selected Mining Regions across Canada

Region	Provinces & Territories	Critical Minerals/ Elements	Description
Northern BC	BC	Copper, nickel, molybdenum, gold, silver	'Gold Triangle' or 'Copper Corridor', the region already has several active mines but holds significant potential for copper and nickel.
Yukon	Yukon	Copper, zinc, tung-sten, lead	Polymetallic deposits present significant opportunities but lack energy and infrastructure.
Great Bear Magmatic Zone	NWT	Copper, REE, cobalt, bismuth, high purity iron, nickel, phosphorus, vanadium, gold, silver	The Great Bear Magmatic Zone hosts several polymetallic systems, including iron-oxide-apatite and iron-oxide-copper-gold deposits.
North Slave Geological Province	NWT, NU	Gold, lithium, REE, base metals	Currently several diamond mines, but potential for gold, base metals, rare earth and lithium.
Alberta	AB	Lithium, iron, vanadium, helium, oil sands	Unique feedstocks such as large lithium brine reserves from oilfields, iron and vanadium from Clear Hills or petroleum fly ash, and bitumen for conversion to graphite or hard carbon.
Athabasca Basin	SK, AB	Uranium, rare earths	World-class cluster with leading active uranium mining and milling, with rare earth elements not yet mined.
Southern Saskatchewan	SK	Potash, lithium, helium	World-class potash industry, developing helium sector, and promising lithium brine reserves.
Flin-Flon-Thompson	SK, MB	Copper, zinc, nickel, lithium	Historical mining region for copper (Flin-Flon) and nickel (Thompson), featuring active mines but closed smelters. Contains some hard rock lithium deposits.
Northwest Ontario-Eastman	ON, MB	Lithium, cobalt, cesium, tantalum, copper	Active tantalum mine and lithium & base metals exploration in MB, along with numerous hard rock lithium opportunities north of Thunder Bay.
Abitibi Greenstone belt	ON, QC	Gold, copper, zinc, silver, cobalt, nickel	Historical gold rush region around Timmins & Val d'Or, with active base metal mining, a copper smelter, and promising projects for nickel and lithium.

Sudbury Basin	ON	Nickel, copper, gold, silver, PGMs, cobalt	Historical nickel, copper, and cobalt mining remains very active, with nickel and cobalt smelters still operational.
Quebec Graphite Clusters	QC	Graphite	Laurentides & Outaouais have the only active graphite mine in North America and numerous prospects, while Côte-Nord possesses large deposits.
Eeyou Istchee James Bay	QC	Lithium	Large hard rock lithium deposits in the Eeyou Istchee James Bay area, with major projects underway.
Labrador Trough	NL/QC	Iron, manganese, nickel	Historical and active high-grade iron ore mining suitable for green steel. Nickel mining occurs in Voisey's Bay.

Regarding the midstream segment, which transforms mining concentrates into materials through metallurgy or chemistry, several facilities already operate in Canada. The following table highlights a selection of critical mineral metallurgical plants, both active and planned.

Table 6: Selected Metallurgical and Processing Plants and Regions across Canada

Site	Organizations	Status	Location	Critical, Minerals/Elements
Trail Smelter	Teck	Active	BC	Lead, zinc, and many rare metals
Kitimat Smelter	Rio Tinto	Active	BC	Aluminum
Fort Saskatchewan	Sherritt	Active	AB	Nickel, cobalt
NICO Refinery	Fortune Minerals	Project	AB	Copper, gold, bismuth, cobalt
Rare Earth Processing Facility	SRC	Active	SK	REE
Blind River & Port Hope	Cameco	Active	ON	Uranium
Sudbury	Glencore, Vale	Active	ON	Nickel, cobalt
Hamilton	ArcelorMittal, Stelco	Active	ON	Iron, steel
Horne smelter	Glencore	Active	QC	Copper
Bécancour	Nemaska, Nouveau Monde Graphite, …	Project	QC	Lithium, graphite, aluminum, etc.
Saguenay	Rio Tinto	Active	QC	Aluminum
Long Harbour	Vale	Active	NL	Nickel, copper, cobalt

4.2 Federal and provincial strategies

At the federal level, the **Critical Minerals Centre of Excellence** (CMCE) was created within **Natural Resources Canada** (NRCan) through *Budget 2021* and received further support from *Budget 2022*. The CMCE is responsible for leading the development and coordination of Canada's critical minerals policies and programs, working with industry, provincial, territorial, Indigenous, non-governmental, and international partners. Its main goal is to promote critical mineral resources and value chains that support a sustainable, green, and digital economy.

The Canadian Critical Minerals Strategy, launched on December 9, 2022, and supported by up to **CA$3.8 billion** in federal funding (announced in *Budget 2022*), acts as a comprehensive federal government-wide plan. This followed the *Canadian Minerals and Metals Plan* (2019) and Action Plans (2020 and 2021). The 2022 strategy aims to establish Canada as a preferred global supplier of **responsibly sourced critical minerals** and the **clean and digital technologies** they support. In 2024, the federal government updated the list of critical minerals, increasing from **31 to 34** minerals, to reflect changing market conditions and strategic priorities. Cobalt, copper, nickel, rare earth elements, graphite, and lithium are the **6 prioritized critical minerals** identified in the strategy.

An update of the Strategy was also released in 2024. Various federal entities, such as Natural Resources Canada (NRCan), Innovation, Science, and Economic Development Canada (ISED), and the Canada Growth Fund (CGF), have employed different funding and support mechanisms to implement this federal strategy.

The federal government launched the Major Projects Office in August 2025. The office will also support the strategy by streamlining regulatory approvals and mobilizing investments to ensure that major critical minerals projects reach final investment decisions quickly and efficiently. The federal government also announced a $2 billion Critical Minerals Sovereign Fund in Budget 2025 to make strategic investments in critical minerals projects and companies.

As of November 2025, **9 of Canada's 13 provinces** and territories have unveiled dedicated strategies or priority frameworks for critical minerals. Two others follow broader mining strategies that include critical mineral components, while at least **5 jurisdictions** have also published their own lists of critical minerals, often with slight variations from the federal list at the time of release. These strategies differ in scope, depth, and focus, reflecting each jurisdiction's unique resource base and economic context. The table below compiles all known strategies and provides links to the relevant documents.

Table 7: Summary of federal, provincial and territorial critical mineral strategies and lists[6]

Jurisdiction	Critical Mineral Strategy	Release Year	Strategy Link	Specific List (# of Critical Minerlas)	List Link
Federal					
Canada	Yes	2022 (updated 2004)	Link	Yes (34)	Link
Provincial					
British Columbia	Yes	2024	Link	No	/
Alberta	Yes	2021	Link	Yes (28)	Link
Saskatchewan	Yes	2023	Link	No	/

[6]

Jurisdiction	Critical Mineral Strategy	Release Year	Strategy Link	Specific List (# of Critical Minerlas)	List Link
Manitoba	Yes	2024	Link	No	
Ontario	Yes	2022	Link	Yes (33)	Link
Québec	Yes	2020	Link	Yes (28)	Link
New Brunswick	No	Aimed for 2026	Link	No	/
Nova Scotia	Yes	2024	Link	Yes (20+4)	Link
Prince Edward Island	No			No	/
Newfoundland & Labrador	Yes	2023	Link	Yes (34)	Link
Territorial					
Yukon	General mining strategy	2021	Link	Inventory (25)	Link
Northwest Territories	Yes	2023	Link	No	/
Nunavut	General mining strategy	2020	Link	No	/
First Nation					
Grand Council of the Crees	General mining policy	2024	Link	No	/
Taku River Tlingit First Nation	General mining policy	2019	Link	No	/
First Nation of Na-Cho Nyäk Dun	General mining policy	2025	Link	No	/
Tŝilhqot'in National Government	General mining policy	2023	Link	No	/
Tahltan Tribal Council Resource Development Policy Statement	General mining policy	1987	Link	No	/

Note: the listing of First Nation mining policies is not comprehensive. Proponents or Crown Governments are encouraged to ask a First Nation if they have a mining policy, as not all are publicly available and may contain confidential information related to Aboriginal and treaty rights.

4.3 Major players in the Canadian market

In mining, the Canadian ecosystem includes both **junior** and **senior** companies. Some senior companies also manage other segments, such as processing, refining, and in some cases, advanced materials manufacturing.

Over the last three decades, the global mining and metallurgy sector has undergone major mergers and acquisitions, creating the consolidation of **powerful multinational conglomerates** with operations spanning several continents. This trend was driven by the search for economies of scale, diversification of resources, and access to capital markets. This led to the emergence of a few dominant players globally, including Glencore (Switzerland), Vale (Brazil), BHP (Australia/UK), Rio Tinto (UK/Australia), and Anglo American (UK), all of which now operate in Canada.

As a result of this consolidation, a drawback was the decrease of **Canadian-owned or Canadian-based companies**, especially with the acquisition of several flagship mining and metallurgical firms in the late 1990s to mid-2000s.

A few examples are:

- **Inco** and **Falconbridge** (nickel, copper, cobalt) were both acquired by **Vale** and **Glencore**, respectively.
- **Alcan** (aluminum) was taken over by **Rio Tinto**.
- **Noranda** (copper, gold, zinc) was absorbed through a series of mergers, eventually tied to Glencore's expansion.
- **Dofasco**, a major steel producer, was acquired by ArcelorMittal.

These acquisitions marked a shift from Canadian-controlled mining giants to foreign ownership, reducing national corporate control but integrating Canada into the global capital and production network.

The hollowing out of mid-tier mining companies has also created a structural financing gap in the Canadian mining ecosystem. Market conditions, consolidation and mergers, and limited access to capital have reduced the number of companies able to advance projects that remain too small for the majors. As a result, many deposits stall after discovery, during the stage that requires sustained engagement, NI 43-101 compliance, engineering and feasibility studies, and environmental assessment work.

While public and private funding mechanisms often support early-stage exploration and drilling in Canada, they rarely cover this intermediate development phase. This gap creates a "zone of death" where technically viable projects struggle to advance. Addressing this challenge could create opportunities for industry, governments, and First Nations to form stronger partnerships focused on project de-risking, shared capacity building, and long-term value creation.

Geopolitical tensions, trade restrictions, and tariffs are currently impacting this globalized system. This carries with it a renewed emphasis on review of foreign direct investments, particularly mergers and acquisitions.

For First Nations, this trend could mean a greater likelihood of engaging with a company as a project proponent that has less understanding of the Canadian context surrounding First Nation engagement, consultation, and consent. It could also create additional uncertainty around whether a foreign company can obtain the necessary regulatory approvals to proceed with investments. It is difficult to assess how relevant these risks are, and they may vary widely from region to region, reflecting in part differing provincial legal frameworks.

Only a few Canadian-headquartered mining firms maintain global standing while still operating in Canada, among which Teck Resources (copper, zinc, lead, molybdenum, germanium), Sherritt International (nickel, cobalt, fertilizers), Nutrien (potash, fertilizer), Hudbay Minerals (copper, gold, silver, molybdenum), Agnico Eagle (gold) and Cameco (uranium). Teck has recently announced that it will merge with Anglo American to form Anglo Teck, which will be headquartered in Canada.

Barrick Mining, Lundin Mining, Kinross Gold, and First Quantum Minerals (base and precious metals) are companies with a strong global presence headquartered in Canada. At the same time, they have no significant operations within Canadian territory.

In the advanced materials manufacturing and downstream segment, Canadian companies can be categorized into three groups:

- **innovative startups** developing their IP and aiming to scale,
- medium-to-large **Canadian-owned specialized firms** (such as Ballard, Neo Performance Materials, 5N Plus, Nano One, etc.), or
- **foreign-owned large multinational corporations** and joint ventures seeking to manufacture in Canada (such as GM, Posco, Stellantis, LG Energy Solutions, Volkswagen, and Honda).

Infobox 5 : Reconciliation Action Plans

Reconciliation Action Plans are similar to a strategic plan, but focus specifically on a company's committed actions toward Indigenous Peoples. For First Nations evaluating opportunities in the critical minerals sector, they can provide insights into the company's corporate culture and language to anchor conversations.

Agnico Eagle's *Reconciliation Action Plan* sets out as the company's primary commitment "…to support the sustainable self-reliance of Indigenous Nations in the geographical areas where we operate by creating lasting opportunities for employment, business, and education, and contributing to their social and economic well-being."

It lays out the following pillars, with an identified action under each;

- Leadership & Governance
- Education
- Employment
- Community
- Economic Engagement
- Environment
- Wellness, Health and Safety.

Agnico Eagle's Plan is available in Inuktitut, with summaries provided in Inuinnaqtun, Cree, and Anishinaabe.

Case Study 1

Sandvik's Maintenance, Repair & Overhaul Facility in Sudbury

Sandvik, a global Swedish engineering company known for mining and rock excavation equipment and services, broke ground on an $85 million state-of-the-art maintenance, repair and overhaul (MRO) facility in Greater Sudbury, Ontario, to serve mining operations across Canada.

The new 135,000-square-foot centre on 115 acres will replace its long-standing Lively site, double workshop capacity, and house expanded service bays, warehousing, welding, and paint facilities, as well as battery-electric vehicle-dedicated infrastructure and training simulators, reflecting industry shifts toward electrification and sustainability.

It will sustain approximately 400 jobs, create more than 60 new positions, and support equipment rebuilds, component repairs, and field services for conventional and battery-electric mining fleets, thereby strengthening domestic supply chains and regional advanced manufacturing.

This investment also sets a clear expectation that major mining suppliers will follow suit by expanding their Canadian presence while building durable, respectful partnerships with First Nations to support shared economic participation and long-term project success.

5 How the Critical Minerals Sector Works

Questions this section answers

1. What does it take to develop a critical mineral mine and how long does it take?
2. Who plays what roles?
3. What are the risks associated with becoming an economic participant in a critical minerals mining project?

Top three takeaways

1. Moving a mine from discovery to production now typically takes nearly twenty years in Canada, due to detailed studies, permitting procedures, and challenges in raising capital.
2. There are five stages of mine life: early exploration, advanced exploration, development, production, and closure. Increasingly there is a focus on recycling.
3. Developers face substantial structural risks, including price fluctuations, reliance on imported equipment, and limited domestic refining and advanced manufacturing capabilities.

What you need to know:

A critical minerals mining project in Canada follows a long, regulated lifecycle that spans from early exploration to development, operation and then final closure and reclamation, each stage shaped by provincial and federal rules and requirements for environmental protection. Beyond mining, critical minerals will then be processed into advanced materials later down the value chain.

Moving a mine from discovery to production now typically takes nearly twenty years in Canada, much longer than in previous decades, due to detailed studies, permitting procedures, and challenges in raising capital. While processing and manufacturing facilities can be constructed more rapidly, the mining phases remain slow and uncertain, with only a small percentage of exploration targets ever becoming viable projects. Developers also face substantial structural risks, including price fluctuations, reliance on imported equipment, and limited domestic refining and advanced manufacturing capabilities.

At the project level, companies encounter significant obstacles, including remote infrastructure deficits, labour shortages, permitting delays, and environmental obligations that extend through closure and reclamation. These combined factors hinder Canada's ability to quickly bring new supply online, underscoring the need for strong partnerships, realistic timelines, and early involvement by First Nations.

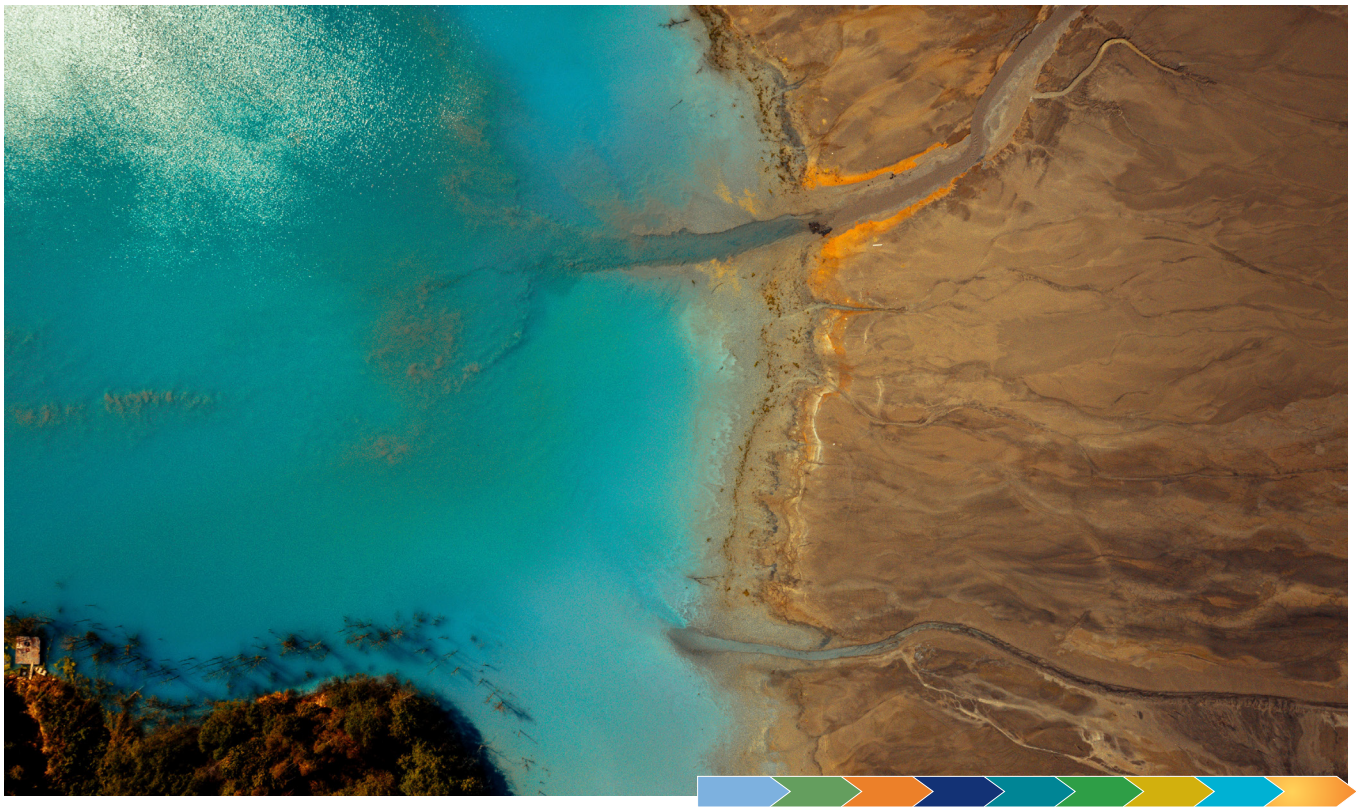
5.1 The life cycle of a critical minerals project

In Canada, the lifecycle of a critical minerals mine typically spans from initial exploration to final site closure and reclamation. This process involves lengthy timelines and comprehensive regulatory and consultation procedures. Each province/territory has its own detailed regulatory framework governing every stage of the mining lifecycle: exploration, development, operation, closure, and reclamation. These frameworks are designed to manage environmental impacts and encourage meaningful Indigenous engagement and consultation, supported by various environmental protection laws and permits specific to mining and related activities.

Exploration

This initial stage involves geologists, prospectors, and small exploration firms searching for promising mineral deposits, identifying **resources that could eventually become reserves**. They conduct geological mapping, geophysical surveys, and exploratory drilling to locate economically viable ore bodies.

Under the common law and rooted in Section 35 of the *Constitution Act*, the Crown has a duty to consult with First Nations about actions or decisions that may adversely affect established or potential Aboriginal or treaty rights. The duty to consult requires the federal government to consult with First Nations at the prospecting stage, but this is an evolving, and hopefully maturing, practice.



Infobox 4: Resources vs. Reserves

Resources are naturally occurring minerals of economic interest with quantities and grades that have reasonable potential for profitable extraction. Resources can be inferred, indicated, or measured, with increasing levels of geological knowledge and confidence.

Reserves are the economically and technically mineable portion of resources. Reserves can be classified as probable or proven, with increasing confidence levels. Both resources and reserves are dynamic and can change over time.

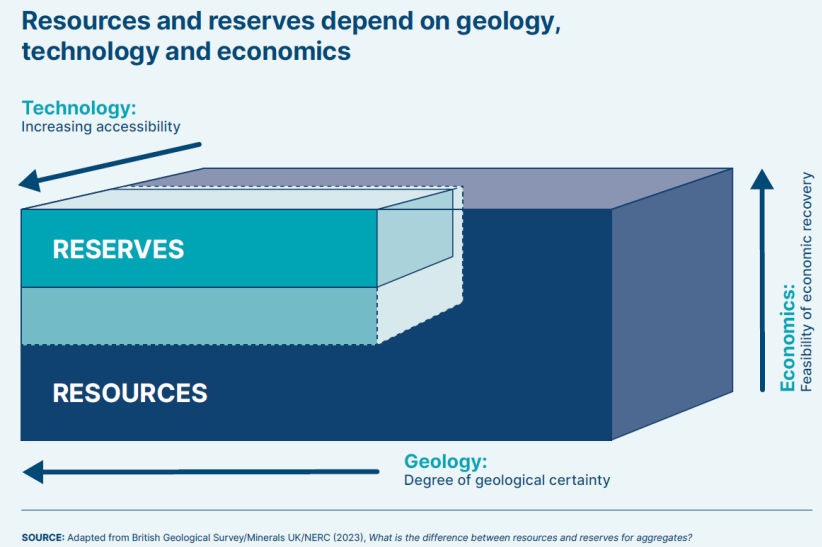
The elements that determine whether a resource is classified as reserves are called modifying factors.

These can include:

- Mining.
- Processing.
- Metallurgical.
- Infrastructure.
- Economic.
- Marketing.
- Legal.
- Environmental.
- Social.
- Government considerations.

For example, a higher lithium price might make it more economically feasible to mine lower-grade lithium resources, thereby increasing reserves. Conversely, advancements in technology that reduce operating costs, more accurate geological modelling, or new regulatory decisions that limit mine size are all factors that can influence how resources are converted into reserves. More details and definitions are available on the Canadian Institute of Mining website.

Image 7: Resources and Reserves Evaluation Criteria



Case Study 2

Exploration Consent Agreement

In January 2026, the First Nation of Na-Cho Nyäk Dun (FNNND) and Snowline Gold signed a Memorandum of Understanding (MOU) related to Snowline Gold's exploration program, as well as environmental and engineering studies required to advance the mine.

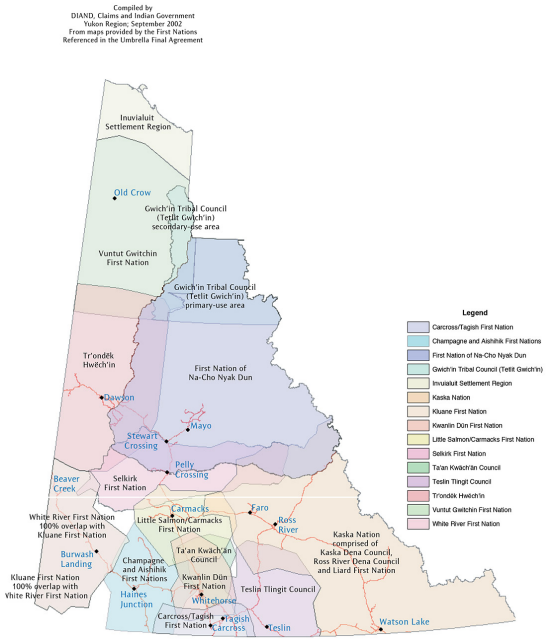


Image 8: Traditional Territories in the Yukon[7]

The MOU provides guidance on :

- Requirements for FNNND's free, prior, and informed consent before the construction of a mine.
- Commitment from Snowline Gold to comply with the FNNND Mining Policy for activities on the FNNND Traditional Territory.
- Establishing a mutually beneficial, cooperative, and productive working relationship between FNNND and Snowline.
- Negotiation of future advanced agreements between the parties.
- Direct involvement of FNNND Citizens to support and inform FNNND's decision-making process on the Rogue Project.
- Capacity funding.
- Collaboration on environmental and rights-related studies in the Rogue Project region.[8]

[7] https://www.rcaanc-cirnac.gc.ca/DAM/DAM-CIRNAC-RCAANC/DAM-TAG/STAGING/images-images/lc_cc_farim_yt_ar_07_09_a7sm_1512746665196_eng.jpg.

[8] https://www.snowlinegold.com/news/snowline-gold-and-first-nation-of-na-cho-nyak-dun-sign-memorandium-of-understanding

Development and Feasibility

Once a viable deposit is confirmed, the project moves into the development stage. The company conducts additional drilling, testing, and detailed studies to assess the mine's technical and economic viability. These studies are often contracted to external consultants rather than to in-house teams. It also completes environmental assessments, secures the necessary permits and financing, and designs the mine. This phase ends with the construction of the mine and related infrastructure, including access roads, processing facilities, and power supply.

Operation (Extraction and Processing)

During the operational phase, the mine becomes fully active and begins producing minerals. It can operate as an underground or open-pit mine, or as a mix of both. The company extracts the ore and processes it on-site or transports it elsewhere for processing to produce the target mineral or concentrate. In most cases, a concentrator is located beside a mine, and a separate site, sometimes owned by a different company, handles the metallurgy. This phase can last many years or even decades, depending on the size of the reserves, the grade of the ore, and market conditions. Operations generate significant economic activity: they create jobs (from miners and engineers to support services) and business for local suppliers, while also generating revenues and royalties.

Closure and Reclamation (Decommissioning)

Closure is the final stage after mining ends, either because the resource is exhausted or the operation becomes unprofitable. The aim is to shut down the site and restore the surrounding environment safely. The company must dismantle its facilities, clean up any contamination, and rehabilitate the land, including recontouring and replanting vegetation, to ensure the area no longer poses long-term risks. Before moving into closure, mines enter a 'care and maintenance' stage that can last for months, years or even decades. For example, in 2026, the Eagle Gold Mine (Yukon), Quintette Coal Mine (B.C.), and Sisson Mine (New Brunswick) are in care in maintenance.

A commitment for First Nation involvement in the development of a Mine Closure Plan can be captured in an Impact Benefit Agreement.

A Mine Closure Plan is a detailed document that incorporates technical expertise from multiple disciplines to lay out:

- The objectives of closure
- The rehabilitation plan for the land
- Uses for the land after mining concludes
- How social and economic impacts of the closure are mitigated
- Timelines
- What must be done to meet regulatory and permit requirements

Re-mining Tailings

Re-mining mine tailings offers a promising opportunity to recover critical minerals, with reports estimating multi-billion-dollar potential across more than 10,000 abandoned Canadian mine sites that contain metals not prioritized in past operations.[9] While data gaps and regulatory complexity remain major barriers, Canadian companies are developing technologies to reclaim tailings, extract critical minerals, remediate contamination, and sequester carbon dioxide through carbon mineralization.

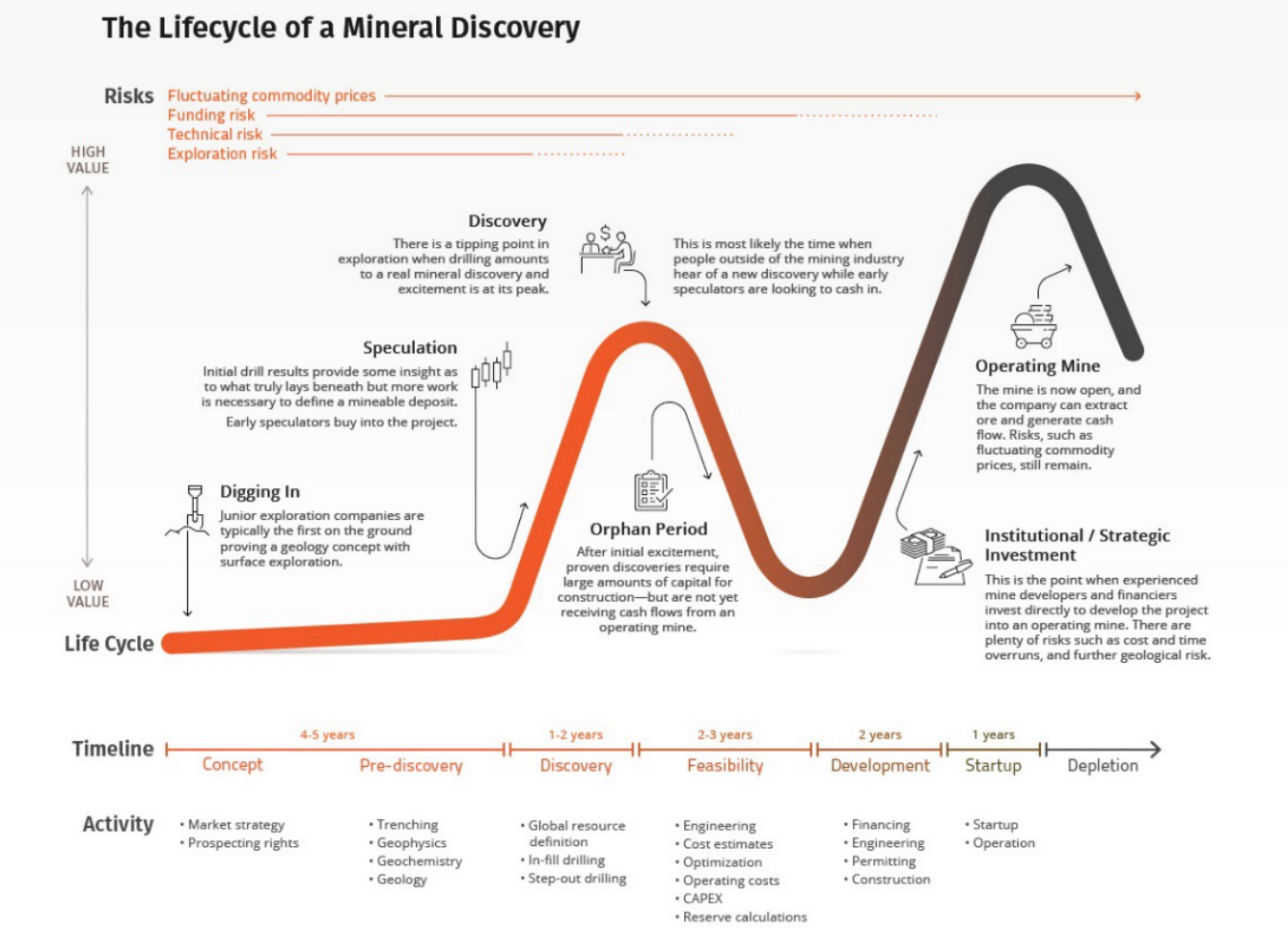
[9] The Government of Canada maintains an inventory of orphaned and abandoned mines. See: https://osdp-psdo.canada.ca/dp/en/search/metadata/NRCAN-FGP-1-330ec960-cc52-47d9-840b-d93470347ab4.

Mining (Upstream) vs. Processing & Manufacturing (Mid- and Downstream)

Mineral processing, metallurgical, or manufacturing projects, such as refineries or battery material plants, follow a different path from mining projects. They do not include an exploration stage because their focus is on refining raw minerals into value-added products or manufacturing. Instead, a processing project begins at the development phase, which involves choosing a suitable site with good infrastructure access, obtaining permits, securing a feedstock supply from mines, and building the plant. Once operational, the facility chemically or metallurgically upgrades the mineral into a marketable product.

These projects can share similar permitting, regulatory, and decommissioning requirements with mines, but their risks vary. For example, a refinery's success depends on a stable feedstock supply and efficient processing technology rather than on discovering and extracting an ore deposit.

Image 9: The Lifecycle of a Mining Discovery[10]

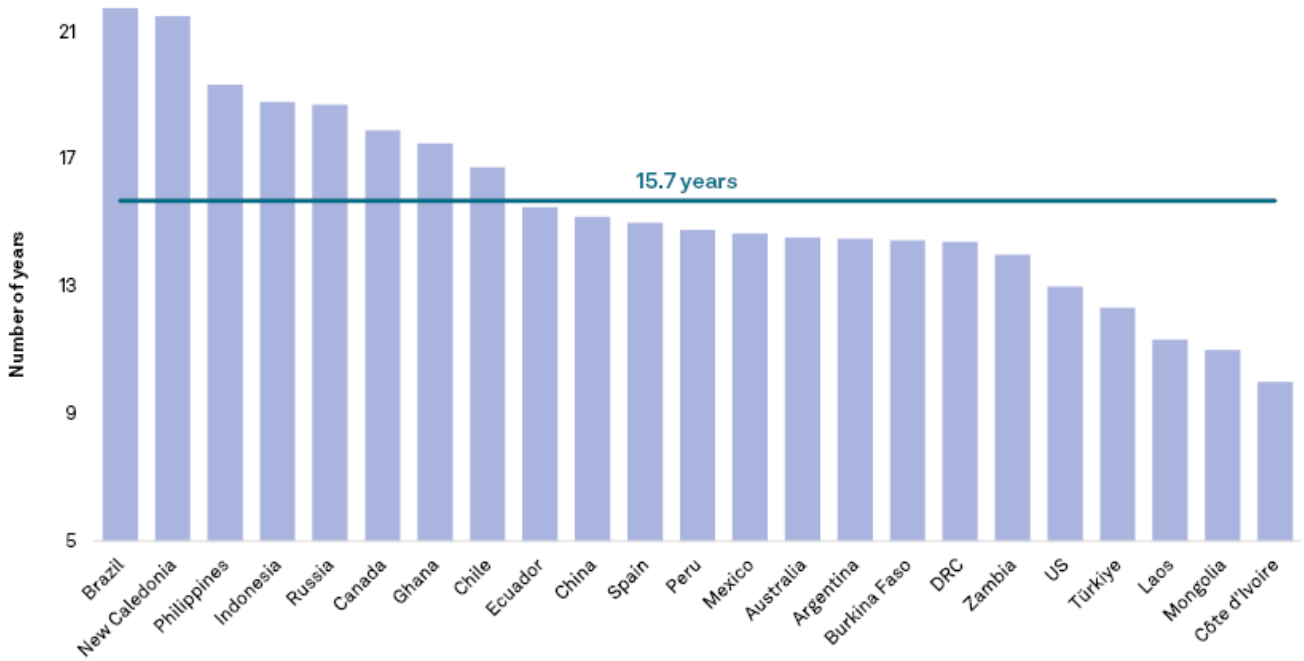


[10] Visual Capitalist

5.2 Timelines of financing and investment, and permitting

One way to quantify a mine's timeline is to look at its **lead time**: the total period from discovery to the start of mine production. This includes the stages of exploration and development mentioned earlier. Each year, S&P Global Market Intelligence compares lead times worldwide. It is notable that different commodity developments have different lead times, and they differ significantly compared to midstream projects.

Image 10: Global Comparisons of Number of Years to Develop a Mine[11]



As of Apr. 4, 2023.
DRC = Democratic Republic of the Congo.
Includes countries with at least two mines.
Source: S&P Global Market Intelligence.

[11] https://www.spglobal.com/market-intelligence/en/news-insights/research/discovery-to-production-averages-15-7-years-for-127-mines

5.3 Roles of government, industry, First Nation rights-holders

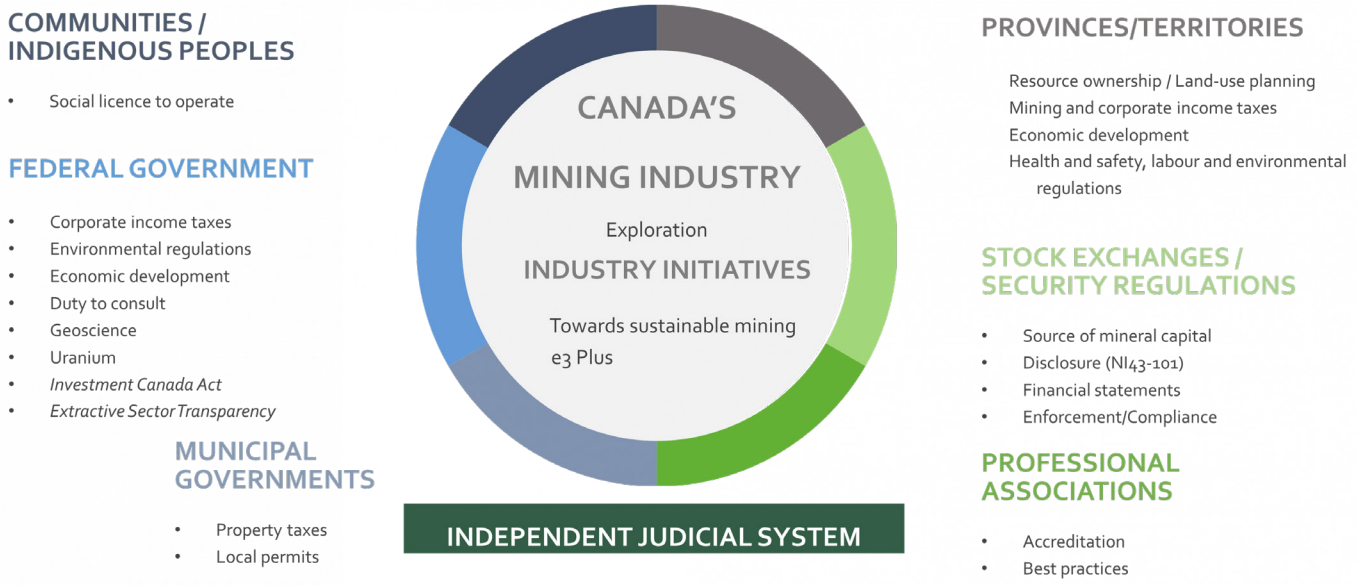
Image 12 below provides an overview of the roles and responsibilities of actors in the critical mineral sector. The roles of First Nations, however, are evolving and depend on the governance path each Nation is on. For example, several modern treaties define both surface and subsurface rights related to minerals.

Roles in permitting are dependent on where the project takes place:

- **Crown land:** the government owns both surface and mineral rights.
- **Private surface land:** minerals are crown property, but in specific cases, a freehold landowner may own both minerals and surface rights.
- **Settlement lands:** surface and sub-surface rights may be held either fully or jointly by an Indigenous government, requiring their permission for access and co-management.
- **On Reserve:** the Government of Canada retains ownership of the minerals, but under the *First Nations Land Management Act*, participating First Nations can make rules governing access to minerals on reserve.

Depending on where the claim is, companies must negotiate access agreements and compensate landowners. However, the claim does not allow mining or production, which requires a separate mining lease, additional regulatory approvals, and potentially an impact assessment.

Image 11: Roles in the Canadian Mining Industry[12]



[12] https://natural-resources.canada.ca/minerals-mining/canadian-mineral-exploration

5.4 Risks (e.g., market volatility, project delays, environmental liabilities)

We can group risks and barriers to the development of critical mineral projects into two categories: strategic concerns and project development challenges.

Several structural issues (outlined in Table 8 below) can persist regardless of the progress of individual projects. Even if Canada had faster permitting and better infrastructure, these system-level gaps would still limit long-term growth and competitiveness. These constraints impact the entire value chain.

Table 8: Strategic and Project-level Challenges

Strategic Challenges

Global Market Exposure and Stability	Dependence on International Inputs	Lack of Midstream and Downstream Capacity
Changing global demand and the concentration of mining/processing in the same countries can cause price volatility. Canadian producers only have a limited ability to affect prices.	Canada's dependence on imported equipment and refined materials is a significant vulnerability that reduces resilience and raises exposure to geopolitical and supply-chain risks.	• A recurring concern is the limited domestic and manufacturing processing infrastructure, including: • Gaps in midstream capacity, such as refining, separation, and upgrading. • Limited downstream capabilities in advanced manufacturing. • Low Canadian ownership and control over these stages, diminishing both economic and strategic sovereignty.

Project-level Challenges

Infrastructure Deficits	Workforce	Project Phase
• **Energy infrastructure:** lack of electricity, transmission lines, gas, etc. • **Transport Infrastructure:** railways, roads, ports.	Shortages in technical, operational and trades occupations.	**Exploration** Exploration is a high-risk stage, and most exploration efforts do not lead to a new mine: only a 1-in-10,000 chance that an exploratory drill hole will develop into a producing mine **Development** Requires significant capital investment and is often the most expensive phase of the project. It also involves considerable risks that can all halt progress. • Delays in regulatory and permitting • Technical challenges during construction • Cost overruns, which are common in construction • Local opposition from community members. In Canada, extensive consultation with local communities is vital to address concerns and obtain social approval before operations begin. **Operations** • **Worker safety incidents:** impacting investor confidence, employee attraction and retention, and potential legal issues. • **Environmental impacts:** regulators must maintain oversight during this phase to make sure operations meet safety standards and comply with environmental protections. • **Market volatility:** Although a strategic risk, it is worth noticing that volatility can stop an already active mine due to commodity price fluctuations that affect profitability.

[12] https://natural-resources.canada.ca/minerals-mining/canadian-mineral-exploration

Together, these strategic and project-level barriers illustrate the dual challenge facing Canada's critical minerals sector: enabling timely project delivery while simultaneously addressing the structural weaknesses that constrain national competitiveness and supply chain resilience.

Infobox 5: Greenfield vs. Brownfield projects:

Greenfield vs. Brownfield projects: while new discoveries have long lead times, brownfield projects also have financial risks. Because we have historically mined the most accessible ore bodies, the financial feasibility of developing existing brownfield sites can lead to higher capital costs, as they may involve deeper and more complex ore bodies.

Image 12: Greenfield versus Brownfield Development

6 Segments of the Critical Minerals Economy & Supporting Infrastructure

Questions this section answers

1. What types of companies are developing projects at each stage?
2. How are projects permitted and financed?
3. What are the technical requirements that companies must fulfill?

Top three takeaways

1. The mining process that starts with high-risk exploration led mainly by junior companies.
2. Even the most advanced feasibility studies cannot ensure a mine's success, as costs, markets, and technical assumptions change as new information emerges.
3. Once operational, mines can operate for decades but may close early if commodity prices drop, regulations change, or safety and environmental concerns arise.

What you need to know:

Critical mineral **mining projects** go through a lengthy and regulated process that begins with high-risk exploration led mainly by junior companies. These companies stake claims, drill early targets, and attract investors well before any mine gains approval. When promising resources are found, the focus shifts to development, which involves detailed technical studies, permitting, financing, and engagement with Indigenous communities. Even the most advanced feasibility studies cannot ensure a mine's success, as costs, markets, and technical assumptions change as new information emerges. Once operational, mines can operate for decades but may close early if commodity prices drop, regulations change, or safety and environmental concerns arise.

Mines create jobs and procurement opportunities while managing tailings, water quality, and environmental risks under continuous oversight by regulators and Indigenous Land Guardians. Some critical minerals are not mined; instead, they are produced from liquid brines, gas, or as byproducts of other mineral processing. When operations cease, companies must dismantle facilities, remediate contamination, and restore the site, supported by mandatory closure plans and financial assurances to protect communities and taxpayers.

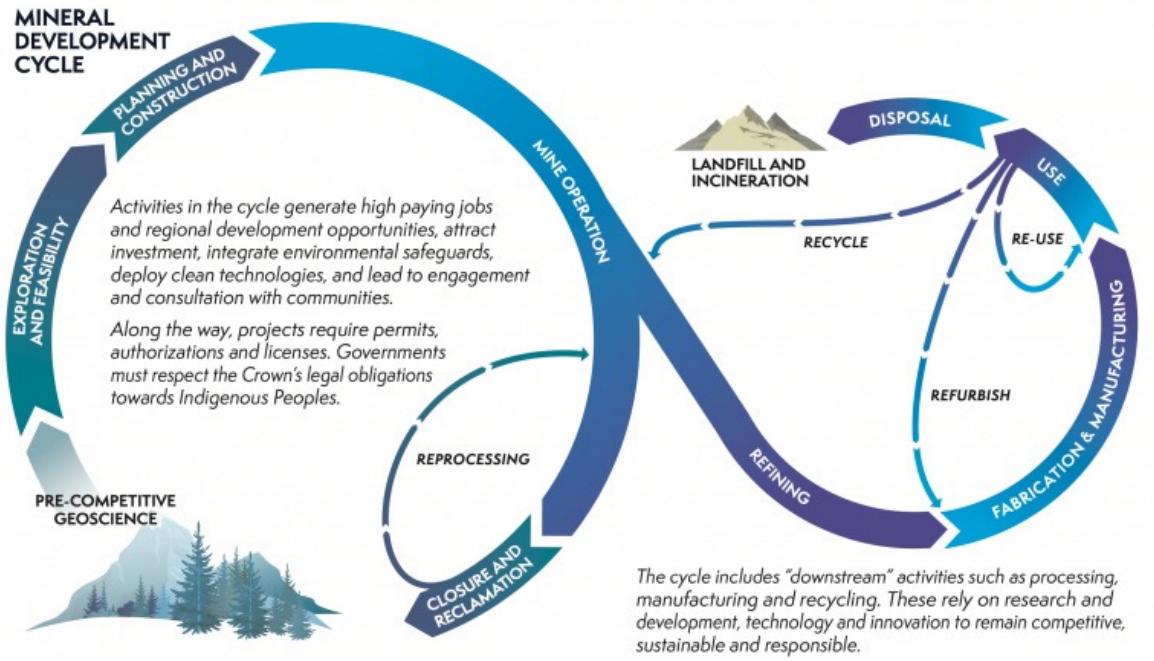
Canada's **midstream and downstream segments** are crucial for transforming mined materials into refined metals and advanced products, such as batteries, solar panels, wind turbines, electric motors, magnets, semiconductors and fuel cells. Yet, capacity in those segments remains uneven across commodities and underdeveloped, especially for 'new' critical minerals such as lithium, graphite, and rare earths.

Limited processing and advanced materials capacity create a "chicken and egg" problem for North America; for instance, large battery manufacturers are not scaling up to buy refined materials, which prevents miners and refiners from investing in producing the necessary battery-grade chemicals consistently to make advanced materials. This considerably slows the development of the value chain and maintains dependence on foreign entities such as China.

While downstream manufacturing can scale rapidly and Canada has attracted significant investments in battery and clean-tech sectors, progress has been mixed.

Recycling gives critical minerals a second life, since, unlike fossil fuels, many metal-based materials remain recoverable after use. A circular approach, from reuse to second-life batteries and final recycling, can reduce long-term mining demand, but recovery rates vary widely, with strong recycling rates for metals like nickel and platinum and far weaker results for lithium and rare earths. Canada's recycling and re-mining ecosystem is growing, yet high costs, inconsistent supply, volatile prices, and regulatory hurdles still limit its full potential.

Image 13: Mineral Development Cycle[13]



Transport and energy infrastructure are two of the biggest supporting factors influencing where critical mineral projects can succeed and how much value stays in Canada. Transport is essential for moving critical minerals from remote deposits to processing facilities and global markets, but many regions face significant gaps in access. Mines and plants depend on reliable roads, railways, ports, and airports not only to ship concentrates and finished products but also to bring in fuel, equipment, chemicals, and workers. Canada's rail and port systems already move enormous volumes of mineral products, yet long, multi-step routes illustrate how costly and fragile these supply chains can be.

Established mining regions benefit from existing infrastructure, while emerging northern areas struggle with the lack of year-round roads, compounded by climate change that is reducing the reliability of ice roads.

Energy infrastructure is equally decisive: it determines both the cost and the carbon footprint of Canada's critical minerals sector, especially for energy-intensive refining and advanced materials production. Provinces with abundant hydroelectricity, such as Quebec and British Columbia, hold a major advantage, while regions with fossil-fuel-based grids or limited transmission struggle to attract new investment. Governments are responding through grid expansions, Small Modular Reactor collaborations, and low-carbon electricity generation, even as mines and plants continue to rely on diesel, natural gas, and coke while gradually shifting toward electrification, hydrogen, and renewables.

[13] https://www.northernminer.com/wp-content/uploads/2020/12/circulareconomy.jpg

Case Study 3

Wicehtowak Solar Project

Case Study of an Independent Power Producer with Wheeling: **Wicehtowak Solar Project**

Business Structure

The 32.4 MW solar project is 100% owned by the George Gordon First Nation and located on a fee-simple parcel of their traditional land. The electricity and environmental attributes will all be purchased by K+S Potash Canada for 30 years for their existing mine 3 kilometres away. The project is expected to result in 28,000 tonnes CO_2 /yr of avoided emissions.

Vision and Initiation

- K+S has a long history of collaboration with George Gordon First Nation and offered to sell them 160 acres of pre-disturbed land.
- K+S aims to reduce emissions, supported by the federal industrial carbon price.
- SaskPower created the Renewable Access Service pilot program.

Regulatory Environment

This project encouraged the creation of SaskPower's Renewable Access Service program.

Financial Success Elements

The $84M project is expected to generate 62,980 MWh of clean electricity annually[9]. Key financial elements include:

- Federal government included a $33M grant from SREP, $432,400 from Indigenous Services Canada's Strategic Partnerships Initiative and Community Opportunity Readiness Programs[10].
- Canada Infrastructure Bank provided a $42M loan and Saskatchewan provided a $7M loan guarantee[11].
- SaskPower waived the Open Access Transmission Tariff, considering how close the mine was to the solar project.

[9] George Gordon First Nation. 2025. Wicehtowak Solar Flyer.
[10] Capkun, Anthony. "Wicehtowak Solar Project Secures $33 M Federal Funding, $7 M Loan Guarantee." *Electrical Business Magazine*, 27 Aug. 2025. Accessed 30 Oct. 2025.
[11] Government of Saskatchewan. 2025. SIIFC Supporting New Wicehtowak Solar Project. Accessed September 10, 2025.

Image 14: Map of Wicehtowak Solar Project

6.1 Exploration

Mineral exploration is the high-risk, initial phase of the mining life cycle, where geologists, prospectors, and often **Junior Miners** look for economically viable ore bodies. This work begins with research and analysis of public geoscience data and **mineral claims**. The aim is to find mineral resources that can eventually be turned into reserves.

Claiming

Specifically, to claim, a company must stake a mineral claim to obtain the legal right to explore for underground minerals on a specific area of land for a designated duration, which is often renewable (e.g., two years in Ontario for the initial term). Once a company or individual registers the claim, the government grants exclusive exploration rights, subject to annual work requirements. Claimholders often hold claims for long periods without developing, as long as minimal work is completed. In some jurisdictions, this can be waived for a certain period if a fee is paid. A mineral claim allows access to Crown land for exploration, but it does not include surface rights, which governments treat separately.

Infobox 6 : Free-entry mining system

Under the free-entry mining system, anyone who obtains a prospector's license can register a claim on any open Crown land. This grants the prospector exclusive right to occupy the land and conduct exploration activities, often with minimal government discretion, and without any consultation with the government or First Nations.

Free-entry has been the prevailing system in major mining provinces and territories, such as British Columbia, Ontario, Quebec, and the Yukon.

First Nations have challenged the legal validity of the free-entry system on the grounds that it is inconsistent with the Crown's duty to consult. Courts in British Columbia and the Yukon have upheld that the Crown does have a duty to consult prior to issuing claims and that the free entry mining system does not provide the opportunity for this consultation. Still, the free entry mining system persists, despite the Yukon ruling having been issued in 2012.

In Quebec, a case was brought in 2024 by and before a judgment was rendered, the provincial government introduced legislation to amend the provincial Mining Act and to limit the prospector's rights, and requiring government consultation with First Nations. As of early 2026, a case was still pending in Ontario's courts brought by Grassy Narrow First Nation and six other First Nations.

First Nations have also criticized the low barrier of entry associated with the free entry mining system. The cost of staking a claim varies based on jurisdiction. For example, in Manitoba it is $67.00 per claim and non-refundable, whereas in Newfoundland and Labrador it is $60 per claim, $50 of which is a refundable security deposit. This concern is heightened for First Nations who have secured Resource Revenue Sharing Agreements with the Crown in the mineral sector as the economic return on the early works required to develop a mine is not seen to be attractive compared to environmental and socio-economic impacts.

14

[14] https://www.manitoba.ca/iem/mines/staking/index.html and https://www.gov.nl.ca/em/faq/mines/

Exploration

The exploration process involves multiple stages of data collection, including geological mapping, geophysical surveys (such as magnetic or electrical conductivity measurements), and geochemical tests on rock, soil, or water samples to detect elevated mineral levels. When favourable signs are identified, prospectors proceed to **physical exploration**, which may include techniques like stripping (removing soil and vegetation over a few metres), trenching (removing rock with explosives or jackhammers), or extracting underground core samples with a diamond drill to define the extent and quality of the resource. These activities, especially advanced exploration, require companies to obtain necessary permits, such as an **Exploration Permit**, an **Endangered Species Act permit**, or a permit to take water, after submitting an exploration plan to the relevant Minister. Indeed, those activities do not usually trigger federal impact assessment or provincial environmental assessments, but rather screening and permitting. During screenings, a jurisdiction might decide that further assessments are necessary.

Infobox 7: Additional Resources

- Exploration and Permitting: exploration permitting guide provided by the Prospector & Developers Association of Canada (PDAC)
- First Nation involvement in impact assessment: FNMPC has created a range of tools to support First Nations in participating in both Crown impact assessment processes and in conducting their own Indigenous-led assessments.

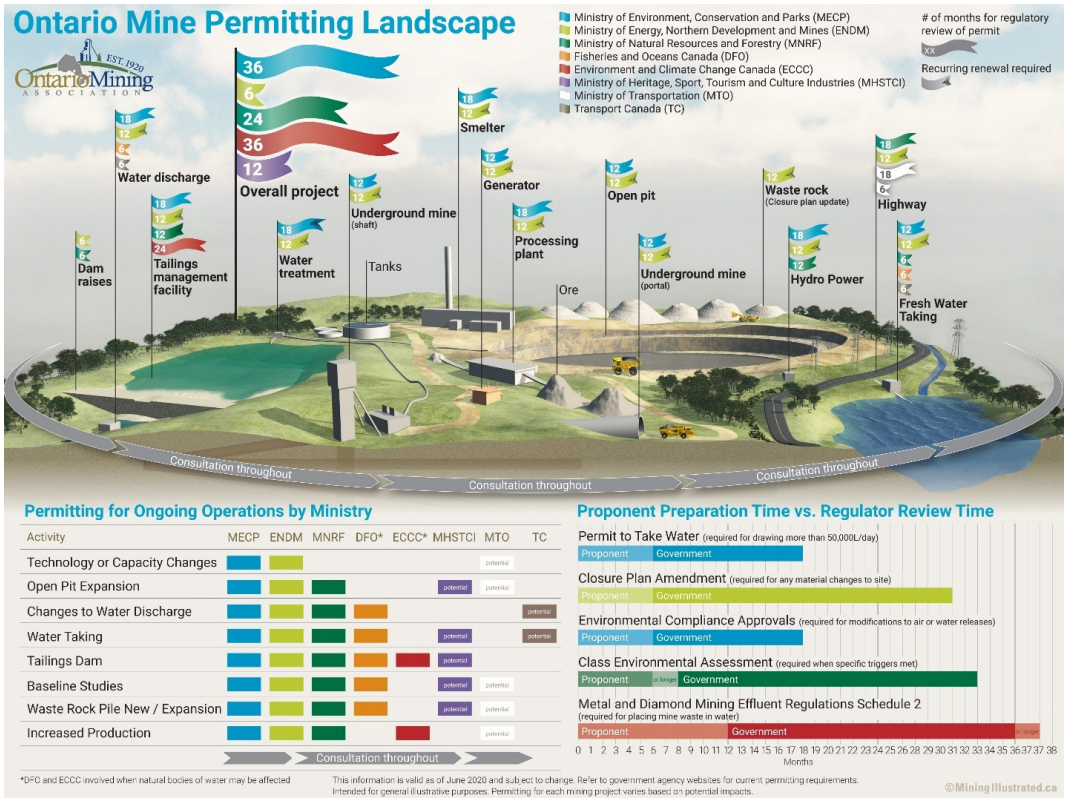


Image 15 : Ontario Mine Permitting Landscape[15]

[15] https://nextinvestors.com/learn-to-invest/mining/mining-company-life-cycle-explained/.

Exploration Spending

Canada is attracting exploration spending from global sources. In 2022, the country accounted for 19% of global exploration expenditure. However, half of this spending was directed toward precious metals, mainly gold and silver, rather than critical minerals.

Infobox 8: Junior vs. Senior Mining Companies

Junior Mining Companies focus on early-stage, high-risk exploration and deposit assessment activities, relying heavily on **equity financing** from investors to fund their projects, as they usually have no operating revenue. Although successful discoveries are very rare (only a small percentage of claims show enough promise for diamond drilling), a discovery can lead to significant increases in a company's share price, highlighting the high-risk, high-reward nature of this stage. Their goal is not always necessarily to build a mine themselves but to "de-risk" a property enough to attract a buyer or partner.

According to Natural Resources Canada, in 2023:

- There were 675 junior companies in Canada compared to 158 senior ones
- They accounted for 77% of active mining projects

Senior Mining Companies focus on developing and operating mines; they have capital, technical teams, and infrastructure, but often rely on juniors for exploration. While they might acquire, or more likely invest in, minority stakes in juniors with promising discoveries, they often acquire or form a joint venture for de-risked projects after a technical study shows potential profitability (typ-ically after Preliminary Economic Assessment).

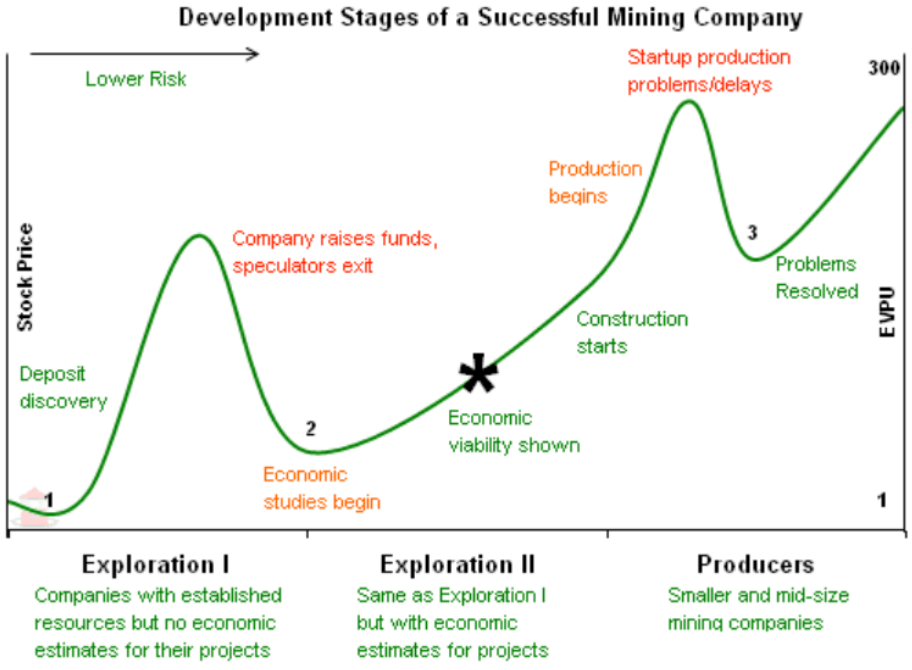
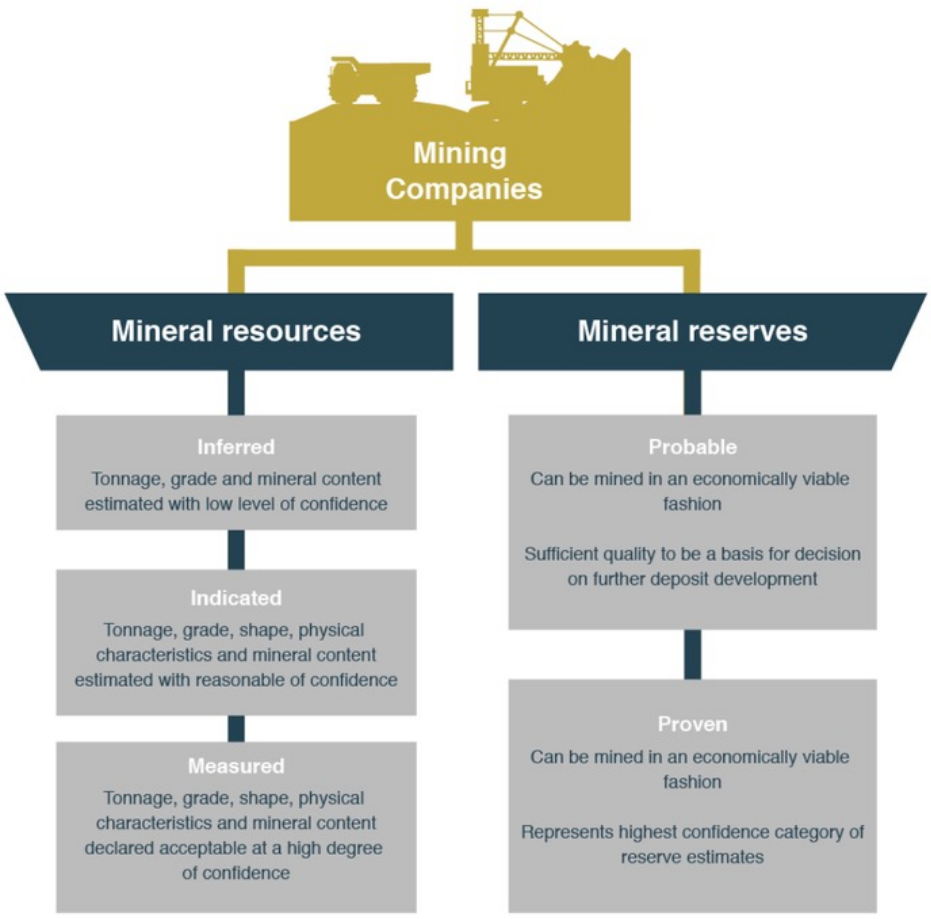


Image 16: Development Stages of a Successful Mining Company

6.2 Project development and permitting

After identifying a viable deposit, the project moves into the development stage, also called **deposit appraisal**. Companies focus on securing investments and obtaining mining permits to advance the project. To achieve this, they continue drilling, testing, and analysis to produce technical reports, begin regulatory review, and seek social licence through Indigenous and community engagement.

Image 17: Mineral Resources versus Mineral Reserves[16]



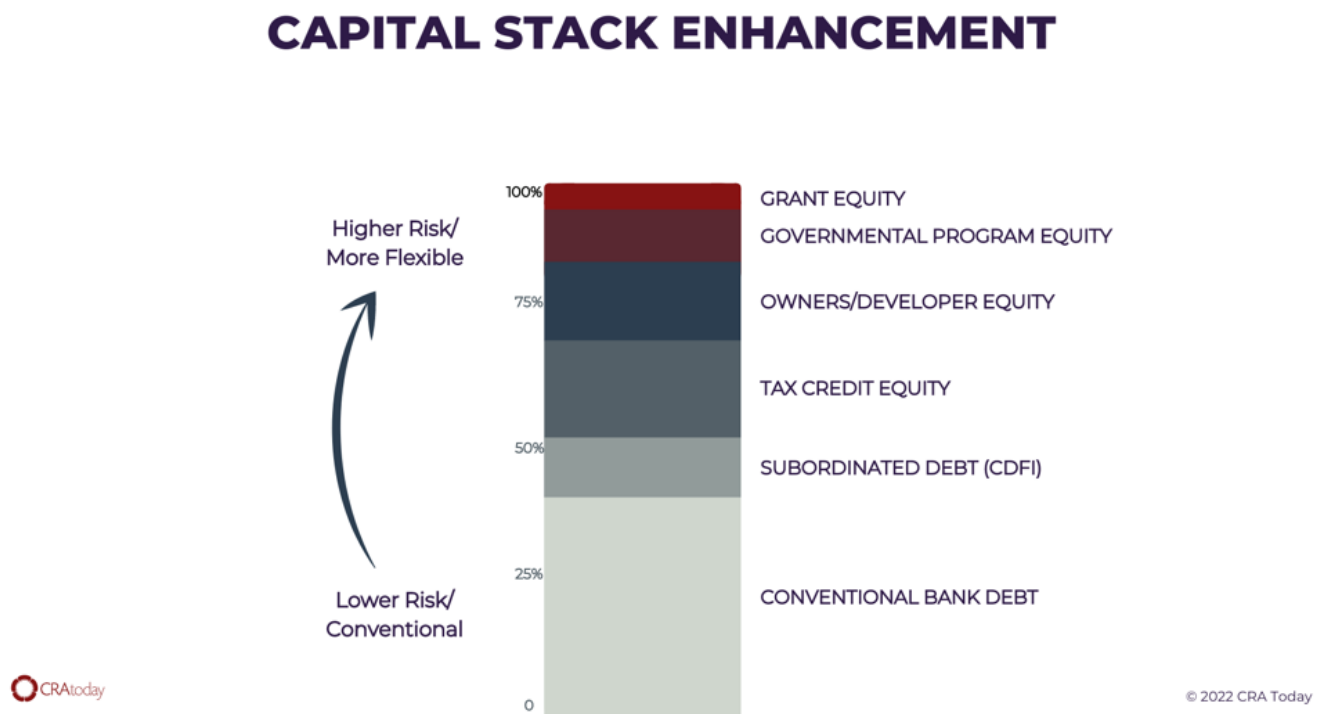
Financing

During project development, the company typically refines its capital structure, secures external funding, and optimizes available tax incentives to de-risk construction and attract investors. Activities focus on combining private financing (e.g., equity, debt, royalties, metal streaming agreements where an investor provides upfront capital to a mining company in exchange for the right to purchase a portion of the mine's future production at a fixed price, and royalties) with federal and provincial programs and tax credits targeted to mining and critical minerals.

[16] https://nextinvestors.com/learn-to-invest/mining/mining-company-life-cycle-explained/

A detailed project financing plan can combine equity raises, project debt, and alternative instruments, such as royalties and metal streaming, to reduce upfront capital requirements and share risk. For junior companies, issuing flow-through shares is common, allowing the firm to renounce eligible Canadian Exploration and Development Expenses to investors, who then claim deductions and mineral exploration tax credits, lowering the effective cost of capital. The company might also apply for relevant federal and provincial supports, such as critical minerals programs (e.g., Critical Minerals Infrastructure Fund) and Indigenous partnership or loan-guarantee frameworks that facilitate equity participation and improve bankability (see Section 8).

Image 18: Capital Stacks of Mining Projects[17]

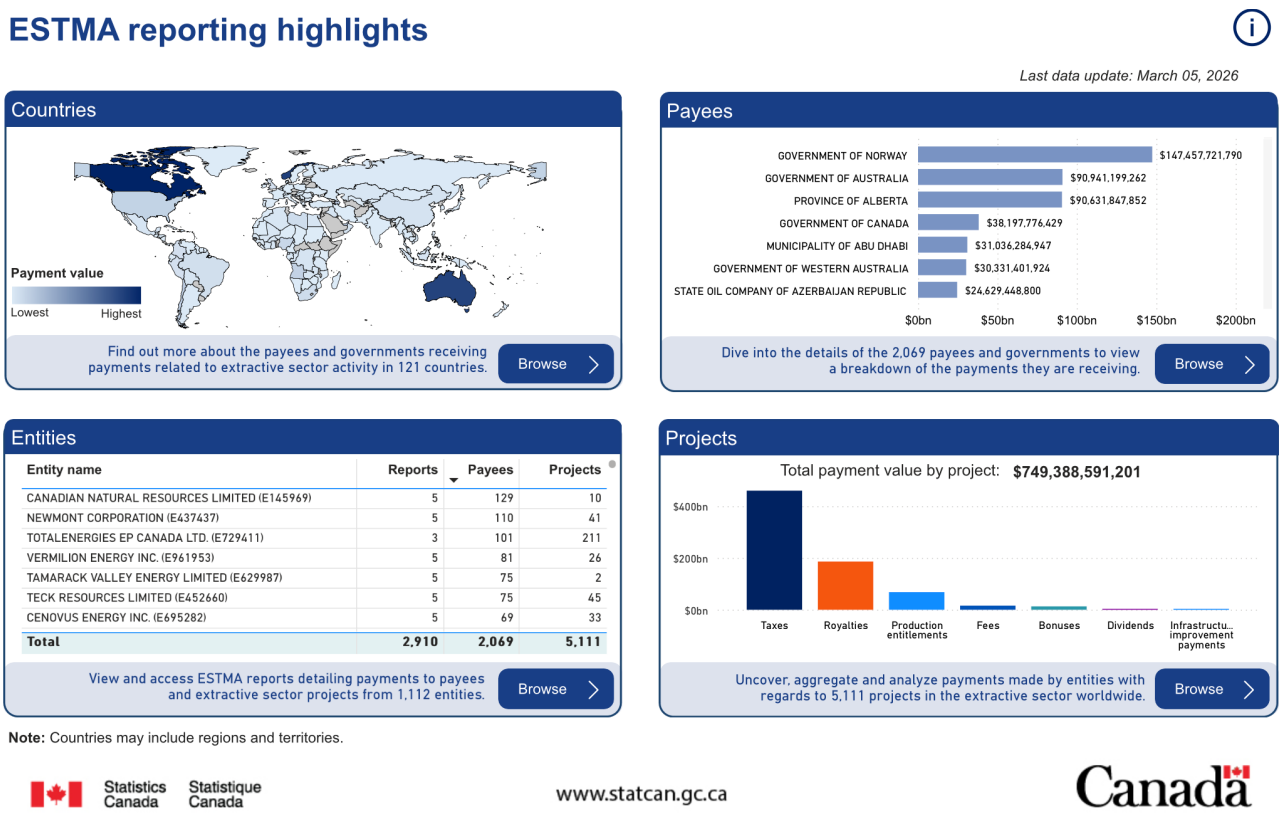


Tax planning work includes structuring expenditures to qualify for incentives, including the federal Mineral Exploration Tax Credit and the Critical Mineral Exploration Tax Credit, and coordinating overlapping provincial mining and flow-through incentives. These financing and tax activities are integrated into the feasibility study, financial model, and investment materials to demonstrate after-tax project returns and secure final investment decisions from lenders and investors.

Introduced in 2015, **Canada's Extractive Sector Transparency Measures Act (ESTMA)** requires mining companies operating in Canada, or listed on Canadian exchanges, to publicly disclose payments of CAD $100,000 or more made to all levels of government, including Indigenous governments. These disclosures cover taxes, royalties, fees, bonuses, and infrastructure payments across all stages of a project, from exploration to closure. While ESTMA does not affect permitting or project approvals, it increases transparency around benefit sharing, strengthens accountability, and requires companies to track and report financial flows as a standard part of mine development and operation. The ESTMA data from the last five calendar years is openly accessible on the ESTMA Data Portal website.

[17] https://cratoday.com/whats-a-capital-stack-and-how-does-it-work/

Image 19: ESTMA Reporting Dashboard[18]



Reporting Codes & Technical Studies

In Canada, security laws require mining companies to adhere to **NI 43-101** when disclosing information about mineral projects, particularly in public reporting of exploration results, resources, and reserves, to maintain consistency and build investor confidence. Technically, this is a **securities law in Canada**, not a regulation specific to mining operations. Consequently, this requirement applies to any material mineral project, whether greenfield (new) or brownfield (existing mine, expansion, or restart), if the company is publicly listed on a Canadian stock exchange such as the TSX or TSXV. The law does not oblige privately owned companies to follow it, but they may choose to do so voluntarily.

Regulators introduced NI-43-101 in 2001 following the Bre-X scandal, where false resource estimates were fraudulently reported for a gold mine. Other reporting frameworks exist worldwide, such as the JORC Code in Australia and New Zealand, PERC in Europe, SAMREC in South Africa, or SEC S-K 1300 in the U.S. Most of the world's listed mining companies have adopted either JORC or NI-43-101.

Mining companies routinely rely on external engineering and technical consultants to complete key project evaluations, including technical studies. These studies require independent, specialized expertise across geology, mining engineering, metallurgy, environmental assessment, and economics, and are often prepared in compliance with NI 43-101 disclosure standards. Engaging external consultants provides credibility with regulators, investors, and lenders and enables companies to access deep technical capacity without maintaining large in-house teams. Because Preliminary Economic Assessments, Pre-feasibility Studies, and Financial Studies inform production rates, mine life, environmental footprint, and financial performance, consultant-led studies play a decisive role in shaping a mine's long-term trajectory. These

[18] https://natural-resources.canada.ca/minerals-mining/services-mining-industry/extractive-sector-transparency/links-estma-reports

technical decisions directly influence the distribution of economic benefits, including employment, procurement, infrastructure development, and partnership opportunities with Indigenous communities and other regional stakeholders.

The NI-43-101 mining disclosure standards require that technical reports include:

- An independent oversight by **Qualified Persons** (QP), who are expert engineers or geoscientists meeting several criteria.
- A **standardized definition** of resources (inferred, indicated, measured) and reserves (probable, proven).
- **ESG disclosures** with environmental and community impact assessment.
- **Technical studies** that are detailed and updated as the project progresses.
- **Non-compliance** is enforceable by Canadian law with severe penalties.

Here are the various types of **technical studies** typically encountered during mining project development, some of which are defined by the Canadian Institute of Mining Metallurgy and Petroleum (CIM):

- **MRE (Mineral Resource Estimate)**: An initial technical study that measures the quantity and grade of a mining deposit according to the definitions and confidence levels of *Inferred, Indicated, and Measured* resources. Companies typically conduct an MRE during exploration to determine if a project warrants further evaluation. They can update the MRE as new information becomes available. The MRE does not confirm the deposit's economic viability.

Image 20: Relationship Between Mineral Reserves and Mineral Resources

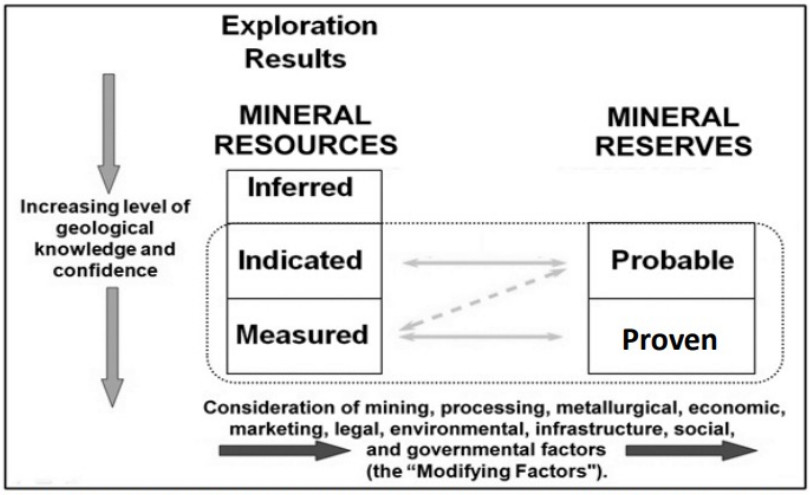


Figure 1, Relationship between Mineral Reserves and Mineral Resources

- **PEA (Preliminary Economic Assessment)**: An early scoping study that provides a first indication of *whether a project could be profitable and worth progressing*. A Preliminary Economic Assessment outlines a potential mine plan and processing method based on the known resource, providing high-level estimates of required capital and operating costs, as well as potential economic returns from the project. The confidence level of a Preliminary Economic Assessment is lower than that of a Pre-Feasibility Study or Feasibility Studies; it is not a confirmation of financial viability but an informative snapshot for fundraising before companies conduct more detailed studies.

[19] https://mrmr.cim.org/media/1092/cim_definition_standards_20142.pdf.

- **Pre-Feasibility Study**: A more comprehensive evaluation than the Preliminary Economic Assessment, with a greater confidence level in the project's technical and economic viability. It guides stakeholders on *what the project should be*. A Pre-Feasibility Study refines the project's design and upgrades the resource classification, supported by detailed engineering analyses, revised cost estimates, and extensive fieldwork, such as metallurgical testing and geotechnical studies. It marks the first step at which a company can declare an initial **mineral reserve**.
- **Feasibility Study**: A Feasibility Study is the most thorough and detailed assessment of a mining project, usually serving as the final study before a company decides to proceed with building the mine by making a final investment decision. A Feasibility Study can be thought of as *a description of what the project will be*. It focuses on a single, well-defined development plan that includes extensive engineering across all aspects of the project, including detailed mine and processing plant designs, production schedules, and infrastructure (power, water, roads). It also specifies environmental management strategies, permitting, and closure plans. Cost estimates are highly accurate and rest on a high level of confidence.
- **Definite Feasibility Studies or Bankable Feasibility Studies**: Law does not define Definite Feasibility Studies or Bankable Feasibility Studies. Industry uses these terms as shorthand for increasing levels of detail for engineering/construction or project financing.
- **Additional Engineering Studies**: Following the Feasibility Studies, detailed engineering, such as Front-End Engineering Design (FEED) or detailed engineering drawings, aims to enhance construction design, procurement, equipment, and schedule planning before construction.

Security law does not require First Nations to review or approve NI-43-101 technical reports. Industry-standard practices include preliminary and ongoing engagement with First Nations, with those discussions informing what goes into the reports and how credible they are to investors. Specific report sections detail the parallel processes planned or already underway, including permitting, environmental assessments, and social and community impacts. Best industry practices are to include a summary of First Nation consultation and agreements in these sections.

Companies generally post those technical studies on their websites, and stakeholders should treat them as recommended reading. Additional details on these studies and their implications are readily available online.

Readers should exercise caution when interpreting these technical studies. A Preliminary Economic Assessment is conceptual, a Pre-Feasibility Study is still preliminary, and a Feasibility Study is detailed, but none guarantees success. These studies aim to inform investors and policymakers, not to confirm that a mine will be built. Readers should treat them as evolving estimates that may change as new data emerge. Each study also relies on assumptions about metal prices, operating costs, exchange rates, recovery rates, production rates, and labour costs, which can vary over time. Additionally, early-stage studies often cannot fully capture many costs, especially for infrastructure or logistics, and even small changes in assumptions can significantly impact a project's economics. Lastly, compliance with NI 43-101 or the completion of a technical study does not mean regulators have validated the project's economics, safety, or feasibility. Regulators assess these aspects separately through the permitting process.

Permitting and Regulatory

Mine regulations are primarily within the jurisdiction of **territories and provinces**, each with its own laws and by-laws specifically for mining. After discovering a viable deposit, the project must undergo a provincial assessment, which may include an impact assessment, and a comprehensive permitting process that complies with legislation covering construction, operation, closure, and reclamation, as well as general environmental and safety regulations.

Key approvals and permits can typically include:

- **Environmental assessment approval**: a decision that confirms the project's impacts are acceptable, often including mitigation conditions.
- **Mining lease or permit**: authorization to extract minerals under the provincial mining act.
- **Environmental permits**: licenses for water use, effluent discharge, air emissions, hazardous waste handling, and tailings storage facility constructions.

The federal government primarily oversees uranium mining activities within the nuclear fuel cycle, activities related to federal Crown corporations, operations on federal lands and offshore regions, as well as the transportation of explosives and certain minerals.

However, the federal government requires that all mine projects comply with the regulations listed below:

- *The Explosive Act.*
- *The Species at Risk Act.*
- *The Migratory Birds Convention Act.*
- *The Canadian Environmental Protection Act.*

If applicable, a project might also require federal approval under the:

- *Fisheries Act and the Metal and Diamond Mining Effluent Regulations.*
- *Canadian Navigable Waters Act.*[20]

[20] https://natural-resources.canada.ca/minerals-mining/canadian-mineral-exploration.

Impact Assessment

Finally, depending on the scale of the mine (capacity above 5,000 tonnes of ore per day), major mining projects are currently regulated under the *Impact Assessment Act*, which came into force in 2019. The impact assessment is a multi-year, five-phase process overseen by the Impact Assessment Agency. This thorough assessment identifies significant biophysical, social, and economic impacts to determine if the project ultimately benefits the public interest. This includes impacts on Indigenous peoples and their rights, as well as the requirement for mandatory Indigenous consultations. See the Indigenous Participation in Impact Assessment page on the federal government's website for more information. The phases include planning, impact statement preparation, the impact assessment, decision-making, and post-decision follow-up. See the federal guide published online for more information.

Infobox 9: Guide to Effective Indigenous Involvement in the Federal Impact Assessment

The *Guide to Effective Indigenous Involvement in Federal Impact Assessment* (the guide) is intended to enhance the capacity of Indigenous Nations to effectively engage in the new federal impact assessment (IA) process. It is also intended to support Indigenous Nations active involvement as key players, rather than mere participants, in the new IA process.

This guide is written for technical staff and leadership of member Nations of the First Nations Major Project Coalition (FNMPC), as well as of any other Indigenous Nation, who are looking for ways to make the most of the new IA process and gain a greater degree of control when major projects are proposed within Nations traditional territories. Ultimately, the guide seeks to empower Indigenous Nations to take advantage of new opportunities within the new IA process, supporting effective involvement and advancing their rights and interests.

The full report can be accessed at: https://fnmpc.ca/wp-content/uploads/FNMPC_Guide_Oct15202_FINAL.pdf.

In practice, both **provincial and federal permitting and assessment processes often run in parallel**, leading to what the Mining Association of Canada calls redundant studies and delays. However, cooperation agreements between the federal government and some provinces and territories have been signed to conduct coordinated environmental assessments.

While reserve land use is managed federally under the *Indian Act*, the newer *Framework Agreement on First Nations Land Management Act* empowers First Nations to develop their own land-use laws and environmental assessment regimes. Crucially, the Crown has a constitutional duty to consult and accommodate Indigenous Peoples who are potentially impacted by the project before any activity that could potentially create adverse impacts on their rights. Further, both the federal government and British Columbia have acknowledged the principles of free, prior, and informed consent (FPIC) in legislation. As mentioned, these consultation duties are typically carried out by regulatory bodies, such as the federal Impact Assessment Agency, often as part of the environmental impact assessment process.

Case Study 4

Two Projects, Two Paths: Lessons from Brucejack and KSM development pipeline

The Brucejack Mine, an underground gold-silver operation owned by Newmont, 65 km north of Stewart, British Columbia, received environmental approval in 2015, began construction in September of that year, and achieved first commercial production on July 1, 2017. It rapidly became one of Canada's highest-grade precious metal producers after feasibility studies and permitting progressed smoothly under Pretium Resources and later under Newcrest and Newmont ownership.

In contrast, the Kerr-Sulphurets-Mitchell (KSM) Project, owned by Seabridge Gold, also near Stewart and one of the world's largest undeveloped copper-gold-silver-molybdenum deposits, has completed extensive environmental assessment and technical studies, including a 2022 pre-feasibility study, but has endured years of approval delays and extensions to its environmental certificate. It was granted "substantially started" status in 2024 after nearly two decades of development, but it has not yet reached full operational commitment. This comparison highlights that, even with strong fundamentals, very large, capital-intensive projects can languish in development while more moderate, well-timed projects like Brucejack progress to production.

Table 9: Comparison of Development Timelines of the KSM and Brucejack mines

KSM

Report & Status	PEA	PFS	Updated PFS #1	Updated PFS #2	Updated PFS & PEA #3	Updated PFS & PEA #4	Updated PFS & PEA #5
Year	2008	2010	2011	2012	2016	2020	2022

Brucejack

Report & Status	PEA	PEA updates #1	PEA updates #2	MRE updates	FS	Construction Start	Commercial Production
Year	2010	2011	2012	2012-2014	2014	2015	2017

6.3 Extraction and mine operations

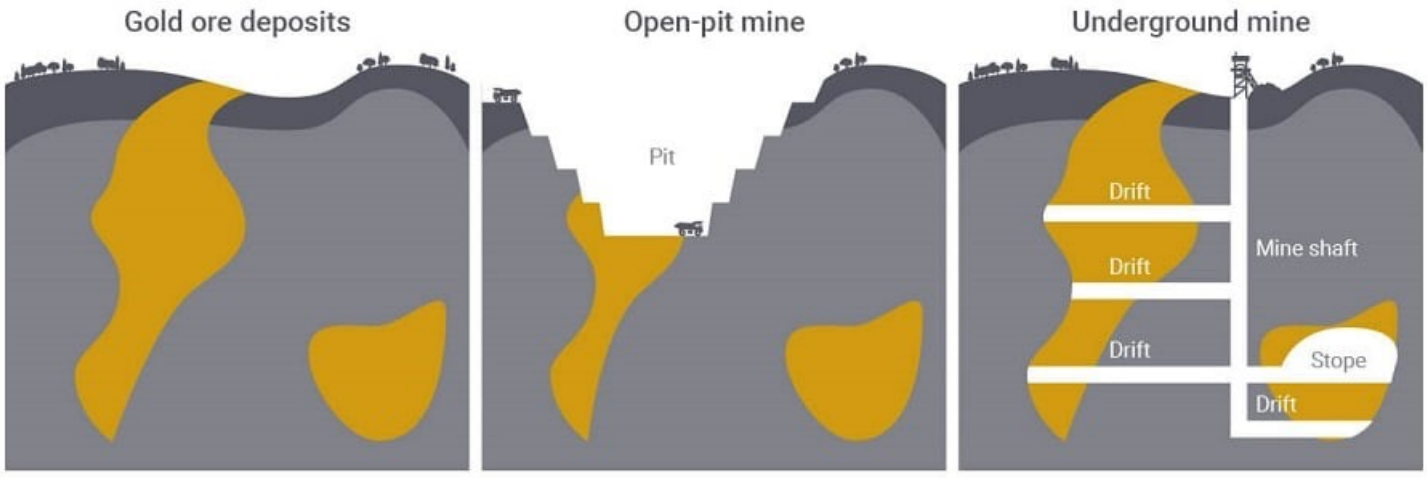
Once construction, commissioning, and ramp-up are complete, the mine enters its **operational phase**. It enters commercial production, and the mine remains active, producing mineral output in a steady state. This stage can last many years or even decades, depending on the size of the reserves, mineral grades, and market conditions. Operations bring significant economic activity: they create jobs (from miners and engineers to support services) and business for local suppliers, while generating revenues and royalties. This is generally the stage at which First Nations start to see the benefits from the IBA. Mines can close for several reasons: a drop in commodity prices that makes the mine not economically viable, safety or environmental issues, or changes in regulations.

Broadly speaking, there are two methods for mining, based on the depth, shape, and grade of the deposits: open-pit and underground operations, although some sites use a mix of both.

1. **Open-pit mining** involves removing overburden, extracting ore, and hauling it from a series of descending benches, creating a large, visible pit at the surface. Operators generally use this method for large, lower-grade, shallow deposits, as it is relatively safer and allows for higher production rates and lower operating costs per tonne.
2. **Underground mining** is for higher-grade or deeper deposits where surface access isn't practical or economic. It requires sinking shafts or driving tunnels to access the ore body, resulting in a significantly smaller surface footprint, lower waste production, but higher development costs and safety risks.

In large deposits, it can sometimes happen that an open-pit mine is converted to an underground mine to extend operation time and access deeper ore zones. In Canada, this is the case for the open-pit Red Chris gold and copper mine in B.C., which is projected to transition to underground block cave mining in the future. The Hemlo gold mining operations, located near Marathon, Ontario, are another example of how mining methods shifted over time: operations initially started as an open-pit mine in 1985, with parallel underground operations soon following, while only underground mining remains active now.

Image 21: Open Pit versus Underground Mining[21]



[21] Source.

Alternatively, solution mining is an additional method for mining specific minerals. It extracts underground minerals by drilling wells and injecting a solvent and/or water to dissolve the minerals of interest. The resulting mineral-rich brine is then pumped back to the surface for processing. This method is particularly relevant for potash and for uranium, as the Denison uranium mine project plans to use it.

Mining companies not only extract ore but also usually perform **beneficiation** on-site. This step aims to remove non-valuable rocks (called gangue) and specific compounds or impurities to create a **mineral concentrate** with a higher concentration of the valuable mineral than is naturally present in the ore body. A mineral concentrate generally simplifies transportation to a processing facility (less weight for more valuable elements) and also makes further processing steps easier.

One important thing to note is that this beneficiation and concentration process creates **mine tailings**. They can contain a mix of waste rocks, toxic heavy metals, acid-generating ores, chemical reagents used for flotation or leaching, and dust-generating materials, making tailings severely hazardous for nearby communities and wildlife. Companies usually store tailings safely in **tailings storage facilities (TSF)**, but incidents caused by seismic activity, poor construction, or extreme weather have led to catastrophic dam failures.

Not all critical minerals are mined:

- **Certain critical minerals are not solid and cannot be mined traditionally.** For example, operators find lithium brine at high concentrations in deep oilfield aquifers and must pump it to the surface using a novel process called Direct Lithium Extraction (DLE). This makes Direct Lithium Extraction operations different from traditional mines. Helium is a gas and must be separated from natural gas. Natural graphite is solid and can be mined, but plants produce synthetic graphite from petroleum and coal byproducts, such as coke and coal tar pitch. Coke, specifically, is a high-carbon fuel produced by heating coal or petroleum in the absence of air, and it is generally used for steelmaking, electrodes, or industrial heating.
- **Other critical minerals are byproducts** of mining other primary minerals. Processors obtain these byproducts during processing, after separation. Cobalt is usually a byproduct of nickel in Canada or copper in the Democratic Republic of Congo. Gallium and germanium are byproducts of zinc smelting. Similarly, producers can obtain vanadium from iron or uranium mining, or by processing petroleum fly ash or bitumen.

During operation, a mine remains subject to **ongoing regulatory oversight**. During this stage, companies implement comprehensive environmental management programs, including water quality monitoring, waste management, and the mitigation of local impacts. Consistent engagement with nearby communities and transparent reporting are essential for maintaining accountability of mining companies' impacts on these important values.

For example, government agencies conduct **regular inspections, audits, and performance reviews** to ensure that operations meet permit requirements and minimize environmental impacts. Indigenous Land Guardian programs also play an important role in on-the-ground ecological monitoring, providing continuous stewardship and integrating Indigenous knowledge into oversight. These ongoing monitoring systems make sure that any emerging risks are detected and addressed throughout the mine's lifespan.

Case Study 5

Mount Polley Tailing Breach

In August 2014, the tailing storage facility at the Mount Polley Mine, an open-pit copper and gold mine operated by Imperial Metals, experienced a dam breach and spilt contaminated material into nearby lakes and ecosystems. An independent investigation ordered by the B.C. government found that the dam failure was caused by faulty design and construction, as a layer of glacial till was not accounted for during engineering. The spill particularly affected the traditional territories of the T'exelc First Nation and the Xatśūll First Nation. Remediation by Imperial Metals has been undertaken through investments in environmental repair and cleanup. A project to raise the tailing dam, previously approved by the BC government, is currently being challenged by the Xatśūll First Nation.

6.4 Mine decommissioning

Before moving into closure, mines enter a 'care and maintenance' stage in which operations are suspended, but the site remains actively managed to meet regulatory, environmental, and safety requirements. This status can last for months, years or even decades. Closure is the final phase once mining ceases, either because the resource is depleted or because the mine is no longer economic. The goal is to shut down the site and restore the environment safely. The company must dismantle facilities, remediate any contamination, and rehabilitate the land so that it poses no long-term hazard. Companies carry out this work through reclamation.

The goal of restoration is to clean up the land and return it to an ecologically functional state once the mine closes. This can include re-contouring land and replanting vegetation. Indigenous communities may lead or participate in mine reclamation efforts.

In Canada, regulators require a detailed closure plan from the outset and a financial security bond to cover reclamation costs. All mining jurisdictions in Canada require proponents to submit a formal closure plan, either as part of the approval process or before commencing operations. This ensures the site will be cleaned up and can be repurposed or returned to nature, under oversight from government and community stakeholders until all environmental criteria are met.

Many provincial/territorial governments require some form of financial assurance, also called financial security, guarantee, or bond, for mine decommissioning. However, they differ in specific details, such as timing, acceptable forms of assurance, and the portion of the estimated liability that companies must cover. For instance, Quebec mandates a financial guarantee covering estimated reclamation costs, and companies often provide it in full or in significant instalments up front. These measures are meant to ensure that clean-up costs are not "shouldered by the public".

Case Study 6

Manitoba's Orphaned and Abandoned Mine Program

Established in 2000, Manitoba's Orphaned and Abandoned Mine (OAM) and legacy oil well closure program was designed to address public safety risks and environmental liabilities at sites with no viable owner. Over nearly two decades, the province has systematically sealed shafts, stabilized tailings, remediated contaminated soil and water, and decommissioned legacy infrastructure, significantly reducing high-risk hazards across the province. With most major remediation work now completed, the program is transitioning from active cleanup to long-term monitoring and care, marking one of Canada's more mature examples of a province-led legacy resource-closure initiative. There are 122 sites within the OAM program, and 4 of them require ongoing, active management.

Case Study 7

Tulsequah Chief Mine

The Tulsequah Chief Mine, a copper, lead, zinc, silver and gold site owned and operated by Cominco (now Teck Resources or Anglo Teck) in northwest British Columbia that operated from 1951 to 1957, became an environmental catastrophe when its abandoned workings began releasing highly acidic, metal-laden water into the Tulsequah River, threatening the transboundary Taku River watershed's salmon habitat and Indigenous lands for more than six decades.

The B.C. government allowed the site to remain in 'care and maintenance' after production stopped, pending restarts by various companies. After two bankrupt owners failed to address the pollution, and years of regulatory and legal delays, the provincial government has now stepped up remediation efforts by partnering with Teck Resources and the Taku River Tlingit First Nation to develop and implement a detailed closure and reclamation plan, involving site access improvements, underground assessments, water-quality monitoring and waste-rock evaluation to inform a final cleanup strategy.

This collaborative work aims to end decades of acid mine drainage, restore ecological integrity, integrate First Nations values and stewardship priorities, and protect the watershed's environment for future generations. A draft cleanup plan is expected within the next few years, and overall remediation could be completed within a decade if the process proceeds smoothly.

6.5 Processing and refining

Image 22: Midstream as Defined in the 2022 Canadian Critical Mineral

The processing stage, categorized as **midstream**, involves the physicochemical and metallurgical transformation of raw materials and concentrates after mining or extraction. The goal is to **separate** and **purify** a valuable element from other compounds.

Processing can occur either **on-site** or at a **different location**. Producers commonly process gold near the mine, but this is not necessarily true for many other minerals. Mine operators currently ship copper concentrates mined in B.C. overseas for smelting. Nickel concentrates from Labrador are sent to Newfoundland for leaching. However, Sudbury, Ontario, does have nickel smelters near the mines, as was previously the case in the Flin Flon region of Manitoba, where Vale operated the Thompson mine and previously owned a nearby smelter. However, the Thompson smelter was closed in 2018, and Vale's Manitoba nickel concentrates are sent to its Copper Cliff smelter and refinery in Sudbury, Ontario. Many factors influence the choice of a processing site, and market economics, access to inexpensive energy and chemicals, industrial infrastructure, and favourable regulations are essential to attract private companies' interest.

A **strong history** in base metals marks Canada's metallurgical and processing capacity for critical minerals, but it currently faces notable gaps, especially for newer critical minerals. Indeed, Canada has a history of expertise in copper, nickel, aluminum, and cobalt metallurgy, as well as in steelmaking and uranium processing. For newer critical minerals linked to the energy transition, such as lithium or graphite, **most conversion plants are still at the project stage**. The Saskatchewan Research Council and several small companies in Ontario have processed rare earth

elements on a smaller scale. As Chinese companies are unwilling to sell their technology, the Saskatchewan Resource Council is also currently developing equipment and technologies to process and refine rare earth elements to scale its operations and sell to other Western countries.

In some cases, major multinational companies use vertical integration to manage their supply chains. Companies like **Glencore** and **Vale** operate active mining and smelting facilities, especially for nickel and cobalt, in regions such as Sudbury, Ontario. Glencore also mines copper and runs Canada's only remaining dedicated copper metallurgical plant, the Horne smelter in Rouyn-Noranda, Quebec, which processes copper ores and scrap into impure copper anodes that are later refined near Montreal. Vale operates the Long Harbour hydrometallurgical plant in Newfoundland, where it refines nickel concentrates from Voisey's Bay in Labrador into pure nickel product. **Rio Tinto** produces high-purity iron powder and plans to process scandium as a byproduct of its titanium operations at its Rio Tinto Iron and Titanium plant in Quebec. Ferroglobe, which owns a quartz mine, also produces metallurgical-grade silicon in Bécancour, Québec.

Mid-tier Canadian companies like **Teck Resources** have also managed both mines and smelting operations, with the Trail integrated lead-zinc smelter-refinery, which produces various critical mineral byproducts. Teck processes concentrates from its Red Dog mine in Alaska. **Sherritt** also processes nickel in Alberta, using nickel concentrates it owns from a joint operation in a Cuban mine. Finally, **Hudbay Minerals** previously operated the Flin Flon copper smelter (closed in 2011) and a zinc metallurgical plant, while it still operates mines in Manitoba.

However, the country severely **lacks processing capacity** for certain base metals, particularly copper, in certain regions. Specifically, almost all copper concentrates produced in Western Canada, particularly in British Columbia (B.C.), are currently shipped overseas, predominantly to Asian smelters, without further processing in Canada.

Unlike vertically integrated operations, many medium-sized or smaller organizations specialize in midstream activities without owning mines. **5N Plus** (antimony, bismuth, cadmium, indium, tellurium) or **Fenix Advanced Materials** (cadmium, indium, antimony, tellurium) focus on refining small quantities of high-value metals and niche chemicals. **SRC** or **Ucore** have specialized in rare-earth processing without operating mines. There is also a wide variety of innovative start-ups and academic spin-offs from universities that focus on developing industrial processes for critical minerals, notably lithium, graphite, and rare earths. For instance, the Mining Innovation Rehabilitation and Applied Research Corporation (MIRARCO) is a not-for-profit research organization affiliated with Laurentian University that supports innovation in the mining value chain, with a focus on metals from the Sudbury Basin and on mine waste valorization and environmental remediation. Engineering consultancy firms such as **Hatch** also develop their own intellectual property for lithium processing.

6.6 Advanced Materials

Advanced material manufacturing is the production of **specialty chemicals** and **high-added-value materials**, and it is classified within the midstream segment of the critical minerals value chain. Those advanced materials require processed metals and materials as a supply, and in turn, manufacturers need them to produce valuable components for end products such as batteries, wind turbines, radars, and lasers.

In the battery value chain, advanced materials include **precursors of cathode active materials (pCAM), cathode active materials (CAM), anode active materials (AAM), separators and electrolytes**. Other advanced materials include **semiconductors** for the electronic, solar PV or defence value chains. Magnetic alloys and **magnetic materials** are also necessary for both magnets and battery & energy storage value chains. China largely dominates global production of many of those industries.

This segment of the value chain, like the previous one, faces hindrances due to a **'chicken and egg problem'** with difficult connections to upstream and downstream. A fundamental constraint, **insufficient downstream demand**,

currently hampers North America's ambition to develop a complete battery value chain.

Specifically, the essential battery cell manufacturers and other large-scale offtakers need to purchase high-volume Cathode Active Material (CAM), but they do not yet operate at the necessary scale in North America to justify the required upstream investments. In addition, there is a **supply challenge**: finding North American suppliers that can produce battery-grade lithium or nickel, cobalt, or phosphoric acid chemicals necessary to make cathodes can be difficult, especially when companies have not yet mined or processed those starting materials.

This is one of the core challenges of developing new value chains domestically, as aligning midstream players can be complicated when connecting the upstream and downstream parts of the value chain from scratch.

Image 23: Selection of Examples of Advanced Material Manufacturing

Cathode materials for lithium-ion batteries:

- **Nano One** conducts R&D in British Columbia and operates a cathode active material production plant in Quebec.
- **Ultium**, a joint venture between General Motors and Korea's POSCO Future M, plans to produce cathode active material in Bécancour, Quebec.

Anode materials for lithium-ion batteries:

- **Nouveau Monde Graphite**, a junior graphite miner, is developing multiple mines and building a graphite processing and coating facility in Bécancour to produce active anode materials.
- **Vianode**, a Norwegian company, is constructing a synthetic graphite anode-active material plant in St. Thomas, Ontario.
- **VoltaXplore**, a subsidiary of NanoXplore (the world's largest graphene producer), is a Canadian company advancing the use of graphene in battery anodes.
- **Makesens**, based in Calgary, Alberta, is developing silicon materials for silicon–graphite anodes used in lithium-ion batteries.

Battery Separator for lithium-ion batteries:

- The **Honda-Asahi Kasei** plant is a planned battery separator facility projected to open in Port Colborne, Ontario.

Materials for next-generation batteries:

- **Neo Battery Materials**, based in Ontario, is developing silicon anode materials.
- **Nanode**, headquartered in Edmonton, Alberta, is developing tin anodes for sodium-ion batteries

Flow battery materials:

- **VanadiumCorp** has opened a pilot plant in Quebec to produce vanadium electrolyte.

Magnet materials:

- **Neo Performance Materials**, a Canada-headquartered company, has expertise in rare earth processing and magnet manufacturing in Europe and China, but currently has no operations in this value chain within Canada.

6.7 Downstream Manufacturing

The **downstream segment** of the value chain involves manufacturing the final product. In the context of the battery value chain, this includes producing electrodes, assembling cells, modules, and packs, and performing overall battery assembly. Their end uses may include **electric vehicles** or **stationary energy storage, both of** which are booming markets. For other value chains, it could encompass manufacturing Solar PV modules, electric motors, wind turbines, fuel cells and advanced electronic components, among others.

China also dominates the global battery value chain, but both **South Korea** and **Japan** are major players with significant expertise in producing NMC batteries. Both countries have heavily invested in Europe and North America to expand manufacturing capacity and deploy new plants, often in collaboration with local automotive companies. Battery plant facilities typically take **less time to plan and build** than mines, with **simpler regulatory approval processes**. For instance, the Ontario Nexstar facility took 3 years to construct.

Canadian governments, both federal and provincial, have concentrated on engagement and policies in recent years to attract investments from foreign automotive manufacturers and battery producers to establish Gigafactories in Canada. Those measures have mainly focused on Eastern and Central Canada, with many announcements made in Ontario and Quebec.

Indeed, since 2022, companies have proposed several large EV battery factories in Canada, but plans have since been reassessed: developers cancelled two projects, postponed one, are proceeding with one, and completed one.

- **NextStar Energy**, a joint venture between Stellantis and LG Energy Solution, has completed construction of its plant in Windsor, Ontario. It also started battery module assembly in late 2024. It will initially switch production focus from EV batteries to batteries for energy storage systems.
- The **Powerco-Volkswagen** plant being constructed in St. Thomas, Ontario, aims to begin production in 2027.
- **Northvolt Six**, an EV battery gigafactory planned for South Montréal, was cancelled after its Swedish and North American parent companies filed for bankruptcy.
- **Honda**, which previously announced an EV assembly and battery plant in Alliston, Ontario, has recently postponed its original plan for another two years.
- **E-One Moli Energy**, a Taiwanese lithium-ion battery manufacturer, previously planned to expand its Maple Ridge site in British Columbia with a battery manufacturing plant. The company halted the plan in late 2024.

Additionally, Invinity operates a 200 MWh vanadium flow battery plant in Vancouver. Vanadium redox flow batteries (VRFBs) are an alternative energy storage technology. For the hydrogen value chain, Ballard is a B.C.-based fuel-cell module and stack manufacturer, specializing in applications for buses and trucks. It has produced 1 GW of fuel cells in total.

Case Study 8

Malahat Battery Technologies

Malahat Nation (51% ownership) and Energy Plug Technology (49%) established Malahat Battery Technologies on Vancouver Island, with plans to open a 25,000-square-foot gigafactory in late 2026 to produce 1 GWh per year of LFP battery for Battery Energy Storage System (BESS) applications, including marine, micro-grids, datacenters, or residential use.

The project forms part of Malahat Nation's broader strategy to build long-term economic independence through participation in the clean-energy supply chain, while creating a hundred skilled jobs and attracting new investments. While the project will source some components from Spain and Taiwan (using SEETEL's BESS products), many components, including the distribution panel, the transformer, and the electrical construction and assembly, will be of Canadian origin.

6.8 Circularity, Recycling and Urban Mining

The difference between fossil fuels and batteries for energy storage is that fossil fuels are burned inefficiently to release energy and produce **greenhouse gases** during combustion, whereas batteries, after their end of life, still contain components that can be separated and **recycled**. Producers can then use these elements to make new batteries or other materials. This principle applies to many non-battery materials that use metallic critical minerals, as well as to non-metallic materials like graphite.

More than just prioritizing recycling a battery at end-of-life, a systemic **circular-economy** strategy would use critical minerals more efficiently. This means eliminating waste along the value chain, circulating high-value materials and products, reusing and refurbishing materials, and also recycling when possible. A Rocky Mountain Institute report found that, over several decades, increased battery and vehicle efficiency, reuse, and recycling could eliminate the need to dig for more critical minerals for the energy transition. In their own words, "minerals only need to be extracted once, while oil needs continuous extraction". This promising, efficient future is technically feasible but will take several decades to achieve.

In the meantime, the energy transition will still require mining and processing a large amount of critical minerals, even if recycling is adopted. To stay optimistic, the Energy Transitions Commission estimated that the total material needed for a global energy shift to net zero from 2022 to 2050 equals the weight of one year's worth of current coal use.

Specifically for **refurbishment** and **second life**, as battery life will likely outlast the lifespan of an EV, finding use for those operating batteries will be an economic opportunity. Second-life usages include stacking them and using them as stationary energy storage systems. For recycling, industries already recover many materials, but end-of-life recycling rates vary by commodity.

In 2021, the IEA estimated that those rates were:

- Platinum/palladium and nickel have a high 60% recycle rate
- Copper is at 45.5%
- Aluminum at 42%
- Cobalt at 32%
- Lithium at 0.5%
- Rare earth elements at 0.2%

Collecting used materials and recycling is also called **urban mining**. It involves extracting critical elements from urban waste, such as e-waste or used batteries, providing an alternative to traditional mining and resource extraction.

More specifically, for battery recycling, the **established lead-acid battery recycling system** serves as an excellent example: The Canadian Battery Association estimates that, on average, manufacturers use recycled materials to make about 80% of a new lead-acid battery. The recycling recovery rate is nearly 100%. **KC Recycling** in Trail, B.C., is an example of a company that recycles lead and plastic from batteries.

For more recent and efficient lithium-ion batteries, the recycling network and system are not yet established. Lithium-ion batteries vary in chemistry and standards, and optimizing recovery processes is still under development. In general, after collecting retired batteries, recycling companies shred them to yield a **black powder**. An example of a company that produces such black powder is **Cirba Solution** in the Kootenays, B.C. In Ontario, **Aki Battery Recycling** is a joint venture between Electra Battery Materials and Three Fires Group, a First Nation-owned investment group that plans to recover copper, aluminum, and steel from batteries and produce black mass.

Recycling companies can then process black mass using various metallurgical methods, such as pyrometallurgy or hydrometallurgy processes, to extract valuable metals and salts. In NMC batteries, recyclers typically target lithium, nickel, cobalt, and manganese for recovery. **Lithion**, based in Quebec, is a company producing black mass and planning to recover lithium, nickel and cobalt. **Recyclico**, a B.C.-based company, produces lithium chemicals and pCAM from black mass while having developed modular plants for on-site battery recycling. **Battery X**, also based in BC, has specialized in recovering all metals from NMC batteries and is designing processes to recover graphite. **Green Graphite Technologies**, based in Quebec, is also developing processes for graphite recovery from secondary sources.

However, the battery recycling business is challenging and depends on **operational costs**, securing a **large volume of end-of-life batteries**, and selling **metal salts products at a viable price**. Previously active Ontario-based company **Li-cycle** had similar ambitions to process black mass, but filed for bankruptcy, and Glencore later acquired the company.

Batteries are not the only materials attracting startups for recycling. Many other Canadian companies are developing recycling processes for critical minerals across various value chains.

pH7 Technologies is a Vancouver-based company focused on extracting critical minerals from e-waste and spent catalysts to recover precious metals. **Neo Performance Materials**, which has expertise in magnet-making, also recovers gallium from new scrap to produce high-purity gallium and gallium compounds at its Peterborough facility. **Geomega Resources**, a Quebec-based startup, is building a rare earth magnet recycling plant in Saint-Hubert. **Cyclic Materials**, based in Kingston, Ontario, opened a commercial demonstration plant to process e-waste and recover recycled mixed rare earth oxide.

Finally, in addition to refurbishing or end-of-life recycling, another potentially interesting avenue for recovering critical minerals is **mine tailings**. A recent report by Action Canada and the Public Policy Forum suggests that re-mining tailings could yield multi-billion-dollar opportunities: with over 10,000 abandoned mines, each containing

waste and tailings with valuable metal resources, this represents a significant opportunity, though there are significant environmental concerns, and each opportunity must be considered individually. Indeed, past mining operations did not prioritize many minerals now considered critical.

However, there is a significant lack of data regarding mine tailings inventory, and regulation for re-mining remains challenging. In July 2025, Ontario became the first Canadian jurisdiction to establish a dedicated regulatory pathway for recovering minerals from mine waste through its new Recovery of Minerals regulation. The regulation allows reprocessing of waste without the need for a full closure plan or a mine lease for public land projects, and mineral recovery follows a distinct permitting regime, unlike in other provinces, where recovery is addressed under existing permits.

The Canadian startup **Baie Minerals** is developing a technology to reclaim asbestos mine tailings in Baie Verte, Newfoundland. This process would simultaneously decontaminate toxic waste, extract valuable critical minerals, and sequester CO2 through carbon mineralization. Vancouver-based company **Arca** is also developing its own technology to use mine waste, such as tailings, for carbon capture by mineralizing CO2 with ultramafic rocks.

6.9 Transport and logistics infrastructure

Transport and logistics infrastructure is a crucial asset category required for the successful development and scaling of Canada's critical mineral value chain, particularly for connecting remote upstream resource extraction with midstream metallurgical processing and downstream manufacturing.

Multiple jurisdictions face widespread challenges due to the geographic complexity and remoteness of many significant deposits, as well as deficiencies in transportation and access infrastructure. Moving raw materials like concentrates, intermediates, and final products to domestic and global markets in a timely and cost-effective way depends on efficient transportation infrastructure, such as **roads, railways, train stations, ports, and Dry Ports**, which are essential. Operators also need to transport supplies, equipment, and fuel necessary for mining operations. **Airports** play a vital role in transporting the workforce in fly-in, fly-out operations at remote mining camps. Midstream and manufacturing operations need transport not only to move end products but also to access chemicals, reagents, and equipment necessary for operations.

Key infrastructure players include rail companies such as Canadian National (CN) and Canadian Pacific Kansas City (CPKC), as well as the ports of Vancouver, Quebec City, and Montreal. Here are a few figures to understand the share of transportation needed for the mining industry:

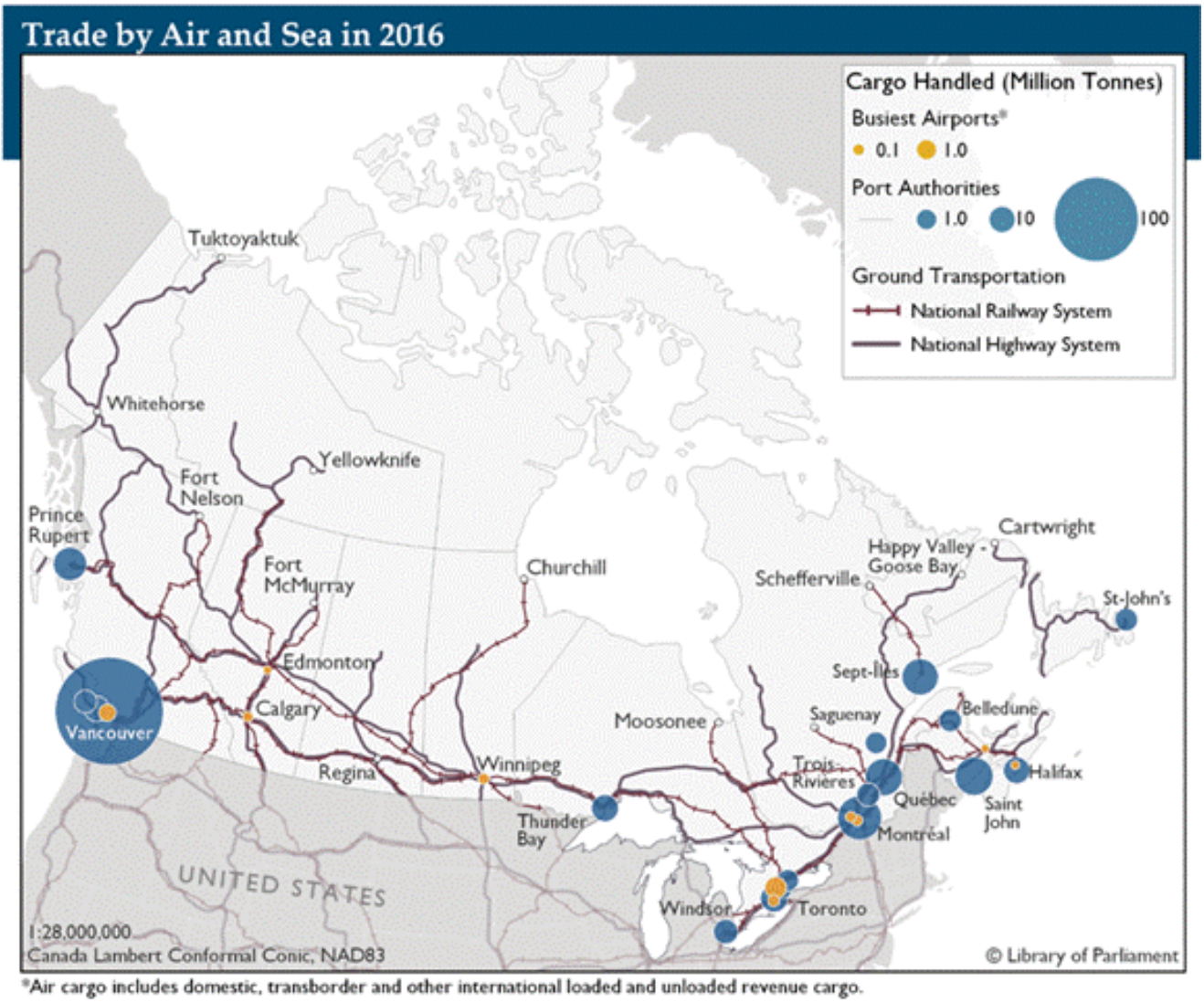
Rail: the mining industry is the largest customer of Canada's railway transport and accounts for more than half of the total freight volume. In 2023, this represented:

- 135.3 million tonnes of crude minerals
- 29.5 million tonnes of processed mineral products

Shipping:

- In 2023, the Port of Montreal handled:
  - 3.7 million tonnes of total dry bulk mined products, or 46% of the port's dry bulk shipment
  - 2.06 million tonnes of mineral & metallurgical products in containers, or 16% of container volume.
- For the Port of Vancouver:
  - Steelmaking coal accounts for 23% of the bulk volume
  - Potash represents 8%

Image 24: Major Trade Routes in Canada[22]



[22] https://www.ourcommons.ca/DocumentViewer/en/42-1/TRAN/report-27/page-66.

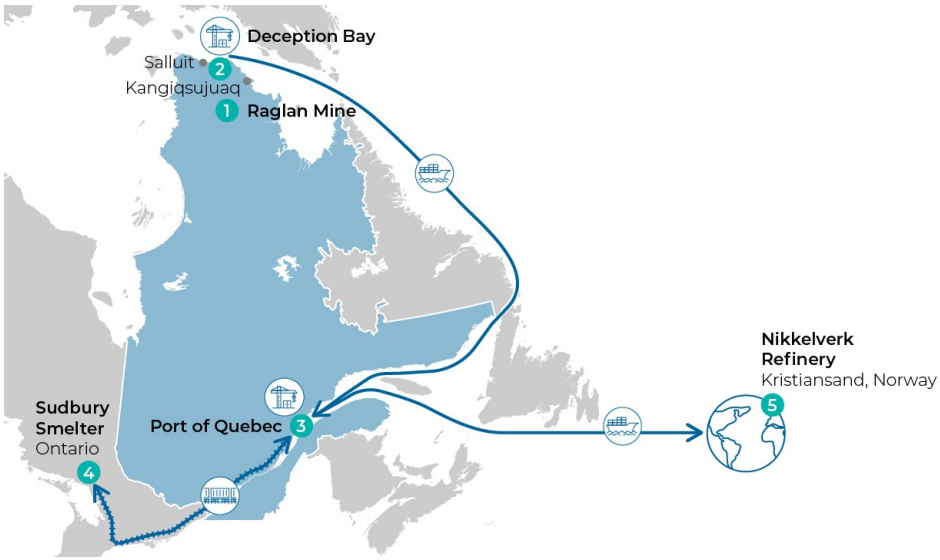
Case Study 9

Transportation of Resources from Glencore Raglan Mine

To illustrate the flow of materials and how transport infrastructure plays a role, here is the example of how nickel travels from the Glencore Raglan mine in Nunavik:

- Glencore mines and concentrates nickel at the Northern Nunavik Raglan mine.
- Trucking crews move the nickel concentrate 100 km to the Deception Bay port.
- Operators then ship it to the Port of Quebec aboard an icebreaker for a 2,600 km journey.
- A train moves the concentrate for another 950 km trip from the port of Quebec to the Glencore Smelter in Sudbury, Ontario.
- After smelting and casting, the nickel matte is transported by rail to Quebec City, then shipped across the Atlantic to Norway for refining.

Image 25: Transportation of Materials from Raglan Mines[23]



There is also an example of an extensive material flow trip with Hudbay Minerals in Northern Manitoba. This includes the previously operating 777 mine and the currently active Lalor Mine. Since the Flin Flon copper smelter closed in 2011, operators have transported copper concentrates by rail to the Horne smelter in Quebec for processing. For nickel, Vale transports nickel concentrates from Manitoba to its Sudbury operations for processing following the closure of its Thompson smelter.

[23] https://www.glencore.ca/en/our-assets/facilities-at-port-of-quebec.

These complex logistics underline the importance of having **multiple transport infrastructures available** for the same material flow. Historical mining regions already have the necessary access roads and infrastructure for their operating sites:

- Northern British Columbia with gold and copper operations, northern
- Saskatchewan with uranium
- Flin Flon/Thompson area with copper, zinc, and nickel.

For those already active regions, the challenge is mainly **maintenance** and increasing **transport capacity**.

Access to existing infrastructure is another challenge; for instance, privately owned transport infrastructure is not readily accessible to other players. This can be true for private road networks owned by incumbent companies that are not made accessible to their competitors. Some uranium companies in Saskatchewan must build runways less than 100 km from existing ones because they cannot use the existing ones.

The Mining Association of Canada also highlights another point: the high cost of transportation, as well as the disruption caused when a railway network is halted, or a port is locked out.
For other remote yet promising mining regions where the mining footprint is not yet established, constructing strategic north-south corridors is essential to connect resource-rich northern areas and territories to southern processing centres for refining, or to railways and ports for international shipping.

In this context, provinces and territories regularly recommend strategic investments in infrastructure development to support mineral exploitation.

The development of transport and logistics infrastructure provides opportunities for First Nations to participate in several ways, advancing other social and economic development goals. It must be recognized that for others, there are concerns about opening access to territories and how this may impact not only the sustainability of wildlife populations for harvest, but also the safety and well-being of people (particularly Indigenous women).

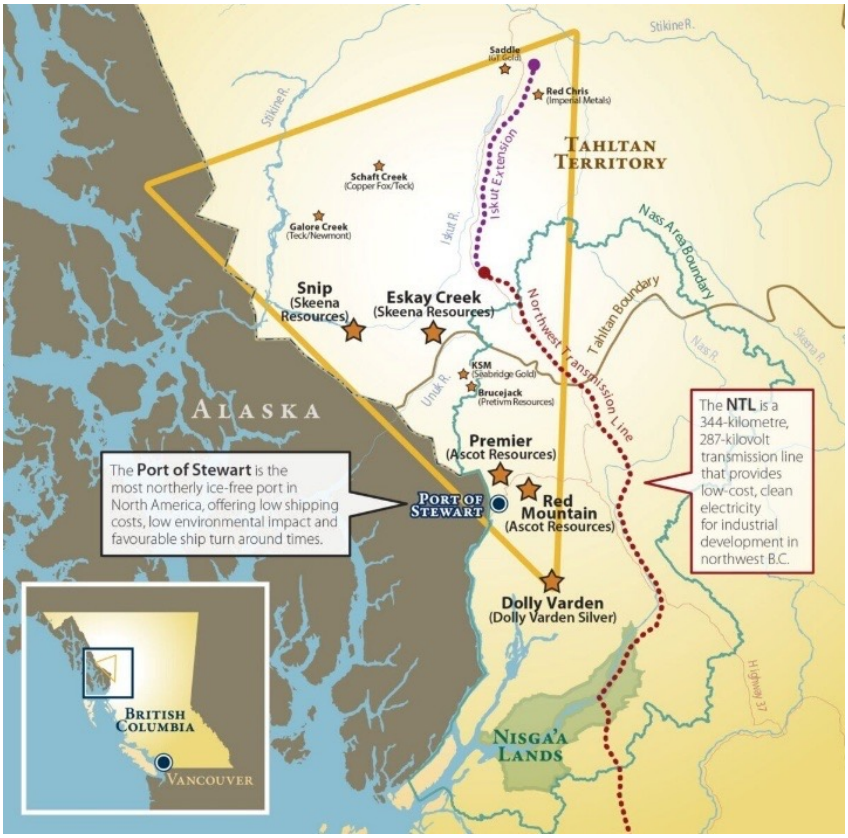
Case Study 10

Port of Stewart

The Nisga'a Lisims Government, the Tahltan Central Government through Tahltan Nation Development Corporation (TNDC) and Arrow Transportation Systems Inc. have formed an equal-share joint venture, Portland Canal Holdings Limited Partnership, to acquire and operate the **Port of Stewart Bulk Terminal**.

The terminal sits within the traditional territory of the Nisga'a near Stewart, B.C., and provides a deep-sea link for shipping copper-gold concentrates and other materials from the Golden Triangle/Copper Corridor region to global markets. The partnership also plans to integrate regional trucking operations to create a vertically-integrated supply chain, aiming to boost local jobs and support First Nation-led economic development in northwestern British Columbia.

Image 26: Golden Triangle in British Columbia[24]



[24] https://www.miningnewsnorth.com/IMG/f5g6I2Yuq35-0yu-7cM4FRNf_I3Bz/XPATH/home/cms_data/dfault/photos/stories/id/3/3/9233/s_bottomXEXT1572x35688is.jpg.

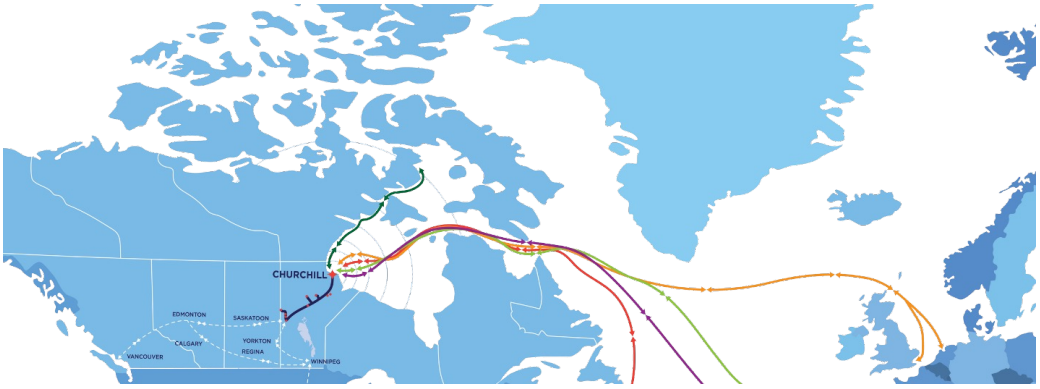
Case Study 11

Port of Churchill

The Arctic Gateway Group owns and operates the Port of Churchill, Canada's only Arctic deepwater tidewater port with a railway connection, and the Hudson Bay Railway, which connects The Pas to Churchill in Manitoba and links to the CN railway network. A partnership of 41 Indigenous and Bayside communities, including 29 First Nations, owns the group.

The port, operating for about 4 months a year, usually ships grain but has started shipping zinc concentrates from Snow Lake, Manitoba. Projects to increase shipments of more diverse products, such as fertilizers (including potash) and canola, as well as natural gas, are under study.

Image 27: Transportation Route from Port of Churchill[25]



[25] https://centreportcanada.ca/about-centreport/

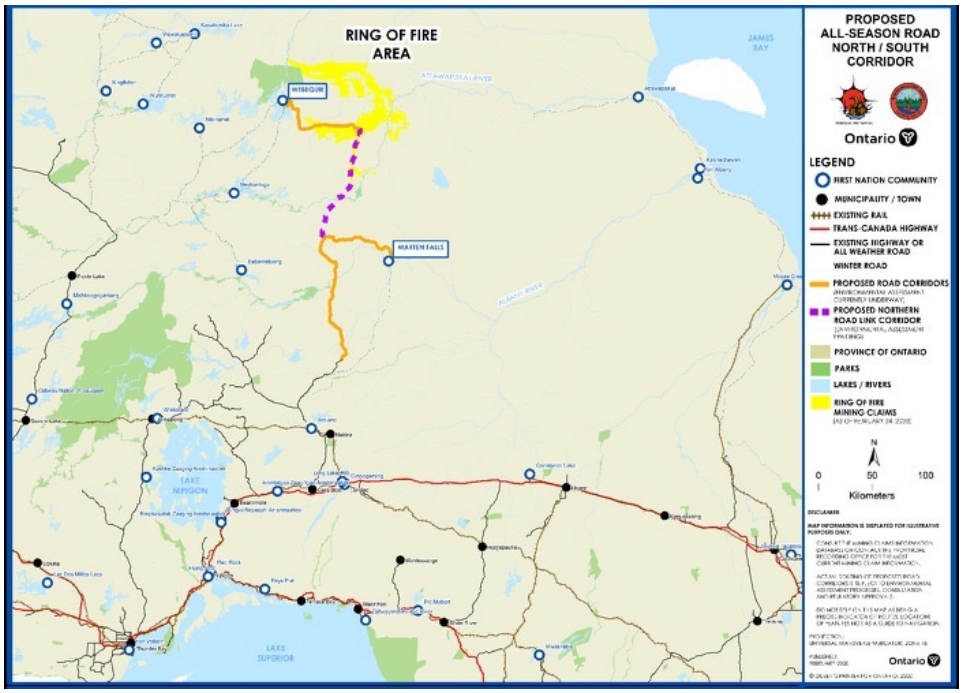
Case Study 12

The Ring of Fire

The Ring of Fire is a remote, mineral-rich area in Northern Ontario with deposits of chromite, copper-nickel, PGM, and titanium, with Wyloo's Eagle Nest being the major project proponent for a mine. To develop the region and allow resource extraction, planners have proposed three all-season roads projects: the Webequie Supply Road, Marten Falls Community Access Road, and the Northern Road Link Project, which would connect the first two roads. Both Webequie and the Marten Falls First Nations designed and submitted terms of reference, which the Ontario government approved for the Northern Road Link in 2023.

The Webequie First Nation also signed a $39.5 million Community Partnership Agreement with the province to advance the supply road and invest in community infrastructure, jobs, and training. However, several controversies have surrounded the region's development, including Ontario's Bill 5 fast-tracking and special economic zones mechanism, environmental impacts, and whether the area should be prioritized for mineral development.

Image 28: Proposed All-Season Roads in the Ring of Fire[26]



[26] https://news.ontario.ca/en/backgrounder/56041/moving-forward-with-road-access-to-ring-of-fire.

Case Study 13

La Grande Alliance

La Grande Alliance is a joint initiative of the Cree Nation Government and the Government of Quebec, launched through a Memorandum of Understanding, to develop sustainable infrastructure in the Eeyou Istchee James Bay region. The Cree Development Corporation (CDC), selected by the Cree Nation Government and the Government of Québec, manages feasibility studies and evaluates the economic, technical, and socio-environmental dimensions of the proposed infrastructure in three phases.

The interim report plan examines upgrades and paving for community access roads, rail lines, and roads, as well as a new harbour to connect the region to global markets. The proposed infrastructure could support numerous lithium mine projects and the local forestry industry. The partnership puts communities at the centre of planning and treats environmental and social criteria as equal to technical and financial considerations, aiming to guide development away from reactive decision-making and toward predictable, sustainable regional growth.

Image 29: Map of Eeyou Istchee[27]

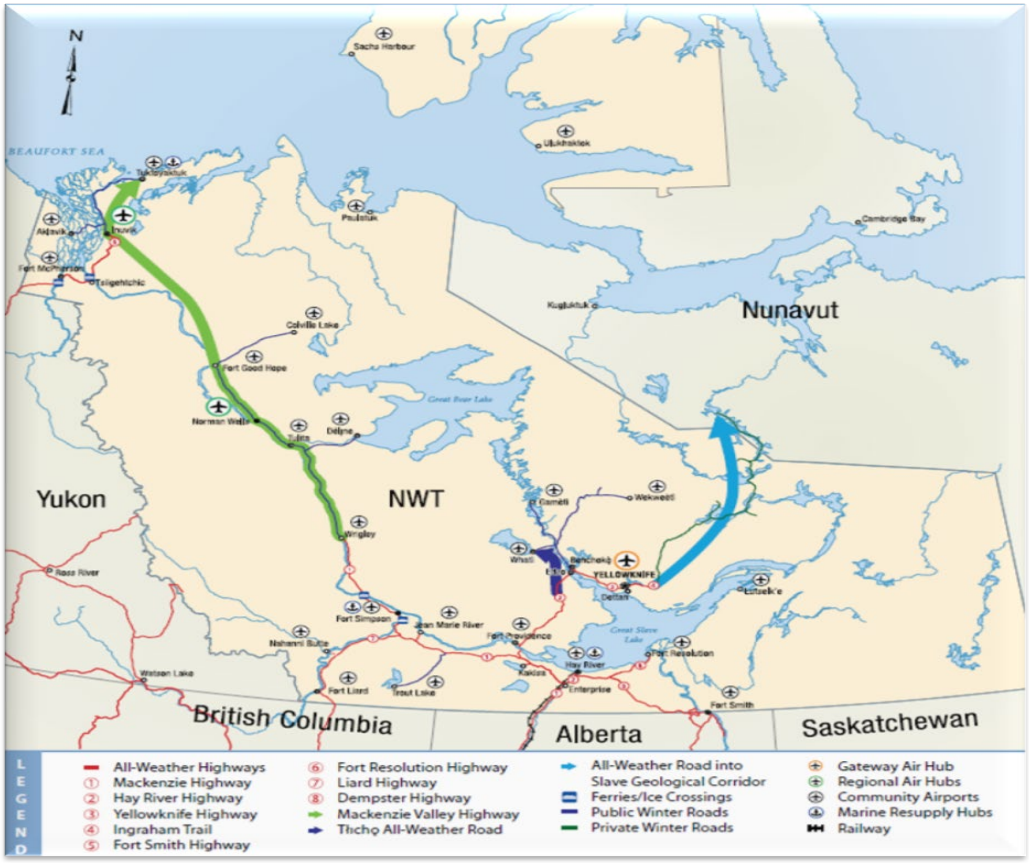
[27] https://www.arcgis.com/apps/mapviewer/index.html?webmap=a2bc4abc61f44dec9b8bf0a6a1f538dc.

Case Study 14

Mackenzie Valley Highway

Part of the "Roads to Resources Program" in the 1960s, the idea of an all-season road through the Northwest Territories to the Arctic Ocean is a longstanding one. The project has re-emerged as part of a transportation network to access resources in the Slave Geological Province and to connect communities to the road network. The project is for a two-lane gravel highway from Wrigley to Norman Wells, approximately 321 kilometres in length and is under environmental assessment by the Mackenzie Environmental Impact Review Board. The project is currently unfunded.

Image 30: Map of the Proposed Route of the Mackenzie Valley Highway[28]



[28] https://www.inf.gov.nt.ca/sites/inf/files/content/mvh_sahtu_community_meetings_feb_19_2020.pdf.

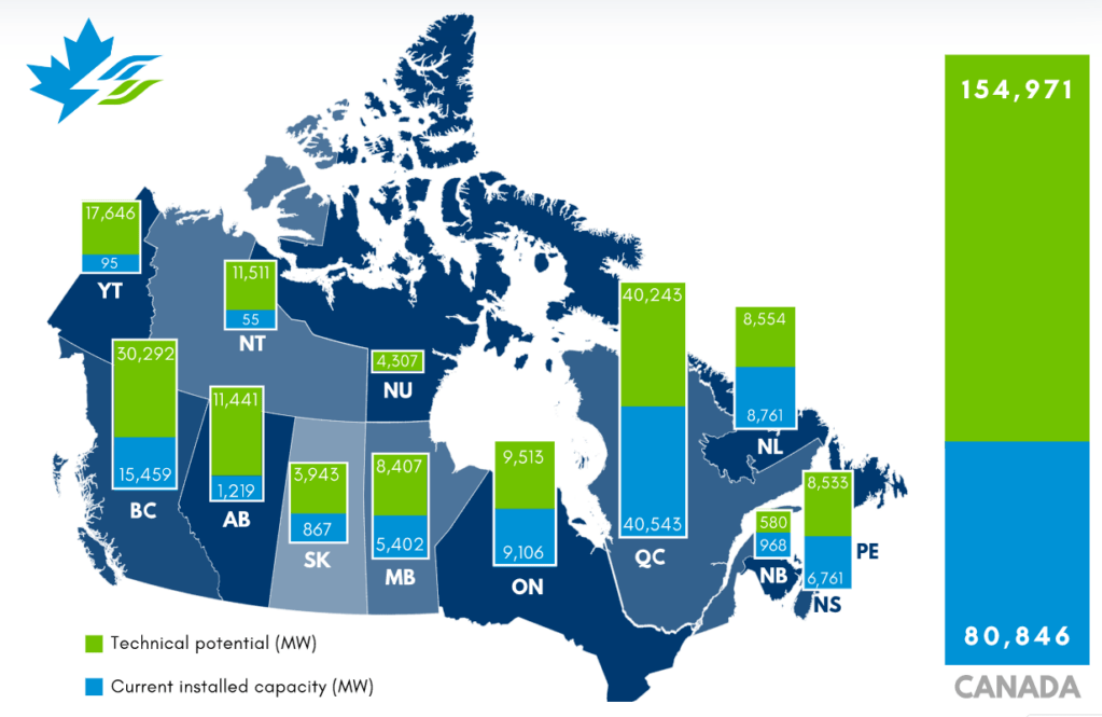
6.10 Energy infrastructure

Historically, metallurgical industries in Canada have tended to cluster around **inexpensive** and **abundant** energy sources. This made hydroelectric dams particularly strategic. As explained in the Development of Metallurgy in Canada since 1900 document, aluminum producers established smelters in Quebec and B.C. due to access to hydroelectric power, as the process requires a lot of electricity. Another example is the Trail Zinc/Lead smelter, which is connected to several hydroelectric plants, and Teck previously owned some of them. There's also Hamilton, Ontario's status as a steelmaking hub, which is not only due to its quick access to U.S. coal *via* the lake and railway, but also to its access to hydropower.

This requirement remains nowadays. For projects related to the **battery value chain** and **clean technology**, as well as associated critical minerals such as lithium, nickel, cobalt, and graphite, investors increasingly demand that critical mineral projects operate on **green** or **low-carbon energy**. This is particularly true in the midstream and downstream segments.

Provinces like British Columbia, Quebec, and Manitoba already benefit from largely decarbonized electricity grids powered mainly by hydroelectricity.

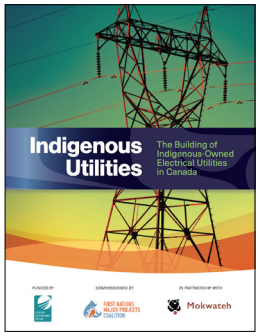
Image 31: Hydroelectric Capacity and Potential in Canada[29]

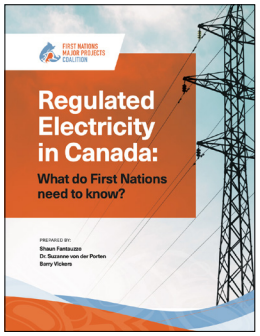


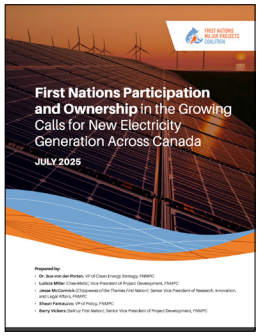
Access to clean energy helps those provinces maintain a competitive edge. However, regions reliant on fossil fuels, such as Alberta, Saskatchewan, and the territories, face a major challenge due to their carbon-intensive grids or a lack of available transmission and generation infrastructure to reach mining sites. This, in turn, can significantly reduce investor appeal. The interest of mining companies in accessing inexpensive, clean energy has been harnessed by First Nations across Canada to become proponents of electricity projects. FNMPC has created resources to support First Nations in the electricity sector.

[29] https://waterpowercanada.ca/learn/blog/all/waterpower-101-canadas-clean-reliable-and-renewable-energy-source/

Infobox 10: Additional Resources on First Nation Participation in the Electricity Sector



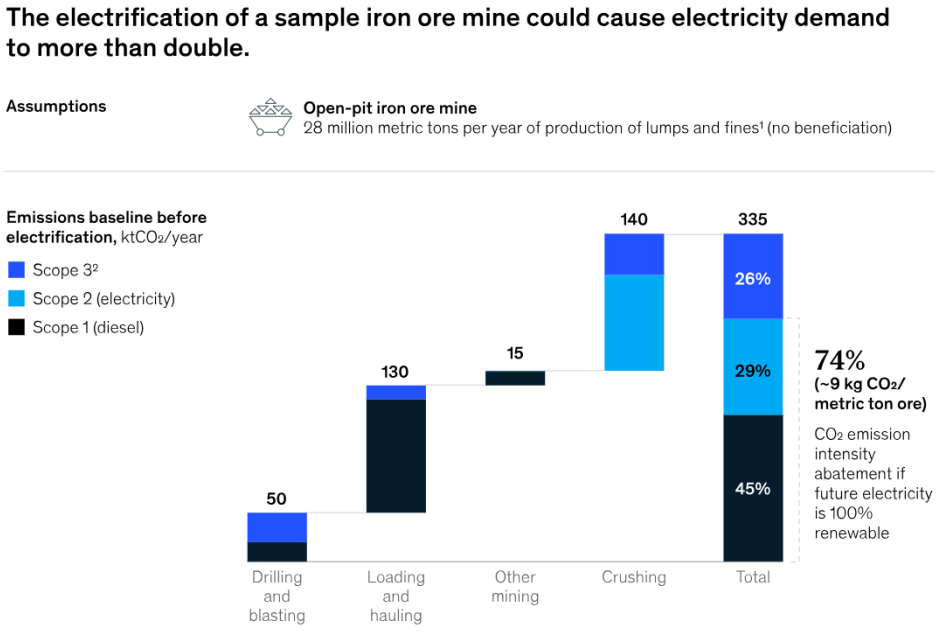




- National Indigenous Electrification Strategy: Strategy to Accelerate Indigenous Ownership of Net Zero Infrastructure in Canada
- Indigenous Utilities: The Building of Indigenous-Owned Electrical Utilities in Canada
- Regulated Electricity in Canada: What do First Nations need to know?
- First Nations Participation and Ownership in the Growing Calls for New Electricity Generation Across Canada

Apart from the electricity supply, the amount of electricity required also varies depending on the **processing method** of a material: A copper refinery that purifies intermediate products from smelters and pyrometallurgy routes only needs 350 kWh per tonne of copper, whereas a copper electrowinning plant, used at the end of a hydrometallurgical or copper oxide leaching process, requires around 2,000 kWh per tonne of copper.

Image 32: Electrification Requirements for Processing Iron Ore[30]



[30] https://www.mckinsey.com/industries/metals-and-mining/our-insights/electrifying-mines-could-double-their-electricity-demand

Besides electricity, **diesel** is especially essential for mining operations: it powers haul trucks, shovels, and certain equipment, while remote, off-grid mines mainly rely on diesel-powered generators. Some new mines in Northern Saskatchewan are considering trucking in liquified natural gas due to challenges and costs associated with grid access.

Metallurgical plants primarily use **natural gas** and **coke** or **coal** for smelting. These fuels also serve dual purposes for heat generation and chemical reduction of the material in a furnace. Efforts to reduce fossil fuel consumption in the mining sector include electrifying truck fleets and mine equipment, connecting to a clean electricity grid, or operating on on-site renewable power. In the midstream segment, such as smelting, hydrogen use as a reductant is in motion to replace coke, and in some cases, electric-arc furnaces can replace gas-powered furnaces.

[30] https://www.mckinsey.com/industries/metals-and-mining/our-insights/electrifying-mines-could-double-their-electricity-demand

7 Opporuntities for First Nations

Questions this section answers

1. What do First Nations need to do to get ready to participate in the critical mineral industry?
2. What types of positive benefits have First Nations been able to negotiate with proponents?
3. How have some First Nations expressed consent and consultation requirements to Proponents?

Top three takeaways

1. Generally, the opportunities for First Nation participation in the critical minerals industry do not vary considerably from the opportunities available in mineral development. However, critical minerals vary from other mining in terms of the level of focus from governments and expediency required given the importance of the energy transition and defence and the development of new supply chains.
2. There are opportunities in critical minerals for First Nations to become investors and to negotiate Impact Benefit Agreements, favourable contracting, and employment standards.
3. First Nations are already proponents (Minago), making equity investments (Selkirk Copper), and receiving contracts through procurement processes (Rise Air).

What you need to know:

Generally, the opportunities for First Nation participation in the critical minerals industry do not vary considerably from the opportunities available in mineral development. It is essential that solid advice on a range of technical matters is accessed to make this determination, as well as the extensive solicitation of the viewpoints of members of the nation. In this section, these opportunities are highlighted to encourage further reflection. FNMPC is a sector-agnostic organization that supports the rights of First Nations to choose their own path; for some, that may be playing a leading or a supportive role at different points along the critical minerals supply chain. Achieving these opportunities, in turn, depends on a set of mechanisms that provide the means to secure the potential outcomes.

7.1 Unique aspects of critical mineral opportunities for First Nations

The critical minerals context, however, differs in the following aspects:

The energy transition and increased economic and security tensions have expanded the range of minerals of commercial interest in Canada. Critical minerals more recently of interest such as lithium, rare earths, and graphite have different market dynamics and downstream processing routes than minerals historically developed in Canada, such as copper, nickel, zinc, iron ore, and gold.

The critical minerals context includes pressures from national security, international relations, and the need for an energy transition. This expands the context of project development and approval from simple business interests into government priorities, particularly in a time of changing geopolitical interests. First Nations may find benefit in an accelerated pace of project development, as proponents and governments are more eager to negotiate. The key challenge will be to achieve this timeline in a manner that First Nations feel is still a respectful partnership, consistent with their protocols, that provides due regard for Aboriginal rights, title, and interests.

Critical minerals involve new and evolving value chains, with enhanced risks across different project phases and the need to maintain social license throughout the lifecycle. The pace of technological change in processing and end-use of metals and chemicals means that future markets for specific minerals and materials derived from them are harder to predict, even if overall demand is on an upward trajectory. This may make direct investment in these projects less attractive to First Nations than other sectors.

Infobox 11: Additional Resources

In the sections that follow, commentary has been limited to the elements that are most directly related to critical minerals. Each topic deserves its own in-depth examination. FNMPC has explored these topics through open-access resources available on its website. Readers wishing to dive deeper should consult:

- **Equity**
  - » *Government Loan Guarantees for First Nation Equity Participation: A Primer* – Provides an overview of how loan guarantees work in practice to support First Nation equity participation.
  - » *Ownership Model Handbook: First Nations Project Ownership and Access to Capital for Investment in Major Infrastructure Projects* – Gives guidance on how to structure a negotiation team for economic benefits and technical information to support economic participation discussions with proponents.
- **Cultural Rights Evaluation**
  - » Spirit of the Land - A series of integrated policy and technical guidance for characterizing and exploring compensation for project-specific and cumulative effects on Indigenous cultural rights, in support of consent-based decision making on major projects and the protection and promotion of Indigenous cultural rights.

FNMPC also provides its members with additional tools that are not publicly available (e.g. on procurement). To gain access, please email: [email address]. First Nations readiness is a key mechanism for unlocking the opportunities and outcomes offered by critical mineral development. Readiness reflects the governance structures, leadership processes, technical capacity, financial resources, and planning tools that support informed decision-making and the long-term interests of First Nations.

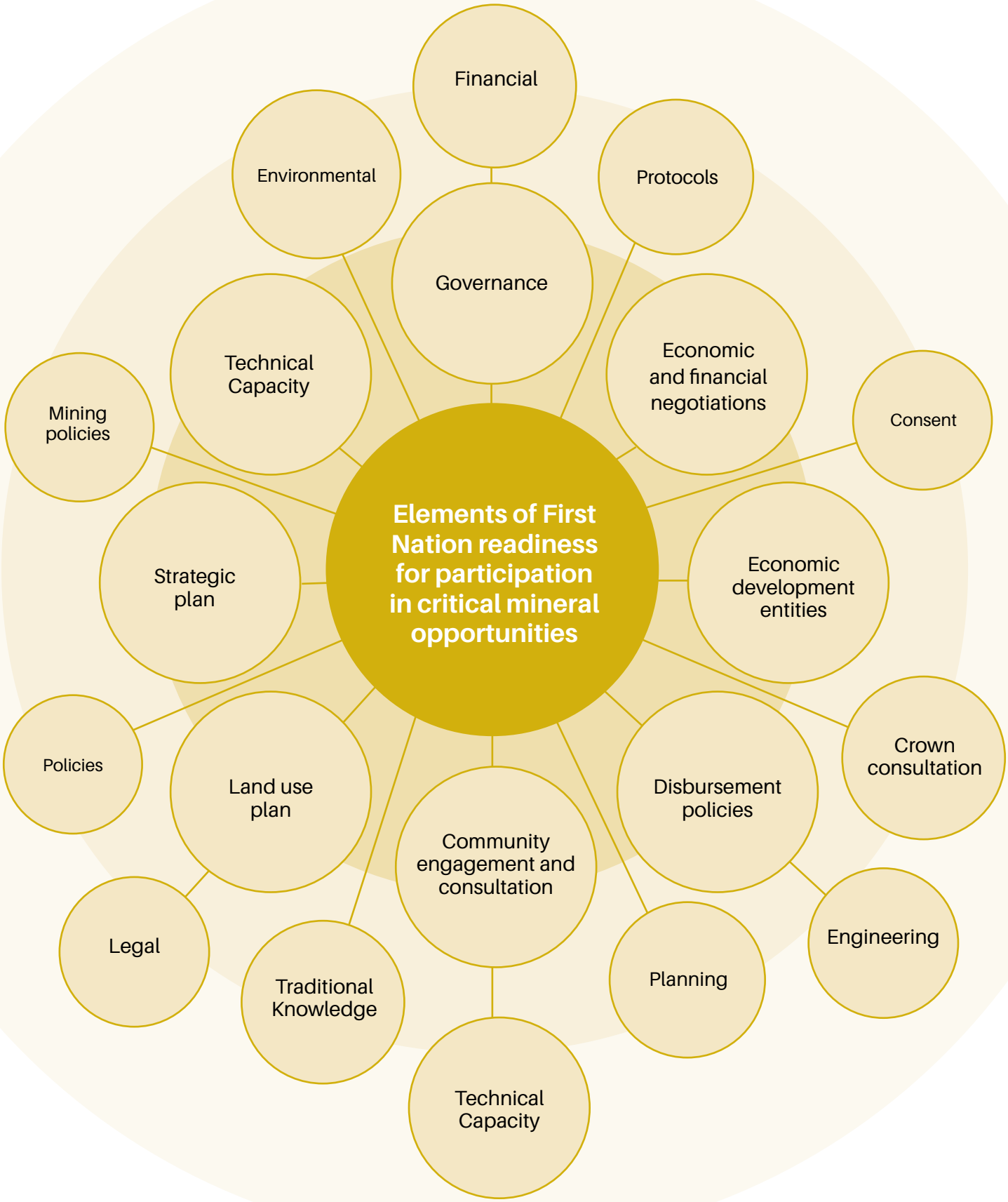


Image 33: Elements of First Nation Readiness for Participation in Critical Minerals Opportunities

7.2 Social and Environmental Standards Setting and Performance Monitoring

First Nations play a vital role in shaping social and environmental standards that influence project planning, permitting, operations, and closure, supporting stewardship, cultural protection, and the mitigation of potential impacts. These standards can be derived from industry best practices (e.g. the Mining Association of Canada's *Towards Sustainable Mining*), expressed in First Nation legislation/policies, negotiated in agreements between the First Nation and the proponents, or codified in permit terms and conditions.

7.3 Resourcing

Project proponents are – at a high level – generally willing to negotiate agreements to support participation, jointly manage and monitor impacts, and to provide shared benefits. Shared benefits may take the form of:

- **Participation funding:** supports engagement throughout the project life cycle, including liaison roles, regulatory reviews, meetings, and involvement in environmental monitoring.
- **Program-specific funding:** supports employment readiness, business development, cultural initiatives, and community wellness.
- **Impact-based compensation:** financial payment for specific adverse effects on land, harvesting, cultural sites, or infrastructure.
- **Revenue sharing:** may involve fixed annual payments, production-based payments, or revenue/profit-based formulas, separate – and potentially in addition to – revenue sharing arrangements with the Crown.

7.4 Contracting and Procurement to Indigenous or Community Businesses or Partnerships

Contracting and procurement represent major economic opportunities. Mining projects rely extensively on goods and services—construction, transportation, camp services, drilling, environmental monitoring, and more. Procurement is often a mine's largest operational expense, creating significant potential for Indigenous businesses to participate meaningfully. Procurement creates opportunities for economic diversification and long-term business development when supported by agreements, capacity-building, and accessible processes.

Infobox 12: Canadian Council for Indigenous Business

Partnerships in Procurement: Understanding Aboriginal Business in the Canadian Mining Industry was published by the CCIB in November 2016. This report investigates how both mining companies and Indigenous businesses can increase Indigenous supplier involvement and engagement in the mining supply chain.

Image 34: Tools for First Nation and Proponent Collaboration in a Critical Mineral Project

Figure 6: A framework for partnerships in procurement

See: https://www.ccib.ca/wp-content/uploads/2016/11/Partnerships-in-Procurement-FullReport.pdf

Indigenous procurement has grown across Canada. In Northern Ontario, more than 142 agreements between mining companies and First Nations include contracting provisions supporting Indigenous supply and service companies. The Aki-eh Dibinwewziwin partnership between Atikameksheng Anishnawbek and Wahnapitae First Nation, and Technica Mining is one example of Indigenous-led contracting. Other examples include a 2025 joint venture between Mattagami First Nation and Dumas Contracting, intended to advance Indigenous participation and employment in the mining sector. In 2024, Z'gamok Enterprises, an economic development organization owned and operated by Sagamok Anishnawbek, acquired a controlling interest in Legend Mining, a contracting firm.

Challenges for First Nations in contracting and procurement include access to capital, bonding requirements, and limited experience with industrial procurement processes. Government programs can be developed to reduce barriers. For example, Ontario's Aboriginal Procurement Program intends to increase contracting opportunities.

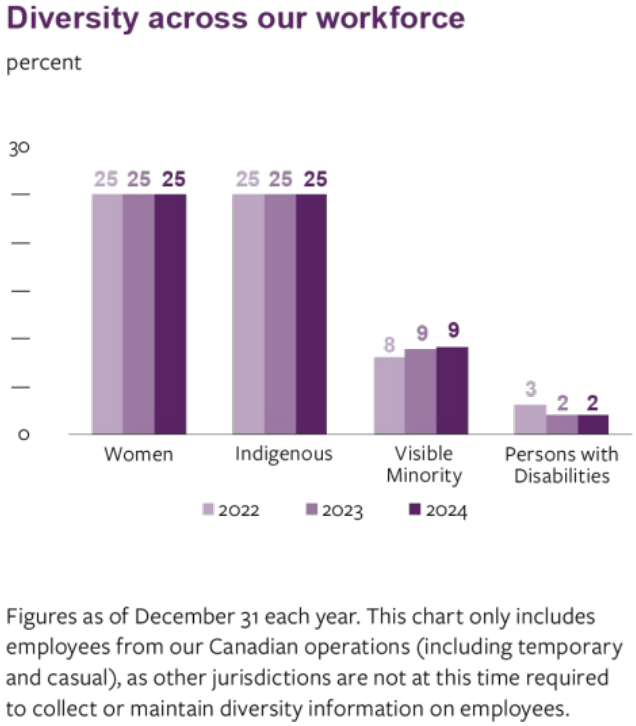
Case Study 15

Uranium sector procurement

Cameco and Orano, two companies leading in uranium mining and milling in Northern Saskatchewan, have signed a 15-year, $500 million procurement deal with Rise Air, an Indigenous-owned airline, to provide workforce transportation services for their operations. Rise Air is 75% owned by Athabasca Basin Development, an investment corporation owned by seven communities[31] in the Athabasca area, and 25% by the Prince Albert Development Corporation, owned by the 12 First Nations of the Prince Albert Grand Council.

Separately, Northern Resource Trucking (NRT) has been contracted by Cameco and Orano for decades. As a partnership of essentially all First Nations in Northern Saskatchewan involved in the uranium sector, NRT reduces the risk of competing First Nations, thereby supporting contracts on better terms. Similarly, Athabasca Catering, Canada's largest First Nations-owned hospitality and site management company, is also jointly owned by all relevant First Nations in the region's uranium sector.

Image 35: Cameco Employment Figures[32]



Figures as of December 31 each year. This chart only includes employees from our Canadian operations (including temporary and casual), as other jurisdictions are not at this time required to collect or maintain diversity information on employees.

[31] Hatchet Lake Development LP – 23%. Black Lake Venture LP – 23%. Fond du Lac First Nation Development LP – 23%, Northern Hamlet of Stony Rapids – 12%, Northern Settlement of Wollaston Lake – 6%, Northern Settlement of Uranium City – 6%, Northern Settlement of Camsell Portage – 6%, and Athabasca Basin Development Corporation – 1%.

[32] https://www.cameco.com/about/sustainability/social.

7.5 Employment and Training

Mining operations support well-compensated jobs, and employment commitments can contribute to skills development and long-term economic opportunity. When linked to training pathways and supportive workplace practices, employment commitments can contribute significantly to long-term economic development for First Nations.

Table 10: Miner Wage by Community in November 2025[33]

Community/Area	Low ($/hour)	Median ($/hour)	High ($/hour)
Canada	**28.00**	**42.00**	**56.00**
Alberta	28.00	43.00	52.00
British Columbia	34.97	43.00	50.33
Manitoba	22.89	38.00	56.00
New Brunswick	22.00	38.46	56.00
Newfoundland and Labrador	28.75	40.00	53.70
Northwest Territories	26.17	44.32	82.28
Nova Scotia	22.89	32.00	55.00
Nunavut	30.00	41.00	60.00
Ontario	27.52	39.70	56.00
Prince Edward Island	n/a	n/a	n/a
Quebec	28.00	42.00	65.93
Saskatchewan	31.00	47.00	57.00
Yukon Territory	25.74	43.62	73.96

Mining activities in regions such as Northern Ontario support more than 40,000 jobs across supply and service companies. Employment agreements between project proponents and First Nations often include hiring targets, training initiatives, and commitments to culturally safe work environments. In one early agreement, the Tahltan in B.C. achieved 39 per cent Indigenous employment at a mine site, exceeding its 20 per cent hiring target.

Training programs include essential skills, safety certifications, trade apprenticeships, and job coaching. First Nations have collaborated with provincial authorities and Indigenous-led education institutions (e.g., the Saskatchewan Indian Institute of Technology and the Gabriel Dumont Institute of First Nations University), which, in turn, increases the capacity of those institutions to train apprentices in skilled trades, contributing to mine construction and community infrastructure projects.

Government programs can also support Indigenous workforce development. The Ontario government's 2025 commitment of $3.1 billion to support Indigenous participation in critical minerals development includes funds for training and employment initiatives in mining.

[33] https://www.on.jobbank.gc.ca/marketreport/wages-occupation/8724/ca.

7.6 Infrastructure Ownership or Partnerships

Contracting roles in infrastructure development—such as road construction and maintenance—have enabled some First Nations to expand business capacity. The Tahltan Development Corporation, for example, secured contracts to build and maintain a 160-kilometre access road to a mine, later expanding into hydroelectric partnerships. The Tłı̨chǫ Highway, which supports the diamond mining industry, is a public-private partnership with Tłı̨chǫ ownership. The Biigtigong Nishnaabeg First Nation is a co-owner and co-decision-maker in a regional port authority, supporting mineral development while ensuring influence over long-term planning.

Financing tools such as the federal Critical Minerals Infrastructure Fund provide up to $50 million for enabling infrastructure, supporting Indigenous participation in ownership or partnership roles. Additionally, the Canada Infrastructure Bank and the First Nations Bank of Canada have partnered to provide low-cost loans to Indigenous communities, with a focus on infrastructure that supports community priorities and enables economic development.

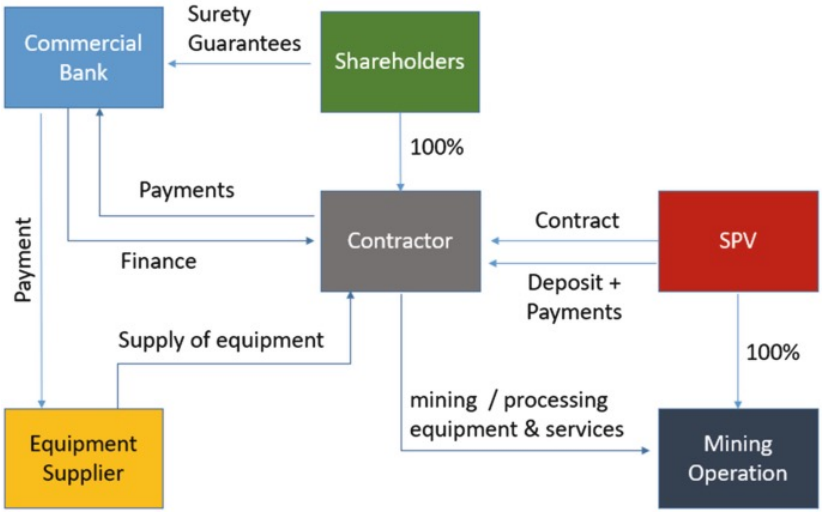
7.7 Equity Ownership in Mines

Infobox 13: What about First Nation equity investments in mining projects?

Having successfully become equity investors – and even proponents – of major electricity projects, some First Nations are considering equity participation in mining projects. However, some lessons from equity participation in the electricity sector are not directly transferable to the mining sector. In principle, the level of financial risk associated with mining is much higher than that for rate-regulated utilities with an approved rate of return.

There are several Northern Ontario projects that First Nations have secured equity or quasi-equity positions alongside procurement and training commitments. Some agreements integrate preferential contracting, environmental monitoring roles, and co-governance frameworks to strengthen participation and align interests over the project life.

Image 36: Sample Project Ownership Structure[34]



[34] https://link.springer.com/chapter/10.1007/978-3-030-31225-1_4

Case Study 16

Minago Critical Minerals Project

In October 2024, the Norway House Cree Nation (NHCN) acquired full ownership of the Minago magnesium, nickel and Platinum Group Metals mining project in northern Manitoba via an $8 million cash deal with Flying Nickel Mining Corp. This made NHCN the first Indigenous community in Canada to hold 100 % ownership of a mineral project. The project is fully permitted and is expected to generate more than 700 million dollars in economic benefits and about 500 direct jobs for First Nations communities.

The project is located within NHCN's Resource Management Area and will use clean hydroelectricity to support a low-carbon profile. The first stage of the project will be to develop a "green magnesium" facility utilizing the dolomite overburden. The second stage of the project will be to find a partner to develop the nickel, platinum, palladium, ruthenium, and rhodium components.

Manitoba highlights its alignment with the provincial Critical Minerals Strategy, and NHCN's existing strengths in camp operations, construction, drilling, training and environmental monitoring to position the Nation to lead development from exploration to operations.

Case Study 17

Canada Nickel

The Taykwa Tagamou Nation (TTN) finalized a $20 million convertible note investment in Canada Nickel Company Inc.'s flagship Crawford Nickel Sulphide Mining Project in Ontario in May 2025. This investment represented 7.9% of the company's shares at that time and secured TTN a seat on the board. It is one of the most significant direct equity investments by a First Nation in Canada's critical mineral sector.

This move enables TTN to participate as genuine equity partners with real authority, ensuring long-term community benefits and supporting responsible development on TTN's Traditional Territory. Although they have not yet finalized a comprehensive Impact Benefit Agreement, the Mattagami, Matachewan, and Flying Post First Nations have signed contractual agreements with Canada Nickel, which include opportunities for contracting, as well as the construction of a railway and the relocation of a highway and an overpass.

Case Study 18

Selkirk Copper

Discovered in the mid-1970s, the Minto Mine began production in 2007 and, over more than a decade of open-pit and underground mining, became one of the Yukon's most significant copper-gold-silver operations, producing over 500 million pounds of copper by the time production ceased in 2023. After its former owner ran into financial and operational difficulties, the mine entered receivership in 2023, and the infrastructure, mineral rights and licenses were ultimately acquired by the Selkirk First Nation in 2025.

Today, the First Nation holds a 22.3% equity interest in Selkirk Copper Mines Incorporated, the new entity that owns the Minto Mine, alongside a 1.5% net smelter royalty on the Minto project. This structure enables Selkirk First Nation to participate directly in both the governance and the upside of the project, through board representation, business decision-making, and future mine restart planning. Following drilling studies, updated mine plans and permitting, this brownfield project aims to reach a restart decision in 2027.

Infobox 14: Resource Revenues and Financial Participation in Mining Projects

What are resource revenues?

Resource revenues refer to the financial benefits derived from the development and extraction of natural resources within a First Nation's territory. These revenues may arise through agreements with governments, direct payments from project proponents, or broader economic participation associated with mining activity.

In practice, First Nations typically receive economic benefits from mining projects through several primary channels:

1. **Impact Benefit Agreement (IBA) financial payments**
2. **Revenue or tax-sharing agreements with provincial or territorial governments**
3. **Employment opportunities associated with the mine**
4. **Direct business contracting opportunities with the mining company**
5. **Indirect business opportunities generated by mine-related economic activity**

Financial Payments within Impact Benefit Agreements

IBAs commonly include financial payment mechanisms intended to ensure First Nations participate in the economic value generated by resource development. While agreements are highly negotiated and often include hybrid approaches, three primary payment structures are most common:

1. Fixed Dollar Payments

An example structure would be: "A payment of C$1 million will be made for each year the mine operates." These payments are often indexed to inflation.

Advantages

- Predictable and stable revenue stream.
- Facilitates long-term financial planning.

Limitations

- Payments do not increase proportionally with higher production levels or commodity prices.
- Limited participation in project upside.

2. Profit Sharing (or Cash Flow Sharing)

An example structure would be: "A payment equal to 5% of annual mine profits." Payments may be tied to measures such as net profits or pre-tax project cash flow.

Advantages

- Allows participation in increased project value when profitability improves.

Limitations

- Calculations can be complex and rely on confidential financial inputs.
- Payments may be volatile due to cost deductions, capital recovery provisions, or accounting methodologies.
- Financial forecasting can be challenging.

These structures effectively share operational and cost risk between the mining company and the First Nation.

3. Revenue Sharing (Royalty-Based Payments)

An example structure would be: "A payment equal to 1% of mine revenues." Many agreements reference **Net Smelter Return (NSR)**, which closely approximates gross revenue from metal sales after limited deductions.

Advantages

- Payments are easier to model using production and commodity price assumptions.
- Revenue data is often publicly disclosed for publicly listed companies.
- Payments are not dependent on project profitability.

Revenue-based structures function similarly to a royalty applied to production value, allowing First Nations to participate directly in the value of resources extracted from their territory.

Key Structural Terms and Clauses

Beyond payment formulas, several contractual provisions significantly influence outcomes:
Payment Frequency

- Historically annual payments were common.
- More recent agreements increasingly provide quarterly payments, particularly for NSR-based structures.

Assignment Rights

- Agreements may range from no assignment rights to full assignment rights.
- Broader assignment rights allow a First Nation to transfer or monetize future payments, potentially converting long-term revenue streams into upfront capital for community priorities or investment.

Role of Revenue and Profit Sharing in Project Development

Revenue and profit sharing mechanisms play an important role in aligning interests between First Nations and project proponents. These structures:

- Provide long-term participation in resource value creation,
- Support economic self-determination and community planning,
- Help establish social licence and project certainty, and
- Form a central financial component of modern benefit agreements alongside employment and business participation.

The chosen structure reflects negotiated priorities, balancing certainty of payments, exposure to commodity upside, administrative complexity, and risk allocation between parties.

7.8 Impact Benefit Agreements

Impact Benefit Agreements (IBAs) and similar agreements are key mechanisms for structuring relationships between First Nations impacted by a project and proponents. These agreements define commitments, expectations, and mechanisms for managing impacts and sharing benefits throughout the life of a project.

IBAs have evolved significantly over time. Earlier agreements tended to focus on employment and basic environmental protections.

Current agreements are generally more comprehensive, addressing a wide range of issues, including:

- contracting and procurement opportunities,
- revenue- or profit-sharing mechanisms,
- training and education,
- cultural protection measures,
- community wellness programs, and
- detailed monitoring and dispute-resolution frameworks.

IBAs now commonly include coordinated approaches to socio-economic and environmental management, including how these will be portrayed to assessors.

Infobox 15: Impact Benefit Agreement Contents

Typical elements of IBAs may include:

- Employment targets and training commitments
- Business development and procurement opportunities
- Revenue, royalty, or profit-sharing arrangements
- Support for cultural programming and language initiatives
- Environmental monitoring, data-sharing, and mitigation measures
- Community health and wellness initiatives
- Dispute-resolution mechanisms and joint implementation committees

The IBA Community Toolkit, prepared in 2015 by Firelight, provides a deeper dive into IBAs and a number of practical tools to inform and guide First Nations. An updated version is expected in spring 2026.

Recent partnerships offer examples of evolving IBA practice in mineral development. Agreements between Canada Nickel Company and several First Nations prioritize Indigenous-owned businesses for major contracts, establish specific engagement processes, and include environmental and land-monitoring roles. These agreements also created First Nations Business Representative roles and specialized training programs to support local skills development.

Some IBAs incorporate First Nations-defined governance structures and regional negotiation models. For example, collective negotiation approaches through tribal councils or regional bodies can establish standards for cultural respect, procurement transparency, and joint monitoring of commitments, while also reducing administrative burdens on individual communities.

At the same time, IBAs can present challenges. Confidentiality clauses, while sometimes requested by either party, may limit community-wide understanding of agreement terms and restrict the ability to compare agreements across projects and regions. Analyses note that such clauses can reduce transparency and pose challenges for internal accountability.[35]

Implementation committees, monitoring programs, and regular review processes help ensure that agreements remain responsive to changing circumstances and First Nations priorities. While other approaches—such as equity ownership or long-term partnership models—are gaining prominence, IBAs remain central to structuring First Nations participation in mineral development due to their flexibility and breadth.

Table 11: Simon Fraser University – Impact Benefit Database[36]

Project	Indigenous Group	Jurisdiction	Year
Baffinland Iron Mines	Qikitani Inuit	Nunavut	2013
Meadowbank Mine	Kivalliq Inuit	Nunavut	2006
Raglan Mine	Innu and Labrador Inuit	Labrador	1995
Diavik Diamond Mines	Tłı̨chǫ (Dogrib Treaty 11 Council), Lutsel K'e Dene Band, Yel-lowknives Dene First Nation, North Slave Metis Alliance and Kitikmeot Inuit Asso-ciation	Northwest Territories	1999
Cigar Lake Uranium Mine	Northern Village of Pinehouse and Kineepik Metis Local Inc	Saskatchewan	2012

**This table summarizes the information available in the database for projects in the mining sector.*

[35] NATO's list of 12 essential raw materials for Allied defence
[36] https://www.iea.org/reports/global-critical-minerals-outlook-2025.

Case Study 19

Consent Agreements between the Tahltan Nation and B.C.

In 2019, British Columbia's provincial government enacted the Declaration Act, establishing the *United Nations Declaration on the Rights of Indigenous Peoples* as the province's framework for reconciliation. Following this, the Tahltan–B.C. Consent Agreements were the first consent-based decision-making agreements. This marked a significant step toward co-governance of mineral resources.

The first consent agreement involved the Eskay Creek Revitalization Project, a gold-silver mining operation owned by Skeena, which sought new approval for a mine that had previously operated from 1994 to 2008. The Tahltan Central Government and BC signed the first consent agreement for this project in 2022.

The second consent agreement, concerning the Red Chris gold and copper mine, was signed in 2023. This mine was already fully operational as an open-pit mine, but the Block Cave Project proposed transitioning to underground mining to extend its lifespan, making this an amendment to an already existing approval. Both agreements are historic case studies that show how the Tahltan Nation's consent will now be required for new projects and for any significant changes to previously approved projects.

8 Supports and Resources

Questions this section answers

1. Where can First Nations access capacity supports from federal and provincial/territorial governments?
2. What types of technical supports should be accessed to by First Nations to support a project?

Top three takeaways

1. Loan Guarantees support First Nations to become equity participants by reducing their borrowing risk and supporting purchases to be financially viable.
2. The federal government specifically tailored the *Critical Mineral Infrastructure Fund (CMIF) Indigenous Grants* to support engagement activities, capacity building and knowledge gathering and sharing.
3. National Aboriginal Capital Corporations Association (NACCA),a network of more than 50 IFIs, which has provided more than 50,000 loans totaling approximately $3 billion to businesses owned by First Nations, Métis, and Inuit people.

8.1 Federal and provincial/territorial programs

Federal and provincial/territorial governments offer various support programs for First Nations seeking support for Critical Mineral Projects:

- **Direct Funding, Grants, Contributions:** These programs offer non-repayable financial assistance to First Nations communities, businesses, or partners to support specific activities related to critical mineral development. They cover feasibility studies, early exploration, infrastructure planning, or community-led initiatives that promote economic readiness. This type of funding helps lower initial costs. One provincial example is the *Manitoba Mineral Development Fund (MMDF)*, which supports local and Indigenous mineral projects in Northern Manitoba, including mineral exploration or capital improvements/infrastructure costs.
- **Loan Guarantees and Financing:** Loan Guarantees support First Nations to become equity partners in major critical mineral and infrastructure projects by backing their loans with government guarantees or low-interest financing. These tools reduce borrowing risk and make Indigenous ownership financially viable, supporting long-term revenue and governance roles. Federally, the Canada *Indigenous Loan Guarantee Corporation* exists, but there are various provincial programs, such as the *Ontario Indigenous Opportunities Financing Program* or the *Alberta Indigenous Opportunities Corporation Loan Guarantees*.

- **Capacity-Building and Consultation Support:** These programs enhance First Nations communities' ability to meaningfully engage in resource development by providing funding for technical expertise, governance planning, and participation in regulatory processes. They enable communities to hire experts, conduct traditional knowledge studies, and engage effectively in consultations or negotiations with industry or government. The federal government specifically tailored the *Critical Mineral Infrastructure Fund (CMIF) Indigenous Grants* to support engagement activities, capacity building and knowledge gathering and sharing. Ontario's *New Relationship Fund* and B.C.'s *New Relationship Trust* are two provincial funds providing support for consultation and capacity-building.

- **Training & Skills Development:** Workforce readiness programs equip individuals with the technical and vocational skills needed to secure employment in critical mineral projects. They fund trade certification, apprenticeships, and on-the-job experience that align with mine construction and operations. These programs address long-standing employment gaps and help communities build a local workforce. One territorial example is the *Mine Training Society of the Northwest Territories*, which helps train and place individuals in mining-related jobs.

- **Regulatory Navigation & Partnership Facilitation:** These supports guide First Nations groups and project proponents through complex permitting and regulatory processes, ensuring that regulators and project proponents consider Indigenous rights, values and interests early and clearly. They often provide dedicated advisors, "concierge" services, or intergovernmental coordination to speed up timelines while respecting Indigenous governance. The Federal-led *Northern Regulatory Initiative* supports Indigenous participation and collaboration in resource management, including by helping with land-use planning and impact assessment processes.

In 2025, the federal government introduced and changed several critical mineral programs. Those include:

- **Major Projects Office:** The Major Projects Office, launched in August 2025, now accelerates regulatory approvals and mobilizes investment so major critical mineral projects can reach final investment decisions quickly and efficiently.

- **First and Last Mile Fund:** The 2025 budget allocates $371.8 million over four years, starting in 2026–27, to Natural Resources Canada to establish the First and Last Mile Fund. The fund will support upstream and midstream critical mineral projects, focus on advancing near-term projects into production, and incorporate the *Critical Minerals Infrastructure Fund* to provide up to $1.5 billion for clean energy and transportation infrastructure through 2029–30.

- **Critical Minerals Sovereign Fund:** The budget allocates $2 billion starting in 2026–27 to Natural Resources Canada to establish the Fund, which will make strategic investments in critical mineral projects and companies.

- **Arctic Infrastructure Fund:** The budget allocates $1 billion over four years, starting in 2025–26, to Transport Canada to establish the Arctic Infrastructure Fund, which will invest in major transportation projects in the North, including airports, seaports, and all-season roads. The goal is to strengthen Canadian sovereignty, support economic development and jobs in Northern communities, advance Indigenous economic reconciliation, and open new gateways to global markets.

8.2 Indigenous financial institutions and organizations

A range of Indigenous financial institutions (IFIs) and regional development corporations support Indigenous participation in mineral development across Canada. These organizations play an important role in enabling communities to pursue economic opportunities aligned with their priorities, including equity ownership, major project financing, procurement, training, and business development.

There are broadly three types of IFIs:

- Aboriginal Capital Corporations
- Aboriginal Community Futures Development Corporations
- Aboriginal Developmental Lenders.

While their status and mandates vary, each contributes to building capacity, expanding access to capital, and supporting Indigenous businesses and governments involved in exploration, mining, and related sectors.

These IFIs together form the National Aboriginal Capital Corporations Association (NACCA), a network of more than 50 IFIs that has provided more than 50,000 loans totalling approximately $3 billion to businesses owned by First Nations, Métis, and Inuit people. NACCA supports this net-work of IFIs by building their capacity and fostering Indigenous business development. NACCA's goal is to provide opportunities for Indigenous entrepreneurs and increase prosperity for Indigenous people in Canada.

Other relevant institutions include:

- **First Nations Finance Authority (FNFA):** a non-profit FNFA with the mandate to provide financing, investment, and advisory services for First Nation governments across Canada that voluntarily adhere to the First Nations Fiscal Management Act and its regulations. As of 2025, there are 185 members, and the loan portfolio exceeds $3.3 billion.
- **First Nations Bank of Canada (FNBC):** an Indigenous-owned chartered bank that provides commercial financing and project loans to Indigenous businesses and communities. FNBC also has a partnership with the Canada Infrastructure Bank to enable communities to obtain loans forinfrastructure development, including the preparation of land for development.
- **Nations Royalty Corporation:** the first majority Indigenous-owned publicly traded company in Canada. Nations Royalty acquires and manages Indigenous Benefit Agreement payments (royalties) from a variety of precious metals and natural resource assets. Nations Royalty issues equity (and/or cash) in exchange for all, or a portion of, a community's future royalty payments. Nations Royalty is not a source of financing; rather, it provides a mechanism for Indigenous communities to manage their royalty payments.

8.3 Technical, legal, and advisory supports

In addition to federal and provincial capacity building programs (discussed above), Indigenous communities can draw on several forms of technical and advisory support for mineral development, including Indigenous-led organizations specializing in resource governance, environmental and regulatory technical advisors, geological and engineering expertise, regional tribal councils, academic partnerships, and specialized Indigenous-focused consulting firms. Communities may also access legal support through private law firms, legal aid mechanisms, advocacy organizations, and Indigenous rights experts, as well as business development advisors through economic development corporations and Aboriginal Financial Institutions. These supports help communities make informed decisions, evaluate impacts, and negotiate agreements.

These supports and organizations can be categorized as follows. Note that their fees can vary widely.

Indigenous-led technical and advisory bodies

- **First Nations Major Projects Coalition (FNMPC):** Provides project evaluation, environmental review, financial modelling, governance frameworks, and equity participation assessment.
- **National Aboriginal Capital Corporations Association (NACCA)** network of Indigenous Financial Institutions: Provide business advisory support.
- **First Nations Energy and Mining Council (British Columbia)**
- **Regional Tribal Councils and Provincial Territorial Organizations:** May have technical staff supporting communities on mining, consultation, and environmental considerations.
- **Saskatchewan First Nation Centre of Excellence:** provides tools, business expertise, and industry guidance.

Environmental and technical consulting firms

- Provide baseline studies, environmental monitoring, impact assessment, cumulative effects, permitting support, and regulatory navigation.
- A number of these firms are indigenous-owned.
- Some universities may also offer such services.

Financial

- **Indigenous Loan Guarantee Program:** offers loan guarantees that help reduce borrowing costs and improve access to capital for First Nations equity investments in major resource and energy projects. These guarantees support First Nations pursuing ownership or partnership arrangements that might otherwise be difficult to finance.
- **Critical Minerals Infrastructure Fund (CMIF):** provides up to $50 million per project for enabling infrastructure, such as roads, power lines, and clean energy systems, required to support critical mineral development. Funding is available to both proponents and First Nations and can facilitate co-ownership or governance roles in infrastructure projects. Since the budget 2025, the Federal government has been incorporating CMIF into the First and Last Mile Fund.

- **Indigenous Natural Resource Partnerships Program:** supports First Nations engagement in resource projects by funding technical assessments, governance development, and participation planning. Recent funding allocations have supported First Nations-led initiatives in mining and related sectors, helping communities strengthen their capacity to evaluate and negotiate project proposals.
- **Alberta Indigenous Opportunities Corporation:** offers loan guarantees for equity investments not only in electricity projects but also in mining, pipelines, and other resource developments, increasing access to capital for First Nations considering ownership or partnership roles.
- **Ontario Indigenous Participation Fund:** supports First Nations engagement in exploration and development, including funding for mineral development advisors and technical review. Financing supports also target training, skills development, and mentorship (as discussed above in Section 7.4).
- **Ontario Junior Exploration Program:** provides funding for early-stage exploration activities, including Indigenous-led or joint-venture projects, with support of up to $200,000 per year.
- **Manitoba Mineral Development Fund:** supports economic development and mining projects in northern Manitoba and can provide financial support to First Nations directly, including through their development corporations.

9 Conclusion

Critical minerals offer new opportunities for Canada's regional economies, whether to support the energy transition, meet growing needs for AI, or respond to newer concerns on defence and security. The range of new resource development opportunities can also advance economic development and reconciliation with Indigenous communities. With a long history of mining and other resource development, First Nations, industry, and governments can benefit from lessons learned about issues such as fairness, consent, equity, and sustainability. Canada is promoting its reputation for social and environmental standards in mining among its allies and like-minded economic partners. It is therefore in the interest of all stakeholders involved that First Nations are empowered with the capacity and the tools to participate as full and equal partners in this new wave of resource development. This report aims to support this process.

Indeed, First Nations across Canada are increasingly shaping the development of critical minerals projects through a combination of governance mechanisms, negotiated agreements, technical capacity, and economic participation tools. The report identifies several areas through which First Nations engage with and influence mineral development, forming a comprehensive framework for Indigenous participation.

First Nations play a central role in setting social and environmental standards. Many First Nations establish their own policies, land-use plans, and consultation protocols that guide proponents from the exploration stage onward. Regulatory processes—particularly environmental assessments—provide additional avenues for First Nations to articulate priorities, identify impacts, and participate in monitoring. These mechanisms help align development with cultural, environmental, and community values.

Community funding arrangements support participation, capacity development, and long-term well-being. Funding may include participation support, program-specific investments, impact-based compensation, and revenue or profit sharing. Provincial revenue-sharing frameworks complement these mechanisms by providing predictable public-sector funding streams. Effective funding structures align with First Nations governance and planning.

Contracting and procurement represent significant economic opportunities. Mining projects often spend substantial amounts on goods and services, creating opportunities for First Nations businesses to participate through development corporations, joint ventures, and procurement commitments embedded in agreements. When supported by capacity-building and practical procurement processes, these opportunities can drive long-term business growth.

Employment and training pathways contribute to workforce development and prosperity. First Nations negotiate hiring targets, training programs, and commitments to a culturally safe workplace. Provincial and federal programs support skills training, while industry frameworks encourage inclusive workplace practices. Employment linked to mining can extend into broader economic sectors, including construction, environmental monitoring, and, with targeted training, into refining and reclamation.

Infrastructure partnerships allow First Nations to participate in the ownership and governance of assets such as roads, ports, and energy systems. These partnerships can improve regional access, create revenue streams, and support broader economic development. Financing tools and First Nations-led governance frameworks help ensure infrastructure aligns with First Nations priorities.

Equity ownership is an emerging mechanism through which First Nations can participate in the financial returns of mineral development. Equity can provide long-term revenue and influence over governance, but First Nations must weigh the financial risks and governance responsibilities. Loan guarantee programs reduce barriers and expand access to ownership opportunities.

First Nations readiness—through strong governance, strategic planning, technical capacity, and financial tools—enables effective participation across all areas. Development corporations and technical advisors play key roles in preparing First Nations to evaluate, negotiate, and oversee projects.
Consultation and consent processes should ensure that First Nation rights and interests are recognized and meaningfully integrated into decision-making. First Nations can use legal, regulatory, and community-driven processes to shape development conditions.

Community and Impact Benefit Agreements (IBAs) remain central tools for structuring long-term relationships and coordinating commitments across employment, procurement, environmental monitoring, cultural protection, and revenue-sharing.

Finally, financing supports—federal, provincial, and Indigenous-led—enhance capacity, reduce barriers, and create options for participation aligned with First Nations goals.

Collectively, these mechanisms provide First Nations with a comprehensive set of tools to shape critical minerals development in ways that support their long-term well-being, environmental stewardship, and self-determined economic development.

10 Annexes

10.1 Glossary of terms

- **AAM (Anode Active Material):** Processed graphite (synthetic or natural) or silicon-based material used in the negative electrode (anode) of lithium-ion batteries.
- **Advanced Material Manufacturing**: integrates innovative technologies such as AI, robotics, and 3D printing to create, process, and optimize high-performance materials, including advanced alloys, composites, and ceramics.
- **Advanced Minerals:** refers to a category of critical minerals and materials essential for modern, high-tech applications, the energy transition, and national security, often characterized by high supply risk and specialized, technology-driven applications.
- **Advanced Products:** items manufactured using cutting-edge, innovative technologies, materials, or processes to achieve superior functionality, efficiency, or quality compared to traditional alternatives.
- **Anode:** an electrode in an electrical device where oxidation occurs and conventional current enters.
- **Battery:** an electrochemical device that converts stored chemical energy into electrical energy through one or more cells, each containing a cathode, an anode, an electrolyte, and a separator. They provide portable or stationary power for various applications. Common rechargeable battery types include lead-acid, Li-ion, and Nickel-Cadmium.
- **BESS (Battery Energy Storage System):** an integrated solution using rechargeable batteries, inverters, and control systems to store electrical energy, which helps stabilize the grid and integrate renewable energy.
- **BMAC (Battery Metals Association of Canada):** Industry association promoting the development of Canada's battery metals value chain.
- **Black Mass:** Powder produced by shredding used lithium-ion batteries, rich in lithium, graphite and other critical minerals depending on the chemistry.
- **Brownfield Project:** Development or expansion of an existing mining or industrial site.
- **CAM (Cathode Active Material):** The positive electrode material in batteries, made from lithium, nickel, cobalt, manganese, or lithium iron phosphate.
- **Canadian Exploration and Development Expenses:** Canadian exploration expenses (CEEs) are the costs incurred while determining the existence, location, extent, or quality of a mineral resource, petroleum, or natural gas in Canada. CEEs are 100% deductible in the year in which they occur. Canadian development expenses (CDEs) are the costs incurred for: sinking or excavating a mine shaft, main haulage way, or similar underground work after a mine comes into production; developing a mine before production; and buying a Canadian mineral property. CDEs can be deducted at a 30% declining balance.
- **Catalyst:** A substance that accelerates a chemical reaction without being consumed in the process. PGMs are essential catalysts for the hydrogen economy, while some REEs are useful for automotive converters or petroleum refining.
- **Cathode Active Materials:** positive electrode components in batteries, especially lithium-ion batteries, that dictate performance such as energy density, safety, and lifespan by enabling lithium-ion movement.
- **CCUS (Carbon Capture, Utilization, and Storage):** Technologies that capture CO_2 emissions and store or reuse them.
- **Care and Maintenance:** a temporary closure phase where active production stops, but the site is maintained, secured, and monitored for safety, environmental compliance, and potential future reopening.
- **Capital Structure:** a company's specific mix of debt (borrowed money like loans, bonds) and equity (owners' funds, stock) used to finance its assets and operations, essentially showing how a firm pays for itself.

- **Chemical Intermediates:** substances formed during intermediate steps of a chemical reaction, acting as temporary, often highly reactive bridges between raw materials and final products. They are produced for, and consumed in, subsequent chemical processing to create advanced materials, such as battery precursors or other applications, pharmaceuticals, polymers, and dyes. Unlike final products, they are not intended for the end consumer.
- **Circular Approach:** a sustainable system designed to eliminate waste and pollution by keeping materials, products, and resources in use for as long as possible.
- **CMCE (Critical Minerals Centre of Excellence):** Federal unit within NRCan coordinating Canada's critical minerals strategy.
- **CIM (Canadian Institute of Mining, Metallurgy and Petroleum):** a national technical organization setting standards and definitions for mining.
- **Closure Plan:** la legally required plan detailing mine decommissioning and site rehabilitation.
- **Concentrate:** a mineral product with increased content of valuable material obtained after beneficiation.
- **Concentrator:** a processing plant or apparatus that separates valuable minerals from waste rock (gangue) to produce a high-grade concentrate.
- **Consent:** the voluntary, enthusiastic, and ongoing agreement to engage in a specific activity, which can be withdrawn at any time.
- **Commodities:** a raw material product that can be bought and sold.
- **Critical Mineral:** non-fossil fuel mineral essential for economic or national security, whose supply chain is at risk.
- **Crown:** represents the state, embodying supreme executive authority and acting as the non-partisan source of government power.
- **DLE (Direct Lithium Extraction):** a method for extracting lithium brine by pumping and using chemical or membrane processes.
- **DTC (Duty to Consult):** legal requirement of the Crown under Section 35 of the 1982 Constitution Act to consult and, where appropriate, accommodate Indigenous peoples when the Crown contemplates actions that may adversely affect established or potential Aboriginal or treaty rights.
- **Downstream:** manufacturing end of the value chain, including battery or engine production.
- **Downstream Segment:** final stage of the industry value chain, focusing on the processing, refining, marketing, and distribution of raw materials into finished products for end-use consumers
- **Dry Ports:** an inland terminal connected by road or rail to a seaport, acting as a hub for handling, storing, and clearing sea cargo.
- **Early Targets:** preliminary, specific, and measurable goals established at the beginning of a project, strategic plan, or development cycle to guide initial efforts and create early accountability.
- **EAF (Electric Arc Furnace):** an electric furnace used in steelmaking, powered by electricity instead of coal or coke.
- **Effluent Discharge:** the release of treated or untreated liquid waste into water bodies or sewer systems.
- **EIA (Environmental Impact Assessment):** Evaluation of a project's potential environmental and social effects.
- **ESG (Environmental, Social, and Governance):** standards evaluating the sustainability performance of companies.
- **EV (Electric Vehicle):** a vehicle powered by electricity stored in batteries, a key driver of critical mineral demand.
- **E-waste (Electronic Waste):** discarded electrical or electronic devices and components that can be processed to recover valuable materials such as copper, gold, lithium, or rare earth elements.
- **Exploratory Drilling:** the process of boring into the ground to obtain core samples and data, allowing geologists to evaluate subsurface conditions, mineral deposits, or oil and gas potential.

- **Export Restrictions:** government-imposed limits or controls on the quantity, type, or destination of goods and technologies leaving a country, used to protect national security, foreign policy, economic welfare, or food security, often involving licenses, quotas, or bans on specific items like weapons, dual-use tech, or certain agricultural products.
- **Export Quotas:** government-imposed restrictions limiting the volume or value of specific goods that can be shipped out of a country over a set period.
- **FEED (Front-End Engineering Design):** Pre-construction phase of detailed engineering and procurement planning.
- **Feedstock Supply:** the end-to-end process of sourcing, harvesting, transporting, storing, and pre-processing raw materials for conversion into industrial goods.
- **First Right of Refusal:** a contractual right giving someone the opportunity to match a third-party offer to buy an asset (like property, shares, or a business deal) before the owner can sell to anyone else.
- **Flow-through Incentives:** a Canadian tax-based financing mechanism designed to encourage investment in high-risk sectors—primarily mining, oil and gas, and renewable energy.
- **Flow-through Shares:** a Canadian tax-incentive investment tool allowing resource companies (primarily mining, oil & gas) to transfer, or "flow through," tax deductions from exploration expenses to investors. Investors purchase these shares to reduce their taxable income, while companies use the capital for projects, often receiving a premium price for the shares.
- ***Free Entry Mining:*** a legal framework, predominantly used in Canada, that allows individuals or companies to stake mineral claims and gain exclusive access to explore for minerals on most crown-owned lands without prior consent, consultation, or formal permits from the government or Indigenous groups. It prioritizes mineral development over other land uses, often allowing exploration activities to begin shortly after registration.
- **FPIC (Free, Prior, and Informed Consent):** UN principle ensuring Indigenous consent before projects affecting their rights, enshrined in the UN Declaration on the Rights of Indigenous Peoples.
- **FS (Feasibility Study):** Comprehensive technical and economic evaluation of a mining project before investment decision.
- **Gangue:** Non-valuable rock separated from ore during mineral processing.
- **Gigafactory:** Large-scale battery manufacturing facility producing gigawatt-hours (GWh) of capacity annually.
- **Geological Mapping:** the systematic, field-based process of observing, recording, and interpreting the distribution of rock types, structural features (faults, folds), and geological boundaries on the Earth's surface. Using tools like GPS, GIS, and aerial photography, geologists create detailed maps that are essential for resource exploration.
- **Geophysical Surveys:** a non-destructive, ground-based or airborne method used to map subsurface characteristics, structures, and anomalies by measuring physical properties like magnetism, gravity, and electrical conductivity. These surveys are essential for mineral exploration.
- **Global Supply Surge:** refers to a rapid, often overwhelming increase in demand for goods or a sudden, unexpected increase in shipping and logistical costs that exceeds the available capacity of global transportation and production networks.
- **Grades:** the concentration of valuable metals or minerals within a rock mass, usually expressed as a percentage for base metals or grams per ton for precious metals.
- **Graphite:** a form of carbon used in anodes, lubricants, and refractories; can be natural or synthetic.
- **Greenfield Project:** a new development built entirely from scratch on previously undeveloped land, with no existing infrastructure to work around.
- **Hydrometallurgy:** metallurgical process using aqueous chemistry (leaching, precipitation, solvent extraction) to extract metals.

- **IAAC (Impact Assessment Agency of Canada):** Federal agency overseeing environmental and impact assessments.
- **IBAs (Impact and Benefit Agreements):** formal agreements between companies and Indigenous communities detailing benefits, commitments, and consultation.
- **IEA (International Energy Agency):** intergovernmental organization that produces energy and minerals outlooks.
- **Indigenous Rights (Section 35):** constitutional recognition of Aboriginal and treaty rights in Canada's 1982 Constitution Act.
- **Joint Ventures:** a commercial enterprise undertaken jointly by two or more parties which otherwise retain their distinct identities.
- **LFP (Lithium Iron Phosphate):** a type of cathode material used in safer, long-life lithium-ion batteries, but suffers from less capacity. China dominates LFP manufacturing.
- **LFP Battery Cathode Production:** involves synthesizing lithium iron phosphate powder through high-temperature, nitrogen-atmosphere kiln roasting of iron phosphate, lithium carbonate, and carbon sources.
- **LFP Technology:** a rapidly advancing, highly stable lithium-ion battery chemistry widely used in electric vehicles (EVs), renewable energy storage, and portable power.
- **Leaching:** a hydrometallurgical process that uses chemical solutions (lixiviants) to selectively dissolve and extract valuable metals—such as gold, copper, and uranium—from ore. It converts metals into soluble salts while leaving impurities behind, enabling cost-effective processing of low-grade, complex ores.
- **Lithium Brine:** saltwater containing dissolved lithium, extracted from underground aquifers.
- **Limited Partnerships:** partners who invest in a business for a share of the profits or losses but do not participate in the operation or management of the business. Their liability is limited to the potential loss of the money they invested in the project.
- **Li-ion Battery (Lithium-Ion Battery):** lithium-ion batteries are high-density, long-life, and efficient rechargeable batteries, with variants like NMC and LFP, that power most electric vehicles, mobile electronics, and grid storage by moving lithium ions between the anode and cathode
- **LME (London Metal Exchange):** global commodities exchange for trading metals
- **MAC (Mining Association of Canada):** national organization representing Canadian mining companies
- **Metal Salts:** ionic compounds formed by replacing hydrogen ions in an acid with metal cations, typically combining metals with anions like halides, sulphates, or carbonates. Used in catalysis, electronics, and electroplating, they include common substances such as copper sulphate, sodium chloride, and zinc chloride. These, often water-soluble, compounds are crucial for industrial applications, pigments, and chemical synthesis.
- **Metallurgy:** the branch of science and technology concerned with the properties of metals and their production and purification.
- **Midstream Segment:** transporting, processing, and storing raw hydrocarbons (crude oil, natural gas, NGLs) using pipelines, tankers, rail cars, and storage terminals.
- **Mine Closure Plan:** a dynamic, comprehensive document outlining strategies to safely rehabilitate, reclaim, and secure a mine site after operations cease.
- **Mineral Concentrate:** a product of mineral processing (or beneficiation) that has a significantly higher concentration of valuable minerals than the original run-of-mine ore.
- **Mineral Claim:** a legal right to explore for and extract specific minerals from a designated area of Crown land, granting exclusive access to subsurface resources.
- **MRE (Mineral Resource Estimate):** quantitative assessment of a mineral deposit's grade and tonnage.
- **Mt / kt:** Megatonne (1 million tonnes) and kilotonne (1,000 tonnes), standard units for mineral production.
- **Mining Lease:** Legal right to extract minerals from a defined area following exploration.

- **Nacelle Assembly Capacity:** refers to the specialized manufacturing capability and volume of a facility to assemble, install, and test the major mechanical and electrical power-generating components of a wind turbine within its protective housing. It is a key metric for measuring the strength of the wind turbine supply chain and the production rate, typically expressed as gigawatts (GW) of capacity produced per year.
- **Neodymium Magnet:** the strongest type of permanent magnet, made from an alloy of neodymium (rare earth), iron, and boron.
- **NMC (Nickel Manganese Cobalt):** Common cathode chemistry for lithium-ion batteries in North America & Europe. It has more capacity but a shorter lifetime than LFP.
- **Non-Valuable Rocks:** generally refer to materials that lack the necessary concentration of minerals, metals, or industrial utility to be mined or processed at a profit.
- **NRCAN (Natural Resources Canada):** Federal department responsible for managing the natural resources and critical minerals strategy.
- **NI 43-101:** Canadian securities regulation requiring standardized technical disclosure for mineral projects, with a strict definition for reserves and resources.
- **Open-Pit Mining:** surface mining technique for shallow, low-grade deposits.
- **Ore:** naturally occurring material from which minerals can be economically extracted.
- **PEA (Preliminary Economic Assessment):** early economic study assessing project viability.
- **Permanent magnet:** a magnetic material that keeps its strong, reliable magnetic field without external power, making it vital for electric motors, wind turbines, and defence technologies. Rare-earth-based permanent magnets such as neodymium magnets are the most powerful type.
- **PFS (Pre-Feasibility Study):** intermediate study increasing confidence in technical and economic feasibility. First report where a reserve can be declared.
- **PGM / PGE (Platinum Group Metals/Elements):** precious metals including platinum, palladium, rhodium, iridium, ruthenium, and osmium.
- **Pilot Electrolyte Plant:** a small-scale, pre-commercial production facility designed to test, optimize, and validate the manufacturing process of battery electrolytes before moving to large-scale, industrial production.
- **Polysilicon:** a high-purity (up to 99.999999999% or 11N), raw material essential for producing solar photovoltaic (PV) cells and semiconductor devices.
- **Preferred Access to Bids:** involves registering on specialized e-tendering portals to download documents, receive notifications, and submit bids for government or private contracts.
- **Private Surface Land:** ownership of the top layer of land, including soil, trees, and buildings, which is distinct from the mineral rights (subsurface) usually owned by the Crown.
- **Pyrometallurgy:** a metallurgical process using heat to extract and refine metals.
- **QP (Qualified Person):** Certified geoscientist or engineer responsible for verifying NI 43-101 technical reports.
- **Rate of Return:** is the net gain or loss on an investment over a specified period, expressed as a percentage of the initial cost. It measures efficiency, with positive percentages indicating profit and negative percentages indicating loss.
- **REE (Rare Earth Elements):** a group of 17 chemically similar elements used in magnets, electronics, and clean technologies.
- **Reclamation:** rehabilitation of land after mining to restore ecosystems and safety.
- **Reconciliation Action Plan:** a strategic, formal framework used by organizations to operationalize their commitment to reconciliation with Indigenous Peoples.
- **Refining:** the final stage of metallurgical processing that purifies extracted raw, impure metals or concentrates, removing remaining waste, chemical impurities, or undesirable materials to achieve high-grade, industrial-spec products.

- **Reserves:** economically mineable portion of a resource proven by technical and economic studies.
- **Resource Nationalism:** the tendency of governments to assert control, ownership, or increased taxation over natural resources (especially critical minerals and energy) within their borders to secure economic and strategic advantages.
- **Resource Revenue Sharing Agreements:** legal, often negotiated agreements between governments (provincial, federal) and Indigenous communities, or between corporations and communities, that distribute a portion of income generated from natural resources (mining, forestry, oil) to the local, impacted community.
- **Resources:** naturally occurring concentrations of minerals with potential economic interest. Not to be confused with reserves.
- **Royalties:** legally binding payments made by mine operators to resource owners (governments or private parties) as compensation for the right to extract and sell natural resources.
- **Screening:** the mechanical process of separating granulated, crushed, or raw ore material into different grades based on particle size using specialized vibrating screens or decks.
- **Semiconductor:** a material with electrical conductivity between that of a conductor and an insulator, enabling precise control of electrical current. Semiconductors form the basis of modern electronics, including computer chips, sensors, and solar cells.
- **SMR (Small Modular Reactor):** a compact nuclear power plant being explored by several provinces for low-carbon energy.
- **Social License to Operate:** ongoing, informal acceptance or approval of a company's project or business practices by local communities, stakeholders, and the public. Unlike legal permits, it is intangible, dynamic, and must be earned through trust, transparency, and legitimacy. It indicates a level of consent beyond regulatory compliance.
- **Solar Cells:** a nonmechanical device that converts sunlight directly into electricity.
- **Solar PV (Photovoltaic):** A technology that converts sunlight directly into electricity using semiconductor materials, typically silicon-based. Solar PV systems are composed of solar cells assembled into panels or modules.
- **Solution Mining (or in-situ leaching):** extracts underground, water-soluble minerals like salt, potash, or uranium by drilling wells, injecting water (often heated) to dissolve the ore, and pumping the resulting mineral-rich brine (a solution) to the surface for processing, avoiding traditional excavation.
- **SRC (Saskatchewan Research Council):** Saskatchewan's Provincial Public Research body operating Canada's first rare-earth processing.
- **Standardized Commodities:** raw materials or agricultural products that are uniform in quality and grade, making them interchangeable regardless of who produced them
- **State Sovereignty:** the supreme, absolute, and uncontrollable power within a state to govern its own territory and population, free from external interference. It establishes a state's legal authority to make laws, control its borders, and conduct foreign relations as a recognized entity in the international system.
- **Stationary Energy Storage Systems:** fixed, non-mobile technologies, such as batteries (BESS), pumped hydro, or compressed air, used to store electricity for grid, commercial, or residential applications, enhancing reliability and smoothing the integration of renewable energy.
- **Supplier Development Programs:** structured, collaborative initiatives where buying organizations invest time, resources, or expertise to improve a supplier's performance, capabilities, and capacity.
- **Surface Rights:** the legal ownership, use, and control of the top layer of land, including improvements.
- **Towards Sustainable Mining (TSM):** Mining Association of Canada's standard promoting environmental and social best practices.
- **Tailings:** residual waste material after ore processing, typically stored in tailings storage facilities (TSFs).

- **Tariff:** a tax or duty imposed by a government on imported goods and services, and occasionally on exports.
- **TSF (Tailings Storage Facility):** engineered containment for mine tailings.
- **Trenching:** a surface exploration method involving the excavation of long, narrow, and relatively shallow channels in the ground to expose bedrock and subsurface geological deposits.
- **TSX / TSX-V:** Toronto Stock Exchange and TSX Venture Exchange, key markets for mining finance.
- **UNDRIP (United Nations Declaration on the Rights of Indigenous Peoples):** international standard requiring free, prior, and informed consent (FPIC) before resource projects affect Indigenous territories.
- **Underground Mining:** targets deeper, higher-grade deposits than open-pit mining through tunnels or shafts, resulting in a smaller surface footprint but higher costs and complexity.
- **Upstream:** early stages of the value chain, designating mining and extraction.
- **Urban Mining:** recovery of valuable metals and minerals from waste materials, such as discarded electronics, batteries, or infrastructure, instead of from natural ore deposits.
- **Vanadium Battery:** also known as vanadium redox flow battery a type of rechargeable flow battery.
- **Vertical Integration:** business model where a company controls multiple stages of production, from mining to refining to manufacturing.
- **Watt and watt-hour (W/Wh):** units for measuring power and energy output. MWh and GWh are often used to define the battery manufacturing capacities of Gigafactory per year. E.g. NexStar Energy is projected to produce 49.5 GWh of batteries per year at term.
- **Wafers:** a thin, circular slice of semiconductor material—most commonly high-purity, monocrystalline silicon—that acts as the foundation for fabricating integrated circuits (ICs), microchips, and photovoltaic solar cells.
- **WTO (World Trade Organization):** global trade body; ruled against China's REE export quotas in 2014.
- **Wholly Owned Corporations:** a business entity where 100% of outstanding shares are owned by another company, known as the parent company. It operates as a separate legal entity, allowing the parent company to control all management, financial decisions, and operations while limiting liability.

10.2 Map of Canadian critical mineral projects and operations

Organization	Tool	Link
Mining Innovation Commercialization Accelerator	Ecosystem Stakeholder Dashboard	Link
Canadian Institute of Mining, Metallurgy and Petroleum	Historical Canadian Mines Data Hub and Visualization Centre	Link
Northern Miner	Northern Miner Interactive Map	Link
Geo.ca	A series of geological maps of Canada, including Nickel, Zinc, REE, Lithium and Graphite	Link
Battery Metals Association of Canada	Value chains map, a commodity map, and an industrial ecosystem map	Link
Natural Resources Canada	Major Project Maps	Link
Natural Resources Canada	Map of Indigenous Mining Agreements	Link
Natural Resources Canada	General Minerals & Mining Map	Link
Natural Resources Canada	Critical Minerals Map, including advanced mining projects, operating mines, and processing facilities	Link

10.3 List of programs and supports

Region	Program/Organization Name	Link	Capacity Building & Consultations	Direct Funding, Exploration	Financing & Loan Guarantee	Regulatory Navigation & Partnership Facilitation	Training & Skills Development
Federal	Critical Minerals Infrastructure Fund – Indigenous Grants	Link	x	x			
Federal	Strategic Partnerships Initiative	Link		x		x	x
Federal	Indigenous Business Navigator Service	Link				x	
Federal	Indigenous entrepreneurship: Business Opportunities	Link		x			x
Federal	Aboriginal Entrepreneurship Program: Access to Capital	Link			x		
Federal/ ON	Indigenous Centre of Excellence for Mineral Development	Link				x	x
BCA	Critical Minerals Office (CMO)	Link	x			x	
BC	New Relationship Trust	Link	x	x		x	x
MB	Mineral Development Fund (MMDF)	Link	x	x			
NS	The Aboriginal Community Development Fund (ACDF)	Link	x	x			
NT	Mining Incentive Program (MIP)	Link		x			
NT	Mine Training Society (MTS)	Link					x
NU	Nunavut Mine Trai-ing Funding	Link					x

Region	Program/Organization Name	Link	Capacity Building & Consultations	Direct Funding, Exploration	Financing & Loan Guarantee	Regulatory Navigation & Partnership Facilitation	Training & Skills Development
ON	New Relationship Fund	Link	x				
ON	Indigenous Economic Development Fund: Regional Partnership Grant	Link					x
ON	Indigenous Participation Fund	Link	x			x	
ON	Advanced exploration and development support	Link		x			
ON	Early exploration support	Link		x			
ON	Engagement and relationship-building	Link	x				
ON	Mineral development advisor stream	Link				x	
ON	Mining conferences funding Sub-Stream	Link	x	x			
ON	Values mapping and related projects	Link	x			x	
ON	Regional Development Program: Advanced Manufacturing and Innovation Competitive-ness (AMIC) Stream	Link		x			
ON	Skills Development Fund: Capital Stream	Link					x
ON	Ontario Junior Exploration Program – Indigenous Participation Incentive	Link		x			
QC	The Cree Mineral Exploration Board	Link		x			x

Region	Program/Organization Name	Link	Capacity Building & Consultations	Direct Funding, Exploration	Financing & Loan Guarantee	Regulatory Navigation & Partnership Facilitation	Training & Skills Development
QC	Nunavik Mineral Exploration Fund	Link	x	x			x
QC	Financial support for major northern projects	Link		x			
QC	Financial support for northern workforce training program	Link					x
QC	Financial Support for Infrastructure Projects in Support of the Mining Sector	Link		x			
YT	Yukon Mineral Exploration Funding	Link		x			
YT	Centre for Northern Innovation in Mining (CNIM)	Link					x