

**EXAMINING CANADA'S ROLE IN CRITICAL  
MINERALS GLOBAL COMPETITION:  
A CASE STUDY ON NICKEL AND RARE EARTH ELEMENTS**

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***Abstract.** With the significant increase in global demand for critical metals, including nickel and rare earths, competition in the market for these resources has become increasingly intense. Canada, a country rich in natural resources, plays a crucial role in this global competition and has a well-defined critical minerals strategy. This article proposes an analysis of Canada's strategy and its role in global competition, focusing on two critical minerals: nickel and rare earths. The research methodology is based on two case studies that follow several key aspects: the benefits of the critical resource, Canada's production and resources, and at the global level, trade exchanges, existing projects, market risks, and production chains. The study shows that Canada plays an important role in the global competition for critical metals - nickel and rare earths - primarily through the prism of its resources and recently launched national strategy. The critical minerals strategy aims to strengthen this position and carefully manage market risks, despite significant challenges such as price volatility, China's position and related dependencies.*

**Keywords:** *global competition, strategy, resources, critical minerals*

**JEL:** *N 51, Q26, Q34*

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**Introduction.** Canada has a robust mining industry, currently extracting 60 minerals and metals from 200 mines and 6500 sand, gravel and quarries. The country is home to nearly half of the world's publicly traded mining and mineral exploration companies. These companies have a combined market capitalization of \$520 billion and are represented in more than 100 countries (Canada Government, 2022a).

In the context of the transition to clean energy and the industries of the future, Canada is in a favourable position. Increasing demand for key minerals is imminent and current supply cannot meet the needs. Canada has competitive advantages, including abundant resources, experience in dealing with environmental issues, industrial know-how, and extensive trade relations (Canada Government, 2022b).

The Canadian government has allocated significant funding for research and development, particularly for critical solutions in the mineral supply chain (Canada Government, 2022a). These efforts will enable Canada to become a major

supplier of responsibly sourced materials and develop technologies for a low-carbon economy. Canada's list of important minerals includes 31 resources, and experts have prioritized six important minerals: lithium, graphite, nickel, cobalt, copper and rare earth elements (Canada Government, 2022c). This selection is based on their benefits to economic growth, their impact on the labour market, and the opportunities they provide to indigenous communities along the entire value chain from mining to recycling. These minerals are important for high value-added products, including green technologies, information technology and communications.

**Method.** The main objective of the article is to analyse the role of Canada in the competition for critical resources in the context of the National Critical Minerals Strategy recently launched by the Canadian government.

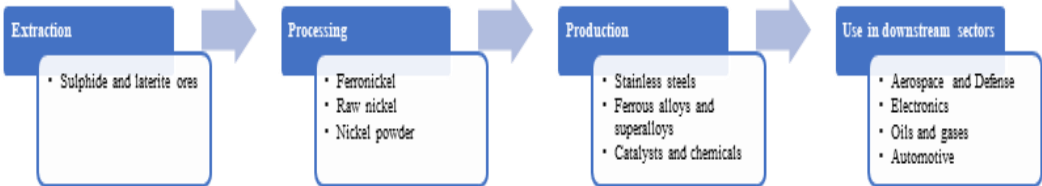
To achieve this objective, a qualitative study was conducted using the case study method, which included a number of specific elements targeting two of the critical resources that Canada considers essential in its National Strategy - nickel and rare earths.

The structure of the case studies followed the following aspects, each with specific objectives: brief description and use of the nickel and rare earth resources in the context of value chains, global production and Canadian production or existing resources, Canadian mining projects targeting the two resources analysed, international trade of Canada and its main global competitor, China, analysis of the market conditions, prices and supply risks.

This method allowed for a comprehensive analysis of the subject and provided the data necessary to assess Canada's position in the global competition for nickel and rare earths and to identify the risks and opportunities associated with these important resources.

**Case study 1: Nickel as a critical mineral for Canada**

**Nickel description and use.** Nickel is a silvery-white metal used mainly to make stainless steel (about 2/3 of total consumption) and other alloys stronger and more resistant to extreme temperatures and corrosive environments. Because of these properties, nickel alloy equipment and parts are often used in harsh environments, such as chemical plants, oil refineries, jet engines, power generation plants, and offshore energy facilities (Geology.com, 2022a). According to statistics, nickel is mainly used for stainless steel (72%), followed by the production of alloys (12%), electroplating (6%), batteries (6%), metallurgical castings (2%) and other products (2%) (Canada Government, 2022d).



*Figure 1. Nickel value chain*

Source: author, based on Ontario Mining Association (2022)

**Nickel production and reserves.** Global nickel production (mining) in 2021 was estimated by the U.S. Geological Survey at 2.7 million tonnes, with Indonesia the largest producer at one million tonnes, or over 30% of the total. Canada ranks sixth with about 4.8% of the world total, while China is about the same with 4.4%.

For 2020, global nickel reserves are estimated at more than 94 million tons, and for 2021 the total value is estimated at more than 95 million tons (U.S. Geological Survey, 2022a). Indonesia has the largest reserves (21 million tonnes), followed by Australia (20-21 million tonnes), Brazil (16 million tonnes), Russia (6.9 million tonnes), Cuba (5.5 million tonnes), the Philippines (4.8 million tonnes), Canada (2 million tonnes), China (2.8 million tonnes).

*Table 1. Nickel production and reserves in 2021 worldwide, in thousands of tons and %*

Country	Production (thousand tons)	% production in total	Reserves (thousand tons)	% in total reserves *
Indonesia	1000	37%	21000	28%
Philippines	370	13,7%	4800	5%
Russia	250	9,3%	7500	8%
Canada	130	4,8%	2000	2,1%
China	120	4,4%	2800	3%
<b>Total</b>	2700	100%	>95000	100%

Source: by author, U.S. Geological Survey (2022a)

\* Approximations, starting from the total volume of 95 million.

Note: the table shows the production and reserves of the leading countries (production 2021), China and Canada

**Canada's access to Nickel and competition with China.** Government statistics show nickel concentrate production of nearly 170 thousand tonnes at Canadian mines in Ontario, Quebec, Newfoundland and Labrador, and Manitoba. In addition, Canada has 3 refineries (Fort Saskatchewan, Alberta; Sudbury, Ontario; Long Harbour, Newfoundland and Labrador), which processing capacity of more than 124 thousand tonnes of refined nickel annually.

According to the GlobalData database, the largest nickel mines in Canada are (Mining Technology, 2021a):

- Raglan Mines (Quebec), owned by Glencore Plc (company based in Switzerland), which produced about 39.23 thousand tons of nickel in 2020; the mine will operate until 2027;
- Voisey's Bay (Newfoundland and Labrador), owned by Vale (Brazil), both surface and underground mine, producing about 35.7 thousand tons of nickel in 2020 and operating until 2034;
- Sudbury Mine (Ontario), also owned by Glencore Plc, with production of approximately 17.67 thousand tons of nickel in 2020 and an operating horizon of 2035;

- Coleman Mine (Ontario), owned by Vale, which produced approximately 14,136 thousand tonnes of nickel in 2020 and is expected to be active until 2030;
- The Nunavik Nickel Project (Quebec), owned by Canadian Royalties, but 100% of whose shares are held by the parent company Jilien Jien Nickel Industry Co. of China, which will produce approximately 11,156 thousand tons of nickel in 2020 and will be exploited until 2028.

At the global level, it is worth mentioning the new position of Indonesia, a country that has played a key role in the global nickel markets (and only there), but whose President Joko Widodo has recently promised to limit (and even stop) exports of commodities from the essential category (such as nickel), with the aim of transforming the country into a major production hub for products for the transport sector (electricity). Therefore, the Indonesian government has restricted nickel exports and at the same time stopped the shipment of bauxite and copper ore, with the stated goal of producing all EV components in the country itself (Mining.com, 2022a).

Despite these constraints, China has doubled its investment in Indonesia in the first half of 2022 compared to the same period in 2021 by building nickel smelters and is also financing projects under the BRI plan. This is all against the backdrop that, according to AidData, Indonesia has "hidden debt" to China of \$17.28 billion (more than four times the reported public debt of \$3.9 billion) (Benar News, 2022). The new nickel smelter project, with a capacity of 1.8 million tonnes, is located in Southeast Sulawesi Province and is being built by PT Gunbuster Nickel Indonesia, a unit of China's Jiangsu Delong Nickel Industry. In addition, earlier this year, another Chinese company, Zhejiang Huayou Cobalt, announced plans to form a joint venture with EVE Energy, Glaucous International and Lindo Investment to develop a \$2.08 billion nickel and cobalt project in Indonesia (Mining Technology, 2021b). Also worth mentioning is Indonesia's first HPAL (High Pressure Acid Leach) project, a joint venture between China's Ningbo Lygend and Indonesia's Harita Group, which was launched in May 2021. At least two other HPAL projects are in the construction pipeline and five others are at the feasibility stage. As Indonesia currently has no domestic battery production capacity, the mining results (nickel and cobalt as secondary products) would be exported to factories in China (CSIS, 2021).

With respect to Canada and its potential ability to gain access to Indonesia's resources, it should be noted that the Asian country is the second largest destination of Canadian foreign direct investment in Southeast Asia, with a total stock of about \$3.5 billion in 2020, and the two countries began negotiations on a comprehensive economic partnership agreement in June 2021, with the first round of negotiations taking place in March 2022 (Canada Government, 2022e). In parallel, Canada is negotiating free trade agreements with ASEAN. Canadian FDI in Indonesia is mainly concentrated in the mining sector (92.8%), with the largest projects in South Sulawesi (89.6%) (Consulate General of the Republic of Indonesia in Toronto, 2021).

Due to export restrictions on Indonesia, the Philippines has become a desirable market and China's largest supplier of nickel ore (Reuters, 2022a). To counterbalance power positions, Canadian strategists highlight 3 key projects as potential opportunities for Canada's access to nickel (Canada Government, 2022f): Tampakan Copper-Gold Project, Silangan copper and gold mine, King-king Copper-Gold mine.

**International nickel trading: Canada and China positions.** Canada's trade in raw nickel, according to OEC statistics (2023a), shows that the country is the world's second largest exporter at \$1.52 billion, with the United States (\$761 million) being the main destination country at about 50%, but with China (\$207 million), the Netherlands (\$177 million), Belgium (\$79.8 million), and Japan (\$51.5 million) also contributing significant weight. Canada's nickel imports totalled \$17.9 million in 2020, insignificant compared to exports. The main import markets were the United States (\$8.09 million) and the United Kingdom (\$4.9 million), less Norway (\$1.17 million), Australia (\$913 thousand), and Russia (\$814 thousand).

In terms of nickel inflows and outflows, China occupies an opposite position to Canada (OEC, 2023b): it is the largest importer - \$1.94 billion in 2020, from the main markets - Russia (\$715 million), Australia (\$417 million), but also Canada (\$207 million), Norway (\$161 million) and Japan (\$144 million). In contrast, 2020 exports reached only \$280 million, mainly to Belgium (\$62.4 million), Chinese Taipei (\$52.3 million), India (\$42.1 million) and, to a lesser extent, Indonesia (\$18.8 million) and Sweden (\$17 million).

**Nickel market conditions and supply risks.** In general, the nickel price fluctuates with the demand for stainless steels and alloys. After an initial slump at the start of the pandemic, nickel prices recovered strongly as demand picked up in China and the US. Analysts expect nickel prices to trend higher in the coming years, mainly due to rising demand for nickel for EV batteries, recovering demand in the aerospace industry or supply shortages. Russia's invasion of Ukraine rattled the global nickel market in a matter of days in March, driving up prices on the London Metal Exchange (LME) by +250% (China Dialogue, 2022).

In the long term, positive prospects are expected, mainly from the demand for EV batteries, but also from the new technologies of nickel-containing batteries, which are expected to be used for storage capacities. Production capacity has been gradually expanded in the main producing countries, with many idled plants and delayed development projects coming back on stream.

It is worth noting that traditional nickel markets have grown steadily by 6-7% over the past decade. The current areas of high potential interest for nickel - water supply systems, marine separators (equipment), and batteries - are all driven by the goals of combating climate change and conserving scarce resources (Nickel Institute, 2020).

Regarding supply chain risks, although nickel is of great economic importance and nickel alloys serve as feedstock for a number of strategic downstream industries, supply chain risks are generally considered to be relatively lower than for other critical minerals, primarily because nickel production, with the

exception of Indonesia, is not highly geographically concentrated. However, there is a significant degree of dependence on other markets such as the Philippines, which has a significant share of production, or Australia and Brazil, which have large potential resources.

Canada is a major importer with diversified markets that give it advantages in negotiations, including with China (more than 10% of the Asian country's imports come from China). However, key mines are not Canadian-owned, which poses a risk to securing access to resources in supply chains for downstream industries.

**Case study 2: Rare earth elements (REE) as a critical mineral for Canada**

**REE description and use.** The rare earths are a group of 15 metals found in the lanthanide series of the periodic table of elements. Although they are not rare earths, scandium and yttrium are commonly included in this classification because they have similar properties to the lanthanides and occur in the same ore bodies (Canada Government, 2022g).

Rare earths are important resources for common electronic devices (computer components, batteries, telephones, magnets, lighting) as well as for a variety of industrial applications.

At the industrial level, the shares of use (2020 estimates) are: permanent magnets (29.4%), catalysts (20.2%), polishing powders and additives (13.6%), metallurgy (8.6%), batteries (7.8%), glass (7.8%), ceramics (2.7%); phosphates (0.6%), pigments (0.4%), other categories (8.9%) (Government of Canada, 2022i). According to the USGS, rare earths in the U.S. are used predominantly for chemical catalysts (74%), but also for ceramics and glass (10%), metallurgy and alloys (6%) (Geology.com, 2022b).

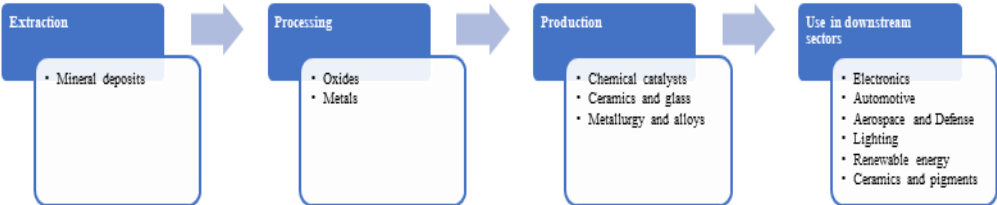


Figure 2. Rare earths chain

Source: author, based on Ontario Mining Association (2022)

**REE production and reserves.** Rare earths are classified as either "light" (lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, and scandium) - products that are even in surplus worldwide - or "heavy" (terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium, and yttrium), which are produced mainly in China and have limited availability.

China is thus the world's largest producer of rare earths, accounting for about 60% of global annual production, estimated at 160 thousand tons in 2021. The remaining 40% of total production is accounted for by the United States, Burma (Myanmar) and Australia.

In terms of reserves, China's share is somewhat smaller, although it continues to dominate with over one-third of the world's reserves (36.7%). Three other countries have a significant, roughly equal weight: the USA (17.5%), Brazil (17.5%), Vietnam (18.3%). Canada has insignificant production at the global level, and the total reserves estimated for 2021 reach only 830 thousand tons (about 0.7% of the total).

**Table 2. Rare earth elements production and reserves in 2021 worldwide, in thousands of tons and %**

Country	Production (thousand tons)	% production in total	Reserves (thousand tons)	% in total reserves *
China	168	60%	44000	36,7%
SUA	43	15,4%	21000	17,5%
Burma (Myanmar)	26	9,3%	:	:
Australia	22	7,9%	4000	3,3%
<b>Total</b>	<b>280</b>	<b>100%</b>	<b>120000</b>	<b>100%</b>

*Source:* by author, U.S. Geological Survey (2022b)

Note: the table shows the production and reserves of the leading countries (production 2021), China and Canada

**Canada's access to REE and competition with China.** According to the International Energy Agency, China controls more than 71% of the world's rare earth production and 87% of the world's rare earth processing capacity, so there is no alternative to its market (Fdi Intelligence, 2022a). Basically, China is the only country in the world that has a complete industrial chain for the production of rare earths (Weijia, 2022).

As part of its plan to strengthen its position to increase efficiency, achieve strategic goals and control prices, China is completing the merger of three state-owned enterprises at the end of 2021 and establishing a new company - China Rare Earth Group Co. Ltd, a megacorporation that will concentrate about 62% of the national supply of heavy rare earths (Zhou & Brooke, 2022).

Canada, while not a major player in rare earth production, hosts a number of advanced exploration projects and some of the largest (measured and indicated) reserves and resources of these metals (estimated at over 14 million tonnes in 2021). Many of Canada's most advanced rare earth exploration projects contain high concentrations of valuable, globally valued heavy metals that are used in high-tech and clean energy applications.

Canada's interest in rare earth production and processing has translated into 20 major projects in 7 regions of the country: the Northwest Territories (2 projects), British Columbia (one project), Alberta (one project), Saskatchewan (3 projects), Ontario (4 projects), Quebec (7 projects), and Newfoundland and Labrador (2 projects). Of the total number of projects, 16 are active and at various

stages - exploration (one project), resource estimation (5 projects), preliminary economic assessment (4 projects), feasibility (2 projects), and only 3 in processing.

**Table 3. Mining Projects - Rare Earth Elements in Canada**

<b>Region</b>	<b>Location / project</b>	<b>Project status</b>
<i>Northwest Territories</i>	Nechalacho T-Zone and Tardiff Zone	Active, processing
	Nechalacho Basal Zone	Active, feasibility
<i>British Columbia</i>	Wicheeda	Active, resource estimation
<i>Alberta</i>	SBH Black Shale	Suspended, preliminary economic evaluation
<i>Saskatchewan</i>	Alces Lake	Active, exploration
	Falcon Point	Active, resource estimation
	Saskatchewan Research Council (SRC) Rare Earth Processing Facility	Active, processing
<i>Ontario</i>	Clay-Howells	Suspended, resource estimation
	Lackner Lake	Suspended, resource estimation
	Elliot Lake	Suspended, resource estimation
	Lavergne-Springer	Active, resource estimation
<i>Quebec</i>	Eldor (Ashram)	Active, preliminary economic evaluation
	Strange Lake	Active, preliminary economic evaluation
	Montviel	Active, resource estimation
	Bruno Rare Earth Recycling Demonstration Plant	Active, processing
	Kwyjibo	Active, preliminary economic evaluation
	Kipawa (Zeus)	Active, feasibility
	Niobec - REE Zone	Inactive, resource estimation
<i>Newfoundland and Labrador</i>	Red Wine	Active, resource estimation
	Port Hope Simpson (Foxtrot)	Active, preliminary economic evaluation

Source: Canada Government (2022g)

Nechalacho (Yellowknife, Canada) is the first rare earth mining project in Canada and the second in North America. It hosts one of the best rare earth deposits in the world and is operated by Cheetah Resources, a subsidiary of the Australian mining company Vital Metals (Financial Times, s.a). The company has set a goal of producing at least 5000 tonnes of contained rare earths annually by 2025. This would make the mine the largest independent source of clean rare earths outside of China. Nechalacho also offers Canada the opportunity to position itself in the rare earth value chain while attracting investment in other strategic downstream industries such as aerospace and defence, electric motor manufacturing, manufacturing and advanced materials, renewable energy and other clean technologies. After mining and on-site processing (a process that separates rare earths from unwanted waste materials) at Nechalacho, the resulting



concentrate is transported to Cheetah's processing facility in Saskatchewan, where it is converted into a mixed rare earth precipitate (Financial Times, s.a.).

Another opportunity for Canada is presented by the projects of Canada Rare Earth Corp, which has entered into an agreement with Mineracao Mata Azul SA that gives the company the right (but not the obligation) to purchase all of the rare earth concentrate produced by the Mata Azul property located in Tocantins, Brazil, at a base price plus a percentage of the difference between the base price and the nominal market value, with the obligation having a minimum term of 20 years (the agreement includes automatic renewal clauses) (GlobalNewsWire, 2014). In addition, Canada Rare Earth Corp. recently announced its intention to develop projects in Rondonia, Brazil (Canada Rare Earth Corporation, 2022).

Other Canadian companies developing rare earth projects include (Kelly, 2022):

- Marvel Discovery - is considering projects for various critical resources, and for rare earths, the company owns Defense Metals' Wicheeda North and Wicheeda REE projects, both located in the strategic Rocky Mountains;
- Ucore Rare Metals - is developing rare earth supply chain projects in the U.S., including Bokan-Dotson Ridge REE on Prince of Wales Island in Alaska, where it plans to build a 2000-ton-per-year separation and purification facility through its Alaska2023 subsidiary;
- Avalon Advanced Materials - has a portfolio of major critical metals – rare earths, lithium, cesium, tantalum, feldspar, tin and indium, including the Nechalacho project.

**International REE trading: Canada and China positions.** Regarding trade in rare earths, OEC statistics (2023c) show that Canada exported \$1.72 million in 2020, with most exports going to the United States (\$1.57 million). The value of imports was higher at \$2.44 million, most of which also came from the United States (\$1.86 million).

China exported \$67 million worth of rare earths in 2020 (third largest exporter), with the top export markets being Japan (\$9.68 million), Hong Kong (\$7.06 million), Germany (\$6.66 million), the United States (\$6.05 million), and Malaysia (\$5.4 million). China's imports totalled \$54.7 million (the second largest importer in the world), with shipments from: Brazil (\$15.8 million), South Africa (\$12.2 million), the United States (\$12.1 million), Chinese Taipei (\$6.53 million) and Estonia (\$5.08 million) (OEC, 2023d).

**REE market conditions and supply risks.** The latest price trends for the most important rare earths range from significant growth (e.g., terbium, dysprosium) to stability (neodymium) to a decline (europium) (Ontario Mining Association, 2022).

Rare earths are used in a wide variety of industrial applications, including electronics, clean energy, aerospace, automotive, and defence sector. Because of their luminescent and catalytic properties, they are also widely used in high-tech and "green" products (Geology.com, 2022b). All of these areas have experienced unprecedented growth, and demand is increasing. In the medium to long term, rare

earths are known to have great potential for green technology applications, and this will keep demand high.

Although measured and indicated rare earth resources in North America are estimated at 2.4 million tons in the United States and over 15 million tons in Canada, rare earths are relatively abundant in the Earth's crust, but mineable concentrations are rarer than for most other mineral commodities (Canada Government, 2022g).

Regarding risks on supply chains, rare earths are considered one of the riskiest commodities in the supply chain, and access to their supply plays an important role in both high-tech and low-tech sectors. Rare earth oxides markets are dominated by China. Because this country tightly controls its production of rare earths, at least in the short term, this leads to supply shortages and instability in international markets, which can lead to rising prices in the absence of alternatives. In addition, recycling rates for rare earths are low, which affects market prices.

China has dominance, production, reserves, and is a major trading partner in trade. Its dominance is a risk for Canada (and not only), especially since the North American country is not a relevant producer and, despite numerous projects and significant exploitation potential, most are not advanced. Moreover, trade depends on relations with the U.S., with foreign projects by Canadian companies outside the North American continent being less relevant.

**Conclusions.** Canada occupies an important position in the global industry for metals such as nickel and rare earths. With significant nickel resources and a favorable production growth trend, Canada plays a key role in meeting global demand, and the industry's increasing reliance on electric vehicle (EV) batteries provides opportunities for export growth and value creation.

Conversely, while Canada is not a major player in rare earth production, it is seeking to increase its influence in this area through the development of advanced projects. As a relatively small importer of rare earths, Canada must continue to develop and support exploration and development projects to strengthen its position in the global market and reduce its dependence on China.

In summary, Canada is in a unique position to help secure important resources such as nickel and rare earths for the world market. With an increased focus on green technology development and supply diversification, Canada can play an important role in providing key resources to global industry and reduce supply risks associated with dependence on China.

## REFERENCES

- Benar News. (2022). *China doubles investment in Indonesia during first half of 2022*. <https://www.benarnews.org/english/news/indonesian/chinese-investment-indonesia-2022-10242022122341.html>
- Canada Government. (2022a). *The Canadian Critical Minerals Strategy*. <https://www.canada.ca/en/campaign/critical-minerals-in-canada/canadas-critical-minerals-strategy.html>

- Canada Government. (2022b). *Canada's hub for critical minerals*. <https://www.canada.ca/en/campaign/critical-minerals-in-canada.html>
- Canada Government. (2022c). *Critical minerals: an opportunity for Canada* <https://www.canada.ca/en/campaign/critical-minerals-in-canada/critical-minerals-an-opportunity-for-canada.html>
- Canada Government. (2022d). *Nickel facts*. <https://www.nrcan.gc.ca/our-natural-resources/minerals-mining/minerals-metals-facts/nickel-facts/20519>
- Canada Government. (2022e). *Mining market in Indonesia*. <https://www.tradecommissioner.gc.ca/indonesia-indonesie/market-reports-etudes-de-marches/0006651.aspx?lang=eng>
- Canada Government. (2022f). *Mining market in the Philippines*. <https://www.tradecommissioner.gc.ca/philippines/market-reports-etudes-de-marches/0006603.aspx?lang=eng>
- Canada Government. (2022g). *Rare earth elements facts*. <https://www.nrcan.gc.ca/our-natural-resources/minerals-mining/minerals-metals-facts/rare-earth-elements-facts/20522>
- Canada Rare Earth Corporation. (2022). *Canada Rare Earth Presents Development Strategy at a Public Forum in Brazil*. <http://www.canadarareearth.com/12-april-2022>
- China Dialogue. (2022). *Nickel drama highlights Tsingshan's role in energy transition*. <https://chinadialogue.net/en/business/nickel-drama-highlights-tsingshans-role-in-energy-transition/>
- Consulate General of the Republic of Indonesia in Toronto. (2021). *Canadian Investment in Indonesia as of Second Quarter 2021*. <https://kemlu.go.id/toronto/en/news/17581/canadian-investment-in-indonesia-as-of-second-quarter-2021>
- CSIS. (2021). *Indonesia's Nickel Industrial Strategy*. <https://www.csis.org/analysis/indonesias-nickel-industrial-strategy>
- Fdi Intelligence. (2022a). *'Rare earths are not that rare'*. <https://www.fdiintelligence.com/content/interview/rare-earths-are-not-that-rare-81560>
- Financial Times. (n. d.). *The rare earths that are elemental to canadian success*. <https://canada-next-best-place-to-home.ft.com/the-rare-earths-that-are-elemental-to-canadian-success>
- Geology.com. (2022a). *Facts About Nickel. Nickel Uses, Resources, Supply, Demand, and Production Information*. <https://geology.com/usgs/uses-of-nickel/>
- Geology.com. (2022b). *REE - Rare Earth Elements and their Uses. The demand for rare earth elements has grown rapidly, but their occurrence in minable deposits is limited*. <https://geology.com/articles/rare-earth-elements>
- GlobalNewsWire. (2014). *Canada Rare Earth Arranges Long Term Supply of Rare Earth Concentrate from Brazilian Joint Venture Project*. <https://www.globenewswire.com/news-release/2014/09/22/1476375/0/en/Canada-Rare-Earth-Arranges-Long-Term-Supply-of-Rare-Earth-Concentrate-from-Brazilian-Joint-Venture-Project.html>

- Kelly. (2022). *Top 3 Canadian Rare Earths Stocks of 2022*. Investing News. <https://investingnews.com/daily/resource-investing/critical-metals-investing/rare-earth-investing/top-canadian-rare-earth-stocks/>
- Mining Technology. (2021a). *Five largest nickel mines in Canada in 2020*. <https://www.miningtechnology.com/marketdata/five-largest-nickel-mines-canada-2020/>
- Mining Technology. (2021b). *Indonesia launches \$2.7bn China-invested ferronickel smelter*. <https://www.mining-technology.com/news/indonesia-china-ferronickel-smelter/>
- Mining.com (2022a). *China hurt most by Indonesia's move to keep nickel at home*. <https://www.mining.com/web/china-hurt-most-by-indonesias-move-to-keep-nickel-at-home/>
- Nickel Institute. (2020). *Opportunity knocks for nickel*. <https://nickelinstitute.org/en/blog/2020/february/opportunity-knocks-for-nickel/>
- OEC. (2023a). *Raw nickel in Canada, interactive*. database. <https://oec.world/en/profile/bilateral-product/raw-nickel/reporter/can>
- OEC. (2023b). *Raw nickel in China, interactive*. database <https://oec.world/en/profile/bilateral-product/raw-nickel/reporter/chn>
- OEC. (2023c). *Articles of rare earths/metals nes in Canada, interactive*. database <https://oec.world/en/profile/bilateral-product/articles-of-rare-earthsmetals-nes/reporter/can>
- OEC. (2023d). *Articles of rare earths/metals nes in China, interactive*. database <https://oec.world/en/profile/bilateral-product/articles-of-rare-earthsmetals-nes/reporter/chn>
- Ontario Mining Association. (2022). *Critical Minerals Analysis*. [https://oma.on.ca/en/ontario-mining/2022\\_OMA\\_Mineral\\_Profiles.pdf](https://oma.on.ca/en/ontario-mining/2022_OMA_Mineral_Profiles.pdf)
- Reuters. (2022a). *Philippines expecting a dozen new mines this year, mostly nickel*. <https://www.reuters.com/article/philippines-nickel-idUSL2N2VE09L>
- U.S. Geological Survey. (2022a). *Nickel. Mineral Commodity Summaries*, january. <https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-nickel.pdf>
- U.S. Geological Survey. (2022b). *Rare Earths. Mineral Commodity Summaries*, january. <https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-rare-earth.pdf>
- Weijia, Hu. (2022). *Canadian firm's rare-earth project won't affect China's advantage*, *Global Times*d. <https://www.globaltimes.cn/page/202208/1273799.shtml>
- Zhou, Q., & Brooke, S. (2022). *China Merges Three Rare Earths State-Owned Entities to Increase Pricing Power and Efficiency*. China Briefing. <https://www.china-briefing.com/news/china-merges-three-rare-earth-state-owned-entities-to-increase-pricing-power-and-efficiency/>