Getting Prices Right: Securing Critical Minerals Demand to Catalyze Canadian Mine Development

CENTRE FOR NET-ZERO INDUSTRIAL POLICY

LE CENTRE DE POLITIQUE INDUSTRIELLE POUR LA CARBONEUTRALITÉ

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Introduction

Projections for the energy transition indicate the need for a massive increase in the production of materials derived from critical minerals. However, there is a time horizon problem: prices are too low today to stimulate the supply we will need tomorrow. Put differently, after 2030, shortfalls in supply will drive prices up, but it will be too late to develop the mines necessary to alleviate the crunch. The rapid change likely to be induced by the energy transition will come up against the long lead times needed to develop mines.

Meanwhile, amid growing geopolitical tensions, Western countries are trying to diversify mineral supply in order to reduce dependence on China. Currently, China dominates the mining and processing supply chains for transition metals. Moreover, China does not suffer from price uncertainty. Its state-owned enterprises can take patient stakes in mining assets and rely on steady, predictable development timelines. When prices dip, Western firms pause investment while Chinese companies step in to scoop up bargain assets.

Canada has the potential to become a major player in critical minerals and materials supply chains. Canada is poised to benefit from the *Inflation Reduction Act* of 2022, which specifically incentivizes minerals and battery components from North America and free trade partners. As a trusted ally with strong resources, a leading environmental record, and deep expertise in the mining sector, Canada is essential to friendshoring efforts in the US, Europe, Japan, and Korea.

The Canadian Federal Critical Minerals Strategy, also launched in 2022, aims to position Canada as a global leader in production and processing of critical minerals. There is $3.8 billion in federal funding available, but in two years practically no new projects have been initiated. Clearly, permitting delays need to be streamlined and fast-tracked, but there are also much bigger challenges to ramping up investment. In a July 2024 report, the Critical Minerals and Materials Task Force convened by Accelerate and MaRS Discovery District shared input from industry leaders on next step actions that can be undertaken in 2024-25 to support the goals of the Canadian Critical Minerals Strategy.[1] Next steps included: developing critical minerals production targets, developing Environmental, Social, Governance and Indigenous (ESGI) standards, focusing on materials manufacturing, driving private investment in critical minerals projects, and developing key performance indicators.

Following the passage of the *Inflation Reduction Act*, Canadian mining projects that were ready to move to final investment decision advanced rapidly as automotive manufacturers scrambled to meet the friendshoring content requirements for key vehicle incentives. But subsequently, only a handful of major projects have advanced. Why, despite Canada's ambitions and strong position, has development been hampered?

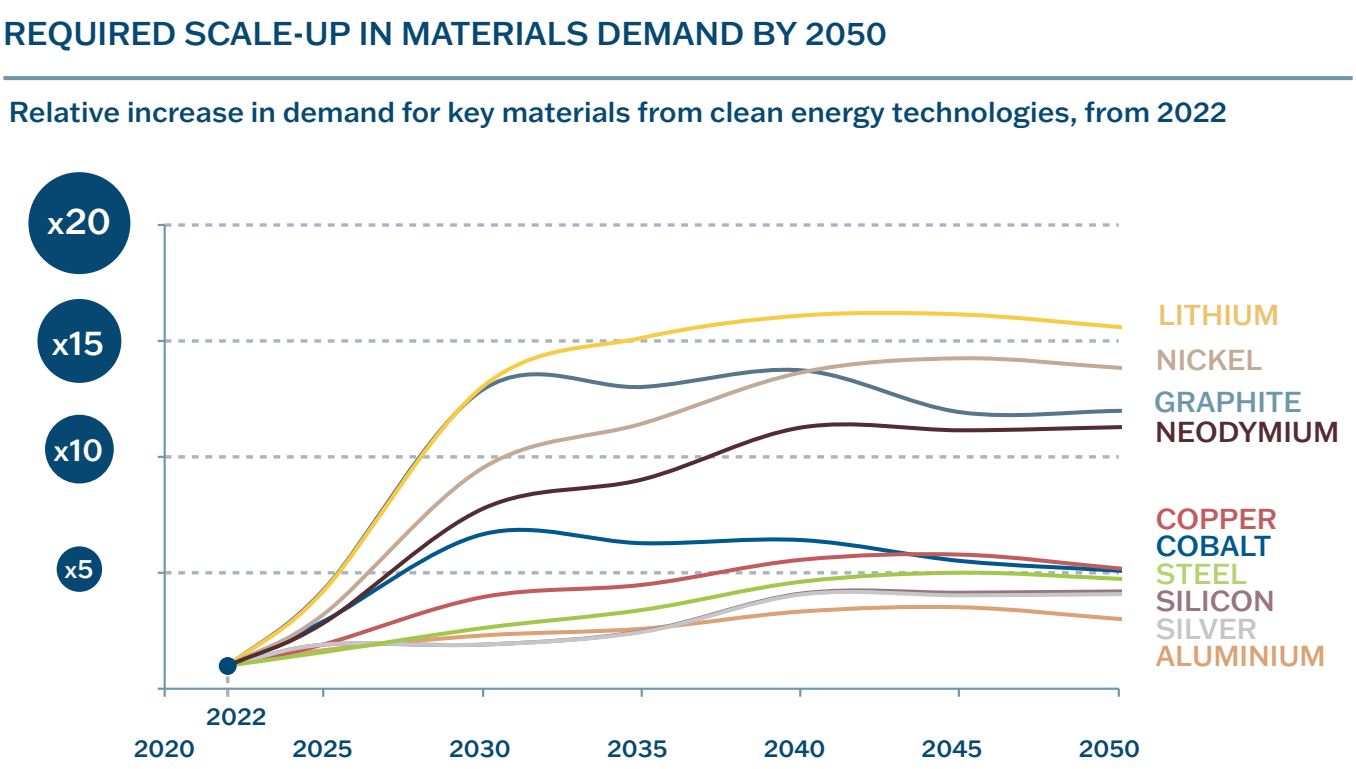
In short, the problem is the uncertainty surrounding demand, which creates price uncertainty. Lithium and nickel prices have crashed from pandemic highs. Copper prices have risen modestly, but big question marks cast shadows over its future. Incredible amounts of graphite are needed for the transition, but the potential growth of synthetic and silicon anode alternatives hampers the long-term outlook.

To overcome these challenges, Western governments and experts are starting to think about mechanisms to create the demand-side certainty necessary to drive needed development today. This policy brief surveys the options which range from a variety of price supports to procurement strategies to financialization efforts.[2] We lay out a framework for evaluating different approaches, arguing that contracts for difference represent a strong option that balances societal risks and benefits.

Investment is not keeping up

The IEA projects that demand for critical minerals will increase considerably, with lithium growing over 40 times (4,000 per cent) by 2040, followed by graphite, cobalt and nickel at 20-25 times.[3] The Energy Transitions Commission estimates that cumulative investment needs for cobalt, copper, graphite, lithium and nickel from 2021–50 are in the US$1.1-1.7 trillion range, with about two-fifths of this

Figure 1 (Source: Energy Transitions Commission, 2023).



(US$480–750 billion) being in the mining stage of the supply chain.[4] The total value of metals production is expected to increase by a factor of four up to 2040.[5]

This could require a staggering 330 new mines to come into operation globally over the next decade.[6] Globally, about three-quarters of the projected investment needs are required within the next decade to meet the increased demand scenarios, or about US$70 billion per year. With average investment levels of US$47 billion over the last decade,[7] the current investment gap is estimated at about US$25 billion per year.[8]

Yet, financing of critical minerals for the energy transition faces considerable structural challenges. Projections of the required growth in production indicate a supply crunch is coming. China currently accounts for the majority of global supply of transition metals, for example, about two-thirds of lithium processing, over 75 per cent of cobalt processing and nearly 100 per cent of germanium processing for EV battery materials. The US, Europe and their allies have a goal of reducing this dependence, while also seeing unprecedented growth in global production. This presents a major opportunity for Canada.

Despite the likelihood of unmet demand, it is difficult to get mines funded, both in Canada and elsewhere. Investors in mines want to see a clear indication of purchase agreements. That is, they want to be certain that demand will be there. At the same time, financers of downstream processing (for example, manufacturing of battery ready materials) also want to see assurances of upstream supply of metal inputs.

The fact that these are long-term investments exacerbates the problem, particularly at the mining stage where it takes 10-20 years to get a mine from exploration to production. Importantly, however, it only takes an average of approximately four years to get a mine from feasibility studies to production (figure 2). Nonetheless, the short-term calculations in capital markets do not match this situation. Therefore, there is more vertical integration, with many auto OEMs moving to secure supply for batteries and constituent minerals, right up the supply chain.

Figure 2 Timescales for mining projects are long, reducing the ability of the sector to respond to supply shortages and high prices

¹ For mining this includes discovery and exploration, and feasibility and construction through to production.

SOURCE: IEA (2021), *The role of critical minerals in clean energy transitions*; Petavratzi and Gunn (2022), *Decarbonising the automotive sector: a primary raw material perspective on targets and timescales*; IEA (2023), *Energy technology perspectives.*

Understanding critical minerals and materials markets

Recent decades have seen strong consolidation in the mining sector at a global level. The structure of the industry has hollowed out, with larger global conglomerates on the one hand, and a larger array of juniors on the other. The financial crisis of 2008 broke the previous commodity supercycle with long-lasting effects in the mining sector.

These structural changes mean that Canada is now home to far fewer major mining companies. Currently, there is a significant lack of financing for mining juniors in Canada. For almost 10 years, returns on junior mining stocks have been too low to interest investors.[9] Some juniors could scale into operators, but again investors may deem a rising firm too risky. Between 2000 and 2020, many Canadian companies found willing investment from China, but with changing geopolitics, the government is screening such FDI moves far more carefully.

A rare recent example of success is Foran Mining Corp., which recently approved a $600 million copper and zinc project in Saskatchewan.[10] The initial funding round for this project caught the attention of critical minerals watchers because it represented a junior moving into operations with a unique group of funders. The round was led by Fairfax Financial Holdings, an insurance company, and the Ontario Teachers' Pension Plan.[11] These are not the kinds of actors that usually take on mining development risk. The experience of the Foran team, featuring the former head of Glencore's Canadian zinc business and a technical lead from Vale Canada, surely is part of the equation here. Nonetheless, it is the exception that proves the rule in Canada: mining projects are not advancing.

To understand the problems in critical mineral investment in Canada we need to take a broader look at minerals markets. Volatility in critical minerals markets is driven by three main factors: the close connection to business cycles, the time horizon problem, and the lack of transparency in relatively illiquid markets. First, mining demand is driven by

economic expansion, so it booms and busts with growth and recession. Second, large price increases induced by structural shortfalls are needed to incentivize investment. In these periods, profit expectations attract more investment than expected demand justifies, resulting in considerable price declines. Third, some emerging critical minerals markets are small and illiquid. Market movements are harder to track as many transactions consist of private deals between individual companies, in contrast to many base metals which are traded on commodities exchanges, such as the London Metals Exchange. This results in a lack of transparent information on prices, and even underlying demand and supply. This is yet another factor increasing uncertainty and restricting investment.[12]

Thus, it is no accident that China has come to dominate the critical mineral sector. Its current position is the result of a deliberate and intentional industrial strategy going back more than two decades.[13] Chinese companies, with state backing, acquired a number of Western interests in a range of minerals over 2005-2020, and also invested in mines in emerging countries. China has also developed domestic mining, particularly of rare earths.[14] The rapid growth that has been observed so far, driven by Chinese state enterprises, has largely bypassed international markets and exchanges (particularly through direct investments and contracting).

On top of that, the market dynamics are distorted and even manipulated by large players for strategic advantage. The biggest example, of course, is China whose approach to industrial policy means that its companies, particularly the state-owned enterprises, are less exposed to market dynamics and pressure from investors in capital markets.

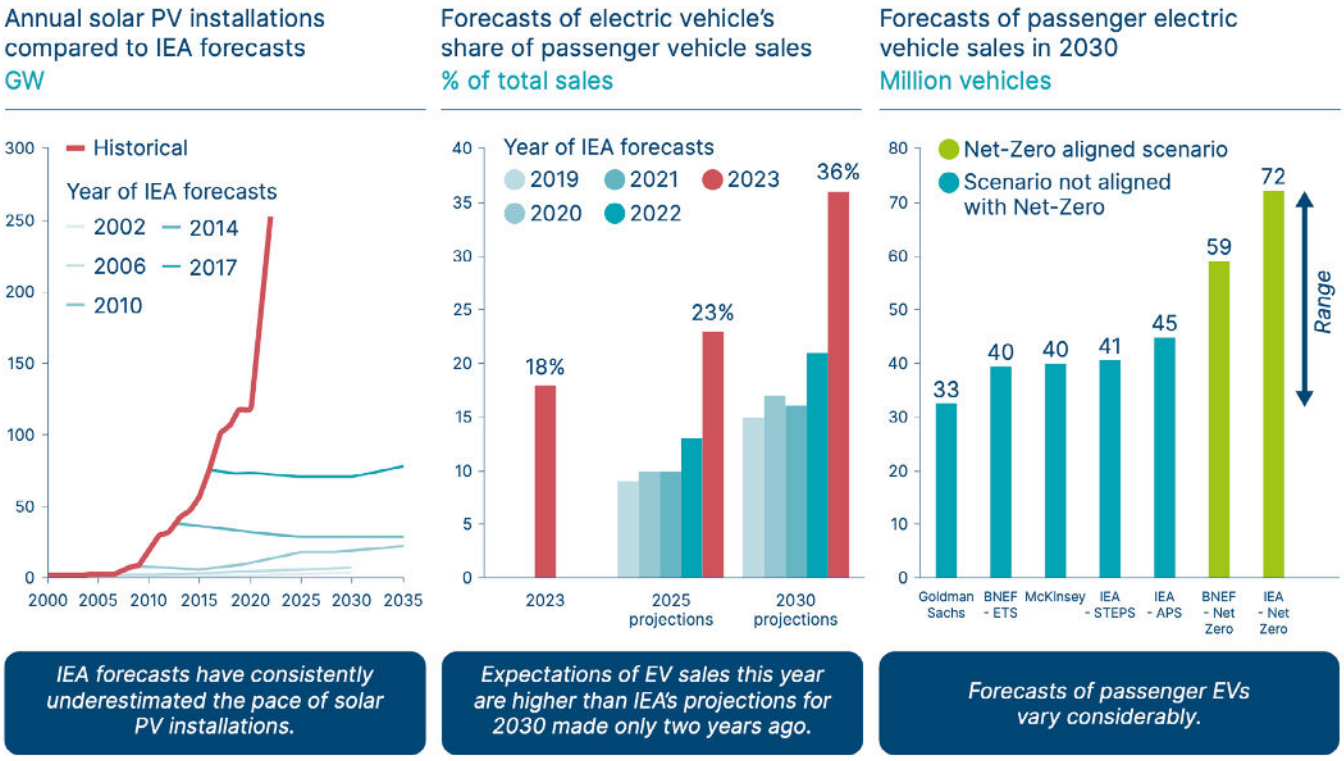
Recent market dynamics over the past year illustrate the challenges facing investors in critical minerals in the face of strategic moves by China. During 2023, lithium spot prices fell by 75 per cent due to concerns about over-investment at the global level, weakening demand for EVs in the US, and strategic market moves by large suppliers.[15] Chinese firms have exploited the market circumstances to dump stockpiles of lithium (and other metals) on international markets. Other strategic moves by China include introducing export restrictions on rare earths, gallium, germanium, and graphite.

Far from being a problem, such volatility is desirable for large players. Mining majors with low-cost operations are in a position to benefit from big price increases that create large profit margins. Moreover, large firms are in a better place to ride out bad times. But price volatility and excessive speculation inhibit supply chain growth, reinforcing a short-term perspective by market players.[16] The result is visible in the current investment shortfall in critical minerals.

In addition, there is the difficulty in accurately forecasting how fast demand will grow for EVs, batteries, and all their inputs. Transitions are typically characterized as following smooth S-curves of adoption. Yet, in reality, the adoption of new technologies, products, and systems follows more of a bumpy road—one that is S-shaped in general, but generally full of stops and starts.

This uncertainty manifests itself in the wide range of demand scenarios for EV sales. These forecasts reflect assumptions about adoption, which are based on production considerations, technological advances, and government support. Just looking at the experience of the last few years demonstrates how such scenarios cannot anticipate specific turning points, which cause an acceleration in sales, possibly of a temporary nature (see Figure 3 on the next page). For example, landmark government initiatives, such as the US Inflation Reduction Act, are particularly prominent in providing a step-jump impulse to investments.

Figure 3. Clean energy deployment is hard to predict, making future material demand forecasts and investment decisions uncertain



NOTES: ETS = Economic Transition Scenario; STEPS = Stated Policies Scenario; APS = Announced Pledges Scenario.

SOURCE: Auke Hoekstra/IEA World Energy Outlooks; Hoekstra et al. (2017), *Creating Agent-Based Energy Transition Management Models That Can Uncover Profitable Pathways to Climate Change Mitigation*; BNEF (2023), *Interactive data tool – Global installed capacity*; Hannah Ritchie/IEA Electric Vehicle Outlooks; BNEF (2022), *Long-term electric vehicle outlook*; Goldman Sachs (2023), *The ecosystem of electric vehicles*; IEA (2023), *Global EV outlook*; McKinsey & Co. (2023), *What is an EV?*

The task of scenario development is even more challenging further upstream in the value chain. On top of the uncertainty surrounding final product demand, there are additional considerations concerning battery innovation, new chemistries, technical efficiencies, feedstocks from waste streams, and recycling possibilities. The bottom line is that a number of factors will continue to drive price volatility as the transition progresses.

Right now, the global mining community is potentially entering another round of consolidation.[17] This is what happened in the early years of the last commodity supercycle. Before large mining companies developed new projects, they sought to expose themselves to in-demand metals through acquisitions. The goal of such action is to acquire producing assets at low cost just before prices enter a structural increase.

How to increase certainty

The business and investment model that has characterized the international mining industry through periods of regular, secular growth is inadequate for rapidly scaling new market segments, such as critical minerals. Current market structure is not suitable to rapidly scaling the use of commodities such as critical minerals because the volatility and uncertainty reduces investment incentives considerably.

How can government work with industry and investors to create greater demand and price certainty for critical minerals projects? There are a number of potential approaches:

- Price supports (including pure subsidies, price insurance, feed-in-tariffs, or contracts for difference)
- Procurement (including government purchasing and strategic reserves)

- Equity stakes
- Local content regulations (including friendshoring requirements)
- Financialization

First, price supports include any measures to offset costs or guarantee prices. This includes pure subsidies such as grants or tax credits. Canada is currently offering investment tax credits to critical minerals projects at the exploration, mining, and processing stages.[18] These subsidies are helpful in increasing the attractiveness of a project, but critically, tax credits do nothing to reduce uncertainty about future prices and returns.

Thus, some have called for forms of price insurance or a global feed-in-tariff.[19] A feed-in-tariff or price insurance sets a floor price and when market prices go below that floor the government covers the difference. Such an arrangement allows firms to keep all the upside when prices rise above the floor but none of the risk on the downside. For this reason, firms prefer it.

Commodity price insurance is not new. Oil-dependent emerging economies developed price insurance schemes to stabilize macrofinancial flows.[20] Large fluctuations in oil import prices can strain government finances and possibly even financing of current account deficits, particularly in the case of emerging economies. In the agricultural sector, the EU has provided minimum guaranteed prices for farmers for principal agricultural commodity crops. This has also acted as a protective, market-distorting measure, leading to complaints from other agricultural exporters. For its part, Canada still has a number of supply management frameworks for some agrifood products (complemented by import barriers) to provide certainty to producers.

A contract for difference in this context is effectively price insurance or a feed-in-tariff, but with risk and revenue sharing. First, governments would write metal- or project-specific contracts at a strike price. If metal prices are below the strike price, the contract operates as insurance for companies. If prices rise above the strike price, the government keeps the upside revenue. In this way, governments and firms share the risk and the profits.

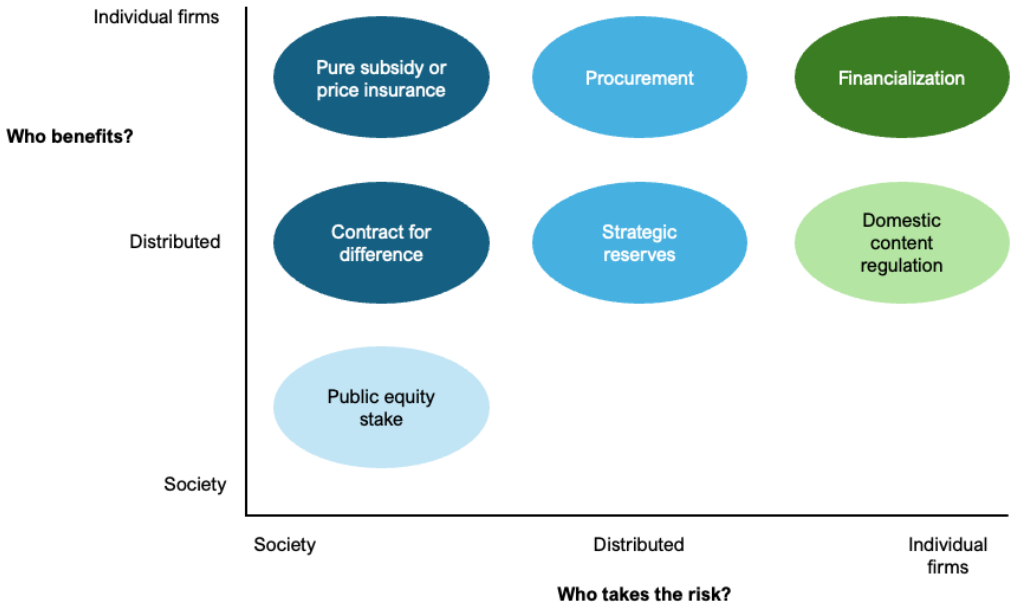
Second, procurement could include any government offtake or purchase agreement. Procurement can advance mine development by ensuring demand-pull at an agreed upon price. To the extent that the government entity buys when other buyers would not, or at a price others would not, it could help advance mine development that would moderate price fluctuations. Procurement efforts might be expanded to encompass recent proposals for expanding strategic minerals reserves into critical minerals.[21] Japan already stockpiles industrial metals, for example, to derisk supply and stabilize costs for its conglomerates.[22] An EU proposal for creating a buyers' club for critical minerals is under development.[23] There have been calls for a strategic minerals reserve analogous to the strategic petroleum reserve in the US.[24] Stockpiles would allow the government to exercise greater control over price movements in supply chains in the future and to ensure continuity of supply.

Such procurement need not be divorced from market dynamics. Procurement contracts can follow the formula pricing used widely in metals markets where payments are benchmarked to future market prices. Such formulas are now being applied in long-term contracts between OEMs and critical materials producers, such as that concluded in February 2023 between Nouveau Monde Graphite and GM and Panasonic.[25] This deal should be seen as emerging from Québec's active industrial strategy to develop a battery supply chain. The commitments to battery plants in Bécancour benefit from provincial and federal support, and build on years of coordinating and catalyzing actions by government agencies and Propulsion Quebec.

Clearly procurement and offtake agreements place considerable demands on the government for technical expertise across a range of minerals and associated materials. For example, procurement agreements would require detailed clauses concerning quality and purity characteristics. This varies even for any specific metal, and will continue to evolve as innovation proceeds, particularly in improving battery chemistries and developing alternatives.

Third, governments can take equity stakes by purchasing shares in mines or mining companies. Investissement Québec took a 12 per cent stake in Nouveau Monde in 2021.[26] The US Development Finance Corporation has supported mine development through equity stakes in Techmet.[27] Equity stakes help reduce demand uncertainty by funding mine developments that might otherwise not be able to secure private investment. However, unlike with pure subsidies, governments can generate returns from these stakes. They put capital at risk in order to drive development, but they can see profits if companies are successful. From the firm's perspective, equity is considered more expensive than debt. Equity "costs" the founders more than debt if the

Figure 4. Tools to ameliorate demand uncertainty in critical minerals markets



company's valuation rises faster than the interest rate. So all things considered, a startup or rapidly growing company would prefer to have cheap debt or a loan guarantee than to dilute equity. Nonetheless, equity stakes can be a powerful way for firms and governments to collaborate.

Fourth, local content requirements mandate that projects or companies use domestically sourced minerals. These regulations are popular among governments because they do not cost anything. Often, local content requirements are imposed as requirements on government-backed loans or tax incentives, as in earlier iterations of Brazil's wind strategy.[28] The *Inflation Reduction Act* expanded the concept to mandate friendshoring: in order to receive the 30D tax credits, companies needed to source materials from North America or free trade agreement partners. Such requirements create secure demand for local or friendshored materials in a very direct manner. However, since prices are ultimately passed on to consumers, mandated high-priced local goods could theoretically have a negative effect on demand.

Finally, financialization efforts seek to create more liquidity and drive countercyclical investment in minerals markets. A recent proposal argues that financial innovation could be used to allow producers to hedge against price volatility while other actors take long positions during price crashes.[29] To make hedging against price movements possible, metals products must be fully standardized and commoditized, to support the operation of benchmark prices and indices. In addition, the government must enable companies to stockpile metal and allow financial products to be designed on those products.

Risk and benefits: evaluating the tools

Which tools are best to create secure demand for critical minerals? Figure 4 provides a framework for thinking about tradeoffs between the different tools outlined here. Consider two broad criteria we could use to assess risk taking and distributional outcomes: Who takes the risk? Who benefits?

In a situation fraught with uncertainty, risk-taking is inevitable. Risk can be taken by individual firms or by society as a whole through government action. Firms have called for governments to de-risk the transition. However, a key principle of market economics is that actors who take on risk should receive the benefits of that risk. If the transition is de-risked by society as a whole through government, society should receive some benefit for risking its capital.

That is, benefits can be distributed across all of society or be returned to individual firms. Firms only measure benefits in revenue, avoided costs, or actions that increase the likelihood of either revenue or avoided costs. But societies pursue

multiple objectives beyond profit. For the purposes of this analysis, we will focus on profit sharing as the critical benefit.

Starting in the top left, a pure subsidy or price insurance uses societal funds to de-risk private investment. When prices are high, firms get to keep all the profits. When prices are low, the government covers the difference. Germany has long offered price guarantees to renewable energy, but recently these have come under fire. When European energy prices spiked upon the Russian invasion of Ukraine, power producers kept all the upside. But now that prices are low again, stress is mounting on the German budget. This has led the government to propose switching from price insurance to an upfront investment subsidy (akin to an investment tax credit, like Canada has).[30]

A contract for difference addresses this by distributing profits between the government and firms. An equity stake goes further, since the government operates as a regular shareholder and thus keeps both the increasing value of the equity and any profits paid out as dividends. Moving to the right, procurement distributes risk, as the government agrees to support a firm at higher than market prices in the hopes that a mine is developed, and the firm is successful. The firm still takes on risk, because they need to invest and operate as usual. But all the profit still accrues to the firm. In this way, procurement operates just like a subsidy if the government pays above market rates.

Strategic reserves distribute benefits and risk. Government entities buy at predominantly market prices and since prices shift, these entities take on risk (the same risk that regular producers and consumers in the market take on). But as in equity stakes and contracts for difference, those public entities can benefit from price increases because their stockpiles will accrue value. If they hedge properly, they will benefit too.

Financialization privatizes risk and benefits. It also leverages the profit motive and funds in financial markets to help reduce uncertainty. But it creates a potentially perverse outcome. Right now, large mining companies dominate the relatively illiquid critical minerals markets. If mining companies profit during periods of steep price increases, those profits stay in the company or in the group of mining investors. If the market is financialized, it creates the possibility that profits and therefore capital will flow out of the mining sector and into the general financial pool. At this time, keeping capital within the sector is desirable, as it drives up investment. Ensuring that mining profits are relatively "sticky" (tied to mining company equity owners) might then be a good thing.

Finally, content requirements sit uneasily in this schema, but broadly they can be seen as splitting risk between producing and consuming firms. By forcing consuming firms to buy from local producers, they can induce a cost to those firms (and their customers), but the risk is still wholly private since no societal funds are used. Profits are all kept private too, so benefits are not directly distributed, but we can see an *indirect* distributed benefit in that a local content requirement guarantees local economic development. It is worth noting that the effectiveness of content requirements in improving investment attractiveness are less clear and need to be further investigated.

In this schema then, financialization, contracts for difference, strategic reserves, and equity stakes all share a common feature: the benefits flow to the parties taking on the risk. Equity stakes are highly desirable in this regard, however since they are expensive to firms they will only have a limited role. Strategic reserves are desirable on this schema too, but are likely to have limited effects on price volatility given the scale of the markets we are dealing with. Financialization also has some desirable characteristics, but it creates the risk that mining profits could be expropriated and taken elsewhere in the economy. It will also be very difficult to achieve technically, because standardization in mineral intermediates is not a simple task.

Contracts for difference also create a risk of expropriation. Government entities could return mining profits to the general purse. However, policymakers could ensure that this does not happen by creating a contracting entity that is able to recycle revenues only within the critical minerals sector. In many respects, the contract for difference, if well designed, is the ideal solution. It would have the same effect as financialization would. Working well, a fully liquid futures market for metals would mean that producer puts and outside options clarify a strike price. But with high quality information about mining costs and optimal internal rates of return (IRR), a negotiated strike price in key markets could be close enough to this ideal and still radically reduce demand uncertainty for would-be developers.

Given that high quality public information for mining investment and operation costs already exists, creating good contracts should be straightforward. The contracts could be structured with expected profits built in. While mining majors might be reluctant to let go of a big piece of their business model, capturing profits from price spikes, many mid-size and junior miners would surely be willing to write a contract with a guaranteed IRR. Moreover, the

Government of Canada has invested in expertise for contracts for difference in carbon markets.[31] So the financial and budgetary side of the policy problem are already well understood. Moreover, Canada has a contracting entity, the Canada Growth Fund, that is already writing contracts.

In short, while there may be a role for any of the nine tools proposed here, contracts for difference would be a particularly powerful tool to catalyze development in Canadian critical minerals markets.

International cooperation

Even with novel instruments such as price insurance or procurement, Canada likely cannot tackle this problem alone. No single country has all the requisite minerals in sufficient quantities, meaning that the supply chains for batteries and their materials will cross national boundaries. Western countries have announced their aim to diversify their supply chains and reduce reliance on China.

The U.S. established the Minerals Strategic Partnership in 2022 together with Canada, 12 other countries, and the EU.[32] The MSP is working to identify and support more than a dozen projects spanning the entire supply chain, focusing on meeting stronger ESG standards. Notably, none of these current projects are located in Canada.

The MSP or other initiatives could lead to international collaboration on offering price guarantees or insurance to project developers. Particularly relevant for emerging economies is the possibility to link such mechanisms with more generous royalties and other value-sharing provisions. A range of additional trade-related supports can be contemplated, including reduced tariffs, concessional financing, and access to technology. The MSP can also inhibit the emergence of international cartels on either the producers or the purchaser side, which could further distort market dynamics and inhibit investment.[33]

Going Forward

If Canada is going to realize its promise in the coming critical minerals boom it will need to innovate mine development in and around market dynamics with an active industrial policy approach. We have three top recommendations:

1. Use the critical minerals strategy funds to unlock a "first project" in 2-5 promising geographies. Think of the funds as catalytic: providing the infrastructure and project finance to demonstrate the viability of Canadian mining development. Ideally, there would be enough funding for one demonstration project in each key area: nickel, copper, graphite, lithium, and rare earths.[34] But if not, nickel and copper in new geographies (e.g., Northern BC) should be prioritized as they have the highest long-term upside.

2. Explore options for enhancing price certainty that would support a limited set of mines in any jurisdiction. Federal and provincial governments should work with experts and allies to identify the potential for using tools, such as contracts for difference or price insurance, to enhance price certainty for critical minerals projects. This would include rigorously assessing the feasibility of creating a strike price for such schemes in nickel, copper, graphite, lithium, and rare earths. This is a tool that is already being deployed outside of the critical minerals context by prominent actors in the clean growth ecosystem (ex: Canada Growth Fund).[35] The next steps should involve sharing expertise among ecosystem actors to inform program design considerations, such as developing critical minerals-specific financial risk modelling. The price could be high enough to support mine development today, but not so high that it enables firms to rent-seek. Whereas the funds above would be deployed in a targeted manner, this program would be more open-ended, but only available for a defined amount of production in each metal to ensure budgetary limitations are respected.

3. Lead global initiatives at the G7 and G20 for joint critical minerals policy and a global contract for difference. Ultimately, if the West wants to de-risk critical minerals supply chains, it will need a patient global capital fund for mining. This fund needs to mobilize approximately $900 billion.[36] If properly capitalized, allied governments would need to put up at least 1/6th of that total, or about $150 billion. This could seed a fund that could issue contracts for difference at agreed strikes, recycling revenue received from prices above the strike into future contracts. Canada should make seeding this fund a key piece of its upcoming G7 presidency.

For critical minerals and downstream materials, state-owned and state-supported enterprises are playing a dominant role in international investments and markets. It is not a question of whether to intervene in the market or not—this is already happening. The question is does Canada, together with allied, friendly governments, want to act to secure societal benefits from the coming mining boom. If so, one or a number of the tools above must be deployed.

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