Mining and the Green Energy Transition

Environmental and Social Considerations

Conservation Council *of* New Brunswick

The world needs to drastically reduce greenhouse gas emissions to keep global warming to 1.5°C and limit the more serious effects of climate change.

The transition to renewable energy technologies will help decrease reliance on greenhouse-gas emitting fossil fuels in all facets of our lives, such as electricity, home heating, and transportation. This transition, however, needs to happen in a way that does not create other social or environmental problems.

The federal government is pursuing two policies that will increase the amount of electricity needed to power our day-to-day lives: a zero-emissions vehicle mandate and a net-zero electricity grid based on a clean electricity standard, both by 2035. The two policies require the widespread use of wind, solar, small hydro, battery storage such as lithium-ion batteries, and energy-efficiency technologies, to power homes, vehicles, and industries with minimal carbon emissions. Many of these technologies require rare earth minerals, metals, and other types of minerals that need to be mined in sometimes invasive and destructive ways. The demand for these metals and minerals to power the green energy transition will increase substantially over the next decade.

It is crucial that the transition to a sustainable economy is fair for workers and Indigenous communities, here and abroad. A green economy in New Brunswick and Canada should not come at the expense of the rights of Indigenous communities or their land anywhere on Earth.

Circular Economy and Reducing New Extraction

The most environmentally-friendly mineral is the one that is not used at all. In addition to more responsible mining practices and policies, businesses and consumers must reduce resource use altogether. Instead of relying on innovations in efficiency and recycling, there are policies that can be enacted today to help lower demand for new metals and minerals.

For example, whereas electric vehicles are resource-intensive technologies, single-occupant vehicles should not be seen as the default, primary mode of transportation. Instead, investments and policies that prioritize public and active transportation can enable people to live car-free and help lower demand for new metals and minerals. City councils should prioritize urban density instead of facilitating sprawl.

The Conservation Council of New Brunswick recommends that Canada work toward a CIRCULAR ECONOMY and develop policies that reduce demand for new metals and minerals to limit the harm done to the environment and Indigenous and settler communities from resource extraction. This factsheet looks at some of the ways we can achieve this.

Dense communities with public and active transportation options help people meet their daily needs without a personal automobile, lowering overall resource and energy demands.

In addition to policies that lower metal and mineral demand, another method is to set rigorous battery recycling programs to reuse as many components of lithium-ion batteries as possible. A 2019 Government of Canada report based on stakeholder consultations identified battery material recycling and the circular economy as significant economic opportunities as the world transitions to a low-carbon economy.

The three objectives of a circular economy, according to a report by the Materials Efficiency Research Group and Enviro Integration Strategies Inc., are to:

1) design waste and pollution out of the economic system;
2) keep products and materials in the system and at their highest utility for as long as possible; and,
3) regenerate natural systems to protect essential ecosystem services such as clean water, clean air, healthy soils, carbon storage, and flood protection.

A report by the Institute for Sustainable Futures highlighted recycling and efficiency upgrades as the most important strategies to offset new mineral demand. Plans must be developed now to offset demand for newly-mined minerals, including repairing and reusing components, refurbishments, remanufacturing, repurposing, and recycling. Governments must mandate battery recycling for all electric vehicles and renewable energy technologies that reach the end of their life.

The goal is to create a circular economy for renewable technologies where products are recycled at the end of their useful lives for the next generation of renewables.

What minerals are most in demand?

Renewable energy technologies such as wind, solar, and battery (lithium-ion) storage require various metals and minerals. For example, in first- and second-generation photovoltaic solar panels, it is the conductivity of crystalline silicon that allows the cells to capture energy from the sunlight and convert it to electricity.

Lithium-ion batteries, important for electric vehicles and energy storage, use several metals and minerals, including lithium, copper, cobalt, nickel, manganese, graphite, and zinc. The mining and processing of these metals and minerals for batteries are among the most in-demand and can be problematic to human health and the environment.

Where does mining take place?

Mining takes place all over the world. While mineral deposits are spread globally, key minerals for the green energy transition are often found in the "global south" and areas with an enduring legacy of colonialism. This makes them vulnerable to exploitative labour practices, less stringent environmental and health regulations, and corruption by mining companies. The majority of the world's supply of cobalt is located in the Democratic Republic of Congo; rare earths and graphite in China; nickel in Indonesia, Philippines, and Russia.

Social and environmental impacts can also be significant for metals and minerals that are mined to a large extent in the "global north" and in advanced democracies, such as lithium in Australia and Chile, nickel in Australia and Canada, and copper in Chile, Australia, and the USA.

Most of the world's publicly-listed mining companies are registered in Canada (75 per cent). Mining industry critics have argued that, from the industry's point of view, Canada is the ideal jurisdiction to register a mining company due to its "permissive regulations, advantageous tax structure for mining companies, unusually strong anti-libel protections for mining companies, and active government support for the industry."

What are the environmental and social consequences of mining?

Although mining operations help supply the minerals necessary for low-carbon energy transition technologies, there are instances of environmental destruction, labour exploitation, serious health complications, and human rights abuses. Many of the mining companies registered in Canada conduct their operations in the global south and regions with enduring legacies of colonialism, exploiting lax environmental and labour protections.

Digging for copper

Photo by Fairphone (Flikr)

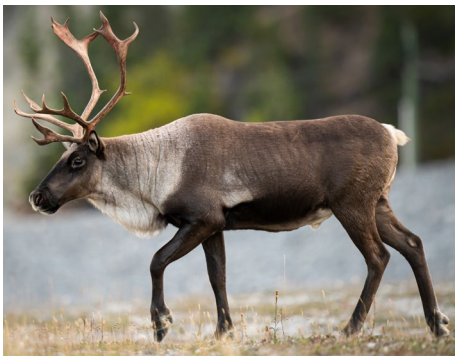
Children show off their copper haul

Here are three examples of the types of injustices or human or environmental damage from mining, in Canada and abroad, that must be fixed as part of the low-carbon transition:

1. Indigenous rights

The rights of Indigenous peoples must be upheld as Canada and nations around the world move to secure mining resources for the energy transition. The proposed "Ring of Fire" mining development in Northern Ontario is a good example of why fair, meaningful engagement with Indigenous peoples is paramount.

Located in Ontario's far north, the Ring of Fire is considered one of the most promising deposits for critical minerals in the province, with government officials claiming the region has long term potential to produce chromite, cobalt, nickel, copper and platinum. The mining development, however, would impact nine First Nations, and several of them have pushed back against it, including a court challenge from Neskantaga First Nation. Neskantaga, which has been under the longest boil water advisory in Canada (26 years), says the provincial government's consultation has been inadequate and says concerns about the mining development include environmental damage, loss of precarious wildlife populations like caribou, drinking water pollution, and loss of the Indigenous way of life. Opposition from Indigenous communities who say they have not been adequately consulted is one of the reasons the Ring of Fire development has seen little movement in 10 years.



The energy transition is part of reconciliation with Indigenous communities, requiring meaningful consultation, Indigenous input and Indigenous co-ownership for resource extraction on their ancestral lands with free, prior, and informed consent. Mining laws in every province need updating to reflect reconciliation and the rights of Indigenous peoples.

2. Environmental


Lithium mine

Lithium mining requires a significant amount of water, which can deplete local water resources for human consumption and farming. Three South American countries—Bolivia, Argentina, and Chile—hold approximately half of the world's known lithium supplies beneath their salt flats. This is problematic as the region is arid and dry. To extract lithium, miners drill holes in the salt flats and pump a water-based mixture into the wells, forcing a salty, mineral-rich brine to the surface.

This creates a 'mineral soup' which is left to evaporate under the sun for approximately 12 to 18 months—until the mixture precipitates or is concentrated enough to extract the lithium carbonate (leaving behind other toxic substances). The whole process uses 500,000 gallons of water to produce one tonne of lithium, which is about enough lithium to make roughly 125 average electric vehicle batteries.

In Argentina, lithium mining contaminated fresh water resources used by locals for livestock and crop irrigation. In addition, there is a chance that chemicals dangerous for human consumption can leak into fresh drinking water, destroying the local ecosystem—as happened in Tibet.

Photo by Fairphone (Flikr)

3. Social

Much of the world's cobalt supply, approximately 60 per cent, is in the Democratic Republic of Congo. Congo is also one of the world's poorest countries, with citizens living in remote communities with few resources and a poor standard of living.

Watch:

Blood Cobalt:
The Congo's Dangerous and Deadly Green Energy Mines

YouTube

The country does have access to rich deposits of cobalt, however, which led to the development of "artisanal mines." These mines are home to terrible working conditions: miners (many of whom are children) using hand tools without any protective equipment (such as helmets or respirators) in hand-dug tunnels without any support structure. These conditions led to the death of at least 80 miners in just one year, between 2014-2015. Despite these poor conditions, Amnesty International reported in 2016 that 16 multinational corporations were potentially sourcing their cobalt from Congo's artisanal mines, including Apple, Sony and Samsung.

Artisanal cobalt mine, Democratic Republic of Congo

Photo by Fairphone (Flikr)

In 2022, artisanal mining persists despite many companies vowing to clean up their supply chain after the Amnesty International report. The purchasing of cobalt is less direct, done mostly through middlemen in non-descript depots in the Congo. A report by ABC's Foreign Correspondent found that artisanal cobalt may be mixed with cobalt from mines that are free of child labour, making it impossible to trace. The report notes that it is then sold to manufacturers of phones and electric vehicles and those companies have little assurance the cobalt did not come from child labour and exploitative conditions.

The experience of miners in the Congo demonstrates the dangers of global mineral demand in a region that is generally underdeveloped due to the legacy of colonialism. Years after the initial cobalt mining boom in the Congo, workers continue to be exploited and lack the proper tools and equipment to mine safely. Despite having cobalt-rich land in their backyard, the Congolese do not own the resource, with the majority of supply being bought by Chinese companies with lax safety standards.

A 2021 report by RAID (Rights and Accountability in Development) describes the labour abuses as "colonial-era" – including excessive working hours, degrading treatment, violence, discrimination, racism, unsafe working conditions and a disregard for basic health provision.

If cobalt is to play a central role in the clean energy transition, there needs to be a concerted effort among governments, companies, and consumers to ensure it is sourced ethically and benefits the community from which it comes.

Solar, wind, and nuclear power have lower lifetime emissions than coal or gas with carbon capture and storage.

Carbon emissions for making and using renewable energy technologies are much less than fossil-based technologies

Low-carbon technologies, despite being essential components of a net-zero future, have a carbon footprint due to the mining, shipping, and manufacturing stages of their lifetime.

Technologies such as wind turbines, solar panels, and batteries for electric vehicles require significant mineral inputs. Yet, their associated climate impact pales in comparison to their fossil counterparts.

For example, while electric vehicles have a higher initial carbon footprint than their fossil fuel counterparts due to the increased use of rare earth minerals, the elimination of tail-pipe emissions gives electric vehicles a significant edge in total lifetime carbon footprint. One analysis found that a Tesla Model 3 would have to be driven only 22,000 km before it does less harm to the environment than a Toyota Corolla. The only continued CO_2 emissions from the Tesla are those associated with the source of the electricity charging its battery, which will decrease in Canada as provinces move toward net-zero electricity grids by 2035.

Similarly, wind turbines and solar panels have low lifetime emissions. One study found that solar, wind, and nuclear power have lower lifetime emissions than coal or gas with carbon capture and storage.

The CO_2 emissions per kilowatt hour (kWh) of electricity generation is just six grams for solar and four grams for wind. Coal with carbon capture and storage (CCS) is 109 grams, gas with CCS is 78 grams, and bioenergy is 98 grams.

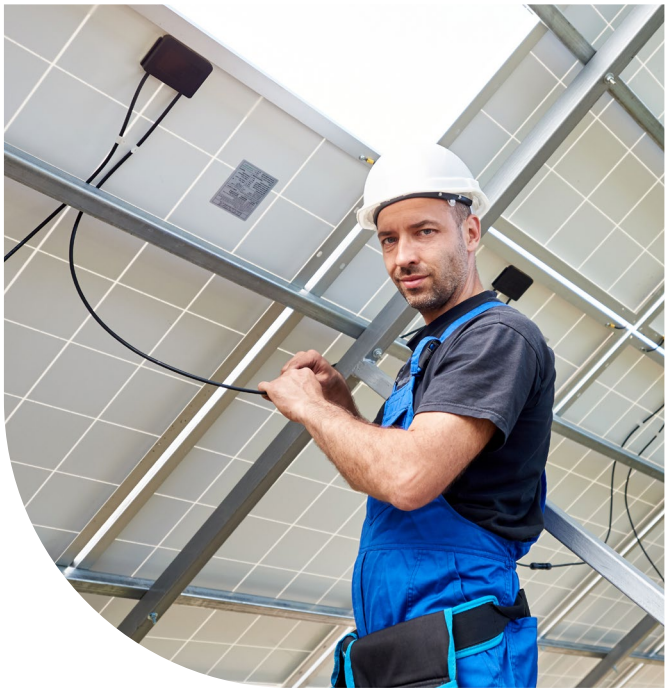
Renewables require more mineral inputs than their fossil counterparts and could result in supply chain challenges

The renewable energy transition requires minerals more than the fossil industry does. As an example, electric cars require six times the mineral inputs than standard combustion vehicles. By and large, the majority of minerals have to be newly mined to meet the initial surge in demand before there is a well-established aftermarket for recycling. The high quantity of mineral and metals inputs needed for electric vehicles makes alternative transportation options not centered around single-occupancy vehicles even more important.

The International Energy Association (IEA) estimates that, in order to sustain the energy transition outlined in the Paris Accord, market demand for copper and rare earth minerals will increase by 40 per cent, nickel and cobalt by 60 to 70 per cent, and lithium by almost 90 per cent. In other words, 90 per cent of lithium produced will go to renewable energy technologies such as lithium-ion batteries for electric vehicles.

The IEA estimates total mineral demand from clean energy technologies will quadruple by 2040. Put in other terms, the total storage capacity of the lithium-ion industry is expected to increase eight-fold from 2017 levels, an increase from 100 gigawatt hours (GWh) of annual energy storage in 2017 to 800 GWhs in 2027. As a result, organizations such as the IEA are urging governments to shift focus from fossil fuels for energy security to reliable, affordable, and sustainable mineral production.

This recommendation is particularly prescient when considering supply chain disruptions caused by the Covid-19 pandemic and the Russian invasion of Ukraine in 2022.



Protecting workers from exploitation and ensuring the health and safety of mining communities

One way to reduce the environmental and climate impact of sourcing minerals for energy transition technologies is to prioritize the recycling, reprocessing, and circularity of those minerals in our economy. While the federal government has made domestic mining in Canada a priority, much of the $3.8 billion committed over the next eight years for critical minerals strategy prioritizes the recycling and circularity of the minerals in our economy—and that's a good thing.

In addition to lowering the climate impact, recycling and reprocessing minerals in Canada poses significant economic benefits. In 2019, the price for lithium spodumene (unrefined) ore was US$600 per tonne; refined battery-grade lithium hydroxide was valued at close to US$16,000. Some of the current or announced supply chain additions in Canada are an EV component factory in Bécancour, QC, an electric vehicle battery plant in Windsor, ON, and a pilot lithium recycling plant in Montreal, QC. Prioritizing the recycling, reprocessing, and the circularity of minerals would be beneficial to the Canadian economy, environment, and workers.

Photo by Fairphone (Flikr)

As discussed earlier, the rights of Indigenous peoples (as well as labour and environmental standards) must be upheld as Canada moves to secure domestic mining resources. Despite efforts to shore up domestic supply, not all components for the energy transition can be sourced from Canada. That doesn't mean, however, that our government should turn a blind eye to the exploitative practices abroad of mining companies registered in Canada. Organizations such as MiningWatch have stepped up to provide oversight of mining companies to ensure that workers, Indigenous communities, and the local environment are treated justly. MiningWatch also runs campaigns to pressure the Canadian government to hold its mining companies, and their subsidiaries, accountable for human rights abuses abroad.

Several organizations also certify environmentally- and socially-responsible mining companies, such as the Initiative for Responsible Mining Assurance, OECD Due Diligence Guidance, Responsible Minerals Initiative, and the Cobalt Institute. While oversight and certification organizations are a good first step, there is no replacement for government regulations and strong labour unions.

Technological advancements in renewable technology

Alongside rigorous recycling regimes and planning for a circular economy, technological advancements in renewable energy technologies can increase efficiencies and reduce input demands. New mining technologies under development in Canada can help lessen the environmental impact of mineral extraction. Likewise, a company in Germany has plans to ship lithium that has zero extraction emissions.

Improvements to lithium-ion batteries have significant positive outcomes for people and the environment. For instance, Tesla has begun to move away from using cobalt for their electric vehicle batteries with the help of researchers from Dalhousie University.

This change reduces battery costs and eliminates the association with unethically-mined cobalt. Companies such as Sila have developed technology that improves the energy density of lithium-ion batteries by 20 per cent, with goals to increase it by 40 per cent. Researchers are exploring the possibility of replacing lithium with sodium for broader applications such as stationary storage and electric vehicle use. Commercially-viable sodium-ion batteries could help unburden the lithium supply market.

Conclusion

A low-carbon future requires the sourcing of metals and minerals such as lithium, cobalt, silicon, nickel and copper, among several others. The expansion in mining, however, poses significant environmental and ethical challenges as resource extraction has been linked to environmental destruction and human suffering.

It is also crucial to invest now in rigorous recycling regimes and plan for a circular economy to reduce the need for newly-mined raw material. A low-carbon future can not come at the expense of the environment, workers, or Indigenous peoples and the well-being of their traditional lands.

Click here for more information on the Conservation Council of New Brunswick's Atlantic Electricity Vision for powering our lives.

Conservation Council *of* New Brunswick

T. (506) 458-8747
E. info@conservationcouncil.ca
www.conservationcouncil.ca

180 St. John Street
Fredericton New Brunswick
Canada E3B 4A9

/conservationcouncil /cc_nb

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