

Quarterly Specialized Report

# Executive Summary

## Introduction to Critical Minerals: Ontario's Unique Position

2022 – 2023



**“The cars of the future will be built in Ontario from start to finish because we made a promise to support our auto sector.”**

—The Honourable Doug Ford, Premier of Ontario

**“Through our Driving Prosperity auto plan, strategic investments across our integrated supply chains, and by reducing the cost of doing business in Ontario by nearly \$7B annually, our government is staking Ontario's claim as a leader in the emerging North American EV battery industry.”**

—The Honourable Victor Fedeli, Ontario Minister for Economic Development, Job Creation and Trade



# Introduction

Our world is fuelled by critical minerals, which are vital components of countless products and technologies. The stability of supply chains is essential to everyday life and is highly dependent upon a reliable supply of critical minerals.

Critical minerals are playing a particularly important role in the clean energy transition, since they are required for the development of several technologies such as electric vehicle (EV) batteries.

Ontario is poised to be a key player in the clean energy transition—and specifically in the production of EV batteries—due to its robust mining and automotive sectors. In addition to its proven track records in both the mining and auto manufacturing sectors, Ontario also has a supportive regulatory framework; an “open for business” attitude; a highly skilled workforce; and a commitment to practices that

align with environmental, social, and governance frameworks. With these strengths, Ontario is uniquely positioned to develop a thriving end-to-end EV value chain that stretches from critical mineral extraction, processing, and refining to battery production, battery use, battery repurposing, and battery recycling.

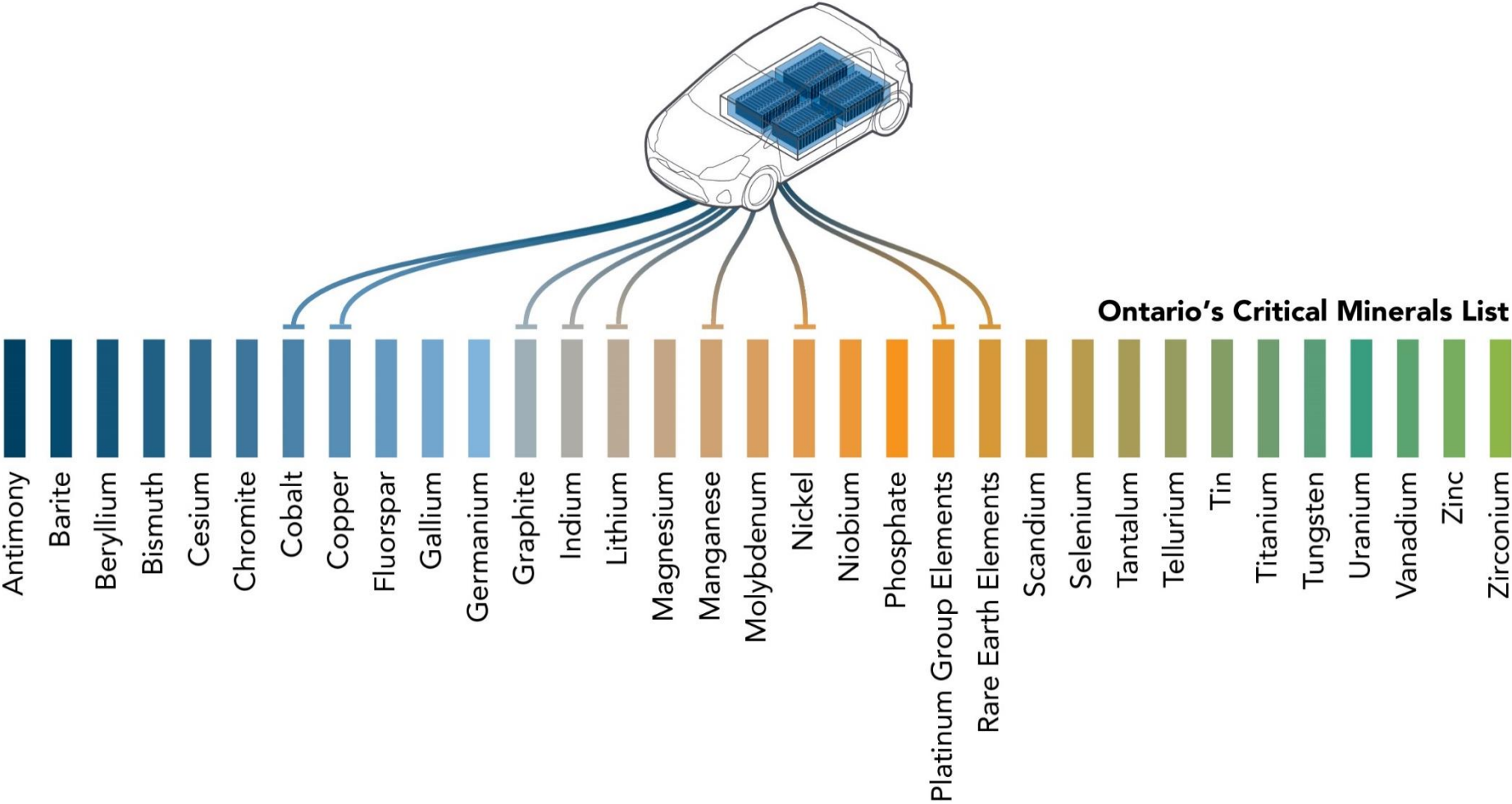
The Ontario Vehicle Innovation Network (OVIN) has developed this Quarterly Specialized Report that presents an overview of critical minerals, highlights their role in EV batteries, and examines Ontario’s existing strengths in the EV battery supply chain. The report also discusses some factors driving change within the broader EV ecosystem and identifies opportunities for Ontario to position itself as a global leader in all stages of the EV battery lifecycle.



# Critical Minerals Overview

Critical minerals are defined as minerals that play an essential role in the development of a broad range of strategic technologies with no viable alternatives. Critical minerals may also have a supply chain that is vulnerable to disruption.

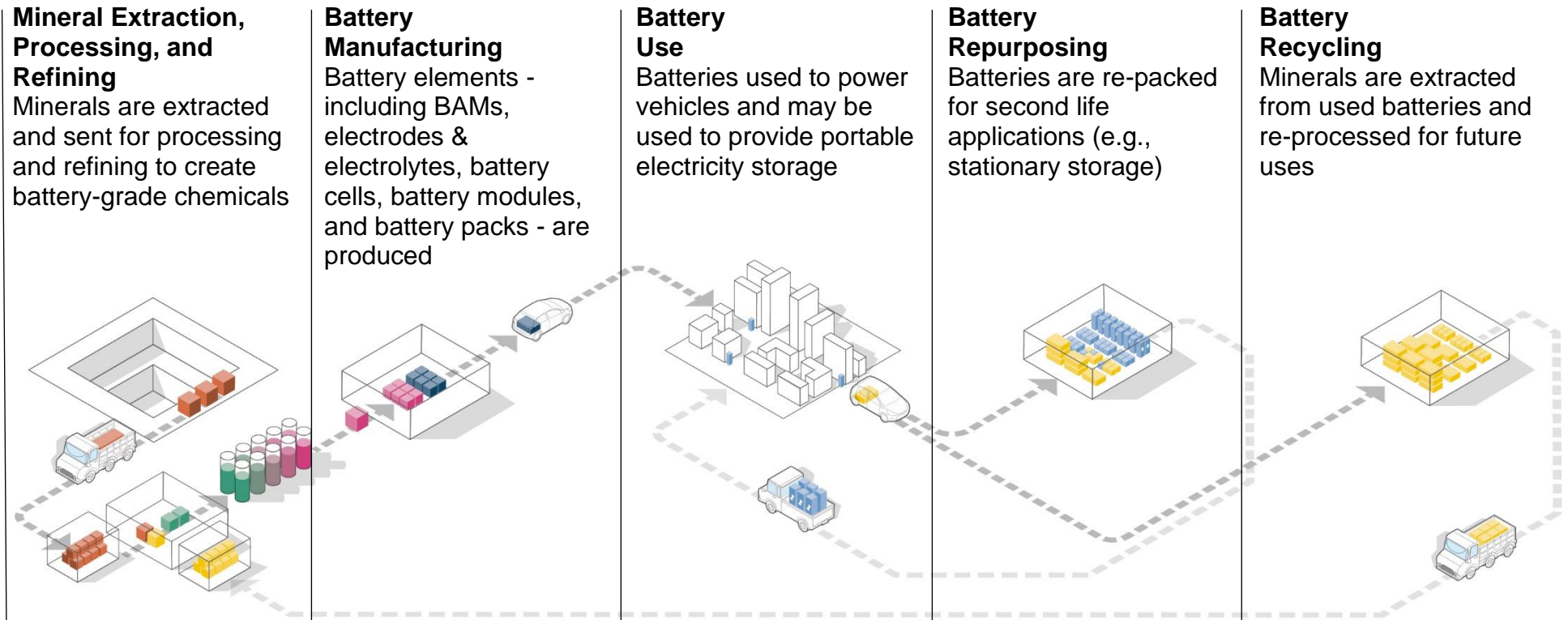
## EV Batteries



# Processes and Players in the Critical Minerals and EV Battery Lifecycle

## EV battery lifecycle

The end-to-end EV battery lifecycle encompasses a wide range of processes, from mineral extraction, processing, and refining to battery recycling.



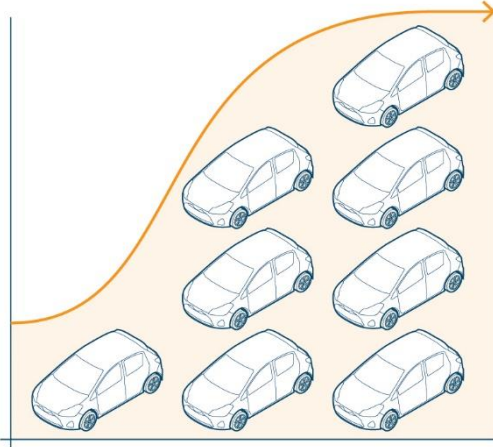
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## Ecosystem players

Ontario's EV battery lifecycle requires a broad range of actors—including multinational enterprises, small- and medium-sized enterprises, start-ups, research groups, and other stakeholders—to ensure the robust, seamless, and economic production of batteries.

# Factors Driving Change

As the clean energy transition progresses, demand for critical minerals is forecasted to increase significantly. In this context, several overarching trends are shaping the future of the critical minerals sector, including:



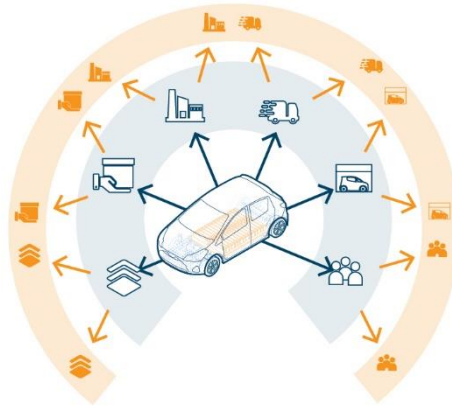
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## Increasing demand for EVs

The future of transportation is electric. Driven by a desire to reduce greenhouse gas emissions and curb climate change, jurisdictions across the world are encouraging the use of EVs in place of vehicles with internal combustion engines.

## The need to diversify production

Critical mineral activity is currently highly concentrated in a few countries and companies, which constrains access to these minerals and reduces market resilience. The high level of concentration is bringing attention to the need to diversify critical minerals supply chains to protect against risks such as geopolitical conflicts, price shocks, or trade restrictions.



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Shift in focus on environmental, social, and governance considerations

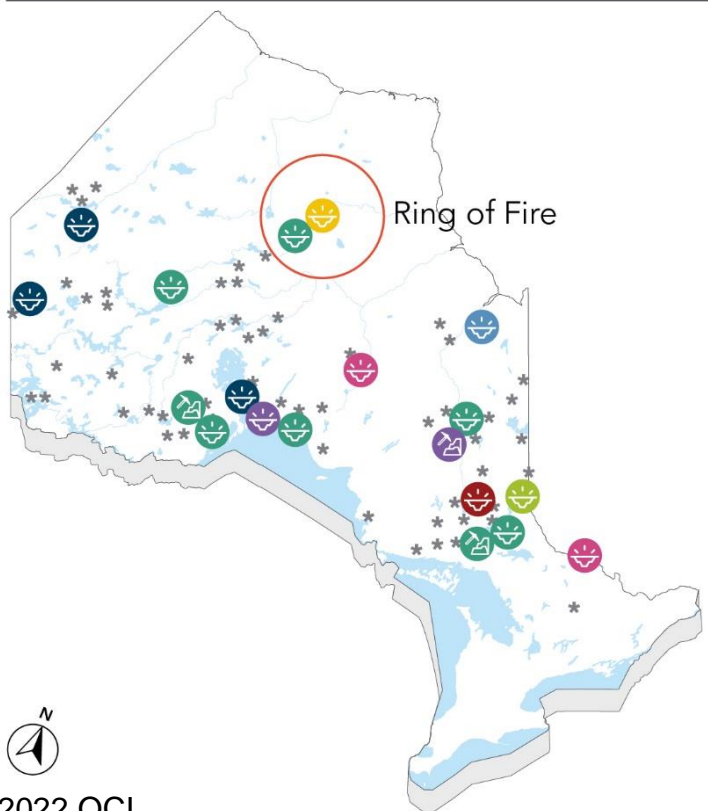
Environmental, social, and governance (ESG) considerations are playing an ever larger role in how companies operate. More and more, consumers want to know that the products they purchase are sustainably and ethically made. This is particularly true of electric-vehicle consumers, who may seek to reduce their own environmental impact through their purchase.

# Ontario's Unique Position

## Access to minerals

<b>37</b>	<b>~130</b>	<b>16</b>	<b>\$11.1B</b>	<b>\$13.7B</b>
active mining operations in Ontario (10 of which produce critical minerals)	early exploration stage critical minerals projects in Ontario	advanced exploration stage critical minerals projects in Ontario	worth of minerals produced in Ontario in 2021 (preliminary estimate)	worth of minerals estimated to be produced in Ontario in 2025

## Map of Critical Minerals in Ontario



## Critical Minerals

Chromite	Cobalt	Copper-Zinc +/- Indium
Copper-Nickel-Platinum Group Elements +/- Cobalt, Selenium, Tellurium		
Graphite	Lithium	Niobium
		Barite

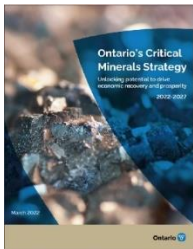
- Critical minerals operating mines
- Critical minerals significant projects
- Critical minerals early exploration projects
- Ring of Fire area (contains significant critical mineral deposits)
- The colour indicates the critical minerals being explored or extracted
- Symbols may represent more than one site

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## Regulatory and policy framework

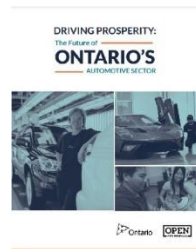
Ontario has a robust regulatory framework that ensures health, safety, and protection of the natural environment while remaining efficient and responsive to project needs. Ontario's general "open for business" attitude provides further support for companies located in the province. Additionally, the provincial and federal governments have released several action plans and strategies that reflect the generally positive regulatory environment and governmental commitment to developing critical mineral mining, battery assembly, and EV production.

### Ontario's Critical Minerals Strategy 2022–2027



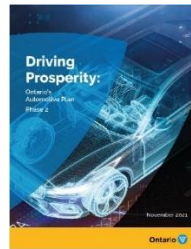
Presents a five-year roadmap for the critical minerals sector, with specific initiatives around mineral exploration, processing & supply chains, regulatory framework, research, development of opportunities with Indigenous partners, and the skilled labour force.

### Driving Prosperity Phase 1



Presents Ontario's plan to position itself as a North American hub for advanced auto manufacturing through a focus on fostering partnerships, planning for the future decade, leveraging assets, and maintaining accountability.

### Driving Prosperity Phase 2



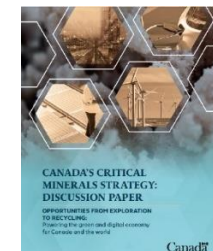
Outlines actions to support the development of electric, autonomous, and connected vehicles and the expansion of an EV supply chain that includes the exploration and production of critical minerals.

### Canada-U.S. Joint Action Plan on Critical Minerals



Guides cooperation between Canada and the U.S. in areas such as industry engagement, information sharing, research and development, and securing supply chains.

### Canada's Critical Minerals Strategy



Currently in draft phase, highlights the need to drive research, accelerate project development, build sustainable infrastructure, advance Indigenous reconciliation, grow a diverse workforce, and strengthen global leadership.

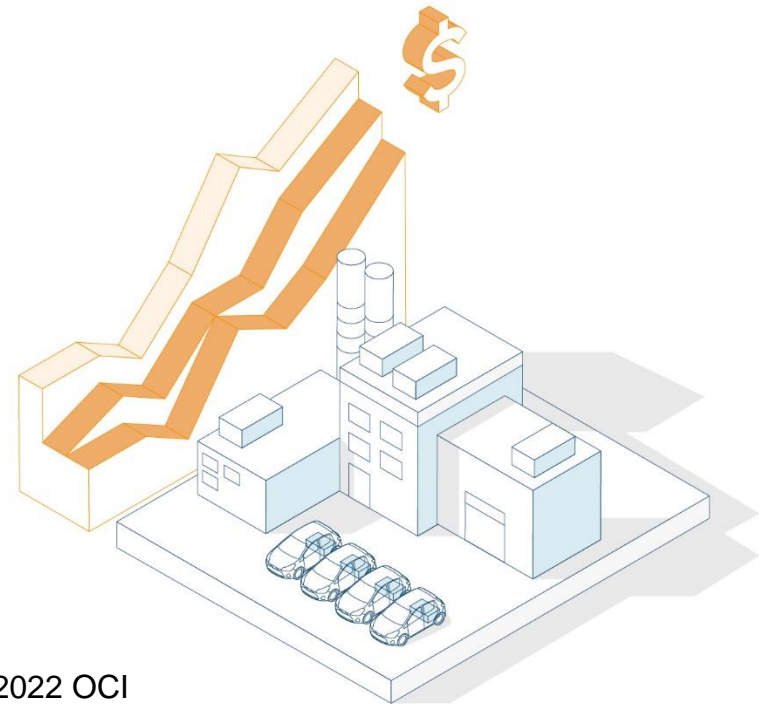


## Government investments

Municipal, provincial, and federal governments are advocating strongly for the development of an end-to-end battery supply chain in Ontario and, more broadly, in Canada. Governments have shown this commitment through investments in private-sector mining companies and support for EV battery research and development (R&D). For example, in 2020, the provincial and federal governments invested a combined \$10M in Electra Battery Materials Corporation to help establish the first battery-grade cobalt refinery in North America.



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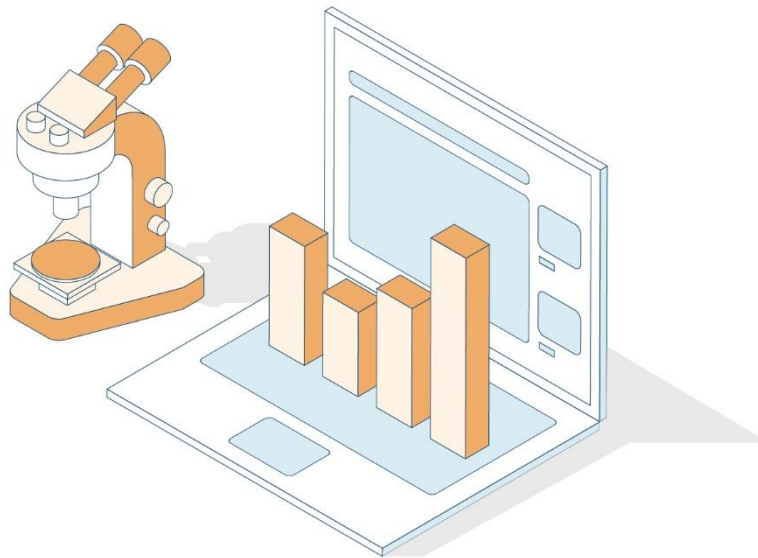
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## Private-sector investments

Recent private-sector investments in mining are fostering Ontario's EV battery supply chain and promoting Ontario's position as a leader in research, innovation, and manufacturing. Key examples include the combined \$4.9B investment from LG Energy Solution and Stellantis to open Canada's first EV battery gigafactory in Windsor, ON; a \$1.8B investment by Ford Motor Company to build a new battery-electric-vehicle (BEV) manufacturing facility in Oakville, ON; and a \$1B investment from General Motors Company to manufacture its new electric van in Ingersoll, ON.

## Research & development

Ontario is positioning itself as a global leader in R&D for mining and EV battery production. Ontario graduates 63,500 students in science, technology, engineering, and mathematics (STEM) fields each year and has a history of collaboration between private-sector, public-sector, and academic institutions. Numerous research centres, development sites, and innovation networks are located within Ontario, helping to spur innovation and commercialize new technologies. Academic research groups across the province are also advancing EV battery technology.



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## Environmental, social, and governance commitments

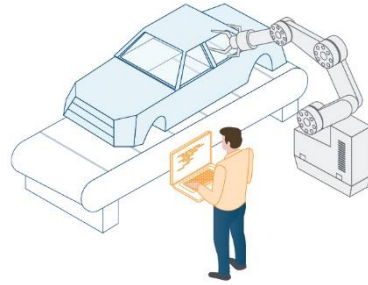
The Canadian mining sector is recognized as a world leader in environmentally friendly and socially responsible practices. The Canadian mining sector uses the Mining Association of Canada's "Towards Sustainable Mining" initiative to ensure responsible mining through a commitment to accountability, transparency, and credibility. The rest of the EV supply chain is driven by sustainability as well. For example, Ontario's clean-electricity grid helps companies achieve sustainability targets. The province has also committed to collaborating with private-sector partners to develop novel recycling methods for minerals in batteries, promoting a circular economy approach for EVs.

# Skills, Talent and Workforce Development



Ontario has launched a series of initiatives to expand the workforce to meet expected demand and train or retrain students and employees with the skills needed to succeed in future positions. Some examples of these initiatives include:

- The Indigenous Workplace Development Program;
- The Career Ready Fund's Auto Stream; and
- A RapidSkills pilot.



Ontario has also committed to a range of additional workforce development programs, including:

- Financial assistance to support local employment development and human resource planning;
- Support for culturally appropriate experiential student training;
- Promotion of mining careers to encourage participation in mining training programs; and
- Support for immigration pathways for foreign workers and international students.



Equity, diversity, and inclusion (EDI) is an integral part of ensuring that Ontario creates and retains sustainable talent pools for the future of the mining and automotive sectors. Provincial initiatives around EDI include:

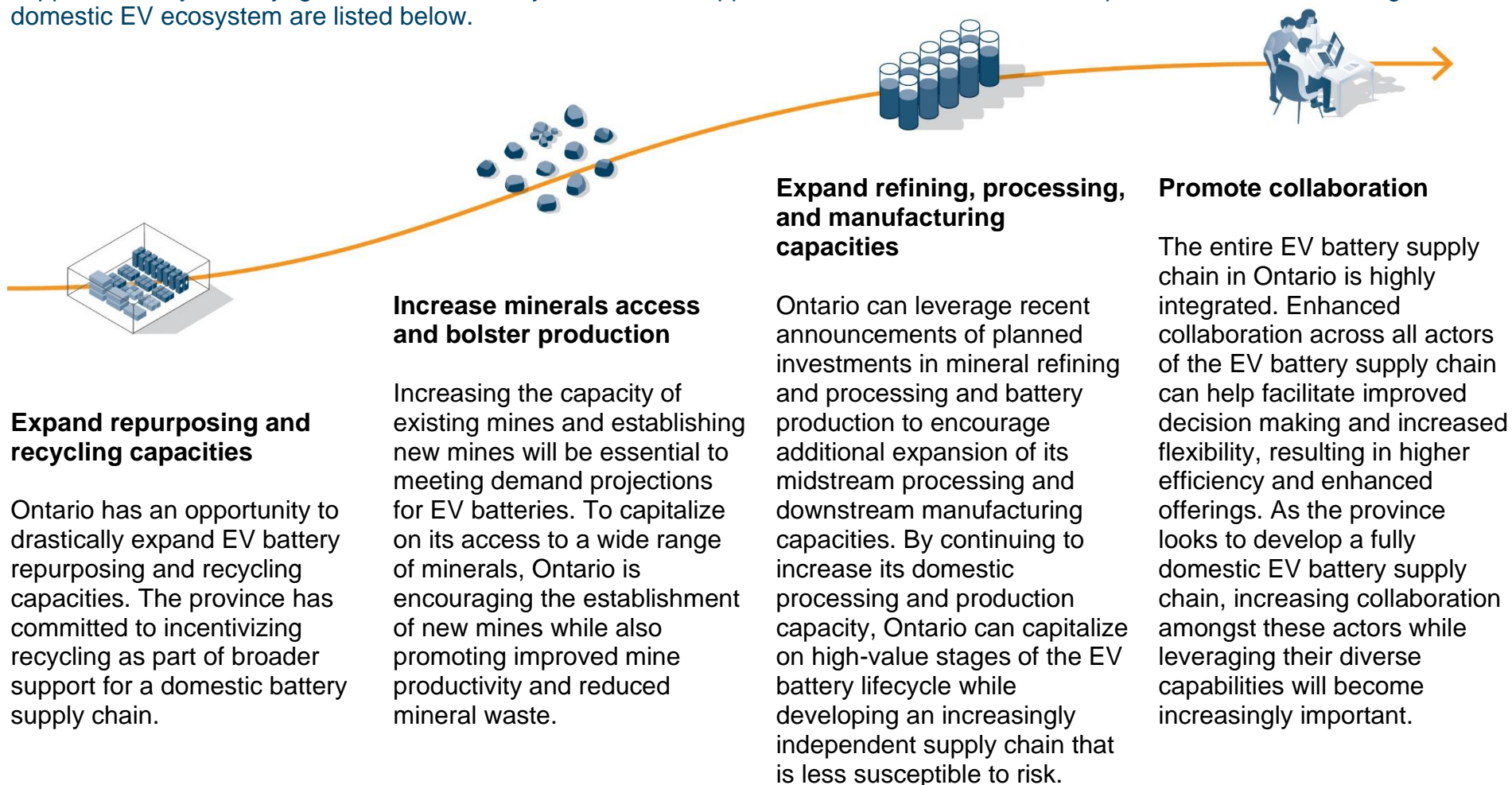
- Support for efforts to hire underrepresented workers; and
- Creation of educational tools with Indigenous communities.



- OVIN provides additional support for talent development through:
- The TalentEdge Fellowship and Internship Programs;
- The Skills & Career Navigator;
- The Talent Strategy & Roadmap; and
- The upcoming development of a made-in-Ontario Upskilling Platform.

# Opportunities to Further Strengthen Ontario's Position as a Leader in the EV Battery Supply Chain

As demand for critical minerals and EVs expands, resiliency in the automotive industry is becoming increasingly important. Ontario is well-positioned to leverage its existing strengths to secure its own position as a leader in the end-to-end EV battery lifecycle and to support industry stability, growth, and resiliency. Some of the opportunities to continue the development of Ontario's thriving domestic EV ecosystem are listed below.





# About OVIN

The **Ontario Vehicle Innovation Network (OVIN)** is a key component of Driving Prosperity, the Government of Ontario's initiative to ensure that the automotive sector remains competitive and continues to thrive. The Government of Ontario has committed \$56.4M for OVIN over the next four years to support research and development (R&D) funding, talent development, technology acceleration, business and technical support, and testing and demonstration sites. OVIN programs support small- and medium-sized enterprises (SMEs) to develop, test, and commercialize new automotive and mobility products and technologies, and cultivate the capacity of a province-wide network to drive future and green mobility solutions, reinforcing Ontario's position as a global leader.

OVIN, led by Ontario Centre of Innovation (OCI), is supported by the Government of Ontario's Ministry of Economic Development, Job Creation and Trade (MEDJCT) and Ministry of Transportation (MTO). The initiative comprises five distinct programs and a central hub.

The OVIN programs are:

- Research and Development Partnership Fund
- Talent Development
- Regional Technology Development Sites
- Demonstration Zone
- Project Arrow

The OVIN Central Hub is the driving force behind the programming, province-wide coordination of activities and resources, and Ontario's push to lead in the future of the automotive and mobility sector globally. Led by a dedicated team, the Central Hub provides the following key functions:

- A focal point for all stakeholders across the province;
- A bridge for collaborative partnerships between industry, post-secondary institutions, broader public sector agencies, municipalities, and the government;
- A concierge for new entrants into Ontario's thriving ecosystem; and
- A hub that drives public education and thought leadership activities and raises awareness around the potential of automotive and mobility technologies and the opportunities for Ontario and for its partners.

To find out the latest news, visit [www.ovinhub.ca](http://www.ovinhub.ca) or follow OVIN on social media @OVINhub.

# OVIN Objectives



Foster the development and commercialization of Ontario-made advanced automotive technologies and smart mobility solutions



Showcase the Province of Ontario as the leader in the development, testing, piloting and adoption of the latest transportation and infrastructure technologies



Drive innovation and collaboration among the growing network of stakeholders at the convergence of automotive and technology



Leverage and retain Ontario's highly skilled talent, and prepare Ontario's workforce for jobs of the future in the automotive and mobility sector



Harness Ontario's regional strengths and capabilities, and support its clusters of automotive and technology

## Meet the OVIN Team



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## Disclaimer

This report was commissioned by the Ontario Centre of Innovation (OCI) through a Request for Proposals titled “Ontario Vehicle Innovation Network (OVIN) – Annual Comprehensive Sector Report & Quarterly Specialized Reports,” dated April 26, 2022, and has been prepared by Arup Canada Inc. It is the first of five reports covering an analysis of Ontario’s automotive technology, electric vehicle and smart mobility landscape while incorporating implications for the sector’s skills and talent landscape.

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