OVIN
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Ontario

OVIN INSIGHTS
Specialized Series

Engine of Growth: Ontario's Automotive Sector

Annual Comprehensive Sector Report

OCI
Where Next Happens

Table of Contents

Note: Throughout this document the graphs reference the North American Industry Classification System (NAICS) codes. Details of these codes can be found at census.gov/naics

Foreword

Ontario is one of North America's foremost automotive and mobility jurisdictions, and is a world-leader when it comes to leading the charge in the global shift towards electrification. From our wealth of critical minerals in the north to the manufacturing might of the south, Ontario has demonstrated key strengths at every stage of the supply chain through significant investments in electric vehicle (EV) battery cell and module, cathode, and other manufacturing capabilities, a strong focus on research and development (R&D), and access to highly-skilled workforce. As a testament to our province's position as a global leader throughout the entire end-to-end supply chain, we have achieved the incredible feat of attracting over $44B in transformative investments in the auto and EV battery-related sectors over the past four years alone. This unique achievement underscores our government's commitment and ability to ensuring that the car of the future will be built in Ontario, by Ontario workers.

Our government continues to fulfill our vision for the future of Ontario's auto sector through the Ontario Vehicle Innovation Network (OVIN). Through its numerous programs, OVIN drives economic development across the auto and mobility supply chain by supporting small and medium enterprises (SMEs) to develop and bring leading-edge technologies to market, partnering with postsecondary institutions to advance R&D, promoting collaboration among stakeholders, and supporting the growth of a highly skilled, future-ready automotive and mobility workforce. Together, we are creating a vibrant innovation ecosystem that continues to strengthen Ontario's position at the forefront of the rapidly evolving and growing automotive and mobility sector, driving prosperity for all.

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

Executive Summary

Ontario is the backbone of Canada's automotive industry supported by a robust ecosystem encompassing raw materials mining and refining, battery manufacturing and recycling, parts production, vehicle assembly, research and development, skilled workforce, and substantial investment and policy support from the Ontario government.

Ontario's mines: sustaining the automotive supply chain

Ontario's mining industry provides a strong foundation for the automotive supply chain in Canada, strengthened by federal and provincial support. The province's abundance of mineral wealth and its flourishing mining industry directly supplies the critical minerals and raw materials required for internal combustion engine (ICE) vehicle parts and electric vehicle (EV) batteries. This supply of locally extracted and refined materials provides a solid basis for a domestic automotive supply chain in Ontario.

The federal government has invested over $800M to support steel manufacturing within Ontario, whilst the provincial government has committed to support the sector via its Critical Minerals Strategy. The Ontario government has also introduced the Building Mores Mines Act 2023 with the intention of attracting more investment within the mining sector in the province, and to further strengthen Ontario's battery and EV supply chain.[1]

Some of the world's largest mining companies are based in Ontario, along with companies which specialize in processing extracted minerals. These efforts continue to strengthen Ontario's position as a global leader in supplying critical minerals and raw materials crucial for the automotive industry.

Battery manufacturing: leading the charge

Several large-scale investments related to battery manufacturing have been announced in recent years across the province, enabled by Ontario's thriving automotive ecosystem. Examples include Honda's recent announcement that it would be investing $15B in the province to expand its EV manufacturing operations – the largest investment not only in Honda's history, but also within the Canadian automotive sector.[2] The second largest investment in Canada was announced in 2023 by PowerCo SE – owned by Volkswagen. The organization announced that it would be investing $7B to build Canada's largest battery manufacturing plant in St. Thomas.[3] Additionally, NextStar Energy announced an investment of $5B to build an EV battery manufacturing plant in Windsor.[4]

Together, these substantial investments in battery manufacturing underscore Ontario's robust economic ecosystem and reinforce its competitiveness in the global automotive sector. They position the province at the forefront of the EV revolution and highlight its strategic position in the evolving automotive market.

Parts manufacturing: Ontario's automotive driving force

Automotive parts manufacturing is a booming industry in Ontario. In 2023, the province exported over $19.6B of automotive parts, making up 90% of all Canadian motor vehicle parts exports.[5] Additionally, 90% of motor vehicle parts manufacturing jobs across Canada are located in Ontario. In 2023, there were more than 700 parts manufacturing organizations based in the

province.[6] These organizations provide a reliable supply of parts to the global automakers located in Ontario and further afield.

Ontario's diverse manufacturing capabilities form a robust and integrated supply chain that underpins the province's prominent automotive industry. This ecosystem supports a range of components, from plastic parts and heating, ventilation, and air conditioning (HVAC) systems to drivetrain motors, EV battery casings, and advanced safety electronics, underscoring Ontario's crucial role in automotive innovation and production. The province's commitment to quality and efficiency enhances its global standing as a hub for automotive excellence.

Recent investments by major parts manufacturers such as Dongshin Motech, Dana, and Mitsui High-tec signify a significant influx of capital into Ontario's automotive sector, particularly for advanced EV manufacturing. Supported by substantial grants from the Ontario government through initiatives like Invest Ontario, these investments are set to create thousands of new jobs in cities like Windsor, Brampton, and Brantford. This influx of capital not only reinforces Ontario's economy but also strengthens its position as a leader in automotive innovation and global investment in the burgeoning EV industry.

Moreover, Ontario's strategic investments in EV manufacturing underscore its commitment to becoming a hub for sustainable technology and automotive innovation. By attracting major players like Dongshin Motech, Dana, and Mitsui High-tec, the province is positioning itself at the forefront of the global transition towards electric mobility, driving economic growth and job creation in the process.

Vehicle assembly: driving progress in Ontario

Ontario is the home of vehicle assembly in Canada. Five original equipment manufacturers (OEMs) have operating plants in the province – Ford, GM, Honda, Stellantis and Toyota – attracted by Ontario's wealth of raw materials and parts manufacturers. These organizations have invested $43B since 2020 to expand their manufacturing capabilities in the province.[7] As the hub of Canadian automotive manufacturing, Ontario's motor vehicle exports in 2023 were valued at more than $55.2B, making up 91% of total Canadian vehicle exports.[8]

Ontario is also at the cutting edge of automotive research. The province led Project Arrow, an innovative program which developed the world's first zero-emission concept vehicle, delivered in partnership between the Ontario Vehicle Innovation Network (OVIN) and the Automotive Parts Manufacturers' Association (APMA).[9] Following the success of this Ontario-based project, a second phase to develop a fleet of vehicles is now underway.

Supported by a domestic supply of parts from the multitude of manufacturers located across the province and an innovative environment enabled by a network of world-leading research facilities, Ontario's vehicle assembly industry is a powerhouse in the global supply chain.

Battery recycling: fostering a circular economy in Ontario

Battery recycling is a key component in ensuring Ontario's automotive supply chain can be delivered domestically and sustainably. Ontario's commitment to battery recycling aligns with its Critical Mineral Strategy, fostering collaboration and research through initiatives like the Ontario Battery and Electrochemistry Research Centre (OBEC).

A number of notable players are located in the province. Examples include Electra Battery Materials, which is a Toronto-based firm specializing in refining, processing, and recycling EV battery

materials. Recently, it received a $5M grant from Natural Resources Canada to advance its proprietary battery metals recycling technology.[10] Glencore Canada is a global mining giant which also excels in end-of-life electronics recycling. Its Sudbury plant, operational since 2004, processes complex secondary nickel and cobalt materials, making it a major player in battery recycling.[11] Additionally, Stelco, a Canadian steel company headquartered in Hamilton, plans to expand its Lake Erie Works in Nanticoke to enable end-of-life EVs and EV batteries to be recycled, recovering valuable materials and contributing to a sustainable supply chain.[12]

The battery recycling industry is still in its early stages globally, but Ontario is making concerted efforts to secure it as a core part of the global automotive supply chain. With the move towards next generation EVs, recycling and repurposing the materials used in batteries will not only reduce their impact on the environment but will also enable a reduction in raw material extraction and processing, enabling progress towards a circular economy.

OVIN: steering the way

The noteworthy investments at each stage of the automotive lifecycle have been enabled by Ontario's thriving automotive ecosystem, catalyzed by the extensive work done by OVIN. OVIN has laid the groundwork for a strong auto and mobility ecosystem and is now expanding a world-leading automotive supply chain, channelling Ontario's strengths in the automotive lifecycle by enabling collaboration and coordination amongst the growing network of research institutions, manufacturing facilities, mining companies, and other stakeholders via its Regional Technology Development Sites (RTDS). Through its suite of programs and initiatives, OVIN supports commercialization from technological development all the way through to piloting and development.

As the driving force of Canadian automotive sector, Ontario is a pioneer for R&D in electric, connected, and autonomous mobility technologies. The province is home to a multitude of world-class research facilities, with specialities spanning the breadth of the automotive landscape.

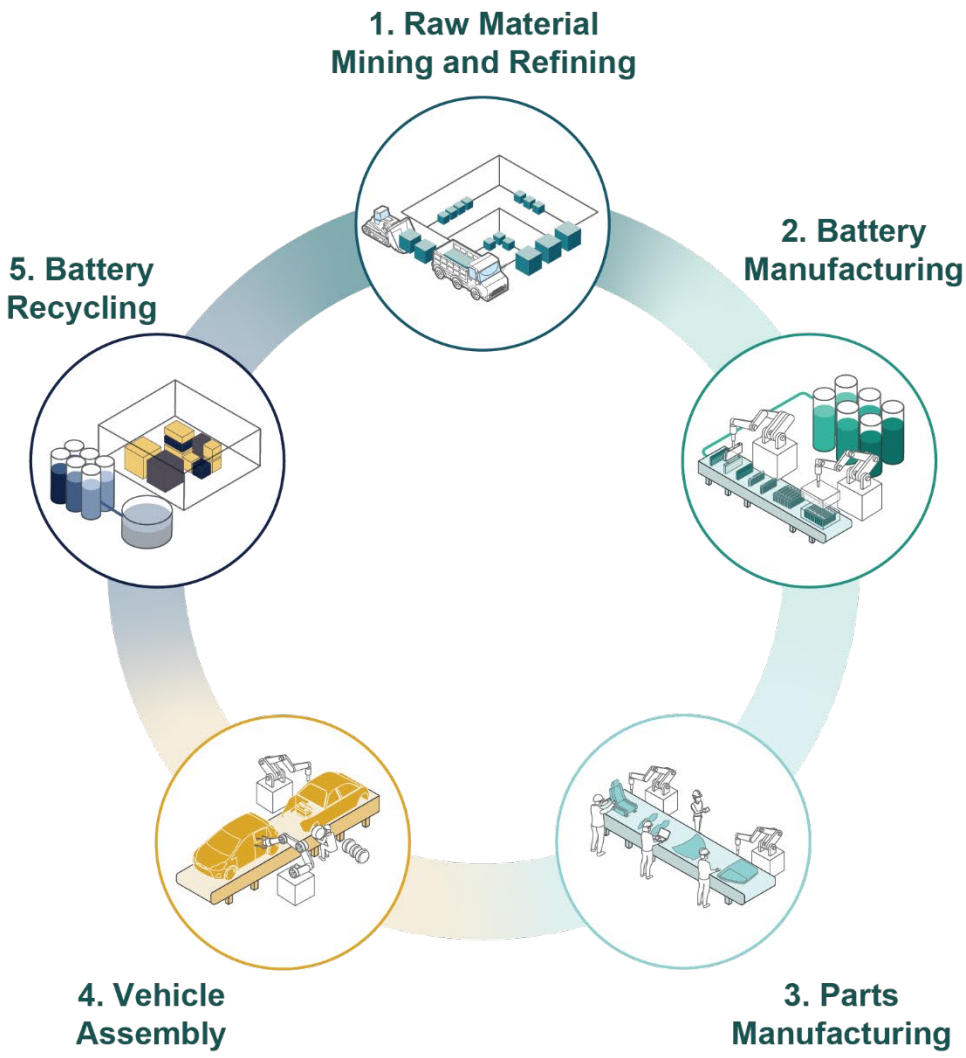
This innovative environment, along with substantial infrastructure investments, progressive policies, and OVIN's visionary mandate, puts Ontario at the forefront of the global adoption of connected, autonomous, and electric mobility.

This report presents a comprehensive commentary of the automotive lifecycle in Ontario, providing an outline of each stage of the supply chain:

1. The first stage is the extraction and processing of raw materials and critical minerals required for the components of ICE vehicles and EVs, which is a prosperous industry in Ontario due to its abundance of mineral wealth.
2. The second stage is the battery manufacturing process, an emerging area for Ontario with plans in place for several battery and battery materials manufacturing plants.
3. The third stage in the vehicle lifecycle is parts manufacturing, which is a diverse and well-established industry in the province.
4. The fourth stage is vehicle assembly, an industry in which Ontario has six prominent players.
5. The final element of the automotive landscape is EV battery recycling, which is an area with ample opportunity for growth in the province.

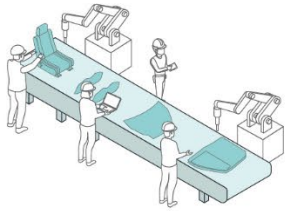
At each stage, the report highlights key players within the ecosystem, significant investments, economic impact, R&D, and initiatives delivered by OVIN and the provincial and federal governments. Through this, the report demonstrates the strength and competitive advantage of the automotive sector in Ontario. The report concludes by examining future opportunities for Ontario to expand on and reinforce its role in the global automotive supply chain.

A Schematic Overview of the Automative Lifecycle



Engine of Growth: Ontario's Automotive Sector

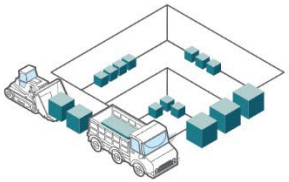
Parts Manufacturing in Ontario



$8.7B
contribution of the parts manufacturing industry to Ontario's GDP in 2023

68.7K
number of people employed in the parts manufacturing industry in Ontario in 2022

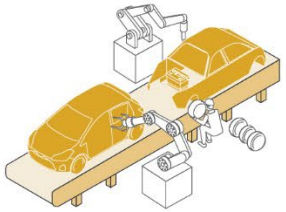
Raw Material Mining and Refining in Ontario



$989M
amount spent on exploration in Ontario in 2022

>21K
number of people employed in the mining sector in Ontario in 2022

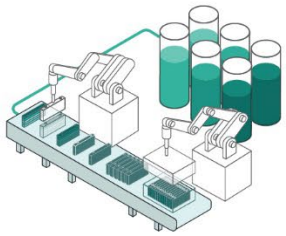
Vehicle Assembly in Ontario

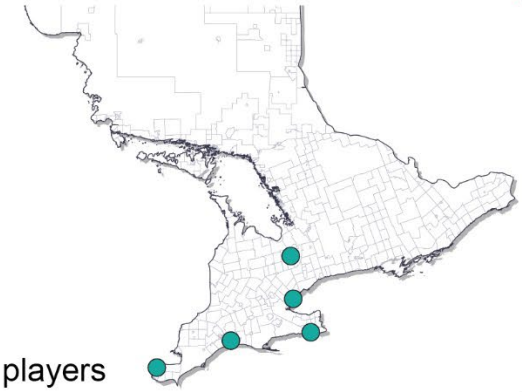


$6.6B
contribution of the vehicle assembly industry to Ontario's GDP in 2023

35.6K
number of people employed in the vehicle assembly industry in Ontario in 2022

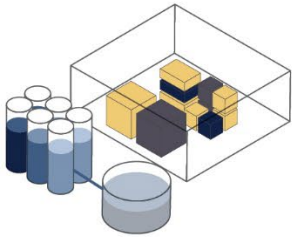
Battery Manufacturing in Ontario

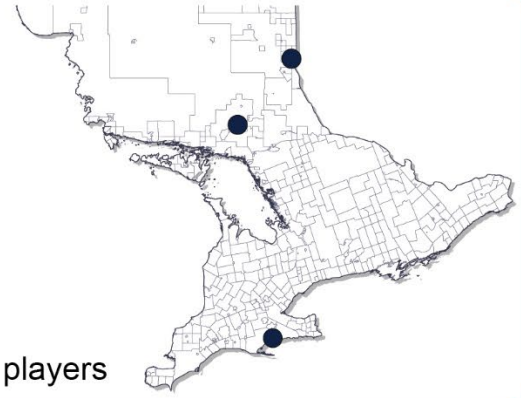




● Key players

Battery Recycling in Ontario



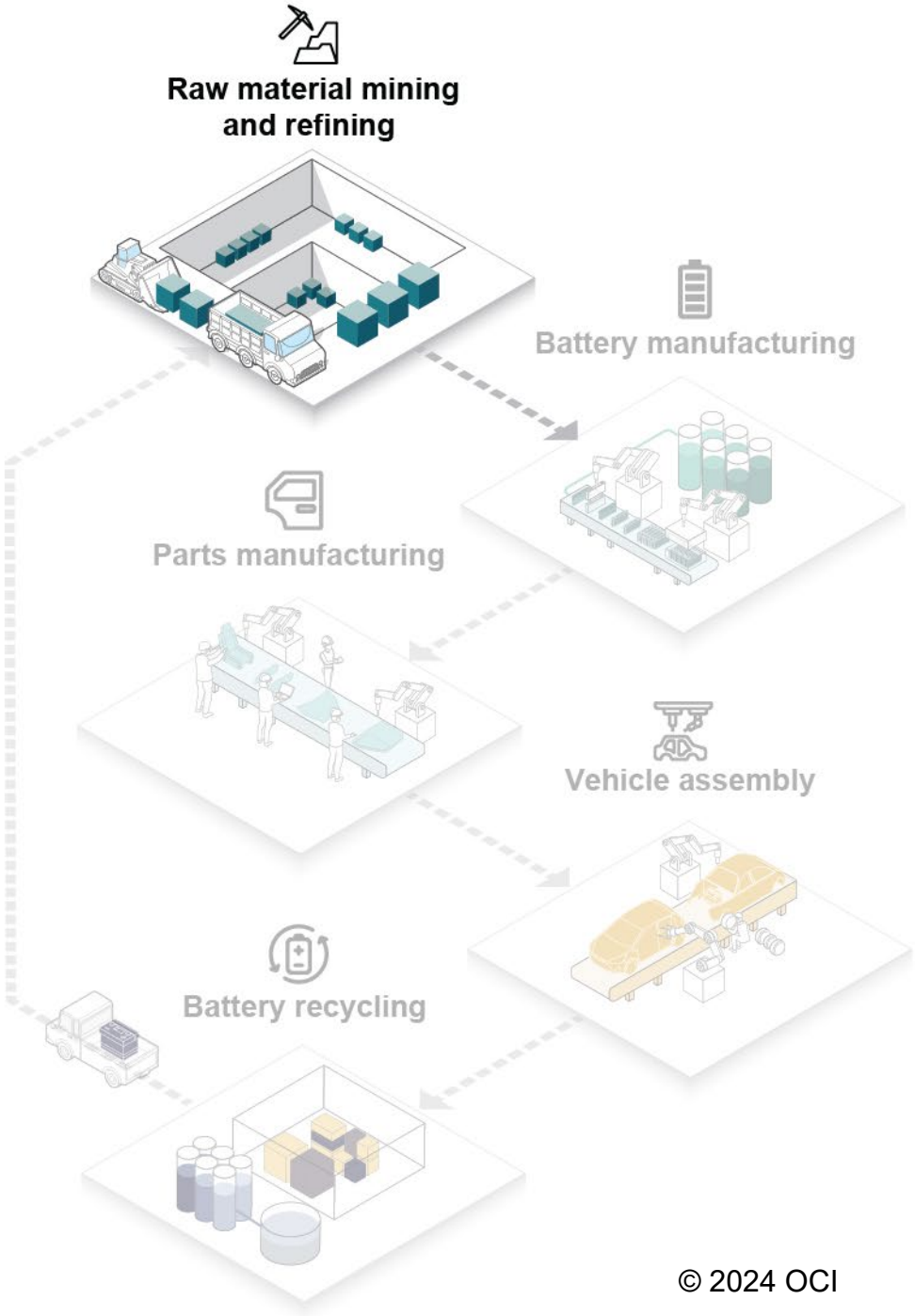


● Key players

1. Raw Material Mining and Refining in Ontario

Ontario has an abundance of mineral wealth.[13] As of 2024, there are 36 active mining operations across the province, 10 of which produce critical minerals.[14] In 2022, Ontario mineral production represented 22% of Canada's total mineral production value, making it one of the top producers nationally.[15] The Ontario Mining Association predicts that the total value of mineral production in the province will reach $13.7B by 2025, growing from $10.4B in 2019.[16] Canada's mining sector is a significant employer, encompassing over 80K jobs nationwide in 2022.[17] Ontario alone accounts for 27% of these jobs, with more than 21K people employed in the industry in 2022. Moreover, the provincial mining industry has experienced a 50% increase in employment since 2010.[18]

Raw materials and critical minerals form the core of the automotive lifecycle. They are essential to both vehicle and EV battery production. Iron ore is required to produce steel needed for a number of components in vehicle assembly, such as body panels, drive train, suspension, fuel tank, tires, and steering and braking systems. The World Steel Association estimates that 900 kilograms of steel is required per vehicle on average. For EVs, the key minerals needed for battery production include cobalt, copper, nickel, graphite, manganese, and lithium. The International Energy Agency estimates that by 2040 demand for minerals in EV production will be 9 to 30 times larger. A range of metals and minerals essential to the automotive supply chain, for ICE vehicles and EVs, are produced in Ontario, including cobalt, copper, nickel, and iron ore.[19] There is also exploration potential across the province for additional minerals required for the electrification of transport, including graphite, manganese, and lithium. There are



currently advanced projects active for each of these minerals.[20] The province continues to expand its mining industry, with $989M spent on exploration in 2022.[21]

Ontario's mining industry provides a strong foundation for the automotive supply chain in Canada, strengthened by federal and provincial support. The federal government has invested over $800M to support steel manufacturing within Ontario, whilst the provincial government has committed to support the sector via a range of strategies, such as the Critical Minerals Strategy, which aims to strengthen the province's raw materials mining and refining sectors, ensuring a strong position in the global supply chain.[22] This strategy encompasses initiatives in mineral exploration, processing, regulatory enhancements, R&D, collaborations with Indigenous partners, and workforce development, with a specific focus on advancing technologies for more efficient mineral recovery from EV batteries. The Ontario government has also introduced the Building Mores Mines Act 2023 with the intention of attracting more investment within the mining sector in the province, and to further strengthen Ontario's battery and EV supply chain.[23]

Ontario's ecosystem of mining and refining facilities is a key pillar of the province's automative industry supply chain. As an example, in 2021, Algoma Steel and ArcelorMittal Dofasco announced ambitious projects valued at $703M and $1.765B respectively, aimed at phasing out coal-fired steelmaking processes to reduce greenhouse gas emissions. Supported by significant federal investments totaling $600M via the Strategic Innovation Fund (SIF) (up to $200M for Algoma Steel, and $400M for ArcelorMittal Dofasco) and $220M via the Canada Infrastructure Bank (for Algoma Steel), these initiatives are set to create thousands of jobs and reinforce Ontario's end-to-end supply chain for vehicle manufacturing.[24] [25] Additionally, Canada Nickel and Electra Battery Materials are pioneering advancements in clean energy technologies in Ontario. Canada Nickel's NetZero Metals Inc. aims to develop zero carbon production of nickel, cobalt and iron,[26] and Electra's Battery Materials Park is poised to establish North America's first integrated battery materials refining and recycling complex.[27] Meanwhile, EV Nickel is focused on creating an innovative Clean Nickel™ Business to produce nickel for the lowest carbon cost possible.[28] Vale, with its extensive Ontario operations, continues to play a pivotal role in responsibly sourcing essential minerals crucial for advancing clean energy solutions globally.[29] These concerted efforts underscore Ontario's pivotal role in driving sustainable practices across mining and manufacturing sectors critical to the automotive industry's supply chain.

R&D in Ontario's mining sector is key for advancing technologies like EVs and autonomous vehicles, as well as for attracting sustainable investment. The Centre for Excellence in Mining Innovation (CEMI), exemplifies this commitment by leading initiatives such as the Mining Innovation Commercialization Accelerator (MICA) network, supported by a $40M federal investment in 2021. This project aims to create 900 jobs, establish 12 new businesses, and commercialize at least 30 new products, services, or processes, enhancing safety, productivity, and environmental performance in the industry.[30]

In line with this, flagship organizations like OVIN are dedicated to the continued growth of raw material mining and refining in Ontario through growing the talent pool, attracting investment, and fostering collaboration throughout the automotive supply chain. OVIN's contributions to the industry, including the Critical Minerals Talent Strategy, are facilitating development of the domestic talent pool, ensuring that the future workforce is ready to meet the demand for critical minerals.[31] Additionally, OVIN is fostering collaboration between the mining industry in the north and the automotive industry in the south via its Northern RTDS, to

ensure that Ontario's end-to-end domestic supply chain continues to develop, from the mining and refining of raw materials, through to the manufacturing of batteries and automotive parts.

This chapter elaborates on the significant contribution of the raw material mining and refining industry in fostering the growth of Ontario's automotive manufacturing sector.

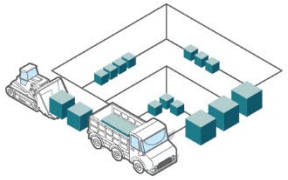
"Through our government's investments in exploration, we are supporting the most critical part of the supply chain and strengthening our mining industry so we can capitalize on this generational opportunity to fuel the future."[32]

The Honourable George Pirie, Ontario Minister of Mines

Raw Material Mining and Refining Facilities in Ontario

Ontario's mining industry is widespread, with mines and refineries for critical minerals, metals, and other raw materials located across the province. Mines and refineries are owned by companies such as Avalon Advanced Materials, Canada Nickel, Electra Battery Materials, EV Nickel, Frontier Lithium, Glencore Canada, and Vale, amongst others. There are also steel manufacturing facilities owned and operated by organizations such as Algoma Steel, ArcelorMittal Dofasco, Stelco, and others.

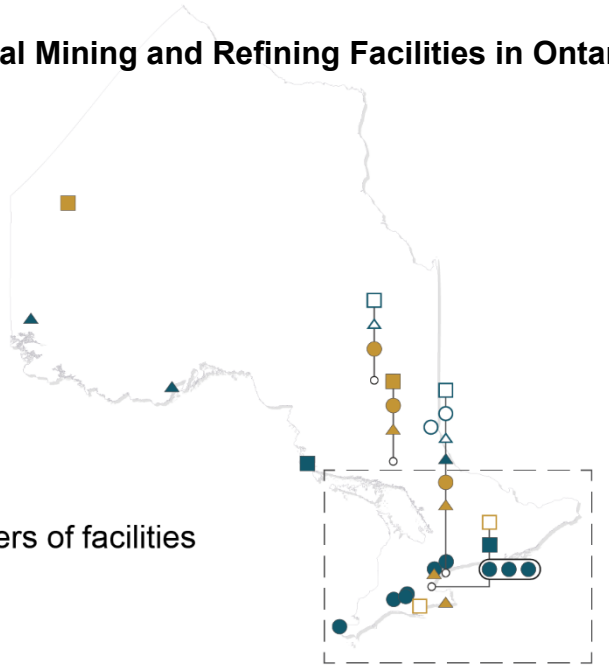
Lifecycle of Raw Materials and Critical Minerals

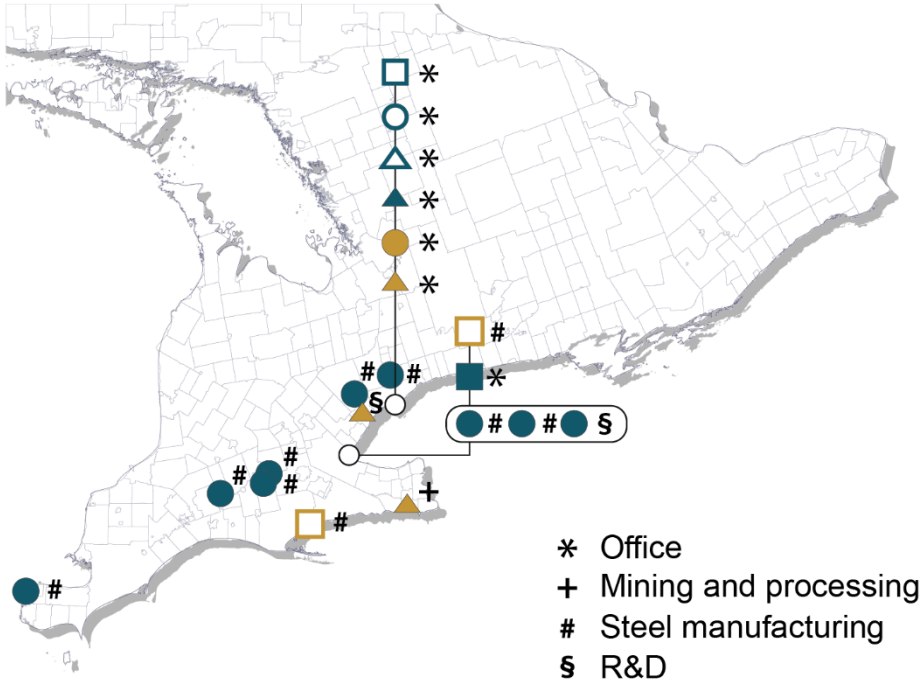


Raw materials and critical minerals mining is the first stage of the automotive lifecycle, which at a high-level can be presented as follows:

1. Exploration of viable mineral deposits. When a viable deposit is identified, pre-production activities – such as consultation, analysis, planning, and financing – must be completed to progress to raw material extraction.[33]
2. Once the necessary pre-production activities are completed, the mine is developed, and mineral extraction begins.
3. Extracted material is then transported to refineries.
4. Refineries then isolate and process the extracted materials using heat and chemical treatments to make them ready for production.

Raw Material Mining and Refining Facilities in Ontario





Legend

- Algoma Steel
  Steel manufacturing
- ArcelorMittal Dofasco
  Steel manufacturing
- Avalon Advanced Materials
  Lithium mining and processing (future)
- Canada Nickel
  Nickel mining and processing (future), stainless steel and alloy processing (future)
- Electra Battery Materials
  Cobalt processing, nickel processing (future), battery pCAM manufacturing (future)
- EV Nickel
  Nickel mining (future)
- Frontier Lithium
  Lithium mining (future), lithium processing (future)
- Glencore Canada
  Copper mining and processing, zinc mining, nickel mining and processing
- Vale
  Nickel mining and processing, copper mining, cobalt mining and processing, platinum group metals mining, gold mining, silver mining, nickel processing, cobalt processing, precious metals and minor metals processing
- Stelco
  Steel manufacturing

Ontario's Raw Material Mining and Refining Ecosystem

Ontario's active mining operations produce a range of metals and minerals, including cobalt, copper, nickel, platinum group elements, zinc, iron, selenium, tellurium, and indium.[34]

Approximately 40% of public mining companies globally were listed on the Toronto Stock Exchange and Toronto Venture Exchange in 2022, demonstrating Ontario's position as a key global player in the industry.[35] Some of the world's largest mining companies are based in Ontario, along with companies which specialize in processing extracted minerals.

This flourishing industry provides a strong foundation for a domestic automotive supply chain in Ontario, allowing EV battery and automotive parts manufacturers to source locally extracted and refined materials. A selection of companies undertaking these activities in the province are highlighted in the following.

Algoma Steel

Algoma Steel is a steel manufacturing company with a facility in Sault Ste. Marie which produces hot and cold rolled sheet and plate products used in automotive unexposed structural systems.[36] In 2021, the company announced a project valued at $703M to retrofit its facility and phase out coal-fired steelmaking processes, in order to reduce greenhouse gas emissions.[37] The federal government announced that it would make an investment of up to $200M through the SIF's Net Zero Accelerator initiative in support of this project, along with $220M of investment from the Canada Infrastructure Bank.[38] The investment is expected to create 500 direct jobs, and over 600 co-op placements for students.[39] Following the retrofit of the Sault Ste. Marie facility, annual raw steel production capacity is expected to reach approximately 3.7M tonnes.[40]

ArcelorMittal Dofasco

ArcelorMittal Dofasco is a steel production and manufacturing company with facilities throughout Ontario which produce advanced high strength steels for automotive exposed parts.[41] In 2021, the organization announced a $1.765B project to phase out coal-fired steelmaking at its facilities, in support of the transition to clean energy.[42] This project, scheduled to be completed in 2028,[43] was supported by a $400M federal investment through the SIF.[44] The investment is expected to maintain 4.6K jobs,[45] along with supporting up to 2.5K construction jobs through subcontracting.[46] It is also expected to enable the production of 2.4M tonnes of high quality steel per year.[47]

Avalon Advanced Materials

Avalon Advanced Materials is an advanced manufacturing business with a focus on sourcing, processing, and distributing lithium.[48] The company, which is based in Ontario, concentrates its efforts on lithium production and technological advancements.[49] Drilling began in the northwest of Ontario, near Kenora, in 2023.[50] In the same year, the company purchased a site in Thunder Bay to build a lithium processing facility.[51]

Canada Nickel

Canada Nickel is an exploration business with a focus on nickel.[52] Its flagship project – the Crawford Nickel-Sulphide Project – is located in the Timmins Nickel District.[53] The company has also launched NetZero Metals Inc. which aims to develop zero carbon production of nickel, cobalt and iron.[54]

Electra Battery Materials

Electra Battery Materials is a mining business which focuses on refining, processing, and recycling EV battery materials, such as lithium, nickel, cobalt, and other critical minerals.[55] The company is building the Electra Battery Materials Park in Ontario; the first fully integrated battery materials refining and recycling complex in North America.[56] When at full capacity, its Ontario refinery is expected to produce enough cobalt sulfate for more than 1M EVs per year.[57]

EV Nickel

EV Nickel is a mining business which aims to accelerate the transition to clean energy by sourcing nickel for EV companies.[58] The company has a focus on creating an innovative Clean Nickel™ Business to produce nickel for the lowest carbon cost possible.[59] In 2022 the company began exploration activities at the Shaw Dome, near Timmins, where it has the rights to more than 30K hectares.[60]

Frontier Lithium

Frontier Lithium is an exploration business with an objective of becoming a strategic domestic supplier of battery-grade lithium.[61] The company has the largest land position and resource in the Great Lakes premium grade lithium mineral district, having first drilled in the region in 2013.[62]

Glencore Canada

Glencore is one of the biggest mining companies in the world, with one of its business operations located in Sudbury.[63] It has been operational here since 1928 and produces nickel and copper as primary metals and cobalt as a by-product.[64] The company processes the material extracted from its Sudbury-based mining sites via its Sudbury Smelter, where it also recycles secondary materials.[65] The Sudbury Smelter produced over 73K tonnes of nickel and nearly 17K tonnes of copper in 2023.[66] Glencore also has operations in Timmins; the Kidd Mine and Kidd Concentrator.[67] Each year this mine produces 40K tonnes of copper and 70K tonnes of zinc on average.[68]

Stelco

Stelco is a Canadian steel company founded in Hamilton.[69] The organization has steel manufacturing facilities in Hamilton and Nanticoke and has been operating in the province for over 100 years.[70] The organization has recently committed to make investments of at least $60M over the next three years to increase steel production at its facilities.[71]

Vale Canada

Vale is another of the world's largest mining companies, with its Canadian operations headquartered in Toronto.[72] The company produces responsibly sourced nickel, copper, cobalt, and platinum group elements, with its Ontario operations being one of the largest integrated mining complexes globally.[73] This complex consists of five mines, a mill, and a smelter in Sudbury, and a refinery in Port Colborne.[74] In 2023, across its Ontario operations, Vale produced nearly 58K tonnes of refined nickel and over 65K tonnes of copper.[75]

Economic Impact of Raw Material Mining and Refining in Ontario

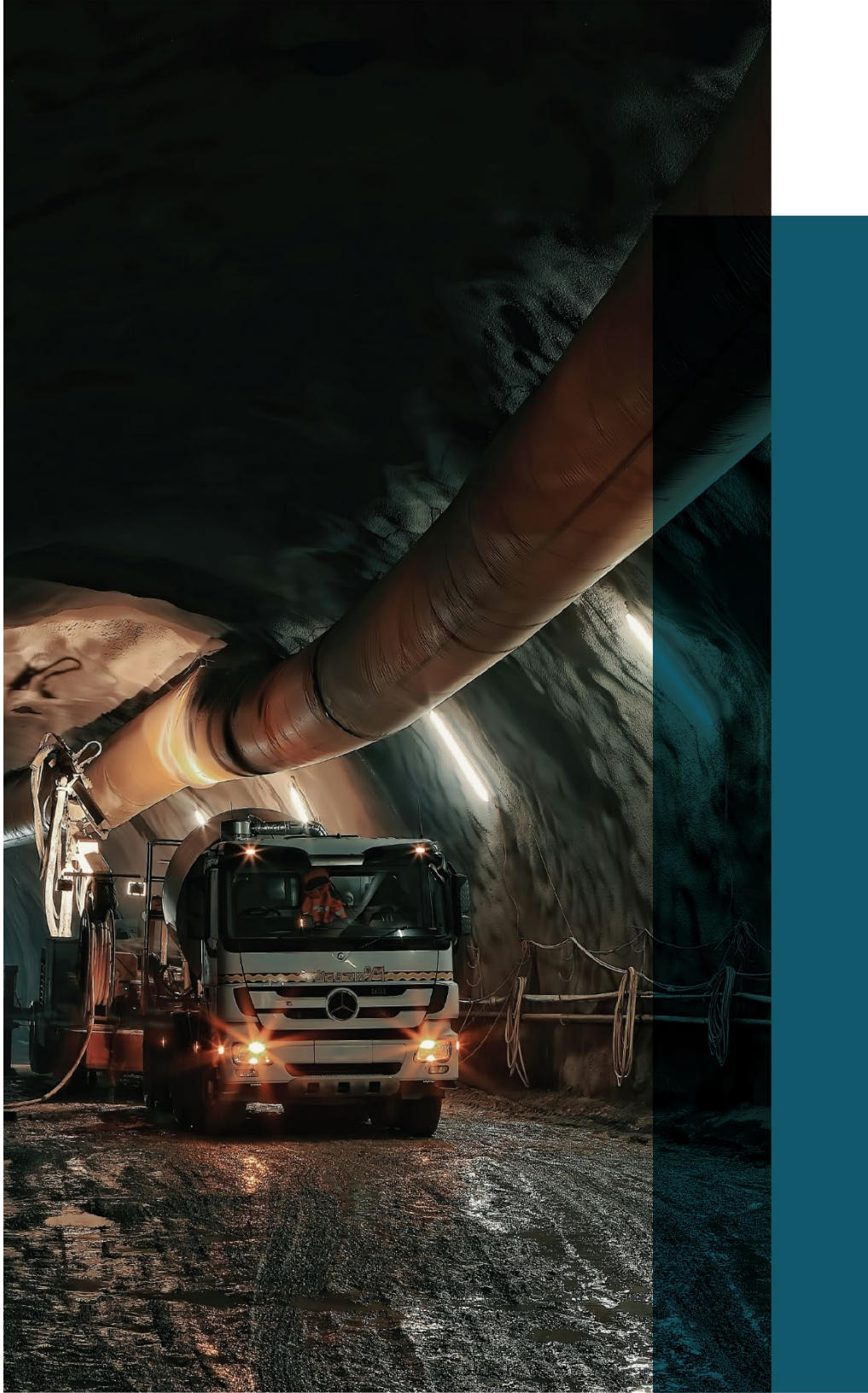
Raw material mining and refining is a prosperous industry in Ontario. Through the vast mining exploration potential in the province, there is significant capacity to expand the economic impact of the industry and contribute further to the domestic automotive supply chain.

Production Value

Ontario produced approximately 1.2K tonnes of by-product cobalt in 2022, the equivalent of $96M worth or 36% of Canada's cobalt production by value.[76] In the same year, approximately 160K tonnes of copper were produced (32% of Canada's copper production by value), and approximately 71K tonnes of nickel (45% of Canada's nickel production by value), worth $1.9B each.[77] The province produced 77% of Canada's platinum group elements in 2022 – approximately 17 tonnes – with a market value of $1.6B.[78]

"As we secure game-changing investments, we're also connecting resources, industries and workers in northern Ontario with the manufacturing might of southern Ontario to build up home-grown supply chains. Every region of Ontario will benefit with thousands of jobs being created and a stronger economy that works for everyone."[79]

The Honourable Doug Ford, Premier of Ontario

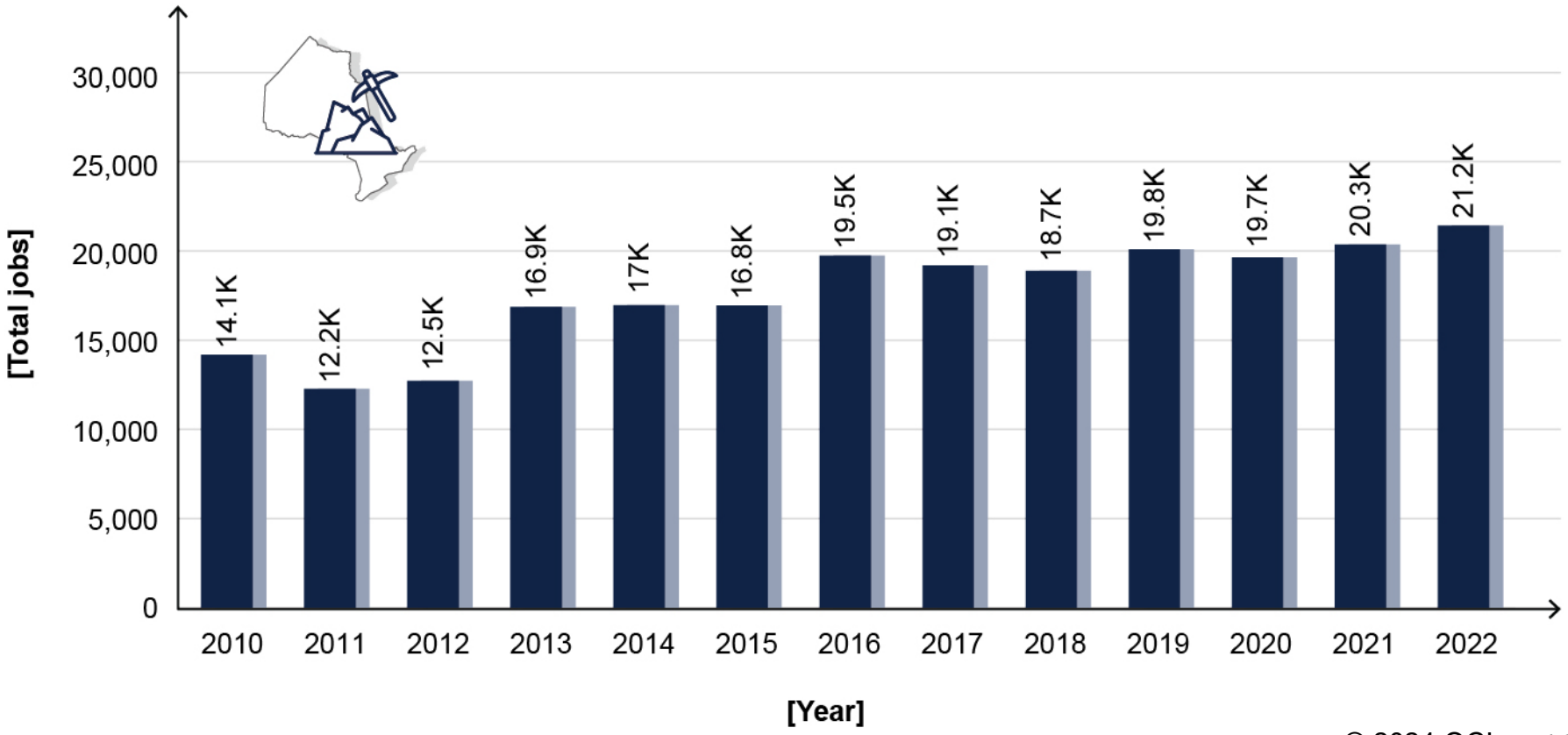


Employment

The mining sector is a key employer in Canada, with over 80K people working in mining and quarrying jobs in 2022.[80] Of these, 27% of jobs were in Ontario, with more than 21K people working in the province's mining sector.[81] Since 2010, there has been a 50% increase in the number of jobs in the mining sector in Ontario.[82] The total wages and salaries for mining jobs in Ontario equated to over $2.4M in 2022, an increase of 100% since 2010.[83]

Mining in Ontario not only supports a substantial workforce with reliable income but also serves as a crucial supplier to various industries, particularly EV battery and automotive parts manufacturing. This ensures stability in the supply chain. As the demand for EVs and the critical minerals needed for their production increases, alongside the growth of domestic EV battery manufacturing, employment opportunities in the extraction and processing of these minerals are expected to grow accordingly.

Total Mining and Quarrying (Except Oil and Gas) Jobs [NAICS 212] in Ontario, 2010-2022[84]



Ontario's Raw Material Mining and Refining Research & Development

There is a strong focus on R&D in Ontario's raw materials mining and refining industry. This is in part driven by the need to meet demand for next generation technologies, such as EVs and connected and autonomous vehicles (CAV), and to attract investment through sustainable operating practices. An example of R&D activity in the province is described below.

Centre for Excellence in Mining Innovation

Ontario's CEMI is headquartered in Sudbury, and its aim is to accelerate commercially viable innovations in the mining industry to improve safety, productivity, and environmental performance.[85] In 2021, the federal government announced that it would be investing $40M to support the development of the MICA network – a CEMI-led project with an overall value of $112.4M.[86]

The MICA network intends to bring together stakeholders from across Canada to accelerate the development and commercialization of innovative technologies.[87] The project is expected to create 900 jobs and at least 12 new businesses, and the commercialization of at least 30 new products, services, or processes.[88]

"Canada has everything it needs to be a global leader in the green economy: access to global markets, a talented workforce, clean energy, world-leading innovation ecosystems and all the critical mineral resources necessary to make EV batteries."[89]

The Honourable François-Philippe Champagne, Minister of Innovation, Science and Industry

Government and OVIN Initiatives Supporting Raw Material Mining and Refining

There are numerous initiatives which have been implemented by the Ontario government to ensure successful advancement of the mining sector in the province. Examples include streamlining the regulatory process for mining projects and launching a digital system for the registration and management of mining claims, known as the Mining Lands Administration System.[90]

A culture of innovation has also been promoted by Ontario through the introduction of industry roundtables and working groups, marketing and investment support, and targeted mining innovation funding, such as through Northern Ontario Heritage Fund Corporation (NOHFC) programs.[91]

A selection of initiatives is outlined below.

Building More Mines Act 2023

In 2023, the provincial government introduced the Building More Mines Act. The intended purpose of this legislation is to attract more investment in Ontario's mining sector, while also strengthening the province's supply chain for batteries and EVs, as well as other advanced manufacturing technologies.[92] The Act, which received Royal Assent in May 2023,[93] is expected to save mining companies time and money by making it easier for companies to get permits to recover minerals from mine tailings and waste; improving closure planning; allowing more flexibility in techniques for rehabilitating mines; and creating more opportunities for payment of financial assurance.[94]

Critical Minerals Strategy 2022-2027

The Ontario Government has committed to support raw materials mining and refining in the province in its Critical Minerals Strategy. This strategy presents a five-year roadmap for the critical minerals sector, to secure the position of the province in the global supply chain. It includes initiatives around mineral exploration, processing and supply chains, regulatory framework, research, development of opportunities with Indigenous partners, and the skilled labour force.[95] More specifically, through this strategy the province has committed to support further R&D into improving mineral recovery from EV batteries.[96]

Critical Minerals Talent Strategy

In May 2024, OVIN published the Critical Minerals Talent Strategy, a series of strategic reports that builds on Ontario's Critical Minerals Strategy 2022-2027, as part of OVIN's Workforce and Talent initiatives.[97] It was developed in partnership with the Ministry of Labour, Immigration, Training and Skills Development; the Ministry of Economic Development, Job Creation and Trade; the Ministry of Northern Development; the Ministry of Indigenous Affairs; and the Ministry of Mines, along with mining industry stakeholders. The Critical Minerals Talent Strategy addresses labour opportunities and challenges pertaining to the increased demand of critical minerals for EV batteries and the broader electrification value chain, highlighting the thousands of job vacancies that will need to be filled in order to build a strong talent pool and highly skilled critical minerals,

automotive, and mobility workforce. In response, the talent strategy highlights key opportunities including engaging youth to increase sector awareness, increasing access to training and education, and promoting engagement with women, Indigenous communities, and other underrepresented groups.[98]

Critical Minerals Innovation Fund

A brand new $5M Critical Minerals Innovation Fund was launched by the Ontario government in 2022.[99] The purpose of the fund is to support enhanced research and development, building on the supply chain for EVs and other clean technologies.[100] The fund also helps grow the exploration, mining, smelting and processing of the critical minerals industry in the province, and promotes collaboration between academia, industry, and start-ups to drive commercialization of technologies.[101]

Ontario Junior Exploration Program

In 2023, the Government of Ontario announced that it would be investing nearly $9M to support junior mining companies in financing early exploration projects to locate critical minerals used in EVs and other advanced technologies.[102] The funding is being delivered via the Ontario Junior Exploration Program (OJEP), which is a government program that boosts growth and the creation of jobs, particularly in northern and Indigenous communities.[103]

Aboriginal Participation Fund

The provincial government supports the development of partnerships between Indigenous communities, industry, and government in mineral exploration and mine development activities through the Aboriginal Participation Fund.[104] There are five funding streams available to Indigenous communities, including advanced exploration and development support, early exploration support, education and relationship building, mineral develop advisor, and values mapping and related projects.[105]

Community Development Agreement

In March 2024, the provincial government signed an agreement with Marten Falls First Nation and Webequie First Nation to develop community infrastructure projects.[106] These projects will help to further progress by allowing access to mineral deposits in Ontario's Ring of Fire region – an area of significant mineral development 500km northeast of Thunder Bay.[107] The infrastructure will include all-season roads to the Ring of Fire region, as well as health and training facilities, recreation centres, commercial buildings, and labour force development programs.[108]

OVIN Northern Regional Technology Development Site

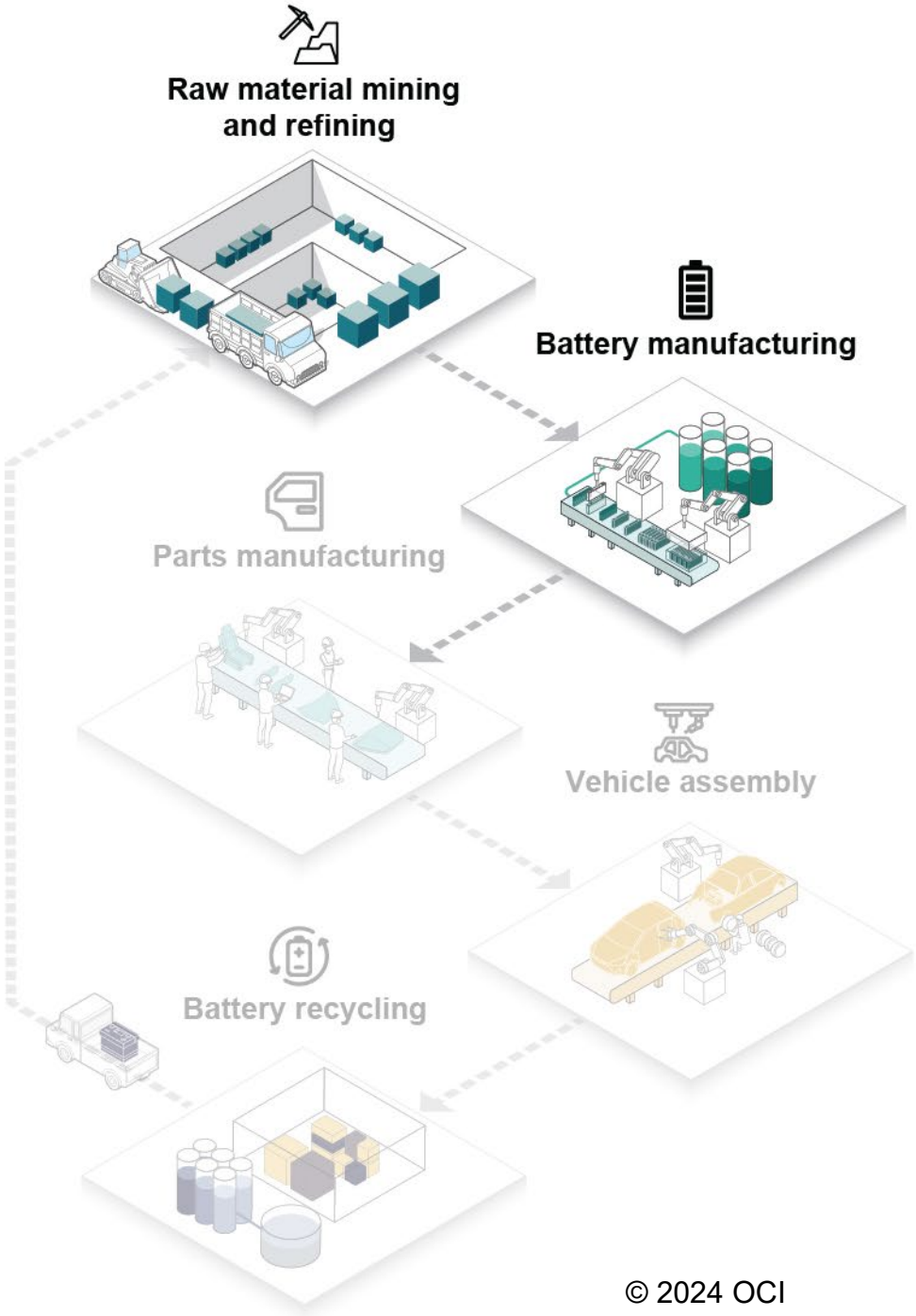
In 2022, OVIN launched its Northern RTDS, known as CORE5.[109] The site covers the northern Ontario region, encompassing North Bay, Sault Ste. Marie, Greater Sudbury, Temiskaming Shores, Timmins, and Thunder Bay.[110] The purpose of the RTDS is to bring together organizations from across the mining and manufacturing sectors, including higher education institutions, Regional Innovation Centres, incubators and accelerators, municipal and regional resources, industry, and other regional collaborators.[111] Supporting collaboration across these organizations will enable Ontario's EV supply chain to be further developed at every stage, including the mining and refining of raw materials, design of battery cells and EV powertrain, and manufacturing.[112]

2. Battery Manufacturing in Ontario

Ontario has proven itself as a leader in the automotive supply chain, through its well-established mining sector and its ever-growing parts and automotive manufacturing sectors. The investments and initiatives implemented to enable this have helped to establish an innovative ecosystem in the province, laying the groundwork for the advancement of battery manufacturing in Canada.

Several large-scale investments related to battery manufacturing have been announced in recent years across Ontario, emphasizing that the province is a stable, attractive place to invest. Global automaker Honda recently announced that it would be investing $15B in the province to expand its EV manufacturing operations – the largest investment in Honda's history, and within the Canadian automotive sector.

Plans include development of a 36-gigawatt hours (GWh) equivalent battery manufacturing plant in Alliston, a battery separator factory in Port Colborne, in a joint venture with Japanese chemicals company Asahi Kasei, and a cathode active materials (CAMs) and precursor cathode active materials (pCAMs) processing plant in a joint venture with South Korea's Posco Chemicals.[113] In a joint venture with LG Energy Solutions, Stellantis announced in 2022 that it would be investing $5B in Ontario – under the name of NextStar Energy – to develop a 49 GWh equivalent EV battery manufacturing plant in Windsor.[114] In



addition, PowerCo SE – owned by Volkswagen – announced in 2023 that it would be investing $7B to build a 90 GWh equivalent EV battery manufacturing plant in St. Thomas.[115] These substantial investments in battery manufacturing underscore Ontario's robust economic ecosystem and its appeal as a stable and attractive destination for global automotive investments, positioning the province at the forefront of the EV revolution.

These specialized advancements are pivotal in positioning Ontario as a leader in the automotive industry and supporting its supply chain. Stromcore's development of highly efficient lithium-ion batteries, supported by federal investment in advanced technologies like Turbo Bank and Electric Cart, strengthens Ontario's capacity to innovate and meet future demands in sustainable transportation solutions.

Meanwhile, NextStar Energy's EV battery facility, set to supply batteries directly to Stellantis plants across North America, not only marks a significant milestone for Stellantis but also solidifies Ontario's role as a key hub in North American EV production. Together, these initiatives boost Ontario's competitiveness in the global automotive sector and reinforce its strategic position in the evolving EV market.

These investments in battery manufacturing are further reinforced by Ontario's commitment to cultivating a skilled workforce through partnerships with leading research facilities. Facilities like the National Research Council (NRC) Battery Performance and Safety Evaluation Research Facility, the OBEC Research Centre, and The University of Toronto Electric Vehicle (UTEV) Research Centre play a crucial role in driving innovation and ensuring that Ontario maintains its leadership in battery design and manufacturing. The NRC Battery Performance and Safety Evaluation Research Facility in Ottawa plays a critical role by conducting rigorous safety and environmental testing of battery packs and cells, crucial for ensuring compliance and enhancing the reliability of EV batteries. Meanwhile, the launch of OBEC at the University of Waterloo underscores Ontario's commitment to advancing EV battery technology, fostering innovation in materials production, recycling, and manufacturing processes, while also cultivating a skilled workforce to support the growing EV battery supply chain.

Additionally, the UTEV Research Centre contributes significantly to EV technology through advanced research in battery management, powertrain optimization, and smart grid integration, positioning Ontario as a leader in global EV innovation and manufacturing capabilities. This strategic alignment enhances the province's attractiveness as a hub for next-generation EV technologies, encouraging continued investment and reinforcing its pivotal role in Canada's evolving automotive supply chain.

Initiatives such as Ontario's Driving Prosperity plan and the federal SIF, are pivotal in supporting the future of Ontario's battery manufacturing sector. Driving Prosperity aims to position Ontario as a hub for advanced automotive technologies, particularly through the development of a robust EV and battery supply chain ecosystem by 2030. Supported by substantial investments such as Volkswagen's $7B investment in PowerCo SE, and Stellantis and LG Energy Solution's $5B commitment to NextStar Energy, these initiatives foster collaboration, innovation, and site readiness, crucial for attracting and sustaining large-scale manufacturing investments across the province.

Moreover, programs like OVIN's RTDS' and Talent Development Internship/Fellowship Program further enhance Ontario's capability to lead in EV and smart mobility technologies, ensuring a dynamic and competitive automotive sector for the future.

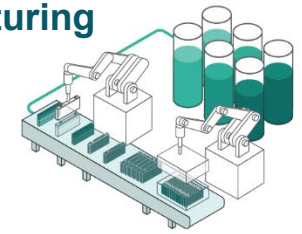
This chapter explores the evolving battery manufacturing industry within the province and its integral role in Ontario's local automotive supply chain.

Battery Manufacturing Facilities in Ontario

Battery manufacturing in Ontario plays a pivotal role in supporting the end-to-end supply chain of the automotive industry by integrating local production of essential components. This strategic focus positions Ontario as a global leader in sustainable automotive technologies, fostering innovation and attracting significant investments that contribute to the province's economic growth and technological advancement. Battery manufacturing in Ontario is in its inception phase, with several large-scale facilities currently under construction to support Ontario's network of automakers.

These facilities have brought in significant investment from global companies such as PowerCo SE and NextStar Energy. There are also specialized Canadian-owned companies operating within the province, such as Stromcore. The map below highlights a selection of organizations operating in Ontario.

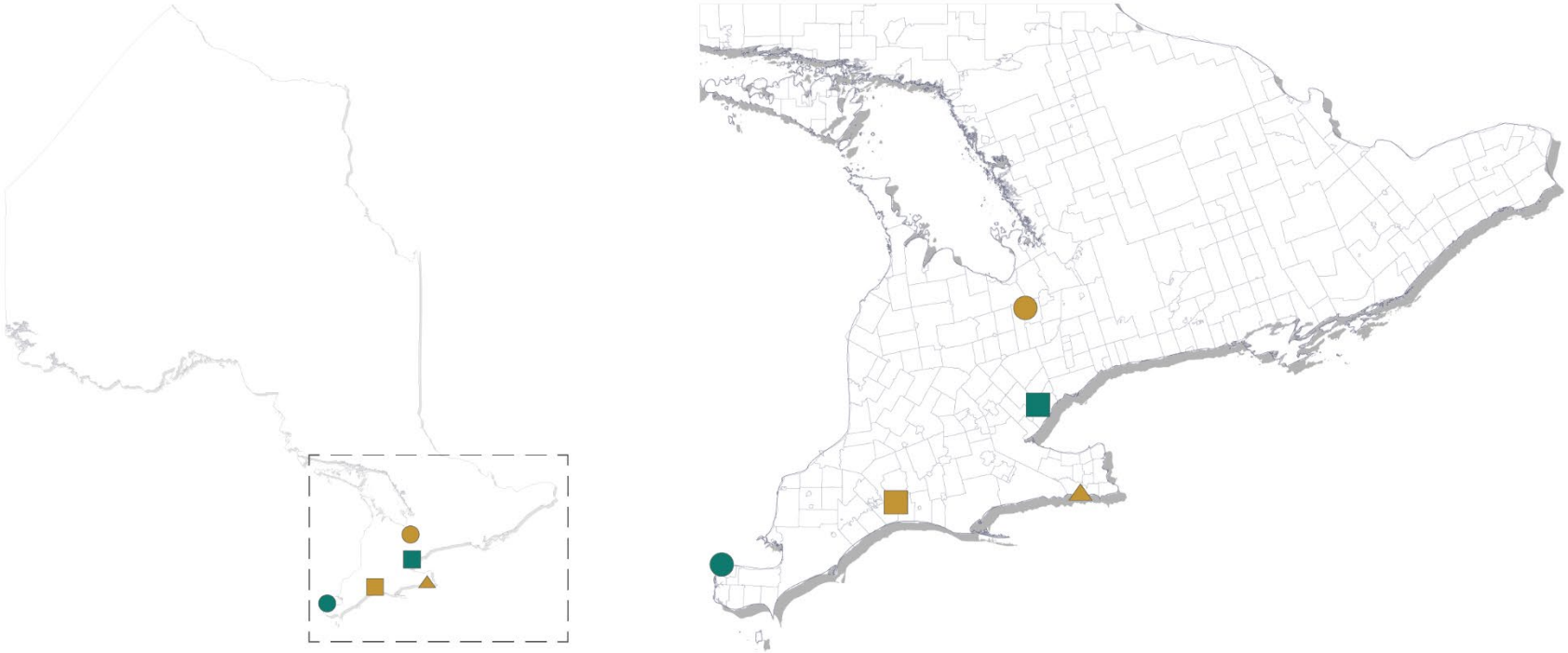
Lifecycle of Battery Manufacturing



Battery manufacturing is the second stage of the (electric) automotive lifecycle. This stage includes:

1. The production of CAMs and pCAMs, which are the chemically active elements of a battery. These are produced from the battery-grade chemicals generated from critical minerals.[116] CAMs and pCAMs form the basis of battery cell production, making up the base elements of the anode, cathode, and electrolyte.[117] These components enable the flow of electricity, and are packaged together to form battery cells.[118]
2. Multiple battery cells are then packed into cases with terminals attached to form battery modules.[119]
3. The final stage of battery production involves several battery modules being joined with electrical connections and cooling equipment to form battery packs, which can be integrated into vehicles.[120]

Battery Manufacturing Facilities in Ontario



Legend

- Volkswagen and PowerCo SE
  Battery manufacturing
- Honda
  Battery manufacturing
- Honda and Asahi Kasei
  Battery parts manufacturing
- Stromcore
  Battery manufacturing
- NextStar Energy
  Battery manufacturing

Ontario's Battery Manufacturing Ecosystem

Ontario's ability to spearhead Canada's end-to-end automotive supply chain has been accelerated by investments in battery manufacturing from global organizations. These investments, along with ready access to the burgeoning raw materials industry, has helped push Canada to become the world's most promising jurisdiction for battery manufacturing in 2024.[121]

There are currently two battery manufacturing plants under construction: NextStar Energy's facility in Windsor, and PowerCo SE's facility in St. Thomas. Additionally, Honda has announced a new battery manufacturing facility in Alliston and two new battery materials manufacturing facilities, one to be developed in partnership with Asahi Kasei and located in Port Colborne, and the other to be developed in partnership with Posco at a yet to be announced location.

In addition to these, Ontario is already home to several companies in the wider EV battery supply chain. A selection of these facilities, along with the battery manufacturing plants which are under construction, are described below.

Honda

The global automaker Honda announced in April 2024 that it would be investing $15B to expand its EV manufacturing operations in North America.[122] This is the largest investment in the history of Canada's automotive sector, and the largest investment by Honda anywhere in its history. A large proportion of this investment includes the development of a 36 GWh equivalent battery manufacturing plant in Alliston, a battery separator factory in Port Colborne, in a joint venture with Japanese chemicals company Asahi Kasei, and a CAMs/pCAMs processing plant in a joint venture with South Korea's Posco Chemicals.[123] The location of the latter joint venture plant has not yet been announced. These three plants, along with an additional EV manufacturing plant, are expected to create at least 1K jobs.[124]

NextStar Energy

NextStar Energy is a joint venture between the automaker Stellantis and the battery manufacturer LG Energy Solution.[125] In 2022, the company announced it would be making an investment of $5B to build a 49 GWh equivalent EV battery manufacturing plant in Windsor.[126] The battery facility will produce batteries for EVs in Canada, with direct supply to Stellantis vehicle manufacturing plants in Windsor and across North America.[127] The plant is due to be operational by 2025 and is expected to create 2.5K jobs.[128]

PowerCo SE

PowerCo SE is a battery company owned by automaker Volkswagen.[129] In 2023, the company announced it would be making an investment of $7B – the second largest investment in the automotive sector within the province – to build a 90 GWh equivalent EV battery manufacturing plant in St. Thomas.[130] It will be the largest battery manufacturing plant in Canada and will be Volkswagen's first EV battery manufacturing plant outside Europe. It will have the potential to produce batteries for up to 1M EVs per year.[131] It is expected to create up to 3K direct jobs and 30K indirect jobs and is due to be fully operational by 2027.[132]

Stromcore

Stromcore is a company which specializes in the design and manufacture of lithium-ion battery systems for forklift trucks.[133] Based in Mississauga, the organization has developed smart lithium-ion batteries which are up to 50% more efficient than similar products on the market.[134]

In 2023, the federal government announced that it would be investing $4.8M in Stromcore to launch two new products; Turbo Bank – an advanced AI-powered charger with improved efficiency – and Electric Cart – a low-emission e-forklift.[135] Both products have the ability to work in cold environments and the capability for fast-charging.[136]

"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 $7 billion annually, our government is staking Ontario's claim as a leader in the emerging North American EV battery industry. By harnessing advanced manufacturing processes and emerging technologies, and leveraging the critical mineral wealth in Northern Ontario, our province has what it takes to develop and build the car of the future, and the batteries those cars need."[137]

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

Ontario's Battery Manufacturing Research & Development

R&D in Ontario's battery manufacturing sector is crucial for driving innovation and expanding the ecosystem. These efforts not only enhance Ontario's capabilities in designing and manufacturing next-generation EV batteries but also solidify its leadership in the global supply chain, attracting investments and fostering sustainable growth in the automotive industry.

A number of research facilities based in Ontario have programs that are focused on EV battery research, empowering the province in its role at the forefront of the design and manufacture of next generation EVs and fortifying its leading position in the global supply chain. A selection of these existing and recently launched R&D programs is outlined below.

NRC Battery Performance and Safety Evaluation Research Facility

Based in Ottawa, the NRC Battery Performance and Safety Evaluation Research Facility provides safety assessment testing, performance analysis, and environmental analysis of battery packs and cells for industry and governmental organizations.[138] The facility has tested batteries for some of the most well-known automakers, as well as providing them with guidance to enable in-house testing.[139]

Ontario Battery and Electrochemistry Research Centre

At the end of March 2024, it was announced that a new battery research centre – OBEC – is being launched at the University of Waterloo.[140] The aim of OBEC will be to advance next-generation EV battery development, as well as battery materials production, recycling, and advanced manufacturing.[141] The facility will also be used to train students and post-doctoral fellows, and to support start-ups and larger businesses involved in the EV battery supply chain.[142]

University of Toronto Electric Vehicle Research Centre

The UTEV Research Centre is a university-industry partnership which focuses on EV technology innovation and research. Providing a hub for advanced EV research through its state-of-the-art battery and power electronics lab, the facility has a research focus on enhanced energy management, next generation powertrain, ubiquitous charging, energy storage for EVs, advanced power modules, and opportunities to expand the utility of EVs and batteries.[143] These opportunities include exploring multi-disciplinary collaborations between electrical, computer, mechanical, industrial and aerospace engineering researchers, and developing chargers which can transfer power from EV batteries to the grid, homes, and other EVs.[144]

Government and OVIN Initiatives Supporting Battery Manufacturing

Government initiatives have cultivated an environment which encourages investment and large-scale manufacturing development. The robust government initiatives have enabled several organizations to select Ontario as a strategic location for their battery manufacturing operations, thereby supporting the province in advancing next-generation EV assembly. This strategic positioning supports the advancement of next-generation EV assembly and reinforces Ontario's role as a hub for innovative manufacturing development. A selection of these initiatives is described below.

Driving Prosperity

In 2019, the Ontario government launched its plan for the future of the automotive sector in the province: Driving Prosperity.[145] The plan consists of two phases, with an overall vision of positioning Ontario as a hub for "developing and building the car of the future through emerging technologies and advanced manufacturing processes".[146] Phase 1 included three pillars for action: a competitive business climate; innovation; and talent.[147] Phase 2 was announced in 2021, with a core objective of building at least 400K EVs and hybrids by 2030, and supporting the development of a battery supply chain ecosystem.[148] This will be done by creating a domestic battery ecosystem through the introduction of at least two or three battery plants, and connecting communities, workers, and businesses across Ontario by strengthening links between the mineral wealth in the north and the manufacturing strength in the south of the region.[149]

Strategic Innovation Fund

In 2017, the federal government introduced the SIF.[150] The core objectives of the fund are to: encourage organizations to invest in R&D activities which result in the commercialization of new products, processes, and services; accelerate innovation; attract large-scale investments; and expand collaboration between the private sector, research institutions, and non-profit organizations.[151]

Through this fund, the government has supported a number of sizeable investments in Ontario. These include a $7B investment in collaboration with Volkswagen towards the new PowerCo SE facility,[152] and a $5B investment in collaboration with Stellantis and LG Energy Solution towards the NextStar Energy facility.[153]

Site Readiness Program

The Ontario government introduced the Site Readiness Program to create new opportunities for manufacturing investments.[154] This program is a funding initiative which helps make industrial sites investment-ready.[155] The program has enabled the investment in, and construction of, large-scale manufacturing facilities across the province, including the battery manufacturing plants currently being built.

OVIN Regional Technology Development Sites

Along with OVIN's Northern RTDS, as described in the previous chapter, there are a number of other RTDS' which focus on EV technology. The Durham RTDS is focused on fostering the development, production, and application of EVs and smart mobility solutions.[156] It allows small and medium enterprises (SMEs) and start-ups to test and develop their innovations in a real-world setting.[157] The Hamilton RTDS is known as the Centre for Integrated Transportation and Mobility. This RTDS is concentrated on supporting start-ups to take their EV and CAV innovations from ideas to commercial products.[158] The Waterloo RTDS is operated as a partnership between Communitech and the University of Waterloo.[159] This RTDS is focused on developing vehicle safety systems for next generation EV, CAV, and mobility technologies.[160]

OVIN Talent Development Internship/Fellowship Program

OVIN offers two talent development programs via the Talent Development Internship/Fellowship Program. The former provides support for college and university students, recent graduates, and Master's graduates,[161] whereas the latter provides support for PhD graduates and post-doctoral fellows.[162] Both programs offer the opportunity for students and recent graduates to gain industry experience in relation to CAV technologies, EVs, battery technologies, and metal and mining technologies.[163]

OVIN R&D Partnership Fund

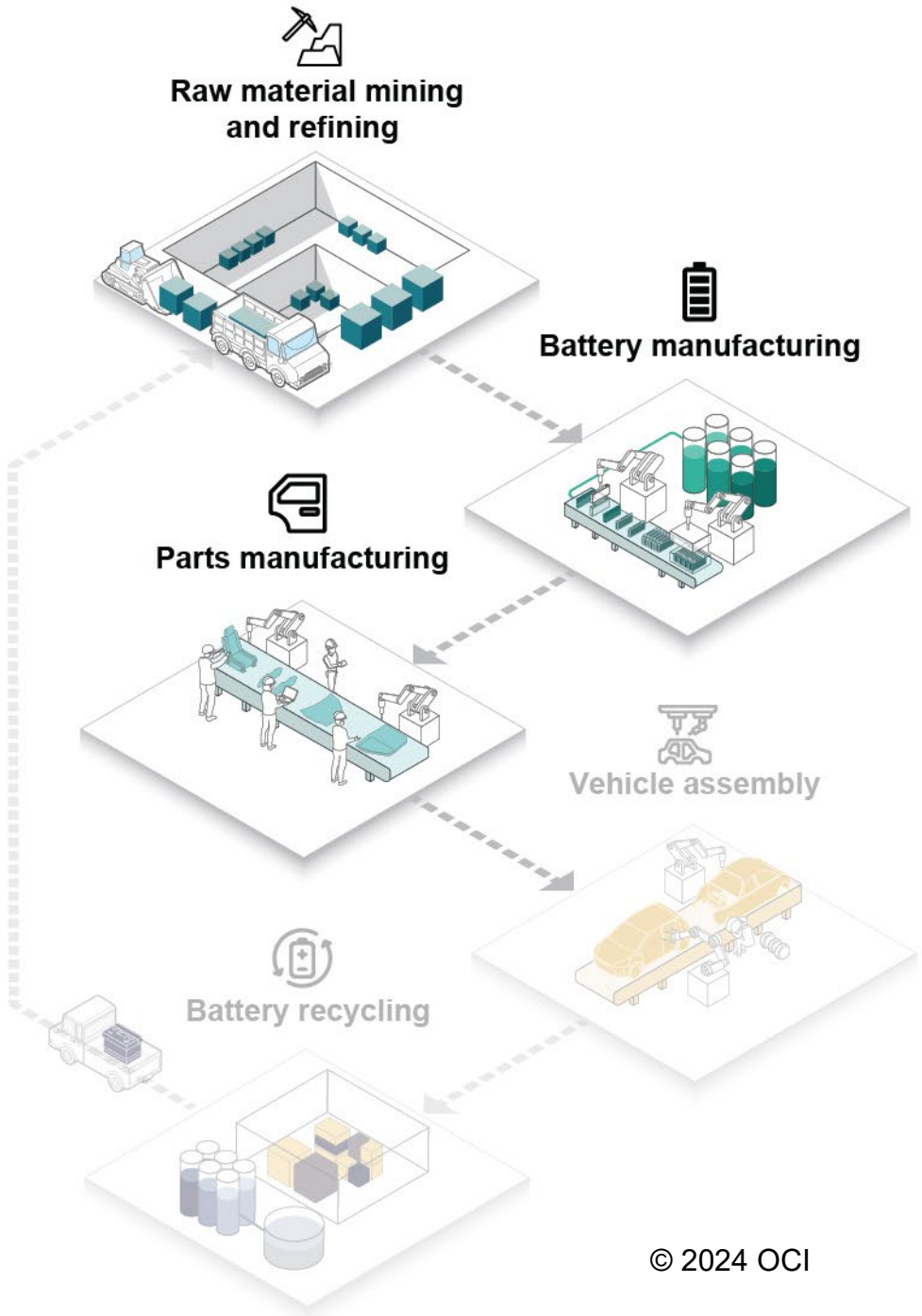
OVIN's R&D Partnership Fund provides support to SMEs based in Ontario. It is made up of a number of different streams, each with a different focus area. The EV Streams 1 and 2 support the development, testing, and validation of EV and battery-focused technologies.[164] Stream 1 offers co-investment of up to $100K, and Stream 2 offers co-investment of up to $1M.[165] There is also the CAV and Smart Mobility Streams 1 and 2, which support projects associated with the development, testing, validation, and demonstration of CAV and smart mobility technologies.[166]

3. Parts Manufacturing in Ontario

Automotive parts manufacturing is a booming industry in Ontario. In 2023, the province exported over $19.6B of automotive parts, making up 90% of all Canadian parts exports.[167] Additionally, 90% of parts manufacturing jobs across Canada are located in Ontario.[168]

There are hundreds of parts manufacturing organizations in Ontario, producing a diverse range of parts – in 2023, there were more than 700 parts manufacturing firms operating in the province, many of which are owned and operated by the largest global players in the automotive market, such as Ford, GM, Honda, Stellantis, and Toyota.[169] They also export a substantial volume of parts globally, positioning Ontario at the heart of the global automotive supply chain. Many of these organizations have received provincial investment to further develop their operations in Ontario, boosting the number of highly-skilled jobs in the region. The diverse array of parts (i.e. plastic components, HVAC systems, electric propulsion systems, safety electronics and battery enclosures) manufactured by these companies in Ontario forms a comprehensive end-to-end supply chain for the automotive industry. This integrated network ensures a seamless flow of components from assembly and injection molding to advanced R&D, supporting the automotive sector's technological advancement and operational efficiency.

These manufacturing organizations are also sustained by a network of leading research facilities. These facilities, such as CanmetMaterials in Hamilton, the Centre for Hybrid Automotive



Research and Green Energy (CHARGE) Lab at the University of Windsor, and the McMaster Automotive Resource Centre (MARC), help to ensure that Ontario remains at the leading edge of automotive innovation, providing opportunities for collaboration between researchers and industry.

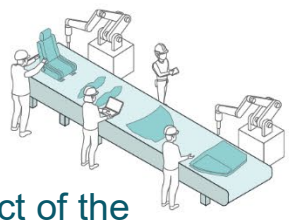
Ontario's role as a leading hub for advanced automotive technologies reinforces its competitive edge in the global EV market. Ontario's strategic investments in EV manufacturing not only stimulate economic growth and job creation but also position the province at the forefront of sustainable transportation innovation. By attracting major international players and supporting local expansions, Ontario demonstrates proactive leadership in fostering a thriving ecosystem for EV production and technology development.

This chapter highlights Ontario's robust parts manufacturing industry and its critical role in the automotive supply chain.

Parts Manufacturing Facilities in Ontario

Ontario's parts manufacturing industry forms a robust cluster primarily located in the southwest of the province, encompassing a diverse spectrum of entities, ranging from dynamic start-ups and SMEs to influential multinational corporations, underscoring its pivotal regional importance. Global OEMs such as Ford, GM, Honda, and Stellantis all have parts and engine manufacturing facilities in Ontario, along with smaller organizations which manufacture specialist parts. Highlighted here are a few of Ontario's hundreds of parts manufacturing firms, offering a glimpse into the province's diverse production capabilities and underscoring their crucial role in its manufacturing sector.

Lifecycle of Parts Manufacturing

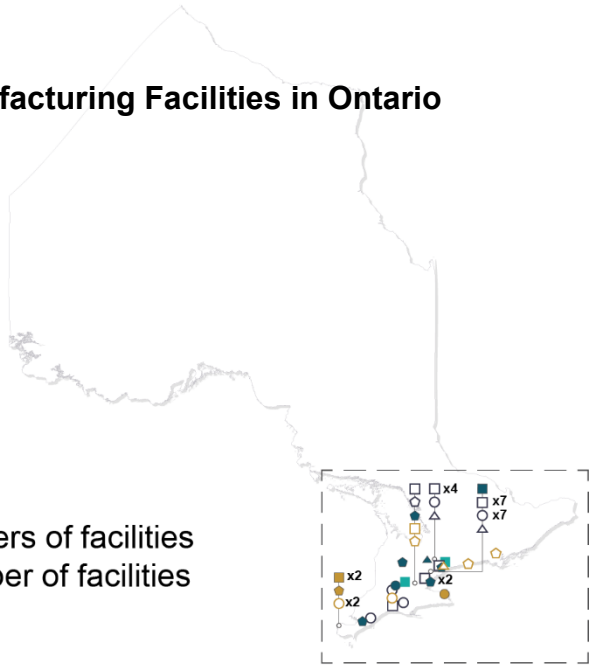


The largest and most diverse aspect of the automotive supply chain, parts manufacturing generally entails:

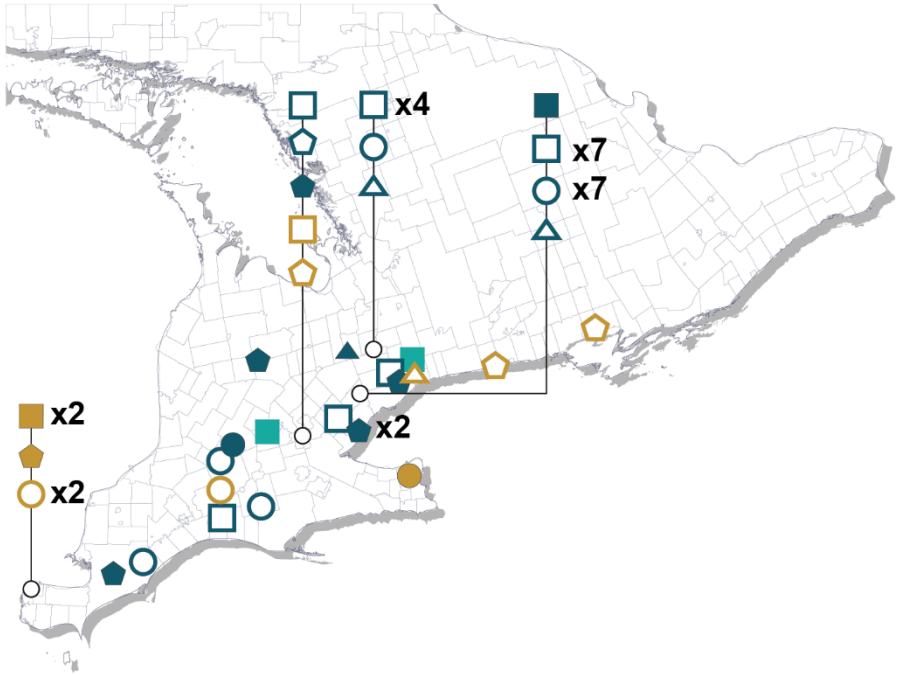
1. Design and engineering, where detailed specifications are developed for each part.
2. Prototyping, where prototypes are built to test design and functionality.
3. Mass production, using specialized machinery and assembly lines.
4. Quality control, where rigorous quality checks are undertaken.
5. Packaging and distribution, where finished parts are packaged and shipped to assembly plants.

The vehicle parts manufactured during this stage of the lifecycle include engine and engine parts, electronic equipment, vehicle steering and suspension components, brake systems, transmission and power train systems, seating and interior trim, metal stamping, and exhaust systems, among others.[170]

Parts Manufacturing Facilities in Ontario



○ Clusters of facilities
xN Number of facilities



Legend

- ABC Technologies
  Parts manufacturing
- Aisin Canada
  Sunroof, doorframes, moldings, seating, and small component manufacturing
- Dana Canada Corporation
  Drivetrain and electrified propulsion systems manufacturing
- F&P Mfg. Inc.
  Stamping, welding, hydroforming, laser cutting, paint, and modular assembly
- Ford
  Engine manufacturing
- Dongshin Motech
  Battery parts manufacturing
- GM
  Engine manufacturing
- Honda
  Engine manufacturing
- Magna International
  Parts manufacturing
- Mitsui High-tec
  EV motor core component manufacturing (future)
- Martinrea
  Parts manufacturing
- Stellantis
  Aluminum die casting
- DENSO
  Heating ventilation and air conditioning unit, radiator, condenser, engine fan and cooling module manufacturing
- CpK Interior Products
  Materials compounding, cast skin and foam, injection moulding, assembly, and sequencing
- Leggett & Platt Automotive
  Parts manufacturing
- Veoneer
  Safety system manufacturing
- Grote
  Lighting manufacturing

Ontario's Parts Manufacturing Ecosystem

Ontario has a thriving parts manufacturing supply chain, supported by provincial investment, a domestic supply of raw materials, and a substantial network of automakers with a constant demand for parts. In 2023, there were more than 700 parts manufacturing organizations operating in the province, from global companies to SMEs.[171] This diverse and extensive network of parts manufacturing firms is crucial for maintaining a robust and resilient supply chain. A selection of the organizations based in Ontario is outlined below.

ABC Technologies

ABC Technologies is an automotive parts supplier specializing in plastic components and systems.[172] The company supplies products such as interior trim, bumper systems, HVAC distribution systems, air induction systems, fluid management systems, and steering column covers.[173] It is a Canadian company that has expanded globally, with its head office located in Toronto.[174]

Aisin Canada

Aisin Canada is a parts manufacturer specializing in products such as sunroofs, doorframes, and frame moldings.[175] It has a manufacturing plant located in Stratford, which supplies Toyota's vehicle assembly plants in Woodstock and Cambridge.[176]

CpK Interior Products

CpK Interior Products is a parts supplier with operations in Guelph, Port Hope, and Belleville.[177] The Guelph facility specializes in assembly and injection molding, the Port Hope facility specializes in tooling and production for cast skin and foam, and the Belleville facility specializes in R&D.[178]

Dana Canada Corporation

Dana Canada Corporation is a manufacturer of drivetrain and electric propulsion motor systems. Among the wide range of parts it produces are cooler systems, transmission systems, and e-drive systems.[179] In 2023, the organization announced an investment of $60M to expand capabilities across its facilities in Oakville and Cambridge.[180] In support of this, the Ontario government announced it would provide an additional $2.5M in investment via Invest Ontario.[181] The investment is expected to create 105 new jobs.[182]

DENSO Manufacturing Canada Inc

DENSO Manufacturing Canada Inc is a parts manufacturer based in Guelph, Ontario.[183] The organization specializes in producing HVAC units, radiators, condensers, engine fans, and engine cooling modules.[184]

Dongshin Motech

Dongshin Motech is a South Korean company which specializes in manufacturing aluminum casings for EV batteries.[185] In 2022, the company announced an investment of at least $60M to build a brand-new 170K square foot facility in Windsor, its first operation in North America.[186] The facility is expected to create 300 jobs and will be a direct supplier to NextStar Energy's battery manufacturing plant.[187]

F&P Mfg. Inc

F&P Mfg. Inc is a parts manufacturer located in Tottenham, Ontario with a focus on automotive components. The company specializes in producing metal products through metal stamping,

welding, hydroforming, e-coating, and modular assembly.[188] The products it manufactures include subframes, suspension arms, pedals, and component parts of brackets, suspension, and crossbeam.[189]

Grote

Grote is a North American automotive lighting manufacturer with its Canadian headquarters in Markham.[190] The products include white lights, signal lighting, warning and hazard lights, fuses, circuit breakers, and interior lighting.[191] Its key markets include heavy-duty trucks and trailers, and light-duty trailers.[192] The products it manufactures include white lights, signal lighting, warning and hazard lights, fuses, circuit breakers, and interior lighting commercial uses such as agriculture, mining, forestry, and construction.[193]

Leggett & Platt Automotive

Leggett & Platt Automotive is a global manufacturer specializing in producing automotive seating comfort and convenience systems.[194] Its products include seat suspension, lumbar, bolster, massage systems, and motors, actuators, and cables for seating and closure systems.[195] The company has facilities in Lakeshore, London, and Oldcastle.[196]

Magna International

Magna International is a parts manufacturer for automakers. The company produces a broad range of parts, including battery enclosures, electronic control modules, lighting, mechatronics, and powertrain modules.[197] In 2023, the company announced it would be investing over $470M in order to expand its operations in Ontario.[198] This expansion includes building a new battery enclosures facility in Brampton, as well as developing its facilities in Guelph, Belleville, Newmarket, Windsor, and Penetanguishene.[199] The investment was supported by $23.6M in grant funding from the Ontario government, and is expected to create over 1K new jobs.[200]

Martinrea

Martinrea is a parts manufacturer which specializes in the production of lightweight structures and propulsion systems.[201] The company operates globally but is headquartered in Vaughan.[202] Included in the products it manufactures are lightweight structures, such as exterior trim and components for suspension, propulsion systems, such as engine blocks, transmission products, fluid and thermal products, and graphene and nylon coated brake lines.[203]

Mitsui High-tec

Mitsui High-tec is a Japanese parts manufacturer specializing in the production of motor cores for electric and hybrid vehicles.[204] The organization is headquartered in Japan but has recently announced an investment of $102M to build a new EV parts manufacturing facility in Brantford, Ontario.[205] This investment was supported by $3.1M in grant funding from the Invest Ontario Fund, and is expected to create 104 new jobs.[206]

Veoneer

Veoneer is a global electronics manufacturer with a production plant in Markham.[207] The company specializes in automotive safety systems such as restraint control systems (RCS), with individual products including RCS electronic control units, remote sensing units, and electronics for motorized seatbelts.[208]

Economic Impact of Parts Manufacturing in Ontario

Automotive parts manufacturing is a vital driver of Ontario's economy, with components manufactured in the province being shipped both across Canada and worldwide. Ontario is increasingly acknowledged as a pivotal player in the global supply chain, thanks to its expanding parts manufacturing industry that has solidified its reputation for delivering high-quality products.

GDP*

The motor vehicle parts manufacturing industry (NAICS 3363) contributed approx. $8.7B to Ontario's GDP in 2023.[209] Metal stamping (NAICS 33637) was the largest contributor, accounting for more than $1.9B.[210] This was followed by transmission and power train parts manufacturing (NAICS 33635) which contributed over $1.7B.[211] Engine and engine parts manufacturing (NAICS 33631) was the next largest contributor, accounting for over $1.4B, followed by "other motor vehicle parts manufacturing (NAICS 33639)" – consisting of air bags, catalytic converters, exhaust systems, filters, radiators, and wheels – which contributed $1.3B.[212] Seating and interior trim manufacturing (NAICS 33636) contributed over $1.1B.[213] The vehicle parts manufacturing industry is a crucial part of Ontario's economy, providing the backbone for the wider supply chain.

Exports

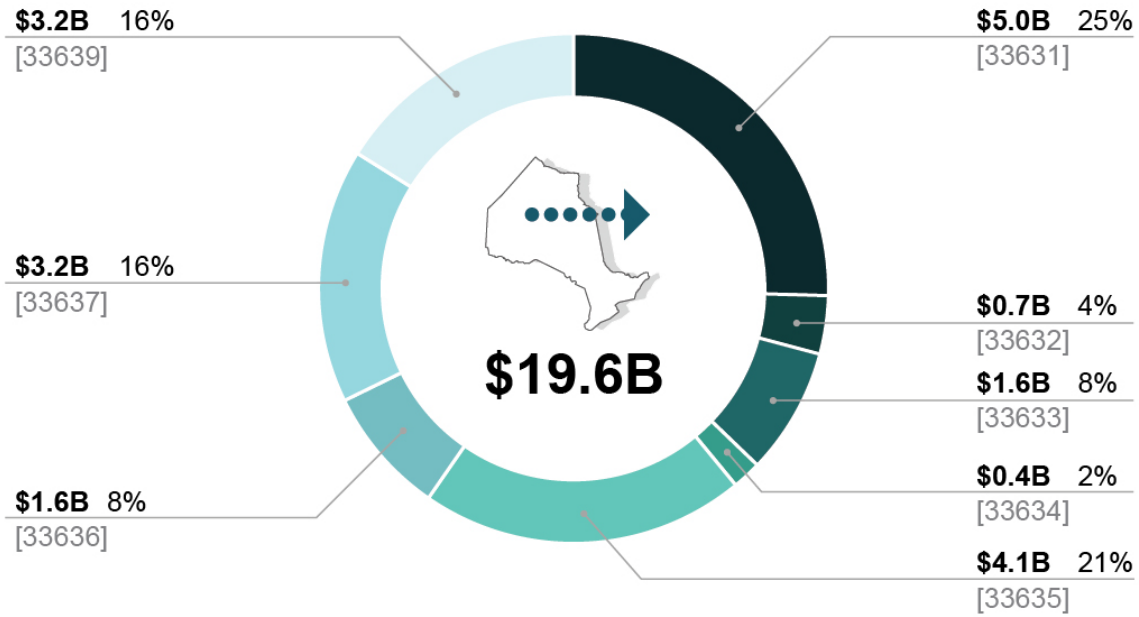
Ontario's motor vehicle parts manufacturing (NAICS 3363) exports are split into the following subcategories: engine and engine parts; electrical and electronic equipment; steering and suspension components; brake system; transmission and power train; seating and interior trim; metal stamping; and other, which includes air bags, catalytic converters, exhaust systems, filters, radiators, and wheels.

Engine and engine parts are the largest source of vehicle parts exports in Ontario. In 2023, 25% of vehicle parts exports were engine and engine parts, with a value of $5B.[214] Vehicle transmission and power train parts made up 21% of exports from the province, with a value of $4.1B.[215] Metal stamping and other parts exports each made up 16% of exports, both valued at $3.2B.[216]

These vehicle parts exports, including those which make a smaller but no less significant contribution, have helped to secure Ontario's position in the global automotive supply chain.

* All GDP data is in 2017 Chained Dollars

Ontario Motor Vehicle Parts [NAICS 3363] Exports Per Industry, 2023[217]

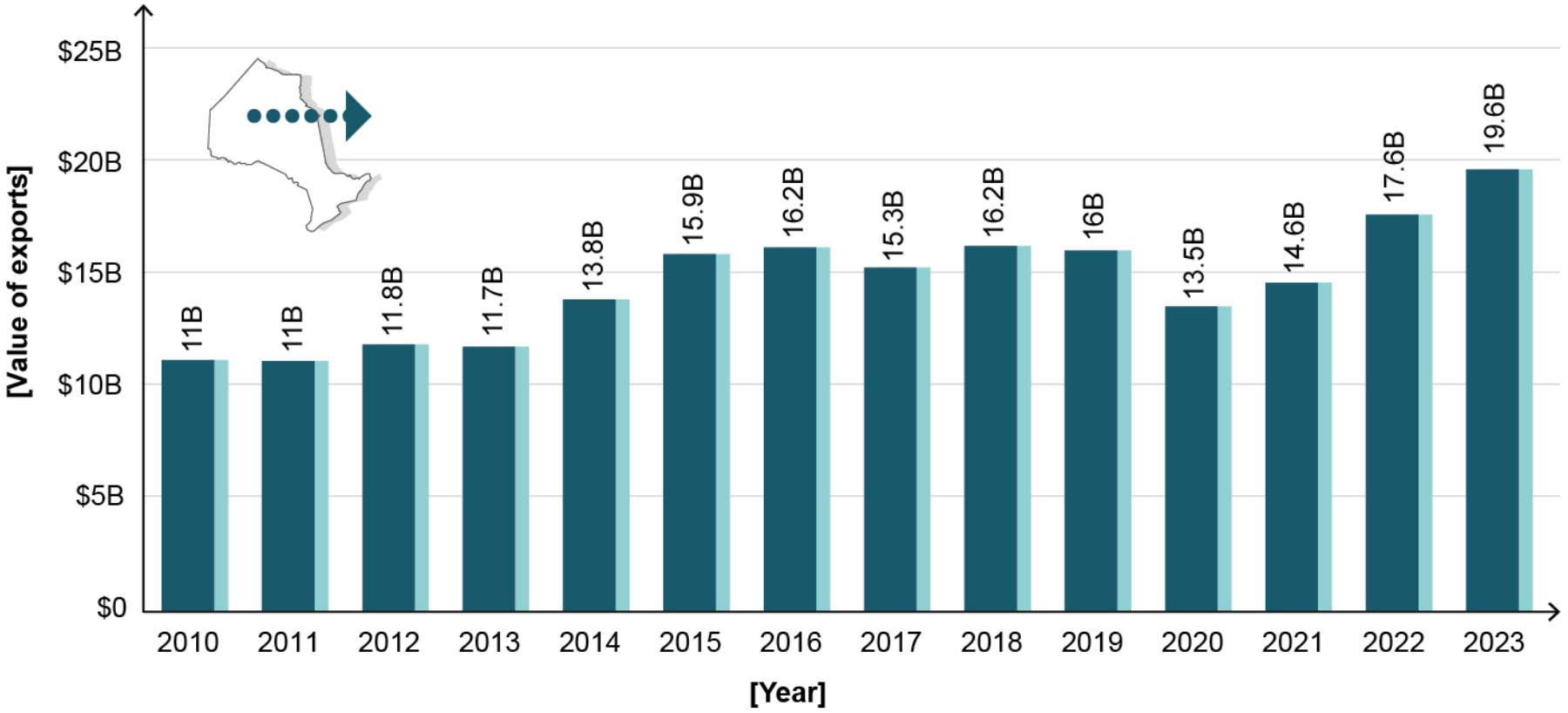


Legend

- Motor vehicle gasoline engine and engine parts manufacturing [33631]
- Motor vehicle electrical and electronic equipment manufacturing [33632]
- Motor vehicle steering and suspension components (except spring) manufacturing [33633]
- Motor vehicle brake system manufacturing [33634]
- Motor vehicle transmission and power train parts manufacturing [33635]
- Motor vehicle seating and interior trim manufacturing [33636]
- Motor vehicle metal stamping [33637]
- Other motor vehicle parts manufacturing [33639]

Ontario's automotive parts manufacturing exports have steadily grown since 2010, from over $11.1B, to over $19.6B in 2023.[218] Overall Canadian motor vehicle parts manufacturing exports were valued at over $21.7B in 2023, meaning Ontario's motor vehicle parts exports market comprises of an impressive 90% of all Canadian motor vehicle parts exports.[219] Ontario is the principal source of vehicle parts exports in Canada, demonstrating its critical role in the Canadian economy.

Ontario Motor Vehicle Parts [NAICS 3363] Exports, 2010-2023[220]

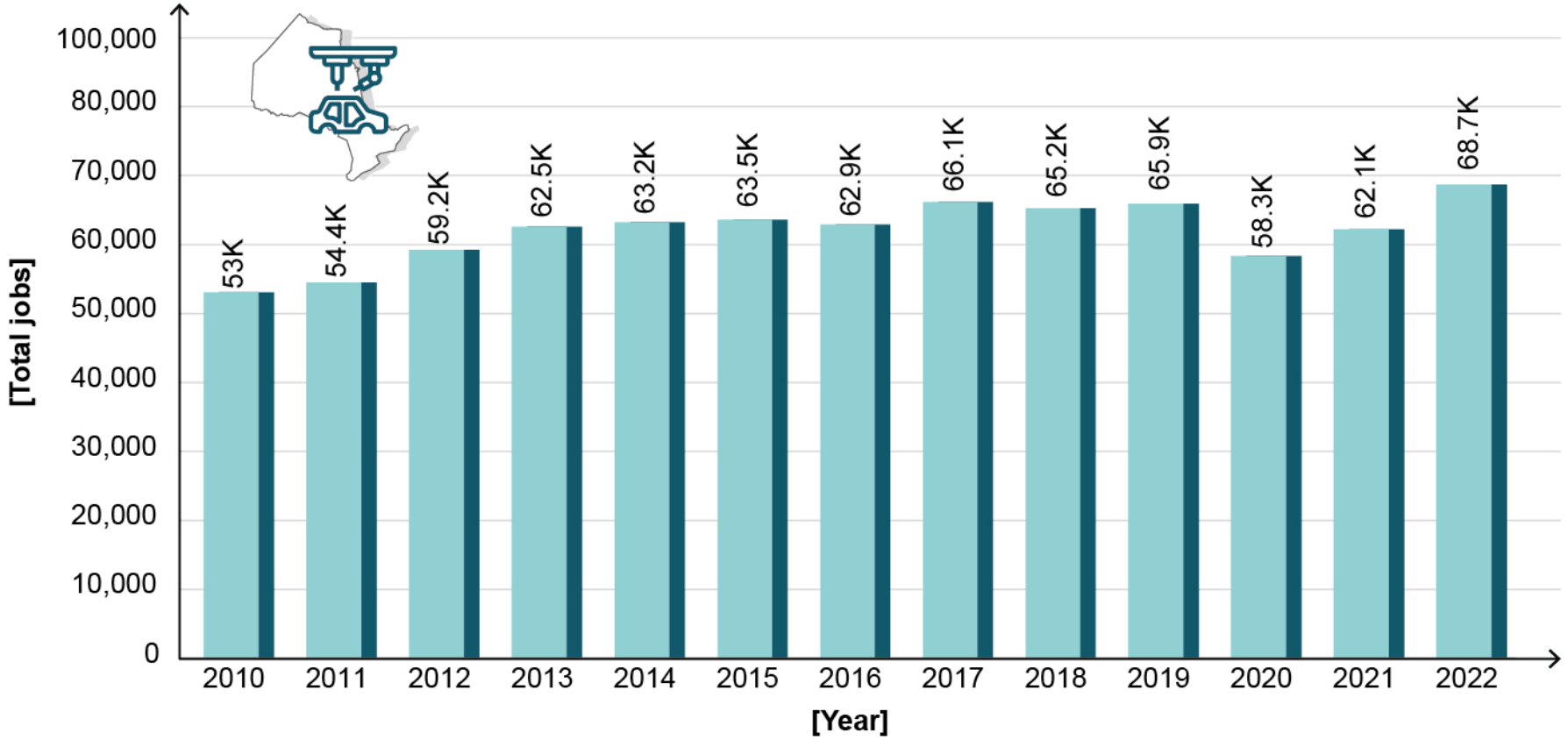


Employment

The vehicle parts manufacturing industry employed nearly 69K people in Ontario in 2022.[221] Across Canada, 90% of parts manufacturing jobs were located in Ontario in 2022, with over 76K people employed in these types of jobs across the nation.[222] Since 2010 there has been a 29% increase in parts manufacturing jobs in the province.[223] The total wages and salaries for parts manufacturing jobs in Ontario equated to over $4.8M in 2022, an increase of 60% since 2010.[224]

Vehicle parts manufacturing in Ontario is a substantial industry that not only enhances the province's job market but also lays the groundwork for Canada's pivotal role in the global automotive supply chain.

Total Motor Vehicle Parts Manufacturing [NAICS 3363] Jobs in Ontario, 2010-2022[225]



Ontario's Parts Manufacturing Research & Development

Ontario's prosperous parts manufacturing industry is further sustained by an extensive network of research facilities, ensuring that the province maintains its position as a trailblazer in automotive manufacturing. Some of these facilities are presented below.

CanmetMATERIALS

CanmetMATERIALS research facility is the largest research lab in Canada dedicated to fabricating, processing, and evaluating metals and materials, with staff researching and developing materials solutions for the transportation, energy, and metal manufacturing sectors.[226] The main facility is located in Hamilton. Within the transportation sector, CanmetMATERIALS largely works with vehicle, engine, and component manufacturers looking for new advanced-materials solutions to improve fuel efficiency whilst maintaining performance and safety standards.[227]

Centre for Hybrid Automotive Research and Green Energy Lab

The CHARGE Lab at the University of Windsor is a research facility with a focus on transformative EV technologies.[228] The facility helps to foster collaboration across disciplines amongst materials, mechanical, electrical, and software engineers.[229] There are three major research programs at the facility, including traction e-machines, traction motor drives and controls, and e-motor and drive testing.[230]

Fraunhofer Project Centre for Composites Research

The Fraunhofer Project Centre for Composites Research is a joint venture between Western University and the Fraunhofer Institute of Chemical Technology in Pfinztal, Germany, with the Fraunhofer Innovation Platform for Composites (FIP-Composites) located at Western University.[231] The FIP-Composites facility develops and tests new lightweight materials and advanced manufacturing processes at an industrial scale, with a focus on composite production for the automotive sector.[232]

McMaster Automotive Resource Centre

Located at McMaster Innovation Park, the MARC is a purpose-built facility which allows researchers to work directly with industry to test and develop new technologies.[233] The facility is home to a number of research groups, including the Canada Excellence Research Chair (CERC) Laureate Program. This program focuses on EV and smart mobility research, including advanced electric motors, power electronics, energy management systems and controls, electrified powertrains, EVs, and autonomous systems.[234]

Centre for Intelligent Antenna and Radio Systems

The University of Waterloo Centre for Intelligent Antenna and Radio Systems (CIARS) is a research facility with a focus on electromagnetic devices, communication, and sensing system development.[235] The centre has five interconnected indoor labs, an outdoor lab, and a highly advance computational facility.[236]

Government and OVIN Initiatives Supporting Parts Manufacturing

A number of initiatives have been introduced by the Ontario government and OVIN to ensure the continued strength of the province's vehicle parts manufacturing industry. A selection of these initiatives is outlined below.

Ontario Automotive Modernization Program

The Ontario Automotive Modernization Program (O-AMP) is a $22M initiative launched by the Ontario government in 2019 to support small and medium automotive parts suppliers in the province, enabling them to introduce new tools, technologies, and manufacturing practices.[237] As of the end of 2023, $17.8M has been invested through O-AMP on over 170 projects.[238] One of these investments, announced in 2023, was for $3.5M to support 26 small and medium automotive parts suppliers across the province to invest in new tools and technology.[239] This investment will create 111 jobs and helps the organizations involved scale-up production, modernize their operations, and increase competitiveness within the automotive parts supply chain.[240]

APMA Future of Work Scholarship

In 2023, APMA ran a scholarship program aimed at post-secondary students pursuing a career in Canada's automotive industry.[241] The program awarded four scholarships worth $2.5K each to students in the following categories: engineering, including chemical, computer, electrical, and mechanical; skilled trades, including mold makers, tool and die, millwright, electric and mechanical technicians; cross border logistics, including supply chain management, cyber security, and sustainable transportation; and policy leadership.[242]

OVIN Learn

OVIN is currently developing a central online learning platform, called OVIN Learn. This platform can be accessed by industry, post-secondary, and the workforce via OVIN's Content Partnerships Program, which ensures that talent within Ontario's automotive industry can develop new and existing skills which align with the sector's needs.[243] There is a focus on micro-credential opportunities designed to upskill the workforce, meet future skills-needs, and promote Ontario's automotive ecosystem to the global market.[244]

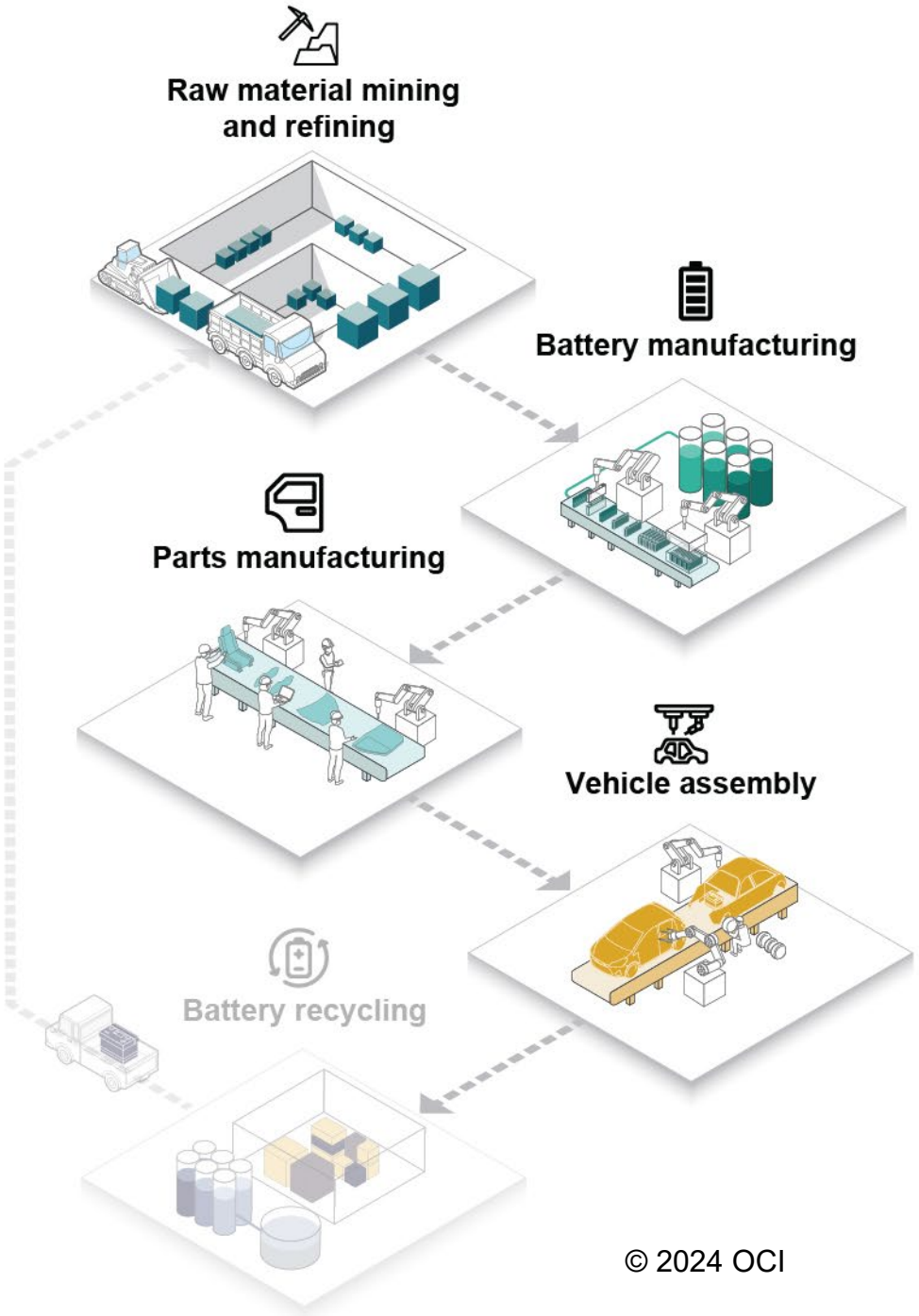
"As we continue to grow our automotive and manufacturing sectors, we want Ontario's auto parts manufacturers to remain competitive both domestically and internationally. When we invest in these companies, the economic benefits reach well beyond local communities, creating highly skilled and good-paying jobs right across the province."[245]

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

4. Vehicle Assembly in Ontario

Ontario is the home of vehicle assembly in Canada. Five OEMs have operating plants in the province: Ford, GM, Honda, Stellantis and Toyota. Attracted by Ontario's wealth of raw materials and parts manufacturers, these organizations have invested substantial amounts over recent years - $43B since 2020[246] - to grow their operations, helping to establish Ontario as the hub of Canadian automotive manufacturing. In fact, in 2023, Ontario's motor vehicle exports were valued at more than $55.2B, making up 91% of total Canadian vehicle exports.[247]

Ontario's automotive sector is thriving with substantial investments from its major players. Ford's $3B investment in expanding truck production at its Oakville complex highlights its significant operations across multiple facilities in the province. GM's $2B commitment to Canada's first full-scale EV plant, supported by federal and provincial funding, underscores its strategic presence in Ontario, maintaining over 5.2K jobs. Honda's $1.4B investment in hybrid vehicle manufacturing and recent $15B pledge towards EV supply chain development further solidify Ontario's leadership in automotive innovation. Stellantis' $3.6B investment in electrification across Windsor and Brampton plants, with substantial government backing, enhances Ontario's role in advanced vehicle architectures. Moreover, Toyota's $1.4B investment in RAV4 production safeguards 8K jobs and introduces advanced manufacturing capabilities, supported by federal initiatives.



Ontario's motor vehicle manufacturing prowess is echoed by its role in cutting edge automotive research. The province led the development of the first zero-emission concept vehicle via Project Arrow, delivered in partnership between OVIN and APMA.[248] Following the success of the Ontario-based project, a second phase is now underway to produce a fleet of vehicles. Additionally, the Ontario Tech University ACE facility offers a unique facility where vehicles can be tested under a broad range of climatic condictions, such as freezing rain and blizzards.[249]

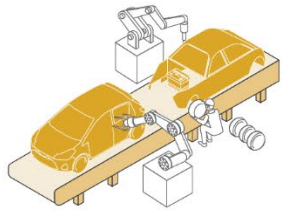
The vehicle assembly industry in Ontario directly supports the wider automotive supply chain, helping the economy in the province to expand and employ Ontarians in highly skilled roles. The industry relies on a diverse network of manufacturers for vehicle parts, supported by materials sourced from Ontario's robust mining sector. Additionally, the province boasts organizations equipped to responsibly extract, recycle, and reuse raw materials at the end of a vehicle's life cycle.

This chapter outlines Ontario's reputable vehicle assembly industry and the pivotal role it plays in positioning Ontario at the heart of Canada's automotive supply chain.

Vehicle Assembly Facilities in Ontario

Ontario is home to a number of vehicle assembly facilities, owned and operated by five of the most well-known global automakers: Ford, GM, Honda, Stellantis, and Toyota. There is also a heavy-duty track assembly facility operated by Hino, which is part of the Toyota group. The vehicle assembly industry, like parts manufacturing, is clustered in the southwest of Ontario. This proximity between the two industries enables the supply chain to function effectively and efficiently.

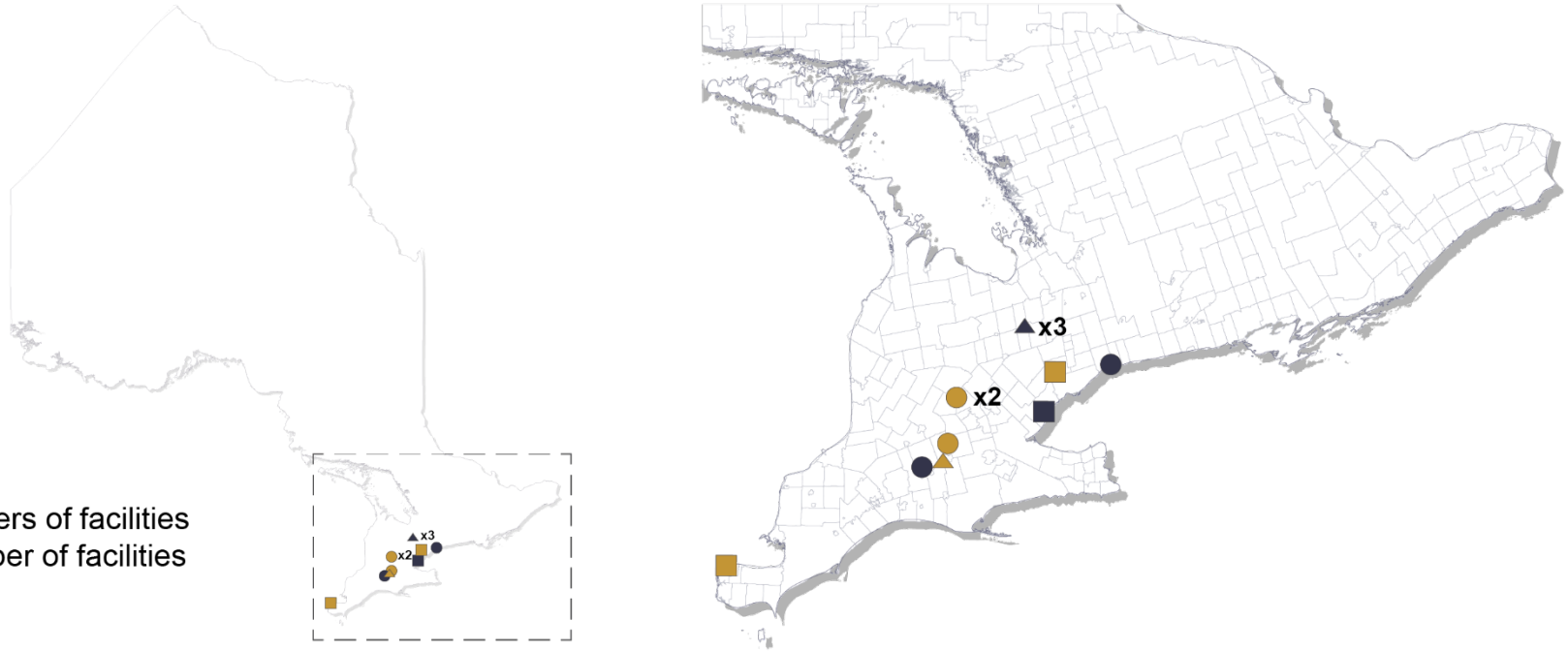
Lifecycle of Vehicle Assembly



Once battery and parts manufacturing is complete, vehicles enter the assembly stage of their lifecycle. At this stage the completed metal, plastic, and electrical components from the previous stages are shipped to automaker assembly plants. At the assembly plants, automakers manufacture vehicle chassis and combine them with the components supplied by parts manufacturers – and battery manufacturers where required – to assemble complete vehicles.[250] These steps are usually automated and involve:

1. Welding, glueing and riveting unpainted body panels together, to produce what is known as the 'body in white'.
2. Priming, seam sealing, painting, polishing and waxing in the paint shop.[251]
3. Undergoing the 'hard trim', whereby instrument panels, steering columns, and body glass are installed.
4. Undergoing the 'soft trim', to install seats, door pads, and upholstery.[252]
5. Final assembly, where components such as the petrol tank, exhaust, bumpers, engine, battery (for EVs), and tires are installed.[253]

Vehicle Assembly Facilities in Ontario



Legend

- ■ Ford
  ICE vehicle assembly, EV assembly (future)
- ● GM
  ICE vehicle assembly, EV assembly
- ▲ Honda
  ICE vehicle assembly, EV assembly (future)
- ■ Stellantis
  ICE vehicle assembly, plug-in hybrid vehicle assembly, EV assembly (future)
- ● Toyota
  ICE vehicle assembly, hybrid vehicle assembly
- ▲ Toyota-Hino
  Truck assembly

Ontario's Vehicle Assembly Ecosystem

Ontario is a hub of automotive manufacturing and vehicle assembly; it is the only province in which all five OEMs in Canada (Ford, GM, Stellantis, Honda, and Toyota) operate, supported by a domestic supply of parts from the multitude of manufacturers located across the province. For more information refer to OVIN's detailed analysis of the automotive manufacturing industry in its recent quarterly report 'Ontario's Automotive Sector: Economic Contribution and Key Players'.[254] An outline of the Ontario operations for a selection of vehicle assembly organizations is provided below, along with recent notable investments.

Ford

Ford's operations in Ontario consist of its national headquarters in Oakville; three vehicle assembly and engine manufacturing plants in Oakville, Windsor, and Essex; a regional office in Oakville; and two parts distribution centres in Paris and Casselman.[255] The organization has recently announced an investment of $3B to expand production of trucks at its Oakville complex, with production expected to begin in 2026.[256]

GM

GM has assembly and propulsion plants in Oshawa, St Catharines, and Ingersoll.[257]

In 2022, GM announced it would be investing more than $2B to develop Canada's first full-scale EV manufacturing plant – the BrightDrop facility.[258] In support of this, the Government of Canada announced an additional $259M through its SIF, with the Government of Ontario making a matching contribution.[259] Over 5.2K jobs are expected to be maintained due to this investment.[260]

More recently, in 2023, GM Canada announced an investment of $280M to support next-generation ICE truck production at its Oshawa Assembly Plant.[261]

Toyota-Hino

Toyota-Hino manufactures heavy-duty trucks and buses.[262] The company has an assembly plant in Woodstock, which was opened in 2006 and produces vehicles for the Canadian market.[263] This plant was expanded in 2016 to meet growing demand for trucks in Canada.[264] In 2021 the organization announced that the facility would begin manufacturing the 2023 Hino XL8 heavy-duty truck at the facility.[265]

Honda

Honda has two vehicle assembly plants in Alliston, along with an engine manufacturing plant in Markham.[266]

In 2022, Honda announced it would be investing approximately $1.4B to upgrade its vehicle manufacturing plants, retooling them to manufacture the next generation of hybrid vehicles.[267] This investment was supported by an additional investment of $131.6M through the federal government's SIF, and a matching contribution by the provincial government.[268] Through this investment, 3.8K jobs are expected to be maintained.[269]

In April 2024, the Japanese automaker announced an additional investment of $15B towards developing the EV supply chain in Ontario.[270] This investment covers the introduction of three EV battery plants, along with a brand-new EV manufacturing plant in Alliston, which is expected to be fully operational in 2028.[271] These four facilities are anticipated to create over 1K jobs.[272]

Stellantis

Stellantis has a number of facilities across Ontario: its Windsor Assembly Plant, Brampton Assembly Plant and Satellite Stamping Plant, and Etobicoke Casting Plant.[273]

In 2022, Stellantis announced it would be investing $3.6B to accelerate its plans for electrification in Canada.[274] The investment enables development of the Windsor and Brampton Assembly Plants to produce flexible multi-energy vehicle architecture and an all-new electric model, respectively.[275] In support of this investment, the federal government announced it would be investing an additional $529M through the SIF, and the provincial government announced additional investment of up to $513M.[276]

Toyota

Toyota has three manufacturing facilities in the province – the North and South plants in Cambridge, and the West Plant in Woodstock.[277] In 2018, Toyota announced an investment of $1.4B into its assembly plants.[278] The investment, which protects over 8K jobs and creates 450 new jobs, introduces a new advanced manufacturing platform for RAV4 production.[279] The federal government announced an additional $110M in support through the SIF.[280]

"Together, with our government, industry and labour partners, we're putting our auto sector back on the map, attracting billions of dollars in new investments, creating thousands of good-paying jobs and ensuring the cars of the future will be made in Ontario, from start to finish."[281]

The Honourable Doug Ford, Premier of Ontario

Economic Impact of Vehicle Assembly in Ontario

The automotive manufacturing industry in Ontario is pivotal to the economy, generating a multitude of well-paying jobs and making substantial contributions to the provincial GDP through valuable exports.

GDP*

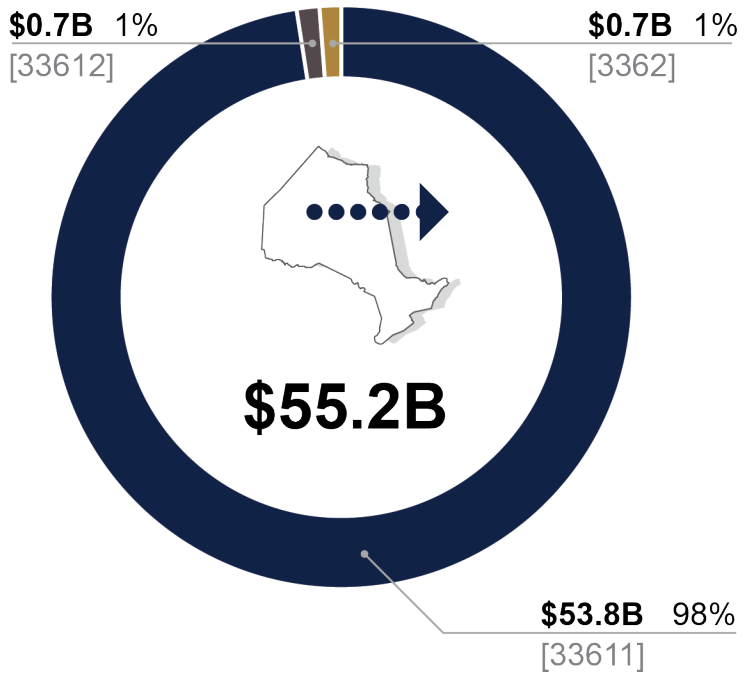
Automobile and light-duty motor vehicle manufacturing (NAICS 33611) contributed over $6.2B towards Ontario's GDP in 2023.[282] Body and trailer manufacturing (NAICS 3362) contributed $0.3B and heavy-duty truck manufacturing (NAICS 33612) contributed $2.9M.[283] Altogether, the vehicle assembly industry contributed $6.6B to the provincial GDP in 2023. Automobile and light-duty motor vehicle manufacturing is an important industry in Ontario, contributing a considerable amount to provincial GDP each year.

Exports

Ontario's motor vehicle exports and imports are divided into the following industries: automobile and light-duty vehicles; heavy duty trucks; and vehicle body and trailer. Most of Ontario's vehicle exports originated from the automobile and light-duty vehicle manufacturing industry in 2023. This industry was the source of a sizeable 98% of total vehicle exports, valued at $53.8B.[284] Heavy-duty truck manufacturing and body and trailer manufacturing both exported $0.7B worth of goods in the same year, equating to 1% each of total vehicle exports.[285]

The dominant role automobile and light-duty vehicle exports play in Ontario's economy represents the part the province plays in the supply chain. Ontario is the home of vehicle assembly in Canada, with more vehicle assembly plants than any other province.

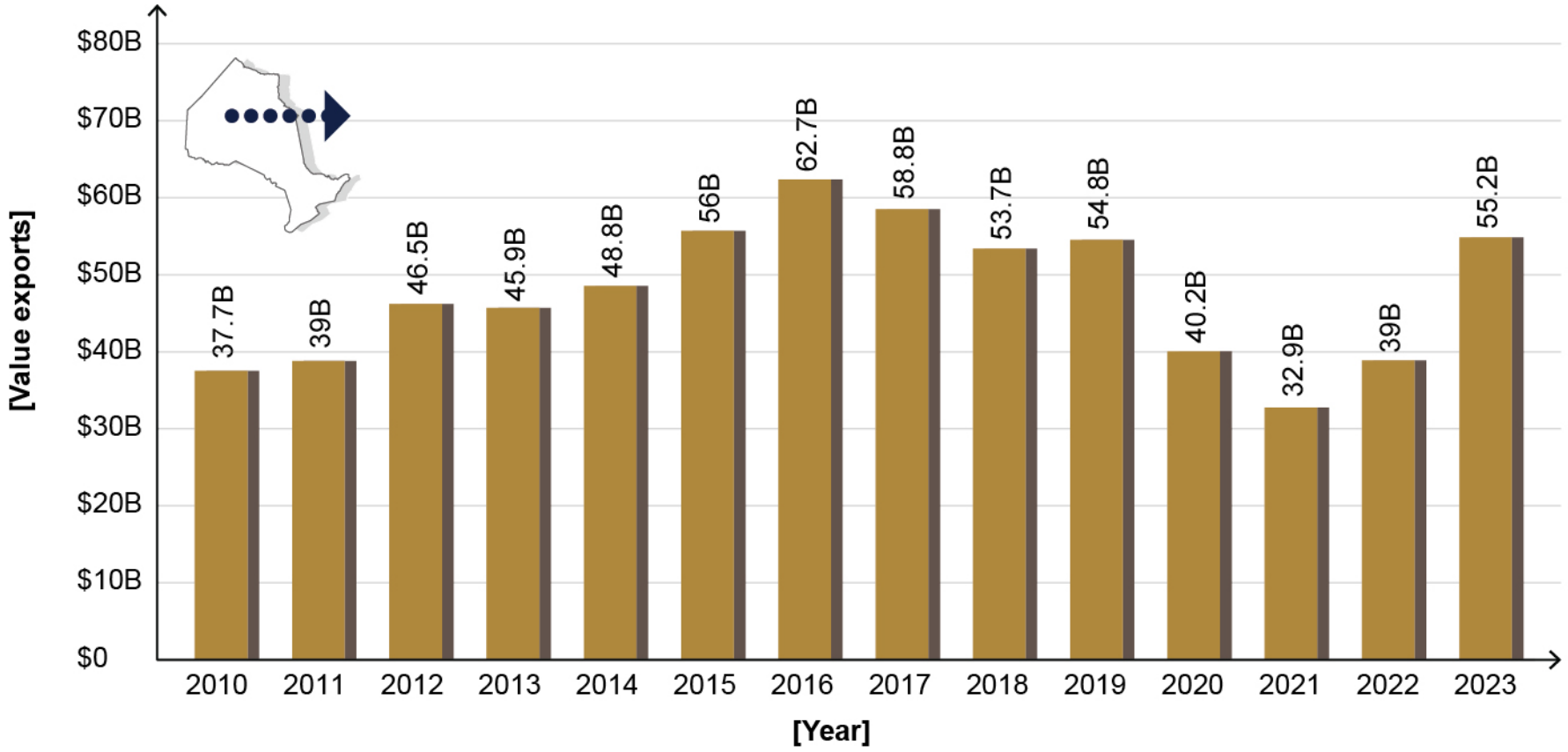
Ontario Motor Vehicle [NAICS 3361 & 3362] Exports Per Industry, 2023[286]



* All GDP data is in 2017 Chained Dollars

In 2023, Ontario's motor vehicle exports market increased notably. Valued at over $55.2B, it has grown from less than $38B in 2010.[287] The Canadian motor vehicle exports market was valued at over $60.8B in 2023, with Ontario's exports comprising a significant 91% of this.[288] Ontario is the leading exporter of vehicles in Canada, highlighting the crucial role the province plays in the global automotive supply chain.

Ontario Motor Vehicle [NAICS 3361 & 3362] Exports, 2010-2023[289]

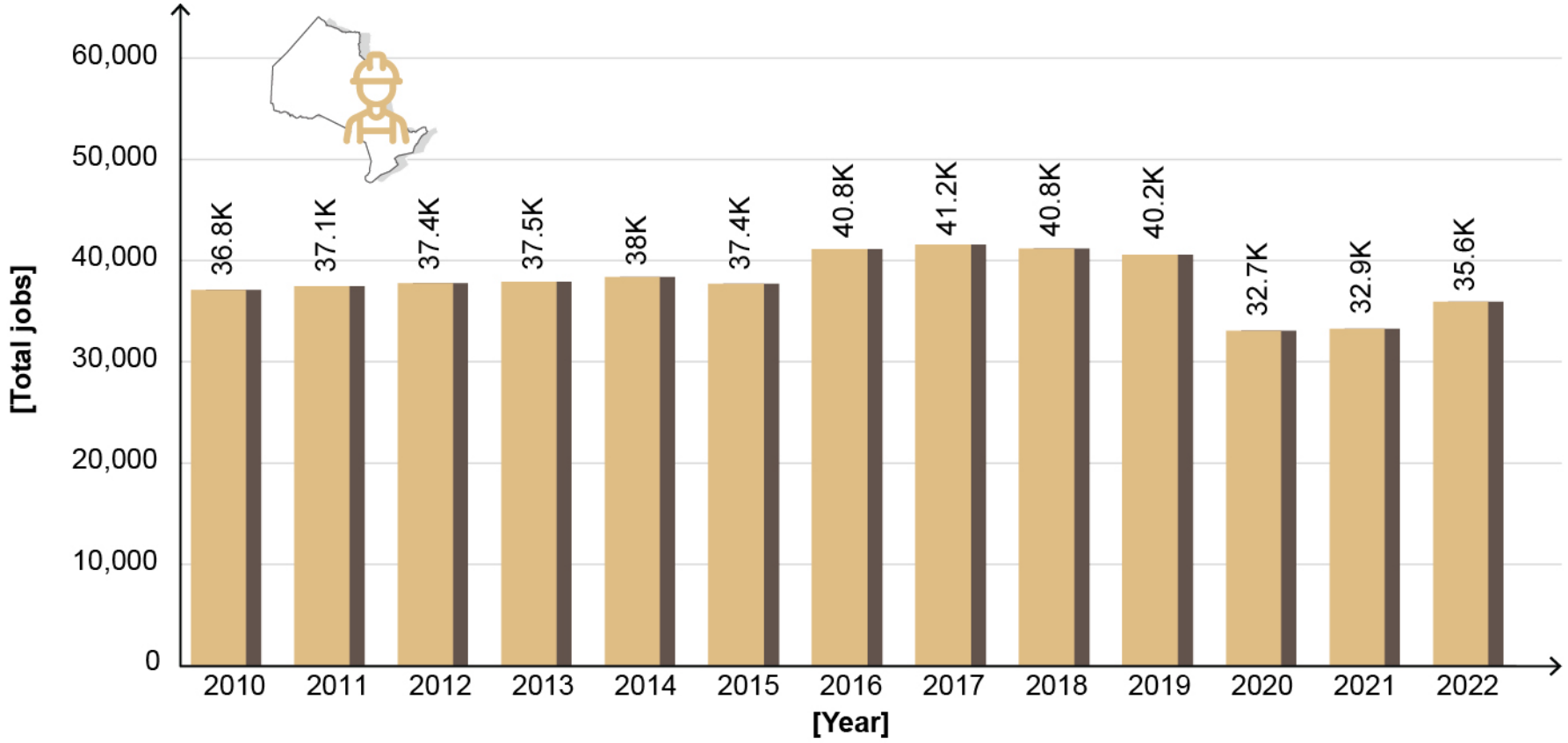


Employment

More than 35.6K people were employed in vehicle assembly jobs in Ontario in 2022.[290] The industry in Ontario makes up a notable 67% of all vehicle assembly jobs in Canada, with over 53.4K people employed nationally.[291] The total wages and salaries for vehicle assembly jobs in Ontario in 2022 was over $3M.[292]

Ontario's place at the heart of Canada's vehicle manufacturing industry is highlighted by the high levels of people employed in these jobs in the province.

Total Vehicle Assembly [NAICS 3361 & 3362] Jobs in Ontario, 2010-2022[293]



Ontario's Vehicle Assembly Research & Development

Ontario's reputation as the home of Canada's automotive industry is not only a result of its manufacturing prowess. It is also at the forefront of automotive research, with a number of world-leading research facilities located in the province. A selection of programs taking place across these facilities is described below.

ACE Climatic Aerodynamic Wind Tunnel

The Ontario Tech University ACE – which is part of OVIN's Durham RTDS – contains a number of testing chambers for aerodynamic, climatic, and structural research and development.[294] Its Climatic Aerodynamic Wind Tunnel can simulate a wide range of conditions, including solar capabilities, rain, freezing rain, light snow, and blizzards, and is capable of reaching wind speeds of 300 km/h and temperatures ranging from -40°C to +60°C.[295]

Project Arrow 2.0

In 2023, APMA of Canada launched the first zero-emission concept vehicle, named Project Arrow.[296] The all-Canadian EV prototype has now moved in to phase two, with development of a fleet of specially designed vehicles which will be used to further EV technology advancements and policy development.[297] Project Arrow 2.0 will produce between 10 and 20 vehicles, each completely unique.[298] Different aspects of the vehicles will be explored, such as alternative low-emission fuel types, cybersecurity, grid integration and integrated charging technologies.[299]

Government and OVIN Initiatives Supporting Vehicle Assembly

The Ontario government and OVIN are actively supporting the continued growth of the automotive manufacturing industry in the province. This includes through programs to develop the next generation of engineers, such as OVIN's Talent Development Internship/Fellowship Program, as well as providing assistance for SMEs to accelerate commercialization, via initiatives such as OVIN's RTDS' and the R&D Partnership Fund, all of which have been covered in more detail in other chapters. Another recent initiative is described below.

Auto Sector European Business Mission

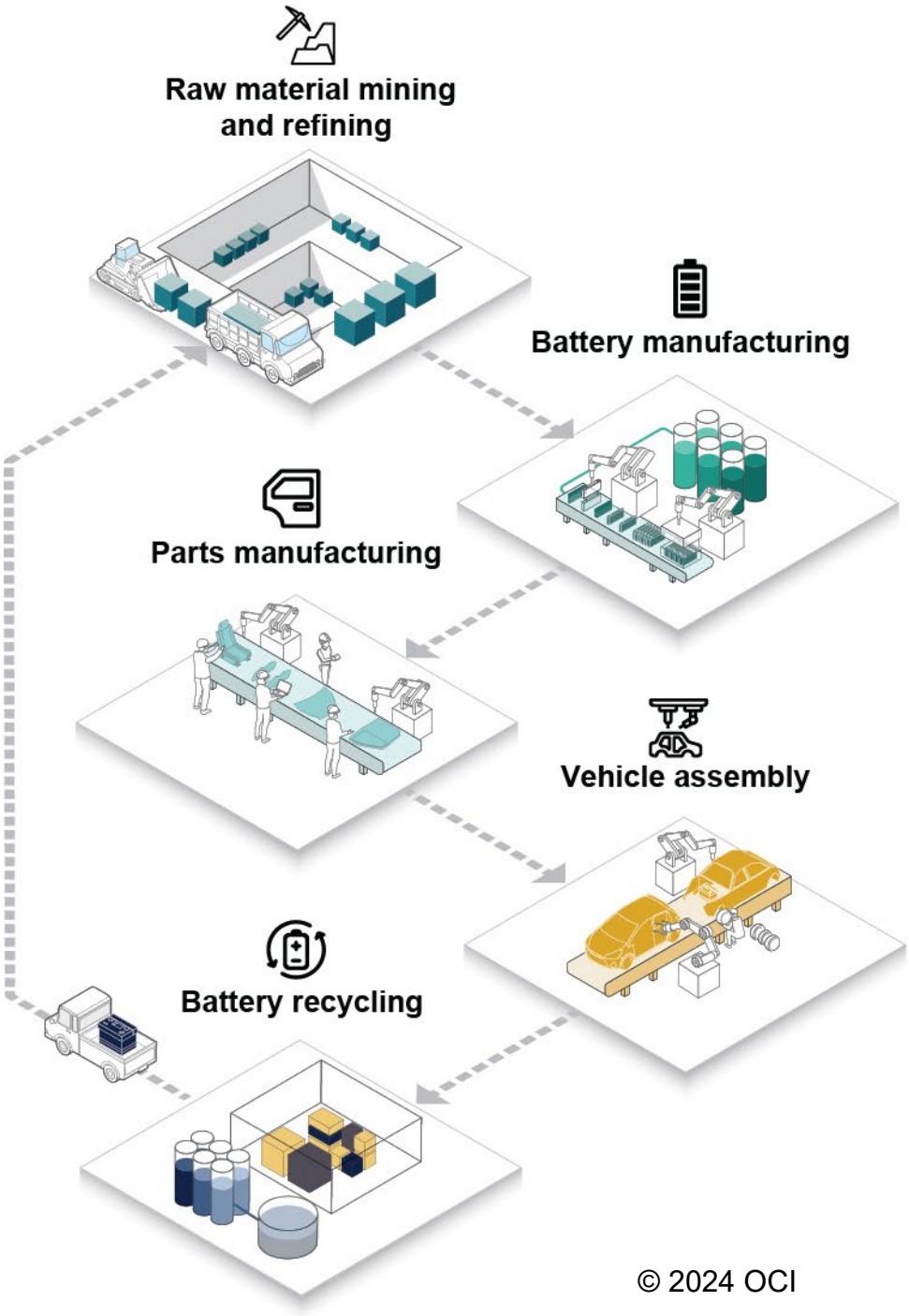
In 2023, the Ontario government undertook a business mission to Germany and Switzerland, with the aim of showcasing the province's auto sector.[300] The purpose of the mission was to attract investment and strengthen relationships, with a delegation of Ontario organizations – including OVIN and Invest Ontario – attending to promote the supply chain and innovation in the province.[301]

5. Battery Recycling in Ontario

In today's automotive industry, the importance of battery recycling cannot be overstated. With the rapid growth of EVs, efficient recycling processes are essential for mitigating environmental impact, conserving valuable resources like lithium and cobalt, and ensuring sustainable production practices. This critical aspect not only supports the industry's shift towards cleaner technologies but also addresses the challenges of managing end-of-life batteries responsibly. Thus, battery recycling plays a pivotal role in shaping the future of automotive sustainability.

In Ontario, this importance is underscored by the burgeoning battery recycling industry, supported by organizations like Electra Battery Materials and Stelco, as well as global entities with Canadian operations such as Glencore, all contributing to raw material processing within the province.

Electra Battery Materials launched a battery recycling demonstration plant in Temiskaming Shores in 2023,[302] and in June 2024, it was awarded $5M by Natural Resources Canada to further advance the development of its proprietary battery metals recycling technology.[303] Stelco announced in 2022 plans to expand its Lake Erie Works in Nanticoke to recycle end-of -life EVs and EV batteries.[304] Glencore Canada has been leading the charge in Ontario at its Sudbury plant, which has had battery recycling capabilities since 2004.[305]



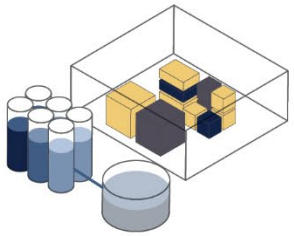
Battery recycling is a key component in ensuring Ontario's automotive supply chain can be delivered domestically and sustainably. The Ontario government has pledged to improve mineral recovery from EV batteries and collaborate with industry partners developing critical mineral recycling processes through its Critical Mineral Strategy.[306] This research and collaboration will be galvanized by the recently announced OBEC research centre, which is working towards progressing EV battery recycling.[307]

This chapter details the emerging battery recycling industry in Ontario, and its key function in enabling a circular economy in Canada's automotive supply chain.

Battery Recycling Facilities in Ontario

The battery recycling industry is still in its initial phases globally, but a number of organizations with aspirations to recover and recycle valuable materials from EV batteries are already based in Ontario. These include, but are not limited to: Electra Battery Materials, which has begun operations in the northeast of Ontario; Glencore Canada, which has had recycling operations in the province for over 33 years; and Stelco, which plans to expand its operations in the south. The map below shows the locations of these facilities.

Lifecycle of Battery Recycling



When an EV battery has reached the end of its operational life, some of the components can be recycled. The battery recycling process generally involves:

1. Removal of the battery from the vehicle.
2. Disassembly and extraction of the valuable materials. There are currently two recycling processes in operation for material extraction: pyrometallurgy and hydrometallurgy. The former uses a high temperature smelting process, while the latter uses aqueous chemistry through leaching in acids and subsequent concentration and purification.[308]
3. Sending extracted materials for reprocessing.[309]

Battery Recycling Facilities in Ontario

Legend

- ■ Electra Battery Materials
  Battery recycling (demonstration plant)
- ● Stelco
  Battery recycling
- ▲ Glencore Canada
  Battery recycling

Ontario's Battery Recycling Ecosystem

Several organizations in Ontario are currently engaged in battery recycling activities or are planning to enter the field. The battery recycling ecosystem in the province has been boosted by recent large-scale investments to build EV battery manufacturing plants, enabling a domestic, end-to-end supply chain. A sample of battery recycling organizations located in Ontario are outlined below.

Electra Battery Materials

Electra Battery Materials is a Toronto-based company which specializes in refining, processing, and recycling EV battery materials.[310] In 2023, the organization launched a battery recycling demonstration plant in Temiskaming Shores.[311] The plant will recover and recycle the valuable materials found in EV batteries, such as nickel, cobalt, lithium, copper, and graphite, using a proprietary hydrometallurgical process.[312] This process has a lower carbon footprint and higher metal recovery rate than the pyrometallurgical smelting process used by other North American battery recyclers.[313] In June 2024, the organization was awarded $5M by Natural Resources Canada to further advance the development of its proprietary battery metals recycling technology.[314]

Glencore Canada

Glencore Canada, in addition to being one of the biggest mining companies in the world, is also recognized as being one of the biggest end-of-life electronics recycling companies.[315] The organization has been processing secondary materials for recycling at its Sudbury plant since 1990,[316] and this facility has had battery recycling capabilities since 2004.[317] As such, the Sudbury Smelter is now one of the largest processors globally of complex secondary nickel and cobalt .[318]

Stelco

Stelco is a Canadian steel company founded in Hamilton.[319] The organization has steel manufacturing facilities in Hamilton and Nanticoke.[320] In 2022, the company announced plans to expand its Lake Erie Works in Nanticoke to recycle end-of -life EVs and EV batteries.[321] The facility will include a hydrometallurgical refinery to recover up to 18.4K tonnes of valuable materials from EV batteries, and up to 40K tonnes of scrap steel from EVs.[322]

Ontario's Battery Recycling Research & Development

R&D is essential for advancing Ontario's battery recycling capabilities, enabling the development of more efficient, cost-effective, and environmentally friendly recycling methods. These efforts are key to maintaining competitiveness, meeting regulatory standards, and reducing the environmental footprint of battery disposal in the province.

Ontario Battery and Electrochemistry Research Centre

The University of Waterloo announced a new battery research centre, known as OBEC, in March 2024.[323] One of the aims of this facility, along with the advancement of next-generation EV battery development, is to progress EV battery recycling.[324] Students and

post-doctoral fellows will be trained at the facility, and start-ups and larger businesses involved in the EV battery supply chain will be provided with support and access to resources.[325]

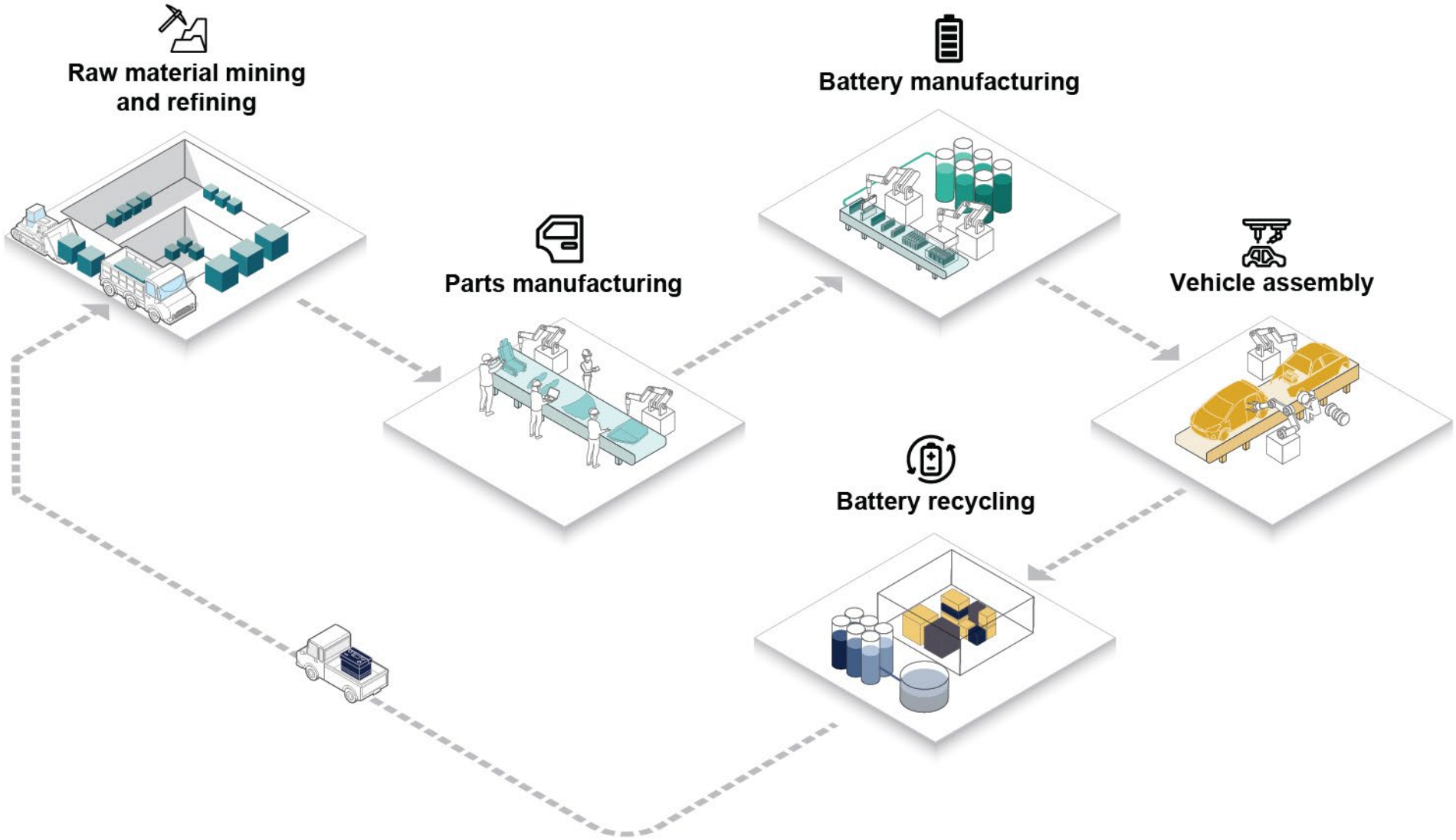
Government and OVIN Initiatives Supporting Battery Recycling

Government initiatives are crucial for supporting battery recycling by providing funding, regulatory frameworks, and incentives that encourage innovation, investment, and compliance in sustainable recycling practices.

Critical Minerals Strategy 2022-2027

In 2022, the Ontario government launched its Critical Minerals Strategy.[326] This document presents a five-year roadmap for the critical minerals sector, securing the position of the province in the global supply chain. This includes the role of critical minerals in the EV lifecycle. Through its Critical Minerals Strategy, the Ontario government is committed to improving mineral recovery from EV batteries.[327] It has pledged to collaborate with private-sector partners to develop novel recycling methods, promoting a circular economy approach.[328]

6. Future Opportunities for Ontario



Ontario possesses a comprehensive opportunity to bolster the automotive industry supply chain and foster growth across various sectors. With abundant mineral resources and a supportive regulatory framework, the province is poised to expand its role in raw material mining and refining, ensuring a stable supply of critical minerals essential for automotive technologies. Concurrently, Ontario's thriving battery manufacturing sector, highlighted by recent multi-billion-dollar investments from global players, underscores its capability to lead in EV production. The province's prowess in parts manufacturing, evidenced by a diverse array of components exported globally, complements its position as a hub for automotive innovation. Moreover, as the home of major OEMs, Ontario's vehicle assembly capabilities are pivotal, supported by significant investments in manufacturing facilities. Lastly, Ontario's commitment to sustainable practices through initiatives like battery recycling further strengthens its automotive supply chain, ensuring long-term viability and competitiveness in the global market. The following section outlines several opportunities aimed at reinforcing the province's leadership across the entire automotive industry supply chain.

Continue to scale up and modernize production of next generation vehicles

A key opportunity for Ontario to capitalize on is to leverage the increasing demand for EVs, aligned with sales targets set by countries globally, including Canada. This, along with an expectation of increased CAV uptake over the coming years, driven by increasing levels of automation and the future deployment of fully autonomous vehicles, will result in a momentous technological shift in the future, with significant consequences for how vehicles are produced.

The global market for autonomous vehicles is anticipated to increase by USD $974.5B at a Compound Annual Growth Rate (CAGR) of 58.78% between 2023 and 2028,[329] while the global EV market is forecast to increase by USD $343.01B at a CAGR of 13.51% over the same period.[330]

Vehicle manufacturing facilities will need to be upgraded and retooled in order to meet the demand for these next-generation vehicles. Ontario also has made meaningful progress towards preparing for large scale production of EVs and CAVs over the past few years. For example, a number of battery manufacturing plants are currently under construction following large scale investments from organizations such as Honda, Volkswagen, and Stellantis.

These OEMs, along with GM, have also announced investments in recent years to modernize and retool their vehicle assembly plants in the province in order to produce next-generation EVs. Ontario’s government has made contributions to complement these investments from OEMs,[331] amongst others, and to support SMEs wishing to modernize through the O-AMP.[332] In future, the province might aim to provide an increasing level of support to businesses in their efforts to adapt their manufacturing practices for EVs and CAVs, via programs such as O-AMP.

Continue to expand repurposing and recycling capacities

The global trend in EV battery repurposing and recycling is gaining momentum as EV adoption increases. The global battery recycling market is estimated to reach USD $40.6B by 2030.[333] However, a significant gap remains in developing efficient, scalable recycling technologies and establishing robust infrastructure to handle the growing volume of end-of-life batteries worldwide.

There is a significant opportunity for Ontario to drastically expand EV battery repurposing and recycling capacities. A significant proportion of the environmental impact of EVs is attributed to batteries and the raw materials required to manufacture them.[334] Adopting a circular economy approach, whereby batteries are recycled and repurposed, is critical to reducing waste and minimizing environmental impact across the EV lifecycle. This will also present an opportunity to reduce the volume of raw material extraction and processing required, as second-life materials are returned to the supply chain, and to reduce the amount of critical material imports.

Ontario is dedicated to developing a domestic battery supply chain, and through this has committed to incentivizing battery recycling. The province's Critical Mineral Strategy highlights a requirement for additional research into the technologies which enable EV battery recycling.[335] Ontario has pledged to improve mineral recovery from EV batteries and collaborate with industry partners developing critical mineral recycling processes.[336] This research and collaboration will be galvanized by promoting institutions such as the University of Waterloo's OBEC research centre, to encourage the establishment of similar institutes.[337]

Continue to expand refining and processing battery-grade material, and battery manufacturing capacities

The global trend in refining and processing battery-grade materials and battery manufacturing is characterized by rapid growth and technological advancements to meet increasing demand. However, a notable gap exists in securing a sustainable and ethical supply chain for critical materials like lithium and cobalt, as well as in developing cost-effective and environmentally friendly manufacturing processes that minimize waste and energy consumption.

There is an opportunity for Ontario to maximize on its participation in the early stages of the EV battery supply chain, via expanding mineral extraction and processing in the province. Ontario has access to many battery materials, but does not currently produce battery-grade nickel, cobalt, manganese, graphite, or lithium.[338] A battery-grade cobalt sulphate refinery is, however, being constructed by Electra Battery Materials as part of its Battery Materials Park, near Toronto.[339] The organization is also exploring the potential for producing battery-grade nickel sulphate at the facility.[340]

The province has, in recent years, made significant investments to expand on battery manufacturing capabilities. Several battery facilities are expected to open in the next few years, including, among others, Honda's battery manufacturing plant in Alliston,[341] NextStar Energy's battery cell manufacturing plant in Windsor,[342] and DongShin Motech's aluminum battery casing plant in Windsor.[343] Furthermore, Ontario's recently introduced Building More Mines Act 2023 will help to attract more investment in the province's mining sector, and will also contribute towards strengthening the domestic EV supply chain.[344]

By continuing to increase capacity of the domestic processing and production of critical materials, Ontario can develop an increasingly independent supply chain which is less susceptible to risk. By increasing local mineral processing and battery manufacturing capacities, the province would also reduce the carbon footprint of Ontario-made batteries; international shipping of the heavy materials required for batteries involves more greenhouse gas emissions than short-distance domestic transportation.

Continue to invest in technological advancement

Ontario's automotive industry is not only dependent on the critical materials required for battery manufacturing, but also on complex technology such as semiconductors. The production of next generation EVs and CAVs is highly dependent on continued advancements in the semiconductor sphere.

Ontario is recognized as a specialized R&D hub due to the presence of several leading semiconductor related research facilities, such as the Vector Institute in Toronto, which focuses on AI, the Giga-to-Nanoelectronics Centre and the Institute for Quantum Computing at the University of Waterloo, the NRC Advanced Electronics and Photonics Research Centre, and ventureLAB's Hardware Catalyst Initiative.[345] In terms of automotive applications, Ontario funds R&D led by SMEs through OVIN's R&D Partnership Fund, which provides funding to support development, testing, and validation of all advanced auto and smart mobility technologies, including EV and battery-focused technologies.[346]

Increasing investment in this area can support expansion of assets such as the Hardware Catalyst Initiative,[347] and develop an ecosystem of semiconductor R&D with a focus on automotive applications. This will enrich the automotive supply chain in the province, cultivating synergies between scientific and technological advancements.

Expand support of research and testing initiatives

Ontario has emerged as a leader in R&D related to EVs and CAVs. This is down to its numerous renowned academic institutions, highly skilled workforce, and supportive environment for start-ups. To ensure that Ontario maintains its position at the forefront of Canada's automotive industry, it is essential that there is continued investment and support in R&D. Pilot testing is another area where there is potential for expansion. Testbeds provide opportunities to develop, test, and prototype advanced automotive technologies in real-world settings. OVIN's Technology Pilot Zones offer Ontario-based SMEs with the chance to pilot their automotive and mobility solutions in practical applications.[348] Additionally, the OVIN Demonstration Zone provides SMEs with the opportunity to demonstrate and showcase their advanced automotive and smart mobility technologies and solutions.[349]

Additional to the drive for innovation is also the desire to advance road safety for all users, including drivers and vulnerable road users. This is a key opportunity for growth in Ontario, particularly related to future plans for the deployment of fully autonomous vehicles. This is an area where more research and testing is needed to demonstrate that autonomous technology is fit for purpose with high levels of safety.

Continued support and investment for these initiatives is important to foster the innovative environment within Ontario's automotive industry. Initiatives such as Project Arrow 2.0 demonstrate Ontario's ability to lead on technological advancements in Canada, fostering a collaborative environment between industry and research institutions. The province is home to a multitude of companies operating in the EV and CAV sphere which are pursuing R&D in the field, as well as numerous research and development initiatives in post-secondary institutions. There is a considerable opportunity for continued support of collaboration across the automotive ecosystem through providing access to research and pilot schemes via investment and provision of resource and facilities.

Continue to promote upskilling

Ontario's automotive industry employs a considerable proportion of the working age population in Canada. The transition to next-generation EVs and CAVs will require the workforce to undergo a paradigm shift in skills. Around the world, to prepare for the production and maintenance of new automotive technologies, jurisdictions are providing programs to enable upskilling for the automotive sector's workers. Ontario is in a position to lead on upskilling the workforce with the specialized skills required for the future of the automotive industry.

Initiatives such as OVIN's Content Partnerships Program ensure that talent within Ontario's automotive industry can develop new and existing skills which align with the sector's needs.[350]

In addition to this is OVIN's Skills and Career Navigator Tool, which provides information and resources to allow users to build a better understanding of Ontario's automotive sector, and to navigate skills and careers pathways.[351] Further investment in opportunities such as these, for upskilling right across the automotive lifecycle, will bolster the breadth and depth of skills in the future workforce.

Ontario has earned recognition as a global tech leader, driven by its exceptional talent pool and cutting-edge advancements across various sectors, including AI, automotive and mobility, business and fintech, cybersecurity, manufacturing, Industry 4.0, and quantum technology.[352] In addition, the province is well-positioned to leverage its extensive network of post-secondary institutions and world-class R&D facilities, such as the UTEV Research Centre and Ontario Tech University's ACE, to further fuel innovation and growth. By capitalizing on these resources, Ontario can enhance its position at the forefront of technological development and maintain its competitive edge on the global stage.

OVIN's contributions to Ontario's automotive and smart mobility ecosystem

As of March 31, 2024

6,103
Jobs Created and/or Retained

$218.2 M
Ontario SMEs revenue growth catalyzed

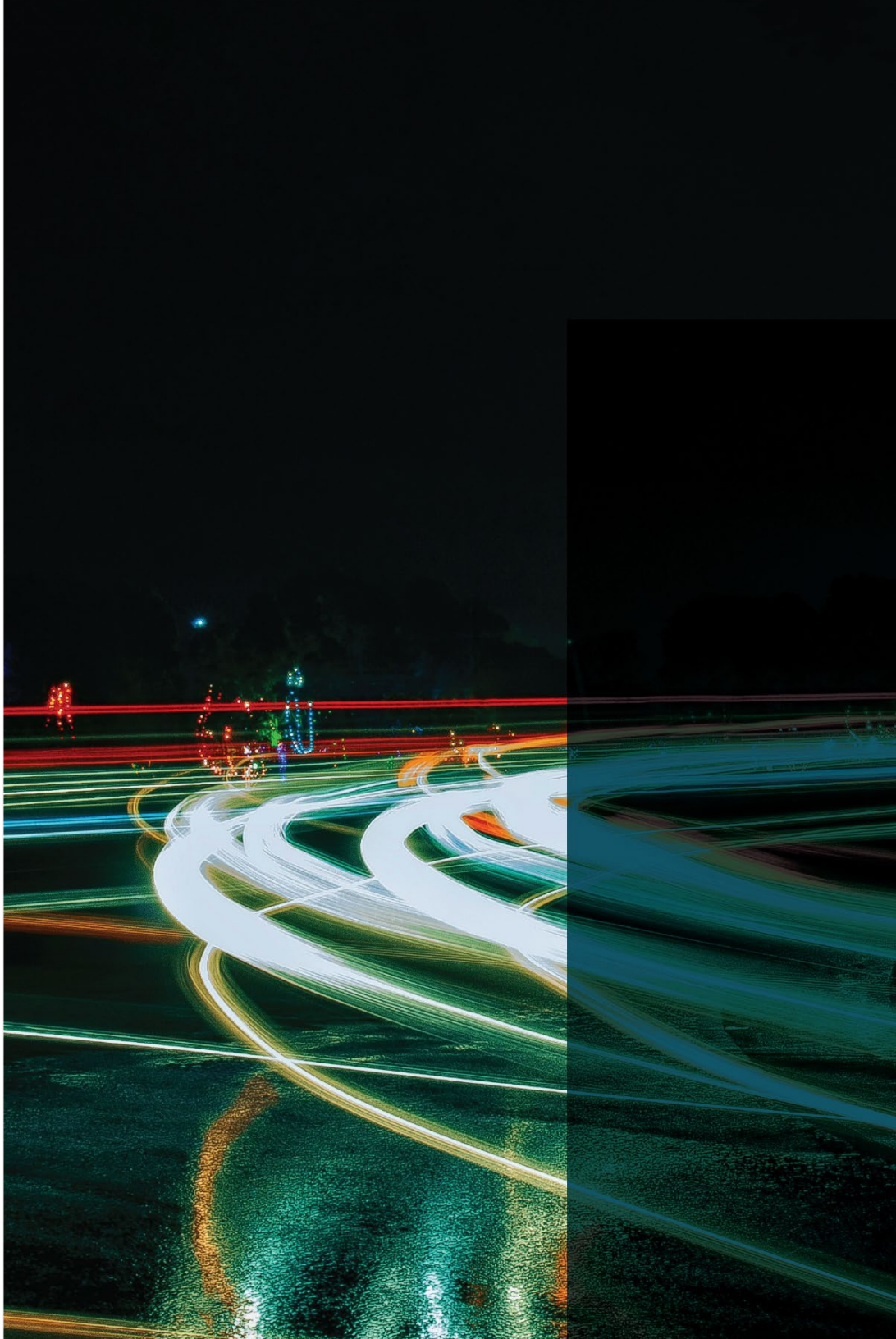
$643.4M
Follow-on investment generated

735
R&D job placements facilitated through internships and fellowships

633
Ontario SMEs supported

$209.3M
Co-investment secured

106
Commercialization partnerships enabled



7. Glossary

ACE	Automotive Centre of Excellence
APMA	Automotive Parts Manufacturers' Association
CAGR	Compound Annual Growth Rate
CAMs	Cathode Active Materials
CAV	Connected and Autonomous Vehicle
CEMI	Centre for Excellence in Mining Innovation
CERC	Canada Excellence Research Chair
CHARGE	Centre for Hybrid Automotive Research and Green Energy
CIARS	Centre for Intelligent Antenna and Radio Systems
EV	Electric Vehicle
FIP-Composites	Fraunhofer Innovation Platform for Composites
GWh	Gigawatt hours
HVAC	Heating, ventilation, and air conditioning
ICE	Internal Combustion Engine
MARC	McMaster Automotive Resource Centre
MICA	Mining Innovation Commercialization Accelerator
NOHFC	Northern Ontario Heritage Fund Corporation
NRC	National Research Council
O-AMP	Ontario Automotive Modernization Program
OBEC	Ontario Battery and Electrochemistry Research Centre
OEM	Original Equipment Manufacturer
OJEP	Ontario Junior Exploration Program
OVIN	Ontario Vehicle Innovation Network
pCAMs	Precursor Cathode Active Materials
R&D	Research & Development
RCS	Restraint Control Systems
RTDS	Regional Technology Development Site
SIF	Strategic Innovation Fund
SME	Small & Medium Enterprise
UTEV	University of Toronto Electric Vehicle Research Centre

8. About OVIN

The Ontario Vehicle Innovation Network (OVIN) is Ontario's flagship initiative for the automotive and mobility sector, with a mission to drive economic development and catalyze a future that builds safer, cleaner, and more efficient transportation.

Led by the Ontario Centre of Innovation (OCI) and supported by the Government of Ontario through the Ministry of Economic Development, Job Creation and Trade (MEDJCT), Ministry of Transportation (MTO), and Ministry of Labour, Immigration, Training and Skills Development (MLITSD), OVIN is driving the future of the sector by supporting the growth of Ontario-made automotive and mobility innovation, developing a highly skilled workforce, and reinforcing Ontario's role as the global automotive and mobility hub of the future.

OVIN supports Ontario-based automotive and mobility companies to accelerate the development and commercialization of transformative technologies and transportation systems through the following programs:

- Research and Development Partnership Fund
- Talent Development
- Regional Technology Development Sites
- Demonstration Zone
- Technology Pilot Zones
- Going Global

OVIN supports the development of a highly skilled, future-ready automotive and mobility workforce through a number of talent strategy and workforce planning initiatives:

- Strategies and frameworks, including the Talent Strategy & Roadmap, Critical Minerals Talent Strategy, and Reskilling Framework
- Pilots and programs, including the Regional Future Workforce and Content Partnerships
- The OVIN Learning Hub, comprised of the Skills and Career Navigator and Upskilling Platform
- DEI Advisory Committee

The OVIN Central Hub drives the province-wide coordination of activities and resources that reinforce Ontario's position as a leading automotive and mobility jurisdiction. The Central Hub is a focal point for all stakeholders across the province, fostering collaboration between industry, small- and medium-sized enterprises, post-secondary institutions, municipalities, government, and new entrants into Ontario's thriving automotive and mobility innovation ecosystem. Through the Central Hub, OVIN drives public education, research, analysis and thought leadership activities, with the goal of raising awareness around the potential of transformative technologies and growth opportunities for Ontario and its partners.

To find out the latest news, visit www.ovinhub.ca or follow OVIN on social media @OVINhub

9. 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

10. Meet the OVIN Team

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11. Disclaimers

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 August 25, 2023, and has been prepared by Arup Canada Inc. It is one 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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