A Spotlight on Skills, Talent & Workforce Development:
Battery Manufacturing for Electrification

Ontario Centre of Innovation – Ontario Vehicle Innovation Network (OVIN)
September 2023
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### Acronyms and Glossary of Terms

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<thead>
<tr>
<th>Acronyms</th>
<th>Glossary of Terms</th>
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<tbody>
<tr>
<td>Automotive manufacturing</td>
<td>Production of vehicles using various techniques and technologies.</td>
</tr>
<tr>
<td>Automotive technologies</td>
<td>Technologies used in designing and producing vehicles.</td>
</tr>
<tr>
<td>Critical minerals</td>
<td>Subset of the raw materials needed to produce advanced products and specialized technologies.</td>
</tr>
<tr>
<td>EAI Software</td>
<td>Enterprise application integration software, which is used to integrate different software applications and systems within an organization.</td>
</tr>
<tr>
<td>High value-added components</td>
<td>Components that add significant value to a product and typically involve specialized knowledge, skills, and technology.</td>
</tr>
<tr>
<td>Riverbed Technology</td>
<td>Company that provides network and application performance solutions, including software and hardware products that help to optimize automated manufacturing processes.</td>
</tr>
<tr>
<td>Robotics</td>
<td>Use of robots and other automated machines to perform tasks and operations that would otherwise be performed by humans.</td>
</tr>
<tr>
<td>Skilled labour</td>
<td>Workers with specialized skills in the labour market.</td>
</tr>
<tr>
<td>Zero-emission</td>
<td>Elimination of greenhouse gas emissions through renewable energy sources electric or other low-emission vehicles.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAD</th>
<th>Computer-aided design</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAE</td>
<td>Computer-aided engineering</td>
</tr>
<tr>
<td>CAM</td>
<td>Computer-aided manufacturing</td>
</tr>
<tr>
<td>CNC</td>
<td>Computerized numerical control</td>
</tr>
<tr>
<td>CIP</td>
<td>Classification of Instructional Programs</td>
</tr>
<tr>
<td>EDI</td>
<td>Equity, diversity and inclusion</td>
</tr>
<tr>
<td>EV</td>
<td>Electric vehicle</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross domestic product</td>
</tr>
<tr>
<td>MEDJCT</td>
<td>Ontario Ministry of Economic Development, Job Creation and Trade</td>
</tr>
<tr>
<td>MLITSD</td>
<td>Ministry of Labour, Immigration, Training and Skills Development</td>
</tr>
<tr>
<td>MRP</td>
<td>Material Requirement Planning</td>
</tr>
<tr>
<td>MTO</td>
<td>Ministry of Transportation</td>
</tr>
<tr>
<td>NAICS</td>
<td>North American Industry Classification System</td>
</tr>
<tr>
<td>NOC</td>
<td>National Occupational Classification</td>
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<tr>
<td>OCI</td>
<td>Ontario Centre of Innovation</td>
</tr>
<tr>
<td>OVIN</td>
<td>Ontario Vehicle Innovation Network</td>
</tr>
<tr>
<td>PLM</td>
<td>Product life-cycle management</td>
</tr>
<tr>
<td>SCADA</td>
<td>Supervisory control and data acquisition</td>
</tr>
<tr>
<td>WMS</td>
<td>Warehouse management system</td>
</tr>
</tbody>
</table>
The Government of Canada has set a mandatory target for new passenger vehicle sales to be zero-emission by 2035, prompting a significant electrification transformation in Ontario’s automotive and mobility sector.

As battery design, development, and manufacturing are high value-added components of the electrification value chain, Ontario’s existing competitive advantages make it well-suited for increased local battery production and a more prominent role in the electric vehicle (EV) battery supply chain. This is due to Ontario’s abundant resources of cobalt, graphite, lithium, and nickel - the primary minerals required for producing lithium-ion batteries used in today’s EVs.\(^1\)

The endowment of these minerals presents a significant opportunity to establish an end-to-end value chain for battery materials, positioning Ontario as a global leader in EV battery production.

In 2021, Belgian multinational corporation Umicore announced a $1.5 billion investment in an EV plant in Loyalist, Ontario. The project alone is expected to supply materials for up to one million EVs annually.\(^2\)

Furthermore, in 2022, LG Energy Solution and Stellantis entered a $5-billion joint venture to open their first large-scale domestic EV battery manufacturing facility in Windsor, Ontario. This investment is anticipated to create 2,500 jobs, generate economic benefits, and contribute to Canada’s net-zero emission goals.\(^3\)

Recently, Volkswagen, one of Europe’s largest automakers, announced that its subsidiary, Powerco, will establish a vehicle battery plant in St. Thomas, Ontario, with operations set to begin by 2027.\(^4\)

As a result of these investments, various occupations and skills are emerging in the battery manufacturing sector due to these investments. Battery cells, module and design, and battery management systems are particularly relevant areas that require expertise in electrical, mechanical, and electrochemical engineering. The increasing focus on automation and digitalization in the industry highlights the major trends in the sector, emphasizing the need for technical skills and adaptability.
This spotlight highlights the following:

**Ontario’s Battery Manufacturing Sector**

Battery Manufacturing is the second stage of the automotive Electrification value chain, and includes various stages of production, notably, battery cell components, battery cells, battery modules, pack assembly, and battery management systems. Below is an illustration of the battery manufacturing in the electrification value chain:

This section provides an overview of Ontario’s recent major sectoral advancements and features the impact of recent technological developments on labour force requirements and skills development needs in the short- and long-term.

**Labour Market and Emerging Skills**

This section highlights the key occupations with the largest shares of employment in the battery manufacturing sector and the associated skills that are required. It also presents a provincial labor market outlook for the next 10 years, identifying occupational gaps and emerging skills.

- **Top occupational employment shares** include technical roles such as mechanical, electronics, and electrical assemblers, as well as engineers.
- **Current skill requirements** include various technologies that demonstrate a growing adoption of software in the design and development of batteries.
- **High occupational gap** is expected for assembly workers and welders in the future.

**Talent and Workforce Development**

This section highlights the workforce education profile indicating a strong focus on qualifications in engineering and engineering-related technologies. This is complemented by an overview of Ontario-based training and development programs tailored to the emerging skills and upskilling requirements essential to the battery manufacturing sector.

**Equity, Diversity and Inclusion**

This section explores current trends in the representation of minority groups in Ontario’s battery manufacturing sector employment. It further examines national and global diversity and inclusion initiatives in the sector, highlighting priorities to promote employment access for underrepresented groups.

This spotlight serves as an introductory informational booklet and is part of a series covering various segments of the automotive and mobility sector. For more information on the highlighted knowledge, tools, skills, and abilities, please refer to the cited references and other relevant sources, including other OVIN publications.
Ontario’s Battery Manufacturing Potential at a Glance

Ontario is uniquely positioned to leverage its resource endowment to become a leader in battery manufacturing.

Several key global industry players are pursuing next-generation battery design, development and manufacturing in Ontario\textsuperscript{2,3,4}

- Umicore
- LG Energy Solution
- Stellantis
- Volkswagen/Powereco

Battery is an integral part of the Electrification transformation, accounting for approximately 30% of the total cost of EVs:\textsuperscript{5}

The automotive manufacturing sector* accounts for 2% of Ontario’s GDP. Since 2020, Canada and Ontario have received investments over $25 billion from global automakers and suppliers of electric vehicles batteries and materials.

The availability of skilled labour workforce supports Ontario’s semiconductor, electrical equipment and related components sector.

As of 2021, 13,480 workers are employed in Ontario’s semiconductor and electrical equipment industries\textsuperscript{6}

Top in-demand occupations

- Labourers in processing, manufacturing and utilities
- Machinery and transportation equipment mechanics (except motor vehicles)
- Machining, technical metal forming, shaping and erecting trades

Top skills required in semiconductor and electrical equipment industries

- Cloud Computing
- Extract Transform and Load (ETL)
- Ada Automation Software
- Riverbed Technology
- Enterprise application integration (EAI) software

Expected in-demand occupations

- Electronics assemblers, fabricators, inspectors and testers
- Welders and related machine operators
- Motor vehicle assemblers, inspectors and testers

Expected Skill Gaps

- Enterprise resource planning (ERP) system
- Supervisory control and data acquisition systems
- 3D computer aided design software
- Materials requirement planning software

Looking ahead, Ontario’s labour force requirements for battery manufacturing point to greater digitalization and technical skills.

Reskilling may help workers adapt to increased digitalization

EDI Snapshot\textsuperscript{7}

Women representation

35.5%

Indigenous representation

1.4%

Visible Minority representation

53.2%

Note: *The automotive manufacturing sector is defined as NAICS 3326, 3335, 3344, 3353, 3359, 3361, 3362, and 3363. The broader mobility sector additionally considers NAICS 3336, 3364, 3365, 3366, and 3369.

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Current Labour Market Insights

Top 10 Occupations in Battery Manufacturing

- The figure below presents the top 10 occupations based on employment in semiconductor, electrical equipment and related components industries, which encompass activities relevant to battery manufacturing.
- The top 10 occupations relevant to battery manufacturing include roles such as:
  - Engineers and computer, software and web designers/developers (e.g., systems designers and programmers involved in battery design and software solutions for battery optimization)
  - Workers in supply chain logistics and material handlers are also important for the transportation of advanced and sensitive chemical materials and manufactured electrodes.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Employment Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervisors, assembly and fabrication</td>
<td>2%</td>
</tr>
<tr>
<td>Longshore workers and material handlers</td>
<td>2%</td>
</tr>
<tr>
<td>Supply chain logistics, tracking and scheduling coordination occupations</td>
<td>3%</td>
</tr>
<tr>
<td>Machine operators and related workers in mineral and metal products processing and manufacturing</td>
<td>3%</td>
</tr>
<tr>
<td>Computer, software and Web designers and developers</td>
<td>4%</td>
</tr>
<tr>
<td>Managers in manufacturing and utilities</td>
<td>5%</td>
</tr>
<tr>
<td>Labourers in processing, manufacturing and utilities</td>
<td>6%</td>
</tr>
<tr>
<td>Technical occupations in electronics and electrical engineering</td>
<td>7%</td>
</tr>
<tr>
<td>Electrical, electronics and computer engineers</td>
<td>8%</td>
</tr>
<tr>
<td>Mechanical, electrical and electronics assemblers and inspectors</td>
<td>16%</td>
</tr>
</tbody>
</table>

13,480 Employed in industries related to Battery Manufacturing in Ontario as of 2021

Note: The occupations in this chart are the top ten occupations with the highest employment as a share of total employment in Battery Production (NAICS 3359 and 3344).

Top Skill Requirements

- Job postings (2018-2022) show that technical skills presented in the chart below are high in demand in the labour market. Qualified workers are also expected to have a strong command on general skills which are effective competencies and transferable across roles.
- Notably, various technologies reflecting greater uptake of automation processes are often requested by employers, including:
  - Precision measuring tools (micrometers, calipers, etc.)
  - Automated machine operations (shears, machining centers, etc.)
  - Digital technologies such as EAI software, Riverbed Technology, etc. which are integrated software applications and hardware that are used to streamline automated manufacturing processes

<table>
<thead>
<tr>
<th>Technologies</th>
<th>Occurrence Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise application integration (EAI) software</td>
<td>1%</td>
</tr>
<tr>
<td>Riverbed Technology</td>
<td>2%</td>
</tr>
<tr>
<td>Ada</td>
<td>3%</td>
</tr>
<tr>
<td>Extract Transform and Load (ETL)</td>
<td>5%</td>
</tr>
<tr>
<td>Cloud Computing</td>
<td>10%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tools and Equipment</th>
<th>Occurrence Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shears</td>
<td>2%</td>
</tr>
<tr>
<td>Dial indicators</td>
<td>2%</td>
</tr>
<tr>
<td>Machining centers</td>
<td>4%</td>
</tr>
<tr>
<td>Calipers</td>
<td>7%</td>
</tr>
<tr>
<td>Micrometers</td>
<td>10%</td>
</tr>
</tbody>
</table>

Occurrence rate is the frequency at which job postings mention a given skill, tool or technology.
Skills Outlook and Expected Gaps

Labour Market Gap Outlook

- The labour market outlook for 2023–32 time period is developed based on projected growth in:
  - Demand: sector expansion driven by economic growth, replacement demand arising from retirements in the sector, and workers transitioning to other sectors; and
  - Supply: new workforce entrants, including new graduates and trainees, immigrants, and workers from related sectors.

Expected Labour Market Gaps by Occupation Category

Expected skills gap is derived as the difference between skills demand and supply projections. This helps identify emerging technical skills for the next ten years (2023–32).

Presented below are standardized scores to illustrate skills where the highest gaps are expected, such as ERP, SCADA, etc., indicating potential need for skill development.

<table>
<thead>
<tr>
<th>Occupation Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise resource planning (ERP) system</td>
<td>0.94</td>
</tr>
<tr>
<td>Supervisory control and data acquisition (SCADA) systems</td>
<td>0.84</td>
</tr>
<tr>
<td>Three-dimensional 3D computer aided design (CAD) software</td>
<td>0.83</td>
</tr>
<tr>
<td>Materials requirement planning (MRP) software</td>
<td>0.81</td>
</tr>
<tr>
<td>Computer-aided engineering (CAE) software</td>
<td>0.80</td>
</tr>
<tr>
<td>Computerized numerical control (CNC) software</td>
<td>0.80</td>
</tr>
<tr>
<td>Inventory control software</td>
<td>0.79</td>
</tr>
<tr>
<td>Product lifecycle management (PLM) software</td>
<td>0.75</td>
</tr>
<tr>
<td>Warehouse management system (WMS)</td>
<td>0.75</td>
</tr>
<tr>
<td>Computer aided manufacturing (CAM) software</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Note: The size of the bubble indicates the relative magnitude of the expected occupational gap for each occupation. The employment numbers denote employment for a combination of industries and occupations relevant to the sector.

Expected Skills Gap, 2023-32

- Based on occupational gaps, skills gap is derived as the difference between skills demand and supply projections. This helps identify emerging technical skills for the next ten years (2023–32).
- Presented below are standardized scores to illustrate skills where the highest gaps are expected, such as ERP, SCADA, etc., indicating potential need for skill development.

Note: Please see Methodology and Data Limitations section on page 13 for further detail on the skills gap analysis.
Training and Education Requirements and Programs

Workforce Education Profile and Requirements\textsuperscript{12}

- The most common fields of study among workers in the battery manufacturing sector are engineering and engineering technologies, which account for 62% of all workers who completed a study program. Specifically, for battery development and production related competencies, electrical, mechanical, chemical and mechatronics engineering are common.
- Additionally, 15% of employees were trained in business, management, marketing and related fields.
- Further, 8% of workers in the segment studied computer and information sciences, while 2% trained in mechanic and repair technologies.

Below is a selection of programs, trainings and certificates across Canada accessible to current and aspiring workers in the EV battery sector in Ontario.

<table>
<thead>
<tr>
<th>Program</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Makermax Systems Inc.</td>
<td>Based in British Columbia</td>
</tr>
<tr>
<td>• Offered online</td>
<td></td>
</tr>
<tr>
<td>• Based in British Columbia</td>
<td></td>
</tr>
<tr>
<td>• Electric Vehicle Battery and Battery Management Systems</td>
<td></td>
</tr>
<tr>
<td>Northern College</td>
<td>Based in Ontario</td>
</tr>
<tr>
<td>• Offered online</td>
<td></td>
</tr>
<tr>
<td>• Based in Ontario</td>
<td></td>
</tr>
<tr>
<td>• Battery - Electric Vehicle course</td>
<td></td>
</tr>
<tr>
<td>University of Guelph</td>
<td>Based in Ontario</td>
</tr>
<tr>
<td>• Offered online</td>
<td></td>
</tr>
<tr>
<td>• Based in Ontario</td>
<td></td>
</tr>
<tr>
<td>• Electrochemical Technology Centre</td>
<td></td>
</tr>
<tr>
<td>University of Victoria</td>
<td>Based in British Columbia</td>
</tr>
<tr>
<td>• Offered online</td>
<td></td>
</tr>
<tr>
<td>• Courses for battery and fasteners which covers concepts of battery maintenance and servicing</td>
<td></td>
</tr>
<tr>
<td>Ovin Canada</td>
<td>Based in Ontario</td>
</tr>
<tr>
<td>• Offered online</td>
<td></td>
</tr>
<tr>
<td>• Based in Ontario</td>
<td></td>
</tr>
<tr>
<td>• Electric Vehicle Battery Testing and Certification</td>
<td></td>
</tr>
<tr>
<td>• Courses on the large batteries used in EV</td>
<td></td>
</tr>
<tr>
<td>Cambrian College</td>
<td>Based in Ontario</td>
</tr>
<tr>
<td>• Industrial Battery Electric Vehicle Maintenance Certificate Program</td>
<td></td>
</tr>
<tr>
<td>• Hybrid and Battery Electric Vehicle Powertrain Design and Development</td>
<td></td>
</tr>
<tr>
<td>• Electrochemical Technology Centre</td>
<td></td>
</tr>
<tr>
<td>• Battery - Electric Vehicle course</td>
<td></td>
</tr>
</tbody>
</table>

Note: Engineering comprises of instructional programs that prepare individuals to apply mathematical and scientific principles to the solution of practical problems. Engineering technologies/technicians comprises of instructional programs that prepare individuals to apply basic engineering principles and technical skills in support of engineering and related projects.
Equity, Diversity, and Inclusion

Current Minority Groups Representation in Battery Manufacturing

Based on 2021 employment, women and Indigenous groups are underrepresented in Ontario’s semiconductor, electrical equipment and related components industries.

Current Initiatives Across Canada

Public and private organizations have developed various initiatives to promote equity, diversity and inclusion (EDI) in the Canadian battery production sector going forward.

Access Employment offers a well-curated electrical engineering connections program for internationally trained electrical engineering professionals. The program helps immigrants and refugees to upskill.

The Canadian Battery Association (CBA) ensures that leaders of the battery sector have sufficient knowledge of the regulations and data to take well-informed decisions. It believes in equal accessibility of knowledge to all members.

The Government of Canada has developed the 50-30 Challenge initiative to encourage partner organizations to reach 50% gender parity and 30% representation from minority groups, including racial minorities, LGBTQ2, among others.

My Battery Recyclers create opportunities for small local and diverse businesses to actively participate in the battery supply chain, with a focus on promoting underrepresented communities.

Proterra offers training, education, upliftment, and continual evolution in battery technology. Its objective is to create a safer and more equitable environment for all.

Stakeholders in the sector are improving EDI by

Upskilling the Immigrants

Agencies, with the support of government and education institutions, provide multiple upskilling programs to immigrants and make them job ready.

Offering Equitable Environment

Companies in the sector are working continuously to provide training, education, and upliftment to all the groups, and no one faces any disadvantages due to the lack of it.

Opportunities to increase women’s representation in battery manufacturing include

Providing Women with Information Platforms

Stakeholders can support this by developing information materials and creating educational partnerships so that women may have accessible knowledge of open opportunities in the field.

Addressing Women Turnover Rate

Companies can implement internal policies to support an inclusive workforce for women where working conditions and advancement opportunities are fair and equitable regardless of gender.

Promoting Women in Leadership Positions

Companies in the field can make an active effort to promote women’s representation in leadership positions across all levels, ensuring a platform for women’s advocacy in the workplace.

Organizations worldwide are promoting EDI in battery production

EEL offers an inclusive and supportive environment by engaging and collaborating in electrochemical research with people of all races, genders, and disability statuses.

Women have accessible knowledge of the regulations and data to take well-informed decisions.

My Battery Recyclers create opportunities for small local and diverse businesses to actively participate in the battery supply chain, with a focus on promoting underrepresented communities.

Proterra offers training, education, upliftment, and continual evolution in battery technology. Its objective is to create a safer and more equitable environment for all.
Leading Ontario’s Automotive and Mobility Transformation

The automotive industry is undergoing a significant shift, with technological advances and evolving mobility preferences redefining its future.

OVIN, led by the Ontario Centre of Innovation (OCI), is supported by the Government of Ontario’s Ministry of Economic Development, Job Creation and Trade (MEDJCT), Ministry of Labour, Immigration, Training and Skills Development (MLITSD) and Ministry of Transportation (MTO). Through OVIN, Ontario is at the forefront of the automotive and mobility sector’s transformation. OVIN capitalizes on the economic potential of advanced automotive technologies and smart mobility solutions such as connected and autonomous vehicles, and electric and low-carbon vehicle technologies, while enabling the province’s transportation and infrastructure networks to plan for and adapt to this evolution.

OVIN is accelerating the development and commercialization of next generation electric, connected and autonomous vehicle and mobility technologies and supporting Ontario’s role as the manufacturing hub of Canada, while leveraging critical minerals in Ontario’s North which are integral to battery development in Ontario’s North.

OVIN has five main objectives:

1. Foster the commercialization of Ontario-made advanced automotive technologies and smart mobility solutions
2. Showcase the Province of Ontario as the leader in the development, testing, piloting and adoption of the latest transportation and infrastructure technologies
3. Drive innovation and collaboration among stakeholders at the convergence of automotive and technology
4. Leverage and retain Ontario’s highly skilled talent, and prepare Ontario’s workforce for jobs of the future in the automotive and mobility sectors
5. Harness the Province of Ontario’s regional strengths and capabilities, and bridge its automotive and technology clusters to promote the development of EV and power train technologies in Ontario
Automotive & Mobility Team

Raed Kadri
Vice President Strategic Initiatives and Head of OVIN
rkadri@oc-innovation.ca

Mona Eghanian
Assistant Vice President, OVIN
meganian@oc-innovation.ca

Ghazal Momen
Manager, Implementation and Delivery
gmomen@oc-innovation.ca

Kathryn Tyrell
Manager, Automotive and Mobility Strategy (on leave)
ktreill@oc-innovation.ca

Shane Daly
Automotive and Portfolio Manager
sdaly@oc-innovation.ca

Natalia Rogacki
Portfolio Manager, Automotive and Mobility
nrogacki@oc-innovation.ca

John George
Sector Manager, Automotive and Mobility
jgeorge@oc-innovation.ca

Greg Gordon
Director, Strategic Partnerships
ggordon@oc-innovation.ca

Stephanie Rodrigues
Manager, Strategic Initiatives
srodrigues@oc-innovation.ca

Joelle Monje
Outreach and Engagement Specialist
jmoje@oc-innovation.ca

Homeira Afshar
Research and Insights Analyst
hafshar@oc-innovation.ca

Shirin Sabahi
OVIN Team Coordinator
ssabahi@oc-innovation.ca

Skills, Talent & Workforce Development Team

Natalia Lobo
Project Manager
nlob@oc-innovation.ca

Aleque Juneau
Project Lead Workforce Development
ajuneau@oc-innovation.ca

Shannon Miller
Project Lead, Strategic Partnerships
smiller@oc-innovation.ca

Rodayna Abuelwafa
Project Lead, Skills Development
rabuelwafa@oc-innovation.ca

Deepan Parikh
Technical Analyst
dparikh@oc-innovation.ca
Methodology and Data Limitations

Methodology

An overview of the methodology of the analysis is presented below:

• **Skill gaps** were defined based on the average occurrence rate of a skill in job posting related to the segment and the average occurrence rate of the same skill in relevant job seeker profiles. Occurrence rate is the frequency or percentage of job postings that mention a given skill, tool, or technology, in relevant occupations. Skill gaps where demand exceeded supply are included in the report.

• **Occupational demand** is projected based on industry’s forecasted growth as per Oxford Economics, in combination with expected changes in the demand for workers, including annual change in employment by occupation and replacement demand. Replacement demand is based on estimated rates of exit from the labour force due to retirement, emigration or death. Exit rates are based on the Canadian Occupational Projection System (COPS) data.

• **Occupational supply** is projected based on three distinct sources: school leavers (i.e. postsecondary graduates and apprenticeship completions), immigrants, and job changers (i.e. individuals currently in the workforce who may enter the sector).

• **Occupational labour gaps** were determined subtracting total projected supply from total projected demand across all forecast years (2023-2032). The skills outlook was based on occupational projections for a common set of skills available in both job postings (demand) and job seeker profiles (supply).

• **The degrees required by employers** in battery manufacturing are reflected in the most common fields of study for workers currently employed in the segment. These fields are identified by triangulating field of study (CIP), occupation (NOC), and industry (NAICS) data.

Data Limitations

Identified limitations with the datasets and approach used in the analysis include:

• Skills data were collected from Vicinity Jobs, a labour market analytics firm, at the level of occupations (4-digit NOC) and grouped into occupation categories based on the similarity of their roles within each segment of the automotive and mobility sector, including information regarding the education level and workforce characteristics (e.g., skills, knowledge, tools & technology) required in postings by occupation.

• The analysis of skills was limited by the availability and completeness of data. There were gaps in terms of job posting and job seeker profiles in Vicinity Jobs data, which means that the estimations of skills demand, supply, and gap should be considered as a ranking rather than a definitive estimation.

• Future skill insights were limited by the skills present in current state data from job posting and job seeker profiles, meaning “new” skills that are not related to occupations in the present could not be identified.

• The data used for the analysis of representation of women, visible minorities, and Indigenous groups in Ontario’s employment by industry and by occupation is sourced from Statistics Canada’s latest Census from 2021. Data for non-binary gender groups are not available at the level of granularity in this analysis.
References

1 Invest in Canada (2022). Retrieved from Ontario: A smart choice for electric vehicle and battery manufacturing | Invest in Canada (investcanada.ca)
2 Invest in Canada (2022). Retrieved from Umicore chooses Canada for first-of-its-kind EV battery materials plant | Invest in Canada (investcanada.ca)
3 Government of Canada (2022, March 23). Retrieved from Government of Canada welcomes largest investment in Canada’s auto industry with the first large-scale domestic EV battery manufacturing facility - Canada.ca
4 Automotive News Canada (2023, March 13). Retrieved from Volkswagen picks Ontario, Canada, for N.A. battery cell plant | Automotive News Canada (autonews.com)
7 Statistics Canada and EY Analysis.
8 Statistics Canada, Census 2021 and EY Analysis.
9 Vicinity Jobs, O*NET Database, and EY Analysis.
12 Statistics Canada, Census 2021, and EY Analysis.
13 Statistics Canada, Census 2021, and EY Analysis.
19 Canadian Manufacturers & Exporters (n.d.). Retrieved from Women in Manufacturing — CME (cme-mec.ca)
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