

## A Spotlight on Skills, Talent & Workforce Development: EV Motor for Electrification

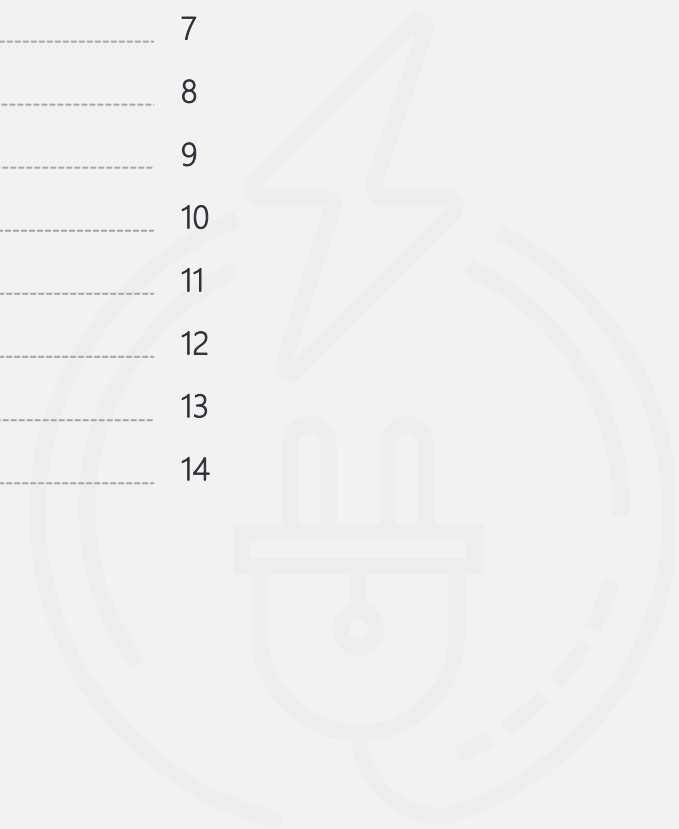
Ontario Centre of Innovation – Ontario Vehicle Innovation Network (OVIN)  
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# Acronyms and Glossary of Terms

Acronyms	
AI	Artificial Intelligence
AngularJS	Angular JavaScript
AutoCAD	Automated computer-aided design
CAE	Computer-aided engineering
CAM	Computer-aided manufacturing
CNC	Computerized numerical control
CIP	Classification of instructional programs
EDI	Equity, diversity and inclusion
EV	Electric vehicle
GDP	Gross domestic product
ICE	Internal combustion engine
MEDJCT	Ontario Ministry of Economic Development, Job Creation and Trade
MLITSD	Ministry of Labour, Immigration, Training and Skills Development
MTO	Ministry of Transportation
NAICS	North American Industry Classification System
NOC	National Occupational Classification
OCI	Ontario Centre of Innovation
OVIN	Ontario Vehicle Innovation Network
SCADA	Supervisory control and data acquisition
UML	Unified Modeling Language

Glossary of Terms	
Advanced manufacturing	Use of technology and innovation to improve efficiency in manufacturing.
Automotive manufacturing	Production of vehicles using various techniques and technologies.
Automotive technologies	Technologies used in designing and producing vehicles.
Automotive supply chain	Network of companies and organizations involved in the design, development, production, and distribution of automotive products and services.
Clean technologies	Technologies that reduce or eliminate environmental impacts, including emissions and waste.
EV motor	Electric motor that provides the propulsion for an electric vehicle.
Hybrid vehicle	Vehicle that uses both an internal combustion engine and an electric motor to power the vehicle.
Power module	An electronic component that contains multiple power semiconductors and passive components, used for power conversion and control.
Powertrain	The components of an electric or hybrid vehicle that generate power and transmit it to the wheels.
Skilled labour	Workers with specialized skills in the labour market.

In 2019, the Government of Ontario announced its **10-year vision for the Driving Prosperity - The Future of Ontario's Automotive Sector** plan. This plan outlines the provincial objectives for transforming the automotive and mobility sector, building on existing competitive advantages. It aligns with the Government of Canada's mandatory target for new passenger vehicle sales to be **zero-emission by 2035**, which is driving a **major electrification transformation** in Ontario's automotive and mobility sector.

Phase 2 of this plan outlines the government's intention to transform the province's automotive supply chain to build the cars of the future. This includes increasing production of hybrid and electric vehicle (EV) batteries, and **boosting exports** of Ontario-made auto parts and innovations. As part of this transformation, the plan also sets provincial goals for positioning Ontario to compete globally by **innovating locally** in the creation, design, production, and adoption of new products and services within the automotive and mobility sector.<sup>1</sup>

Both significant challenges and opportunities exist for the industry in embracing the **future of clean technologies** in the automotive and mobility sector. Ontario holds a **considerable advantage** in designing and producing the next generation of vehicles due to its unique automotive and technological expertise.<sup>2</sup>

Several notable initiatives showcase Ontario's capabilities in innovation and technology development, which are essential for EV motors and the global race to advance EV motor technology and associated power electronics.

One such initiative is the **University of Toronto Electric Vehicle (UTEV) Research Centre**, a university-industry partnership that fosters the development of next-generation EV technologies. Housed in the power electronics lab at the University of Toronto's Edward S. Rogers Department of Electrical & Computer Engineering (ECE), the research center focuses on **advanced power modules** for ultra-compact chargers, next-generation powertrains, and innovative system topologies to **enhance vehicle powertrain efficiency**.<sup>3</sup>

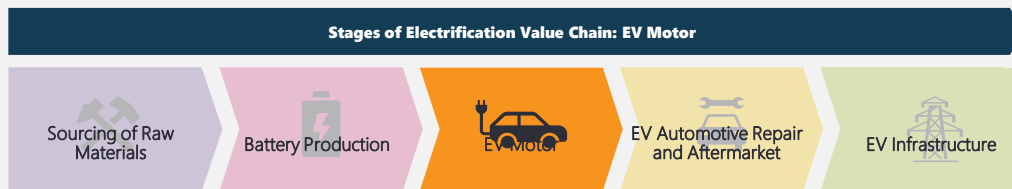
As a result of these sectoral transformations, various **skills and occupations** are emerging in the EV motor sector, particularly in areas related to **motor design and production**, including expertise in **design and electrical engineering**. The **increasing demand** for technical skills and abilities in the sector highlights major trends in automation and digitalization within the sector.



This spotlight highlights the following:

## Ontario's EV Motor Sector

EV motors are crucial to the automotive Electrification value chain as they regulate the power and efficiency of next-generation vehicles. Below is an illustration of the manufacturing of EV motors in the electrification value chain:



This section provides an overview of Ontario's innovation strategies 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 skills and key occupations with the largest shares of employment in the manufacturing industries relevant to the EV motor sector, such as electrical equipment, motor vehicle parts, and spring and wire products. 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 occupations such as mechanical/electronics/electrical assemblers, machining/metal forming trades, etc.

- **Current skill requirements** include various digital technologies, including AI technologies for the design and development phase of the motor.
- **High occupational gap** is expected for assembly workers and manufacturing labourers 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 EV motor sector.

## Equity, Diversity and Inclusion

This section explores current trends the representation of minority groups in industries relevant to the EV motor sector in Ontario. 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 EV Motor Potential at a Glance

Ontario is uniquely positioned to leverage its innovation and manufacturing hubs to become a leader in EV motor development and production.

**In the pursuit of better fuel economy through EV motors, component suppliers for Internal Combustion Engine (ICE) vehicles may experience an advantage due to the low-cost transition and fewer parts and labor hours required.<sup>4</sup>**



**EV motor will be an integral part of the electrification transformation in Ontario's automotive and mobility industries:<sup>5</sup>**

Between 2020 and 2025, **5% of all electric motor production** in North America is expected to take place in Canada, indicating that there is still **ample opportunity to be realized by Canadian component suppliers.**

The availability of skilled labour workforce supports Ontario's manufacturing industries relevant to EV motors.

**EDI Snapshot<sup>7</sup>**

**As of 2021, 66,130 workers are employed in Ontario's EV motor related industries<sup>6</sup>**

**Top in-demand occupations**

- Mathematicians, statisticians, actuaries and data scientists
- Labourers in processing, manufacturing and utilities
- Machinery and transportation equipment mechanics (except motor vehicles)



**Top skills required in EV Motor related manufacturing industries**

- Cloud Computing
- AutoCAD
- Artificial Intelligence (AI)
- Atlassian JIRA
- AngularJS



**Women representation**

**28.2%**

**Indigenous representation**

**1.9%**

**Visible Minority representation**

**43.3%**

Looking ahead, Ontario's EV motor labour force requirements point to greater digitalization and technical skills.

**Reskilling**

**may help workers adapt to increased digitalization**

**Expected in-demand occupations**

- Electronics assemblers, fabricators, inspectors and testers
- Labourers in processing, manufacturing and utilities



**Expected Skill Gaps**

- Supervisory control and data acquisition systems
- 3D computer aided design software
- Computer-aided engineering software
- Computerized numerical control software

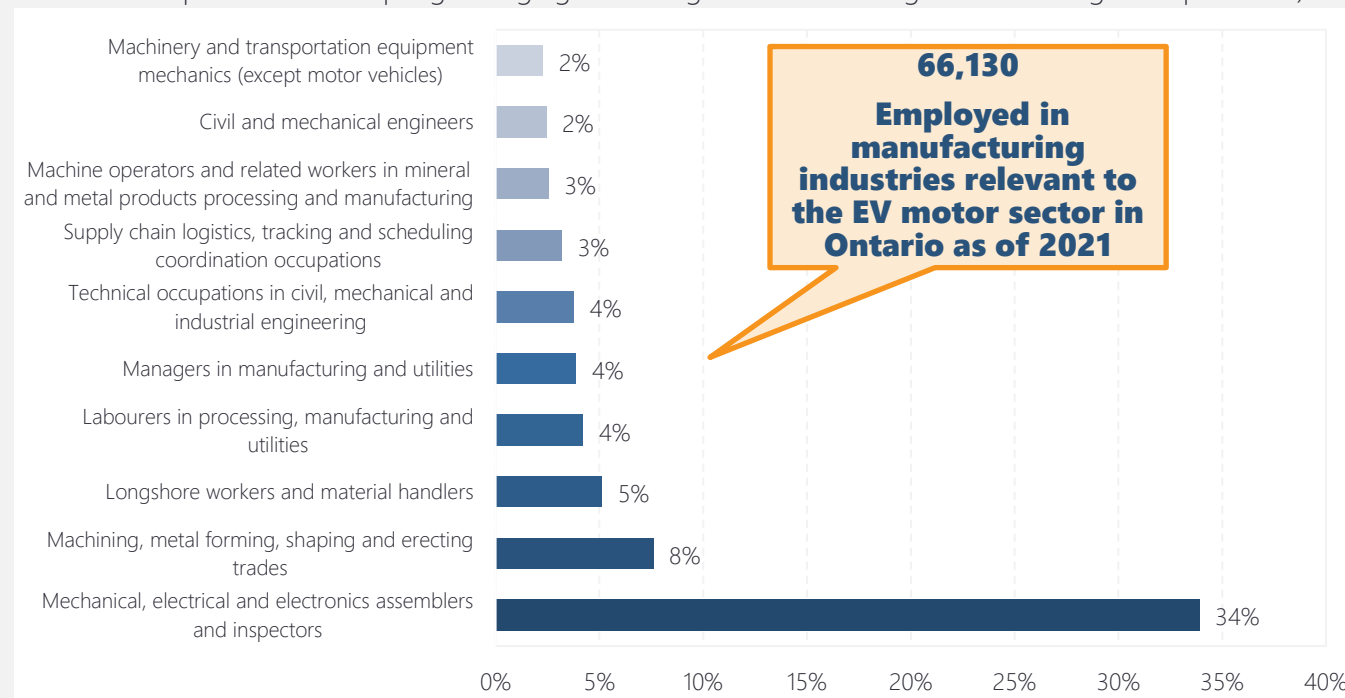




# Current Labour Market Insights

## Top 10 Occupations in EV Motor

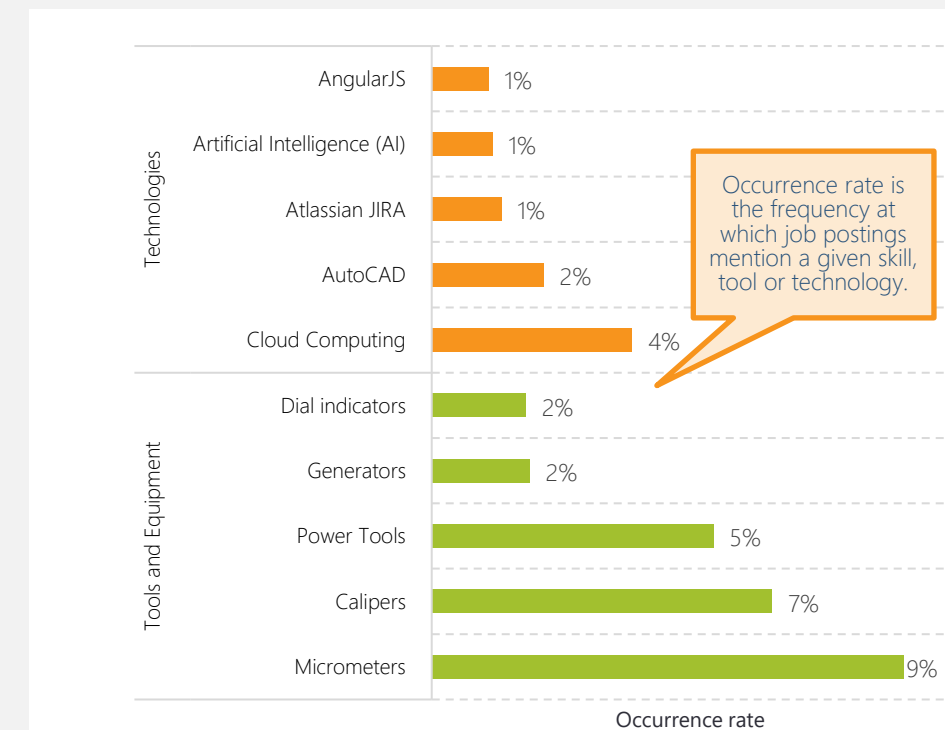
- The figure below presents the top 10 occupations based on employment in the manufacturing industries relevant to the EV motor sector, such as electrical equipment, motor vehicle parts and spring and wire products.
- Besides core occupations in mechanical work and electrical assembly, the top 10 occupations include domain specific occupations, such as:
  - Technical occupations in civil, mechanical and industrial engineering (e.g., engineers developing new motor concepts, designs, methods, etc.)
  - Managers in manufacturing and utilities (e.g., operations/manufacturing managers who are responsible for adopting emerging technologies in streamlining manufacturing and operations).



Note: The occupations in this chart are the top ten occupations with the highest employment as a share of total employment in EV Motor (NAICS 3353, 3363 and 3326).

## Top Skill Requirements<sup>9</sup>

- 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, employers in the EV motor production request various AI technologies in the manufacturing of EV motors.
- Additionally, familiarity with precision measuring tools (e.g., micrometer, caliper, etc.), power tools and generators is typically sought after in the manufacturing phase.





# Skills Outlook and Expected Gaps

## Labour Market Gap Outlook<sup>10</sup>

- 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 labour market gaps are determined based on the difference in future labour demand and supply.

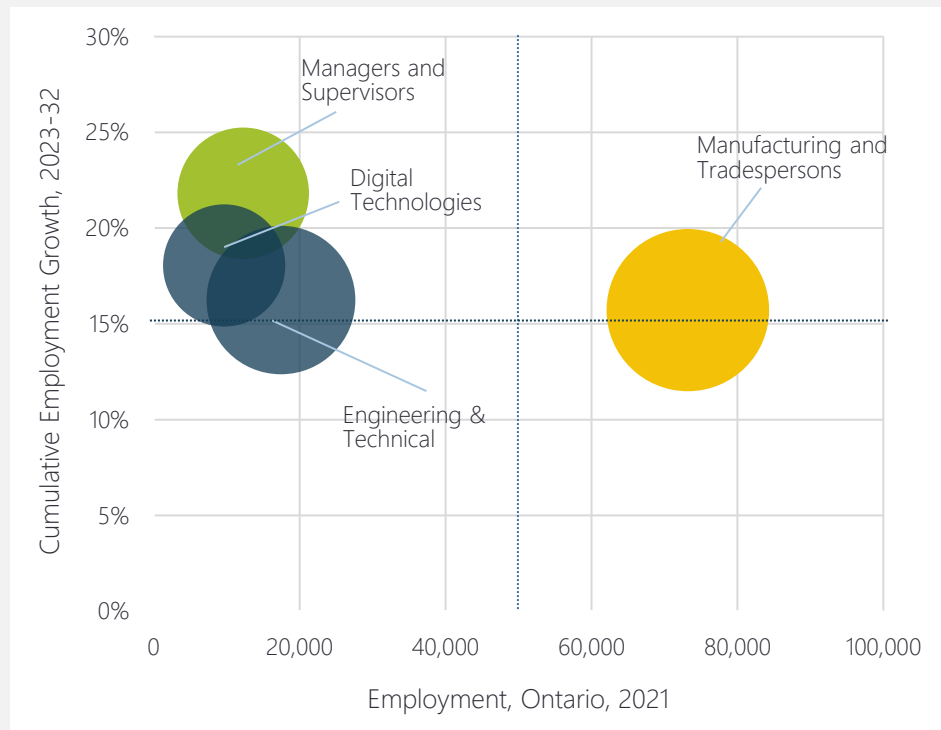
**High**

**Moderate**

**High to moderate labour force gaps** indicate that projected total demand for workers exceeds availability of workers in the labour market, suggesting potential challenges in finding qualified workers. **High gaps** are more acute and prominent for manufacturing competencies, and given high level of employment and expected growth, this is a high priority for talent attraction.

**Low**

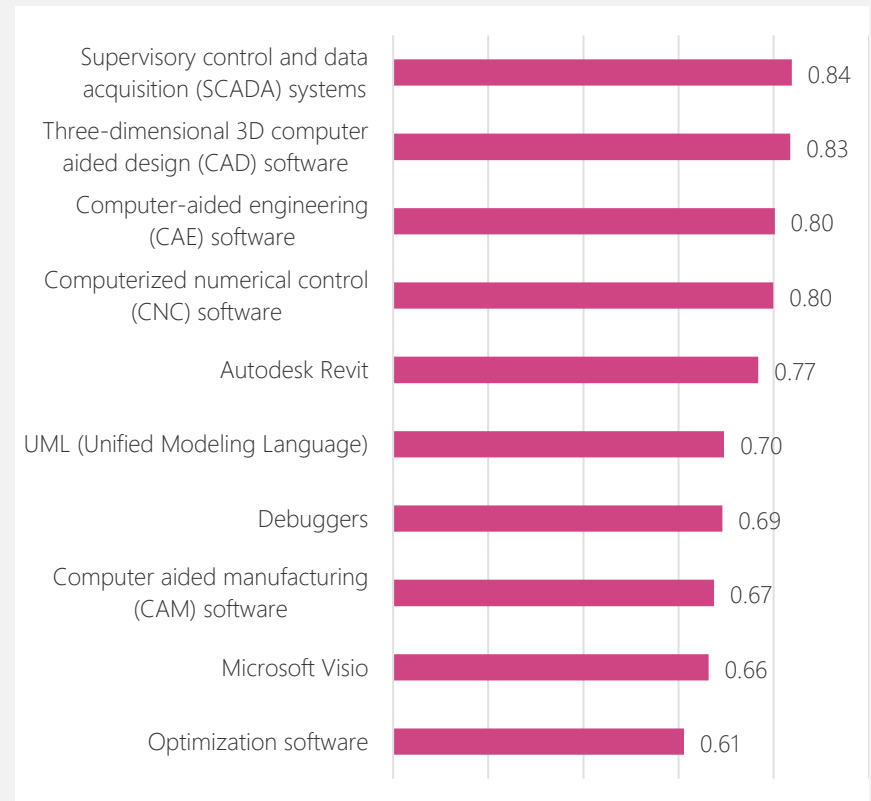
**Low labour force gaps** indicate sufficient availability of workers in the labour market compared to what employers demand. Low gaps are prominent for managerial occupations. Some technical occupations, such as information systems analysts are also expected to see low gaps.



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<sup>11</sup>

- 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 SCADA, CAD, 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.

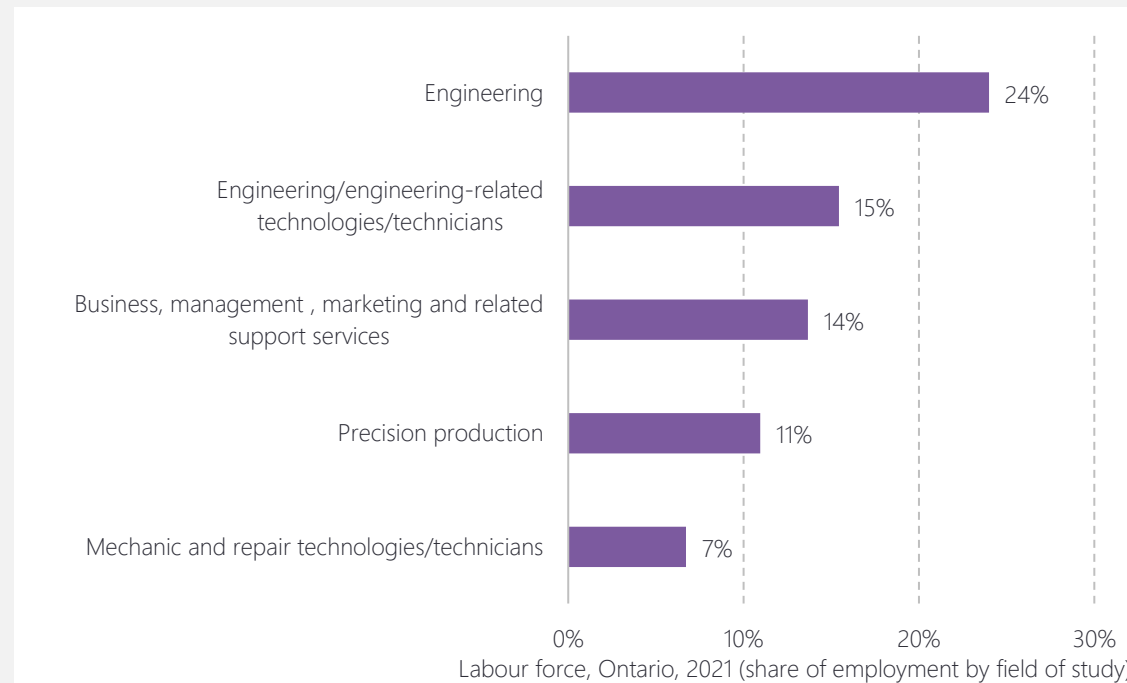




# Training and Education Requirements and Programs

## Workforce Education Profile and Requirements<sup>12</sup>

- The most common fields of study among workers in the manufacturing industries relevant to the EV motor industry are engineering and engineering technologies. These specializations account for 39% of all workers who completed a study program. Specifically, electrical, automobile, industrial and mechanical engineering are common.
- Additionally, 14% of employees were trained in business, management, marketing fields.
- Further, 11% of workers in the sector trained in precision production, while 7% studied mechanic and repair technologies.



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.

## Talent and Workforce Development Programs

Below is an overview of programs, trainings and certificates across Canada accessible to current and aspiring workers in the EV motor sector in Ontario.

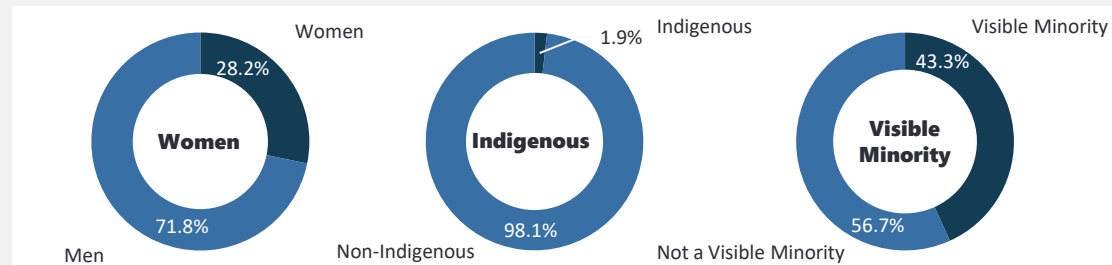
<ul style="list-style-type: none"> <li>• Based in Ontario</li> <li>• Electrical Engineering Technician for foundation in electrical and electronic theory and practices</li> </ul>	<ul style="list-style-type: none"> <li>• Based in Ontario</li> <li>• Electrical Engineering Technician</li> <li>• AutoCAD workshops and certification</li> </ul>	<p>Educational Program Innovations Centre</p> <ul style="list-style-type: none"> <li>• Based in Ontario</li> <li>• Course on motors, motor control circuits and drives</li> <li>• Offers practical knowledge through laboratory workshops</li> </ul>
<ul style="list-style-type: none"> <li>• Offered online</li> <li>• Electric Motor Design for Electric Vehicle's – Advanced</li> <li>• Electric Motor Control</li> </ul>	<ul style="list-style-type: none"> <li>• Based in Ontario</li> <li>• Electric Motor Training Course On Design, Control, Protection, Testing - Best Practices</li> </ul>	<ul style="list-style-type: none"> <li>• Offered online</li> <li>• Motors and Motor Control Circuits</li> <li>• Covers integration of software with motor hardware</li> </ul>
<ul style="list-style-type: none"> <li>• Offered online</li> <li>• Electric Motor Design</li> <li>• Design of motor using MATLAB and ANSYS Maxwell</li> </ul>	<ul style="list-style-type: none"> <li>• Offered online</li> <li>• Design Of Electric Machines With Motor-CAD and simulations</li> </ul>	<ul style="list-style-type: none"> <li>• Offered online</li> <li>• Electric Motors and Motor Control Circuits (includes failure prevention and troubleshooting)</li> </ul>



# Equity, Diversity, and Inclusion

## Current Minority Groups Representation in EV Motor<sup>13</sup>

Based on 2021 employment, women and Indigenous groups are underrepresented in Ontario's manufacturing industries that underscore the EV motor sector.



## Current Initiatives Across Canada

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

<p>Society of Women Engineer - Toronto has been a champion for female engineers and aims to foster a community of female engineers and connect them with industry partners.</p>	<p>Diversio is an AI-based DEI platform designed to give data-driven insights to organizations on their inclusivity. It also provides certifications and are increasingly trusted by industry players, such as Honda.</p>	<p>Access Employment offers a well-curated electrical engineering connections program for internationally trained electrical engineering professionals. It aims to help immigrants and refugees to upskill themselves.</p>
<p>Engineers Canada adopted the 30 by 30 initiative as part of its efforts and goal of raising the percentage of newly licensed female to 30% by 2030.</p>	<p>The Ontario Network of Women in Engineering (ONWiE) was founded in 2005 to support female and non-binary engineers in their careers.</p>	<p>The Women in Engineering is a student body association housed in Concordia University to provide female engineering with academic and professional mentorship and placement.</p>

## Organizations worldwide are promoting EDI in EV Motor

<p>Women In Automotive is a mentorship and networking initiative to educate and inspire women in all areas of the automotive industry.</p>	<p>Women Automotive Network is a global community that is dedicated to empowering women in the automotive industry.</p>	<p>The Center for Automotive Diversity, Inclusion and Advancement was founded in 2017 and strives to support diversity initiatives through networks, consultations, etc.</p>
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## Stakeholders in the sector are improving EDI by<sup>14</sup>

<h3>Fostering a Culture of Diversity and Inclusion</h3> <p>Companies seek to create an inclusive workforce by promoting internal policies, allowing for current and potential workers to feel included regardless of their background or gender.</p>	<h3>Trainings to Marginalized Communities</h3> <p>Companies work on improving employment and mentorship opportunities for poor, vulnerable and marginalized groups through access to skills training which is important in the industry.</p>	<h3>Advocating for Equal Opportunity Policies</h3> <p>A key for EDI promotion is to create consciousness and advocate to local and national authorities for legislature and policy to allow for equal advancement opportunities and treatment.</p>
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## Opportunities to increase women's representation in EV motor include<sup>15</sup>

<h3>Curated Education Programs for Women</h3> <p>Stakeholders can create education programs related to the sector to help women start their careers here. Further, with well-structured programs, they feel inspired to pursue it.</p>	<h3>Global Community for Women</h3> <p>Companies can create global communities for the women that will guide them on every step of their careers in this sector and conduct informative sessions for industry-specific questions.</p>	<h3>Promoting Women in Leadership Positions</h3> <p>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.</p>
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## 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.

## 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

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## 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 EV motor 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

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<sup>1</sup> Government of Ontario (2019). Retrieved from [Driving Prosperity: The Future of Ontario's Automotive Sector | ontario.ca](#)

<sup>2</sup> Ibid.

<sup>3</sup> UTEV Research Centre (n.d.). Retrieved from [UTEV \(utoronto.ca\)](#)

<sup>4</sup> Next generation Manufacturing Canada (2022). Canadian Automotive Supplier Capability and EV Value Chain Analysis.

<sup>5</sup> Ibid.

Government of Canada (2023). Retrieved from [Canada and Ontario welcome historic investment from Volkswagen - Canada.ca](#)

<sup>6</sup> Statistics Canada and EY Analysis.

<sup>7</sup> Statistics Canada and EY Analysis.

<sup>8</sup> Statistics Canada, Census 2021 and EY Analysis.

<sup>9</sup> Vicinity Jobs, O\*NET Database, and EY Analysis.

<sup>10</sup> Statistics Canada, Vicinity Jobs, Oxford Economics and EY Analysis.

<sup>11</sup> Statistics Canada, Vicinity Jobs, Oxford Economics and EY Analysis.

<sup>12</sup> Statistics Canada, Census 2021, and EY Analysis.

<sup>13</sup> Statistics Canada, Census 2021, and EY Analysis.

<sup>14</sup> Women Automotive Network (n.d). Retrieved from [Mentorship – Women Automotive Network](#)

<sup>15</sup> Women in Automotive (n.d). Retrieved from [ABOUT - Women In Automotive](#)

Women Automotive Network (n.d). Retrieved from [Women Automotive Network - working together for a better future](#)



# Disclaimer

This report was commissioned by the Ontario Centre for Innovation (OCI) through a Request for Proposals titled "Labour Market Research Insights: Talent & Workforce Strategy Update," dated September 30, 2022, and has been prepared by a third-party vendor.

In preparing this report, we have relied on information provided by others, and we do not accept responsibility for the content, including accuracy and completeness, of such information.

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