FOCAL Initiative

ICEV TO EV WORKFORCE TRANSITION LABOUR MARKET FORECAST

EASTERN ONTARIO REPORT

MARCH 2024

About the FOCAL Initiative

The Future of Canadian Automotive Labourforce (FOCAL) Initiative, funded by the Government of Canada, is a collaboration of the Canadian Skills Training and Employment Coalition (CSTEC), the Automotive Policy Research Centre (APRC) and Prism Economics and Analysis.

The FOCAL Initiative has produced labour market information and data related to Canada's automotive manufacturing sector, examined key trends affecting the automotive labour market, and produced forecasts of supply and demand for key occupations in the broader automotive sector.

This project is funded in part by the Government of Canada's Sectoral Workforce Solutions Program

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Executive Summary

The Eastern Ontario region is in early stages of the transition towards decarbonization that will have a significant impact on the automotive manufacturing sector across Ontario. Production processes and supply chains have already begun to shift their focus from internal combustion engine vehicles (ICEVs) to electric vehicles (EVs).

Occupation impacts are influenced by the characteristics and timing of the transition. For some occupations (such as vehicle assemblers), the number of needed workers and the tasks that they perform is very closely tied to the type of vehicle being produced. Those occupations will be significantly impacted by the ICEV-EV transition. Other occupations (such as computer network technicians) may experience relatively moderate or little impact if the tasks that they perform are not associated with the type of vehicle produced. Therefore, it is important to examine occupation-level impacts so that industries can ensure that they have the right number of workers with the right skills throughout the transition.

This report explores the labour market impact of the ICEV-EV transition in the Eastern Ontario region for 51 occupations in 49 industries, across a forecast horizon from 2025 to 2040. The term '*recruitment gap*' is the primary indicator of occupation-level impacts in this report. The recruitment gap measures labour market supply and demand dynamics that evolve during the forecast period. Because occupational demand is contingent on the number and type of vehicles being produced, a specific base case production scenario was defined as the context for the analysis. Demographic trends (which influence the entrance of young workers and exit of older workers from the labour force) and immigration were also incorporated into the analysis.

Results of the analysis indicate that several occupations will experience impacts during the transition. The magnitude and timing of impacts are unique for each occupation. Eastern Ontario will experience limited impacts from the ICEV-EV transition because there are no assembly or new battery plants in the region. There are some limited indirect impacts in regional manufacturers who supply parts and components. There will also be pressures as employers in other Ontario regions recruit key occupations in short supply. FOCAL II results identify six specific cases where these pressures are apparent. Readers will find more details on the source and likely timing of these competitive pressures in FOCAL II reports covering regional occupational impacts in Golden Horseshoe, Kitchener-Waterloo-Barrie, London and Windsor-Sarnia.

Introduction

FOCAL I reports (published in 2022) highlighted the crucial role of a broader automotive industry across Canada. As work concluded, it became clear that the emerging transition from internal combustion engine vehicles (ICEV) to electric vehicles (EV) was a new challenge facing the industry. The FOCAL II initiative is helping employers and job seekers manage the transition from (ICEV) to (EV). Assistance includes direct action through wage and training subsidies, and guidance in critical areas like skills transferability, diversity, immigration and apprenticeship. This support is augmented by FOCAL's analysis of the impact of new investments in EVs and the loss of ICEV-related production. The focus is on manufacturing industries, including vehicle assembly, parts production, battery supply and related changes across the supply chain. This process provides measures of changing labour market conditions for industries and occupations. FOCAL II assesses these impacts in three steps.

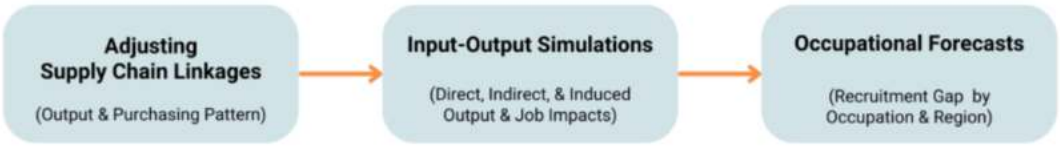
First, the EV Model estimates impacts of announced plans and expected investments and calculates new levels of production and related links across the supply chain. The analysis allocates these direct, initial impacts across;

- a transition horizon from 2025 to 2040
- 49 selected NAICS industries in
- Canada, Ontario, Quebec, Manitoba and seven regions.

Second, the direct impacts of new EV facilities are extended into the broader economy to estimate indirect impacts across all supplying industries and induced impacts related to changes in employment and incomes. This second step uses an expanded input-output capability that captures changes in the distribution of purchases across the supply chain and new patterns of local and external supply.

Third, the full range of impacts on employment are translated into labour market impacts that track changes in recruiting and job search conditions. This report describes these final, labour market impacts across 68 key occupations for Canada. Figure 1 illustrates this three-step process.

Figure 1. Impact analysis steps



Impacts of the transition are sensitive to changes in many factors. These include consumer acceptance of EVs, the timing and scale of investment in new production facilities, emerging economies of scale and technological advances that reduce vehicle and component costs, government policy, and success in Canada securing EV production mandates. Three scenarios

have been created, with each reflecting a different set of outcomes for each of these factors. The scenarios are described fully in the FOCAL II report titled '*The Shift to EV Production in Canada's Automotive Manufacturing Sector: Assessing the Economic and Labour Market Impacts'*. A variation of these scenarios is summarized in a base case scenario that is used for the labour market impact model.

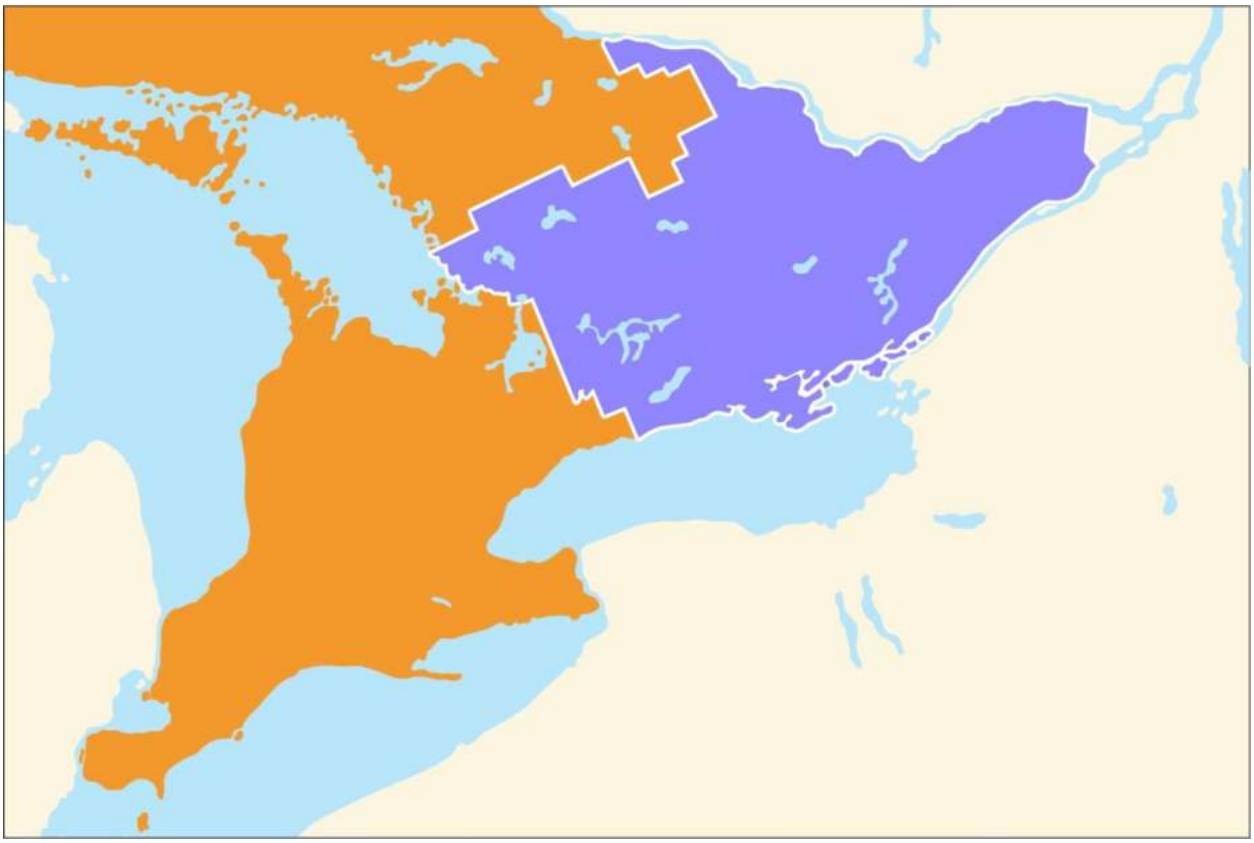
The base case scenario describes an ICEV-EV transition that will comprise both job gains and losses, changes in employment conditions, and related labour market disruptions for selected industries and occupations. Direct impacts spread out from vehicle assembly, parts producers specialized in combustion engines and transmissions and electronic parts, battery assembly, related chemical and mineral processes and, under certain assumptions, mining. Impacts are most disruptive in regions experiencing either new investments in battery plant production or losses as internal combustion engines are phased out. These impacts create a variety of changes, with large and pronounced effects nationally in some occupations (examples are described in Section 4 of this report) and more limited impacts across other occupations (impacts for all selected occupations are described in detail in Appendix D)[1].

This introduction is followed by a background on the Eastern Ontario region. This region has a limited role in production and employment in the traditional automotive industry (including vehicle assembly and parts manufacturing). But there are closely connected industries in the production and supply chain for EVs in the region. Section 3 describes impacts across the ICEV-EV transition in key industries. Section 4 reports detailed impacts across six selected occupations. Conclusions and implications are a reviewed in the final section. A list of the industries and occupations selected for the analysis, a review of the methodology applied in the labour market models, a review of skills transferability matrices and tables of detailed impacts for the occupations are in Appendices.

[1] Occupation impacts vary by province and region, due to differences in industrial characteristics and other labour market supply/demand dynamics unique to those areas. See provincial and regional reports for details.

The ICEV-EV Transition in Eastern Ontario – Background

Eastern Ontario includes the Economic Regions (ERs) of Ottawa, Kingston-Pembroke, and Muskoka-Kawarthas. Total automotive manufacturing employment in the region, including Original Equipment Manufacturer (OEM) plants and parts suppliers, was an estimated 4,000 workers across 19 establishments in 2018, based on findings from industry contacts, company websites, industry literature and other sources of publicly available data. Employment in the five years prior is estimated to have ranged from a low of 3,800 in 2013 and 2014 to a peak of 4,300 in 2016. In comparison, data from Statistics Canada's 2016 Census reports the region's automotive manufacturing employment as totaling 3,400 workers. The Eastern Ontario region is home to CpK Interior Products, which is owned by and supplies to FCA assembly plants across Ontario. Employment in this plant has remained stable since 2013, having reached a high of 426 in 2014. There are an estimated 18 parts suppliers in the region. Parts suppliers are located in the Kingston-Pembroke and Muskoka-Kawarthas ERs and employed approximately 3,600 employees in 2018.



The coming transition from ICEVs to EVs will have limited and impacts across Eastern Ontario. In 2022, the regional workforce of 1,181,200 included 73,400 working in manufacturing and 1,400 in the core automotive assembly and parts industries[2]. Motor vehicle assembly and related activity are critical to the overall well being of the broader Ontario economy. For example, assembled motor vehicles and parts are consistently among the top two or three exports from Canada; often second only to oil and gas extraction[3].

Relative to other industries, employers in manufacturing often identify human resources, skills shortages and recruiting as major challenges in business development. According to Statistics Canada:

> "Businesses in manufacturing were the most likely to expect challenges recruiting staff and these levels have remained unchanged when compared to 2022. In the second quarter of 2023, nearly half (48.4%) of businesses in manufacturing expected recruiting skilled employees to be an obstacle, compared with 47.4% in the second quarter of 2022"[4].

Demographic change has contributed to recruitment challenges in recent years, as the population of Baby Boomers (born between 1946 and 1965) retires. The 2021 Census tracked an increase of 5.8% in the total population of Ontario and 4.3% in the working age population between 15 and 69 compared to 2016. However, the composition of the workforce has been shifting. Baby Boomers now represent a decreasing proportion of the population and immigration, while younger generations increase in relative size. For example, between 2016 and 2021, the proportion of Millennials (born between 1981 and 1996) increased by 10.1% in Ontario while the proportion of Baby Boomers decreased by 3.6%. As shown in Figure 2, it is expected that Millennials will outnumber Baby Boomers in Ontario before 2026 and Generation Z (born between 1997 and 2012) will outnumber Baby Boomers before 2031. [5]

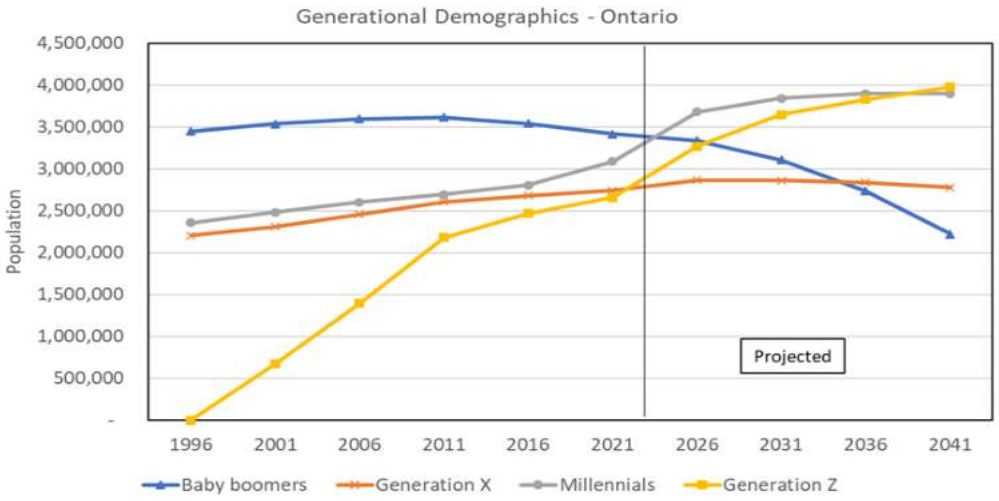
[2] Total employment and manufacturing employment estimates are from Metro Economics. Automotive assembly (NAICS 3361) and parts industries (NAICS 3363) employment estimates are based on data from Statistics Canada Labour Statistics Consistent with the System of National Accounts (Table 36-10-0489-01) and Automotive Policy Research Centre (APRC).

[3] Source: Government of Canada Trade Data Online (https://ised-isde.canada.ca/site/trade-data-online/en).

[4] Source: 'Analysis on labour challenges in Canada, second quarter of 2023' https://www150.statcan.gc.ca/n1/pub/11-621-m/11-621-m2023009-eng.htm

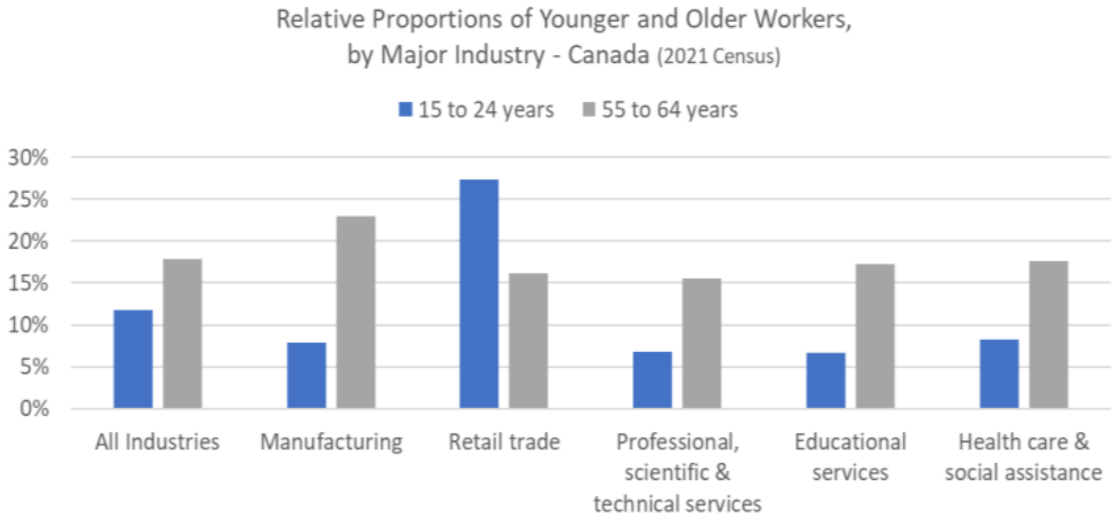
[5] Sources: Statistics Canada 1996 to 2021 Census (historical data); Table 17-10-0057-01 Projected population, by projection scenario, age and sex, as of July 1 (x 1,000) (projected data, M1 scenario)

Figure 2. Changing demographics in Ontario (Source: Statistics Canada)



Demographic trends are not consistent across industries, however. In the manufacturing sector, there continues to be a higher proportion of older workers and a lower proportion of younger workers. As shown in Figure 3 (below), of the five largest industry sectors in Ontario, the manufacturing sector has the highest proportion of employees in the 55 to 64 age group. Thus, the number and proportion of Baby Boomers transitioning out of the labour force in other industries is significantly lower than in the manufacturing sector and recruitment challenges related to the retirement of older workers will persist.

Figure 3. Proportions of older and younger workers in major Ontario industries (Source: 2021 Census)



Research in FOCAL I made the case for defining a broader automotive sector that adds key industries in the manufacturing and technology supply chain to the traditional grouping of assembly and parts manufacturing. Defined traditionally (i.e. NAICS 3361 Motor vehicle

manufacturing and 3363 Motor vehicle parts manufacturing), automotive employment in Ontario grew from 79,400 workers in 2009 to 102,400 workers in 2019. Employment decreased by 14% from 2019 to 2020, primarily due to COVID shutdowns in Ontario and elsewhere[6]. The core automotive workforce continues to recover to pre-COVID levels.

Over 98% of national employment in vehicle and parts manufacturing is concentrated in three provinces: Ontario (representing 89% of total national employment in these two industries), Quebec (with approximately 7% of national employment), and Manitoba (with slightly more than 2% of national employment)[7]. Less than 2% of the Ontario activity is concentrated in the Eastern Ontario region and this is mostly in the parts and related industries.

Table 1 tracks the distribution of employment across the selected industries. In this FOCAL II analysis, the broader automotive industry is defined to include specific new industries joining the automotive supply chain for EV production. This includes battery manufacturing, chemicals, material processing and mining. Eastern Ontario has a very small workforce in these traditional parts and other manufacturing industries in the automotive supply chain. There is a much bigger representation of computer, semiconductor, software and communications employers. These numbers serve as a starting point for measuring employment impacts.

Table 1. 2022 Employment in Eastern Ontario Region's broader automotive sector (Source: Statistics Canada, APRC)

Industry	Employment in 2022
Automobile and light-duty motor vehicle manufacturing	0
Heavy-duty truck manufacturing	0
Parts manufacturing	1,400
Mining	400
Basic chemical manufacturing	700
Other material processing	700
Battery manufacturing	2,300
Management, scientific and technical consulting services	10,200
Plastic product manufacturing	3,400
Other electronic product manufacturing	2,600

[6] Source: Statistics Canada. Table 36-10-0489-01 Labour statistics consistent with the System of National Accounts (SNA), by job category and industry

[7] Ibid. This estimate is calculated using the aggregation of NAICS 3361 (motor vehicle parts manufacturing) and 3363 (motor vehicle parts manufacturing).

Industry	Employment in 2022
Semiconductor and other electronic component manufacturing	2,000
Iron and steel mills and ferro-alloy manufacturing	700
Foundries	500
Forging and stamping	0
Other automotive supply chain	60,500

The ICEV to EV transition will shift employment among the industries in the broader automotive sector. The traditional leading economic role for these industries is clearly at risk as Canada must now compete for its place in the new world of EV production. Attention is focused on the crucial role of batteries in the new EVs and Ontario has been active and successful in the global competition for battery production. FOCAL II research tracks the likely path of the transition across industries and occupations as supply chains are redefined for EVs.
Table 1 tracks employment across 49 selected industries. These comprise the core assembly and parts producers, and include additional upstream industries (e.g., relating to battery production) in the evolving supply chain. A list of the specified industries featured in the labour market impact analysis, identified as the most important players in the EV transition, are found in Appendix A.
The major investments driving the transition have been documented in the media. Vehicle assemblers, parts manufacturers and new battery plants have announced plans for expansion in Canada. These investments include;

- new battery plants,
- commitments to transform existing assembly plants to accommodate high volume EV assembly,
- new production facilities to supply battery plants with specialized components including;
    - anode, cathode, specialized metal processes,
    - mining and mineral processing for speciality rare metals.

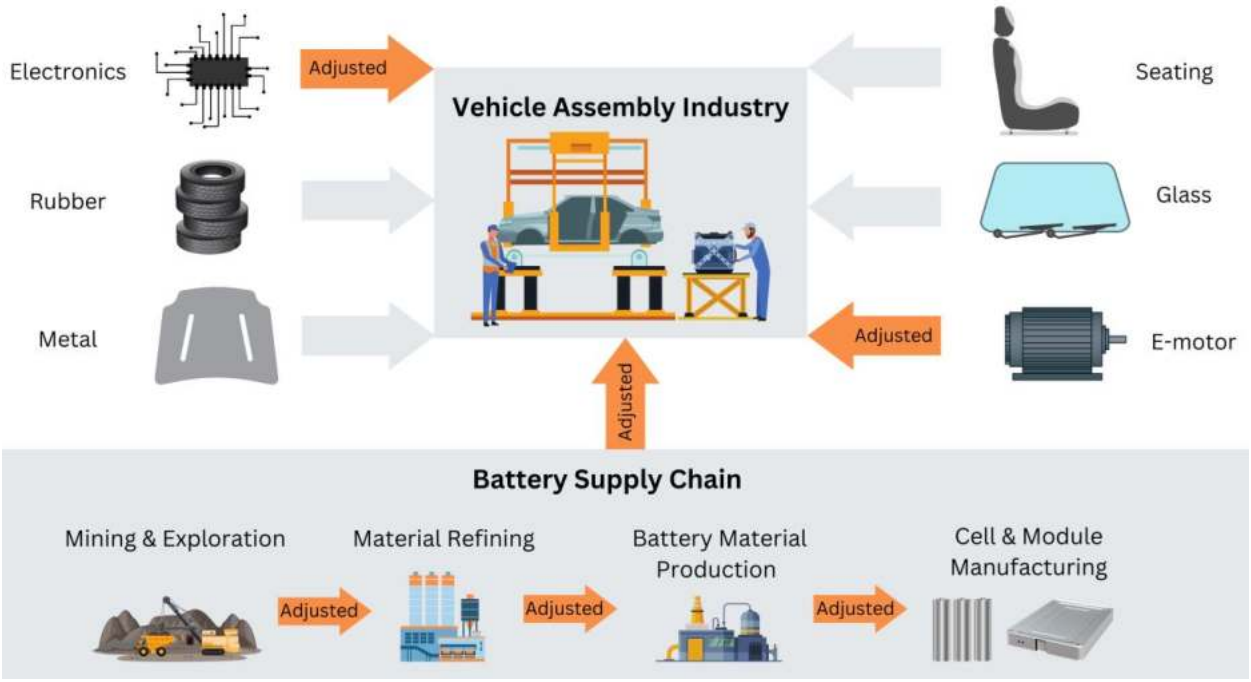
Only a limited amount of this investment is destined for Eastern Ontario. Announced investments at the Umicore Rechargeable Battery Materials facility in Loyalist Township suggests that occupations in the battery supply chain will soon be facing recruitment pressures. Production is expected to begin in 2026 and, in the base case scenario grows to a peak in 2035. With this exception, changes in the region will be indirect impacts that originate in the ICEV-EV processes in other regions. FOCAL II research transforms these plans into specific changes to the current supply chain including the impact on production by industries and timing of the changes across a transition from 2025 to 2040.

Industry Impacts Across the ICEV - EV Transition

This section extends the analysis of announced investment and assembly plans to include the broader impact of these changes across the vehicle supply chain and then the overall economy of Eastern Ontario.

Findings are calculated from the Statistics Canada Interprovincial Symmetric Input-Output table. Input Output tables are standard tools, for Canada and the Provinces, that track the transactions that connect industries and their customers. These tables are the best sources available to analyze the chain of transactions that link motor vehicle assembly to suppliers and to customers. The FOCAL II analysis customized the Ontario IO tables by replacing ICEV supply chains with estimates of new EV supply chains, including the addition of the new battery production facility and related investments in new chemical, mineral and mining production capabilities.[8] Figure 4 illustrates the changes introduced by FOCAL II at this stage of the analysis.

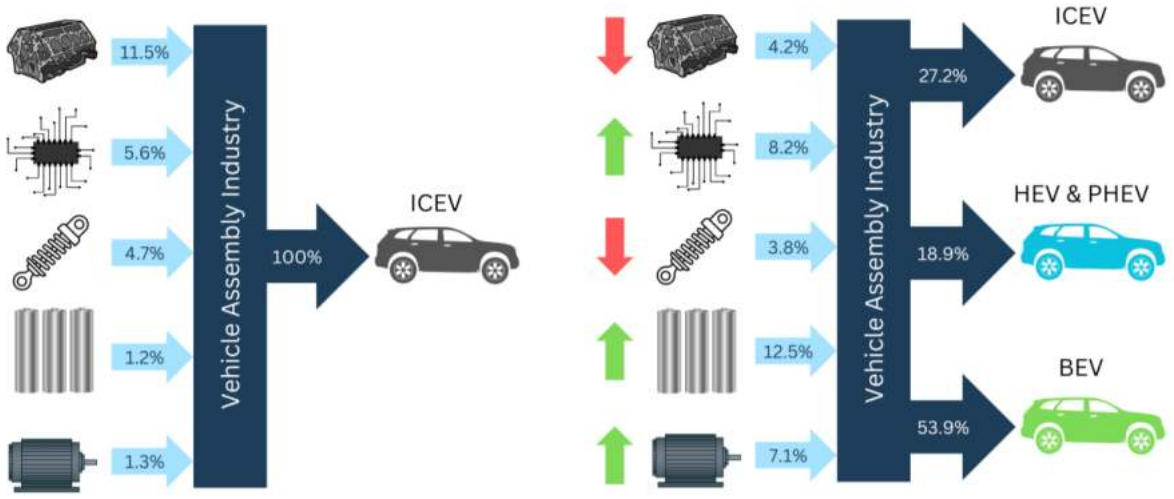
Figure 4. Adjusting automotive and battery manufacturing supply chain linkages for the impact analysis



[8] See Introduction section and Appendix C for more detailed information about the methodology used in the FOCAL II analysis.

Figure 5 provides an example of the changes that are imposed based on analysis of the core industry links from parts manufacturers to assembly. Changes in the distribution of inputs into vehicle assembly, seen in the diagram, capture changes between 2019 and 2030 from the base case scenario.

Figure 5. Vehicle assembly industry supply inputs



Results are reported at three levels of impact. First, d*irect impacts* are the initial change introduced by new levels of vehicle assembly by type, new battery plants and related outputs. Very little of these investments will impact Ontario. Second, the IO system calculates *indirect impacts* that reflect changes in output and sales in response to direct impacts. These are the point of impact for business in Eastern Ontario. For example, many chemical and mineral processing suppliers will alter sales to meet the requirements of battery production. Third, *induced impacts* reflect how changing employment and incomes alter consumer purchases. Total impacts are the sum of direct, indirect and induced impacts.

Base Case Scenario

Direct impacts, which will determine the overall employment impacts, are introduced in the analysis across the transition period from 2025 to 2040 and in specific categories;

- Internal combustion
- Hybrid
- Plug in hybrid
- Battery electric

New battery plants operating, by;

- Plant capacity and suppliers;

The battery supply chain, consisting of;

- Cathode and anode suppliers
- Material filtering and processing
- Mining

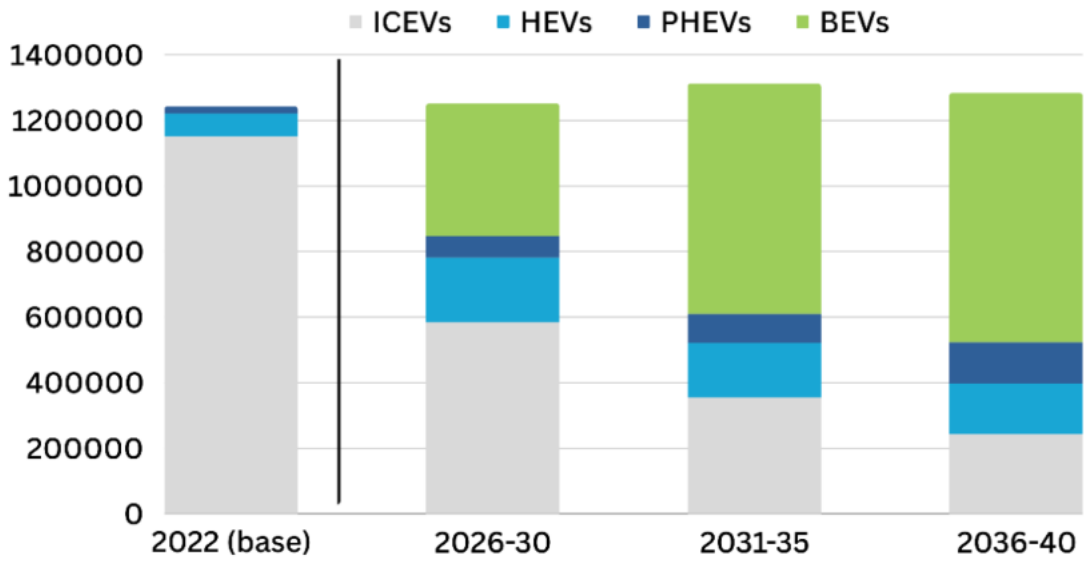
A base case scenario has been developed that combines key assumptions across these categories. The magnitude and timing of these assumptions are expressed in terms of total employment impacts by industry, which are then transformed into detailed occupational impacts. Note that very few of these direct impacts and investments affect Eastern Ontario.

Base Case Scenario Assumptions

The base case scenario assumes a specific path in the transition from ICEVs to EVs. At the start of the transition, vehicle production is overwhelmingly ICEVs with a relatively small number of EVs. By the end of the transition, in 2040, the production mix inverts so that 60% of vehicles produced are EVs. For the impact analysis, the overall transition is divided into intervals. The relative mix of ICEVs and EVs change from one interval to the next. Occupational impacts evolve accordingly.

Figure 6 illustrates the transition in national vehicle production, expressed in units produced. The first column illustrates the production mix at the start of the transition.

Figure 6. Base case scenario – estimated vehicle production, by type of vehicle (Canada)



Note that the number of vehicles assembled across the transition to 2040 stays roughly constant between 1.2 and 1.3 million. Further, the base case scenario reflects a slow pace of adoption of EVs in the market, with BEV production increasing from less than 1% of total vehicle production in 2022 to nearly 60% by 2040. This relatively low assembly level and slow acceptance of BEVs limits employment impacts relative to the 2022 base. This, in turn, limits the indirect impacts originating from assembly.

The base case scenario assumes that four new battery production facilities will be operating in Canada by 2040. The employment impact analysis assumed that these plants will be operating at less than full capacity and accessing one third of needed cathode, anode, mineral and other battery supply chain inputs from Canadian suppliers (see Table 2).

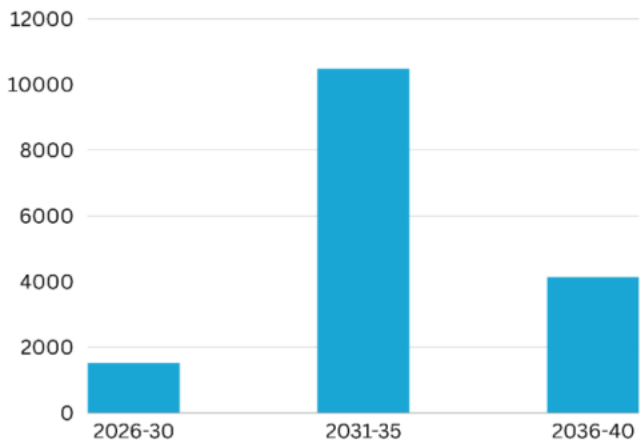
Table 2. Base case scenario - battery supply chain assumptions

Battery Production & Supply Chain	Assumptions
Battery manufacturing (4 plants)	100 GWh
Cathode & anode manufacturing	32.5 %
Material filtering & processing	32.5 %
Mining	32.5 %

Ontario Impacts Across Industries

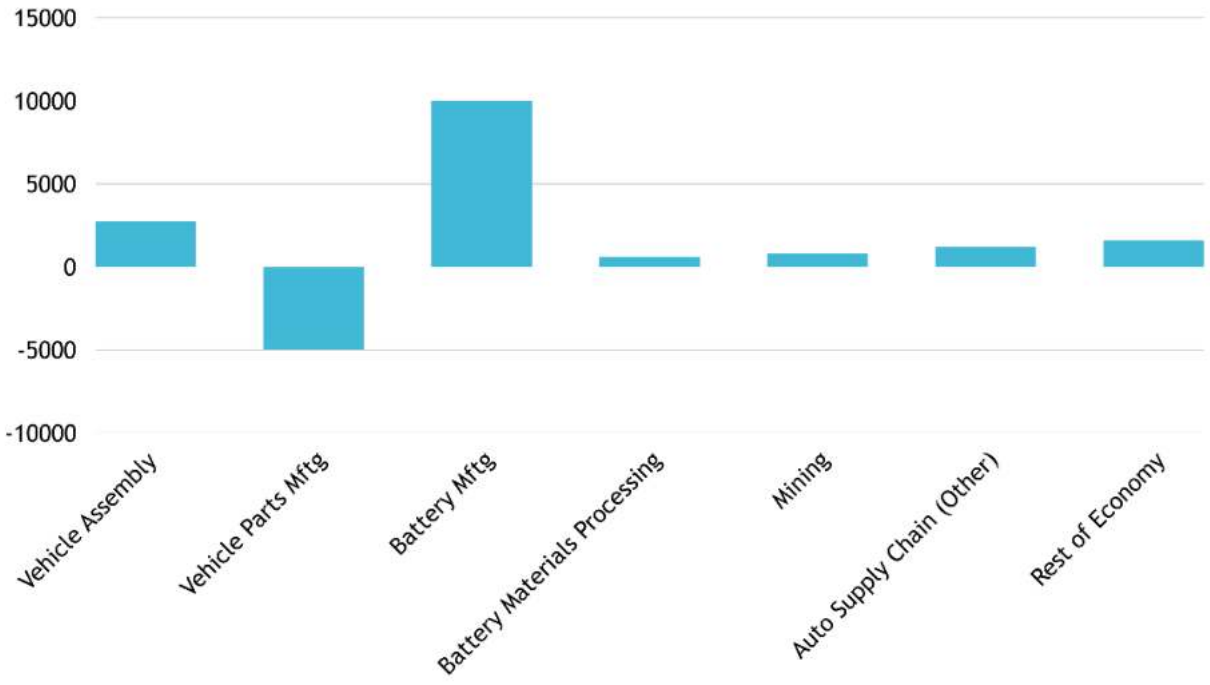
Figure 7 summarizes the total employment impacts in the base case scenario in three intervals of the transition. The total impact is positive, with gains in each of the three five-year intervals, as new activity in battery production and its supply are large enough to offset employment losses related to declining activity in gasoline engine and related production. Initial job gains are limited due to declining assembly and a lag in new battery startups. Impacts peak at 10,500 jobs in the 2031 to 2035 period as battery operations ramp up.

Figure 7. Total impact of ICEV-EV transition on employment - all industries, Ontario



A summary of total Ontario employment impacts, across the transition from 2025 to 2040, by industry is shown in Figure 8. Note that positive impacts are distributed among the battery cell and module manufacturing plants and changes in assembly. The base scenario assumptions distribute limited gains in total vehicle assembly as well as the production mix changes through the transition period but the total number of vehicles assembled rises slowly to 2035 and then declines to 2040. The decline in parts industry production reflects a shift in activity out of the traditional parts production, e.g. internal combustion engines and related areas like transmissions. Electric vehicles will source a much smaller portion of inputs from the traditional parts manufacturers. Activity across the supply chain shifts to battery module, cells and their related suppliers. EV production is less labour intensive than ICEV production and this contributes to lower employment impacts in the last years of the transition.

Figure 8. Total impact of ICEV-EV transition (2025 to 2040) on employment by industry category, Ontario



In the next section, these province-wide industry changes are allocated to occupations in the Eastern Ontario region. Labour market impacts are then calculated.

Labour Market Impacts by Occupations

This section of the report describes the impacts of the ICEV – EV transition on Eastern Ontario labour markets for six occupations. FOCAL II findings signal difficulties for recruiters during the peak and trough periods as the transition unfolds. Changing employment is set against other key trends affecting the labour force available to meet demands. The most important supply-side trends are in demographics and immigration.

Occupations that are concentrated in the broader automotive sector and in key regions participating in the transition face the biggest changes. Labour markets more distant from the investments, assembly plants, and key occupations engaged in other industries face more limited impacts. Among Ontario's regions, Eastern Ontario has the most limited connections to the ICEV-EV transition. Occupations that are working in the selected industries (listed in Appendix A) are included in this section.

Recruitment Gaps

FOCAL has created a "recruitment gap" measure for each occupation and regional market. Recruitment gaps are calculated annually for each occupation and region and summed across the transition intervals. High and rising recruitment gaps signal tight markets with skill and general labour shortages and lower gaps signal broader labour availability and more job search challenges. The recruitment gap (pictured below in Figure 9) is defined as expansion demand plus replacement demand less new entrants.

Figure 9. Recruitment gap components

Expansion demand is measured by the annual change in employment and these changes are determined by the impacts reported above. Change in expansion demand is primarily due to start up and growth in EV assembly activity, new battery production and related impacts across the supply chains. Expansion demand would be reduced by elimination of internal combustion engines and related supply chains. Economies of scale and evolving technology in EV assembly and battery technology will have a long-term impact lowering employment. In these and other ways, attributes and assumptions included in the base case scenario will effect impacts across occupations.

Replacement demand is the sum of exits from the workforce due to retirements and mortality. Trends in Ontario's population have created challenges for recruiting, especially related to Baby Boomers (born between 1946 and 1965) who have been retiring in increasing numbers for more than a decade. These changes have focused human resource management on issues like succession planning and skills training. The last of the Baby Boomers turn 65 in 2030, so the wave of retirements will fade across the last ten years of the transition. This suggests lower recruitment gaps in occupations as they shift to younger age profiles.

New entrants are individuals entering the workforce for the first time. This includes young graduates from education and training programs, and immigrants. Lower birth rates over many years have limited growth in Ontario's natural youth population from age 15 to 30 and this has limited the number of new entrants. It is important to note that these demographic effects are changing at the same time as the ICEV-EV transition.

The recruitment gap measure has been constructed to signal the overall effect of these changes across the transition as employment impacts are distributed among occupations. Future immigration patterns will play a large role in market conditions.

Impacts on Occupations

FOCAL II results identify six occupations in the Eastern Ontario region that experience important changes in recruitment gaps at some point across the transition period. The total recruitment gap is expressed in two ways. In the left panel of Figures 10 to 15, the recruitment gap for each time interval is displayed as the number of additional workers needed, above and beyond the 2022 base year employment. In the left panel of Figures 10 to 15, the recruitment gap for each time interval is expressed as the percentage change in employment relative to the starting level in 2022. In other words, the recruitment gap is not a forecast of total employment for each occupation - it is an estimate of *incremental* workers needed for an occupation, in addition to the employment in that occupation in 2022.

Large recruitment gaps for an occupation (expressed as a headcount, or the number of additional workers needed) indicate the magnitude of the recruiting effort that will be needed. Large recruitment gaps, expressed as a percent of base year employment, suggest more acute recruiting pressures and potential skill shortages because the supply of workers will likely be insufficient to meet demand.

For occupations with older age profiles, recruitment gaps may be exacerbated by both expansion demand and replacement demand. For occupations with younger age profiles (implying low replacement demand), recruitment gaps may nevertheless appear if expansion demand is high. In other words, recruiting pressures may result from *high expansion demand* (for occupations that are in demand due to large impacts across the ICEV – EV transition), *high replacement demand* (for occupations skewing heavily towards older workers), and/or *low numbers of new entrants* into the occupation. Detailed results for each selected occupation are found in Appendix D.

These components of the recruitment gap manifest differently for each occupation and for each regional market. Components of the recruitment gap likely change during different stages of the transition period.

Selected Occupations

A review of the labour market impacts across the Eastern Ontario region reveals six occupations where gaps are important and linked to the ICEV – EV transition. Eastern Ontario is the smallest region in the FOCAL II analysis and employment in many of the occupations of interest elsewhere in the province falls below a threshold of 100 in the Eastern Ontario region (within the industries included in the analysis). Data reliability is a concern in populations this small and this limits the available occupations where recruitment gaps can be reliably measured.

Occupations selected here have above average recruitment gaps during the transition. Recruitment gaps are *not* primarily caused by rising expansion demand in Eastern Ontario. In most cases, jobs are not created in Eastern Ontario directly or indirectly from investments in the ICEV-EV transition. But five of these six occupations are important because their limited availability in Eastern Ontario will aggravate labour shortages for that occupation across the other regions. These occupations are chosen to highlight the differences with labour market impacts in other regions.

The recruitment gap for all other occupations has been added to capture the specific and direct impact of the new investments in chemical plants. These impacts are concentrated in the transitions 2026 – 2035 as production at the new facilities ramp up. Employment impacts are distributed across many occupations. The rise in the recruitment gaps is limited, but above average during this phase of the transition and this captures this new activity for the region.

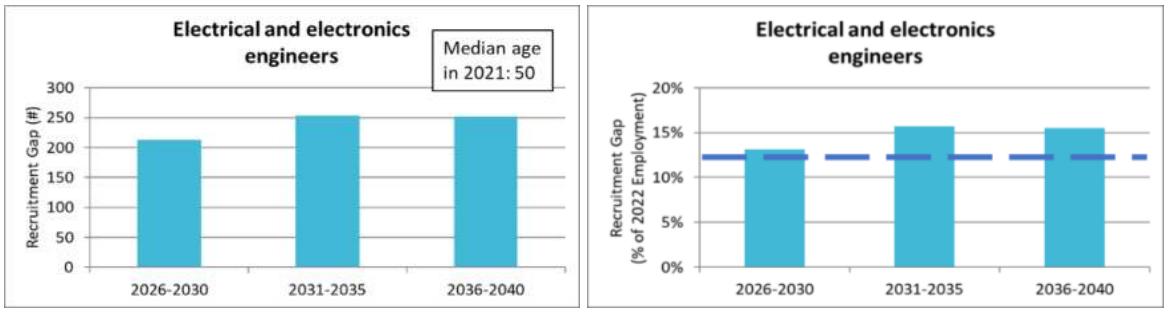
To illustrate the distinctive pattern of recruitment gaps for the selected occupations, the right-hand panel in Figures 10 to 15 contains a horizontal bar at 12%. This is the average recruitment gap for all of the selected occupations in the FOCAL II analysis within the Eastern Ontario region across the transition.[9] This key reference point highlights both the total gap as a percent of base year employment and the distinctive peaks and troughs. There is also a box insert in the left-hand panel, indicating the median age for each occupation[10].

<u>*Electrical and electronics engineers*</u> (Figure 10): There is a notable shift within engineering occupations, with electrical engineers increasing their share of employment. In contrast, impacts for mechanical and other engineering disciplines are limited mostly because of the declining levels of ICEV assembly. Labour market conditions for this occupation in Eastern Ontario are

[9] See Appendix B for a complete list of occupations used in the analysis.
[10] Median ages are calculated using 2021 Census data for each occupation in selected industries (see Appendix A for list of industries). The median age for all occupations in the selected industries in the Eastern Ontario region is 46 years old in 2021.

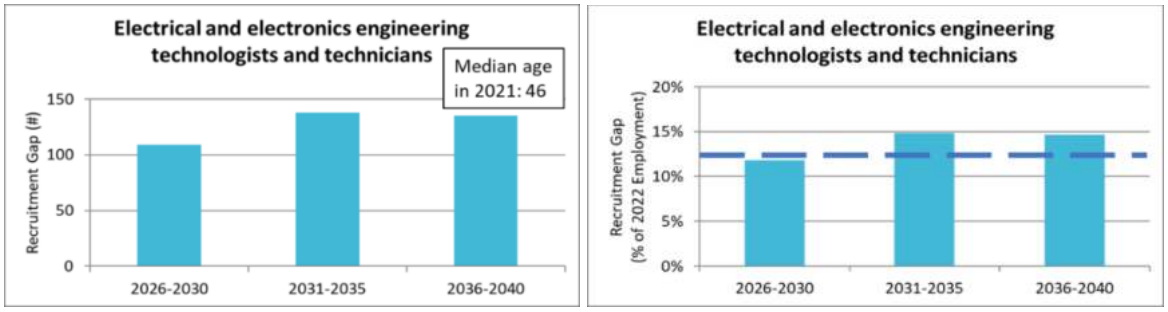
already tight. Expansion demand is not impacted directly or indirectly by the ICEV – EV transition. But employment is higher for electrical and electronic engineers, in all regions. Workers in this occupation are older (with a median age of 50), compared to workers in all occupations across the industries selected for this analysis, so there may be future pressures relating to retirement.

Figure 10. Recruitment gap – electrical and electronics engineers



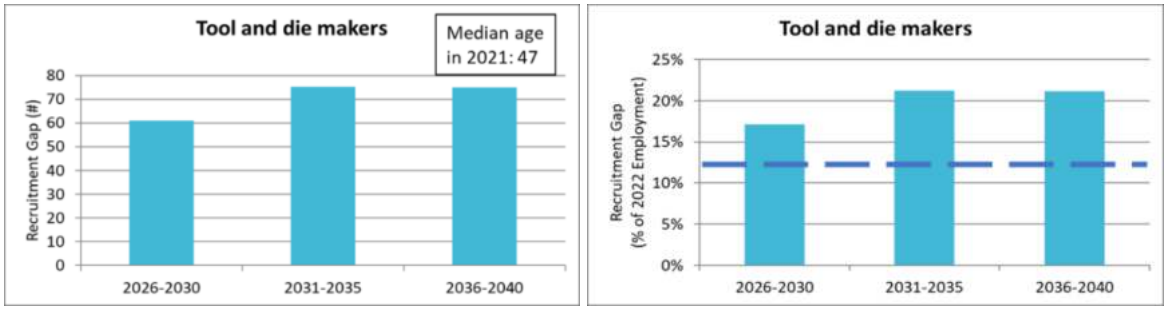
Electrical and electronics engineering technologists and technicians (Figure 11): The shift within engineering occupations, with electrical engineers increasing their share of employment, also appears for the electrical engineering technicians and technologists. This occupation is well represented in both the battery and assembly industries. This occupation is already in short supply in Eastern Ontario and expansion demand related to the transition in other regions will aggravate the situation. The age profile for this occupation (median age 46) is similar to all occupations in the selected industries in the region.

Figure 11. Recruitment gap – electrical and electronics engineering technologists and technicians



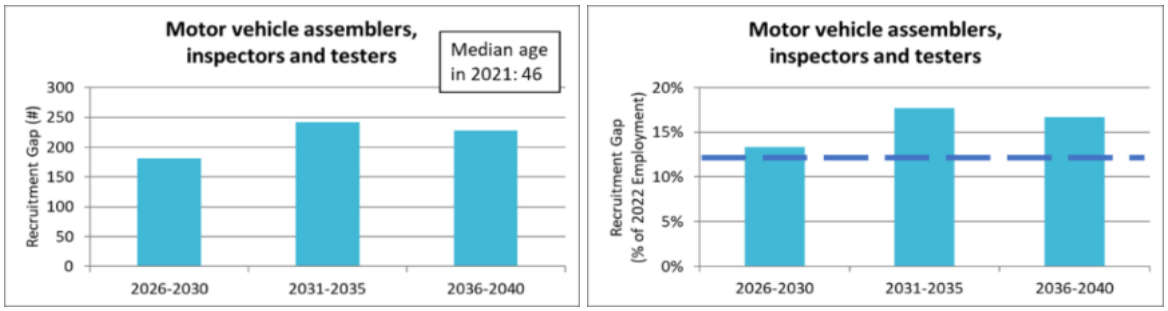
Tool and die makers (Figure 12): Labour shortages in skilled trades are common across all Ontario regions. This is particularly true for tool and die makers and the high level of recruitment gaps in Eastern Ontario are a good example. This trade is noted in most of the other Ontario regions for its high recruitment gap. While there is no direct or indirect impact of the ICEV-EV transition in Eastern Ontario, market pressures from elsewhere in the province will impact local markets.

Figure 12. Recruitment gap - tool and die makers



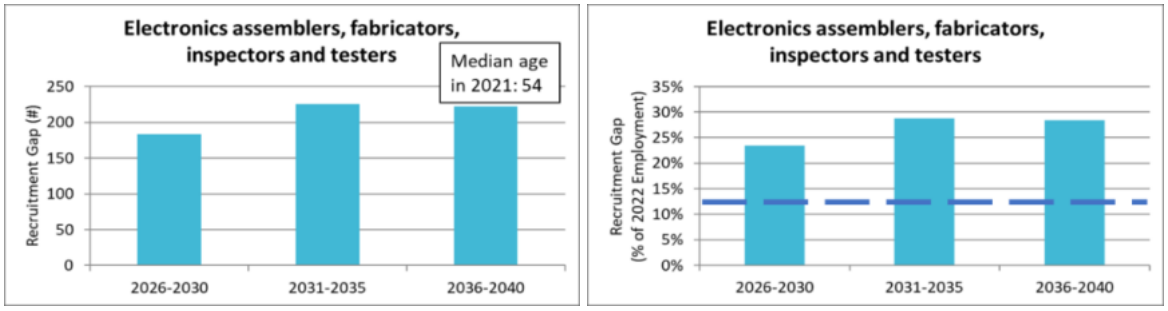
<u>*Motor vehicle assemblers, inspectors and testers*</u> (Figure 13): While there is no vehicle assembly in Eastern Ontario, this occupation emerges as a source of labour shortage. A closer examination reveals that assemblers are working in the parts industries and recruitment gaps are high as the transition is beginning. Here again market conditions in Eastern Ontario will be complicated by expansion demands for this occupation in other regions. This will be especially true in the 2031-2035 period. This occupation has age profile comparable to all occupations in the selected industries in this region, and a lower recruitment gap at the start of the transition.

Figure 13. Recruitment gap – motor vehicle assemblers, inspectors and testers



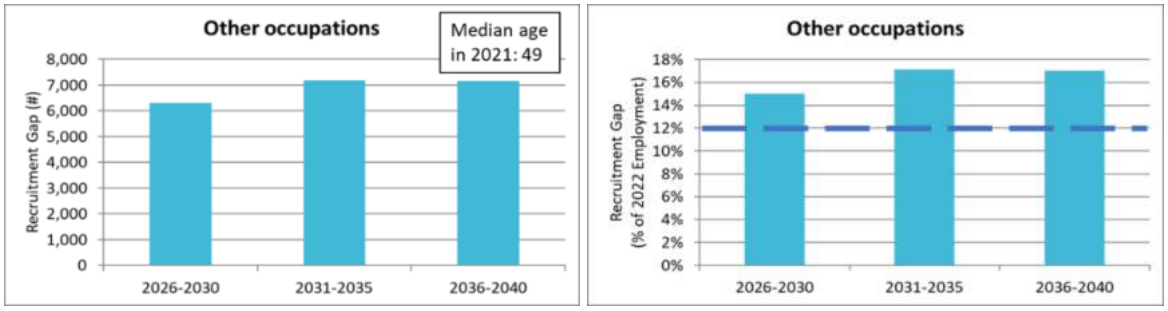
<u>*Electronics assemblers, fabricators, inspectors and testers*</u> (Figure 14): For this occupation, expansion demand impacts related to the ICEV-EV transition are very limited in Eastern Ontario. But electronics assemblers are working in other industries in the region and conditions are tight. Indeed, recruitment gaps, as a percent of base employment, are highest of any occupations. This situation will be complicated with strong demand and very high peaks as the new battery plants start up in other regions during the 2026-2030 period. A significantly older age profile suggests that retirement-related pressures play a role during the transition period for this occupation.

Figure 14. Recruitment gap – electronics assemblers, fabricators, inspectors and testers



Other occupations (Figure 15): Production at a new chemical facility supplying the battery production supply chain will start up in 2026. Employment impacts will be spread across a range of occupations that is best captured in the "other occupations" group. The recruitment gap rises after 2026, signalling broadly based job gains. These new jobs will likely require training for new skills adopted to new technologies in the battery supply chain.

Figure 15. Recruitment gap – other occupations



Implications for Recruiting and Job Search

This section draws out some implications and trends in the findings.

Results indicate that hiring challenges will be concentrated in engineering, skilled trades and assemblers. Results for these occupations across the Eastern Ontario region are often inherited from the past. This implies that recruitment gaps, in many occupations, are high as the transition begins. Examples of this include; electronics assemblers, fabricators, inspectors and testers, manufacturing managers; electrical and electronics engineering technologists and technicians, most supervisor workforces and all of the skilled trades. Recruiting for these occupations in other regions will add to the market challenges during the transition.

Province-wide impacts reflect very different types of change to employment and work conditions across industries and occupations. Impacts may be caused by added new jobs or lost jobs in the ICEV supply chain. For example, managers, supervisors and assemblers in the assembly and parts industries may face changing work conditions where employers will be able to transfer staff to new EV assembly lines. For managers, supervisors and assemblers in electronics assembly

the impacts will often be in new jobs and skills, often in new plants. For a relatively small workforce, mostly on the ICEV supply chain related to gasoline engines, transmissions, exhaust systems and a few other areas, the impacts will be lost employment.

Notes in the engineering occupations mention a shift from mechanical to electrical engineering across the transition. Indeed, the expansion demand gains for electrical engineers, technicians and technologists exceed the gains of all other engineering disciplines taken together. Another factor here is the important role of mechanical engineers in the traditional parts industry where job losses are expected.

There is a similar shift across the skilled trades. Expansion demand gains for machinists, tool and die makers, industrial electricians and millwrights reflect their new prominence in the battery and related industries. But the reported employment impacts are the *net* result and include some job losses for these trades. Employment of these trades in the parts industry will be eroded as ICEV production closes down and eliminates jobs in gasoline engine, transmissions and exhaust systems.

A final, general observation notes that recruitment gaps tend to be lower in the final 2036 - 2040 interval. This is related to two anticipated changes that span the transition. The first is the trend to higher productivity and lower vehicle and battery costs across the supply chain as the technologies and processes mature and global markets grow. These changes anticipate long-term gains in labour productivity or relative declines in employment across the base case scenario. The second is the demographic trend to fewer retirements and lower age profiles in the later years of the transition as Baby Boomers leave the workforce.

Tracking these labour market changes suggests potential labour mobility across occupations. For example, quite distinct recruitment gaps are apparent across occupations that signal the potential for mobility. FOCAL has prepared skills transferability matrices (STMs) that track the potential for filling openings in occupations with a skills shortage with candidates from related occupations with similar skill profiles[11]. An example of a skills transferability matrix for the electronic assemblers, fabricators, inspectors and testers occupation is shown in Appendix E. Readers are invited to review FOCAL findings for the matrices on the FOCAL website: www.futureautolabourforce.ca. The STMs will assist recruiters and job seekers as they navigate the transition of workers across occupations and sectors.

Focal findings offer a similar insight into the potential for inter-regional labour mobility for occupations as differences in recruitment gaps emerge in the regional analysis. For example, results reported here for, the Eastern Ontario region, can be compared to results in for London and Windsor-Sarnia. Each regional report includes the measures for recruitment gaps for

[11] FOCAL has developed Skills Transferability Matrices (STMs) using artificial intelligence (AI) and complex algorithms for occupations in the sector to help identify transferable skills, tasks, technical knowledge and abilities across other occupations and sectors.

occupations revealing higher and lower gaps for specific occupations across regions. There is a clear potential for inter regional workforce mobility implied here.

A summary of this perspective on the FOCAL II results can be seen in Table 3. The table compares labour market conditions in the Eastern Ontario region to the other regions for the transition interval 2026-2030. This interval will feature the ramping up of new battery production facilities across Ontario. At this time in the transition, labour markets promise to be most strained in London and Windsor-Sarnia as new battery plants and their suppliers open operations.

Presented in this way, it is tempting to anticipate inter regional labour mobility that would balance demands. Recruiters in regions with high recruitment gaps might look to recruit in regions with lower gaps. So, for example, it might be possible to recruit electronic and electrical engineers and technicians and technologists into Windsor Sarnia from Eastern Ontario. Of course, such mobility will depend on many other factors. In addition, the relative gaps among regions will change across intervals and they might be very different in a different scenario

Table 3. Regional comparison of recruitment gaps (% of 2022 base year employment), selected occupations – 2026-2030

Selected Occupations	Eastern Ontario	Golden Horseshoe	Kitchener-Waterloo - Barrie	London-Stratford-Bruce Peninsula	Windsor -Sarnia
14400 Shippers and receivers	7%	9%	5%	15%	20%
20010 Engineering managers	8%	9%	8%	19%	22%
21310 Electrical and electronics engineers	13%	9%	8%	15%	25%
22310 Electrical and electronics engineering technologists and technicians	12%	10%	6%	18%	28%
72100 Machinists and machining and tooling inspectors	8%	14%	9%	9%	5%
72101 Tool and die makers	17%	16%	7%	14%	11%
72201 Industrial electricians	<1%	13%	8%	14%	27%
72400 Construction millwrights and industrial mechanics	7%	14%	10%	15%	16%
73300 Transport truck drivers	9%	7%	13%	22%	22%
82020 Supervisors, mining and quarrying	*	*	*	*	*
90010 Manufacturing managers	5%	15%	12%	20%	24%
92020 Supervisors, motor vehicle assembling	*	18%	13%	12%	17%

Selected Occupations	Eastern Ontario	Golden Horseshoe	Kitchener-Waterloo - Barrie	London-Stratford-Bruce Peninsula	Windsor -Sarnia
92021 Supervisors, electronics and electrical products manufacturing	<1%	6%	3%	*	*
94110 Chemical plant machine operators	11%	9%	<1%	*	*
94200 Motor vehicle assemblers, inspectors and testers	13%	14%	7%	9%	8%
94201 Electronics assemblers, fabricators, inspectors and testers	23%	21%	1%	86%	120%
94203 Assemblers, fabricators and inspectors, industrial electrical motors and transformers	*	18%	22%	*	*
95109 Other labourers in processing, manufacturing and utilities	<1%	11%	4%	23%	25%

* Regional findings are suppressed for occupations with fewer than 100 employees

Readers are encouraged to investigate these labour market outcomes at the regional details in FOCAL II reports.

Conclusions and Implications

The ICEV – EV transition, in the base case scenario, will create disruptions in labour markets for at least six occupations Eastern Ontario. Recruiting challenges will emerge in these labour markets, with the peak challenges concentrated between 2026 and 2035 as EV assembly builds to a peak and new battery and related supply production comes on stream. Recruiting for engineering, skilled trades and assembly occupations will add to skills challenges and general shortages. For many occupations, the ICEV-EV transition demands arrive when markets are already challenged by, among other things, high levels of retirements.

The actual nature of these impacts will vary. One challenge will be filling new jobs created in the new battery cell, module and related supplier production where, in some cases, unique skills and training will define entirely new occupations. At the other extreme that will be lost jobs in gasoline engine, transmission and related manufacturing across the ICEV supply chain. This will create a small but important source of job seekers with important experience, but possible needs to upgrade training.

Another area will be occupations in vehicle assembly where jobs might be transferred across existing processes from ICEV to new EV production perhaps even in the same company or

facility. One example of this change will be the addition of work assembling battery modules into battery packs – likely in or close to final assembly.

Employers in Eastern Ontario are not directly affected by the shifts in assembly, new battery plants and adaptations in the supply chain. However, recently announced investments such as Umicore Rechargeable Battery Materials in Loyalist Township[12] suggest that occupations in the battery supply chain will soon be facing recruitment pressures. In the meantime, primary changes will originate in other regions of the province and changes there will create indirect strains as recruiters in other regions reach into local markets. This experience will be most apparent in five occupations that are in short supply locally as well as elsewhere. FOCAL II findings indicate the expected timing of these shifts.

Labour market shifts in all these areas, industries and occupations will have skill, training qualification and geographic dimensions. Thus, recruiters and job seekers may find themselves in proximity to jobs and candidates in nearby regions or related occupations having transferable skills and experience.

The broad range and depth of HR challenges clarifies the critical impact of the ICEV-EV transition. These changes are both a risk and a reward. Human resources management risks are not new to manufacturing in the region, but the scale of EV related changes may raise these risks to new, higher levels. There is a major reward here as the transition, as represented in the base case scenario, will leave all Ontario, in 2040, with a larger and almost completely adapted automotive vehicle industry. Other FOCAL II scenarios show more dramatic success as Canadian assembly of EVs increases its share of markets and a larger and longer supply chain reaches back to new mining potential. This is, after all, Canada's second most important export industry and circumstances described here confirm its emergence as a new and global force.

[12] 'New eastern Ontario plant to add hundreds of jobs, create battery components' (https://www.cbc.ca/news/canada/ottawa/new-electric-vehicle-battery-plant-loyalist-township-1.6997613)

Appendices

Appendix A – Industries Analyzed in the Labour Market Impact Model

Table 4. List of industries analyzed in the labour market impact model, with NAICS industry codes

Industry (NAICS Code)
2122 Metal ore mining
2123 Non-metallic mineral mining and quarrying
3132 Fabric Mills
3133 Textile and Fabric Finishing and Fabric Coating Mills
3251 Basic chemical manufacturing
3252 Resin, Synthetic Rubber, and Artificial and Synthetic Fibers and Filaments Manufacturing
3255 Paint, coating and adhesive manufacturing
3259 Other chemical product manufacturing
3261 Plastic product manufacturing
3262 Rubber product manufacturing
3272 Glass and glass product manufacturing
3279 Other non-metallic mineral product manufacturing
3311 Iron and steel mills and ferro-alloy manufacturing
3312 Steel product manufacturing from purchased steel
3313 Alumina and aluminum production and processing
3314 Non-ferrous metal (except aluminum) production and processing
3315 Foundries
3321 Forging and stamping
3322 Cutlery and hand tool manufacturing
3323 Architectural and structural metals manufacturing
3325 Hardware manufacturing
3326 Spring and Wire Product Manufacturing
3327 Machine shops, turned product, and screw, nut and bolt manufacturing
3328 Coating, engraving, cold and heat treating and allied activities
3329 Other fabricated metal product manufacturing
3335 Metalworking machinery manufacturing
3341 Computer and peripheral equipment manufacturing
3342 Communications equipment manufacturing
3344 Semiconductor and other electronic component manufacturing
3345 Navigational, measuring, medical and control instruments manufacturing
3351 Electric lighting equipment manufacturing
3353 Electrical equipment manufacturing
3359 Other electrical equipment and component manufacturing
3361 Motor vehicle manufacturing:
336110 - Automobile and light Duty Motor Vehicle Manufacturing
336120 - Heavy-duty truck manufacturing

Industry (NAICS Code)
3363 Motor vehicle parts manufacturing:
336310 - Motor vehicle gasoline engine and engine parts manufacturing
336320 - Motor vehicle electrical and electronic equipment manufacturing
336330 - Motor vehicle steering and suspension components (except spring) manufacturing
336340 - Motor vehicle brake system manufacturing
336350 - Motor vehicle transmission and power train parts manufacturing
336360 - Motor vehicle seating and interior trim manufacturing
336370 - Motor vehicle metal stamping
336390 - Other motor vehicle parts manufacturing
415 Motor vehicle and motor vehicle parts and accessories merchant wholesalers
4173 Computer and communications equipment and supplies merchant wholesalers
4931 Warehousing and storage
5413 Architectural, engineering and related services
5415 Computer systems design and related services
5416 Management, scientific and technical consulting services

Appendix B – Occupations Analyzed in the Labour Market Impact Model

Table 5. List of occupations analyzed in the labour market impact model (Eastern Ontario Region)

Occupation (NOC21 code)
11200 Human resources professionals
13201 Production and transportation logistics coordinators
14400 Shippers and receivers
20010 Engineering managers
20012 Computer and information systems managers
21101 Chemists
21211 Data scientists
21220 Cybersecurity specialists
21221 Business systems specialists
21222 Information systems specialists
21223 Database analysts and data administrators
21230 Computer systems developers and programmers
21231 Software engineers and designers
21232 Software developers and programmers
21233 Web designers
21234 Web developers and programmers
21301 Mechanical engineers
21310 Electrical and electronics engineers
21311 Computer engineers (except software engineers and designers)
21320 Chemical engineers
21321 Industrial and manufacturing engineers
22100 Chemical technologists and technicians
22220 Computer network and web technicians
22222 Information systems testing technicians
22301 Mechanical engineering technologists and technicians
22302 Industrial engineering and manufacturing technologists and technicians
22310 Electrical and electronics engineering technologists and technicians
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations
72100 Machinists and machining and tooling inspectors
72101 Tool and die makers
72106 Welders and related machine operators
72201 Industrial electricians
72400 Construction millwrights and industrial mechanics
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers
73300 Transport truck drivers

Occupation (NOC21 code)
75101 Material handlers
90010 Manufacturing managers
92021 Supervisors, electronics and electrical products manufacturing
93101 Central control and process operators, petroleum, gas and chemical processing
94100 Machine operators, mineral and metal processing
94105 Metalworking and forging machine operators
94106 Machining tool operators
94110 Chemical plant machine operators
94111 Plastics processing machine operators
94200 Motor vehicle assemblers, inspectors and testers
94201 Electronics assemblers, fabricators, inspectors and testers
94212 Plastic products assemblers, finishers and inspectors
94213 Industrial painters, coaters and metal finishing process operators
95100 Labourers in mineral and metal processing
95102 Labourers in chemical products processing and utilities
95109 Other labourers in processing, manufacturing and utilities

Appendix C– Methodology Notes

There are three distinct research steps needed to provide accurate and detailed impacts that span the supply chain, industries and occupations.

1. New EV production
2. Economic impacts across the supply chain
3. Labour market impacts by region and occupation

1. New EV production

The FOCAL II EV Transition report presents a detailed analysis of new EV production. This includes careful review of the supply chain for EV assembly, battery technology and of announced plans for new battery production facilities and related changes in the supply chain. The review spans the supply chain; reaching upstream to chemical manufacturing, mineral processing and mining potential. In addition, the analysis tracks the related decline in assembling ICEV. The timing and magnitude of new production and shifts in the supply chain have been set out with alternative scenarios that reflect possible future outcomes.

The new EV production analysis estimates specific changes expected in industries spanning four stages in the supply chain for assembled motor vehicles, as illustrated in Figure 25.

Figure 16. The EV supply chain

The second step in the research assesses how these specific and direct changes to industrial activity will impact the broader automotive industry, its supply chain and the overall economy.

2. Economic impacts across the supply chain

At this stage the analysis calculates broader estimates of impacts on industry output and employment across the entire economy with detail set out for 55 selected industries in 10 regions and three provinces. Results in this second stage are impacts on industry employment – the key driver for labour market impacts.

Specific changes, estimated for the four stages and ten industries established in the EV Production analysis, are translated into broader economic measures using the system of Input-

Output Tables. These tables are an economy wide accounting system that measures transactions connecting industries and customers. These are produced annually for Canada and the provinces/territories covering over 250 industries and 180 types of final customers.
Input-output (IO) tables are prepared by Statistics Canada as part of the system of national accounts. Calculations draw on surveys and economic statistics each year to update the detailed pattern of purchases and sales that link activity and spread the impact of changes across the economy. Annual measures track the pattern of each industry's purchases from suppliers and sales to both other "downstream" industries and final purchasers (e.g. exports, investments, government spending, and household consumption).

The tables are converted into an IO model that can be used to calculate the impacts of changes across the economy. The FOCAL II research creates new versions of these national and provincial IO models to estimate the impacts of the new EV production changes described in the first research stage. Specific changes are taken from the new EV production analysis and applied in the IO models. For example, the IO model analysis is based on;

1. new production levels for EVs and ICEVs in the assembly industry
2. new production levels for internal combustion engines
3. a new pattern of suppliers to the assembly industry
4. new production levels announced for battery plants
5. a new pattern of suppliers to battery production
6. new production levels announced for chemical, mineral and mining production

These changes are described as "direct" impacts that will be introduced into the economy at a specific time and place in the transition from ICEV to Evs. The magnitude and timing of direct impacts are different in each scenario.

Each direct impact prompts a series of indirect impacts across the economy as the pattern of purchases and sales changes according to the structure of the economy set out in the IO tables. A final round of induced impacts are included as the IO model tracks the changes in household income and the associated change in expenditures.

Finally, the IO model totals the direct, indirect and induced impacts on employment in each industry. These employment impacts are the key drivers for labour market analysis.

It is important to note some features of IO models that need to be reflected in the interpretation of findings. First, given the complexity of these models, there is a time lag in the release of tables such that, at the time of FOCAL II research, the most up to date IO data for Canada and the provinces was from 2019. Advanced features in our system allowed for the addition of base year data for 2022. Also, IO models do not contain measures of the production capacity of individual industries and calculated impacts are not constrained. This is important in, for example, the analysis of the impacts of the transition across Canada's mining and mineral processing industries. Finally, IO impacts calculated in the models are not time specific. Thus, the EV

production analysis, at the first research stage, sets out specific assumptions of the scheduling of the start and completion of new activity across the transition from 2025 to 2040.

3. *Labour market impacts by occupation and region*

Regional Labour Market reports provide analysis of the labour market impacts, including measures of market conditions for approximately 70 occupations[13]. These results are linked to further labour market and human resource management implications and related conditions in training, immigration, apprenticeship, diversity and other areas. This analysis assesses the likelihood of skill and labour shortages and other market imbalances in specific occupations and regions as the transition from ICEV to EV progresses.

Labour market models track both patterns of hiring and labour demand as well as elements of labour supply. Three broad components of employment and hiring are identified; expansion demand, replacement demand and recruitment gaps.

Expansion Demand

Expansion demand is defined by the employment impacts generated by the IO model analysis described above. These impacts are linked to the direct industry changes associated with the transitions from ICEV to EV in the selected industries and the broader economy. Employment changes by industry are spread across the transition interval from 2025 to 2040 and are specific to each transition scenario. These impacts are intended to highlight labour market disruptions. Expansion demand for each occupation was determined by taking the overall employment forecast by industry and transforming that forecast from the industry level to the occupation level within each industry.

The transformation from industry impacts to occupation impacts was accomplished by using industry (NAICS) and occupation (NOC) data from the 2021 Census.

Replacement Demand

Labour market conditions for each occupation and region will depend on other factors. The most critical of these are the demographic trends that are working their way through the economy. This includes the aging of the population, immigration and other factors. To capture these effects, a measure is added for replacement demand or estimates of retirement and mortality by occupation and region.

Final replacement demand changes were based on summing occupational estimates of labour force exits due to retirements and deaths across every age-year between 15 and 69 years. Mortality and exit rates were available from Statistics Canada at the national and provincial level.

[13] Findings for occupations with base year employment of less than one thousand (for national results) or less than one hundred (for provincial and regional results) are suppressed due to data reliability concerns.

Regional estimates incorporate provincial mortality and exit rate data, based on availability of data. Mortality and exit rates were applied to the existing single-year demographic profile by occupation by industry.

Labour market conditions were summarized by these measures to provide signals of possible skill and labour shortages across the transition in each occupation and region.

New Entrants

A similar demographic trend is captured with a measure of new entrants. Also linked to demographics and participation, this measure captures the effect of young entrants and the more volatile effects of immigration.

Total new entrants by province were based on historic data and projections of total population and labour force participation rates. Population projections were taken from Statistics Canada population projection data. Labour force participation rates were assumed to remain equal to 2022 levels for the transition period.

Recruitment Gaps

The recruitment gap comprises the interaction of three different labour market supply and demand components: expansion demand, replacement demand, and new entrant dynamics.

The recruitment gap is defined as;

Recruitment Gap = Expansion Demand plus Replacement Demand less New Entrants

The recruitment gap was calculated for 68 selected occupations in 49 industries in the national analysis (see Appendix A and B, respectively). As noted in the report, it represents expansion demand plus replacement demand less new entrants.

Other Methodology Notes

2022 Base Year Employment

The base year for the forecast was 2022. Although problematic due to COVID-related labour market adjustments from 2020 to 2023, it was the most recent year in which complete data on employment by industry was available. Base year employment was determined using multiple data sources, including Statistics Canada, APRC, Metro Economics, and Prism Economics and Analysis.

Occupation Age Profiles

Single-year age profiles (by occupation and by industry) were produced from 2021 Census data. Census data was collected during May 2021, in the midst of COVID-related labour market disruptions.

Appendix D – Detailed Results

This Appendix contains detailed tables of occupational impacts for each component of the recruitment gap: expansion demand (Table 5), replacement demand (Table 6), and new entrants (Table 7). These are followed by tables that show recruitment gaps expressed as headcounts (Table 8) and as a percentage of 2022 base year employment (Table 9).

Expansion Demand

Expansion demand impacts reflect the direct industry changes associated with the transitions from ICEV to EV in the selected industries and the broader economy. Values for each column in Table 7 are expressed as expansion demand relative to 2022 base year employment.

Table 6. Expansion demand – detailed results (Eastern Ontario Region)

Expansion Demand	2026-30	2031-35	2036-40	2025-40
11200 Human resources professionals	0	0	0	0
13201 Production and transportation logistics coordinators	0	0	0	0
14400 Shippers and receivers	-10	0	0	-10
20010 Engineering managers	0	0	0	0
20012 Computer and information systems managers	0	0	0	0
21101 Chemists	0	0	0	0
21211 Data scientists	0	0	0	0
21220 Cybersecurity specialists	0	0	0	0
21221 Business systems specialists	0	0	0	0
21222 Information systems specialists	0	0	0	0
21223 Database analysts and data administrators	0	0	0	0
21230 Computer systems developers and programmers	0	0	0	0
21231 Software engineers and designers	0	0	0	0
21232 Software developers and programmers	0	0	0	0
21233 Web designers	0	0	0	0
21234 Web developers and programmers	0	0	0	0
21301 Mechanical engineers	0	0	0	0
21310 Electrical and electronics engineers	-10	0	0	0
21311 Computer engineers (except software engineers and designers)	0	0	0	0
21320 Chemical engineers	0	0	0	0
21321 Industrial and manufacturing engineers	0	0	0	0
22100 Chemical technologists and technicians	10	0	0	10
22220 Computer network and web technicians	0	0	0	0

Expansion Demand	2026-30	2031-35	2036-40	2025-40
22222 Information systems testing technicians	0	0	0	0
22301 Mechanical engineering technologists and technicians	0	0	0	0
22302 Industrial engineering and manufacturing technologists and technicians	0	0	0	0
22310 Electrical and electronics engineering technologists and technicians	-10	0	0	0
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	0	0	0	0
72100 Machinists and machining and tooling inspectors	0	0	0	0
72101 Tool and die makers	0	0	0	-10
72106 Welders and related machine operators	-10	0	0	0
72201 Industrial electricians	0	0	0	0
72400 Construction millwrights and industrial mechanics	0	0	0	-10
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	0	0	0	0
73300 Transport truck drivers	10	0	0	0
75101 Material handlers	-10	10	0	-10
90010 Manufacturing managers	-20	10	0	-20
92021 Supervisors, electronics and electrical products manufacturing	-10	0	0	-10
93101 Central control and process operators, petroleum, gas and chemical processing	20	0	-10	10
94100 Machine operators, mineral and metal processing	-10	0	0	-10
94105 Metalworking and forging machine operators	0	0	0	0
94106 Machining tool operators	0	0	0	0
94110 Chemical plant machine operators	0	0	0	0
94111 Plastics processing machine operators	0	0	0	0
94200 Motor vehicle assemblers, inspectors and testers	-10	20	0	0
94201 Electronics assemblers, fabricators, inspectors and testers	-20	0	0	-20
94212 Plastic products assemblers, finishers and inspectors	0	0	0	0

Expansion Demand	2026-30	2031-35	2036-40	2025-40
94213 Industrial painters, coaters and metal finishing process operators	0	0	0	0
95100 Labourers in mineral and metal processing	0	0	0	0
95102 Labourers in chemical products processing and utilities	0	0	0	0
95109 Other labourers in processing, manufacturing and utilities	-30	10	0	-30

Replacement Demand

Replacement demand represents occupational estimates of labour force exits due to retirements and deaths across every age-year between 15 and 69 years. Values for each column in Table 8 are expressed as replacement demand relative to 2022 base year employment.

Table 7. Replacement demand – detailed results (Eastern Ontario Region)

Replacement Demand	2026-30	2031-35	2036-40	2025-40
11200 Human resources professionals	120	130	130	390
13201 Production and transportation logistics coordinators	30	30	30	90
14400 Shippers and receivers	130	150	150	450
20010 Engineering managers	100	110	110	340
20012 Computer and information systems managers	280	320	320	960
21101 Chemists	0	0	0	0
21211 Data scientists	20	20	20	70
21220 Cybersecurity specialists	30	40	40	110
21221 Business systems specialists	110	120	120	370
21222 Information systems specialists	640	710	710	2,170
21223 Database analysts and data administrators	40	40	40	120
21230 Computer systems developers and programmers	70	80	80	230
21231 Software engineers and designers	320	360	360	1,090
21232 Software developers and programmers	240	270	270	820
21233 Web designers	40	40	40	120
21234 Web developers and programmers	70	80	80	230
21301 Mechanical engineers	140	160	160	490
21310 Electrical and electronics engineers	260	290	290	870
21311 Computer engineers (except software engineers and designers)	110	120	120	370
21320 Chemical engineers	10	10	10	40

Replacement Demand	2026-30	2031-35	2036-40	2025-40
21321 Industrial and manufacturing engineers	30	30	30	100
22100 Chemical technologists and technicians	20	20	20	70
22220 Computer network and web technicians	70	80	80	250
22222 Information systems testing technicians	20	20	20	70
22301 Mechanical engineering technologists and technicians	40	40	40	130
22302 Industrial engineering and manufacturing technologists and technicians	20	20	20	70
22310 Electrical and electronics engineering technologists and technicians	150	160	160	500
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	30	40	40	110
72100 Machinists and machining and tooling inspectors	80	90	90	280
72101 Tool and die makers	80	90	90	260
72106 Welders and related machine operators	80	80	90	260
72201 Industrial electricians	0	0	0	10
72400 Construction millwrights and industrial mechanics	70	80	80	240
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	10	10	10	30
73300 Transport truck drivers	40	40	40	130
75101 Material handlers	310	350	350	1,050
90010 Manufacturing managers	130	150	150	450
92021 Supervisors, electronics and electrical products manufacturing	10	10	10	20
93101 Central control and process operators, petroleum, gas and chemical processing	10	10	10	50
94100 Machine operators, mineral and metal processing	0	0	0	10
94105 Metalworking and forging machine operators	10	10	10	30
94106 Machining tool operators	30	40	40	110
94110 Chemical plant machine operators	20	30	30	80
94111 Plastics processing machine operators	100	110	110	330
94200 Motor vehicle assemblers, inspectors and testers	240	270	270	810
94201 Electronics assemblers, fabricators, inspectors and testers	220	240	240	720

Replacement Demand	2026-30	2031-35	2036-40	2025-40
94212 Plastic products assemblers, finishers and inspectors	30	30	30	100
94213 Industrial painters, coaters and metal finishing process operators	10	10	10	20
95100 Labourers in mineral and metal processing	10	10	10	20
95102 Labourers in chemical products processing and utilities	0	0	0	0
95109 Other labourers in processing, manufacturing and utilities	80	90	90	280

New Entrants

This measure captures the movement of young people into the labour force as well as immigration.

Table 8. New entrants – detailed results (Eastern Ontario Region)

New Entrants	2026-30	2031-35	2036-40	2025-40
11200 Human resources professionals	30	30	30	90
13201 Production and transportation logistics coordinators	30	20	20	80
14400 Shippers and receivers	50	50	40	150
20010 Engineering managers	20	20	10	50
20012 Computer and information systems managers	30	30	30	100
21101 Chemists	20	20	20	60
21211 Data scientists	20	20	20	60
21220 Cybersecurity specialists	10	10	10	30
21221 Business systems specialists	20	20	20	50
21222 Information systems specialists	70	60	60	210
21223 Database analysts and data administrators	10	10	10	40
21230 Computer systems developers and programmers	40	40	40	130
21231 Software engineers and designers	170	160	160	530
21232 Software developers and programmers	200	190	180	610
21233 Web designers	20	20	20	60
21234 Web developers and programmers	110	100	100	330
21301 Mechanical engineers	70	70	60	210
21310 Electrical and electronics engineers	40	40	40	120

New Entrants	2026-30	2031-35	2036-40	2025-40
21311 Computer engineers (except software engineers and designers)	20	20	20	80
21320 Chemical engineers	20	20	20	60
21321 Industrial and manufacturing engineers	20	20	20	60
22100 Chemical technologists and technicians	10	10	10	30
22220 Computer network and web technicians	40	40	40	130
22222 Information systems testing technicians	10	10	10	30
22301 Mechanical engineering technologists and technicians	40	40	40	130
22302 Industrial engineering and manufacturing technologists and technicians	30	20	20	80
22310 Electrical and electronics engineering technologists and technicians	30	30	30	100
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	10	10	10	20
72100 Machinists and machining and tooling inspectors	30	20	20	80
72101 Tool and die makers	10	10	10	40
72106 Welders and related machine operators	50	50	40	150
72201 Industrial electricians	10	10	10	40
72400 Construction millwrights and industrial mechanics	20	20	20	70
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	10	10	10	40
73300 Transport truck drivers	10	10	10	40
75101 Material handlers	170	160	150	520
90010 Manufacturing managers	40	30	30	110
92021 Supervisors, electronics and electrical products manufacturing	10	10	10	20
93101 Central control and process operators, petroleum, gas and chemical processing	10	10	10	40
94100 Machine operators, mineral and metal processing	0	0	0	10
94105 Metalworking and forging machine operators	20	20	20	60
94106 Machining tool operators	10	10	10	40
94110 Chemical plant machine operators	10	10	10	20
94111 Plastics processing machine operators	20	20	20	60

New Entrants	2026-30	2031-35	2036-40	2025-40
94200 Motor vehicle assemblers, inspectors and testers	50	40	40	140
94201 Electronics assemblers, fabricators, inspectors and testers	20	20	10	50
94212 Plastic products assemblers, finishers and inspectors	10	10	10	20
94213 Industrial painters, coaters and metal finishing process operators	10	10	10	30
95100 Labourers in mineral and metal processing	10	10	10	40
95102 Labourers in chemical products processing and utilities	10	10	10	20
95109 Other labourers in processing, manufacturing and utilities	90	90	80	280

Recruitment Gap (#)

The recruitment gap is defined as expansion demand plus replacement demand less new entrants. Values for each column in Table 10 are expressed as the recruitment gap relative to 2022 base year employment.

Table 9. Recruitment gap (#) – detailed results (Eastern Ontario Region)

Recruitment Gap (#)	2026-30	2031-35	2036-40
11200 Human resources professionals	90	100	100
13201 Production and transportation logistics coordinators	<10	10	<10
14400 Shippers and receivers	70	110	100
20010 Engineering managers	80	100	100
20012 Computer and information systems managers	250	290	290
21101 Chemists	<10	<10	<10
21211 Data scientists	<10	<10	<10
21220 Cybersecurity specialists	20	30	30
21221 Business systems specialists	90	110	110
21222 Information systems specialists	580	650	650
21223 Database analysts and data administrators	20	30	30
21230 Computer systems developers and programmers	30	40	40
21231 Software engineers and designers	150	200	200
21232 Software developers and programmers	40	80	90
21233 Web designers	20	20	20
21234 Web developers and programmers	<10	<10	<10
21301 Mechanical engineers	70	100	100

Recruitment Gap (#)	2026-30	2031-35	2036-40
21310 Electrical and electronics engineers	210	250	250
21311 Computer engineers (except software engineers and designers)	80	100	100
21320 Chemical engineers	<10	<10	<10
21321 Industrial and manufacturing engineers	10	20	20
22100 Chemical technologists and technicians	20	10	10
22220 Computer network and web technicians	30	40	40
22222 Information systems testing technicians	10	10	10
22301 Mechanical engineering technologists and technicians	<10	10	<10
22302 Industrial engineering and manufacturing technologists and technicians	<10	<10	<10
22310 Electrical and electronics engineering technologists and technicians	110	140	140
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	30	30	30
72100 Machinists and machining and tooling inspectors	50	70	70
72101 Tool and die makers	60	80	80
72106 Welders and related machine operators	20	40	40
72201 Industrial electricians	<10	<10	<10
72400 Construction millwrights and industrial mechanics	50	60	60
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	<10	<10	<10
73300 Transport truck drivers	30	30	30
75101 Material handlers	130	200	190
90010 Manufacturing managers	80	120	110
92021 Supervisors, electronics and electrical products manufacturing	<10	<10	<10
93101 Central control and process operators, petroleum, gas and chemical processing	20	10	<10
94100 Machine operators, mineral and metal processing	<10	<10	<10
94105 Metalworking and forging machine operators	<10	<10	<10
94106 Machining tool operators	20	20	20
94110 Chemical plant machine operators	20	20	20
94111 Plastics processing machine operators	80	90	90
94200 Motor vehicle assemblers, inspectors and testers	180	240	230
94201 Electronics assemblers, fabricators, inspectors and testers	180	230	220
94212 Plastic products assemblers, finishers and inspectors	20	30	30

Recruitment Gap (#)	2026-30	2031-35	2036-40
94213 Industrial painters, coaters and metal finishing process operators	<10	<10	<10
95100 Labourers in mineral and metal processing	<10	<10	<10
95102 Labourers in chemical products processing and utilities	<10	<10	<10
95109 Other labourers in processing, manufacturing and utilities	<10	10	10

Recruitment Gap (% of 2022 base year employment)

Recruitment gap values from the previous table are expressed in Table 11 as a percentage of 2022 base year employment.

For example: If the recruitment gap percentage is 100%, then employment in the occupation would have to double in size relative to 2022 employment levels (taking into consideration demographic and immigration supply-side transitions in the labour market) to meet increased demand associated with the ICEV-EV transition as defined by the base case scenario.

Table 10. Recruitment gap (% of 2022 base year employment) – detailed results (Eastern Ontario Region)

Recruitment Gap (% of 2022 Base Year Employment)	2026-30	2031-35	2036-40
11200 Human resources professionals	12%	14%	14%
13201 Production and transportation logistics coordinators	<1%	1%	1%
14400 Shippers and receivers	7%	10%	9%
20010 Engineering managers	8%	10%	10%
20012 Computer and information systems managers	11%	13%	13%
21101 Chemists	<1%	<1%	<1%
21211 Data scientists	<1%	1%	1%
21220 Cybersecurity specialists	7%	8%	8%
21221 Business systems specialists	15%	17%	17%
21222 Information systems specialists	15%	17%	17%
21223 Database analysts and data administrators	7%	8%	9%
21230 Computer systems developers and programmers	3%	5%	5%
21231 Software engineers and designers	4%	5%	5%
21232 Software developers and programmers	1%	3%	3%
21233 Web designers	5%	6%	6%
21234 Web developers and programmers	<1%	<1%	<1%
21301 Mechanical engineers	5%	7%	7%
21310 Electrical and electronics engineers	13%	16%	16%

Recruitment Gap (% of 2022 Base Year Employment)	2026-30	2031-35	2036-40
21311 Computer engineers (except software engineers and designers)	8%	10%	10%
21320 Chemical engineers	<1%	<1%	<1%
21321 Industrial and manufacturing engineers	1%	4%	4%
22100 Chemical technologists and technicians	8%	6%	5%
22220 Computer network and web technicians	3%	5%	5%
22222 Information systems testing technicians	3%	4%	4%
22301 Mechanical engineering technologists and technicians	<1%	1%	1%
22302 Industrial engineering and manufacturing technologists and technicians	<1%	<1%	<1%
22310 Electrical and electronics engineering technologists and technicians	12%	15%	15%
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	14%	17%	17%
72100 Machinists and machining and tooling inspectors	8%	10%	10%
72101 Tool and die makers	17%	21%	21%
72106 Welders and related machine operators	3%	6%	6%
72201 Industrial electricians	<1%	<1%	<1%
72400 Construction millwrights and industrial mechanics	7%	9%	8%
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	<1%	<1%	<1%
73300 Transport truck drivers	9%	9%	8%
75101 Material handlers	5%	7%	7%
90010 Manufacturing managers	5%	8%	8%
92021 Supervisors, electronics and electrical products manufacturing	<1%	3%	3%
93101 Central control and process operators, petroleum, gas and chemical processing	6%	2%	<1%
94100 Machine operators, mineral and metal processing	<1%	<1%	<1%
94105 Metalworking and forging machine operators	<1%	<1%	<1%
94106 Machining tool operators	8%	12%	12%
94110 Chemical plant machine operators	11%	12%	12%
94111 Plastics processing machine operators	13%	16%	15%
94200 Motor vehicle assemblers, inspectors and testers	13%	18%	17%
94201 Electronics assemblers, fabricators, inspectors and testers	23%	29%	28%
94212 Plastic products assemblers, finishers and inspectors	14%	15%	15%
94213 Industrial painters, coaters and metal finishing process operators	<1%	<1%	<1%

Recruitment Gap (% of 2022 Base Year Employment)	2026-30	2031-35	2036-40
95100 Labourers in mineral and metal processing	<1%	<1%	<1%
95102 Labourers in chemical products processing and utilities	<1%	<1%	<1%
95109 Other labourers in processing, manufacturing and utilities	<1%	1%	1%

Appendix E – Skills Transferability Matrix (STM) Example

FOCAL has developed Skills Transferability Matrices (STMs) using artificial intelligence (AI) and complex algorithms for occupations in the sector to help identify transferable skills, tasks, technical knowledge and abilities across other occupations and sectors. A sample STM is shown below (Figure 17). See the FOCAL website (www.futureautolabourforce.ca) for a more detailed description and additional STMs.

Figure 17. Skills transferability matrix – electronic assemblers, fabricators, inspectors and testers

Electronic Assemblers, Fabricators, Inspectors and Testers					
Occupations	Skills	Technology	Tasks	Abilities	Total
Machine operators and inspectors, electrical apparatus manufacturing	96%	100%	74%	96%	92%
Assemblers and inspectors, electrical appliance, apparatus & equipment manufacturing	96%	100%	74%	95%	91%
Assemblers, fabricators and inspectors, industrial electrical motors and transformers	94%	100%	75%	94%	91%
Mechanical assemblers and inspectors	94%	92%	60%	92%	84%
Boat assemblers and inspectors	92%	92%	61%	91%	84%
Motor vehicle assemblers, inspectors and testers	93%	92%	58%	91%	83%
Other products assemblers, finishers and inspectors	92%	92%	58%	91%	83%
Plastic products assemblers, finishers and inspectors	92%	92%	56%	93%	83%
Inspectors and testers, mineral and metal processing	91%	92%	54%	91%	82%
Inspectors and graders, textile, fabric, fur and leather products manufacturing	91%	92%	54%	91%	82%
Machining tool operators	88%	63%	34%	84%	67%
Metalworking and forging machine operators	88%	54%	41%	82%	66%
Contractors and supervisors, machining and metal forming trades	71%	58%	12%	81%	56%
Industrial painters, coaters and metal finishing process operators	89%	21%	23%	86%	55%
Supervisors, electrical products manufacturing	67%	54%	12%	78%	53%