FOCAL Initiative

ICEV TO EV WORKFORCE TRANSITION LABOUR MARKET FORECAST

WINDSOR-SARNIA 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.

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Executive Summary

The Windsor-Sarnia region of Ontario is at the center and in the 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 Windsor-Sarnia region for 44 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 for the Windsor-Sarnia region indicate that several key occupations will experience impacts during the transition. The magnitude and timing of impacts are unique for each occupation. Windsor-Sarnia is already a key center for vehicle assembly and parts manufacturers. This role is certain to continue as many key employers have announced investments in the ICEV-EV transition including adapting major assembly and adding new battery plants. Windsor–Sarnia is a relatively small region and the impacts on some occupations will be dramatic when compared to other regional economies. Readers will find more details on the source and likely timing of these competitive pressures in FOCAL II reports covering regional occupational impacts in Eastern Ontario, Golden Horseshoe, Kitchener-Waterloo-Barrie and London-Stratford-Bruce Peninsula.

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.

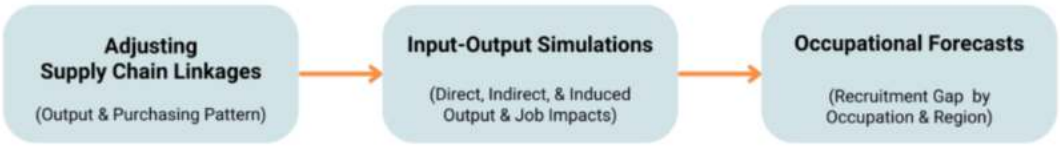
First, the EV Model estimates impacts of announced plans and expected investments and calculates new levels of production and related links across the supply chain. The analysis allocates these direct, initial impacts across;

- 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].

These impacts will be very apparent in the Windsor-Sarnia region, as this region has deep roots and major employers in motor vehicle production. Announced investments in renewed EV assembly capabilities, new battery plants, and related additions across the supply chain make the region a major focus for labour market adjustments in all the key occupations. Section 4 of the report identifies ten selected occupations that have prominent impacts across the province. Impacts across other occupations are described in detail in Appendix D[2].

This introduction is followed by a background on the Windsor-Sarnia region. Section 3 describes impacts across the ICEV-EV transition in key industries. Section 4 reports detailed impacts across ten 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.
[2] 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 the Windsor-Sarnia Region – Background

The Windsor-Sarnia region is comprised of the Economic Region (ER) of Windsor-Sarnia and three Census Divisions (CDs): Chatham-Kent, Essex, and Lambton. The region's GDP was an estimated $28.4 billion in 2022, 20% of which was generated by the manufacturing sector. Manufacturing is also a major employer in the region, accounting for nearly 18% of the total labour force. The Windsor-Sarnia region's population was an estimated 692,000 in 2022. Population growth will likely be driven primarily by migration with a negative net natural population change[3].

The region is home to one assembly and two engine plants that employed over 6,000 workers in 2022. The region's largest automotive manufacturing-related employers include Stellantis, Ford, and TRQSS[4].

The coming transition from ICEVs to EVs will have a major impact across the Windsor-Sarnia region. In 2022, the regional workforce of 311,500 included 55,000 working in manufacturing and 14,200 in the core automotive assembly and parts industries[5]. Motor vehicle assembly and related activity are critical to the overall economic well being, especially for the Windsor-Sarnia region but also for the broader Ontario economy. For example, assembled motor vehicles and

[3] Economic and population estimates for the Windsor-Sarnia region are from Metro Economics.
[4] Source: Automotive Policy Research Centre (APRC)
[5] 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).

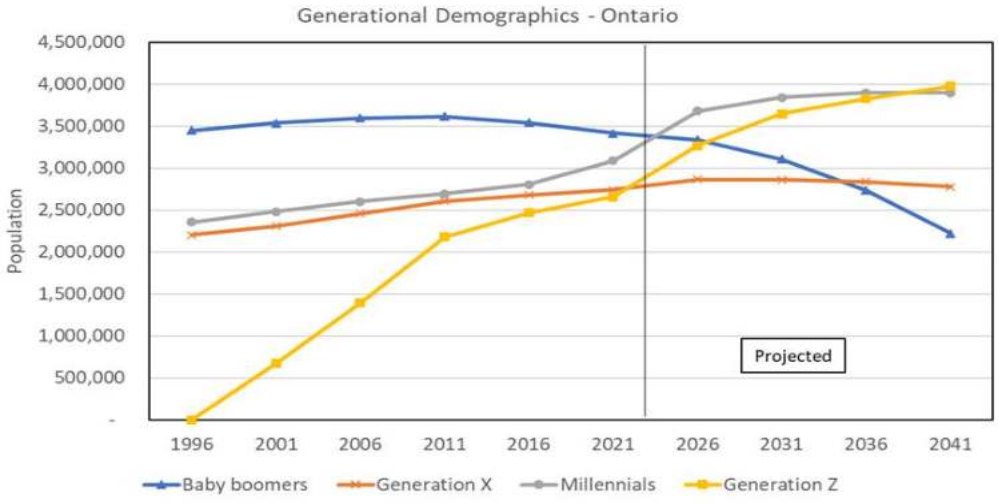
parts are consistently among the top two or three exports from Canada; often second only to oil and gas extraction[6].

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"[7].

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. [8]

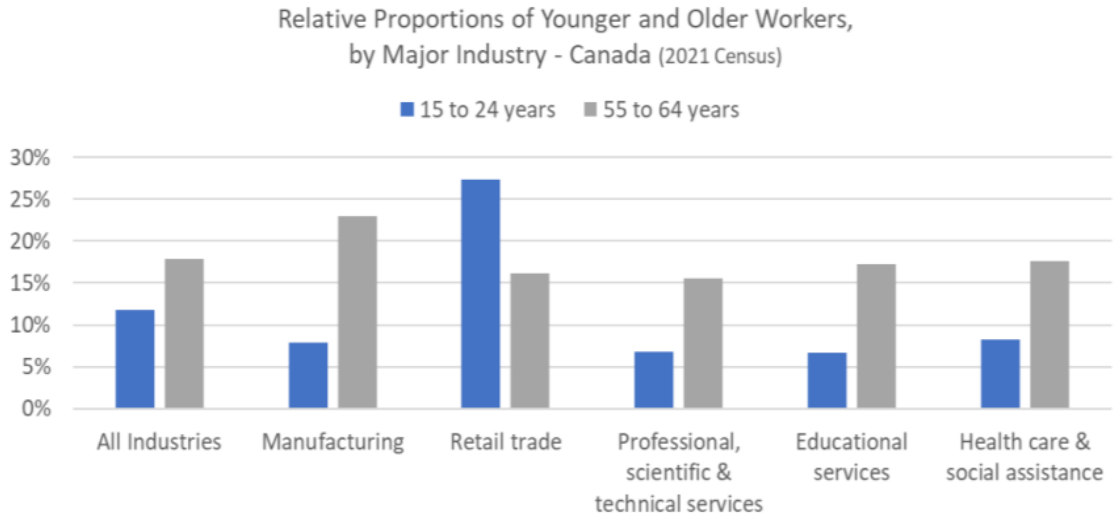
Figure 2. Changing demographics in Ontario (Source: Statistics Canada)



[6] Source: Government of Canada Trade Data Online (https://ised-isde.canada.ca/site/trade-data-online/en).
[7] 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
[8] 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)

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[9]. 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)[10]. Less than 2% of the Ontario activity is concentrated in the Eastern Ontario region and this is mostly in the parts and related industries.

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

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

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. The Windsor-Sarnia region has a large workforce in these traditional parts and other manufacturing industries in the automotive supply chain. These numbers serve as a starting point for measuring employment impacts.

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

Industry	Employment in 2022
Automobile and light-duty motor vehicle manufacturing	5,000
Heavy-duty truck manufacturing	0
Parts manufacturing	9,200
Mining	100
Basic chemical manufacturing	1,200
Other material processing	300
Battery manufacturing	200
Management, scientific and technical consulting services	48,700
Plastic product manufacturing	3,700
Other electronic product manufacturing	400
Semiconductor and other electronic component manufacturing	100
Iron and steel mills and ferro-alloy manufacturing	300
Foundries	400
Forging and stamping	200
Other automotive supply chain	21,600

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.

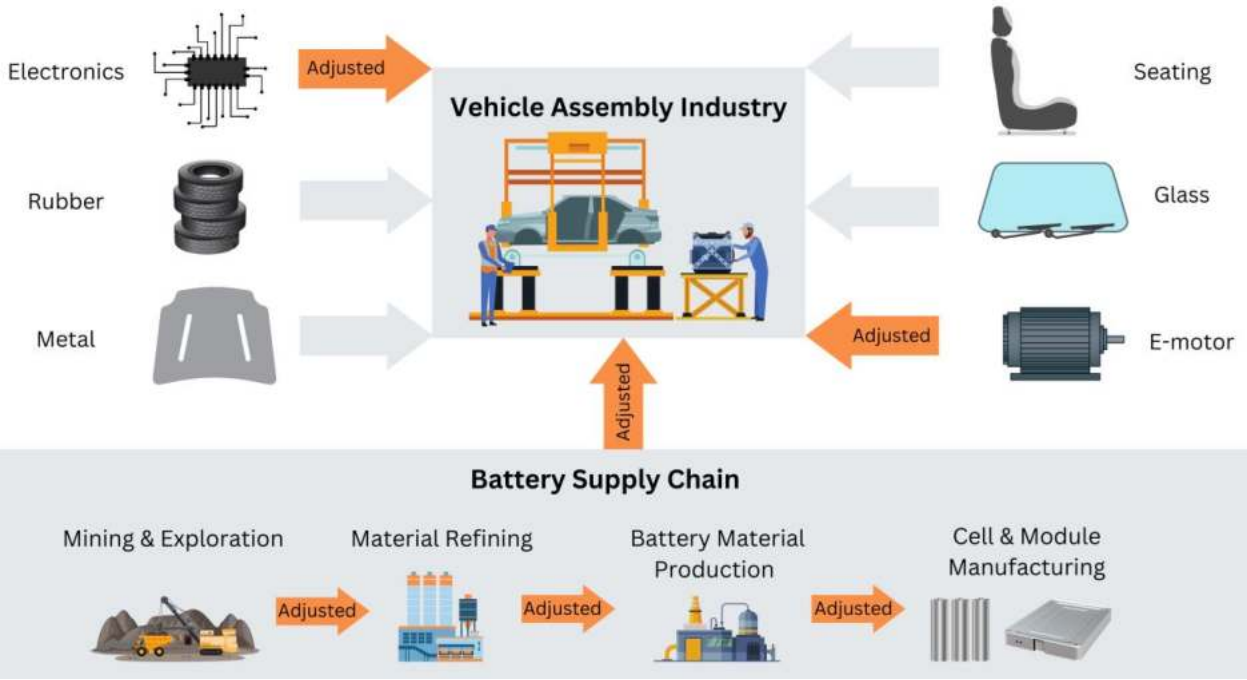
Major investments in new battery production and EV assembly are planned for the Windsor-Sarnia region. Battery production is expected to begin in 2025 and, in the base case scenario, grows to a peak in 2030. Assembly activity rises and shifts to EV production from 2025 to 2035. FOCAL II research transforms 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 Windsor-Sarnia regional economy.

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.[11] Figure 4 illustrates the changes introduced by FOCAL II at this stage of the analysis.

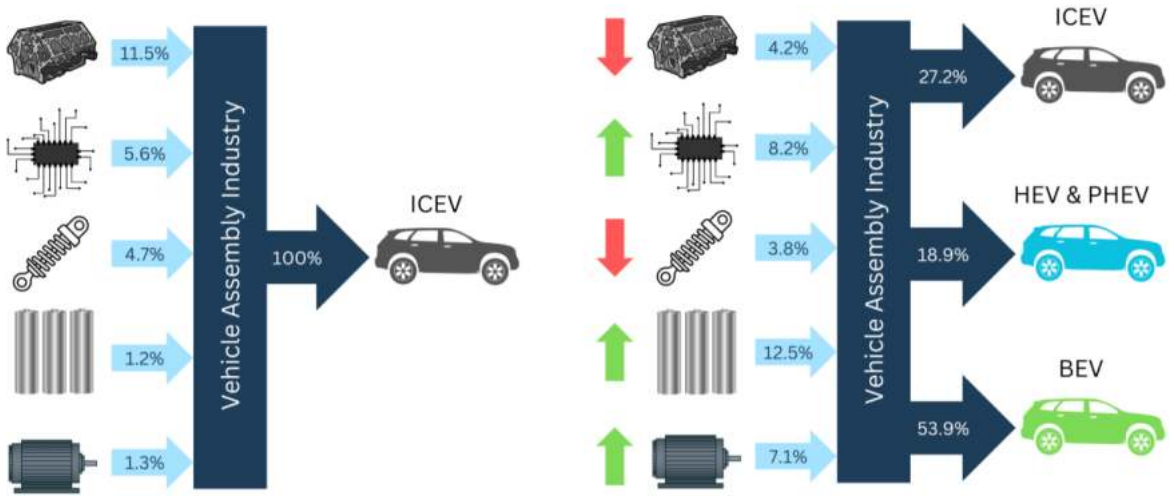
Figure 4. Adjusting automotive and battery manufacturing supply chain linkages for the impact analysis



[11] 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. Second, the IO system calculates *indirect impacts* that reflect changes in output and sales in response to direct impacts. For example, parts manufacturers, 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

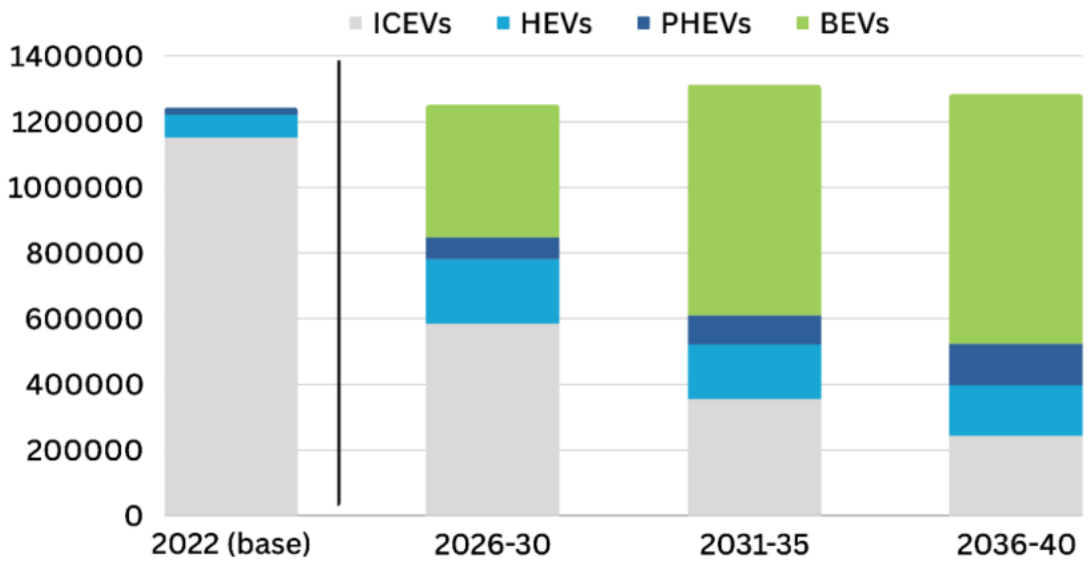
A base case scenario has been developed that combines key assumptions across these categories. The magnitude and timing of these assumptions are expressed in terms of total employment impacts by industry, which are then transformed into detailed occupational impacts.

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).

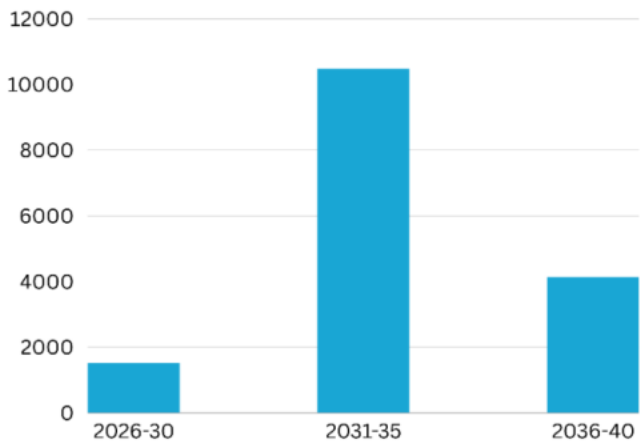
Table 2. Base case scenario - battery supply chain assumptions

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

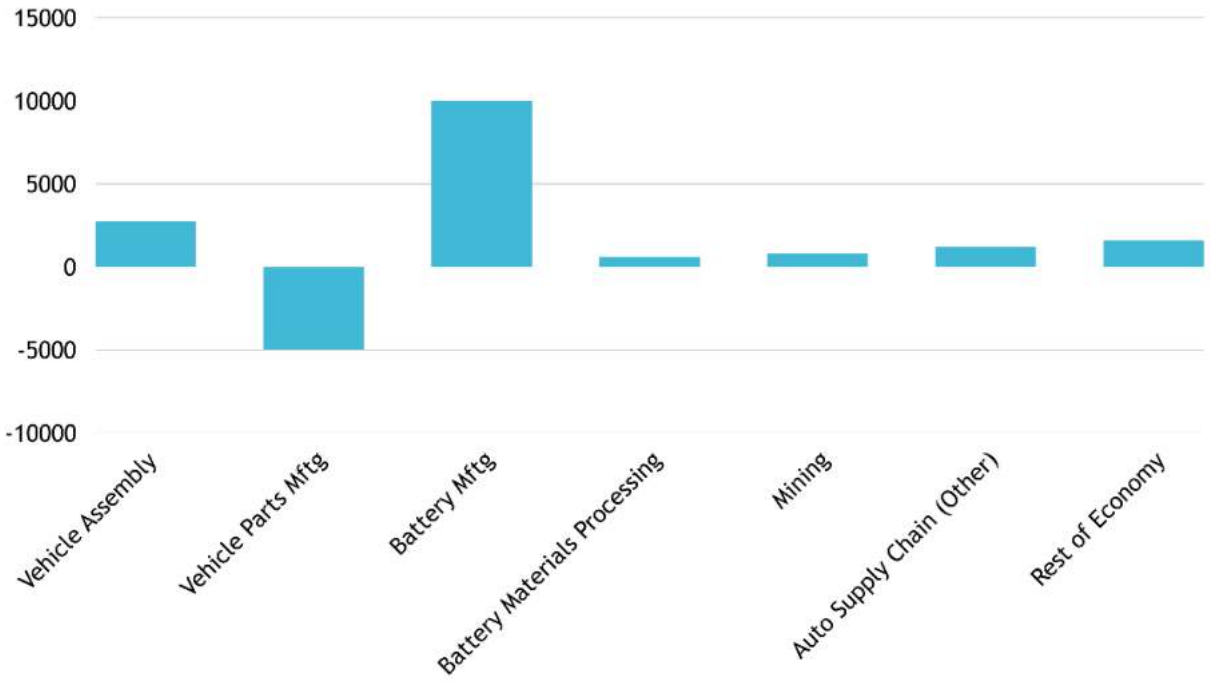
Figure 7 summarizes the total employment impacts in the base case scenario in three intervals of the transition. The total impact is positive, with gains in each of the three five-year intervals, as new activity in battery production and its supply are large enough to offset employment losses related 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 Windsor-Sarnia 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 the Windsor-Sarnia regional labour markets for ten occupations. FOCAL II findings signal difficulties for recruiters during the peak 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. Changes are particularly notable in the Windsor-Sarnia region as the workforce there is smaller than in other regions and the investments and assembly changes are among the largest. There is also an established parts industry in the region that includes engine plants and related suppliers who are vulnerable to the decline in ICEV production. 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. Demographic trends 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 ten occupations in the Windsor-Sarnia 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 17, 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 right panel, the recruitment gap for each time interval is expressed as the percentage of base year employment 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

Windsor-Sarnia is among the smaller regions in the FOCAL II analysis and employment in some occupations falls below a threshold of 100. Data reliability is a concern in populations this small and this restricts the available occupations where recruitment gaps can be reliably measured.

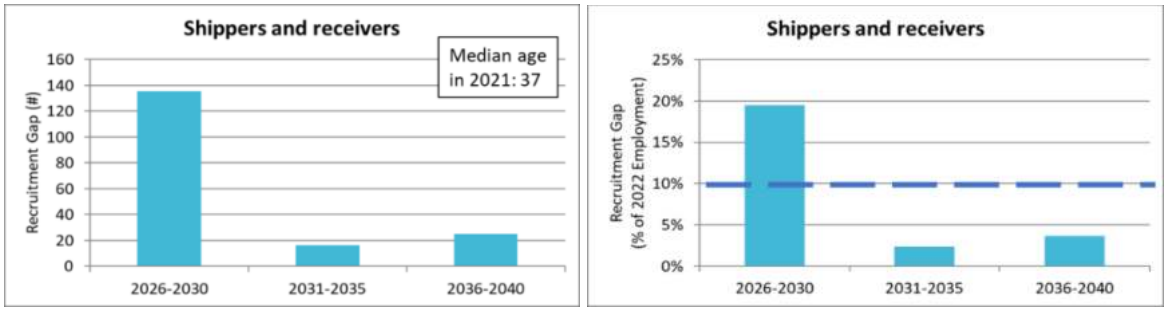
Occupations selected here have above average recruitment gaps during the transition. There are three major sources of employment change; new jobs in battery plants and their suppliers, rising and shifting assembly activity across the transition from ICEV to EV and declining employment in parts manufacturing – especially engines and drive chains. All three of these changes are impacting important employers in the Windsor-Sarnia region.

Direct impacts emerge at different time intervals, with new jobs in battery and related activity peaking in the 2025-2030 period. Job losses in parts are spread across the 2025 – 2040 periods and impacts across assembly activity peak in 2035. Employment impacts are distributed across many occupations but are most prominent in the following ten.

To illustrate the distinctive pattern of recruitment gaps for the selected occupations, the right-hand panel in Figures 10 to 17 contains a horizontal bar at 10%. This is the average recruitment gap for all the selected occupations in the FOCAL II analysis within the Windsor-Sarnia region before and after the transition.[12] 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[13].

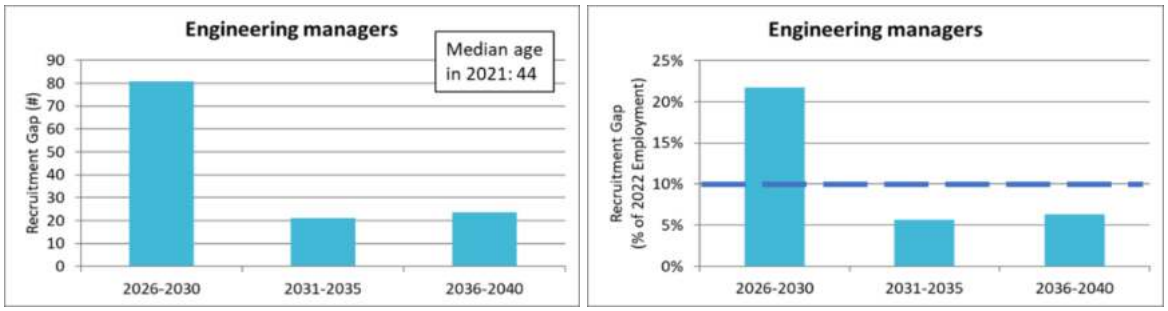
Shippers and receivers (Figure 10): Shippers and receivers are working in virtually all automotive industries. Recruitment gaps are generally high across the regions but the 20% peak in Windsor-Sarnia is the highest across all regions. The very low median age contributes to a lower in market strains before and after the transition peak. Retirements are not an issue here. The peak in 2026-2030 suggests that most of the demands are arising in the new battery plants and their suppliers.
Figure 10. Recruitment gap - shippers and receivers

[12] See Appendix B for a complete list of occupations used in the analysis.
[13] 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 Windsor-Sarnia region is 45 years old in 2021.



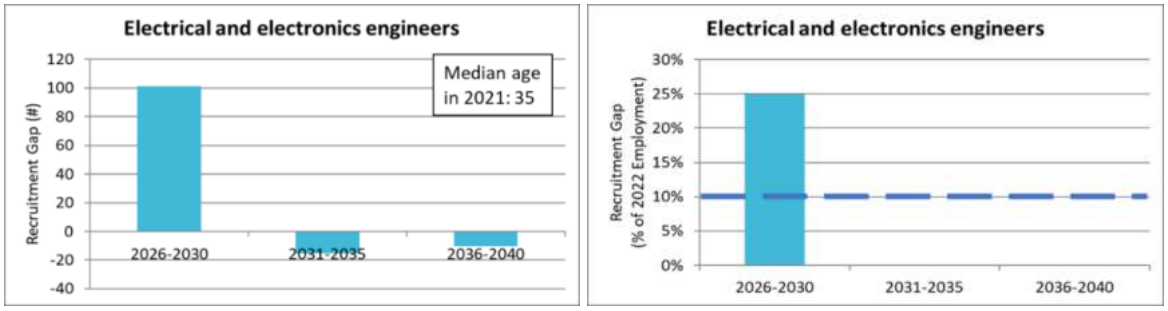
Engineering managers (Figure 11): Engineering managers are a small but critical workforce in all the automotive industries. Like all management occupations, they are top priorities hires and often in short supply. Here again the Windsor-Sarnia region posts the highest recruitment gap across all regions. Managers have a typically high age profile and retirements are a factor.

Figure 11. Recruitment gap – engineering managers



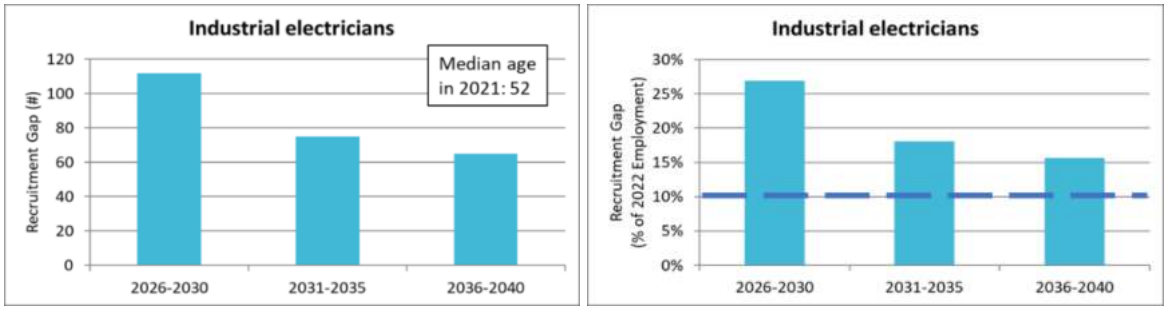
Electrical and electronics engineers (Figure 12): Electrical engineers are a priority across the transition. Other engineering disciplines have a higher profile in the traditional assembly and parts industries but this changes across the transition. Electrical engineers replace mechanical and industrial engineers – creating high recruitment gaps. This impact is dramatic in the Windsor-Sarnia region, where new jobs drive recruitment gap peaks with the start up of the batteries in 2025 but then the drop in new hires eliminates any gap at all. This pattern is unusual and related to the dominant impact of new jobs in a relatively small workforce. Again, at the peak in 2026-2030, the recruitment gap in Windsor-Sarnia is the highest in any region in Ontario. Electrical engineering technicians and technologists have a very similar profile across a smaller workforce.

Figure 12. Recruitment gap – electrical and electronics engineers



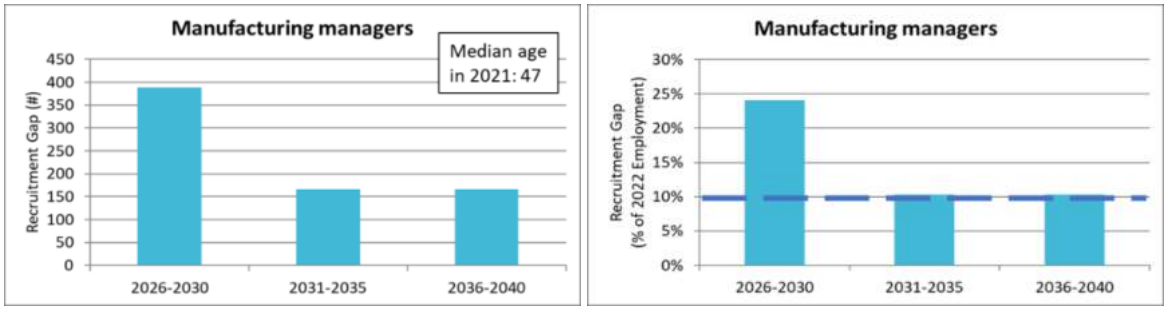
Industrial electricians (Figure 13): Skilled trades in all industries and regions share the highest recruitment gaps. Industrial electricians are a key workforce across all the automotive and electrical industries at the start of the transition and their importance will grow. The 28% recruitment gap for this occupation in Windsor-Sarnia is the highest among Ontario regions. The very old age profile adds to the challenges. This looks like a priority area for recruiting, training and retention.

Figure 13. Recruitment gap – Industrial Electricians



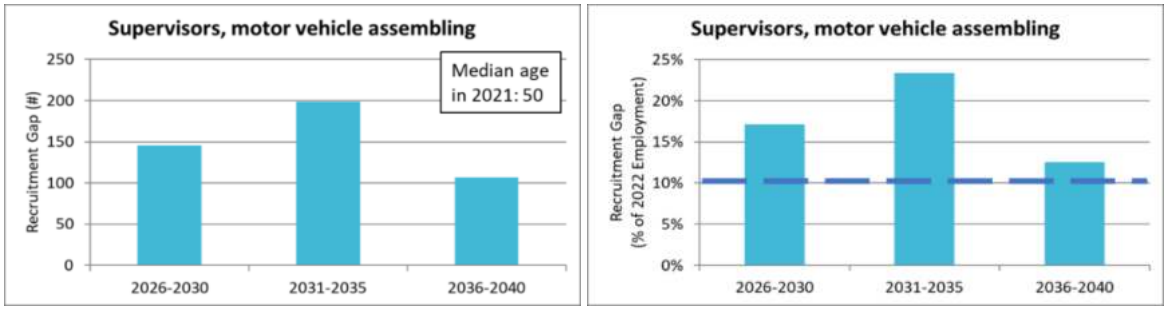
Manufacturing managers (Figure 14): Here we return to the management occupations and find high recruitment gaps relates to both age profiles and new jobs in the battery plants. This is by far the largest management and supervisory workforce, presenting a high number of openings across the transition. Here again the Windsor-Sarnia region faces the highest recruitment gap, during the 2026-2030 interval, found in any other regions. A moderate age profile adds replacement demands to market conditions.

Figure 14. Recruitment gap – manufacturing managers



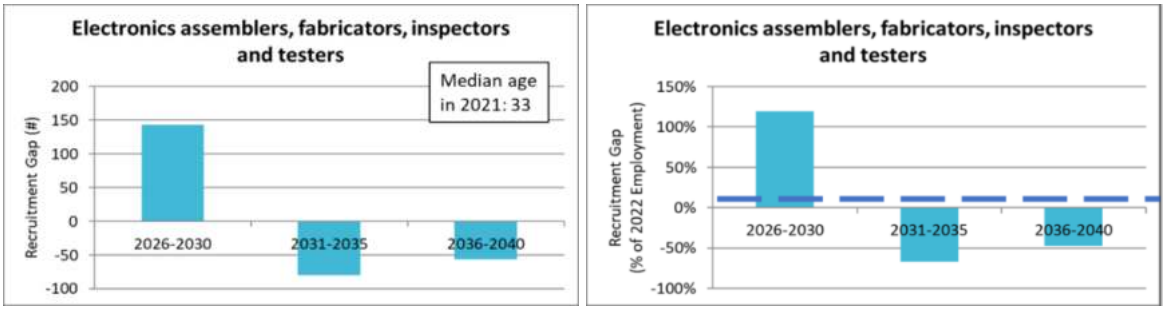
Supervisors, motor vehicle assembling (Figure 15): Vehicle assemblers and their supervisors are the biggest workforce in the vehicle industry core and supply chain. Their numbers alone suggest a priority focus of market assessment. Assemblers and related occupations have a different profile with peak market tightness occurring in the 2031-2035 period that coincides with the highest level of vehicle assembly in the base scenario and the sharpest shift from ICEV to EV. This workforce has a very high age profile – even among management and supervisory occupations. Also, the Windsor-Sarnia region does not register the highest recruitment gaps in the assembly occupations. Assembly dominates the transition in the Golden Horseshoe region – but Windsor-Sarnia is a close second.

Figure 15. Recruitment gap – Supervisors, motor vehicle assembling



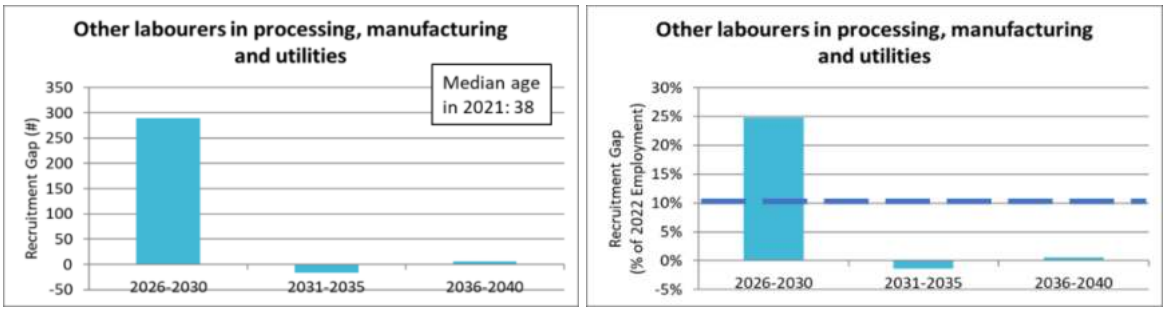
Electronics assemblers, fabricators, inspectors and testers (Figure 16): This is a key occupation in the electrical equipment industries and will be at the center of hiring priorities as the battery plants and suppliers start up. As the transition starts, this is a very small workforce in the Windsor-Sarnia region, but it will soon more that double. Dramatic gains in the 2026-2030 interval will be followed by some cutbacks as economies of scale and more efficient battery production reduces costs and employment. This occupation and their supervisors register the highest recruitment gaps found in the base case FOCAL II analysis. Note the very young age profile. The dramatic swings in the recruitment gap indicate that all the change is in expansion demand and none in replacement demand – a unique situation.

Figure 16. Recruitment gap - electronics assemblers, fabricators, inspectors and testers



<u>*Other labourers in processing, manufacturing and utilities*</u> (Figure 17): This occupation is the largest workforce among selected occupations and across most of the broader automotive industries. There are persistent and above average shortages of labourers across most industries and regions. The gap in Windsor-Sarnia, in the 2026-2030 period, is the highest across all the Ontario regions – although London-Stratford-Bruce is a close second. Impacts are concentrated in the battery plants and their suppliers, and this raises questions about whether new hires will need training. The age profile for this group is average and this adds replacement demands to the current and expected future challenges.

Figure 17. Recruitment gap – other labourers in processing, manufacturing and utilities



<u>*Supervisors, electronics, and electrical products manufacturing:*</u> The supervisory workforce in the electronics and electrical products industry in the region is very small. Indeed, the levels fall below the threshold that we have sent for reliability and the values of the estimates are not published. But it is mentioned here to highlight peak demands as the battery plants come on-line in the 2026-2030 period. The rise and then drop in expansion demand across the intervals is capturing the addition of, effectively, a new occupation in the region. Once the plants reach peak capacities, operating efficiencies will begin, battery costs and prices will fall and some of the new jobs will be eliminated. This is among the most dramatic shifts in labour market conditions across all the FOCAL II estimates. Of course, the profile developed here is closely dependent on the base case assumptions about new battery plants and the level and timing of EV assembly.

<u>*Chemical plant machine operators:*</u> This occupation is another example of a small regional workforce that will be impacted by the ICEV–EV transition. While the available data is limited and estimates are not released, the occupation serves as an example of important impacts. In this

case, the impacts appear farther up the supply chain and are linked to the major investment in a new battery plant. FOCAL II analysis of the transition tracks the new demand for chemical and mineral materials that are unique to new battery systems. This occupation experiences a notable jump in recruitment gap in the 2026-2030 interval as these new battery systems ramp up to peak production. The percent impacts are high, in part, because the starting work force is small. This is another example of a unique, regional recruiting challenge created by the transition.

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 [14]. 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 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

14 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.

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%
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 major disruptions in labour markets for at least ten occupations in the Windsor-Sarnia region. Recruiting challenges will emerge in these labour markets, reaching a peak 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 possibly 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 the Windsor-Sarnia region will be directly affected by the shifts in assembly, new battery plants and adaptations in the supply chain. Skill and labour shortages are expected to be more severe in the Windsor-Sarnia area than in other Ontario regions. The relatively small workforce in the area will have to manage some of the biggest investment in battery plants and changes in assembly and parts activity as the industry moves from ICEV to EV production.

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 challenge 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.

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 (Windsor-Sarnia 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 18. 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[15]. 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. 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.

[15] 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.

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 (Windsor-Sarnia region)

Expansion Demand	2026-30	2031-35	2036-40	2025-40
11200 Human resources professionals	10	0	0	10
13201 Production and transportation logistics coordinators	40	-10	-10	20
14400 Shippers and receivers	100	-40	-30	40
20010 Engineering managers	50	-20	-10	30
20012 Computer and information systems managers	10	0	0	10
21101 Chemists	0	0	0	0
21222 Information systems specialists	10	0	0	10
21230 Computer systems developers and programmers	0	0	0	0
21231 Software engineers and designers	20	0	0	10
21232 Software developers and programmers	20	0	0	10
21234 Web developers and programmers	0	0	0	0
21301 Mechanical engineers	30	10	-10	20
21310 Electrical and electronics engineers	90	-30	-30	50
21311 Computer engineers (except software engineers and designers)	10	0	0	10
21320 Chemical engineers	10	0	0	10
21321 Industrial and manufacturing engineers	40	-10	-10	20
22100 Chemical technologists and technicians	0	0	0	0
22220 Computer network and web technicians	20	-10	-10	10
22301 Mechanical engineering technologists and technicians	20	-10	-10	0
22302 Industrial engineering and manufacturing technologists and technicians	0	0	0	0
22310 Electrical and electronics engineering technologists and technicians	80	-30	-20	40

Expansion Demand	2026-30	2031-35	2036-40	2025-40
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	30	-10	-10	10
72101 Tool and die makers	10	-10	-10	-10
72106 Welders and related machine operators	50	-20	-20	10
72201 Industrial electricians	40	-10	-10	30
72400 Construction millwrights and industrial mechanics	60	-20	-20	30
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	0	10	0	0
73300 Transport truck drivers	20	0	0	10
75101 Material handlers	140	-40	-50	60
90010 Manufacturing managers	190	-60	-60	100
92020 Supervisors, motor vehicle assembling	50	80	-20	100
93101 Central control and process operators, petroleum, gas and chemical processing	30	-10	-10	10
94100 Machine operators, mineral and metal processing	50	-20	-10	20
94105 Metalworking and forging machine operators	20	-10	-10	10
94106 Machining tool operators	20	-10	-10	10
94111 Plastics processing machine operators	20	-10	-10	10
94200 Motor vehicle assemblers, inspectors and testers	80	120	-90	30
94201 Electronics assemblers, fabricators, inspectors and testers	160	-60	-40	80
94204 Mechanical assemblers and inspectors	10	0	0	10
94212 Plastic products assemblers, finishers and inspectors	0	0	0	0
94213 Industrial painters, coaters and metal finishing process operators	20	0	-10	10
95100 Labourers in mineral and metal processing	10	-10	0	0
95109 Other labourers in processing, manufacturing and utilities	240	-90	-70	120

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 (Windsor-Sarnia region)

Replacement Demand	2026-30	2031-35	2036-40	2025-40
11200 Human resources professionals	40	40	40	120
13201 Production and transportation logistics coordinators	10	20	20	50
14400 Shippers and receivers	70	90	80	260
20010 Engineering managers	40	50	50	150
20012 Computer and information systems managers	20	30	30	80
21101 Chemists	0	0	0	0
21222 Information systems specialists	50	50	50	160
21230 Computer systems developers and programmers	0	0	0	10
21231 Software engineers and designers	10	20	20	50
21232 Software developers and programmers	20	20	20	60
21234 Web developers and programmers	10	10	10	40
21301 Mechanical engineers	80	90	90	290
21310 Electrical and electronics engineers	40	50	50	140
21311 Computer engineers (except software engineers and designers)	0	0	0	10
21320 Chemical engineers	20	30	30	80
21321 Industrial and manufacturing engineers	20	30	30	90
22100 Chemical technologists and technicians	0	10	10	20
22220 Computer network and web technicians	10	10	10	30
22301 Mechanical engineering technologists and technicians	80	100	100	290
22302 Industrial engineering and manufacturing technologists and technicians	60	60	60	180
22310 Electrical and electronics engineering technologists and technicians	10	10	10	30
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	70	80	80	230
72100 Machinists and machining and tooling inspectors	110	130	130	380

Replacement Demand	2026-30	2031-35	2036-40	2025-40
72101 Tool and die makers	240	270	270	820
72106 Welders and related machine operators	60	70	70	210
72201 Industrial electricians	80	90	90	270
72400 Construction millwrights and industrial mechanics	100	120	120	350
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	40	50	50	150
73300 Transport truck drivers	50	60	60	170
75101 Material handlers	210	250	240	730
90010 Manufacturing managers	220	260	250	770
92020 Supervisors, motor vehicle assembling	100	130	130	380
93101 Central control and process operators, petroleum, gas and chemical processing	20	30	20	80
94100 Machine operators, mineral and metal processing	0	0	0	0
94105 Metalworking and forging machine operators	20	20	20	60
94106 Machining tool operators	40	40	40	120
94111 Plastics processing machine operators	90	100	100	300
94200 Motor vehicle assemblers, inspectors and testers	650	740	750	2,250
94201 Electronics assemblers, fabricators, inspectors and testers	0	0	0	10
94204 Mechanical assemblers and inspectors	30	40	40	130
94212 Plastic products assemblers, finishers and inspectors	40	40	40	120
94213 Industrial painters, coaters and metal finishing process operators	40	40	40	130
95100 Labourers in mineral and metal processing	10	20	20	50
95109 Other labourers in processing, manufacturing and utilities	130	150	140	440

New Entrants

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

Table 8. New entrants – detailed results (Windsor-Sarnia region)

New Entrants	2026-30	2031-35	2036-40	2025-40
11200 Human resources professionals	10	10	10	40
13201 Production and transportation logistics coordinators	10	10	10	50
14400 Shippers and receivers	30	30	30	100
20010 Engineering managers	10	10	10	40
20012 Computer and information systems managers	10	10	10	40
21101 Chemists	10	10	10	30
21222 Information systems specialists	20	20	20	50
21230 Computer systems developers and programmers	10	10	10	20
21231 Software engineers and designers	30	30	30	90
21232 Software developers and programmers	30	20	20	80
21234 Web developers and programmers	10	10	10	40
21301 Mechanical engineers	40	40	40	130
21310 Electrical and electronics engineers	30	30	30	100
21311 Computer engineers (except software engineers and designers)	10	10	0	20
21320 Chemical engineers	10	10	10	20
21321 Industrial and manufacturing engineers	20	20	20	60
22100 Chemical technologists and technicians	10	10	10	20
22220 Computer network and web technicians	10	10	10	40
22301 Mechanical engineering technologists and technicians	40	40	30	120
22302 Industrial engineering and manufacturing technologists and technicians	20	20	20	70
22310 Electrical and electronics engineering technologists and technicians	20	20	20	50
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	70	70	70	230
72101 Tool and die makers	70	60	60	210

New Entrants	2026-30	2031-35	2036-40	2025-40
72106 Welders and related machine operators	70	70	60	220
72201 Industrial electricians	10	10	10	30
72400 Construction millwrights and industrial mechanics	30	30	30	110
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	0	0	0	10
73300 Transport truck drivers	10	10	10	30
75101 Material handlers	50	50	50	150
90010 Manufacturing managers	30	30	30	90
92020 Supervisors, motor vehicle assembling	10	10	10	40
93101 Central control and process operators, petroleum, gas and chemical processing	20	20	20	70
94100 Machine operators, mineral and metal processing	20	20	20	60
94105 Metalworking and forging machine operators	20	20	20	80
94106 Machining tool operators	30	30	30	90
94111 Plastics processing machine operators	20	20	20	70
94200 Motor vehicle assemblers, inspectors and testers	270	260	250	840
94201 Electronics assemblers, fabricators, inspectors and testers	20	20	20	60
94204 Mechanical assemblers and inspectors	0	0	0	10
94212 Plastic products assemblers, finishers and inspectors	10	10	10	20
94213 Industrial painters, coaters and metal finishing process operators	20	20	20	50
95100 Labourers in mineral and metal processing	20	20	10	50
95109 Other labourers in processing, manufacturing and utilities	80	80	70	240

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 (Windsor-Sarnia region)

Recruitment Gap (#)	2026-30	2031-35	2036-40
11200 Human resources professionals	40	20	20
13201 Production and transportation logistics coordinators	40	<10	<10
14400 Shippers and receivers	140	20	30
20010 Engineering managers	80	20	20
20012 Computer and information systems managers	30	10	10
21101 Chemists	<10	<10	<10
21222 Information systems specialists	40	40	40
21230 Computer systems developers and programmers	<10	<10	<10
21231 Software engineers and designers	<10	<10	<10
21232 Software developers and programmers	10	<10	<10
21234 Web developers and programmers	<10	<10	<10
21301 Mechanical engineers	80	60	40
21310 Electrical and electronics engineers	100	<10	<10
21311 Computer engineers (except software engineers and designers)	10	<10	<10
21320 Chemical engineers	30	20	20
21321 Industrial and manufacturing engineers	40	<10	<10
22100 Chemical technologists and technicians	<10	<10	<10
22220 Computer network and web technicians	10	<10	<10
22301 Mechanical engineering technologists and technicians	60	50	50
22302 Industrial engineering and manufacturing technologists and technicians	40	30	30
22310 Electrical and electronics engineering technologists and technicians	70	<10	<10
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	60	70	70
72100 Machinists and machining and tooling inspectors	70	40	50
72101 Tool and die makers	180	200	200
72106 Welders and related machine operators	40	<10	<10
72201 Industrial electricians	110	70	70
72400 Construction millwrights and industrial mechanics	130	70	60

Recruitment Gap (#)	2026-30	2031-35	2036-40
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	40	50	40
73300 Transport truck drivers	60	50	40
75101 Material handlers	300	150	150
90010 Manufacturing managers	390	170	170
92020 Supervisors, motor vehicle assembling	150	200	110
93101 Central control and process operators, petroleum, gas and chemical processing	30	<10	<10
94100 Machine operators, mineral and metal processing	30	<10	<10
94105 Metalworking and forging machine operators	20	<10	<10
94106 Machining tool operators	30	<10	<10
94111 Plastics processing machine operators	90	70	70
94200 Motor vehicle assemblers, inspectors and testers	460	600	410
94201 Electronics assemblers, fabricators, inspectors and testers	140	<10	<10
94204 Mechanical assemblers and inspectors	50	40	40
94212 Plastic products assemblers, finishers and inspectors	30	30	30
94213 Industrial painters, coaters and metal finishing process operators	40	30	20
95100 Labourers in mineral and metal processing	10	<10	<10
95109 Other labourers in processing, manufacturing and utilities	290	<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 (Windsor-Sarnia region)

Recruitment Gap (% of 2022 Base Year Employment)	2026-30	2031-35	2036-40
11200 Human resources professionals	14%	10%	9%
13201 Production and transportation logistics coordinators	14%	<1%	<1%
14400 Shippers and receivers	20%	2%	4%
20010 Engineering managers	22%	6%	6%

Recruitment Gap (% of 2022 Base Year Employment)	2026-30	2031-35	2036-40
20012 Computer and information systems managers	9%	5%	5%
21101 Chemists	<1%	<1%	<1%
21222 Information systems specialists	9%	8%	8%
21230 Computer systems developers and programmers	<1%	<1%	<1%
21231 Software engineers and designers	1%	<1%	<1%
21232 Software developers and programmers	2%	<1%	<1%
21234 Web developers and programmers	<1%	<1%	<1%
21301 Mechanical engineers	8%	7%	5%
21310 Electrical and electronics engineers	25%	<1%	<1%
21311 Computer engineers (except software engineers and designers)	10%	<1%	<1%
21320 Chemical engineers	19%	10%	10%
21321 Industrial and manufacturing engineers	12%	<1%	<1%
22100 Chemical technologists and technicians	<1%	<1%	<1%
22220 Computer network and web technicians	8%	<1%	<1%
22301 Mechanical engineering technologists and technicians	8%	7%	6%
22302 Industrial engineering and manufacturing technologists and technicians	6%	6%	5%
22310 Electrical and electronics engineering technologists and technicians	28%	<1%	<1%
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	17%	20%	20%
72100 Machinists and machining and tooling inspectors	5%	3%	3%
72101 Tool and die makers	11%	12%	12%
72106 Welders and related machine operators	4%	<1%	<1%
72201 Industrial electricians	27%	18%	16%
72400 Construction millwrights and industrial mechanics	16%	8%	8%
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	16%	21%	18%
73300 Transport truck drivers	22%	18%	17%
75101 Material handlers	18%	9%	9%
90010 Manufacturing managers	24%	10%	10%
92020 Supervisors, motor vehicle assembling	17%	23%	13%
93101 Central control and process operators, petroleum, gas and chemical processing	9%	<1%	<1%
94100 Machine operators, mineral and metal processing	22%	<1%	<1%
94105 Metalworking and forging machine operators	5%	<1%	<1%
94106 Machining tool operators	6%	<1%	1%
94111 Plastics processing machine operators	14%	11%	11%

Recruitment Gap (% of 2022 Base Year Employment)	2026-30	2031-35	2036-40
94200 Motor vehicle assemblers, inspectors and testers	8%	10%	7%
94201 Electronics assemblers, fabricators, inspectors and testers	120%	<1%	<1%
94204 Mechanical assemblers and inspectors	26%	25%	21%
94212 Plastic products assemblers, finishers and inspectors	15%	17%	17%
94213 Industrial painters, coaters and metal finishing process operators	13%	9%	7%
95100 Labourers in mineral and metal processing	4%	<1%	<1%
95109 Other labourers in processing, manufacturing and utilities	25%	<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 19. 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%