FOCAL Initiative

ICEV TO EV WORKFORCE TRANSITION LABOUR MARKET FORECAST

KITCHENER – WATERLOO – BARRIE 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 Kitchener-Waterloo-Barrie 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 Kitchener-Waterloo-Barrie region for 55 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 Kitchener-Waterloo-Barrie region indicate that several key occupations will experience impacts during the transition. The magnitude and timing of impacts are unique for each occupation. Kitchener-Waterloo-Barrie 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. Kitchener-Waterloo-Barrie is not a large region and the impacts in some occupations will be more pronounced when compared to other, larger 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, London-Stratford-Bruce and Windsor-Sarnia.

Introduction

FOCAL I reports (published in 2022) highlighted the crucial role of a broader automotive industry across Canada, Ontario, and five regions within Ontario. The scale and impact of the broader industry was expanded to show important links to the rest of the economy. Motor vehicle assembly and related activity are critical to the overall wellbeing of the 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[1].

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. This report considers the impact of the ICEV – EV transition in the Golden Horseshoe region of Ontario. The FOCAL II initiative is helping the many employers and job seekers active in the industry in the Golden Horseshoe region to 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 guided 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 plants and related changes across the supply chain. This analysis 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;

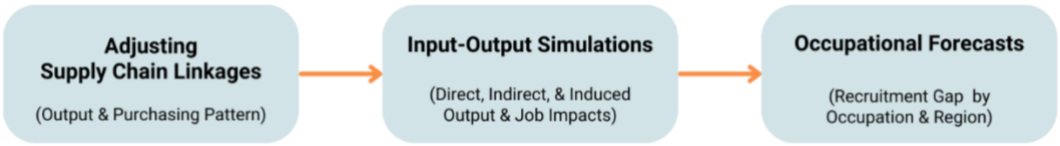
- a transition horizon from 2025 to 2040,
- 49 selected NAICS industries in
- Canada, Ontario, Quebec, Manitoba and seven regions.

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 67 key occupations for the Golden Horseshoe (Greater Toronto Area, Hamilton and Niagara) region.

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

Figure 1. Impact analysis steps



The path of the transition will be 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 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 analysis in the regions.

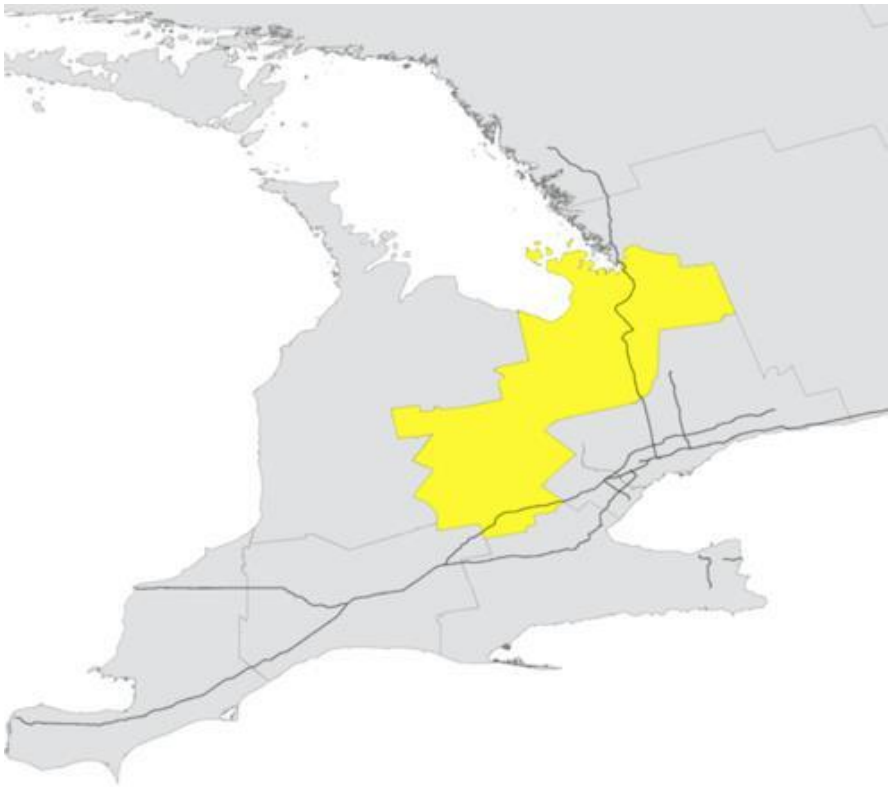
The base case scenario describes an ICEV-EV transition that will comprise both job gains and losses, changes in employment conditions, and related labour market disruptions for selected industries and occupations. Direct impacts spread out from vehicle assembly and new battery plants to alter activity across the supply chain. This includes parts producers, 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 in 17 selected occupations (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)[2].

These impacts will be very apparent in the Kitchener-Waterloo-Barrie region, as this region has deep roots and major employers in motor vehicle production. Announced investments in renewed EV assembly capabilities and related additions across the supply chain define the region's labour market adjustments in key occupations. Section 4 of the report identifies seven selected occupations that have notable impacts. Impacts across other occupations are described in detail in Appendix D[3].

[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.
[3] 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.

This introduction is followed by a background on the Kitchener-Waterloo-Barrie region. Section 3 describes impacts across the ICEV-EV transition in key industries. Section 4 reports detailed impacts across seven selected occupations. Conclusions and implications are 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.

The ICEV-EV Transition – Background



The Kitchener-Waterloo-Barrie region is a single Economic Region (ER). It is an aggregate region comprised of four Census Divisions (CDs) as defined by Statistics Canada: Wellington, Dufferin, Waterloo, and Simcoe. The Waterloo CD is the largest of the four divisions and includes the cities of Cambridge, Kitchener, and Waterloo. The Kitchener-Waterloo-Barrie region is home to 10% of Ontario's population and covers a land area of nearly 10,400 square kilometers. The region includes Highways 400 and 401, and major trade routes between Canada and the United States.

The region is home to two large OEM assembly plants: Honda assembly in New Tecumseth and a Toyota plant in Cambridge. The region is also home to a Honda-owned sub-assembly plant and an FCA-owned plant that produces interiors, as well as an estimated 75 additional parts suppliers. The primary vehicle parts industries in the region are metal stamping (NAICS 33637) and transmission & power train parts manufacturing (NAICS 33635)[4].

The coming transition from ICEVs to EVs will have a major impact across the region. In 2022, the regional workforce included a total of 802,100 employed with 128,400 in manufacturing and 25,400 in the core automotive assembly and parts industries[5]. Motor vehicle assembly and

[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

related activity are critical to the overall economic well being, especially for the Kitchener-Waterloo-Barrie region but also for the broader Ontario economy. One example of the overall importance of the assembled motor vehicles and parts industries is that they 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].

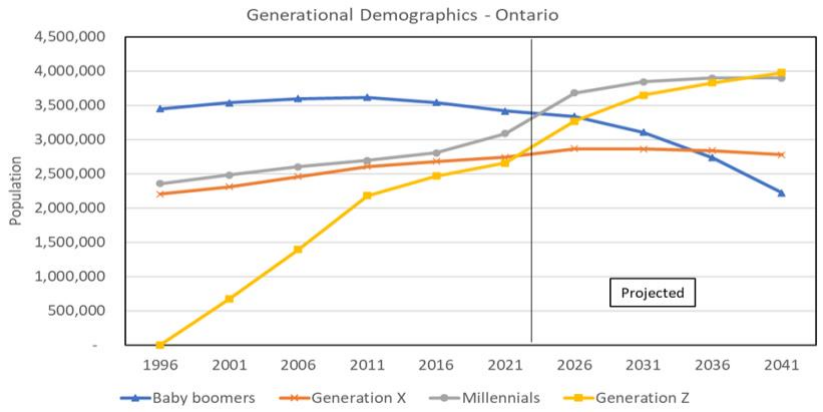
Statistics Canada Labour Statistics Consistent with the System of National Accounts (Table 36-10-0489-01) and Automotive Policy Research Centre (APRC).

[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

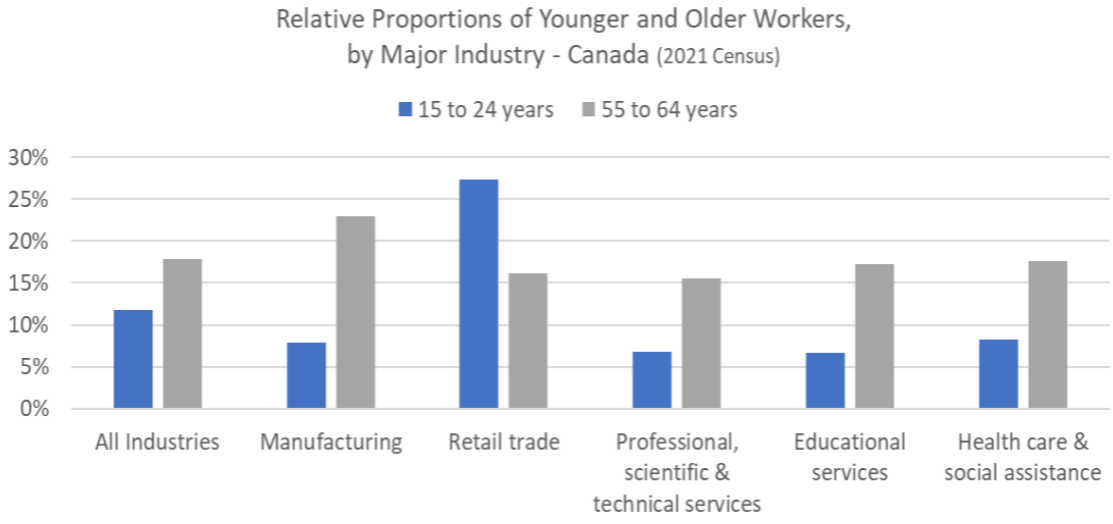
[8] Sources: Statistics Canada 1996 to 2021 Census (historical data); Table 17-10-0057-01 Projected population, by projection scenario, age and sex, as of July 1 (x 1,000) (projected data, M1 scenario)

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[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]. Twenty-seven percent of the Ontario activity is concentrated in the Kitchener-Waterloo-Barrie region.

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 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. It is important to note, for example, that, among the five Ontario regions, the Kitchener-Waterloo-Barrie region has the biggest concentration of employment in the assembly industry and a small parts industry than, for example, in the Golden Horseshoe region.

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

Industry	Employment in 2022
Automobile and light-duty motor vehicle manufacturing	12,100
Heavy-duty truck manufacturing	0
Parts manufacturing	13,300
Mining	200
Basic chemical manufacturing	300
Other material processing	1,600
Battery manufacturing	800
Management, scientific and technical consulting services	5,700
Plastic product manufacturing	7,200
Other electronic product manufacturing	1,300

[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).

Industry	Employment in 2022
Semiconductor and other electronic component manufacturing	900
Iron and steel mills and ferro-alloy manufacturing	700
Foundries	700
Forging and stamping	500
Other automotive supply chain	49,600

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.

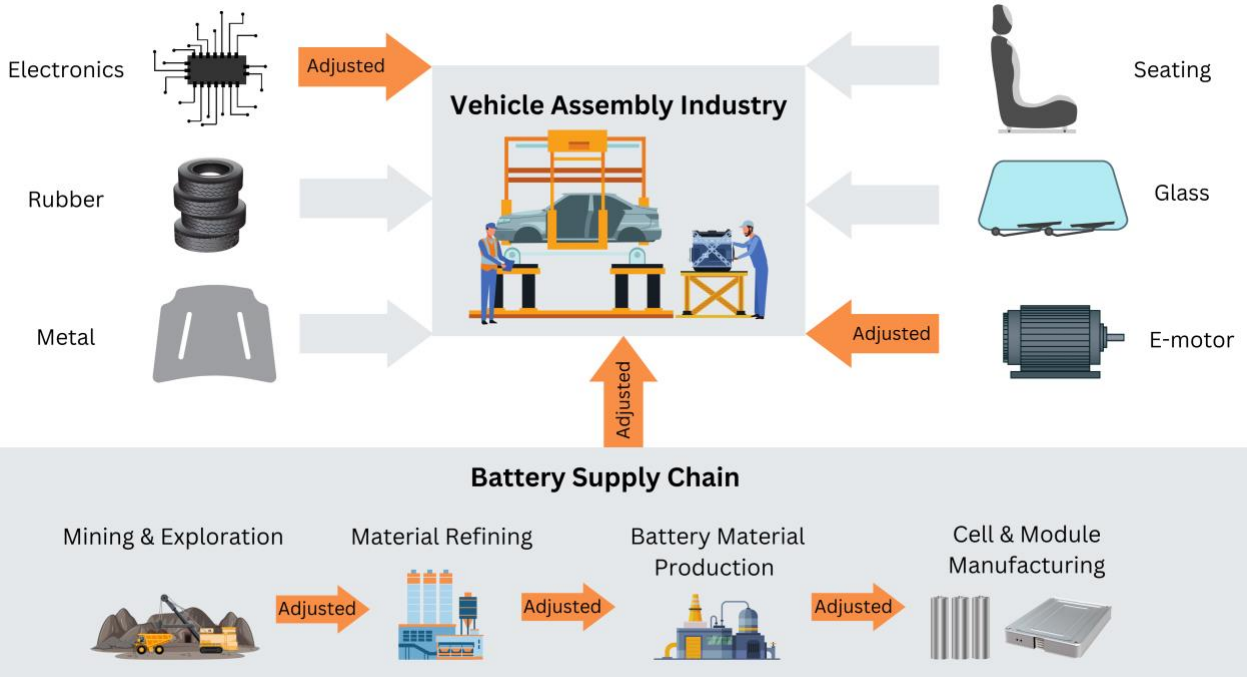
No major investments in new battery production and EV assembly are planned for the Kitchener-Waterloo-Barrie region. Battery production in other regions is expected to begin in 2025 and, in the base case scenario, grows to a peak in 2030. Assembly activity rises and shifts to EV production from 2025 to 2035 and this aspect of the base case scenario is the most important for the Kitchener-Waterloo-Barrie region. 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 the Golden Horseshoe region.

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 over a fixed period of time. 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.

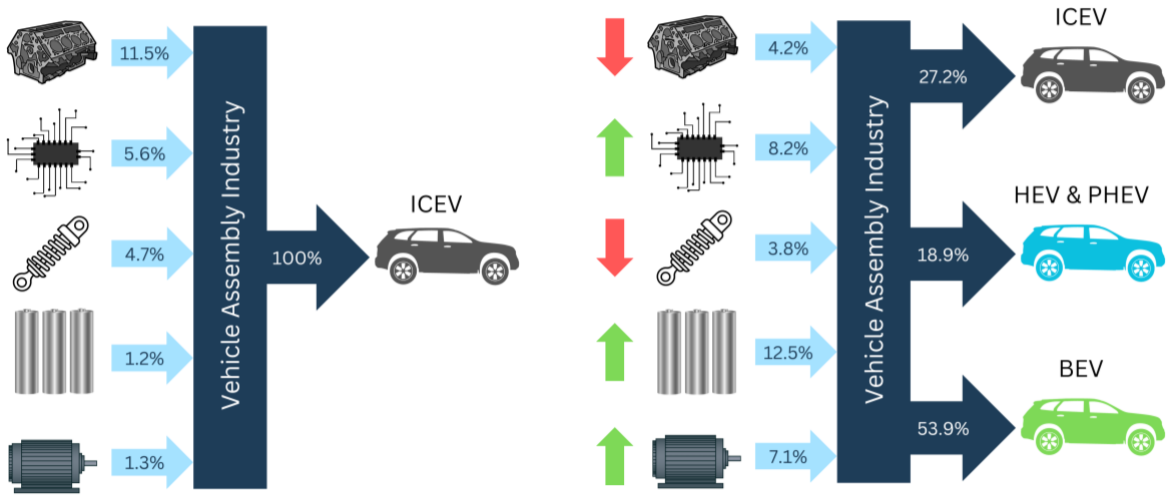
Figure 4. Adjusting automotive and battery manufacturing supply chain linkages for the impact analysis



[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

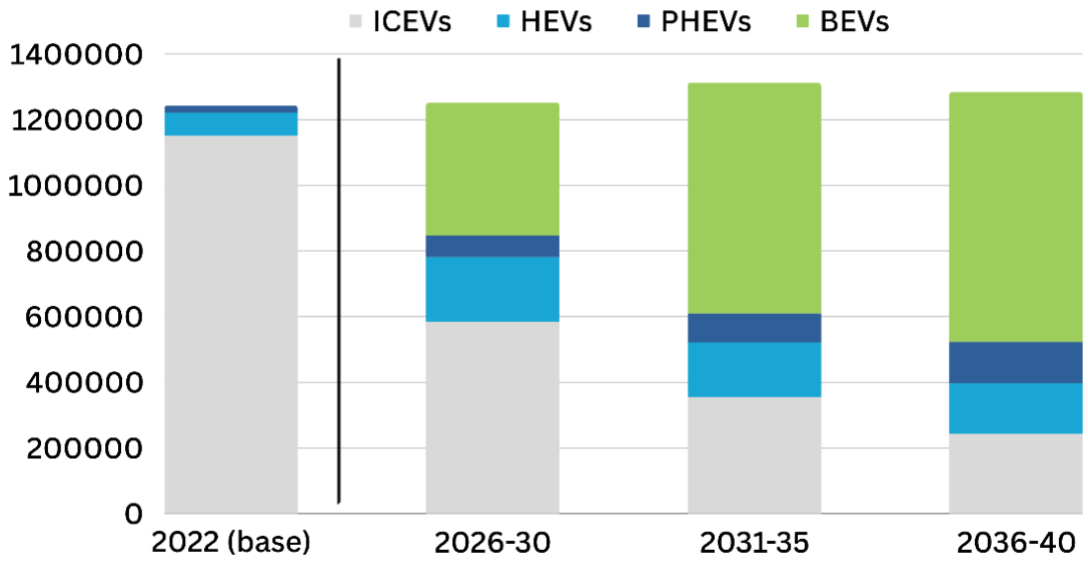
A base case scenario has been developed that combines key assumptions across these categories. The magnitude and timing of these assumptions are expressed in terms of total employment impacts by industry, which are then transformed into detailed occupational impacts.

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).

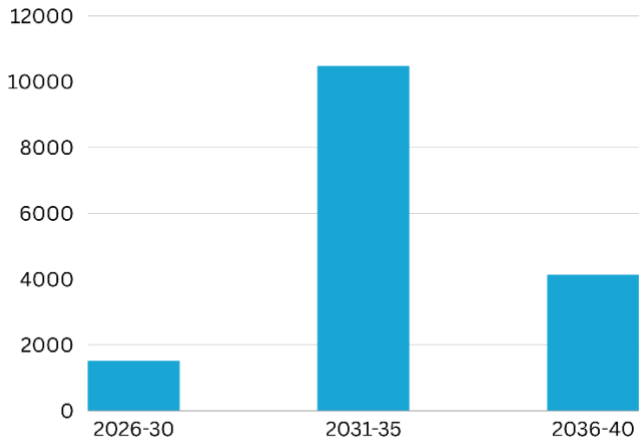
Table 2. Base case scenario - battery supply chain assumptions

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

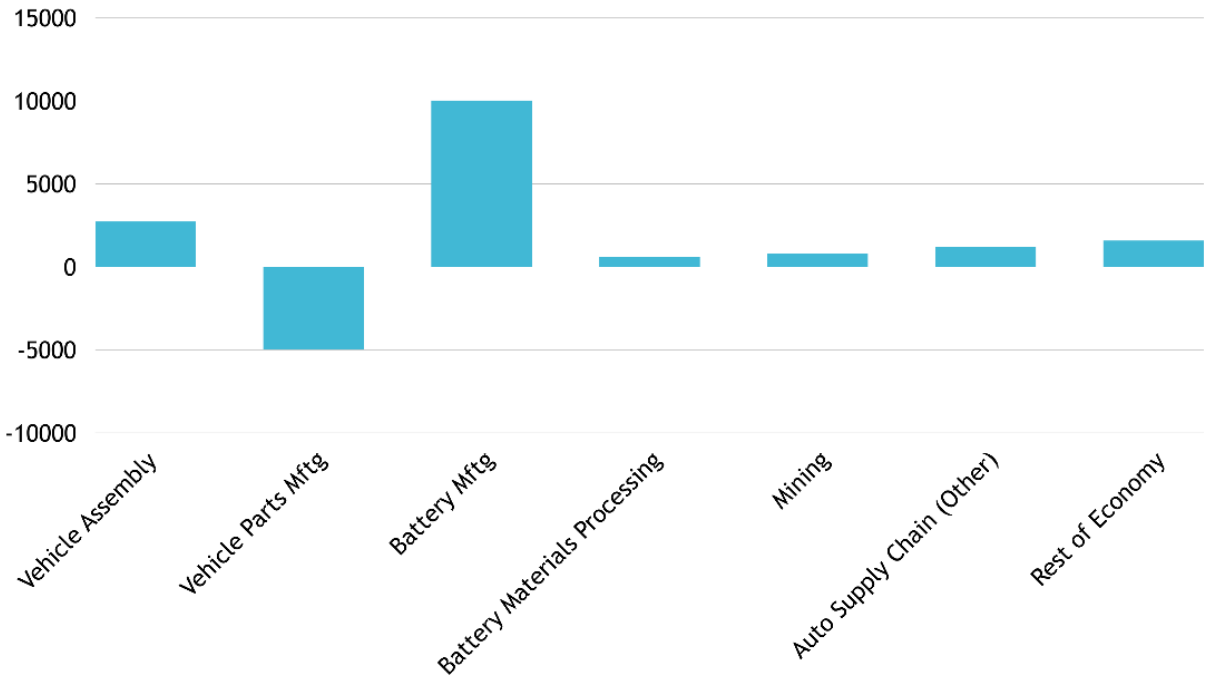
Figure 7 summarizes the total employment impacts in the base case scenario in three intervals of the transition. The total impact is positive, with gains in each of the three five-year intervals, as new activity in battery production and its supply are large enough to offset employment losses related 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 Kitchener-Waterloo-Barrie 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 Kitchener-Waterloo-Barrie regional labour markets for seven 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 have a distinct profile in the Kitchener-Waterloo-Barrie region as the largest workforce there is concentrated in vehicle assembly. There is also a smaller 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 seven occupations in the Kitchener-Waterloo-Barrie 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 16, the recruitment gap for each time interval is displayed as the number of additional workers impacted, 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 impacted in an occupation, in addition to the employment in that occupation in 2022.

Large recruitment gaps for an occupation (expressed as the number of additional workers needed) indicate the magnitude of the expected recruiting effort. Large recruitment gaps, expressed as a percent of base year employment, suggest more acute recruiting pressures and potential skill shortage.

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

Employment in the Kitchener-Waterloo-Barrie workforce, in some occupations, falls below a threshold of 100. Results for these occupations are not published. 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 Kitchener-Waterloo-Barrie region.

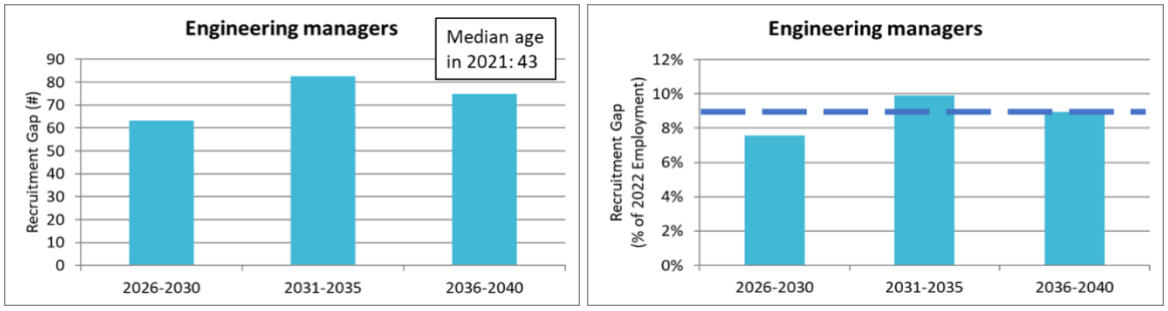
Direct impacts emerge at different time intervals, with new jobs in battery and related activity peaking in the 2025-2030 period. Job losses in parts manufacturing are spread across the 2025-2040 periods and impacts across assembly activity peak in 2035. Employment impacts are distributed across many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

To illustrate the distinctive pattern of recruitment gaps for the selected occupations, the right-hand panel in Figures 10 to 16 contains a horizontal bar at 9%. This is the average recruitment gap for all the selected occupations in the FOCAL II analysis within the 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].

Engineering managers (Figure 10): 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. Kitchener-Waterloo-Barrie posts above average recruitment rates for the region but rates are even higher for this occupation in other regions. Managers have a typically high age profile, but the profile is much lower in this region.

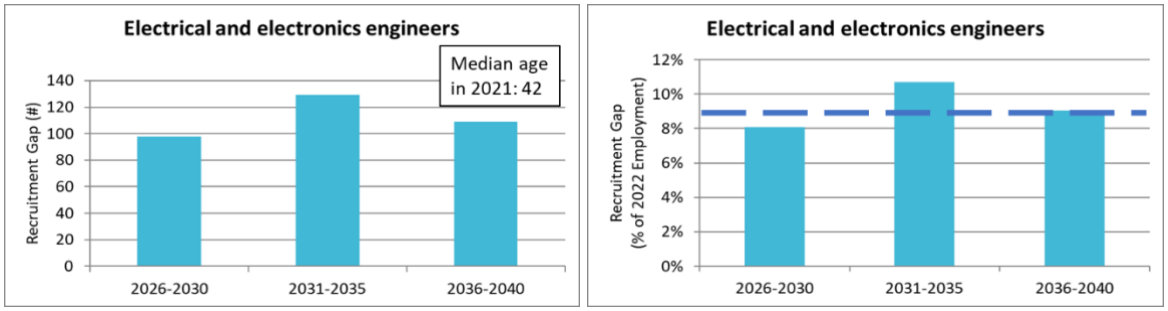
[12] See Appendix B for a complete list of occupations used in the analysis.
[13] Median ages are calculated using 2021 Census data for each occupation in selected industries (see Appendix A for list of industries). The median age for all occupations in the selected industries in the Kitchener-Waterloo-Barrie region is 43 years old in 2021.

Figure 10. Recruitment gap - engineering managers



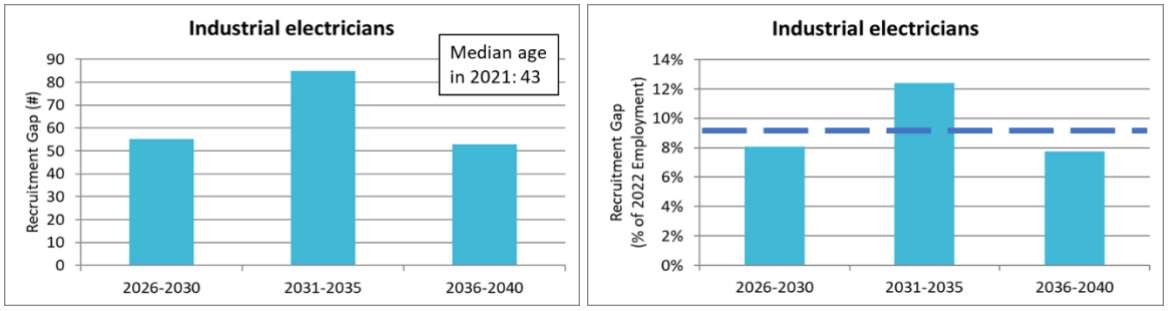
Electrical and electronics engineers (Figure 11): Electrical engineers are a priority across the transition. Other engineering disciplines have a higher profile in the traditional assembly and parts industries but this changes across the transition. Electrical engineers replace mechanical and industrial engineers – creating high recruitment gaps in many markets. This impact is apparent in the Kitchener-Waterloo-Barrie region, where recruitment gaps peak in the 2031-2035 interval. At the peak, the recruitment gap in Kitchener-Waterloo-Barrie is high but below the peaks reported for this occupation in the 2026-2030 interval in London-Stratford-Bruce and Windsor-Sarnia as the battery plants come online. Electrical engineering technicians and technologists have a very similar profile across a smaller workforce in all the regions.

Figure 11. Recruitment gap – electrical and electronics engineers



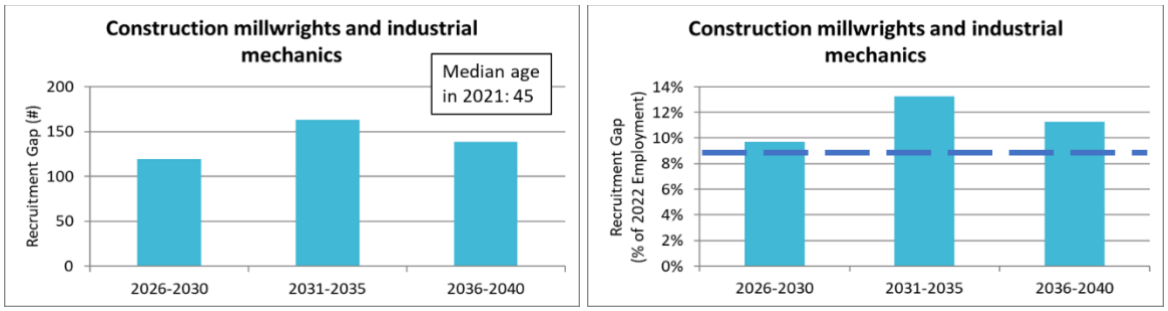
Industrial electricians (Figure 12): In general, skilled trades have high recruitment gaps in all regions. This skilled trade plays a moderately stronger role in the assembly industry compared to battery plants. An increasing role here will create higher recruitment gaps as the transition moves forward. Industrial electricians have an age profile comparable to all occupations in the selected industries in this region, and a lower recruitment gap at the start of the transition. While industrial electricians have a higher than average recruitment gap in this region, the gap here is lower than in most other regions.

Figure 12. Recruitment gap – industrial electricians



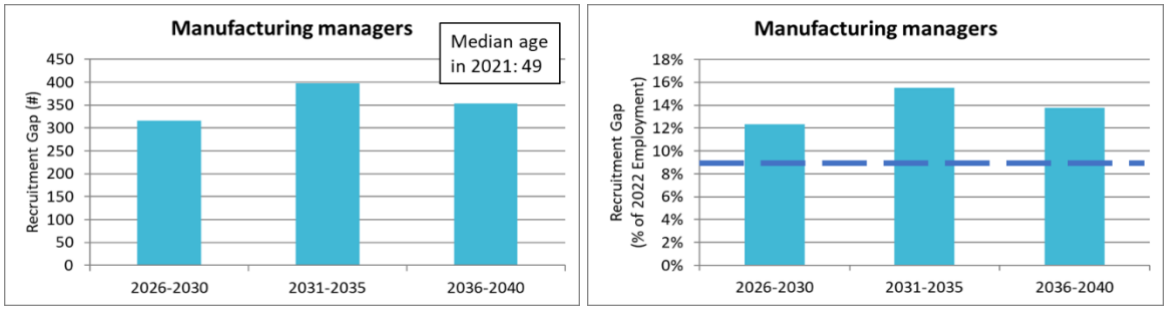
Construction millwrights and industrial mechanics (Figure 13): This trade plays a notable role in both assembly and battery industries and will be key in the start up of new production processes. Millwrights have a strong share in the traditional parts industry and some jobs may be lost there across the transition. Employment impacts here will create higher recruitment gaps as the transition moves forward. While the gap here is above the regional average, it is below gaps reported in the surrounding regions. The trade has an older age profile (with a median age of 45), with moderate recruitment gaps at start and a moderate peak indicating a modest ICEV-EV impact.

Figure 13. Recruitment gap – construction millwrights and industrial mechanics



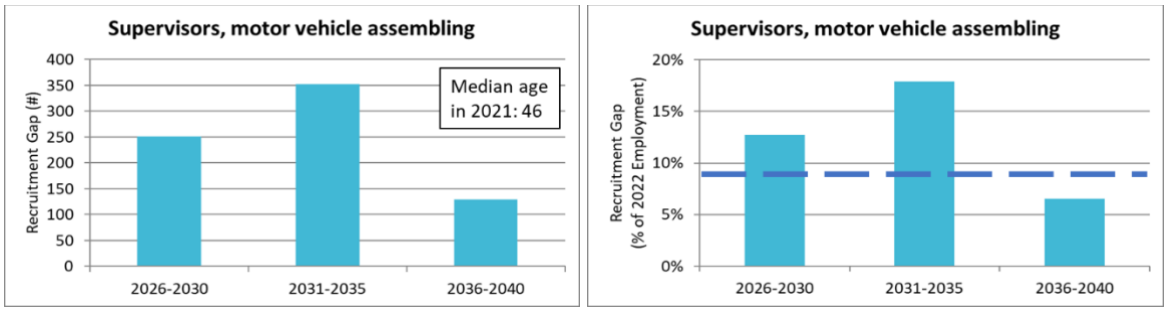
Manufacturing managers (Figure 14): Here we return to the management occupations and find high recruitment gaps related to both age profiles and new jobs in the battery plants. This is, by far, the largest management and supervisory workforce, presenting a high number of openings across the transition. Here again manufacturing managers in Kitchener-Waterloo-Barrie faces a higher-than-average recruitment gap, during the 2031-35 interval, but this is lower than gaps in other regions. An older age profile adds replacement demand pressures to market conditions.

Figure 14. Recruitment gap – manufacturing managers



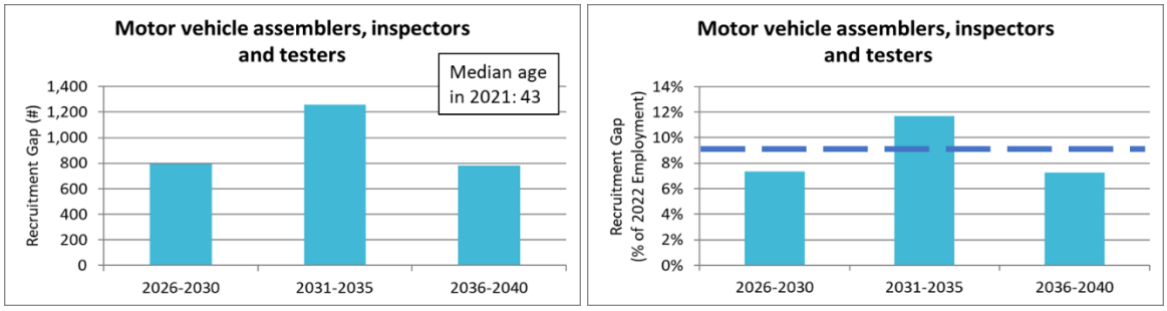
Supervisors, motor vehicle assembling (Figure 15): Vehicle assemblers and their supervisors are the biggest workforce in the vehicle industry core and supply chain. Their numbers alone suggest a priority focus of market assessment. Supervisors and assemblers face peak market tightness in the 2031-2035 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 an older profile – even among management and supervisory occupations. Note, the Kitchener-Waterloo-Barrie region does not register the highest recruitment gaps in the assembly occupations. Assembly dominates the transition in the Golden Horseshoe region.

Figure 15. Recruitment gap – supervisors, motor vehicle assembling



Motor vehicle assemblers, inspectors and testers (Figure 16): As noted above, this occupation is by far the largest workforce impacted by the transition in this region. Peak labour market pressures are in the 2031-2035 interval when the number of vehicles assembled peaks and the major shift from ICEV to EV happens.

Figure 16. Recruitment gap - motor vehicle assemblers, inspectors and testers



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 management and supervision, engineering, skilled trades and assemblers. Results for these occupations signal important labour shortages. Recruitment gaps in Kitchener-Waterloo-Barrie, in most selected occupations, are slightly lower than other Ontario regions, especially in the 2031-2035 interval. Examples of this include vehicle assemblers, fabricators, inspectors and testers, manufacturing managers, electrical and electronics engineers, most supervisor workforces, and many skilled trades. Stronger recruiting for these occupations in other regions will add to the market challenges during the transition.

Impacts reflect very different types of change to employment and work conditions across industries and occupations. Impacts may be caused by added new jobs in battery plants or lost jobs in the ICEV supply chain. In contrast, managers, supervisors and assemblers in the assembly and some 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 manufacturing, the impacts will often be in new jobs and skills, often in new plants.

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 tool and die makers, industrial electricians and millwrights reflect their prominence in both assembly and 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 lost as ICEV production closes down and eliminate 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 Kitchener-Waterloo-Barrie region can be compared to results in the Golden Horseshoe region. Both of these regions have a major role in assembly. Results for the Golden Horseshoe regional report generally higher recruitment gaps for assembly occupations. There is a clear potential for inter-regional workforce mobility implied here.

A summary of this perspective can be seen in Table 3. The table compares labour market conditions in Kitchener-Waterloo-Barrie to the other regions for the transition interval 2031-2035. This interval features the peak in assembly activity across Ontario. At this time in the transition, labour markets for assembly occupations promise to be most strained in the Golden Horseshoe region.

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. 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	10%	11%	8%	4%	2%
20010 Engineering managers	10%	10%	10%	6%	6%
21310 Electrical and electronics engineers	16%	11%	11%	<1%	<1%
22310 Electrical and electronics engineering technologists and technicians	15%	13%	8%	<1%	<1%
72100 Machinists and machining and tooling inspectors	10%	17%	11%	7%	3%
72101 Tool and die makers	21%	19%	10%	15%	12%
72201 Industrial electricians	<1%	17%	12%	5%	18%
72400 Construction millwrights and industrial mechanics	9%	17%	13%	9%	8%
73300 Transport truck drivers	9%	9%	16%	18%	18%
82020 Supervisors, mining and quarrying	*	*	*	*	*
90010 Manufacturing managers	8%	18%	16%	7%	10%
92020 Supervisors, motor vehicle assembling	*	23%	18%	16%	23%
92021 Supervisors, electronics and electrical products manufacturing	3%	11%	8%	*	*
94110 Chemical plant machine operators	12%	11%	<1%	*	*
94200 Motor vehicle assemblers, inspectors and testers	18%	18%	12%	12%	10%
94201 Electronics assemblers, fabricators, inspectors and testers	29%	25%	3%	<1%	<1%
94203 Assemblers, fabricators and inspectors, industrial electrical motors and transformers	*	23%	25%	*	*
95109 Other labourers in processing, manufacturing and utilities	1%	14%	6%	2%	<1%

* 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 seven occupations in the Kitchener-Waterloo-Barrie 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 management, 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 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 Kitchener-Waterloo-Barrie region will be directly affected by the shifts in assembly. Skill and labour shortages are expected to be less severe in the Kitchener-Waterloo-Barrie area than in other Ontario regions. The workforce in the area will have to manage some change in assembly patterns but the big investment in battery plants and the supply change is focused in other regions.

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 resource risks are not new to manufacturing in the regions, but the scale of EV related changes will 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 electric 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 (Kitchener-Waterloo-Barrie 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

Occupation (NOC21 code)
73300 Transport truck drivers
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.

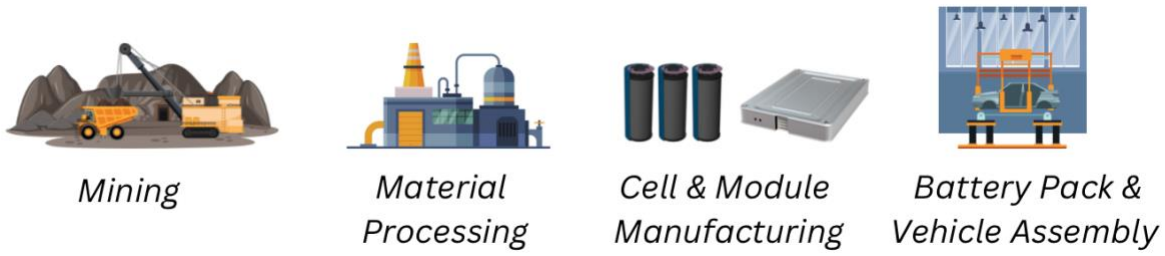
1. New EV production
2. Economic impacts across the supply chain
3. Labour market impacts by region and occupation

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 17. 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.

[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.

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.

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 ((Kitchener-Waterloo-Barrie region)

Expansion Demand	2026-30	2031-35	2036-40	2025-40
11200 Human resources professionals	0	10	0	0
13201 Production and transportation logistics coordinators	0	0	0	0
14400 Shippers and receivers	-10	10	0	-10
14402 Production logistics workers	0	0	0	0
20010 Engineering managers	0	10	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	10	0	10
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	10	20	0	20
21232 Software developers and programmers	10	10	0	10
21233 Web designers	0	0	0	0
21234 Web developers and programmers	0	0	0	0
21301 Mechanical engineers	20	50	-10	40
21310 Electrical and electronics engineers	10	20	0	30
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	10	0	0
22100 Chemical technologists and technicians	0	0	0	0

Expansion Demand	2026-30	2031-35	2036-40	2025-40
22220 Computer network and web technicians	0	0	0	0
22222 Information systems testing technicians	0	0	0	0
22301 Mechanical engineering technologists and technicians	0	10	0	-10
22302 Industrial engineering and manufacturing technologists and technicians	0	0	0	-10
22310 Electrical and electronics engineering technologists and technicians	0	10	0	10
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	0	0	0	0
72020 Contractors and supervisors, mechanic trades	0	0	0	0
72100 Machinists and machining and tooling inspectors	-10	10	0	-10
72101 Tool and die makers	-10	0	-10	-20
72106 Welders and related machine operators	-10	10	-10	-20
72201 Industrial electricians	10	30	-10	20
72400 Construction millwrights and industrial mechanics	0	20	-10	0
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	10	20	0	10
73300 Transport truck drivers	0	10	0	0
75101 Material handlers	0	40	-10	0
90010 Manufacturing managers	0	40	-10	10
92020 Supervisors, motor vehicle assembling	130	200	-40	240
92021 Supervisors, electronics and electrical products manufacturing	0	0	0	0
93101 Central control and process operators, petroleum, gas and chemical processing	0	0	0	0
94100 Machine operators, mineral and metal processing	0	0	0	0
94105 Metalworking and forging machine operators	0	0	0	-10
94106 Machining tool operators	-10	0	0	-10
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	100	380	-130	170
94201 Electronics assemblers, fabricators, inspectors and testers	0	10	0	0

Expansion Demand	2026-30	2031-35	2036-40	2025-40
94203 Assemblers, fabricators and inspectors, industrial electrical motors and transformers	10	10	0	30
94204 Mechanical assemblers and inspectors	10	20	0	20
94212 Plastic products assemblers, finishers and inspectors	0	0	0	0
94213 Industrial painters, coaters and metal finishing process operators	10	20	0	20
95100 Labourers in mineral and metal processing	0	0	0	0
95109 Other labourers in processing, manufacturing and utilities	-10	20	0	0

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 (Kitchener-Waterloo-Barrie region)

Replacement Demand	2026-30	2031-35	2036-40	2025-40
11200 Human resources professionals	50	60	60	180
13201 Production and transportation logistics coordinators	20	20	20	60
14400 Shippers and receivers	160	180	180	540
14402 Production logistics workers	10	10	10	30
20010 Engineering managers	90	100	100	300
20012 Computer and information systems managers	100	110	110	330
21101 Chemists	10	10	10	20
21211 Data scientists	0	0	0	0
21220 Cybersecurity specialists	10	10	10	30
21221 Business systems specialists	30	30	30	100
21222 Information systems specialists	220	250	250	770
21223 Database analysts and data administrators	20	20	20	70
21230 Computer systems developers and programmers	30	30	30	100
21231 Software engineers and designers	90	90	90	290
21232 Software developers and programmers	80	80	80	260
21233 Web designers	10	10	10	30
21234 Web developers and programmers	30	30	30	110
21301 Mechanical engineers	140	150	160	470

Replacement Demand	2026-30	2031-35	2036-40	2025-40
21310 Electrical and electronics engineers	150	170	170	500
21311 Computer engineers (except software engineers and designers)	30	30	30	90
21320 Chemical engineers	0	0	0	0
21321 Industrial and manufacturing engineers	20	30	30	80
22100 Chemical technologists and technicians	10	10	10	30
22220 Computer network and web technicians	40	50	50	150
22222 Information systems testing technicians	10	10	10	30
22301 Mechanical engineering technologists and technicians	80	90	90	260
22302 Industrial engineering and manufacturing technologists and technicians	80	90	90	280
22310 Electrical and electronics engineering technologists and technicians	70	80	80	230
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	40	50	50	140
72020 Contractors and supervisors, mechanic trades	10	20	20	50
72100 Machinists and machining and tooling inspectors	210	230	230	700
72101 Tool and die makers	140	160	160	470
72106 Welders and related machine operators	170	190	190	590
72201 Industrial electricians	60	80	80	230
72400 Construction millwrights and industrial mechanics	160	180	180	550
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	40	50	50	150
73300 Transport truck drivers	80	90	90	260
75101 Material handlers	400	450	450	1,370
90010 Manufacturing managers	360	400	400	1,210
92020 Supervisors, motor vehicle assembling	160	190	200	580
92021 Supervisors, electronics and electrical products manufacturing	10	10	10	30
93101 Central control and process operators, petroleum, gas and chemical processing	10	10	10	30
94100 Machine operators, mineral and metal processing	0	0	0	0
94105 Metalworking and forging machine operators	40	40	40	130
94106 Machining tool operators	80	90	90	270

Replacement Demand	2026-30	2031-35	2036-40	2025-40
94110 Chemical plant machine operators	0	0	0	0
94111 Plastics processing machine operators	130	150	150	440
94200 Motor vehicle assemblers, inspectors and testers	1,240	1,410	1,420	4,270
94201 Electronics assemblers, fabricators, inspectors and testers	30	30	30	100
94203 Assemblers, fabricators and inspectors, industrial electrical motors and transformers	30	40	40	110
94204 Mechanical assemblers and inspectors	10	20	20	50
94212 Plastic products assemblers, finishers and inspectors	30	40	40	110
94213 Industrial painters, coaters and metal finishing process operators	40	40	40	130
95100 Labourers in mineral and metal processing	40	50	50	140
95109 Other labourers in processing, manufacturing and utilities	230	260	260	800

New Entrants

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

Table 8. New entrants – detailed results (Kitchener-Waterloo-Barrie region)

New Entrants	2026-30	2031-35	2036-40	2025-40
11200 Human resources professionals	20	20	20	70
13201 Production and transportation logistics coordinators	20	20	20	70
14400 Shippers and receivers	70	70	70	220
14402 Production logistics workers	10	10	10	20
20010 Engineering managers	20	20	20	70
20012 Computer and information systems managers	20	20	20	70
21101 Chemists	10	10	10	30
21211 Data scientists	20	20	20	60
21220 Cybersecurity specialists	10	10	10	30
21221 Business systems specialists	20	20	20	60
21222 Information systems specialists	60	60	60	190
21223 Database analysts and data administrators	10	10	10	20

New Entrants	2026-30	2031-35	2036-40	2025-40
21230 Computer systems developers and programmers	40	40	30	120
21231 Software engineers and designers	150	140	130	450
21232 Software developers and programmers	140	130	130	430
21233 Web designers	10	10	10	30
21234 Web developers and programmers	70	70	70	220
21301 Mechanical engineers	130	130	120	400
21310 Electrical and electronics engineers	60	60	60	190
21311 Computer engineers (except software engineers and designers)	30	30	30	100
21320 Chemical engineers	20	20	20	50
21321 Industrial and manufacturing engineers	40	40	40	130
22100 Chemical technologists and technicians	10	10	10	30
22220 Computer network and web technicians	30	20	20	80
22222 Information systems testing technicians	10	10	10	30
22301 Mechanical engineering technologists and technicians	50	50	40	150
22302 Industrial engineering and manufacturing technologists and technicians	40	30	30	110
22310 Electrical and electronics engineering technologists and technicians	30	30	30	90
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	20	10	10	50
72020 Contractors and supervisors, mechanic trades	10	10	10	20
72100 Machinists and machining and tooling inspectors	60	60	50	180
72101 Tool and die makers	40	40	40	130
72106 Welders and related machine operators	100	100	90	320
72201 Industrial electricians	20	20	20	60
72400 Construction millwrights and industrial mechanics	40	40	40	120
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	20	20	20	60
73300 Transport truck drivers	20	20	20	60
75101 Material handlers	230	220	210	700
90010 Manufacturing managers	40	40	40	120
92020 Supervisors, motor vehicle assembling	40	40	40	120

New Entrants	2026-30	2031-35	2036-40	2025-40
92021 Supervisors, electronics and electrical products manufacturing	0	0	0	10
93101 Central control and process operators, petroleum, gas and chemical processing	10	10	10	30
94100 Machine operators, mineral and metal processing	10	10	10	30
94105 Metalworking and forging machine operators	30	30	30	100
94106 Machining tool operators	30	20	20	80
94110 Chemical plant machine operators	10	10	10	20
94111 Plastics processing machine operators	40	40	40	120
94200 Motor vehicle assemblers, inspectors and testers	550	530	510	1,700
94201 Electronics assemblers, fabricators, inspectors and testers	20	20	20	70
94203 Assemblers, fabricators and inspectors, industrial electrical motors and transformers	0	0	0	10
94204 Mechanical assemblers and inspectors	10	10	10	50
94212 Plastic products assemblers, finishers and inspectors	30	20	20	80
94213 Industrial painters, coaters and metal finishing process operators	30	30	30	100
95100 Labourers in mineral and metal processing	20	20	20	60
95109 Other labourers in processing, manufacturing and utilities	140	140	130	440

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 (Kitchener-Waterloo-Barrie region)

Recruitment Gap (#)	2026-30	2031-35	2036-40
11200 Human resources professionals	30	50	40
13201 Production and transportation logistics coordinators	<10	<10	<10
14400 Shippers and receivers	80	120	110
14402 Production logistics workers	<10	<10	<10
20010 Engineering managers	60	80	70

Recruitment Gap (#)	2026-30	2031-35	2036-40
20012 Computer and information systems managers	80	90	90
21101 Chemists	<10	<10	<10
21211 Data scientists	<10	<10	<10
21220 Cybersecurity specialists	<10	<10	<10
21221 Business systems specialists	10	10	10
21222 Information systems specialists	160	200	190
21223 Database analysts and data administrators	10	20	20
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
21233 Web designers	<10	<10	<10
21234 Web developers and programmers	<10	<10	<10
21301 Mechanical engineers	30	80	20
21310 Electrical and electronics engineers	100	130	110
21311 Computer engineers (except software engineers and designers)	<10	<10	<10
21320 Chemical engineers	<10	<10	<10
21321 Industrial and manufacturing engineers	<10	<10	<10
22100 Chemical technologists and technicians	<10	<10	<10
22220 Computer network and web technicians	20	30	20
22222 Information systems testing technicians	<10	<10	<10
22301 Mechanical engineering technologists and technicians	20	50	40
22302 Industrial engineering and manufacturing technologists and technicians	40	60	60
22310 Electrical and electronics engineering technologists and technicians	40	50	50
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	30	30	30
72020 Contractors and supervisors, mechanic trades	10	10	10
72100 Machinists and machining and tooling inspectors	140	180	170
72101 Tool and die makers	90	120	110
72106 Welders and related machine operators	60	110	90
72201 Industrial electricians	60	80	50
72400 Construction millwrights and industrial mechanics	120	160	140
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	30	50	30
73300 Transport truck drivers	60	70	70
75101 Material handlers	170	270	230
90010 Manufacturing managers	320	400	350

Recruitment Gap (#)	2026-30	2031-35	2036-40
92020 Supervisors, motor vehicle assembling	250	350	130
92021 Supervisors, electronics and electrical products manufacturing	<10	10	10
93101 Central control and process operators, petroleum, gas and chemical processing	<10	<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	50	70	60
94110 Chemical plant machine operators	<10	<10	<10
94111 Plastics processing machine operators	90	110	110
94200 Motor vehicle assemblers, inspectors and testers	790	1,260	780
94201 Electronics assemblers, fabricators, inspectors and testers	<10	20	10
94203 Assemblers, fabricators and inspectors, industrial electrical motors and transformers	40	40	40
94204 Mechanical assemblers and inspectors	10	20	<10
94212 Plastic products assemblers, finishers and inspectors	10	10	10
94213 Industrial painters, coaters and metal finishing process operators	20	30	10
95100 Labourers in mineral and metal processing	20	30	30
95109 Other labourers in processing, manufacturing and utilities	80	150	130

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 (Kitchener-Waterloo-Barrie region)

Recruitment Gap (% of 2022 Base Year Employment)	2026-30	2031-35	2036-40
11200 Human resources professionals	5%	7%	6%
13201 Production and transportation logistics coordinators	<1%	<1%	<1%
14400 Shippers and receivers	5%	8%	7%
14402 Production logistics workers	<1%	2%	1%

Recruitment Gap (% of 2022 Base Year Employment)	2026-30	2031-35	2036-40
20010 Engineering managers	8%	10%	9%
20012 Computer and information systems managers	6%	7%	7%
21101 Chemists	<1%	<1%	<1%
21211 Data scientists	<1%	<1%	<1%
21220 Cybersecurity specialists	<1%	1%	1%
21221 Business systems specialists	2%	4%	4%
21222 Information systems specialists	8%	9%	9%
21223 Database analysts and data administrators	7%	9%	9%
21230 Computer systems developers and programmers	<1%	<1%	<1%
21231 Software engineers and designers	<1%	<1%	<1%
21232 Software developers and programmers	<1%	<1%	<1%
21233 Web designers	<1%	<1%	<1%
21234 Web developers and programmers	<1%	<1%	<1%
21301 Mechanical engineers	1%	4%	1%
21310 Electrical and electronics engineers	8%	11%	9%
21311 Computer engineers (except software engineers and designers)	<1%	<1%	<1%
21320 Chemical engineers	<1%	<1%	<1%
21321 Industrial and manufacturing engineers	<1%	<1%	<1%
22100 Chemical technologists and technicians	1%	2%	1%
22220 Computer network and web technicians	3%	4%	4%
22222 Information systems testing technicians	<1%	1%	1%
22301 Mechanical engineering technologists and technicians	2%	5%	4%
22302 Industrial engineering and manufacturing technologists and technicians	5%	8%	7%
22310 Electrical and electronics engineering technologists and technicians	6%	8%	7%
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	6%	9%	8%
72020 Contractors and supervisors, mechanic trades	5%	8%	6%
72100 Machinists and machining and tooling inspectors	9%	11%	10%
72101 Tool and die makers	7%	10%	9%
72106 Welders and related machine operators	4%	6%	5%
72201 Industrial electricians	8%	12%	8%
72400 Construction millwrights and industrial mechanics	10%	13%	11%
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	5%	8%	4%
73300 Transport truck drivers	13%	16%	14%
75101 Material handlers	5%	7%	6%

Recruitment Gap (% of 2022 Base Year Employment)	2026-30	2031-35	2036-40
90010 Manufacturing managers	12%	16%	14%
92020 Supervisors, motor vehicle assembling	13%	18%	7%
92021 Supervisors, electronics and electrical products manufacturing	3%	8%	6%
93101 Central control and process operators, petroleum, gas and chemical processing	<1%	1%	<1%
94100 Machine operators, mineral and metal processing	<1%	<1%	<1%
94105 Metalworking and forging machine operators	<1%	2%	2%
94106 Machining tool operators	7%	10%	10%
94110 Chemical plant machine operators	<1%	<1%	<1%
94111 Plastics processing machine operators	8%	11%	10%
94200 Motor vehicle assemblers, inspectors and testers	7%	12%	7%
94201 Electronics assemblers, fabricators, inspectors and testers	1%	3%	2%
94203 Assemblers, fabricators and inspectors, industrial electrical motors and transformers	22%	25%	21%
94204 Mechanical assemblers and inspectors	3%	6%	<1%
94212 Plastic products assemblers, finishers and inspectors	2%	4%	4%
94213 Industrial painters, coaters and metal finishing process operators	3%	5%	2%
95100 Labourers in mineral and metal processing	5%	8%	8%
95109 Other labourers in processing, manufacturing and utilities	4%	6%	6%

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 18. 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%