FOCAL Initiative

ICEV TO EV WORKFORCE TRANSITION LABOUR MARKET FORECAST

MANITOBA - WINNIPEG 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

Manitoba and the Winnipeg region are in the early stages of a transition to decarbonization that will have a significant impact on heavy-duty vehicle manufacturing and related industries. Production processes and supply chains have begun to shift their focus from internal combustion engine vehicles (ICEVs) to electric vehicles (EVs).

FOCAL II has created a national, provincial and regional methodology for assessing the occupational and labour market impacts of this transition. This report considers the findings of this analysis and the implications for Manitoba and the Winnipeg region. 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 may experience relatively moderate or little impact if the tasks that they perform are not associated with the type of vehicle produced. Assessing occupation-level impacts can ensure that labour markets 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 Manitoba and the Winnipeg region, considering up to 45 occupations in 49 industries, across a forecast horizon from 2025 to 2040 (the analysis for Manitoba includes 45 occupations and the analysis for the Winnipeg region includes 40 occupations). The analysis measures a '*recruitment gap*' as the primary indicator of occupation-level impacts in this report. The recruitment gap incorporates labour market supply and demand dynamics that evolve across the transition. 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.

The FOCAL II process begins with announced plans for investments in new or reorganized production in vehicle assembly, battery production and the related supply chains. Results in each region identify occupations that will experience significant impacts. The magnitude and timing of impacts are unique for each occupation. Manitoba has not seen any new investment announcements yet, but the province is already a center for heavy-duty vehicle assembly and parts manufacturers. This role is certain to continue as many key employers adapt to the ICEV-EV transition. Other regions of Canada have new investments in assembly, battery production and their suppliers. As these changes begin in Manitoba, the pattern of investment and related labour market change will be reflected in local occupational impacts. Specific impacts are apparent in

occupation groups like management and supervision, skilled trades, engineering and related technicians and assemblers in motor vehicles, electrical and electronics and chemical production. This report assesses current and expected labour market conditions in Manitoba and the Winnipeg region, and determines local occupations and labour markets where skills shortages and training challenges can be expected as the ICEV-EV transition takes hold in Manitoba and the Winnipeg area.

Introduction

FOCAL I reports (published in 2021) highlighted the crucial role of a broader automotive industry across Canada and in Manitoba. 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[1]. 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 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 supply and related changes across the supply chain. This process measures 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;

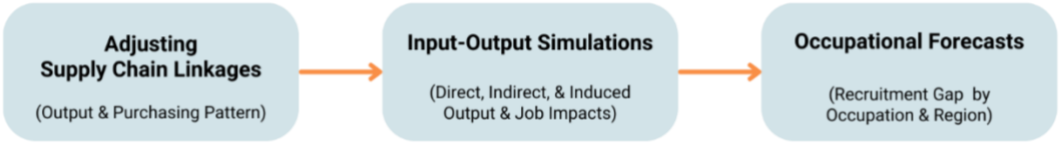
- a transition horizon from 2025 to 2040,
- 49 selected industries in,
- Canada, Ontario, Quebec, Manitoba and seven regions.

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, 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 45 key occupations in Manitoba and 40 key occupations in the Winnipeg region[2].

Figure 1 illustrates this three-step process.

Figure 1. Impact analysis steps



[1] *The Impact of EV Production on the Automotive Manufacturing Supply Chain: Sources, Methods and Findings, October, 2021*

[2] For this analysis, the Winnipeg region comprises the following Economic Regions (as defined by Statistics Canada): ER 4610 – Southeast, ER 4620 – South Central, ER 4640 – North Central, ER 4650 Winnipeg, ER 4660 - Interlake

Changes in employment across the transition will be sensitive to 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, government policy, and success in 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 base case scenario, combining features of the three different scenarios, is used for the labour market impact results.

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 heavy-duty vehicle assembly, parts production, battery assembly, related chemical and mineral processes and mining. Impacts are most disruptive in regions experiencing either new investments in battery plant and supply chain production or losses as internal combustion engines are phased out.

These impacts will be very apparent in Manitoba, as the economy has deep roots and major employers in heavy-duty vehicle production. Announced investments in new battery plants, and related additions across the supply chain make can be expected to alter labour market conditions in many occupations. Section 4 of the report identifies selected occupations, mostly along the supply chain for vehicle assembly and new battery production that face impacts in other provinces and regions. Labour market conditions in Manitoba are then assessed and potential impacts of the provincial ICEV-EV transition on occupations is assessed.

This introduction is followed by a background on the province of Manitoba and the Winnipeg region. Section 3 describes impacts across the ICEV-EV transition in key industries. Section 4 reports detailed impacts across 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 and a review of skills transferability matrices are included in appendices.

The ICEV-EV Transition in Manitoba – Background

The coming transition from ICEVs to EVs will have an impact across the province. In 2022, the provincial workforce of 651,700 included 63,200 working in manufacturing and 2,600 in the core automotive assembly and parts industries[3]. Vehicle assembly and related activity are important to the overall economic well being of the Manitoba and Winnipeg region economies. Nationally assembled motor vehicles and parts production consistently provides the top two or three exports from Canada; often second only to oil and gas extraction[4].

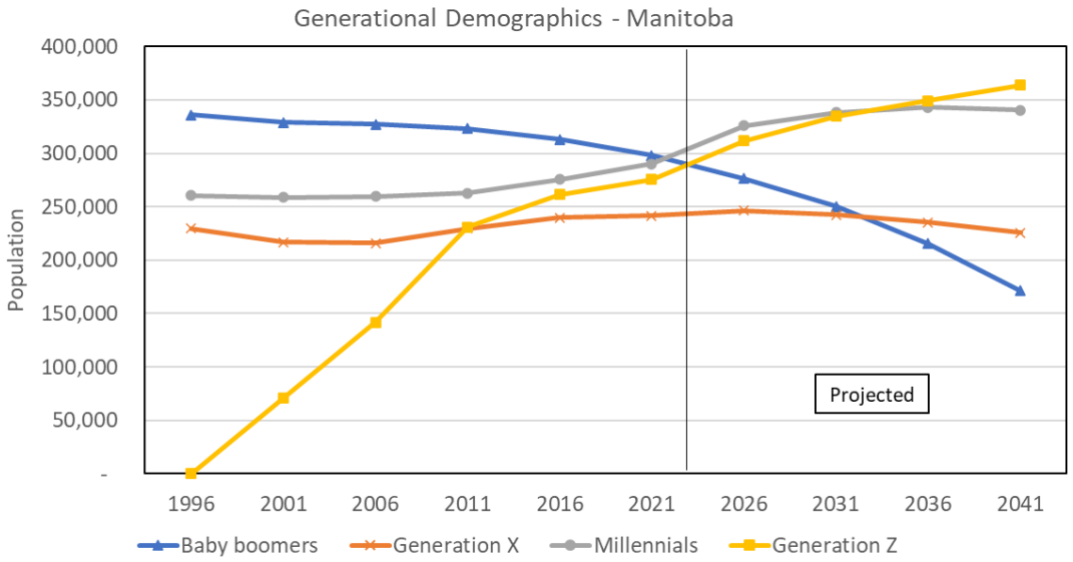
Relative to other industries, employers in manufacturing often identify human resources, skills shortages and recruiting as major challenges in business development. According to Statistics Canada:

> "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"[5].

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 5.0% in the total population of Manitoba and 3.6% 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 5.3% in Manitoba while the proportion of Baby Boomers decreased by 4.8%. As shown in Figure 2, it is expected that Millennials and Generation Z (born between 1997 and 2012) will outnumber Baby Boomers before 2026. [6]

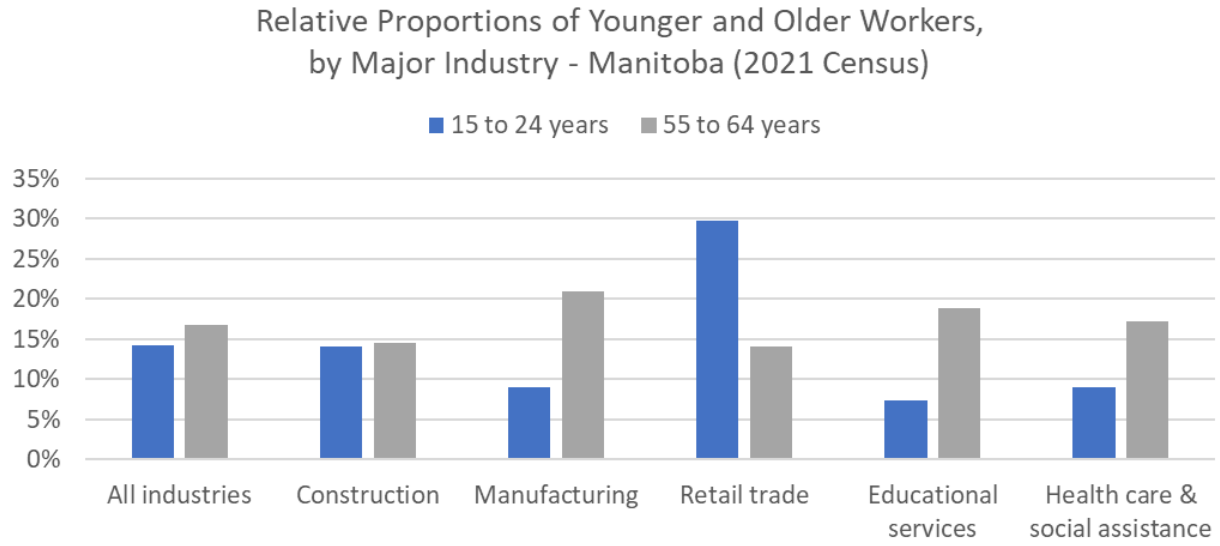
[3] Source: Statistics Canada Labour Statistics Consistent with the System of National Accounts (Table 36-10-0489-01)
[4] Source: Government of Canada Trade Data Online (https://ised-isde.canada.ca/site/trade-data-online/en).
[5] Source: 'Analysis on labour challenges in Canada, second quarter of 2023' https://www150.statcan.gc.ca/n1/pub/11-621-m/11-621-m2023009-eng.htm
[6] 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 Manitoba (Source: Statistics Canada)



Demographic trends are not consistent across industries. 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 Manitoba, 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 manufacturing is significantly higher than in other industries and recruitment challenges related to the retirement of older workers will persist.

Figure 3. Proportions of older and younger workers in major Manitoba 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 Manitoba grew from 2,500 workers in 2013 to 3,700 workers in 2019. Employment decreased by 10% from 2019 to 2020, partly due to COVID shutdowns[7]. 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)[8].

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. Manitoba has an established workforce in the 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 Manitob Region's broader automotive sector (Source: Statistics Canada, APRC)

Industry	Manitoba Employment in 2022	Winnipeg Region Employment in 2022
Automobile and light-duty motor vehicle manufacturing	0	0
Heavy-duty truck manufacturing	1,800	1,800
Parts manufacturing	900	900
Mining	2,200	600
Basic chemical manufacturing	3,700	2,300
Other material processing	700	500
Battery manufacturing	0	0
Management, scientific and technical consulting services	1,900	1,700

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

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

Industry	Manitoba Employment in 2022	Winnipeg Region Employment in 2022
Plastic product manufacturing	3,200	3,200
Other electronic product manufacturing	100	0
Semiconductor and other electronic component manufacturing	300	300
Iron and steel mills and ferro-alloy manufacturing	600	600
Foundries	700	700
Forging and stamping	0	0
Other automotive supply chain	19,800	18,400

The ICEV to EV transition will shift employment among the industries in the broader automative sector. The traditional economic role for these industries is clearly at risk as Manitoba must now compete for its place in the new world of EV production. Attention is focused on the crucial role of assembly and battery production in the new EVs. Manitoba's abundant and inexpensive hydro power helps to make it competitive in the global competition for battery production and investment in supplying industry capacity. Further evidence reported here suggests that an available and skilled workforce in some key occupations may also be a competitive advantage. 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, new battery plants and suppliers have announced plans for expansion in Ontario and Quebec. 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.

FOCAL II analysis of these plans can shed light on the possible ICEV-EV transition in Manitoba and the Winnipeg region. Manitoba has an established heavy-duty vehicle industry, with

experience in EV production and attention focuses on access to battery capacity for new electric vehicles. Providing the needed workforce and skills will be an important part of future growth.

Industry Impacts Across the ICEV - EV Transition

Analysis of announced investment and assembly plans can be extended to include the broader impact of these changes across the vehicle supply chain and then the overall Manitoba 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 heavy-duty vehicle assembly to suppliers and to customers. The FOCAL II analysis has customized the Canadian, Ontario and Quebec 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.[9] The Manitoba Input-Output table can be adjusted in the same way. 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

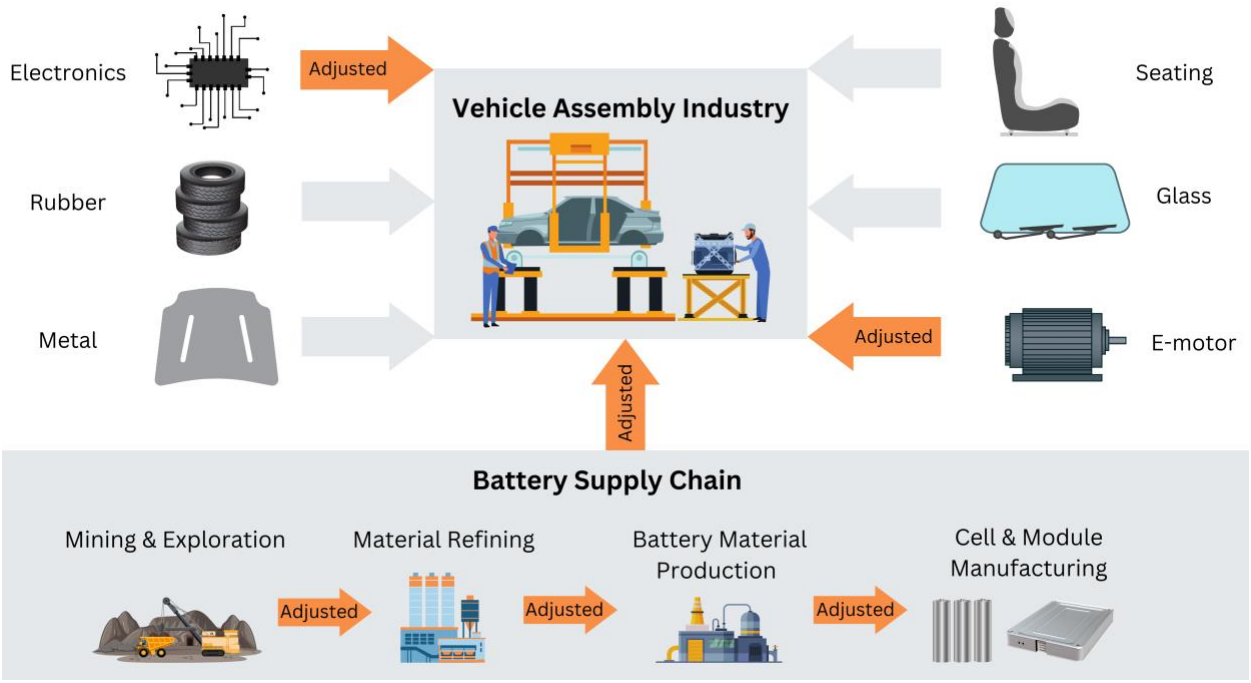
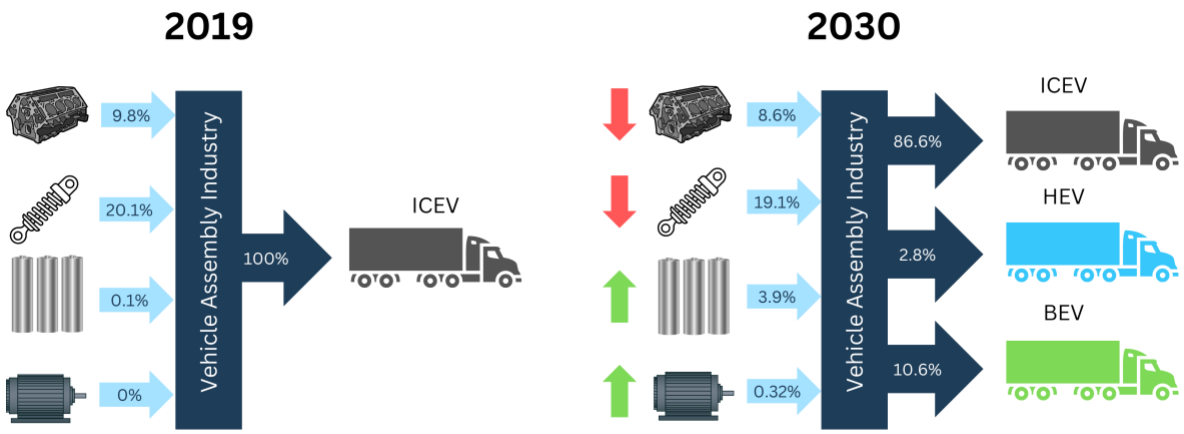


Figure 5 provides an example, taken from the IO model, of the changes that are imposed based on analysis of the core industry links from parts manufacturers to heavy vehicle assembly.

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

Changes in the distribution of inputs into heavy vehicle assembly, seen in the diagram, capture changes between 2019 and 2030 from the base case scenario. Similar changes might be expected in the Manitoba supply chain.

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 are introduced in the analysis across the transition period from 2025 to 2040 and in specific categories;

Vehicle assembly, by type;

- 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 for Canada, Ontario and Quebec 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. An equivalent scenario could be developed for Manitoba based on announced or projected heavy duty vehicle assembly, new battery plant plans, supply chain investments including chemical, mineral and mining production.

Base Case Scenario Assumptions

For Canada, Ontario and Quebec the base case scenario assumes a specific path in the transition from ICEVs to EVs. At the start of the transition, heavy 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 one third of heavy-duty vehicles produced are BEVs. For the impact analysis, the overall transition is reported in three intervals 2026 to 2030, 2031 to 2035, 2036 to 2040. The relative mix of ICEVs and EVs change from one interval to the next. Occupational impacts evolve accordingly.

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

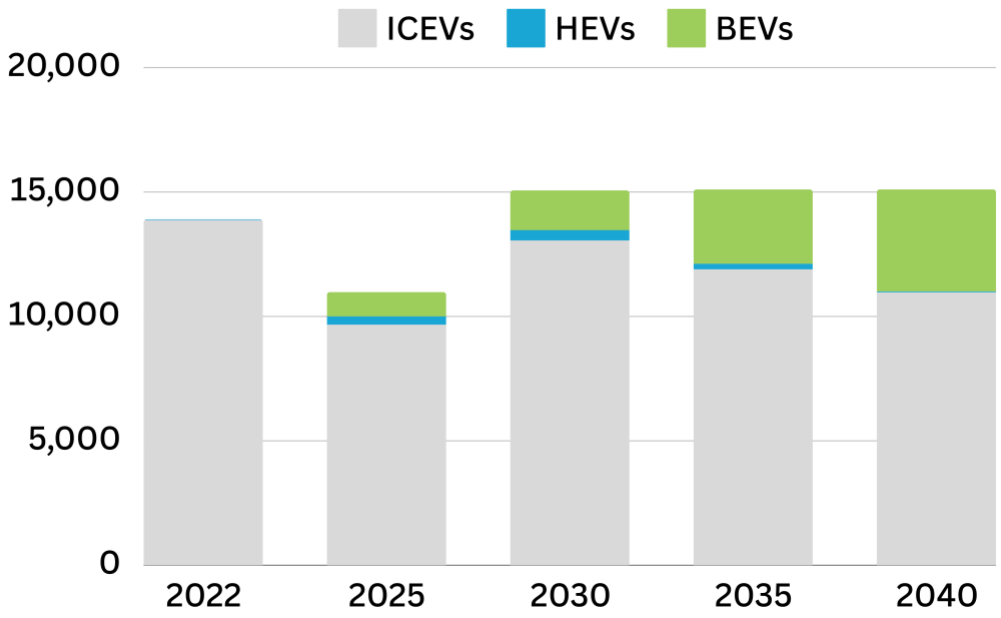


Figure 6 illustrates the transition in national heavy-duty vehicle production, expressed in units produced. The first column illustrates the production mix at the start of the transition.

Note that the number of heavy-duty vehicles assembled across the transition to 2040 stays roughly constant between 12,500 and 15,200. Further, the base case scenario reflects a slow pace of adoption of BEVs in the market, with BEV production increasing from less than 1% of total vehicle production in 2022 to nearly 33% 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 facility will be operating in Canada by 2040. Several chemical and material processing plants will be opening; building a longer and more robust supply chain that reaches back to mining new minerals. Much of this production will be located close to resource sources. 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).

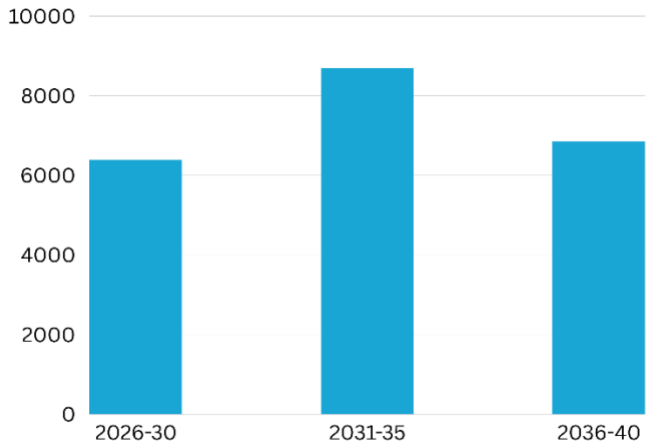
Table 2. Base case scenario - battery supply chain assumptions

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

Impacts Across Industries

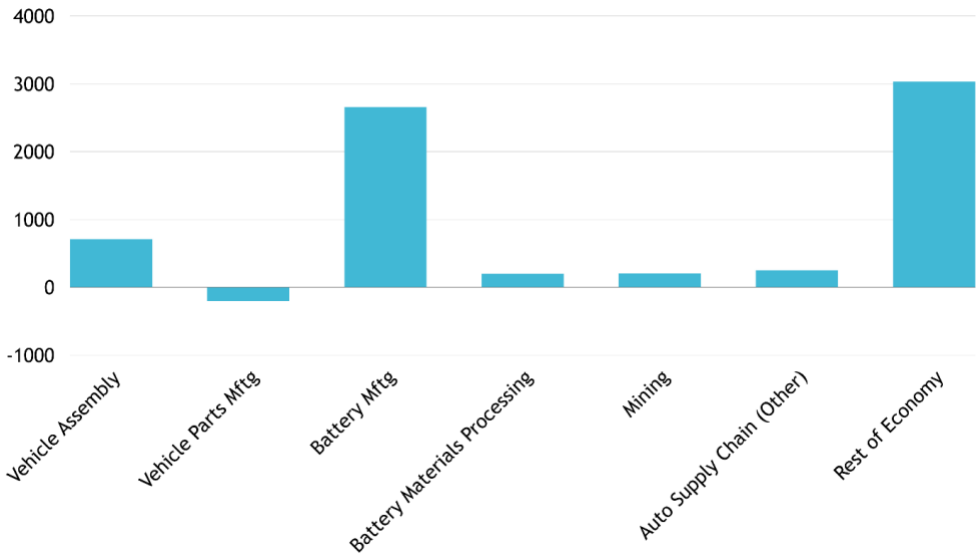
Figure 7 summarizes the total employment impacts in the base case scenario in three intervals across the transition. Quebec's experience is chosen as an example here as it more closely resembles what might be expected in Manitoba given the large role of heavy-duty vehicle production in both provinces. 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 internal combustion engines and related production. Impacts in Quebec peak at 8,700 jobs in the 2031 to 2035 period as battery operations ramp up.

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



A summary of total Quebec 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 heavy duty 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 modules, 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, Quebec



In the next section, these province-wide industry changes are allocated to occupations are interpreted in Manitoba and Winnipeg region labour markets. Labour market impacts are then assessed.

Labour Market Impacts by Occupations

This section of the report describes the impacts of the ICEV-EV transition on the labour markets in Ontario and Quebec, and implications for Manitoba and the Winnipeg region. 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 in key regions will face the biggest changes. Labour markets more distant from the investments, assembly plants, and key occupations in other industries face more limited impacts. Occupations that are working in the selected industries (listed in Appendix A) are included in this section.

Recruitment Gaps

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

Figure 9. Recruitment gap components

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

Replacement demand is the sum of exits from the workforce due to retirements and mortality. Trends in Ontario's population have created challenges for recruiting, especially related to Baby

Boomers (born between 1946 and 1965) who have been retiring in increasing numbers for more than a decade. These changes have focused human resource management on issues like succession planning and skills training. The last of the Baby Boomers turn 65 in 2030, so the wave of retirements will fade across the last ten years of the transition. This suggests lower recruitment gaps in occupations as they shift to younger age profiles.

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

The recruitment gap measure has been constructed to signal the overall effect of these changes across the transition as employment impacts are distributed among occupations. Future immigration patterns will play a large role in market conditions. *FOCAL II has created replacement demand estimates for Manitoba and the Winnipeg region across the transition intervals.*

Impacts on Occupations

FOCAL II results identify 24 occupations in Ontario, Quebec and six regions in the provinces that experience important changes in recruitment gaps at some point across the transition period. Large recruitment gaps for an occupation indicate the magnitude of the expected recruiting effort. These gaps suggest more acute recruiting pressures and potential skill shortages because the supply of workers will likely be insufficient to meet demand.

Impacts are measured in both the number of jobs altered across transition from 2025 to 2040 and as a percent of base year (2022) employment. Recruitment gaps are reported in three, five year intervals (2026-2030, 2032-2025 and 2036-2040). Data gathered to measure the recruitment gaps and components are from many sources. The analysis works with very detailed occupational definitions in regional labour markets. Working at this level of detail often means that data is limited by population size. In many cases it is necessary to impose reporting restrictions that suppress results in populations of fewer than 100 employed in a specific occupation and region. Data reliability diminishes at these levels.

For occupations with older age profiles, recruitment gaps may be increased 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.

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

FOCAL II results identify 24 occupations selected across all the regions where above-average recruitment gaps emerge 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. As Manitoba and the Winnipeg region move into the transition, all these labour market changes might be expected locally. Preparation for these impacts might include training programs, career promotion and targeted immigration.

In each province and region, direct impacts emerge at different periods across the three, five-year intervals. This pattern is determined by the assumed transition set out in the base case scenario. New jobs in battery and related activity generally peak in the 2031-2035 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 as regional economies embrace new activities.

Based on the results in regional labour markets in Ontario and Quebec, investments in new plants and shifts in the supply chain will likely impact the following 24 occupations in Manitoba and the Winnipeg region:

1. Engineering managers
2. Manufacturing managers
3. Supervisors, mining and quarrying
4. Supervisors, motor vehicle assembling
5. Supervisors, electronics and electrical products manufacturing
6. Supervisors, other products manufacturing and assembly
7. Electrical and electronics engineers
8. Electrical and electronics engineering technologists and technicians
9. Material handlers
10. Shippers and receivers
11. Machinists and machining and tooling inspectors
12. Welders and related machine operators
13. Tool and diemakers
14. Machining tool operators
15. Industrial electricians
16. Construction millwrights and industrial mechanics
17. Chemical technologists and technicians
18. Chemical plant machine operators
19. Labourers in chemical products processing and utilities
20. Inspectors and testers, mineral and metal processing

21. Motor vehicle assemblers, inspectors and testers
22. Electronics assemblers, fabricators, inspectors and testers
23. Assemblers, fabricators and inspectors, industrial electrical motors and transformers
24. Other labourers in processing, manufacturing and utilities

These 24 occupations cover several broad groups including; managers and supervisors, engineers and engineering technicians and technologists, skilled trades, assemblers, operators, labourers and support workers. There is also a clear division of impacts by industry across the supply chain. Impacts spread across vehicle assembly, parts, battery production, chemical and mineral suppliers and mining. Labour market impacts in each region are directly linked to the local participation in the ICEV-EV transition. For example, assembly impacts are strongest in Ontario's Golden Horseshoe and Kitchener-Waterloo-Barrie regions. Impacts from the new battery plants are biggest in the Windsor-Sarnia, London-Stratford-Bruce Peninsula and Montreal regions. Upstream impacts in chemical and mineral production are prominent in Quebec outside of the Montreal region.

Given these findings, Manitoba and the Winnipeg region can anticipate recruiting challenges that would result from new investment across these elements of the ICEV-EV transition.

FOCAL II findings can further guide provincial planning by assessing recruitment gap measures for Manitoba and the Winnipeg region. Table 3 assesses the possible impacts of the ICEV-EV transition in Manitoba and the Winnipeg region by noting both the base year level of employment in 2022 and recruitment gaps (for replacement demand and new entrants) expressed as a percent of base year employment. Recruitment gap measures are calculated as the average for three five-year intervals (2026-2030, 2031-2035,2036-2040). A benchmark measure for labour market pressures in the FOCAL II findings was recruitment gaps greater than 10% in any of the five-year intervals.

Table 3 provides results from a preliminary impact analysis of Manitoba and Winnipeg region labour markets, revealing occupations facing potential labour market limitations and shortages. Occupations listed in the first column of the table are expected to experience large recruitment gap impacts at some point in the ICEV-EV transition in Ontario and/or Quebec. Base year employment for each occupation in Manitoba and the Winnipeg region indicate the size of the available workforce. Note that data for some occupations (marked as 'N/A' in the table) are suppressed because of their smaller sized workforces in Manitoba and the Winnipeg region. Recruitment gaps are reported here as the average of the three, five-year intervals noted above.

Table 3. Base year employment and recruitment gap (% of 2022 base year employment), selected occupations, Manitoba and Winnipeg region

Occupation	Manitoba		Winnipeg Region	
	Workforce Size 2022	Recruitment Gap (Replacement Demand + New Entrants)*	Workforce Size 2022	Recruitment Gap (Replacement Demand + New Entrants)*
All selected occupations	35,600	13%	30,800	13%
Engineering managers	300	3%	300	4%
Manufacturing managers	700	9%	700	7%
Supervisors, mining and quarrying	200	11%	N/A	N/A
Supervisors, motor vehicle assembling	N/A	N/A	N/A	N/A
Supervisors, electronics and electrical products manufacturing	N/A	N/A	N/A	N/A
Supervisors, other products manufacturing and assembly	N/A	N/A	N/A	N/A
Electrical and electronics engineers	400	6%	400	6%
Electrical and electronics engineering technologists and technicians	300	4%	300	3%
Material handlers	1,500	7%	1,300	8%
Shippers and receivers	700	8%	700	7%
Machinists and machining and tooling inspectors	300	20%	300	20%
Welders and related machine operators	1,100	10%	1,000	14%
Tool and die makers	100	<1%	100	<1%
Machining tool operators	200	16%	200	16%
Industrial electricians	200	6%	100	8%
Construction millwrights and industrial mechanics	500	6%	300	5%
Chemical technologists and technicians	200	<1%	100	<1%
Chemical plant machine operators	200	6%	100	8%
Labourers in chemical products processing and utilities	N/A	N/A	N/A	N/A
Inspectors and testers, mineral and metal processing	N/A	N/A	N/A	N/A

Occupation	Manitoba		Winnipeg Region	
	Workforce Size 2022	Recruitment Gap (Replacement Demand + New Entrants)*	Workforce Size 2022	Recruitment Gap (Replacement Demand + New Entrants)*
Motor vehicle assemblers, inspectors and testers	400	15%	400	15%
Electronics assemblers, fabricators, inspectors and testers	100	12%	100	12%
Assemblers, fabricators and inspectors, industrial electrical motors and transformers	200	17%	200	18%
Other labourers in processing, manufacturing and utilities	500	4%	400	5%

*Average of three five-year intervals: 2026-2030, 2031-2035, 2036-2040

These initial results signal possible labour market challenges as the ICEV-EV transitions progresses across Manitoba. For example, note that several occupations have been suppressed as they have workforces with fewer than 100 workers in 2022. Industry plans to recruit for assembly, battery production or new supply chain capacity will create expansion demands that are not likely to be met from these limited labour pools. On the other hand, there are several occupations in Manitoba and the Winnipeg region where the available workforce may successfully meet the demands of ICEV-EV changes. In these cases, the recruitment gap in Manitoba and the Winnipeg region would fall well below average levels for these occupations in other labour markets. These would include;

- Engineering managers
- Manufacturing managers
- Electrical and electronic engineers
- Electrical and electronic engineering technicians and technologists
- Material handlers
- Shippers and receivers
- Industrial electricians
- Construction millwrights
- Chemical technologists and technicians
- Chemical plant operators
- Other labourers in processing, manufacturing and utilities

In contrast, labour markets in Manitoba and the Winnipeg region are expected to face high replacement demand pressures and limited access to new entrants for the following occupations;

- Supervisors in mining and quarrying
- Machinists and machining and tooling inspectors
- Machining tool operators
- Motor vehicle assemblers, inspectors and testers
- Assemblers, fabricators and inspectors, industrial electrical motors and transformers

It is important to note the last two occupations as this workforce dominates the critical vehicle assembly industry. Labour market changes across the transition are virtually certain and these initial estimates suggest recruiting issues in the labour market.

Implications for Recruiting and Job Search

This section draws out some implications and trends to be expected as labour markets in Manitoba and the Winnipeg region adapt to the transition from ICEV to EVs.
Results indicate that hiring challenges will be concentrated in management and supervision, engineering, skilled trades and assemblers in vehicle and battery production and the supply chain. Results for these occupations signal a risk of labour shortages in local Ontario and Quebec regions. These same impacts are anticipated for Manitoba and the Winnipeg region as the production of electric vehicles expands.

Impacts will involve different changes in employment and work conditions across industries and occupations. For example, impacts may be new jobs in battery plants or lost jobs in the ICEV supply chain. In contrast, 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 manufacturing, the impacts will often be in new jobs and skills, often in new plants.

There is a shift from industrial and mechanical to electrical engineers and engineering technicians and technologists, across the transition. There is a similar shift across the skilled trades. Expansion demand gains for machinists, tool and die makers, industrial electricians and millwrights reflect their prominence in the battery and related industries. But the reported employment impacts also include job losses for skilled trades as employment in the parts industry is eroded.

New investments in electrical, electronics and related chemicals and mineral production concentrate recruiting challenges among supervisors, technicians, operators and labourers. It may be the case that new processes and technologies will impact the skills and training needed across this workforce and there may be a case for programs to prepare the new workforce.
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 [10]. An example of a skills transferability matrix for the electronic assemblers, fabricators, inspectors and testers occupation is shown in Appendix D. 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.

These observations have been drawn from FOCAL II research of regional labour markets in Ontario and Quebec and can be applied in Manitoba and the Winnipeg region. Analysis of local conditions anticipates that there are several occupations, including assembly industry supervisors and workers, where labour shortages might be anticipated. At the same time there are other occupations, locally, where recruitment issues may be less of a concern than was found in Ontario and Quebec. These initial findings suggest opportunities to develop career promotion and training programs to prepare the work force for the transition. The availability of a skilled and experienced workforce is a major competitive advantage in the pursuit of new investments in vehicle assembly, battery production and added supply chain capacity in chemical, mineral processing and mining development.

Conclusions and Implications

The ICEV-EV transition, in the base case scenario, will create major disruptions in labour markets for several specific occupations in the motor vehicle assembly and related industries. As the transition continues, 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 investments are launched. Recruiting for management, engineering, skilled trades and assembly occupations will add to human resource 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.

10 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.

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 internal combustion 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.

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, 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 of Canada and Manitoba, in 2040, with a larger and partially adapted electric vehicle industry. Other FOCAL II scenarios show more dramatic success as assembly of EVs increases its share of markets and builds a larger and longer supply chain reaches back to new mining potential. Vehicle assembly is Canada's second most important export industry and opportunities described here set Manitoba on a track to participate in the transition.

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 (Manitoba and Winnipeg 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.

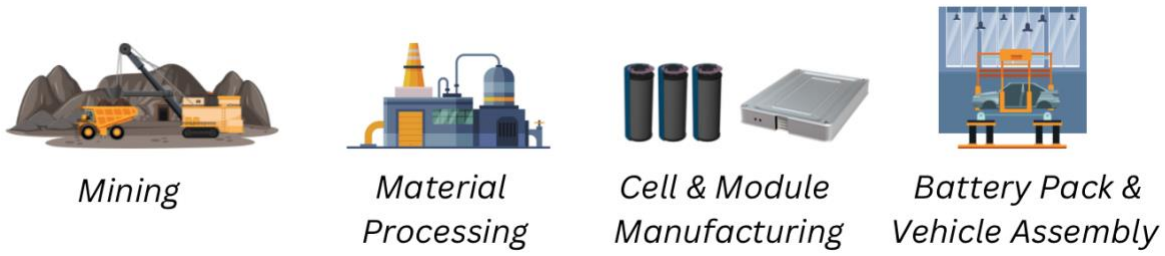
1. New EV production
2. Economic impacts across the supply chain
3. Labour market impacts by region and occupation

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 16.

Figure 10. 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[11]. 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.

[11] 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.

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.

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 (Montreal 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	10	10	0	10
14400 Shippers and receivers	20	10	-10	20
14402 Production logistics workers	0	0	0	10
20010 Engineering managers	20	10	-10	20
20012 Computer and information systems managers	10	10	0	10
21101 Chemists	10	10	0	10
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	10	0	0	10
21223 Database analysts and data administrators	0	0	0	0
21230 Computer systems developers and programmers	10	0	0	10
21231 Software engineers and designers	0	0	0	0
21232 Software developers and programmers	0	0	0	0
21233 Web designers	0	0	0	0
21234 Web developers and programmers	0	0	0	10
21301 Mechanical engineers	50	30	-20	50
21310 Electrical and electronics engineers	30	20	-10	30
21311 Computer engineers (except software engineers and designers)	0	0	0	0
21320 Chemical engineers	10	0	0	10
21321 Industrial and manufacturing engineers	10	0	0	10
21322 Metallurgical and materials engineers	0	0	0	0

Expansion Demand	2026-30	2031-35	2036-40	2025-40
22100 Chemical technologists and technicians	10	10	0	10
22220 Computer network and web technicians	10	0	0	10
22222 Information systems testing technicians	0	0	0	0
22301 Mechanical engineering technologists and technicians	20	10	-10	30
22302 Industrial engineering and manufacturing technologists and technicians	20	10	-10	30
22310 Electrical and electronics engineering technologists and technicians	40	30	-20	50
22312 Industrial instrument technicians and mechanics	0	0	0	0
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	10	0	0	10
72020 Contractors and supervisors, mechanic trades	0	0	0	0
72100 Machinists and machining and tooling inspectors	20	10	-10	20
72101 Tool and die makers	10	10	0	10
72106 Welders and related machine operators	40	10	-10	40
72200 Electricians (except industrial and power system)	10	0	0	10
72201 Industrial electricians	10	0	0	10
72400 Construction millwrights and industrial mechanics	30	20	-10	30
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	10	0	0	10
73300 Transport truck drivers	10	0	0	10
73400 Heavy equipment operators	10	0	0	10
75101 Material handlers	50	30	-20	50
83100 Underground production and development miners	0	0	0	0
90010 Manufacturing managers	50	30	-20	60
92021 Supervisors, electronics and electrical products manufacturing	10	10	0	10
92024 Supervisors, other products manufacturing and assembly	0	0	0	0
93101 Central control and process operators, petroleum, gas and chemical processing	10	10	-10	20

Expansion Demand	2026-30	2031-35	2036-40	2025-40
94100 Machine operators, mineral and metal processing	10	10	0	10
94101 Foundry workers	10	0	0	10
94104 Inspectors and testers, mineral and metal processing	0	0	0	0
94105 Metalworking and forging machine operators	0	0	0	0
94106 Machining tool operators	0	0	0	0
94110 Chemical plant machine operators	0	0	0	0
94111 Plastics processing machine operators	10	0	0	0
94200 Motor vehicle assemblers, inspectors and testers	40	-10	0	30
94201 Electronics assemblers, fabricators, inspectors and testers	50	40	-30	60
94203 Assemblers, fabricators and inspectors, industrial electrical motors and transformers	10	10	0	10
94204 Mechanical assemblers and inspectors	20	0	0	10
94212 Plastic products assemblers, finishers and inspectors	0	0	0	0
94213 Industrial painters, coaters and metal finishing process operators	10	0	0	10
95100 Labourers in mineral and metal processing	0	0	0	10
95102 Labourers in chemical products processing and utilities	20	10	-10	20
95109 Other labourers in processing, manufacturing and utilities	30	20	-10	30

Replacement Demand

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

Table 7. Replacement demand – detailed results (Montreal Region)

Replacement Demand	2026-30	2031-35	2036-40	2025-40
11200 Human resources professionals	140	160	160	460
13201 Production and transportation logistics coordinators	40	50	50	150
14400 Shippers and receivers	190	220	220	620
14402 Production logistics workers	0	0	0	0

Replacement Demand	2026-30	2031-35	2036-40	2025-40
20010 Engineering managers	120	130	130	380
20012 Computer and information systems managers	390	440	440	1,260
21101 Chemists	30	40	40	100
21211 Data scientists	0	0	0	10
21220 Cybersecurity specialists	30	30	30	90
21221 Business systems specialists	60	60	60	180
21222 Information systems specialists	710	800	800	2,310
21223 Database analysts and data administrators	60	70	70	210
21230 Computer systems developers and programmers	280	310	310	890
21231 Software engineers and designers	200	220	220	640
21232 Software developers and programmers	180	210	210	600
21233 Web designers	30	30	30	100
21234 Web developers and programmers	130	140	140	400
21301 Mechanical engineers	150	170	170	480
21310 Electrical and electronics engineers	200	230	230	660
21311 Computer engineers (except software engineers and designers)	80	90	90	250
21320 Chemical engineers	20	20	20	50
21321 Industrial and manufacturing engineers	40	50	50	140
21322 Metallurgical and materials engineers	10	10	10	20
22100 Chemical technologists and technicians	30	30	30	90
22220 Computer network and web technicians	170	200	200	570
22222 Information systems testing technicians	10	20	20	40
22301 Mechanical engineering technologists and technicians	80	100	100	280
22302 Industrial engineering and manufacturing technologists and technicians	50	50	50	150
22310 Electrical and electronics engineering technologists and technicians	240	270	270	790
22312 Industrial instrument technicians and mechanics	30	40	40	110
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	60	60	60	190
72020 Contractors and supervisors, mechanic trades	0	0	0	10
72100 Machinists and machining and tooling inspectors	270	310	310	890
72101 Tool and die makers	40	50	50	130

Replacement Demand	2026-30	2031-35	2036-40	2025-40
72106 Welders and related machine operators	230	260	260	760
72200 Electricians (except industrial and power system)	0	0	0	10
72201 Industrial electricians	10	10	10	30
72400 Construction millwrights and industrial mechanics	100	110	110	320
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	60	60	60	180
73300 Transport truck drivers	280	300	300	880
73400 Heavy equipment operators	40	40	40	120
75101 Material handlers	510	570	570	1,650
83100 Underground production and development miners	0	0	0	0
90010 Manufacturing managers	340	390	390	1,110
92021 Supervisors, electronics and electrical products manufacturing	10	10	10	20
92024 Supervisors, other products manufacturing and assembly	0	10	10	10
93101 Central control and process operators, petroleum, gas and chemical processing	10	10	10	30
94100 Machine operators, mineral and metal processing	40	50	50	130
94101 Foundry workers	30	40	40	110
94104 Inspectors and testers, mineral and metal processing	10	10	10	20
94105 Metalworking and forging machine operators	80	90	90	260
94106 Machining tool operators	50	60	60	170
94110 Chemical plant machine operators	60	70	70	200
94111 Plastics processing machine operators	270	300	300	870
94200 Motor vehicle assemblers, inspectors and testers	80	90	90	250
94201 Electronics assemblers, fabricators, inspectors and testers	260	290	290	840
94203 Assemblers, fabricators and inspectors, industrial electrical motors and transformers	30	30	30	100
94204 Mechanical assemblers and inspectors	10	10	10	20
94212 Plastic products assemblers, finishers and inspectors	80	90	90	260

Replacement Demand	2026-30	2031-35	2036-40	2025-40
94213 Industrial painters, coaters and metal finishing process operators	40	40	40	120
95100 Labourers in mineral and metal processing	10	10	10	20
95102 Labourers in chemical products processing and utilities	110	120	120	340
95109 Other labourers in processing, manufacturing and utilities	180	200	200	580

New Entrants

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

Table 8. New entrants – detailed results (Montreal Region)

New Entrants	2026-30	2031-35	2036-40	2025-40
11200 Human resources professionals	30	30	30	90
13201 Production and transportation logistics coordinators	20	20	20	70
14400 Shippers and receivers	50	50	50	170
14402 Production logistics workers	0	0	0	10
20010 Engineering managers	10	10	10	40
20012 Computer and information systems managers	30	30	30	100
21101 Chemists	10	10	10	20
21211 Data scientists	10	10	10	40
21220 Cybersecurity specialists	10	10	10	20
21221 Business systems specialists	20	10	10	50
21222 Information systems specialists	100	100	90	310
21223 Database analysts and data administrators	10	10	10	40
21230 Computer systems developers and programmers	100	90	90	300
21231 Software engineers and designers	70	70	60	220
21232 Software developers and programmers	140	140	130	430
21233 Web designers	20	20	20	50
21234 Web developers and programmers	130	130	120	410
21301 Mechanical engineers	60	60	50	170
21310 Electrical and electronics engineers	40	40	40	120
21311 Computer engineers (except software engineers and designers)	10	10	10	40

New Entrants	2026-30	2031-35	2036-40	2025-40
21320 Chemical engineers	10	10	10	20
21321 Industrial and manufacturing engineers	20	20	20	50
21322 Metallurgical and materials engineers	0	0	0	10
22100 Chemical technologists and technicians	10	10	10	20
22220 Computer network and web technicians	60	50	50	170
22222 Information systems testing technicians	50	50	50	150
22301 Mechanical engineering technologists and technicians	30	30	30	90
22302 Industrial engineering and manufacturing technologists and technicians	10	10	10	40
22310 Electrical and electronics engineering technologists and technicians	30	30	20	80
22312 Industrial instrument technicians and mechanics	0	0	0	10
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	10	10	10	30
72020 Contractors and supervisors, mechanic trades	10	10	10	20
72100 Machinists and machining and tooling inspectors	30	30	30	80
72101 Tool and die makers	0	0	0	10
72106 Welders and related machine operators	50	50	50	150
72200 Electricians (except industrial and power system)	10	10	0	20
72201 Industrial electricians	10	10	10	20
72400 Construction millwrights and industrial mechanics	30	20	20	80
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	10	10	10	40
73300 Transport truck drivers	20	20	20	50
73400 Heavy equipment operators	10	10	10	20
75101 Material handlers	100	100	90	310
83100 Underground production and development miners	0	0	0	10
90010 Manufacturing managers	20	20	20	80
92021 Supervisors, electronics and electrical products manufacturing	0	0	0	10

New Entrants	2026-30	2031-35	2036-40	2025-40
92024 Supervisors, other products manufacturing and assembly	0	0	0	10
93101 Central control and process operators, petroleum, gas and chemical processing	0	0	0	10
94100 Machine operators, mineral and metal processing	10	10	10	30
94101 Foundry workers	10	10	10	20
94104 Inspectors and testers, mineral and metal processing	0	0	0	10
94105 Metalworking and forging machine operators	10	10	10	30
94106 Machining tool operators	10	10	10	30
94110 Chemical plant machine operators	10	10	10	20
94111 Plastics processing machine operators	30	30	30	110
94200 Motor vehicle assemblers, inspectors and testers	10	10	10	30
94201 Electronics assemblers, fabricators, inspectors and testers	20	20	20	50
94203 Assemblers, fabricators and inspectors, industrial electrical motors and transformers	0	0	0	10
94204 Mechanical assemblers and inspectors	10	10	10	20
94212 Plastic products assemblers, finishers and inspectors	10	10	10	20
94213 Industrial painters, coaters and metal finishing process operators	10	10	10	30
95100 Labourers in mineral and metal processing	10	10	0	20
95102 Labourers in chemical products processing and utilities	20	20	20	70
95109 Other labourers in processing, manufacturing and utilities	30	30	30	90

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 (Montreal Region)

Recruitment Gap (#)	2026-30	2031-35	2036-40
11200 Human resources professionals	120	130	130
13201 Production and transportation logistics coordinators	40	30	30
14400 Shippers and receivers	150	170	160
14402 Production logistics workers	<10	<10	<10
20010 Engineering managers	120	130	120
20012 Computer and information systems managers	370	410	400
21101 Chemists	30	30	30
21211 Data scientists	<10	<10	<10
21220 Cybersecurity specialists	20	20	20
21221 Business systems specialists	40	50	50
21222 Information systems specialists	620	710	710
21223 Database analysts and data administrators	50	60	60
21230 Computer systems developers and programmers	190	220	220
21231 Software engineers and designers	130	150	150
21232 Software developers and programmers	50	70	80
21233 Web designers	10	20	20
21234 Web developers and programmers	<10	10	20
21301 Mechanical engineers	140	140	100
21310 Electrical and electronics engineers	190	210	180
21311 Computer engineers (except software engineers and designers)	60	70	70
21320 Chemical engineers	10	20	10
21321 Industrial and manufacturing engineers	30	40	30
21322 Metallurgical and materials engineers	<10	<10	<10
22100 Chemical technologists and technicians	30	30	20
22220 Computer network and web technicians	130	150	140
22222 Information systems testing technicians	<10	<10	<10
22301 Mechanical engineering technologists and technicians	80	80	60
22302 Industrial engineering and manufacturing technologists and technicians	60	50	30
22310 Electrical and electronics engineering technologists and technicians	250	270	230
22312 Industrial instrument technicians and mechanics	30	40	30
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	50	60	50
72020 Contractors and supervisors, mechanic trades	<10	<10	<10
72100 Machinists and machining and tooling inspectors	270	290	270
72101 Tool and die makers	50	50	40

Recruitment Gap (#)	2026-30	2031-35	2036-40
72106 Welders and related machine operators	220	230	210
72200 Electricians (except industrial and power system)	<10	<10	<10
72201 Industrial electricians	10	10	<10
72400 Construction millwrights and industrial mechanics	100	100	80
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	50	50	50
73300 Transport truck drivers	270	290	280
73400 Heavy equipment operators	40	40	30
75101 Material handlers	460	500	460
83100 Underground production and development miners	<10	<10	<10
90010 Manufacturing managers	360	390	340
92021 Supervisors, electronics and electrical products manufacturing	10	10	<10
92024 Supervisors, other products manufacturing and assembly	<10	<10	<10
93101 Central control and process operators, petroleum, gas and chemical processing	20	20	<10
94100 Machine operators, mineral and metal processing	40	40	30
94101 Foundry workers	30	40	30
94104 Inspectors and testers, mineral and metal processing	<10	<10	<10
94105 Metalworking and forging machine operators	70	80	80
94106 Machining tool operators	50	50	50
94110 Chemical plant machine operators	60	60	60
94111 Plastics processing machine operators	240	270	270
94200 Motor vehicle assemblers, inspectors and testers	110	70	70
94201 Electronics assemblers, fabricators, inspectors and testers	290	310	250
94203 Assemblers, fabricators and inspectors, industrial electrical motors and transformers	40	40	30
94204 Mechanical assemblers and inspectors	20	<10	<10
94212 Plastic products assemblers, finishers and inspectors	70	80	80
94213 Industrial painters, coaters and metal finishing process operators	40	40	30
95100 Labourers in mineral and metal processing	10	<10	<10
95102 Labourers in chemical products processing and utilities	100	100	90
95109 Other labourers in processing, manufacturing and utilities	170	190	160

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 (Montreal Region)

Recruitment Gap (% of 2022 Base Year Employment)	2026-30	2031-35	2036-40
11200 Human resources professionals	7%	8%	8%
13201 Production and transportation logistics coordinators	4%	4%	3%
14400 Shippers and receivers	6%	7%	6%
14402 Production logistics workers	2%	1%	<1%
20010 Engineering managers	10%	11%	9%
20012 Computer and information systems managers	8%	9%	9%
21101 Chemists	8%	8%	6%
21211 Data scientists	<1%	<1%	<1%
21220 Cybersecurity specialists	3%	4%	4%
21221 Business systems specialists	4%	5%	5%
21222 Information systems specialists	8%	9%	9%
21223 Database analysts and data administrators	6%	7%	7%
21230 Computer systems developers and programmers	4%	5%	5%
21231 Software engineers and designers	3%	4%	4%
21232 Software developers and programmers	1%	1%	1%
21233 Web designers	2%	2%	2%
21234 Web developers and programmers	<1%	<1%	<1%
21301 Mechanical engineers	5%	5%	4%
21310 Electrical and electronics engineers	9%	10%	8%
21311 Computer engineers (except software engineers and designers)	4%	5%	5%
21320 Chemical engineers	4%	4%	2%
21321 Industrial and manufacturing engineers	4%	4%	3%
21322 Metallurgical and materials engineers	2%	3%	3%
22100 Chemical technologists and technicians	8%	8%	6%
22220 Computer network and web technicians	4%	4%	4%
22222 Information systems testing technicians	<1%	<1%	<1%
22301 Mechanical engineering technologists and technicians	6%	6%	5%

Recruitment Gap (% of 2022 Base Year Employment)	2026-30	2031-35	2036-40
22302 Industrial engineering and manufacturing technologists and technicians	7%	7%	4%
22310 Electrical and electronics engineering technologists and technicians	12%	13%	11%
22312 Industrial instrument technicians and mechanics	19%	21%	21%
72010 Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations	9%	10%	9%
72020 Contractors and supervisors, mechanic trades	<1%	<1%	<1%
72100 Machinists and machining and tooling inspectors	10%	11%	10%
72101 Tool and die makers	15%	15%	13%
72106 Welders and related machine operators	8%	9%	8%
72200 Electricians (except industrial and power system)	2%	1%	<1%
72201 Industrial electricians	4%	3%	1%
72400 Construction millwrights and industrial mechanics	6%	7%	5%
72410 Automotive service technicians, truck and bus mechanics and mechanical repairers	7%	6%	6%
73300 Transport truck drivers	17%	18%	17%
73400 Heavy equipment operators	11%	11%	9%
75101 Material handlers	9%	10%	9%
83100 Underground production and development miners	1%	<1%	<1%
90010 Manufacturing managers	13%	14%	12%
92021 Supervisors, electronics and electrical products manufacturing	7%	7%	1%
92024 Supervisors, other products manufacturing and assembly	1%	1%	1%
93101 Central control and process operators, petroleum, gas and chemical processing	8%	7%	<1%
94100 Machine operators, mineral and metal processing	5%	6%	4%
94101 Foundry workers	9%	10%	8%
94104 Inspectors and testers, mineral and metal processing	1%	2%	2%
94105 Metalworking and forging machine operators	10%	11%	11%
94106 Machining tool operators	7%	8%	7%
94110 Chemical plant machine operators	12%	14%	13%
94111 Plastics processing machine operators	12%	13%	13%
94200 Motor vehicle assemblers, inspectors and testers	16%	10%	10%
94201 Electronics assemblers, fabricators, inspectors and testers	18%	19%	15%
94203 Assemblers, fabricators and inspectors, industrial electrical motors and transformers	16%	17%	12%
94204 Mechanical assemblers and inspectors	8%	<1%	<1%

Recruitment Gap (% of 2022 Base Year Employment)	2026-30	2031-35	2036-40
94212 Plastic products assemblers, finishers and inspectors	13%	14%	14%
94213 Industrial painters, coaters and metal finishing process operators	7%	6%	5%
95100 Labourers in mineral and metal processing	2%	2%	<1%
95102 Labourers in chemical products processing and utilities	9%	9%	8%
95109 Other labourers in processing, manufacturing and utilities	11%	12%	10%

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 11. 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%