JUNE 2023

Ready for Green Jobs

How ready are Canadian regions to attract and support the skilled workforce needed to reach climate targets and drive clean growth?

Smart Prosperity Institute | PLACE Centre Smart Prosperity Institute | Future Skills Centre Centre des Compétences futures

About the PLACE Centre

The PLACE Centre, which stands for Propelling Locally Accelerated Clean Economies, focuses on the complex challenges limiting clean economic growth in Canadian communities. Our core approach is "place-based," meaning the PLACE team works with all levels of government, industry, and civil society organizations to ensure regions across Canada have the solutions needed to overcome the challenges they face in advancing clean economic growth. With this approach, the PLACE team can create practical, place-based recommendations where everyone involved can collaborate and work towards making progress in solving these problems. That way, every region and community across the country can be included in, and benefit from, Canada's growing clean economy.
placecentre.smartprosperity.ca

About Smart Prosperity Institute

Smart Prosperity Institute is a national research network and policy think tank based at the University of Ottawa. We deliver world-class research and work with public and private partners—all to advance practical policies and market solutions for a stronger, cleaner economy.
institute.smartprosperity.ca

About the Future Skills Centre

The Future Skills Centre (FSC) is a forward-thinking centre for research and collaboration dedicated to driving innovation in skills development so that everyone in Canada can be prepared for the future of work. We partner with policymakers, researchers, practitioners, employers and labour, and post-secondary institutions to solve pressing labour market challenges and ensure that everyone can benefit from relevant lifelong learning opportunities. We are founded by a consortium whose members are Toronto Metropolitan University, Blueprint, and The Conference Board of Canada, and are funded by the Government of Canada's Future Skills Program.

Acknowledgements

The authors of this report are Teslin Augustine, Mykensie Kendrick, Abdullah Khan, John McNally, Grace Newcombe, Chinweizu Okeke, and Nicholas Renzetti. Hem Dholakia provided editing, analytical, writing support, and insights. Analysis was conducted by Navius Research's Michael Wolenitz and Kjartan Jaccard. The authors would like to thank Jonathan Arnold, Derek Eaton, and the team at Future Skills Centre for their comments and insights. This report does not necessarily reflect the views of the funder or any of the reviewers. Any errors remain the sole responsibility of the authors.

Suggested citation

Augustine, T., Kendrick, M., Khan, A., McNally, J., Newcombe, G., Okeke, C. & Renzetti, N. (2023). *Ready for Green Jobs: How ready are Canadian regions to attract and support the skilled workforce needed to reach climate targets and drive clean growth?* The PLACE Centre. Smart Prosperity Institute.

June 2023

With support from

Future Skills Centre | Centre des Compétences futures

Canada

PLACE Centre
Smart Prosperity Institute

The report *Ready for Green Jobs: How ready are Canadian regions to attract and support the skilled workforce needed to reach climate targets and drive clean growth?* is funded by the Government of Canada's Future Skills Program. The opinions and interpretations in this publication are those of the author and do not necessarily reflect those of the Government of Canada.

Abbreviations

AB	Alberta
AIP	Atlantic Immigration Program
BC	British Columbia
CMA	Census Metropolitan Area
ERP	Emissions Reduction Plan
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IRCC	Immigration, Refugees and Citizenship Canada
MB	Manitoba
Mts	Megatonnes
NAICS	North American Industry Classification System
NB	New Brunswick
NL	Newfoundland and Labrador
NOC	National Occupation Classification
NS	Nova Scotia
OECD	Organization for Economic Cooperation and Development
ON	Ontario
PEI	Prince Edward Island
PNPs	Provincial Nominee Programs
PWD	Population-Weighted Density
QC	Quebec
SPI	Smart Prosperity Institute
SK	Saskatchewan

TABLE OF CONTENTS

List of Tables

List of Figures

Executive summary

Canada's next decade will feature a number of major trends, but few will offer more positive outlooks for Canada's economic prosperity than clean economic growth. In the next seven years, advancing projects alongside designing, selling, operating, and maintaining goods and services that reduce greenhouse gas (GHG) emissions will create tens to hundreds of thousands of jobs across the country. Sectors like construction, manufacturing, transportation, agriculture, and forestry can expect billions in new investment as regions benefit from their ambitions to reduce GHG emissions.

For Canada's workforce, this presents an opportunity. Discussions of how this upcoming climate action and clean growth will impact the workforce usually focus on stories of job loss or uncertain outlooks for skilled workers. Yet our analysis shows that, as climate action advances, individuals looking for stable and attractive careers will have no shortage of options across the country in sectors like manufacturing, construction, forestry and the growing utilities sector. Overall, Canada's clean economy could create up to 300,000 jobs within the next seven years.[1] Building projects that reduce Canada's domestic GHG emissions will produce many of these roles. Meanwhile, developing and manufacturing low-carbon exports for Canadian companies to sell into international markets will be the other main source of job creation. These jobs will primarily be in occupations and industries that exist today, with workers applying a combination of new and existing skills to projects designed to reduce GHG emissions.

With this in mind, Canada's clean economy workforce story is not about growing entirely new sectors from nothing. Rather, it is about workers advancing emissions-reducing projects in existing sectors and regions and gradually learning new skills to advance these projects. To realize this vision, Canada must navigate two primary challenges. First, workers must have the required skills to fill these roles and work on these new projects. This report identifies several trends that are likely to impact skills needs in specific sectors and occupations, some of which are driven by climate action and others that are not. For example, in agriculture, trends such as greater use of machinery, corporate consolidation of farmland, and increased demand for sustainability practices are driving a need for farm managers to be digitally literate, possess strong business skills (such as managerial and Human Resources skill sets), and have greater knowledge of biological and physical sciences.[2] Whether driven by climate action or not, all of these trends will be relevant for clean growth. Additionally, individuals working in jobs created by climate action will likely not work solely on projects that improve environmental performance (i.e., "green" projects). Many will work on a variety of green and non-green projects, such as electricians installing heat pumps one day and working on new affordable housing projects the next or architects designing both mass timber and conventional steel-and-concrete structures for clients. Ensuring all individuals working in the sectors detailed in this report (agriculture, construction, forestry, manufacturing, mining, oil and gas, transportation, and utilities) have the skills needed to advance clean growth will be critical.

The second challenge is that sectors and regions will need to ensure they can fill these new roles. This is no small task—skilled labour shortages are already seen as chronic and are only expected to worsen as Canada's aging workforce experiences more retirements in the coming years. With job opportunities expected to grow from climate action, these factors mean that

even more work is needed to attract, train, and retain workers in these growing sectors if Canada is to meet its climate ambitions. One example is that clean growth could create between 56,000–146,000 jobs in construction. Yet the sector already faces a worker shortage of almost 90,000 individuals, meaning the true need for new workers will likely be much higher in the next decade. Manufacturing and clean energy face similarly positive growth outlooks, but each will also need to address its current workforce deficits. Even in sectors where decreases in labour demand are expected, such as agriculture, the risk of not having enough workers remains. High levels of job vacancies and a workforce with almost three times as many workers over the age of 55 as there are workers under 35 means the agricultural sector would need to attract many more workers to fill expected roles by 2030—workers who would need to pioneer projects and practices around sustainable agriculture, clean technology, and regenerative farming.

Regions will need to ensure they have the proper supports in place to attract and support growth in their workforces. 80% of Canada's labour force growth is due to immigration.[3] Policymakers must consider the factors that matter most to these individuals when they are deciding where to move and work: accessible and affordable housing in alignment with local wage levels, the presence of family and friends, attractive career prospects in growing sectors, and creating a "thick" local labour market by attracting more people and businesses. This report identifies how well positioned each province is to offer these supports to several clean economy roles that will be created by 2030, assigning a grade from A to D. Overall, no Canadian province currently has an "A" grade on their ability to attract and support skilled workers in the clean economy, as seen in **Table 1**.

Table 1: Grading of provinces on regional readiness

	Career prospects*	Housing affordability	Presence of family and friends	Population density	Overall grade
AB	C	C	B	B	C
BC	B	D	A	A	B
MB	C	C	B	C	C
NB	C	B	D	D	C
NL	C	A	D	B	C
NS	D	D	C	D	D
ON	B	D	A	A	B
PEI	C	B	D	C	C
QC	C	B	A	A	B
SK	B	A	C	D	C

**For specified occupations in the construction and utilities sectors that will grow as a result of climate action by 2030.*

Key findings from this report

- **Overall, climate action and clean growth in Canada could create approximately 28,000–300,000 new jobs within the next seven years.** The overall outlook for Canada's economy will vary based on levels of trade, supply chain disruptions, and global economic growth. In the most favourable scenarios, supply chain disruptions will be minimal and global growth and trade will be strong. In the least favourable scenario, levels of trade will be lower, and Canada's status as a trading nation will result in a weaker economic outlook. Even if this latter scenario occurs, the country could still create tens of thousands of new jobs through significant investments in construction and clean energy. Scenarios with lower levels of job creation see high volatility in job figures—with some sectors experiencing large job losses and others experiencing large job growth—that offer fewer overall jobs created.
- **Across all potential futures, job growth is expected in construction, clean energy, and forestry.** The construction sector experiences significant job growth in every scenario modelled in this report and could create between 56,000–146,000 new jobs by 2030. Clean energy jobs grow in ten of the thirteen provinces and territories across Canada in all scenarios in the next seven years, with forestry jobs following a similar trajectory. Even in Alberta and Saskatchewan, two oil-producing provinces, construction could create twice as many new jobs as the combined oil and gas production, distribution and services sectors. Clean energy jobs are also expected to grow at a faster rate than job growth in oil and gas.
- **Job vacancies are most pronounced in the construction and manufacturing sectors, and least pronounced in utilities, mining, and oil and gas.** Combined, the construction and manufacturing sectors face a worker shortfall of almost 170,000 workers. Yet, in some futures, the two sectors could create over 300,000 jobs. When coupled with the prospect for growth, labour shortages will be a severe challenge Canada must overcome if it is to achieve its clean economy objectives.
- **It is unhelpful to think of workers or jobs as being "green" or "non-green."** Rather, clean growth will create new projects that will mostly be completed by workers in existing occupations in a range of sectors. Workers will need to apply a wide range of skills to many different projects, some of which will reduce GHG emissions and others that may not. For example, an electrician or architect may install heat pumps in residential homes or design a mass timber structure one day and work on a completely different project that does not offer environmental improvements the next. A more helpful way to think about the impacts of climate action on the workforce is by identifying how clean economy projects will influence the skills workers need to do their jobs, as well as consider how regions looking to grow their workforce can better attract and support the skilled talent required to fill the emerging roles that will help fulfil their climate ambitions.
- **Expected retirements by 2030 are highest in the agriculture, forestry, manufacturing, and transportation sectors.** The ratio of younger workers (25–34 years old) to older workers (55+ years old) is most significant in the agriculture and forestry, manufacturing, and transportation sectors. With these sectors also seeing job growth in many of the scenarios, the challenge of meeting 2030 workforce needs intensifies. Businesses will not only have to find additional workers for the new jobs created, but also replace retiring workers.
- **Severe labour shortages could make it more difficult to meet climate targets.** If roles go unfilled, there are consequences beyond difficulties in hiring. Projects may face delays, incur cost overruns, not be completed, or be outright cancelled. These impacts reduce the attractiveness of projects for private investors, as they increase costs, can slow development timelines, or even threaten a company's capacity to fulfill operational requirements. A recent survey[4] found that 62% of Canadian manufacturers lost or had to turn down commercial contracts or faced production delays due to worker shortages. The same manufacturing survey referred to above found that 43% of the manufacturers had to postpone or altogether cancel capital projects because of labour shortages. These trends could counter-act many of the beneficial impacts of policies aimed at supporting greater investment into producing and adopting clean technologies. Therefore, a macroeconomic consequence of advancing fewer projects could be that Canada makes less progress on emissions reductions, and climate targets go unmet.
- **Even sectors where job declines are expected will still need to attract new workers as retirements increase.** Even for agriculture, where decreases in labour demand are expected, the number of available workers may not prove sufficient to fill all available jobs, given that the sector has almost three times more workers over 55 years old than those under 35. This will prove a challenge to adopting new practices in the coming years and supporting any new sources of economic growth within the sector. Ultimately, there is a clear need for almost all sectors, even those where overall employment is expected to decline, to recruit new talent.
- **British Columbia, Ontario, and Quebec are currently best positioned to attract and support clean economy talent.** All three provinces score highly on career prospects, presence of family and friends, and population-weighted density (PWD). However, for British Columbia and Ontario, the positive scores are offset somewhat by the housing affordability gap for workers in the construction and utilities sectors, which receive low scores because of unaffordable housing in these provinces. Quebec's low score on career prospects brings its aggregate grade to a B.

- **Nova Scotia is currently the least well-positioned province to support the growth of its clean economy talent** and scored the lowest of any province, receiving a "D" grade. With increasing home prices in and around the Halifax Regional Municipality, a less favourable outlook for jobs, and lower-than-average expected wage growth, the province is least well-positioned to attract and support skilled labour.
- **Alberta, Manitoba, New Brunswick, Newfoundland and Labrador, Saskatchewan, and PEI all score an aggregate C grade on being well positioned to attract and support skilled workers,** but for different reasons. Alberta scores relatively poorly on housing affordability and career prospects; Manitoba receives low grades in all but the presence of family and friends factor; New Brunswick receives low grades in all but housing affordability; Newfoundland and Labrador receives high grades in housing affordability and population density, but obtains low grades in career prospects and presence of family and friends; Saskatchewan receives high grades in housing affordability and career prospects, but gets low grades in the other two factors; and PEI receives low grades in all but housing affordability.
- **Housing unaffordability across Canada will hold back clean growth, despite higher-than-average wages.** There is no single province where housing levels are affordable enough that salaries generated from clean growth jobs put home ownership within reach. Lack of home affordability and ownership is not related to compensation levels within the clean economy, which studies have noted are higher than average within sectors.[5] Rather, this is a by-product of Canada's unaffordable home ownership and rental markets, given that it is seen in every province.

This report identifies the following steps to help workers better adapt to changes in skills needs, help sectors grow their workforces, and ensure regions can attract and support skilled workers:

Recommendation #1: Canada should remain committed to meeting its 2030 climate target, which will create jobs regardless of what occurs globally.

Recommendation #2: Ensure all training and education programs for sectors included in this analysis incorporate foundational "green literacy" skills that workers will need, focusing on social and emotional skills which are necessary for all sectors and scenarios.

Recommendation #3: Develop place-based sectoral strategies to help grow the workforce and equip workers with the necessary skills, as well as create new skill training models to pair alongside the strategies that act as innovative intermediaries responsible for funding and coordinating.

Recommendation #4: Invest in place-based clean growth opportunities in regions that will be hit hardest by global trends, building on work done by the Government of Canada's Regional Energy and Resource Tables.

Recommendation #5: Create more regional programs like the Atlantic Immigration Program (AIP) and structure Provincial Nominee Programs (PNPs) to lower associated costs and broaden the focus to attract immigrants with skilled trades experience.

Recommendation #6: Fund more sector and region-specific programs aimed at lowering barriers to accessing jobs for equity-deserving groups.

Recommendation #7: Create incentives and lower regulatory barriers to enable the building of more housing, with the goal of improving affordability for renting and home ownership. Specific changes include changing land-use rules and reintroducing accelerated depreciation rates for rental housing units.

Introduction

Canada's clean economy is set to grow. In fact, meeting the country's ambitious 2030 and 2050 climate targets for reducing greenhouse gas (GHG) emissions could catalyze hundreds of billions in new investment and position Canada as a competitive player in a number of critical opportunities.[6] This growth is already happening. Major investments in opportunities like zero emissions vehicle manufacturing are being driven into communities like Windsor and St. Thomas, ON. And over $30 billion CAD in capital has been pledged to hydrogen production opportunities around the Edmonton, AB region. These are just two examples of the many sets of opportunities that Canadian communities could realize in the coming years.

Future clean growth could create hundreds of thousands of new jobs.[7] In just the next seven years, industries like construction, clean energy, manufacturing, and forestry look well-positioned to create tens of thousands of new roles in provinces across the country. For Canada's workforce, this presents a tremendous opportunity. Workers looking for stable and attractive careers working on clean economy projects will have no shortage of options in these growing industries. And despite mainstream discussions, many of these jobs will not be entirely novel occupations or be the result of full-scale reinventions of our current industries. Rather, they will primarily be in occupations and industries existing today, with workers applying a combination of new and existing skills to projects designed to reduce GHG emissions.

This distinction, which our report unpacks, is a critical one. Ultimately, Canada's clean economy workforce story is not about growing entirely new sectors from nothing; it is about workers advancing projects in many existing sectors and regions while learning new skills to advance these projects along the way. The analysis in this report identifies that, in many sectors, the need for more workers will grow, with some futures potentially leading to the creation of hundreds of thousands in industries like manufacturing and construction. However, this positive finding still represents a challenge—skilled labour shortages are already being seen as chronic and are expected to worsen as Canada's aging workforce experiences more retirements in the coming years. These trends mean that more work is needed to attract, train, and retain workers in these growing sectors if Canada is to meet its climate ambitions. Sectors and regions will need to ensure they become more attractive to workers to appeal to skilled talent and offer what matters most to skilled workers looking to fill roles in the opportunities each will have in the coming years.

This challenge is one Canada is well positioned to meet, but supporting future workers will require first understanding how many jobs will be created, what skills may be required, and what will matter to workers in making decisions about their careers. This report tries to answer all three of these questions. It focuses first on the labour demand challenge by unpacking the scale of skilled workers needed in different sectors for Canada to successfully meet its 2030 climate targets and advance clean growth in a time of global economic uncertainty. This section also identifies what skills these workers will need. The report then focuses on the challenge of labour supply by examining how existing worker shortages and impending retirements could affect each sector or region's ability to meet this new growth in labour demand. Once these current and upcoming challenges are better understood, this report then identifies how well-positioned regions across the country are to attract and retain skilled workers in the industries expected to grow in that region. This

report considers the needs of workers advancing climate and clean economy projects to be similar to the needs of any worker in a sector rapidly adopting and scaling new technologies: they need affordable housing, access to skills training and education, healthy career prospects, and social networks to plug into. All of these factors will be needed for Canada to attract and retain the required talent to advance clean growth. The last factor (the presence of family/friends) is especially relevant in an era of labour shortages, as workers will have many opportunities to choose from and are more likely to settle in regions where they already have family and friends or are close to existing urban centres. This analysis of attractiveness, focussed on growing occupations in construction and clean energy (which are representative of the clean economy workforce), is followed by identifying the strengths and areas of improvement for each province across the country. This report concludes by combining the labour supply and demand discussions to offer recommendations on how workers, sectors, and regions can take steps to realize the potential benefits of climate action, meet their climate targets, and better support workers.

In an era of uncertainty around the direction of our economy, the cost of living, and the future of work, climate action and clean growth can offer a positive story on all three fronts. Clean growth will create jobs and attract investment in regions across the country. But steps will need to be taken to ensure workers, sectors, and regions are well-positioned to thrive in the decades to come.

Report overview

This report starts by assessing Canada's labour demand needs, both in terms of jobs and skills needs, as the country meets its 2030 climate target. This report models the amount of economic activity generated if Canada meets the upper range of its 2030 climate targets (40% reduction in GHG emissions by 2030). To incorporate greater uncertainty into this analysis, the report models four global scenarios in which Canada meets its 2030 climate targets. These scenarios are differentiated by levels of global trade and potential disruptions the world could experience from future armed conflicts, natural disasters, or pandemics. This differentiation allows for identifying how different global futures might impact climate action in Canada, even if domestic policy remains unchanged and the emissions reduction target is met. All of these trends will affect Canada's clean economy workforce, and understanding how each trend might affect job creation is pivotal to unpacking where job growth or decline can be expected in provinces across the country. The report then identifies how skills could change as a result of climate action and clean growth in key sectors across the economy. Next, this report examines the state of Canada's labour supply (i.e., how ready are regions and sectors to meet this growing demand). This report compares these national and regional workforce changes to existing vacancies and expected retirements within key sectors. This analysis of labour shortages, both current and prospective, allows for an understanding of which sectors could face challenges in growing their workforce in the years to come. This report then identifies the priorities that will matter most to workers looking for careers in these growing sectors and focuses on how well-positioned each province is to support workers as industries grow, change, and new skills needs emerge. This report assesses the provinces on their ability to support and grow their workforce to respond to climate action and clean growth based on four factors identified through a literature review of which region-specific criteria matter most to immigrants when making career decisions. The time and cost associated with entering growing occupations for new entrants to Canada are also considered to ensure significant barriers to entry within occupations set to grow in this report are identified and compared across different provinces. Finally, this report ends by combining the labour demand and supply discussions by identifying steps policymakers could take to better support workers, sectors, and regions in a decarbonizing Canada. The analysis in this report is outlined throughout this work and in greater detail in the **Technical Appendix**.

How will climate action and clean growth impact the workforce?

Taking ambitious climate action will substantially impact workers nationwide. To understand why, consider the level of action and ambition required to meet Canada's 2030 federal climate target, a critical component of advancing clean growth in the next decade. Canada's most recent reporting on its GHG emissions showed that national emissions were roughly 672 megatonnes (Mts) in 2020.[8] To meet the upper end of the country's current 2030 climate target (a 40% reduction of emissions from 2005 levels by 2030), emissions need to decrease by approximately 229 Mts below 2020 levels. Assuming that 2020 emissions levels are roughly equal to emissions levels in 2023, this equates to an annual average GHG reduction of over 30 Mts in the next seven years to reach this federal target. The scale of action required is unprecedented, given that Canada has never reduced this many emissions in a single year, let alone for seven consecutive years. It will require changes in the technologies we use, the processes we employ, and the decisions we make, all of which will impact jobs and skills needs.

Adopting these new solutions at scale will require changes in jobs in the economy and the skills workers use in these jobs. Our analysis shows that, in most sectors, much of the job growth will be in existing occupations. However, many of the activities completed in these occupations will change. Given this shift, workers will now have a wider range of activities they conduct as part of their occupation. For example, an electrician may install residential heat pumps in the morning and wire new homes at a construction site in the afternoon. This addition in tasks will require workers to be flexible and possess a wide range of skills to apply to both "green" and "non-green" projects (i.e., projects that offer improvements in environmental performance and those that do not).

To support the job growth needed to meet climate targets, two major challenges need to be addressed by 2030. First, there is a need to upskill workers to ensure they have the skills needed to fill emerging roles. This upskilling is critical to ensure workers in a wide range of roles receive the additional skills needed to complete new activities associated with clean growth projects. Upcoming analysis from the PLACE Centre has identified many of the skills gaps that need to be targeted, allowing for workers to build on existing foundational skill sets they already have rather than fully retrain.[9] Second, there is a need to attract sufficient workers to fill vacant roles. As previously noted, labour shortages may pose challenges for future projects, and workers will be needed to fill open positions within the decade. By addressing skills changes and attracting and supporting workers, policy-makers can ensure the workforce is well prepared to support the scale of change needed to advance climate action and drive clean growth.

Which trends will shape the outlook for the workforce as the clean economy grows?

To conduct this analysis and thoroughly understand job creation generated from climate action and clean growth however, this report must consider more than Canada's policy choices. If this analysis were only to examine how reducing emissions in Canada could impact jobs, the picture provided would leave out many trends that will affect where jobs are created, which jobs are created, and what challenges need to be navigated in supporting those who will fill these roles. Additional factors and details are essential for planning to support the workforce and are therefore included in this report.

First, certain international factors will influence where, when, and which jobs are created in Canada from clean growth. This is because future jobs created will vary based on which projects are built and where they are built. And project investment decisions are heavily shaped by several factors determined mainly by the actions of stakeholders outside Canada's borders. These factors include: the price and availability of key commodities and inputs; the cost of deploying decarbonizing technologies such as electric vehicles, solar panels, and wind turbines; access to international markets (heavily shaped by levels of global trade); and the ambition of climate action taken internationally. Each of these distinct yet interconnected factors influence which projects are more attractive to invest in, both regionally and relative to one another. Suppose the costs of commodities such as oil and gas are high, but critical minerals costs are low, and innovation has driven down the cost of zero-emissions vehicles. The investment outlook for transportation is very different than if the inverse were true. These changes can significantly influence whether jobs are created in construction roles setting up new charging infrastructure for vehicles or in sectors connected to reducing emissions from fossil fuel production, as just two examples.

Second, there are domestic trends beyond climate policies, such as existing labour shortages, an aging workforce, housing affordability, and immigration, that are directly linked to the current and future state of the workforce. If these trends continue on their current trajectories, they will deepen future workforce needs in critical occupations, including many skilled trades.[10] Sectors of the Canadian economy where decarbonization-driven jobs are expected to be created in the coming years are already facing skilled labour shortages.[11] Canada is not alone in this. Globally, there is a skilled labour shortage in several sectors, and some estimates suggest that the global shortage will be as much as 85 million workers by 2030.[12] Additionally, Canada's workforce is aging, and recent years have seen a rapid increase in the proportion of workers that have reached retirement age (persons aged 65 and over).[13] This demographic shift is due to a combination of lower fertility rates and a wave of retirements of "baby boomers" (persons born between 1946 and 1965).[14] Additionally, about 22% of working-age persons in Canada are between 55 and 64 years old and are expected to be leaving the workforce as 2030 approaches.[15] An aging workforce is a particularly acute problem in sectors where jobs are expected to be created in the coming years, as the demand for workers is likely to increase at a time when the supply of workers is declining.

This report integrates these international and domestic factors to analyze the scale of Canada's future workforce challenges. International factors such as technology cost and availability,

the costs of commodities, and global ambitions to reduce GHG emissions are considered in the modelling estimates of the jobs created through investments in climate action and the clean economy by 2030. Domestic factors, such as impending retirements and existing levels of job vacancies, are detailed by sector to offer insights into how prepared each sector is to support growth and how current trends could impact the acuteness of future workforce needs. One factor not included in this analysis is the specific role that automation may have on the workforce. This choice is primarily because this analysis assesses job creation within the next seven years, and this report does not expect that automation will have a profoundly transformative impact on many occupations detailed in this work within this time frame. However, the model used in this report incorporates innovation rates into its calculations, meaning there is still some consideration of how technological changes could impact labour demand.

Modelling 2030 workforce needs

The first step in understanding the impacts regions and sectors will experience through clean growth is to identify how many jobs will be created or destroyed. To conduct this analysis, this report conceptualizes four scenarios or futures. All four scenarios modelled in this report assume that Canada will meet its 2030 climate targets through pledged climate policies from federal and provincial governments. The complete list of policies included in this modelling is outlined in **Appendix 1**. One key limitation of this analysis is that it does not include several of the tax credits introduced in the 2023 Federal Budget, as the analysis was completed before the credits were introduced.[16] However, it is expected that the $20.9 billion CAD pledged for tax credits in manufacturing, carbon capture and storage, clean electricity, and hydrogen will support job creation in a number of sectors identified in this report, although it is currently unclear how many additional jobs these incentives will create beyond what this report already captures.

The four scenarios, shown in **Figure 1**, represent global outlooks Canada could face this decade and are defined by two trends: 1) changes in trade cooperation, and 2) disruptions to the global economy from conflict, pandemics, and natural disasters. These two trends will influence the costs, availability, and performance of the solutions available to Canada as the country acts to reduce emissions. For example, low levels of multilateral trade cooperation might make new clean technology innovations inaccessible to Canadian governments and companies if nations choose to hold onto key technologies for political or security reasons. Meanwhile, high levels of trade cooperation will improve access to cleantech. Low international ambition to reduce GHG emissions may slow the rate at which clean technology costs fall, thereby slowing overall adoption rates of existing technologies.

Similarly, disruptions to the global economy and events could impact the price or availability of key commodities, divert the world's attention away from climate action, lower global climate ambition, and significantly impact Canada's 2030 decarbonization pathway. The ongoing Russia-Ukraine conflict and COVID-19 are recent examples of events that have disrupted the global economy. Mitigating climate change, investing in climate adaptation, or cooperating with other nations to develop key decarbonizing technologies could take a back seat to the more urgent need to increase military spending or deal with a global pandemic.[17] Given Canada's economic role as a country whose wealth is primarily based on exports within a stable trade environment, these factors greatly matter and will likely have a meaningful impact on the country's choices in reducing its GHG emissions.

Figure 1: Scenarios for 2030 labour market modelling

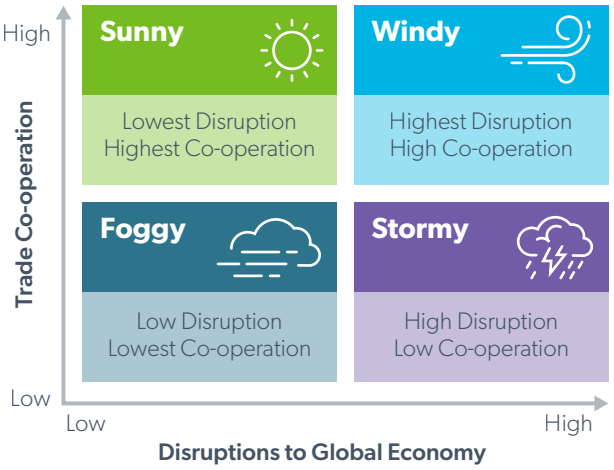


Figure 1 represents four scenarios. The sunny scenario sees the lowest disruption and highest cooperation; windy sees the highest disruption and high trade cooperation; stormy sees high disruption and low cooperation; and foggy sees low disruption and lowest cooperation.

The four scenarios in this report, modelled using Navius Research's gTech model, are titled **Sunny**, **Windy**, **Stormy**, and **Foggy**. Sunny sees the lowest levels of disruption and the highest levels of trade cooperation; Windy sees the highest level of disruption and high levels of trade cooperation; Stormy sees high levels of disruption and low trade cooperation; and Foggy sees low levels of disruption and the lowest relative levels of trade co-operation. **Box 1** provides details on these scenarios as well as their potential implications for climate action in Canada. In each scenario, these two trends influence a number of variables, including:

- **Overall economic prosperity**: The economic prosperity in various scenarios is measured using the variation of growth rates for Canada's Gross Domestic Product (GDP) between 2022 and 2030. The rates range from 1.5%/year–3%/year by 2030. These GDP assumptions were inputted into the model as changes in the labour force and labour productivity by province.
- **Multilateral climate cooperation**: The level of climate cooperation is represented in the scenarios by varying the cost of emerging GHG abatement technologies and the presence of border carbon adjustments. These technologies include direct air capture, carbon capture and storage, low GHG steel, and small modular nuclear reactors.
- **Multilateral trade**: Differences in future levels of multilateral trade impact the price of raw materials, such as metals and critical minerals, that are inputs used to manufacture technologies such as zero-emissions vehicles and wind and solar electricity generation. In gTech, multilateral trade is partially represented by varying the costs of these commodities and thereby, the costs of GHG abatement technologies.
- **Energy costs**: Oil and gas prices will vary depending on the level of disruption and trade cooperation. For Canada, higher energy costs in lower-carbon energy sources relative to fossil fuel-based sources could make decarbonization less fiscally attractive and delay spending decisions on clean economy projects, which, in turn, could mean fewer jobs in the decarbonizing sectors. However, the inverse is also true, where more costly oil and gas make decarbonization more immediately attractive for end users. In gTech, varying energy costs are represented using different crude oil and natural gas price forecasts for Canada's various global futures.
- **Food prices**: The future price of agricultural commodities will vary depending on fluctuations in trade cooperation and disruptions to the global economy. gTech varies the cost of four key agricultural commodities—corn, canola, soybean, and wheat—between the four scenarios to analyze the impact of changing food prices on sectoral outputs, energy investment decisions, and subsequent domestic labour needs.

Detailed discussions on the gTech model used to model these scenarios, each of the four scenarios, the assumptions used in the modelling, and the variables considered for the modelling can be found in **Appendices 1–4**.

Box 1: Overview of scenarios modelled in this report

Sunny (Low Disruption, High Cooperation): This scenario sees the lowest levels of disruption and the highest levels of trade cooperation. Disruptions to the global economy will largely cease before the middle of the decade and that the world will not experience another major conflict or pandemic between now and 2030. In this future, there will be very high levels of global trade cooperation resulting in the free flow of goods and services between international borders. For climate action in Canada, this means that metals and minerals costs alongside food prices are at their lowest compared to the other scenarios, making investments in renewable energy sources and alternative fuels such as biofuels more attractive. There is also a higher likelihood of technology sharing and alignment on climate objectives between nations, leading to lower costs for GHG abatement technologies such as wind turbines and solar panels as they are adopted at scale.

Windy (High Disruption, High Cooperation): In this scenario, the world experiences ongoing and new disruptions to the global economy until the end of the decade as well as high levels of multilateral trade (albeit lower than in the Sunny scenario). Trade around goods and services relevant to managing disruptions, such as trade in weapons, energy, food, and other conflict-related goods and services, will be high. Countries will likely not be on track to meet their GHG emissions reduction targets. In response, Canada will implement a border carbon adjustment scheme to preserve its domestic competitiveness. Additionally, countries will have low levels of technology sharing for low-carbon solutions since their focus will be on managing ongoing disasters rather than reducing GHG emissions. This circumstance will increase the costs of GHG abatement technologies for Canada.

Stormy (High Disruption, Low Cooperation): This scenario is characterized by high levels of disruption and low trade cooperation. Ongoing disruptions to the global economy will continue until the latter half of the decade. This could mean a continuation of the Russia-Ukraine conflict or the emergence of another conflict on a global scale. International trade will slow down considerably as domestic rebuilding following disasters or war takes precedence over international climate action. In this scenario, food and energy costs are at their highest. High energy costs and economic volatility will stimulate greater investment into fossil fuel production. Meanwhile, high food costs will increase the cost of biofuels as an alternative fuel source, increasing the costs of reducing emissions from sectors where biofuel use could have otherwise offered lower-cost reductions.

Foggy (Low Disruption, Low Cooperation): This scenario sees low levels of disruption and the lowest relative levels of trade cooperation. Current ongoing conflicts, such as the Russia-Ukraine conflict, will be resolved by mid-decade, and there will not be any other major disruptions to the global economy between now and 2030. International trade will slow as countries focus more on domestic or regional economic challenges. Instead, trade will become more regional in nature (i.e., between neighbouring nations or trade blocs). Climate action will also reflect this shift in trade, with countries forming smaller regional blocs through which ambitions to reduce GHG emissions are advanced. In response to low levels of cooperation and to protect the interests of members of its new "climate club," Canada will implement a border carbon adjustment scheme on parties outside the bloc's borders. Technology costs decline moderately as technology sharing occurs between bloc members, and commodity prices stabilize at 2021 levels. However, levels of technology sharing are low internationally, which is also reflected in the costs of zero-emissions technologies.

How many workers will Canada need to reach 2030 climate goals?

This analysis presents results for sectors that will explicitly be affected by emissions reductions. These sectors are broadly classified into eight categories, further described in **Table 2**: agriculture, forestry, construction, manufacturing, mining, oil and gas, transportation, and utilities. **Appendix 4** details the North American Industry Classification System (NAICS) codes under each sector's categories.

Table 2: Sector descriptions used in this report

#	Sector	Description
1	Agriculture	Includes farming; agriculture services; fishing and hunting; and residue for bioenergy feedstock.
2	Forestry	Includes forestry; logging; and wood processing activities.
3	Construction	Includes all construction and related activities such as repairing, renovating, engineering works, and developing land.
4	Manufacturing	Includes hydrogen production; biofuels production from feedstock; metals manufacturing; manufacturing of non-metallic minerals such as cement, lime, and gypsum; chemicals manufacturing; and other advanced manufacturing.
5	Mining	Includes coal and metal mining; mining and quarrying of non-metallic minerals; and mining services.
6	Oil & Gas production, distribution and services ("Oil and Gas")	Includes petroleum refining; natural gas and oil production; natural gas extraction; bitumen upgrading; and oil and gas services.
7	Transportation	Includes air, truck, rail, and other transportation; transit and ground passenger transportation; and pipeline transportation of natural gas.
8	Utilities	Includes renewable and fossil-fuel electric power generation, transmission, and distribution.

Across all futures, clean growth and climate action are expected to create jobs and benefit Canada's economy, regardless of the scenario. Depending on the scenario, climate action could create between 28,000–300,000 direct jobs in this decade in the eight sectors highlighted above. The highest number of jobs is seen in the Sunny scenario (which sees the lowest levels of disruption and highest levels of trade cooperation). However, even in the least favourable outlook—a Foggy future (which sees low disruption and lowest levels of trade cooperation)—approximately 28,000 jobs are created. The Windy (highest levels of disruption and high levels of trade cooperation) and Stormy (high levels of disruption and low levels of trade cooperation) scenarios see job growth of 67,000 new jobs and 102,000 new jobs respectively. Importantly, these are net jobs, meaning that job losses and gains are uneven across sectors. In Foggy and Windy, for example, substantial job gains in some sectors are offset by job losses in others, as seen in **Figure 2** and **Figure 3**.

Figure 2: Change in the number of jobs between 2020 and 2030, by sector

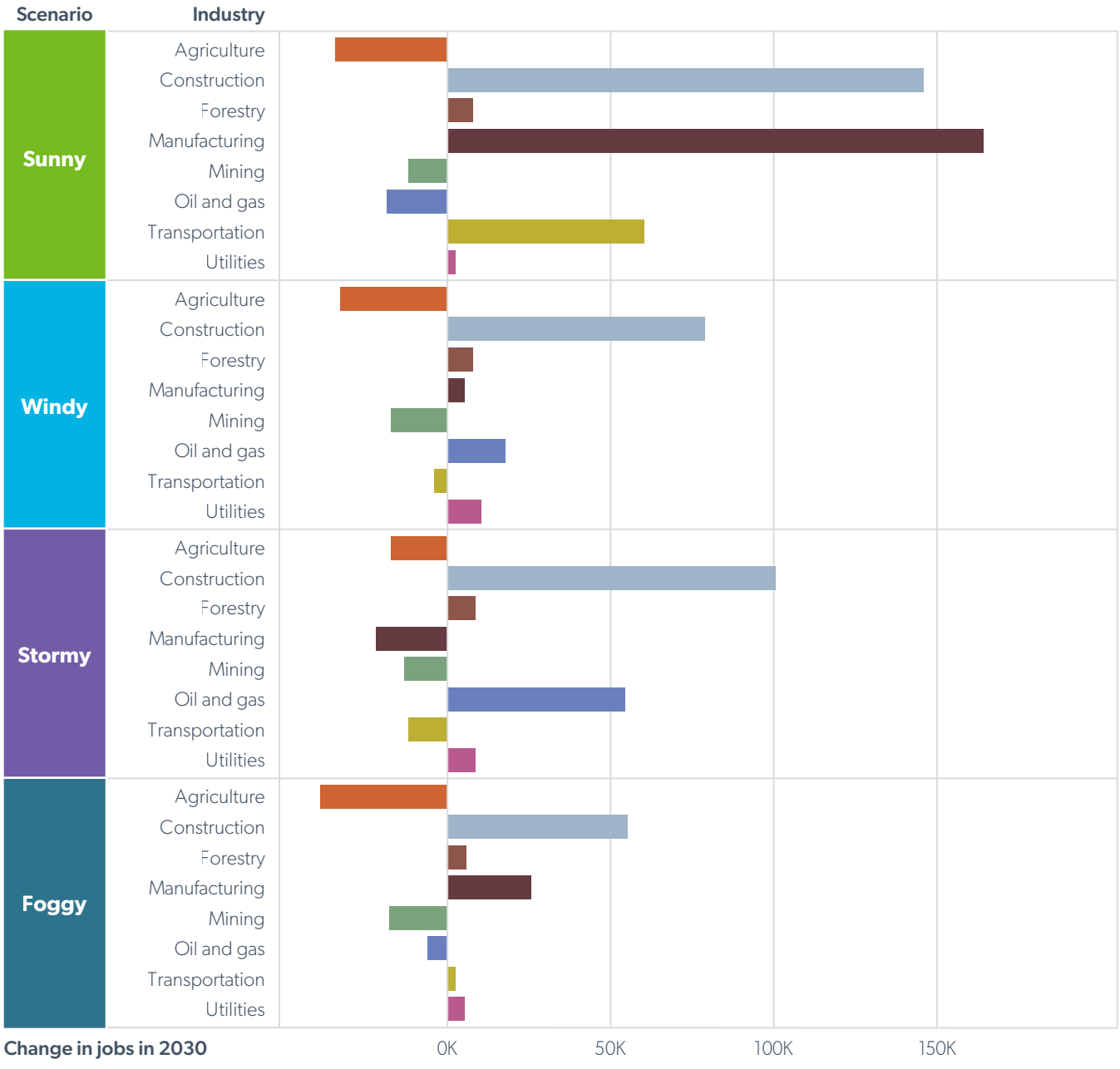


Figure 2 indicates how the number of workers required by each sector is expected to change between 2020 and 2030 across the scenarios.

Figure 3: Percentage change in the number of 2030 jobs relative to 2020 jobs, by sector

Figure 3 indicates the percentage change in 2030 jobs for each sector across the scenarios relative to 2020 jobs.

Workforce needs by sector

Agriculture: While agriculture has historically been a significant employer of Canadians, employing 30% of Canadians in 1921,[18] its share of overall employment has decreased over the years with mechanization and job growth in manufacturing and services. All four scenarios predict a continuation of this trend, with the sector experiencing job declines ranging from 17,000–38,000 jobs—equalling a decrease in labour demand of 5%–10% below 2020 levels. Decreased labour demand in the sector is primarily a reflection of changes in commodity and input prices, particularly increases in the prices for fuel and lower prices for wheat across scenarios. In Stormy, where wheat prices are at their highest ($450 USD/tonne), the agriculture sector sees decreases in labour demand of 5% below 2020 levels. In the other three scenarios, lower wheat prices decrease labour demand between 9%–10%. Notably, despite the overall lower labour demand, demand for workers may still outpace the supply of these workers. An aging workforce may mean workers exit the sector without being directly replaced. It is, in fact, possible that the sector continues to experience simultaneous decreases in labour demand alongside skills and labour shortages if there are not enough skilled workers to fill available positions.

Forestry: Jobs in the forestry sector could grow, with all scenarios showing growth between 5,970 jobs in Foggy to 8,460 jobs in Stormy—equal to a 10%–14% increase of the workforce above 2020 levels. This growth in forestry jobs occurs in every province and territory across the scenarios, with only a few specific regional exceptions. This analysis however, does not incorporate any reductions in wood fibre supply, which could impact these results.

Construction: Construction has traditionally been one of the largest employers in Canada,[19] and this trend is retained across all four future scenarios. Construction is expected to grow across all futures and could create between 56,000 jobs in Foggy to 146,000 jobs in Sunny, representing increases in labour demand of 3.6%–9.4% above 2020 levels. Strong growth in the construction sector is due to investments in large-scale and capital-intensive projects that Canada will need to build to replace existing carbon-intensive infrastructure, as well as other investments in housing which is needed to support economic growth. These include jobs on clean economy projects such as constructing hydrogen production plants and renewable energy installations. Job creation is highest in Sunny, as low disruption and high cooperation result in low raw material prices and a stable supply chain for construction projects. In the Windy and Stormy scenarios, despite low GDP growth, growth in the oil and gas sector increases demand for oil and gas-related construction, thus leading to an increase in construction jobs by about 79,000 and 100,000 respectively. However, in the Foggy scenario, low GDP growth and low oil prices result in the slowest job growth in construction, creating only 56,000 new jobs.

Manufacturing: Manufacturing has the highest employment rate in all four scenarios and, in absolute terms, could create the highest number of jobs across all scenarios. These new jobs represent new opportunities for a sector whose total employment has declined in the last two decades.[20] Compared to 2020 levels, the number of workers needed in the manufacturing sector could grow by up to 164,000 or decline by as much as 21,000, equal to a growth of -1%–+8% relative to 2020 levels. Manufacturing jobs are directly linked to the rate of GDP growth across the scenarios and are heavily reliant on international stability and economic cooperation, leading to strong job growth in scenarios with high rates of economic cooperation and trade. Job creation is mainly driven by subsectors which involve higher value-added goods—such as food, clothing, textiles, and advanced manufacturing. Manufacturing sees the strongest job growth in Sunny, where global trade experiences strong growth and Canada capitalizes on international opportunities in green economy areas like electric vehicles, food and beverages, and low-carbon plastics. In Windy and Foggy however, low economic growth coupled with low trade and high oil prices result in only 5,100 jobs in Windy and 25,600 jobs in Foggy. In Stormy, due to high disruption and low trade cooperation, jobs decline by about 21,000. Importantly, jobs in emerging manufacturing sectors, such as in the production of electric vehicles, see growth in all four scenarios.

Mining: Mining in Canada has experienced a decline in recent years, particularly[21] due to falling commodity prices and the closure of coal mines. All four scenarios see a continuation of this trend. Job declines could comprise 10%–14% of the labour force between 2020 and 2030. Two factors driving this employment outlooking in mining are the combination of uncertain commodities prices and the reduction of worldwide coal demand. Mining experiences more substantial job declines of over 17,500 jobs in both Windy and Foggy as a result of low economic growth and lack of global trade. Sunny experiences the least significant job decline of only 12,000 jobs approximately. These results however, do not reflect potential future job gains from developing domestic critical mineral resources important for clean technologies such as electric vehicles, wind turbines, etc. This gap is a limitation of this analysis, although given the twelve-year timeline associated with developing a new mine in Canada, the scale of job creation resulting from critical mineral development within the next seven years remains unclear.[22]

Oil and gas production, **distribution and services:** The Oil and Gas sector typically experiences volatility in its employment as its economic outlook is tied to changes in oil prices. The sector's past volatility is indicative of what to expect in the future. More oil and gas jobs are seen in scenarios with high levels of economic disruption, which leads to higher levels of investment in the sector. The number of workers needed by this sector by 2030 increases in certain scenarios by as much as 54,5000 jobs (30%) and decreases in other scenarios by 18,500 jobs (10%). The jobs outlook of the oil and gas industry will vary across futures, primarily due to the price of oil and natural gas compared to renewables. With more disruption and reduced trade, and subsequent reduced investment in clean technologies, costs for these technologies are expected to be higher, thereby decreasing their attractiveness relative to fossil fuels. In the Sunny and Foggy scenarios, jobs in the sector decline by about 18,500 and 5,500 respectively. In the Windy and Stormy scenarios, jobs

grow by over 17,500 and 54,500 new jobs respectively. There are two reasons why this finding should be interpreted with caution. First, futures in which oil and gas production grows will require the adoption of carbon capture and storage technologies to meet climate targets. This analysis assumes rapid uptake of these technologies later in the decade (in scenarios where they are available), but their adoption is critical to remaining in line with climate targets. If they are not adopted, additional oil and gas developments will likely not align with meeting climate targets. Second, the model used in this analysis represents job creation, in part, as a function of investment entering a given sector. Given the volatility and an uncertain future outlook in the oil and gas sector, there is no guarantee that increased investment leads to increased employment, as climate action and automation are changing the link between capital and employment impacts. Within this analysis, there are scenarios in which investment levels increase, but jobs decline as investment is directed into labour-reducing technologies. This trend of investing into labour-reducing technologies is already a common practice in the sector.[23] Policies deterring new oil and gas projects could also disrupt the market's tendency to increase investment in the sector during times of high oil prices.

Transportation: Transportation jobs are related to moving goods and people, rather than automotive or vehicle manufacturing, and therefore, are closely linked to oil prices, trade, and GDP growth. The sector experiences the highest growth in the Sunny scenario of over 60,000 jobs when GDP growth and trade flows are highest and oil prices are at their lowest. The number of additional workers required by 2030 declines by 1.3% in Stormy but increases by approximately 6.6% in Sunny. The Foggy scenario experiences slight job growth of about 2,600 jobs as lower oil prices lead to a lower cost of business. Lower trade flows and higher oil prices in Windy and Stormy result in fewer avenues for growth and the highest cost of doing business in the sector, thus leading to decreases in labour demand. Labour demand in Stormy and Windy respectively declines by approximately 12,000 jobs and 4,000 jobs.

Utilities: The Utilities sector experiences steady job growth in all scenarios and could add between 2,600–10,600 jobs by 2030. The number of additional workers needed by the utilities sector by 2030 increases by between 2.2%–9.0% depending on the scenario. The higher oil prices in Windy and Stormy respectively result in the creation of an additional 10,600 jobs and 8,100 jobs in electricity generation. This is due to high oil prices causing a shift away from fossil fuel-based power generation and lower-cost renewable technologies being a more attractive alternative. In Sunny and Foggy, jobs in the sector grow by 2,600 and 5,200 respectively.

Figure 4 and **Table 3** below illustrate the regional distribution of jobs, with Table 3 offering a detailed breakdown by province, scenario, and sector. While this average of the four scenarios does not lend insight into what the workforce might experience if Canada follows any one path, it simplifies comparing outcomes between sectors and regions. This visualization, in turn, can help identify relevant trends across all futures. It should be reiterated that across all scenarios, Canada reaches its 2030 climate target, and this analysis represents an average of scenarios where climate ambitions across the country are achieved. For greater detail on how sectors in each province will be affected by each future, please refer to PLACE Centre's previous report on meeting Canada's 2030 labour needs, *As the Weather Changes*.[24]

In **Figure 4**, Alberta, British Columbia, Ontario, and Quebec account for the largest concentration of 2030 jobs, which is arguably a function of their population and the size of their economies. Out of these four provinces, three—Alberta, British Columbia, and Ontario—also experience job growth between 2020 and 2030 in all scenarios.

Figure 4: Distribution of 2030 demand for workers among provinces, average across four scenarios

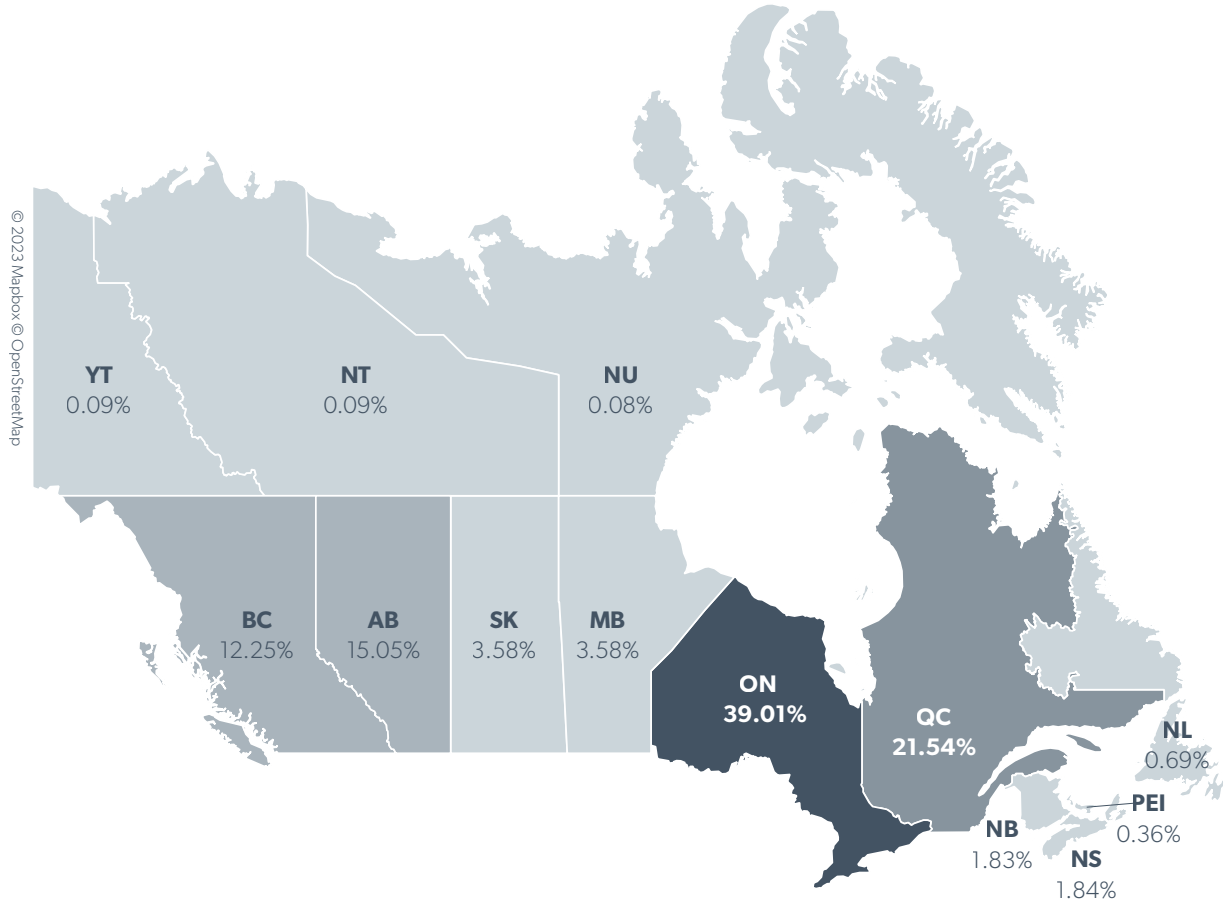


Figure 4 shows the regional distribution of 2030 jobs (average across all scenarios). Provinces in dark green are expected to experience a higher concentration of new jobs created in 2030 compared to the provinces in light green, which are expected to experience a lower concentration of 2030 jobs. In gTech, job growth numbers are in aggregate for all three territories. Job growth for the territories has been distributed based on population.

As **Table 3** shows, Alberta, British Columbia, and Ontario are the only three provinces that experience overall job growth in all scenarios. In Alberta, jobs grow by an average of 8%, spurred by the utilities and the construction sectors. In all scenarios, utilities and construction outpace the growth in the oil and gas sector, which has been a traditional generator of jobs in Alberta. The rise in oil prices in the Windy and Stormy scenarios generates jobs in the oil and gas sector, while in Sunny and Foggy, the sector experiences decreases in labour demand. As previously stated, this job growth will require the deployment of carbon capture technologies alongside increased development of oil and gas. Otherwise, increased oil and gas production risks not being aligned with Canada's climate ambitions. All sectors in British Columbia see job growth in nearly all scenarios except for transportation. Two strong drivers of growth in BC are utilities and the oil and gas sector. Job growth in oil and gas across all scenarios is primarily driven by investment in natural gas-related infrastructure, particularly gas pipeline and liquified natural gas infrastructure, which are expected to continue independent of changes in oil prices. In Ontario, transportation is the strongest generator of job growth across all scenarios. The manufacturing sector also sees job growth in all scenarios, albeit to a modest extent. The majority of variance in outlooks for Ontario results from global economic growth trajectories, with GDP and trade being significant drivers. Since Ontario produces little or no oil, the impact of higher oil prices on jobs is not pronounced.

All of the other provinces experience more mixed economic outlooks across the scenarios. Although Quebec has a high concentration of national jobs by 2030, it experiences an overall jobs decline in jobs in all scenarios except Sunny. Only the province's manufacturing sector experiences job growth across all scenarios. The utilities and construction sectors, which are jobs generators for most other provinces, experience negative job growth in Quebec. Saskatchewan's outlook is similarly mixed, experiencing job growth in only Stormy and Windy scenarios. Job growth in the province is driven by the oil and gas and construction sectors, which grow by an average of 45% and 32% respectively. The dominance of oil and gas jobs means that job growth in the province is especially sensitive to the price of oil and resulting activity in the conventional oil and oil sands sectors, making the province a source of economic growth in periods of higher-than-average global disruption. The province's utilities sector also contributes to job growth, between 2%–13% in all four scenarios.

Table 3: Percentage changes in labour demand by sector, scenario, and province for 2030

Prov.	Scenario	Agriculture & Forestry	Construction	Manufacturing	Mining	Oil and Gas	Transportation	Utilities	Average Job Change
AB	**Average**	**-16%**	**22%**	**-5%**	**-35%**	**8%**	**12%**	**104%**	**8%**
	Sunny	-9%	15%	13%	-35%	-11%	9%	76%	7%
	Windy	-20%	23%	-11%	-36%	12%	12%	151%	7%
	Stormy	-21%	40%	-19%	-30%	33%	20%	90%	15%
	Foggy	-16%	11%	-2%	-39%	-2%	7%	98%	2%
BC	**Average**	**6%**	**7%**	**5%**	**5%**	**18%**	**1%**	**15%**	**5%**
	Sunny	4%	8%	9%	4%	11%	7%	10%	8%
	Windy	8%	6%	4%	4%	15%	-1%	18%	5%
	Stormy	10%	8%	4%	10%	37%	-3%	20%	5%
	Foggy	4%	5%	5%	3%	9%	1%	12%	4%
MB	**Average**	**-8%**	**-1%**	**0%**	**-8%**	**9%**	**2%**	**-12%**	**-1%**
	Sunny	-9%	3%	6%	-5%	-26%	8%	-15%	2%
	Windy	-8%	-1%	-1%	-9%	11%	2%	-12%	-2%
	Stormy	-5%	-2%	-3%	-8%	60%	-2%	-6%	-3%
	Foggy	-10%	-2%	-2%	-8%	-10%	2%	-14%	-3%
NB	**Average**	**10%**	**-14%**	**10%**	**-12%**	**-50%**	**-13%**	**5%**	**-3%**
	Sunny	6%	2%	6%	-9%	47%	-3%	8%	4%
	Windy	9%	-18%	11%	-13%	-100%	-16%	4%	-5%
	Stormy	13%	-24%	13%	-10%	-100%	-18%	2%	-5%
	Foggy	10%	-16%	8%	-14%	-47%	-14%	6%	-4%
NL	**Average**	**-8%**	**-40%**	**-18%**	**27%**	**-40%**	**-43%**	**-15%**	**-29%**
	Sunny	-6%	-39%	-15%	22%	-38%	-42%	-20%	-29%
	Windy	-7%	-39%	-17%	27%	-41%	-43%	-14%	-29%
	Stormy	-8%	-38%	-19%	37%	-39%	-41%	-9%	-28%
	Foggy	-11%	-42%	-20%	21%	-43%	-45%	-18%	-32%
NS	**Average**	**8%**	**-20%**	**5%**	**-29%**	**-68%**	**-10%**	**17%**	**-4%**
	Sunny	12%	-12%	9%	-23%	-59%	-1%	16%	1%
	Windy	6%	-22%	2%	-32%	-75%	-12%	18%	-6%
	Stormy	7%	-26%	3%	-31%	-65%	-16%	19%	-8%
	Foggy	7%	-19%	3%	-30%	-73%	-11%	15%	-5%
ON	**Average**	**-6%**	**6%**	**3%**	**-19%**	**-14%**	**7%**	**1%**	**3%**
	Sunny	-9%	14%	7%	-16%	-25%	12%	0%	8%
	Windy	-5%	4%	2%	-21%	-15%	5%	2%	2%
	Stormy	1%	0%	0%	-17%	7%	4%	0%	1%
	Foggy	-9%	7%	1%	-21%	-23%	6%	2%	3%
PEI	**Average**	**1%**	**-16%**	**13%**	**67%**	**-30%**	**-9%**	**42%**	**-1%**
	Sunny	-4%	-7%	16%	96%	-30%	2%	49%	3%
	Windy	2%	-18%	13%	62%	-31%	-12%	39%	-2%
	Stormy	7%	-22%	13%	36%	-27%	-15%	34%	-3%
	Foggy	-2%	-16%	11%	75%	-32%	-10%	44%	-3%
QC	**Average**	**-5%**	**-5%**	**3%**	**-5%**	**-40%**	**-5%**	**-7%**	**-1%**
	Sunny	-8%	3%	7%	-4%	-39%	2%	-10%	4%
	Windy	-6%	-7%	1%	-6%	-30%	-8%	-6%	-3%
	Stormy	2%	-12%	3%	0%	-43%	-11%	-1%	-4%
	Foggy	-8%	-4%	2%	-8%	-49%	-6%	-9%	-2%
SK	**Average**	**-14%**	**32%**	**-9%**	**-20%**	**45%**	**-19%**	**8%**	**3%**
	Sunny	-15%	5%	9%	-11%	10%	-4%	2%	-1%
	Windy	-15%	40%	-15%	-22%	48%	-23%	13%	4%
	Stormy	-11%	68%	-23%	-25%	90%	-27%	10%	13%
	Foggy	-16%	16%	-8%	-22%	30%	-20%	6%	-3%
Terr.	**Average**	**0%**	**-35%**	**276%**	**-27%**	**56%**	**-22%**	**52%**	**-15%**
	Sunny	11%	-28%	64%	-21%	56%	-17%	66%	-11%
	Windy	20%	-37%	217%	-29%	56%	-23%	54%	-18%
	Stormy	-44%	-41%	568%	-33%	58%	-26%	45%	-18%
	Foggy	13%	-33%	254%	-24%	53%	-21%	42%	-15%

For Manitoba, PEI, New Brunswick, and Nova Scotia, Sunny is the only scenario with favourable job growth. Increases in conflict and declines in trade do not favour many sectors in Manitoba's economy; in particular, the utilities and agriculture sectors are negatively impacted. Job decline in PEI is most apparent in the oil and gas and construction sectors, whose outlooks are based on economic and population growth in different scenarios. Most sectors in New Brunswick see decreases in labour demand on average, although the forestry and manufacturing sectors each grow by an average of 10% across all scenarios. Across all futures in Nova Scotia, the oil and gas, mining, transportation, and construction sectors see decreases in labour demand. This is due to lower levels of trade reducing the demand for global shipping and rising material prices impacting the number of construction projects advanced in the province.

For Newfoundland and the territories, all scenarios bring negative outlooks. Newfoundland and Labrador's job decline is attributable to the impacts of various global futures on the province's oil and gas industry and overall economic growth. The current declining population trend in Newfoundland and Labrador is expected to continue into the near future, which could worsen labour shortages. By contrast, decreases in labour demands in the territories are attributable to reduced mining activity.

For provinces and territories where decreases in labour demand are expected, it should be noted that forecasts are not destiny. There will be opportunities to advance clean growth projects that create jobs in every region across Canada, which policymakers should support through thoughtful and strategic investment decisions.

Box 2: Who are these workers? A brief demographic and equity analysis

As these jobs continue to grow across Canada, it is important to better understand the workers filling these roles. The current state of workforce participation is different among multiple demographic groups; the barriers to, and enablers of, workers' success—especially among equity-deserving populations—are something that policymakers should consider. Charts and data visualizations detailing labour force participation rates for different demographic groups can be found in **Appendix 8** and **9**.

Immigrants have increasingly become one of the largest demographic components of the Canadian workforce, with their share of the total workforce rising from 23% in 2011 to 27% in 2021.[25] Within major cities, this percentage rises significantly, with 52% of Toronto, ON's core working-age members of the workforce being immigrants.[26] Even more importantly for our discussion of the changing nature of labour needs, immigration contributed to 80% of the growth in Canada's labour force from 2016 to 2021.[27] These workers are frequently underemployed, with university-educated immigrants accounting for 70% of the growth in low-skilled employment but only 38% of the growth in high-skilled employment from 2001–2016.[28]

Despite women making up slightly over half of the population of Canada, women only made up 47.5% of the workforce in 2022, and for several of the industries covered in this report, that gender gap is much wider. And in the modelled scenarios, many of the industries with the most substantial labour demand also face the widest gender gaps. In 2022, only 26% of utility workers and 13.6% of construction workers were women.[29] Similar figures can be found for manufacturing (29%), oil and gas production (18%), and agriculture, forestry, and fishing (32%).[30]

Indigenous peoples are one of the fastest-growing demographics in Canada. Yet, they are still underrepresented proportionally in the workforce and face educational barriers, with a lower high school and university competition rate than non-Indigenous Canadians.[31] From the 2017 Aboriginal People's survey, the employment rate of the off-reserve and working-age population was only 67%.[32] More Indigenous men work in trades-related occupations, and more Indigenous women work in sales and services, indicating a gender gap between types of roles.[33] Specifically, Indigenous men have greater employment in construction (17%) and manufacturing (9%) as compared to Indigenous women, with greater employment for women in health care and social assistance (24%), retail trade (11%), and education (10%).[34]

Persons with disabilities also face significant challenges when entering the workforce, despite the fact that almost one in five Canadians has a disability.[35] For severe disabilities in particular, women and men with only a high school education face major difficulties finding employment, with only 29% and 32% being employed respectively.[36] Additionally, university graduates with more severe disabilities are still less likely to be employed than individuals without disabilities who have a high school degree or less.[37] It is to address these barriers as persons with disabilities are currently overrepresented in low-skill and low-education occupations, often in sales, personal services, and retail.[38]

What skills will these workers need?

By 2030, projects across Canada will lead to increases or decreases for workers in the sectors and communities where we work. But what skills will these workers require to build these projects? Previous work from Smart Prosperity Institute (SPI) has detailed many of these skills changes in reports such as *Jobs and skills in the transition to a net-zero economy*, using the O*NET taxonomy to identify changes in skill requirements that arise as industries reduce their GHG emissions. This section builds on this previous analysis by identifying how skills needs will change in the eight sectors analyzed in this report. Given that skills needs will differ by region and sector, governments should emphasize that the future training and education providing workers with these skills be place-based and sectoral. Additionally, skills that will be needed across all sectors should form a common framework administered to all those seeking to retrain and upskill.

Skills profile: Agriculture

What are the skills impacts of these workforce changes?

Previous research from SPI found that the top essential skills for agriculture, in order, were critical thinking, monitoring, decision-making, and coordination.[39] This is partly due to a greater need to interact with machinery and digital technology as mechanization advances, alongside a need for more robust business skill sets as a farm operator.[40] Technology that improves on-farm productivity, such as software-enabled tractors and combine harvesters or monitoring drones, requires technicians and workers to possess both mechanical and digital skills capable of completing basic repairs and operating machinery.[41] Additionally, as farm sizes continue to grow through consolidation, primary producers need additional business skills, such as leadership and management skills. A survey from the Canadian Agricultural Human Resource Council identified gaps in interpersonal, business management, marketing management, and human resource skills amongst producers, identifying that more training is needed in these areas.[42] Finally, the growth of on-farm sustainability practices has also led to changes in skills needs, with familiarity with data analysis and greater knowledge of biological and physical sciences both growing in importance.[43]

Which subsectors and occupations will be most affected by skills changes?

Although not explicitly featured in this jobs analysis, many changes in Canada's agricultural sector have already had impacts that cross sub-sectoral boundaries. Examples of the impacts of these trends can be seen in both crop and livestock production. Many subsectors are already "entrenched," meaning that machinery has primarily replaced labour-intensive physical work. Beef cattle and feedlots, as well as oilseed and grain production, are the most entrenched, illustrating that these are the subsectors where familiarity with automated machinery and data analytics are of great importance. Additionally, familiarity with technology and more knowledge of biological and physical sciences are of growing importance in the greenhouse and nursery sectors, where sustainability practices are becoming increasingly common. These changes will continue to impact a range of occupations. Farm owners and operators will need greater digital expertise, leadership abilities, and critical thinking skills.[44] As farm equipment becomes more complex, technicians will need greater critical thinking, monitoring, and interpersonal skills.[45] Specialists like plant scientists, livestock managers, and regulatory experts are also expected to increase, with new roles

requiring an understanding of various scientific fields as well as being able to communicate and collaborate with stakeholders outside of agriculture.[46] For labourers, upskilling or retraining may be required as additional automation occurs, pointing to the growing importance of skills like judgement, fine dexterity, and digital interfacing skills.[47]

Skills profile: Construction

What are the skills impacts of these workforce changes?

With construction, the sector can be expected to see "an increasing demand for generic skills" applied to tasks like retrofitting buildings to improve their resilience and energy efficiency, advancing large-scale infrastructure projects, and building residential and commercial developments.[48] These skills are critical thinking, monitoring, coordination, time management, and decision-making, which are all pre-existing skills whose importance will grow as clean growth continues.[49] Technical skills, like operations monitoring and quality control, will also be required. Additionally, as workers and tradespeople become more involved in decision-making for new projects, other general skills like communication and cooperation can be expected to become more important for occupations ranging from construction managers to skilled trades apprentices, including carpenters, plumbers, and masons.[50] This requirement of greater general and technical skills will form the "green literacy" necessary to build many new green projects, including building retrofits informed by building science principles and employing "building as a system" approaches.[51]

Which subsectors and occupations will be most affected by skills changes?

Subsectors related to the construction of residential homes and buildings will experience strong job growth. Previous analysis from SPI identified that new developments and retrofit projects will need to meet stricter environmental standards, be designed according to emerging and developing technical specifications, and adopt new technologies and building processes, all of which will change skills requirements.[52] Many occupations within the building construction sector will be affected by an increased need for broad-based skills, including construction managers, carpenters, and contractors.[53] However, for some occupations, such as electricians and plumbers, changes in building codes and increased adoption of emerging technologies, such as heat pumps and thermal hot water heaters, will drive a need for new technical skill sets.[54] Additionally, the increased frequency of building retrofits to improve emissions performance and resilience to climate impacts will lead to job growth for occupations such as carpenters, steam/pipe fitters, plaster and drywall installers, refrigeration and air conditioning mechanics (HVAC trades), and mechanical engineers.[55]

Skills profile: Forestry

What are the skills impacts of these workforce changes?

Overall, job changes will be brought about by structural changes in the industry. Natural Resources Canada has identified that the growth of forestry products is expected to arise primarily as a result of increased demand for wood products in construction, advanced manufacturing, and new sectors emerging in the growing "bioeconomy."[56] Moving forward, essential skills for forestry professionals include forest measurement, navigation and inventory, health and safety, lumber grading, log scaling, and equipment operation.[57] Stakeholders also have identified that emerging bioeconomy opportunities and growth in manufacturing will lead to the emergence of new subsectors that will demand that individuals possess international market connections as well as business development and sales skills.[58] Similar to agriculture, shifts within the sector will lead to greater demand for managerial and business skills, as these skill sets are essential to supporting the growth of companies in new sectors. Sustainable forest management practices and planning will also continue to be an important forestry skill.[59]

Which subsectors and occupations will be most affected by skills changes?

The growth of new opportunities in forestry will strongly impact virtually every aspect of the value chain, although specific subsectors are likely to be deeply affected by one given trend. The Forestry Products Association of Canada has noted that thousands of professionals in engineering, skilled trades, mill and woodlands operations, and administration will be needed in Canada's forest products sector as new technologies in primary production and sawmills are adopted.[60] For example, increased use of wood in construction will have a substantial impact on the wood products and paper manufacturing subsectors since many emerging wood construction projects will require manufactured wood products.[61] Currently, demand for these workers is high as companies report fierce competition for individuals in specialized occupations, such as woodworking machine operators, wood processing machine operators, furniture and fixture assemblers, and inspectors. In British Columbia, shortages across subsectors were also identified for industrial designers and drafting technologists and technicians.[62] Additionally, emerging opportunities in emerging subsectors will drive demand for managers, salespeople, and account representatives with specific product knowledge.[63] Importantly, these skills will be needed in largely northern and rural communities.

Skills profile: Manufacturing

What are the skills impacts of these workforce changes?

The skills needs for manufacturing are expected to change as greater adoption of automated and digital solutions grows, as well as what Canada manufactures domestically changes. Previous research from SPI has identified that the most important skills for manufacturing moving forward will be critical thinking,

monitoring, coordination, time management, and decision-making.[64] This focus on soft and cognitive skills, especially for management and supervisory roles, is attributable to the need for workers to collaborate with others and communicate more using new technologies. Some solutions will require greater collaboration between teams and more focus on creative problem-solving as new industries like battery manufacturing emerge. Others, like mass timber, will require greater collaboration with customers and clients to ensure these new pre-fabricated construction materials can be built to exact design specifications. The technical skills needs in the sector are expected to adjust to reflect the trends of increased automation and continued deployment of digital technologies. This outlook means that, moving forward, manufacturing occupations will require greater mechanical and digital skills than are currently required.

Which subsectors and occupations will be most affected by skills changes?

Some of the manufacturing sub-sectors this skills transition will impact include electrical and electronic equipment manufacturing, machinery manufacturing, and transportation equipment and vehicle manufacturing. Given the concentration of Canada's manufacturing sectors in Ontario and Quebec, these are the regions wherein we can expect to see these changes affect the most. Zero-emissions vehicle production growth will also impact skills demand in British Columbia, as it is home to Canada's largest cluster of hydrogen and fuel cell companies.[65] For the transportation equipment and vehicle manufacturing sub-sector, the structural manufacturing of the vehicle's body will not see significant changes in the shift to zero-emissions vehicles. However, the number of roles and importance of engineers, computer/software programmers, UI/UX designers, and electric battery workers (battery engineers and technicians) will increase due to changes in the software systems and power trains.[66] These hardware, software, and power systems changes will also require current automotive engineers and technicians to upskill by increasing their knowledge of battery management and staying up-to-date with software upgrades and changes to power electronics systems. For machinery manufacturing, occupations in this sub-sector will need to adjust to increased automation and use of technology, with these changes being felt most by welders and metal fabricators, who make up the largest share of workers in this sub-sector.[67] This trend means a shift from occupations that centre more on hand-made metal parts to a greater role for mechanical, industrial, and manufacturing engineers in operating and managing machines used for the same metalworking process. These occupations have greater technical skill requirements like programming, technical knowledge, and technological design. However, across all occupations, broad-based skills like problem-solving and coordination are expected to remain important.[68]

Skills profile: Mining

What are the skills impacts of these workforce changes?

Although this is not captured within scenario modelling for this report, skills needs for mining are expected to change as the sector extracts more critical minerals like cobalt, lithium, and nickel. Automation, advanced digital technology, and environmental, social, and governance requirements will also change the skills the workforce needs.[69] Previous research identified monitoring, critical thinking, judgement, and decision-making as essential future skills in the industry.[70] This finding was echoed by a report outlining skills needs in the mining sector from the provincial government in British Columbia. It stated that, given these changes to the workforce, some of the most important future skills are cultural awareness, judgement, critical thinking, and complex problem-solving.[71] This emphasis on social and emotional skills aligns with the increased needs for workers to work alongside digital technologies and as part of larger, more complex, and more diverse teams.[72] Given the projected workforce reduction in mining, some workers will also need to find new positions in other industries, while others will need to adapt to the technological changes. For workers who transition out of the industry, there are many comparable skills in carbon capture and renewable energy, including technical skills in HVAC, engineering, technical mining, and machinery mechanics.[73]

Which subsectors and occupations will be most affected by skills changes?

In the exploration and extraction stages of mining, skills like critical thinking, digital literacy, data analytics, and cultural awareness (especially with regard to Indigenous communities) will become in greater demand.[74] One of the largest subsectors of mining is coal production, with almost half of all coal produced in Canada mined in British Columbia (with 48% of 2019 production).[75] These positions are at risk of both skill changes and broader employment shifts as alternative energy sources become cheaper, and these workers may need to retrain for other industries and sectors.[76] Some of the most affected occupations by this reduction of jobs will be positions like underground production and development miners, mine labourers, and underground service and support workers.[77] These positions often only require a high school diploma and on-the-job training and are also the most at risk of automation and technological replacement.[78] Positions supporting and accompanying the technological changes, such as network analysts and heavy and automated equipment repair technicians and operators, will become much more in demand.[79] Primary scientific positions like geological, mineral, electrical, and metallurgical engineering, especially in the exploration and development stages of mine cycle production, are also expected to remain in demand. However, enrollment in university programs for these disciplines has fallen over the last several years.[80]

Skills profile: Oil and gas production, distribution and services

What are the skills impacts of these workforce changes?

Previous research from SPI identified that the skills most highly occurring and in demand in the oil and gas sector—namely critical thinking, monitoring, problem-solving, coordination, decision-making, and time management—are similar to the top skills in other sectors.[81] Even in future scenarios where there is increased investment and corresponding labour demand, trends in the sector—such as climate action and automation—will change the types of skills and capabilities required by oil and gas workers.[82] Highly technical positions that require greater education and training will emerge in the sector, while less technical occupations are at greater risk of automation. Increasing digitization and digital emissions monitoring for wells and offshore platforms will require more specialized technical knowledge, as well as more management and understanding of regulatory requirements.[83] The increased sectoral focus on environmental issues, public consultations, and well restoration and recovery will also require different skills, including communications, technical ecology expertise, and regulatory understanding.[84]

Which subsectors and occupations will be most affected by skills changes?

Regionally, oilsands production for heavy oil and bitumen is found mostly in northern Alberta and, to a lesser extent, Saskatchewan. Future skills needs for these subsectors will expand to include automation and networked data tools, as well as soft skills around biological restoration, communications, and emissions monitoring and reduction.[85] Light oil production in Canada is more distributed. Production hubs in the Atlantic provinces include offshore platforms in Nova Scotia and Newfoundland and Labrador alongside local refineries in communities like Saint John, NB. This region is projected to be more heavily impacted across all futures, and the workforce needs may focus more on transitions into growth opportunities.[86] Natural gas production and distribution, especially in British Columbia, is expected to be less affected its less volatile pricing structure and existing terminal and pipeline infrastructure. However, the increased focus on monitoring methane emissions and coordination and communication with Indigenous communities will be critical for this sector.[87] As noted, fewer workers will be needed for some occupations moving forward. Previous research has found that three-quarters of oil and gas workers do not have a university degree, and many of these positions are at risk of automation, including occupations like extraction workers, wellhead pumpers, and pumping station operators.[88] Even in modelling scenarios with more positive job growth, positions like these will be more susceptible to job losses, and workers may need to retrain into industries with more stable outlooks, such as construction, utilities, or manufacturing.[89] Occupations within the skilled trades like construction managers, industrial electricians, crane operators, and facility operations managers will more easily be able to transition into other industries should the economic prospects of the sector deteriorate.[90] Their combination of technical and soft skills is very attractive to other industries like manufacturing, wind and solar production, and carbon capture and storage.[91]

Skills profile: Transportation

What are the skills impacts of these workforce changes?

Transport Canada has identified that the majority of jobs created in Canada's transportation system are likely to come from changes in how we transport goods and passengers as well as from expanding many existing systems.[92] Transport Canada has also identified the trends expected to have the biggest impact on the workforce, including the adoption of technologies, such as zero-emission passenger and freight vehicles; the increasing complexity of transportation networks as they digitize and expand; and a changing climate.[93] Previous research from SPI has identified that the most important skills for transportation workers in the future will be process skills, such as critical thinking and monitoring, and technical skills, such as operations monitoring, time management, and operations and control.[94] In addition, continued expansion of transport networks will require increased efficiency and cost-effectiveness in the sector, strong management of data among supply chain partners, and increased adoption of low and zero-carbon solutions. Skills such as technical environmental expertise, coordination, and complex problem-solving will be needed for these changes.[95]

Which subsectors and occupations will be most affected by skills changes?

Workers in the trucking industry will see skills needs shift towards greater importance on technical skills around automation, installation, maintenance, and monitoring, alongside softer skills around logistics, fleet management, and communications.[96] In air transportation, workers such as pilots, air traffic controllers, flight services specialists, and aircraft mechanics will be increasingly required to work with complex systems, technologies, and regulatory and licensing changes.[97] Many of these changes are expected to be filled by upskilling existing and incoming workers. Other occupations throughout transportation subsectors, like supply chain analysts, administrative workers, and logistics managers, will need more process skills, such as critical thinking and monitoring, which are transferrable skills across subsectors in transportation. In the maritime and aviation subsectors, research has identified that hydrogen, biofuels, and ammonia will play an important decarbonization role. Adopting these novel technologies will see skills like data analytics, critical thinking, technical monitoring, and digital literacy grow in importance.[98] Some of the most affected occupations will be positions like production operators, equipment technicians, and mechanics.[99] These positions typically require a high school diploma and are at higher risk of being displaced through automation, making additional training vital for supporting these individuals. Meanwhile, technical skills will grow in importance for positions such as

information systems analysts, development engineers, electronics technicians, and vehicle technicians.[100] Specialized managerial positions in supply and value chain analytics, administration, and logistics will also require more process skills, such as critical thinking and monitoring alongside digital and carbon literacy.[101]

Skills profile: Utilities

What are the skills impacts of these workforce changes?

The utilities industry market and business models are expected to change rapidly as a result of the growth in renewable energy, battery storage, electric vehicles, smart buildings, and other technologies seen in modelled scenarios. Research on the skills needs arising from these changes has identified a need for increasingly specialized technical, digital, and data-analysis skills.[102] Service orientation and systems analysis skills also feature in energy generation and distribution jobs, skills which differentiate this sector from others.[103] Given the level of technological change the sector is experiencing in the coming years, other important skill sets to emerge are process skills, like critical thinking and monitoring, and cross-functional skills, like problem-solving and decision-making. This change is due to individuals needing to work with new technologies in new environments where soft skills are most required.[104] In addition to these soft skills, leadership, collaboration, and teamwork were all identified as critically important given the need for sector participants to work on large, interdisciplinary teams as the sector grows and changes in the years to come.[105]

Which subsectors and occupations will be most affected by skills changes?

Transportation electrification is expected to grow substantively, necessitating wider adoption of digital tools that help manage the transformation of the grid. This transition will require upskilling the existing workforce, including electricians, electronic system technicians, computer communication specialists, infrastructure installers, utility planners, and corporate strategic planners, to support the deployment of clean energy technologies.[106] Additionally, subsectors supporting grid modernization and flexibility, such as local electricity utilities and local distribution companies responsible for electric power transmission, will grow as intermittent generation capacity and storage options expand, greater load management is required, and there is more significant investment in distribution infrastructure.[107] Scenario results show that solar and wind energy installers and technicians will be needed in every province across the country. Additionally, occupations associated with renewable or low-GHG energy jobs, which are expected to experience the most growth, include civil engineers, contractors/supervisors, electrical engineers, electrical line workers, electrical operators, and power system electricians. Each of these occupations will require slightly different skills. For example, within engineering occupations, technical skills such as operations monitoring, operations and control, and quality control are more important for electrical engineers than civil engineers.[108] Civil engineers, on the other hand, require more operation analysis skills and cross-functional skills like systems analysis and time management. Meanwhile, operations monitoring is the most important for electrical operators. Finally, while all skills needed by contractors and supervisors who oversee electricians and line workers have similar importance, installation, troubleshooting, and repairing are more critical for these occupations than others.[109]

Are sectors prepared to support this increase in their workforces?

This report has identified which jobs could be created in different regions and sectors by meeting Canada's 2030 climate target and what skills will be needed in these sectors as clean growth advances. Yet the modelling in this report has only highlighted labour demand, which is one side of the discussion. Ultimately, workers will need to fill these roles. As previously identified, two trends—labour shortages and an aging workforce—create challenges in filling positions. Many sectors and occupations of the Canadian economy where decarbonization-driven jobs are expected to be created in the coming years are already facing skilled labour shortages.[110] And given Canada's aging workforce, this shortage could worsen. Currently, about 22% of persons of working age in Canada are between 55 and 64 years old and are expected to leave the workforce soon.[111] These two factors will make finding enough workers to meet the growing labour demand a challenge.

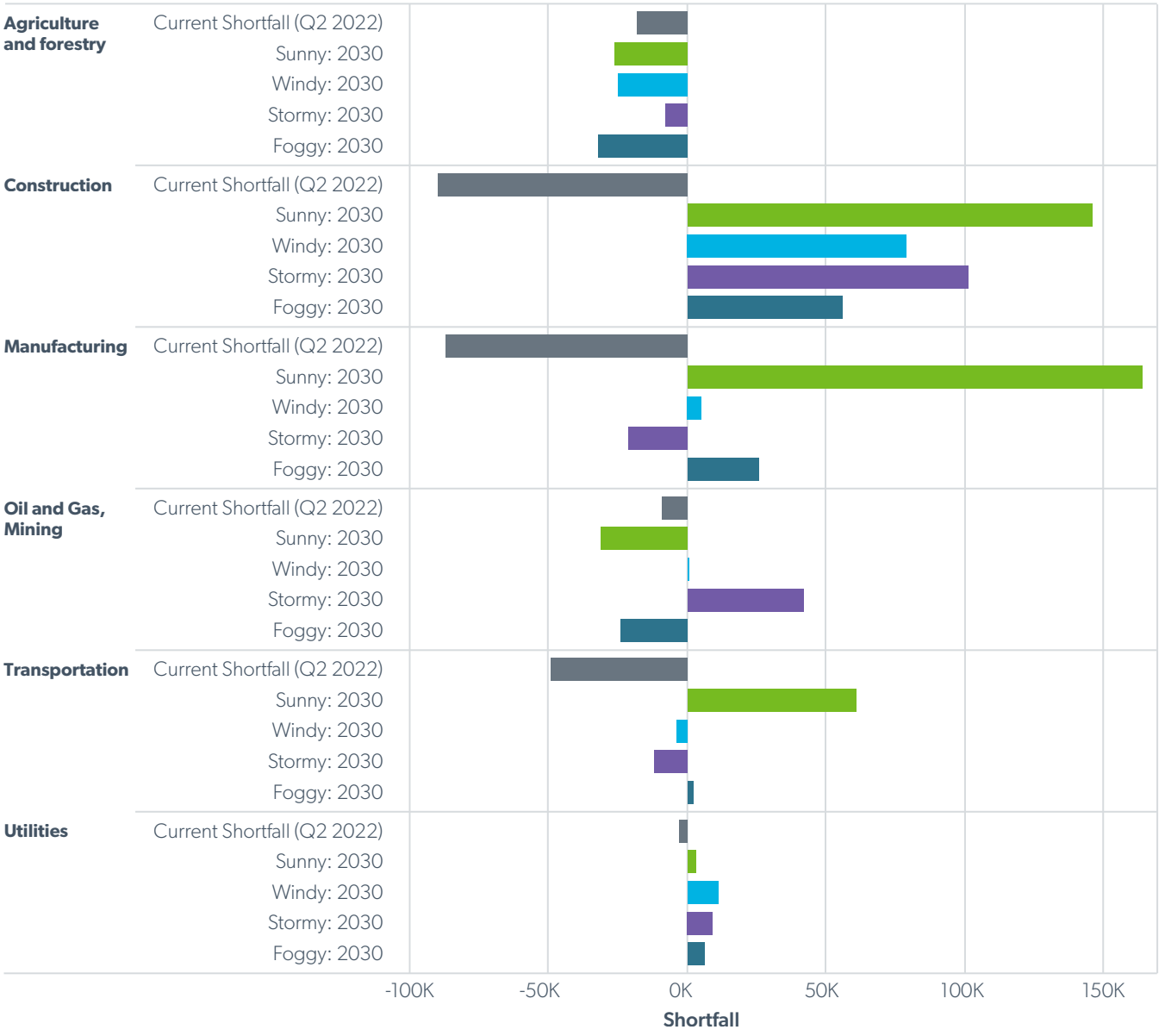
If roles go unfilled, there are consequences beyond difficulties in hiring. Projects may face delays, face cost overruns, not be completed, or be outright cancelled. These impacts reduce the attractiveness of projects for private investors, as they increase costs, can slow development timelines, or even threaten a company's capacity to fulfill operational requirements. These outcomes are being felt in sectors like food processing in the Prairies, where regional shortages of occupations like technicians and automation specialists are delaying—or even preventing—capital investments from companies to expand their operations.[112] The challenge goes beyond a single sector. A recent survey[113] found that 62% of Canadian manufacturers lost or had to turn down commercial contracts or faced production delays due to worker shortages. The same manufacturing survey referred to above found that 43% of the manufacturers had to postpone or altogether cancel capital projects because of labour shortages. These trends could counter-act many of the beneficial impacts of policies aimed at supporting greater investment into producing and adopting clean technologies. Therefore, a macroeconomic consequence of advancing fewer projects could be that Canada makes less progress on emissions reductions and thus, misses its climate targets.

It is critical that regions and sectors across Canada have enough workers to meet the growing labour demand. This report examines existing labour shortages and aging workforce demographics in the eight sectors previously discussed. Trends are identified by region and sector to better determine how vacancy rates might impact sectors across the country and where they are most acute. This report assesses labour shortages by looking at job vacancy rates (the number of vacant positions in a sector, expressed as a percentage of total labour demand). The report further assesses how aging demographics may impact a sector in the coming years by examining the ratio of workers aged 25–34 years old to workers aged 55+. If a sector has a larger number of older workers relative to new entrants, challenges around hiring may worsen in the coming years.

Which sectors are experiencing labour shortages today?

Labour shortages, as measured by job vacancy rates, have been on the rise in Canada, even after the disruptive impacts of the COVID-19 pandemic on labour markets. In the second quarter of 2022, the job vacancy rate[114] across all sectors stood at 5.7%, an "all-time high" according to Statistics Canada.[115] A number of the sectors examined in this report are currently experiencing high rates of job vacancies, which this report also refers to as labour shortages. As **Figure 5** shows, these vacancies stand in contrast with expected increases in labour demand.

Figure 5: Job vacancies in 2022 versus 2030 workforce needs



Source: Authors. Based on data from Statistics Canada. Table 14-10-0326-01 Job vacancies, payroll employees, job vacancy rate, and average offered hourly wage by industry sector, quarterly, unadjusted for seasonality

Nationally, the manufacturing and transportation sectors face the most significant gaps between expected demand and current vacancies. In the Sunny scenario, manufacturing might need an additional 164,000 workers and transportation an additional 61,000 workers. However, both sectors currently have labour shortages of 87,000 workers and 49,000 workers respectively. The construction sector may require between 56,000–146,000 new workers in 2030, while the current labour shortfall is roughly 90,000 workers. **Table 4** shows the sectoral and regional distribution of these job vacancies in the second quarter of 2022. Data points that are not shaded or are lightly shaded represent sectors with relatively lower levels of job vacancies. Data points shaded in darker colours represent sectors with relatively higher levels of job vacancies. The bolded and italicized data points represent sectors that will experience average job growth between 2020–2030 across all scenarios.

Table 4: Job vacancies by province, April–June 2022

	Agriculture & Forestry	Construction	Manufacturing	Oil & Gas, Mining	Transportation	Utilities
AB	1,325	***13,775****	4,680	***4,115***	***7,415***	***315***
BC	***4,265***	***21,115***	***9,895***	***1,485***	***9,465***	***655***
MB	895	2,045	2,205	N/A	***2,555***	10
NB	***375***	1,755	***1,610***	65	1,045	N/A
NL	N/A	600	450	***125***	315	50
NS	***365***	2,090	***1,700***	50	910	35
ON	6,135	***28,630***	***32,700***	1,210	***16,610***	***1,065***
PEI	***295***	365	***710***	N/A	220	N/A
QC	3,200	17,270	***31,985***	835	9,430	N/A
SK	755	***1,985***	1,065	***935***	1,180	50

**** Bold and italicized:*** *sectors that will experience average job growth between 2020–2030 across all scenarios*

Several provincial sectors currently face labour shortages where additional labour demand is expected by 2030. New Brunswick's manufacturing sector, and to a lesser extent its agriculture and forestry sectors, could grow by 2030 but currently face labour shortages of 1,610 and 375 workers respectively. In Nova Scotia, the manufacturing sector is already facing high job vacancies of 1,700 workers and could add between 500 to 2,500 jobs. In Ontario, the manufacturing (32,700 vacancies), construction (28,360 vacancies), and transportation sectors (16,610 vacancies) are facing labour shortages, which stands in contrast with the tens of thousands of jobs that could be created across all three sectors. PEI and Quebec's manufacturing sectors (710 and 31,985 vacancies respectively) and Saskatchewan's construction sector (1,985 vacancies) are also facing high labour shortages, despite all three sector's positive growth outlook this decade.

Which sectors will see the largest number of retirements relative to their workforce?

In the past several years, the ratio of older workers close to retirement age (i.e., 55 years and over) and younger workers entering the workforce (i.e., workers aged 25 to 34) has been tipping as the average age of the workforce increases.[116] A direct substitution of younger workers would see the ratio of retiring workers to younger workers equalling 1:1. However, as seen in **Figure 6**, in 2021, the agriculture and forestry, manufacturing, and transportation sectors show a disparity between workers aged 25–34 and workers aged 55 and over. In agriculture and forestry, the ratio is 1:2.8, which means that for every three workers about to leave the workforce, only one young worker is entering the workforce. In transportation, where the ratio is 1:1.6, for almost every three workers about to retire, only two young workers are entering the workforce. In manufacturing, with a ratio of 1:1.3, for every four retirements, three new workers are entering the workforce.

The imbalance between the ratio of workers aged 25–34 and workers aged 55 and over is particularly worrisome for the transportation and manufacturing sectors, which are also expected to see increases in labour demand in many of the scenarios. Encouragingly, aging demographics is not as significant a concern for the utilities and construction sectors, which are also expected to see job growth in all scenarios. **Table 5** shows how various sectors and regions fare regarding aging workforce demographics.

Figure 6: Ratio of workers aged 25–34 and workers aged 55 and over, 2021

Source: Authors. Based on data from Labour Force Survey, Statistics Canada Catalogue no. 71-543-GIE

Table 5: Workers aged 55+ years for every 1 worker aged 25–34 years, 2021

	Agriculture & Forestry		Construction		Manufacturing		Oil & Gas, Mining		Transportation		Utilities	
Province	**2017**	**2021**	**2017**	**2021**	**2017**	**2021**	**2017**	**2021**	**2017**	**2021**	**2017**	**2021**
AB	1.9	6.6	0.5	0.7	0.8	0.8	0.7	0.5	0.8	1.8	0.9	0.7
BC	4.3	2.0	0.7	0.9	0.9	1.5	0.3	1.2	1.3	1.8	0.2	2.1
MB	2.5	4.1	0.6	0.7	0.9	0.9	0.4	0.8	1.3	0.8	0.8	0.4
NB	1.6	1.9	0.9	1.1	1.4	2.2	1.6	0.8	2.6	1.7	0.6	0.8
NL	1.3	4.3	0.9	0.6	1.2	2.6	0.7	0.7	1.5	5.3	0.8	1.1
NS	1.5	3.2	1.1	1.1	1.8	1.6	0.9	0.4	2.4	1.8	1.1	0.6
ON	1.9	2.5	0.8	0.9	1.2	1.3	0.8	1.1	2.2	1.5	0.5	0.7
PEI	1.3	1.8	1.3	1.1	1.3	0.8	NA	NA	2.2	7.6	NA	NA
QC	1.9	2.6	0.5	0.9	0.8	1.4	0.7	1.4	0.8	2.0	0.9	0.5
SK	2.9	3.3	1.2	0.5	1.6	0.6	0.6	1.0	2.0	1.5	1.1	0.6

For every 1 worker aged 25–34, there are >1 workers aged 55+

See average job growth between 2020–30 across all scenarios, and for every 1 worker aged 25–34, there are >1 workers aged 55+

In Alberta's transportation sector, which is expected to require more workers by 2030, for approximately every two workers about to retire, only one young worker is entering the workforce. Transportation in Alberta is also already facing significant labour shortages. In BC's agriculture and forestry and transportation sectors, for approximately every two workers leaving the workforce, only one worker enters the workforce. The manufacturing and utilities sectors in the province are also seeing similar imbalances. In New Brunswick, the agriculture and forestry and manufacturing sectors have aging workforces, with one worker entering the workforce for every two workers leaving. All of these sectors are also already facing labour shortages. Similarly, Nova Scotia's agriculture and forestry and manufacturing sectors have aging workforces, with over three workers leaving the workforce for every new entrant. Nova Scotia's manufacturing sector is also facing high job vacancies. Manufacturing and transportation in Ontario, agriculture and forestry in PEI, and manufacturing in Quebec are also facing similar demographic challenges.

What is the overall outlook for sectors impacted by clean growth?

Many of the sectors where job growth will occur are those where job vacancies are already high, and impending retirements will make it more difficult to fill roles moving forward. In manufacturing, a sector primed to create over 160,000 jobs in a Sunny future, vacancies are already at 87,000. Plus, for every three workers entering the industry, four are expected to leave by 2030. Similar stories of current and future vacancies can be seen in construction, clean energy, and forestry sectors in different provinces, all of which will see job creation in any future in the years to come. This trend is not uniform across all sectors impacted by clean growth—oil and gas workers are younger, and vacancy rates are low in the sector. However, the outlook for this sector is not favourable across all futures, which could imply younger workers will be driven into sectors where labour demand is higher. Even in sectors where decreases in labour demand are expected, such as agriculture, the risk of not having enough workers remains. High levels of job vacancies and a workforce with almost three times as many workers over 55 years old as there are workers under 35 mean the agricultural sector will need to attract many more workers to fill expected roles by 2030.

These findings make it clear that Canada's economy needs to attract, retain, and support a skilled workforce to fill emerging roles. The workers who will fill new jobs may come from other sectors, regions, or countries. But wherever they come from, they will be needed. In the next section, this report examines how well-positioned provinces across Canada are to attract and support the workers they will need to build these projects.

How well positioned are regions across Canada to support the growth of their clean economy workforce?

In sectors and regions where jobs will be created, but vacancy rates are high or waves of retirements are expected, greater focus is needed on attracting, retaining, and supporting workers. To ensure provinces and communities are well-positioned to attract and support talent, they will need to determine how attractive they are to job seekers. This analysis can help each identify how the provinces will be perceived by individuals considering moving to these regions for work in these emerging fields, either newcomers to Canada or individuals seeking to move between provinces as part of a career transition.

What makes a region attractive to skilled workers?

When analysing factors that contribute to the attractiveness of a region, this research places greater emphasis on attractiveness for international immigration. As previously stated, immigration currently accounts for approximately 80% of Canada's labour force growth[117] and is expected to play a key role in the country's future labour force growth. That said, the factors detailed herein are also relevant for attracting skilled talent from other Canadian provinces, including many of those who may be seeking employment in new regions as jobs decline in some regional industries and increase in others.

To identify factors that contribute to the attractiveness of a region, a literature review was conducted where certain macro and micro-elements were identified to form an overall outlook for regional attractiveness and supportiveness for skilled workers. Overall, these macro and micro-elements relate to a sense of safety and security, a sense of economic opportunity, and the presence of social support connections for individuals seeking employment. The macro-elements include political stability, environmental hazards, education, and cost of living.[118] The micro-elements include the career prospects offered by a region, the availability of affordable housing, the presence of family and friends within a region, and a region's population density. In Canada, while there is some regional differentiation between the macro-elements, such as the cost of living, macro-elements are largely consistent nationally when held up against international peers. On the other hand, many of the micro-elements vary from province to province and city to city. Given the relative consistency of macro-elements in making Canada attractive as a whole, this research looks at the micro-elements which help determine the relative attractiveness of various provinces to skilled labour to better understand how workers may view opportunities across the country. This understanding, in turn, can help identify priority areas a given region can focus on to become more attractive and supportive to grow its workforce in key sectors of the clean economy. There are additional factors relevant to drawing in talented workers, but are beyond the scope of regional policymakers. These include company-level factors like workers wanting to work in organizations that value them, recognize their efforts, and provide a sense of purpose.[119] These are critical but are often not directly connected to why someone may seek employment in a particular region or sector. Rather, they are indicative of why an individual might join a particular organization and therefore, are out of this report's scope.

This report analyzes the following four factors to determine the attractiveness of a region to talent. These factors illustrate the economic and social dynamics that act as regional "pull factors," or factors that attract workers, for skilled talent:

Career Prospects: Career prospects, as measured by the future employment and wage or income opportunities offered by a region, are important determinants in a person's decision to migrate.[120] The choice to migrate is led by expectations about an individual's labour market position in the destination region or country compared to one's home region or country. Historically, international migration patterns typically flow from poorer to richer countries as workers seek higher wages and better employment opportunities. High-income levels serve to pull migrants to a specific country or region, and as income differentials increase, there is a more significant incentive to migrate. The reverse also holds true. According to 2021 data from the Organization for Economic Cooperation and Development (OECD), with an average wage of $56,006 USD, Canada compares relatively favourably to many countries. While it has a higher average wage than the United Kingdom ($49,979 USD), it still falls short of average wages in Australia ($56,600 USD) and the United States ($74,738 USD).[121] The strong position held by Canada based on its per capita income means that wage and job opportunities are extremely likely to be pull factors for immigration to the country. This pull however, might differ province by province. Consequently, this focus on wages does not offer insights into factors such as the distribution of income between occupations within these sectors.

Availability of Affordable Housing: High housing costs affect a person's decision to stay in one place or move to another location.[122] Research has identified that high relative housing prices in an area reduce labour mobility to the region, particularly in terms of migration.[123] This paper also analyzes age and level of education to show that the negative impact of high relative housing prices and homeownership on mobility tends to be more significant for young persons and highly skilled individuals. In the face of soaring house and rent prices in Canada, especially in metropolitan areas, housing affordability plays an increasingly important role as a "pull" factor for individuals. In this report, both purchase and rental markets are analyzed to assess housing affordability. Subject to data availability, data for all census metropolitan areas (CMAs) in Canada was looked at to develop an average for each province. However, given limitations around data availability, the samples drawn on for each province differ. For instance, the results for Nova Scotia are based purely on Halifax's housing affordability, compared to the results for Quebec, which are based on housing affordability data from five CMAs.

Presence of Family and Friends: Perhaps the most significant social pull factor that attracts skilled immigrants to Canada, or a region within Canada, is the presence of family and friends.[124] Immigrants are often attracted to host countries with large diasporas from their country of origin and countries that enable individuals to immigrate with family members.[125] The pull of family and friends is owing to two reasons. First, family and friends act as sources of information about a new city within their networks[126] and thereby act as "migrant multipliers."[127] Once migration from one place to another has begun, the momentum of people moving from one place to another can build independent of policy and economic changes.[128] Second, personal connections in a city or country reduce the social, cultural, and even financial costs and risks associated with immigration. Financial and psychological support from immigrating with family members or from a community of people who speak the same language and share the same culture makes it more likely, and easier, for immigrants to integrate into their new communities. This support could come in the form of finding a home, accessing the medical system, obtaining education and training, or finding employment.

Population Density: Immigrants tend to settle down in urban areas due to the economic, cultural, and social opportunities that large cities can offer.[129] Along with these opportunities, the available market for jobs, social networks, and historical and cultural links act as pull factors for immigrants as metropolitan regions experience significantly faster growth and development than their more rural counterparts. In Canada's case, historically and as shown in studies,[130] immigrants tend to choose the largest Canadian cities and economic centres to settle, namely: Montreal, QC, Toronto, ON or Vancouver, BC[131] — known as the "MTV effect."[132] Immigrant concentration and population growth may have important implications for policymakers looking to grow the clean economy workforces of businesses outside these three cities.[133]

Box 3: Defining migration and immigration

Movement of skilled talent or migration can take two primary forms:

Immigration: This involves the movement of people from other countries into Canada. Canada has one of the highest immigration rates in the world, second only to Australia.[134] Immigrants comprised over 8.3 million, or 23%, of Canada's population in 2021.[135] By 2041, immigrants are expected to represent as much as 34% of the total population.[136] Immigrants to Canada are overwhelmingly (95.8%) under the age of 65, and a majority (64.2%) are in the core working age of 25–54 years. Overall, international immigrants to Canada are responsible for almost twice as many new arrivals into regions across the country as inter or intra-provincial migration.

Internal Migration: Inter-provincial migration (between two provinces) and intra-provincial migration (within the same province) are considered internal or domestic migration. Inter-provincial migration rate has remained relatively stable since the late 1990s, ranging from 254,000 to 305,000. Between 2016 and 2021, an average of 269,080 people moved annually from one province or territory to another province or territory in Canada.[137] Ontario, British Columbia, and Alberta are the most popular destination provinces and provinces of origin for inter-provincial migration.[138] Meanwhile, between 2016 and 2021, approximately 220,000 people migrated intra-provincially annually. While Hamilton, ON, Kitchener-Waterloo-Barrie, ON, and Montérégie, QC were the most popular destinations for intra-provincial migrants, Toronto, ON, Montreal, QC and Lower Mainland-Southwest, BC were the most common regions of origin for intra-provincial migrants.[139]

Overview of regional attractiveness analysis

This report compares provincial and regional attractiveness based on the four factors outlined above against a subset of clean economy jobs discussed in this report. This analysis focuses on two sectors that are set to grow across all futures and will need to recruit additional workers: the construction and utilities sectors. These two sectors are detailed as case studies in this analysis to better understand how well-positioned regions are to support their growth. These two sectors will each require many new workers across the country, yet each faces different challenges. High vacancy rates and expected retirements in the construction sector will make meeting expected growth in labour demand more difficult. The utilities sector, on the other hand, is young, and vacancy rates are currently low. But it will require additional workers in ten of Canada's thirteen provinces and territories across all scenarios modelled in this report. These two sectors are used as the basis for all aspects of this analysis, from regional career prospects to wage levels, to determine how well-positioned provinces are to support their clean economy workforce.

Based on a comparative assessment of provinces on the four factors, this report assigns each province a grade for each factor, ranging from A to D. Grade "A" provinces are those that, when compared to others, are in the top 25th percentile in terms of career prospects, affordable housing, presence of family and friends, and population density. Grade "B" provinces are in the top 50th percentile, grade "C" provinces are in the 75th percentile, and the remaining provinces are marked grade "D." The grades assigned to provinces are not an indicator of their attractiveness in absolute terms. The analysis first compares provinces on each factor, then assigns a cumulative grade which averages provinces' grades across all four factors.

Box 4: Methodology for components of analysis

Results for employment and wage opportunities in the construction and utilities sectors are represented as an average percentage change across the four scenarios. The regional housing affordability analysis is based on the incomes of a subset of occupations using the National Occupation Classification (NOCs) within the construction and utilities sectors. For measuring affordability for key NOCs within these sectors, it is assumed that households are single-income, and the analysis uses the top 50% of NOCs in each sector (measured by which occupations make up the largest percentage of the workforce in the sector). The yearly income of the NOCs assessed ranged from $25,808 to $103,919 CAD, depending on the NOC and the province. The average salary in Canada is around $54,630 CAD.[140] Therefore, although this analysis only looks at construction and utilities sectors, findings are arguably representative of a broad range of occupations across all sectors. The complete table of NOCs can be found in **Appendix 5**. The affordability of renting and home ownership was assessed for all CMAs in Canada where data was available, and an average was taken to evaluate the overall affordability level for each province. Data availability limited the scope of results. For instance, the results for Nova Scotia were based purely on Halifax housing affordability. In comparison, Quebec was based on housing affordability data from five CMAs. Therefore, the findings, while indicative of regional variations in housing affordability, may not fully represent a given province.

Data from Canada Mortgage and Housing Corporation was used to analyze rental affordability. The most recent rental data from Canada Mortgage and Housing Corporation at the time of data collection was dated October 2020. The rental market has fluctuated considerably between 2020 and 2022, and rental affordability findings do not reflect more recent changes in the rental market. Data from the Canadian Real Estate Association was used to analyze the affordability of home buying. The latest purchase data from Canadian Real Estate Association at the time of data collection was for May 2022. Calculations for purchase affordability were based on a 30-year mortgage with 3% interest rates due to the historical average at the time of data collection. However, house prices have changed since May 2022, and so too have mortgage interest rates which are now considerably higher. Therefore, the analysis does not perfectly reflect current housing affordability across the regions examined.

The third factor (the presence of family and friends) is assessed based on data from Statistics Canada on the regional immigrant populations of different provinces. Provinces are compared based on the proportion of recent immigrants (i.e., persons who obtained landed immigrant or permanent resident status between 2016–2021). Future research may add to this and look at ways to compare provincial immigration programmes, another element that would impact the presence of family and friends in a province. Finally, the last factor (population density) is assessed based on a population-weighted density (PWD) calculation of all CMAs across Canada (where data was made available by Census 2021). Further methodological details can be found in **Appendix 6**.

Career prospects

Provinces' ability to attract skilled workers to advance clean growth projects depends on the career prospects that key sectors of the economy can offer.[141] The literature identifies that the economic attractiveness of a region is increased by having more available jobs for workers and by higher wages associated with filling these roles. Therefore, this analysis views provinces with many available jobs and higher wages as more attractive to potential residents.

Employment opportunities

Across construction and utilities, as seen in **Figure 7**, Alberta, British Columbia, Ontario, and Saskatchewan see increased employment opportunities in both sectors. Alberta and British Columbia have stronger jobs numbers in utilities than construction, while Ontario and Saskatchewan's strength lies in construction. Quebec looks set to experience a decrease in labour demand of 5% in construction and 7% in utilities.

Figure 7: Employment opportunities in construction and utilities, by province

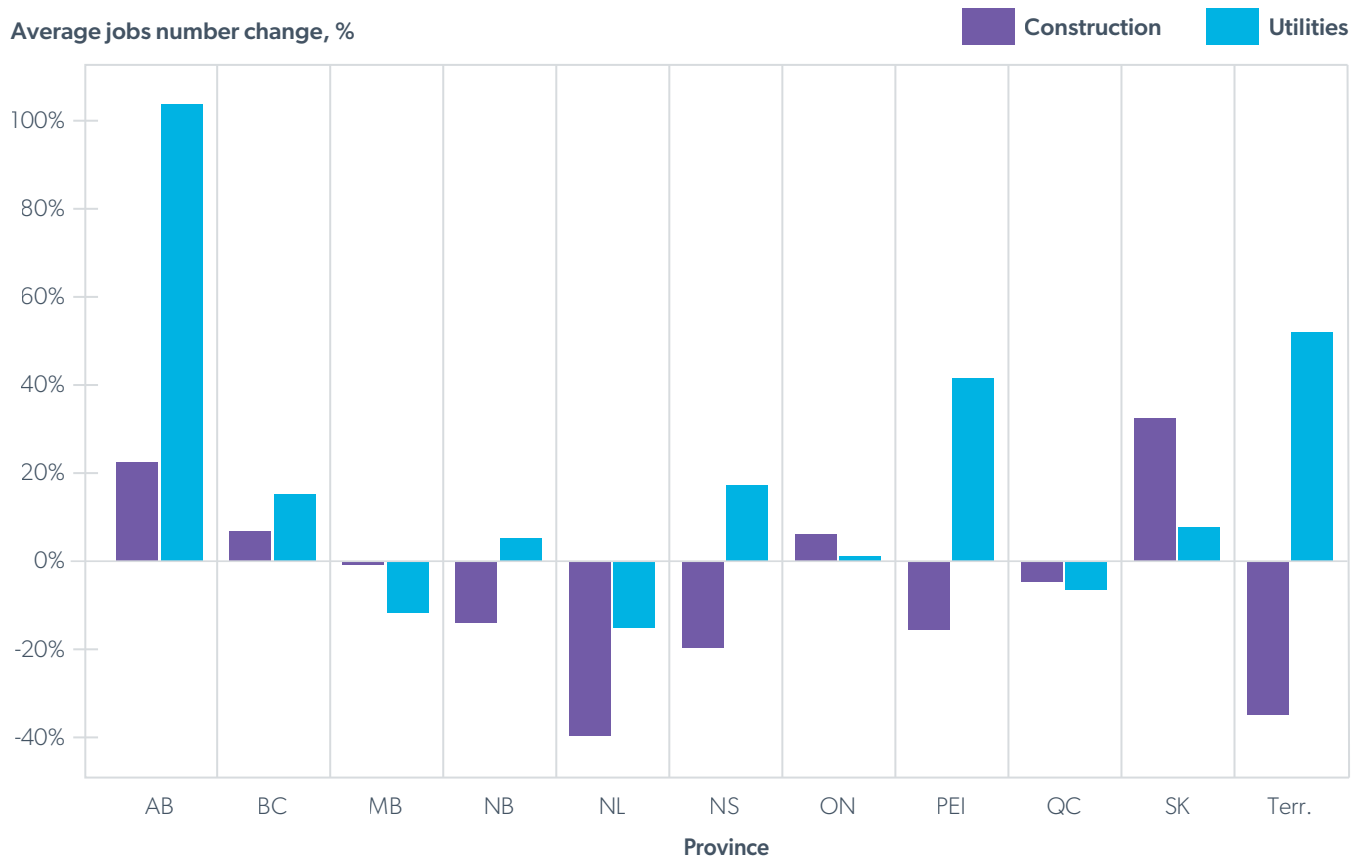


Figure 7 shows the percentage change in provinces' 2030 construction and utilities jobs relative to 2020 numbers. It represents average job growth across all four scenarios.

The territories, in contrast, see growth in labour demand in utilities and decreases in labour demand in construction. The growth in utilities sector jobs could result from the adoption of several policy measures meant to build a sustainable and affordable energy system in communities that currently rely on fossil fuels (including off-grid diesel communities). It should be noted that this analysis does not account for every potential project that could be advanced. One example of excluded roles is construction jobs that might be created by major energy projects, such as hydrogen production facilities, or by meeting ambitious provincial/territorial housing construction targets. Therefore, these job creation estimates should be interpreted as conservative.

Wage opportunities

Across the regions analyzed, nearly all provinces experience wage increases. However, these increases notably do not follow the job growth patterns discussed above. Specific reasons for wage changes are difficult to determine. Wages offered in an industry are reflective of labour demand, specialization, market demand, and underlying norms within a given occupation. Wage changes can occur with economic growth or population changes, which have subsequent impacts on the demand and supply of workers.[142] Industries experiencing a higher intensity of labour shortages may also offer higher wages compared to the national average.[143] It is important to note that wage increases generally do not always amount to wage increases or higher salaries for new residents or immigrants. Typically, longer-term

employees (those that have been working for their employer for more than 12 months) or those in the top 25% in terms of wages (>$40.00 CAD per hour) are more likely to have seen their wages increase and keep pace with inflation.[144] Immigrants might not fall into either of these categories, as they earn significantly less on average than their Canadian-born counterparts (between 3% and 21% less, depending on their time spent in Canada).[145] That said, the perception of increased wages or future income opportunities is what contributes to a region's attractiveness rather than the actual wages.

Newfoundland and Labrador is expected to have the highest wage increase of 16% in the construction sector and 17% in the utilities sector. In the case of Newfoundland and Labrador, shrinking population numbers out to 2030 and resulting labour supply reduction or shortage might explain wage growth in the province. Manitoba also performs highly in terms of wage changes, with both the construction and utilities sectors showing an expected increase of 10%. PEI expects to see the lowest wage changes—only 0.4% wage growth in construction and 4% in utilities. For PEI, slower economic growth might explain the relatively low wage increases. Historically, wage rates have tended to be lower in Atlantic Canada, given slower growth and lower overall labour demands.

The four major provinces and economies of Alberta, British Columbia, Ontario, and Quebec have median outlooks in terms of wage increases across both sectors, and the wage change patterns across the four provinces are similar. Out of the four provinces, Quebec is forecast to have the highest wage increases of 10% in both construction and utilities. Ontario also sees significant wage increases across both sectors—approximately 9%. While the utilities sector in Alberta has the second lowest increase in wages, only above PEI, the construction sector sees slightly higher wage increases and is more comparable to British Columbia's construction sector wages. British Columbia's utilities sector sees lower wage increases than its construction sector, yet wages are expected to be 3% higher than in Alberta's utilities sector.

Figure 8: Wage opportunities in construction and utilities, by province

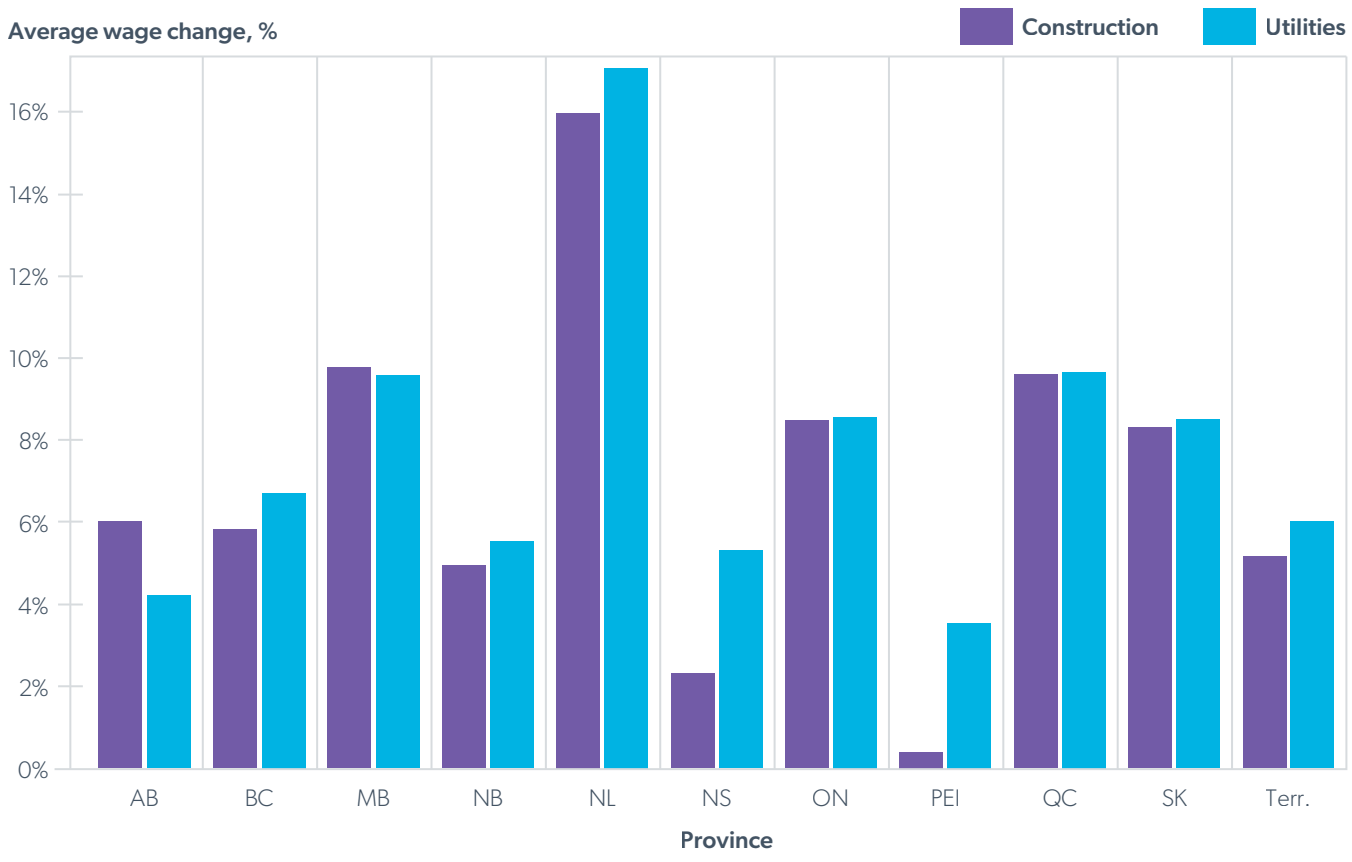
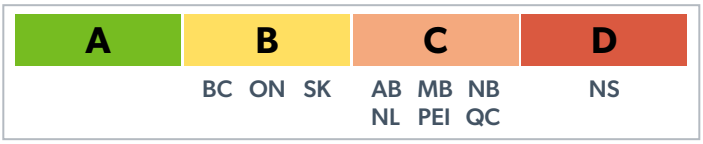


Figure 8 shows the percentage increase in 2030 wages (relative to 2020 wages) for workers in the construction and utilities sectors for all provinces.

Provincial comparison: career prospects



Grades given to provinces reflect aggregate employment and wage opportunities in each province. Thus, for example, a province which gets an A in employment opportunities but scores a C in wage opportunities is given an overall rating of B. A province with an A in employment opportunities and a B in wage opportunities is given an overall rating of B. Provinces with lower grades are those who would benefit most by improving the attractiveness of career prospects for workers in Canada.

No province has an overall A grade for its career opportunities and wage prospects, suggesting that all provinces could be doing more to attract and support a growing workforce. While Alberta and Saskatchewan score an A in employment opportunities, their overall career prospects grade fall due to lower rankings on wage opportunities. Saskatchewan, British Columbia, and Ontario offer the most attractive career prospects to workers in green economy roles. Despite a high score in employment opportunities, Saskatchewan scores only a B on wage growth, making its overall grade a B. Meanwhile, BC and Ontario score a B in both employment and wage opportunities. Provinces with slightly less favourable overall career prospects are Alberta, Newfoundland and Labrador, New Brunswick, Manitoba, Prince Edward Island and Quebec. Despite a high score in employment opportunities, Alberta's low D score in wage prospects brings down its overall grade to C. Newfoundland scores highly on wage prospects but loses out on employment opportunities, resulting in an aggregate C grade. New Brunswick scores C in both employment and wage opportunities. Both Manitoba and Quebec score poorly on employment opportunities, earning D grades, but both score A grades on wage opportunities, resulting in an aggregate C grade. PEI is the opposite, scoring highly on employment opportunities but poorly on wage opportunities. Meanwhile, Nova Scotia scores poorly on both metrics, with a C in employment and a D in wage opportunities.

Availability of affordable housing

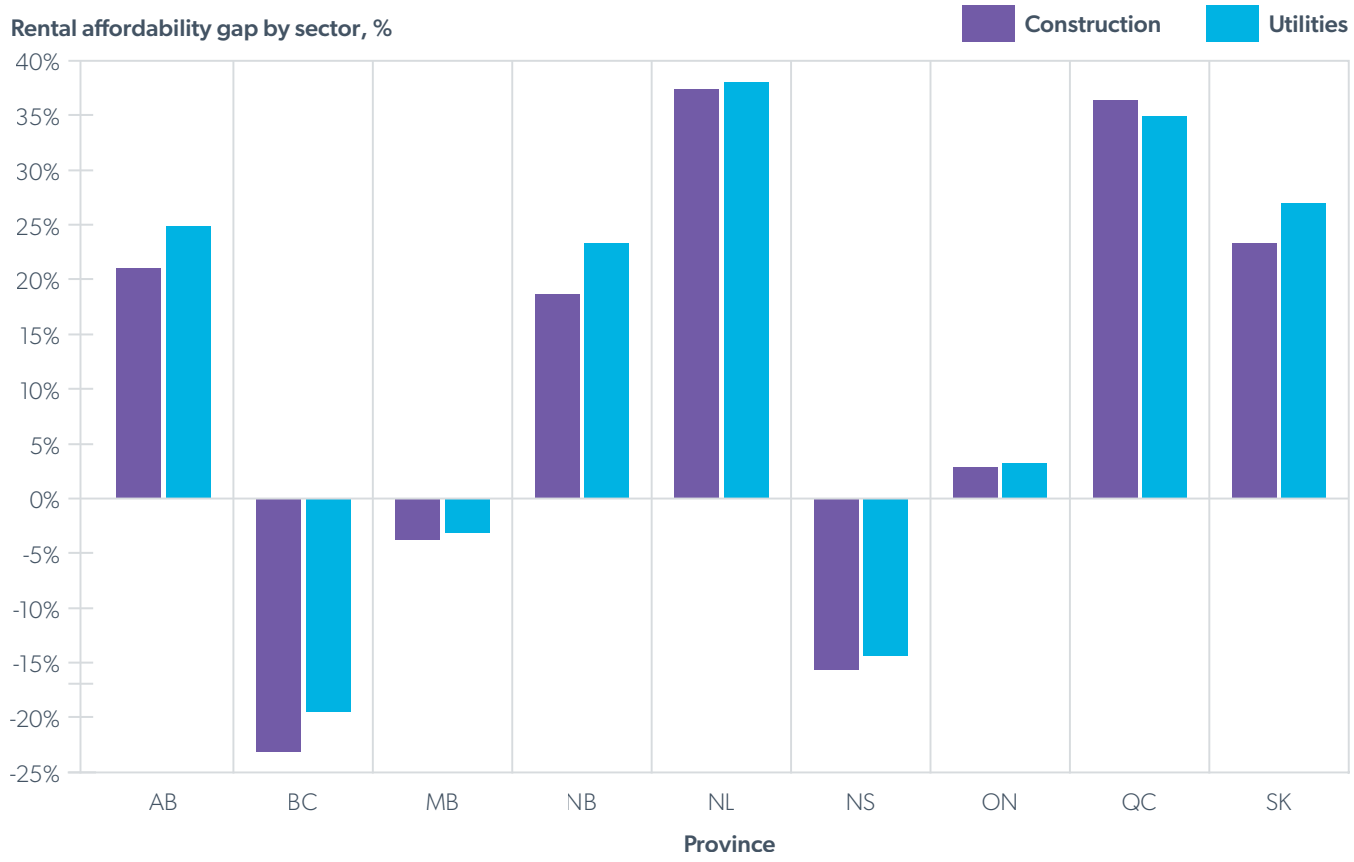
The presence of an affordable home to live in, whether through buying or renting, is critical to attracting and retaining talent. While there are many ways to define affordability, arguably the most widely used definition of affordable housing is often called the 30% Rule. Per the 30% Rule, housing is deemed affordable when it costs less than or equal to 30% of a household's pre-tax income.[146] This report assesses housing affordability by identifying the cost of home ownership and renting an apartment for key occupations within construction and utilities. This report looks at affordability for two types of housing: apartment renting (2-bedroom) and a single-family home purchase.[147] Affordability between provinces is compared based on a measurement of the "affordability gap," which in this report is defined as the percentage difference between what it actually costs to rent or buy a home and what would be considered affordable for an income group according to the 30% house affordability rule. A positive affordability gap reflects additional income after accounting for what is needed to afford a home. A negative gap reflects how much additional income an individual would need to afford the actual housing cost. Further methodological details for this analysis can be found in **Appendix 7**. It should be noted that affordability is less common in Canada than it used to be. Housing prices in Canada have increased dramatically since the 1990s, with total ownership costs, including mortgage payments, now being up to 60% of a typical household's income.[148] Canada has one of the highest house price-to-income ratios in the Organization for Economic Cooperation and Development (OECD), with lower housing affordability than peer countries such as the United States, the United Kingdom, and Australia.[149] However, an analysis comparing housing affordability in different provinces is still helpful in understanding how accessible housing is for growing the clean economy workforce, and how provinces and territories compare to one another.

Affordability for rentals

Newfoundland and Labrador was found to be the most affordable province, with an average rental affordability gap of 37% and 38% respectively. In other words, on average, workers in Newfoundland and Labrador's construction sector earn 37% more than what is required to afford to rent a 2-bedroom apartment in the province. Meanwhile, workers in the province's utilities sector earn 38% more than what is essential to afford to rent. Quebec follows very closely in affordability, where workers have an affordability gap of 36% in both sectors. Alberta also performs well on 2-bedroom rental affordability, with an affordability gap of 21% in the construction sector and 25% in the utilities sector. Ontario does less well, although renting is still affordable, with a 3% affordability gap for both sectors.

British Columbia is the least affordable province for both sectors. Construction workers, on average, have an affordability gap of -23. Similarly, workers in the utilities sector have an average affordability gap of -19%. Both Nova Scotia and Manitoba are also unaffordable, on average, for both sectors. Construction workers would require an increase in monthly income of 16% (Nova Scotia) and 4% (Manitoba), while workers in the utilities sector would require an increase of 14% (Nova Scotia) and 3% (Manitoba). A recent Rentals.ca survey found that Nova Scotia had the highest increase in year-over-year average rent of 21%.[150] This trend was partly driven by the pandemic, which fuelled an increase in interprovincial movement to Halifax, NS from larger cities such as Toronto, ON due to lower rent prices.

Figure 9. 2-Bedroom rental affordability for construction and utilities



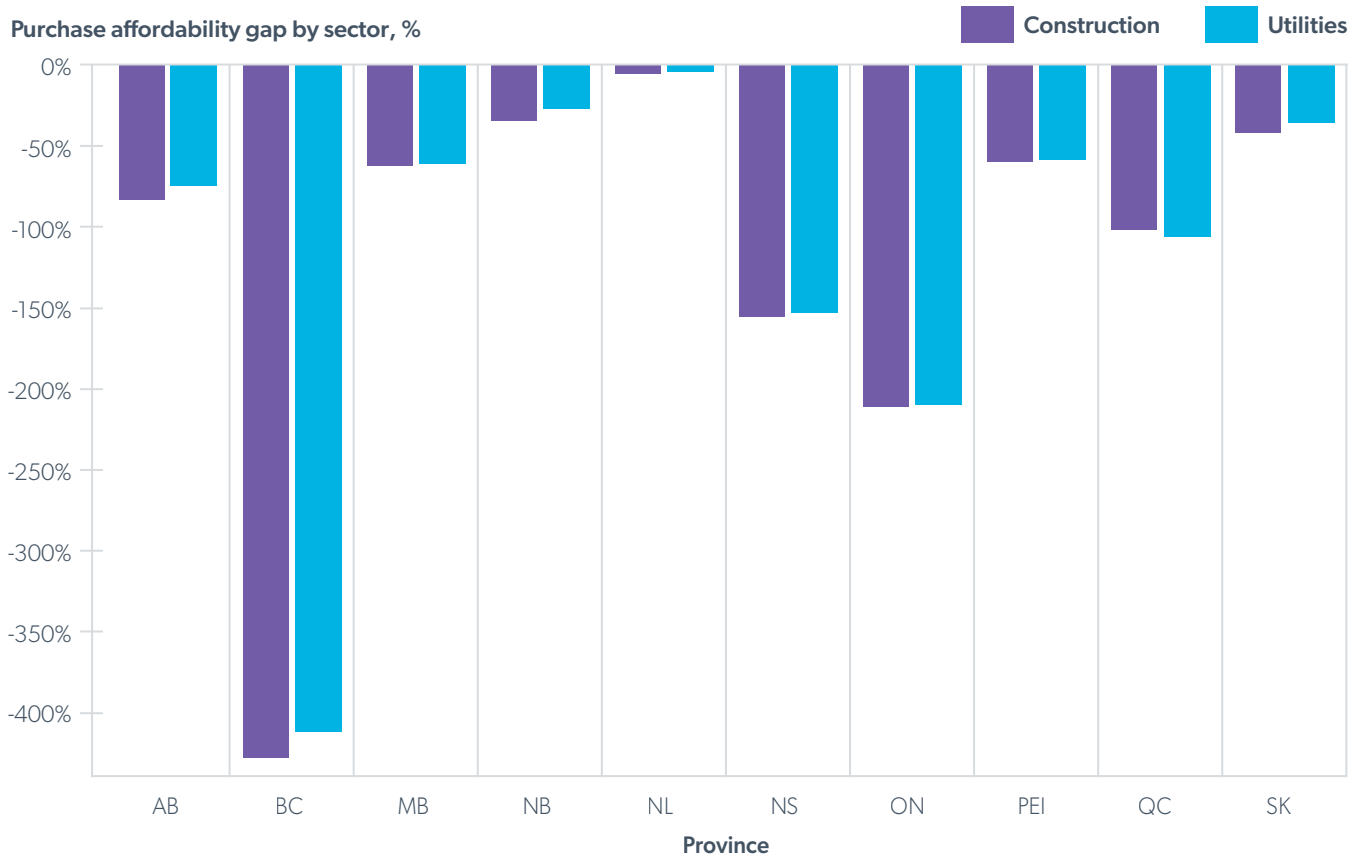
Source: Author. Based on Data from CMHC 2022. Figure 9 shows the affordability gap (defined as the percentage difference between what it actually costs to rent a home and what would be considered affordable for an income group based on the 30% house affordability rule) for renting a 2-bedroom apartment for workers in the construction and utilities sectors in all provinces. PEI and the territories are excluded due to a lack of data.

Affordability for home ownership

The analysis shows that, on average, workers in the construction and utilities sectors cannot afford to buy a single-family home in any province. This trend is not a product of average wage rates in these two sectors. Rather, it is a reflection of how unaffordable housing costs have become in Canada. Similar to the rental market, Newfoundland and Labrador is the most affordable province for both sectors, with an average affordability gap of -5%. New Brunswick is the second most affordable, where construction workers have an affordability gap of -34% and workers in utilities have an affordability gap of -27%.

At the other end of the spectrum, British Columbia is again the most unaffordable and purchasing a home is entirely unreachable for most workers. On average, construction workers in BC have an affordability gap of -427%. This means workers would have to increase their yearly income by 427% to be able to afford to purchase a single-family home in the province. Similarly, workers in the utilities sector in British Columbia have an average affordability gap of -412%. Ontario is the second least affordable province for home purchase, with affordability gaps of -211% and -210% in the construction and utilities sectors respectively. Nova Scotia is also highly unaffordable, with workers in both the construction and utilities sectors needing to increase their yearly income by 154%, on average, to afford to buy a single-family home in Nova Scotia. According to The Nova Scotia Association of Realtors, in October 2022, Nova Scotia saw a price increase of nearly 10% on a year-over-year basis for single-family homes.[151] Quebec and Alberta are both similarly unaffordable. With average affordability gaps of -101% and -106% in Quebec's construction and utilities respectively, an individual worker in these sectors would have to double their yearly income to purchase a home. Alberta faces a smaller but significant affordability gap of -83% in construction and -74% in utilities.

Figure 10: Single-family home buying affordability for construction and utilities



Source: Author. Based on Data from CREA, 2022. Figure 10 shows the affordability gap for buying a single-family home for workers in the construction and utilities sectors in all provinces. The territories are excluded due to lack of data.

Provincial comparison: housing affordability

A	B	C	D
NL SK	NB PEI QC	AB MB	BC NS ON

Grades given are an aggregate of rental and purchasing affordability in each province. Thus, for example, a province which gets an A in rental affordability but scores a C in purchasing affordability is given an overall rating of B. A province with an A in rental affordability and a B in purchasing affordability is given an overall rating of B.

Newfoundland and Labrador and Saskatchewan have the lowest affordability gaps and therefore are graded A in this report. New Brunswick, PEI, and Quebec follow in the B category: New Brunswick scores an A on purchasing affordability and a B on rental affordability; PEI[152] scores a B on purchasing and rental affordability; and Quebec scores an A on rental affordability and a C on purchasing affordability. Alberta and Manitoba receive a score of C as a whole. Alberta scores a B on rental affordability but a C on purchasing affordability, which pulls down its overall grade. Manitoba's rental market scores a D, indicating it is not particularly affordable, whereas buying a home is more affordable and is graded B, which makes its overall score a C. The most significant housing affordability gaps for the construction and utilities sector are in Ontario, Nova Scotia, and British Columbia. Renting in Ontario is marginally more affordable than buying but is still highly unaffordable overall, giving it a D. In BC and Nova Scotia, both renting and purchasing are highly unaffordable and score a D. These provinces will need to invest heavily in making housing more affordable to better support their workforce, or they risk making it more difficult for clean economy companies in these provinces to find skilled workers. It should be reiterated that the findings of this analysis have little to nothing to do with compensation levels in any of the growing clean economy occupations in this analysis. Wage levels for these occupations are typically above-average market wages, and many occupations outlined in this analysis have similarly competitive benefits packages supported by membership in labour unions.[153] This analysis is entirely a reflection of the unaffordable nature of Canada's housing market, although it is clear home ownership is far less affordable than the rental market.

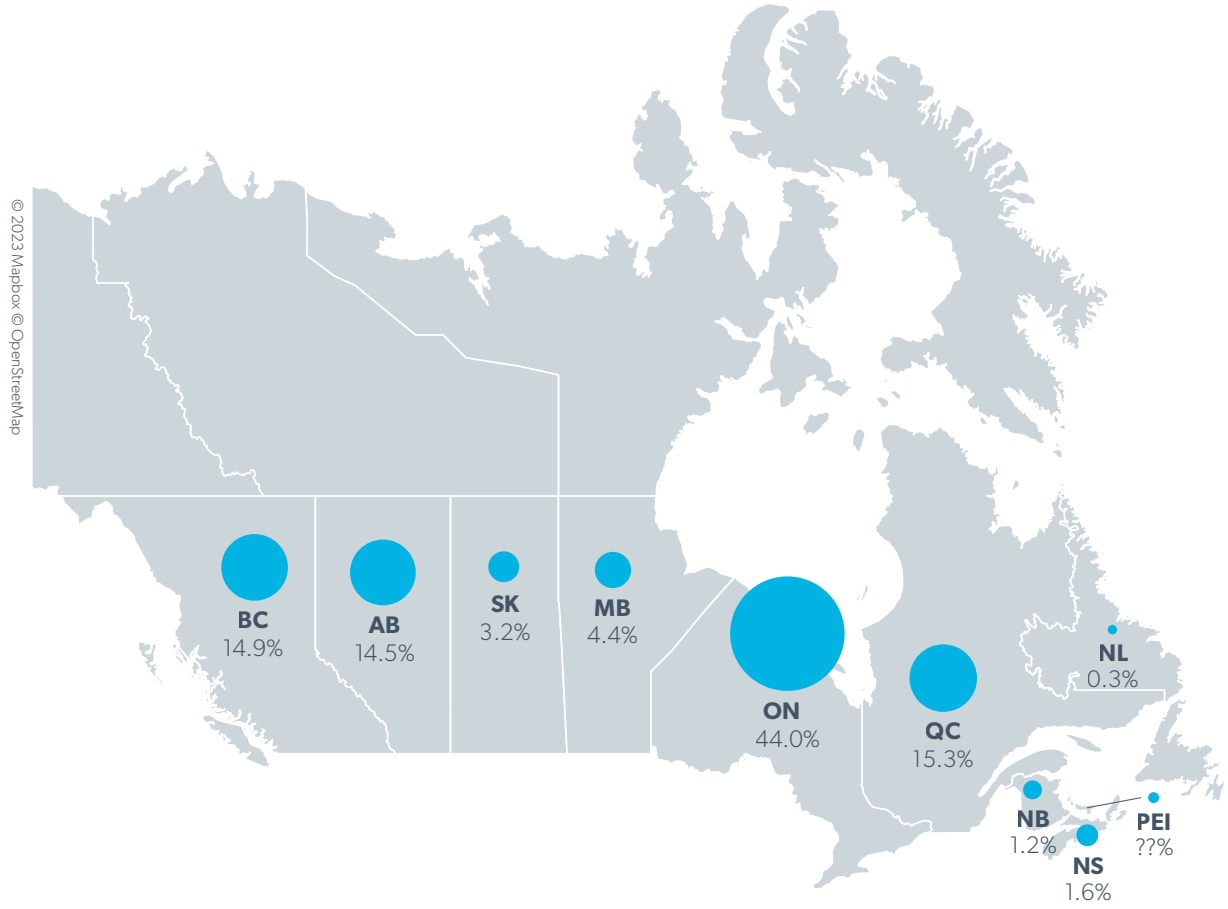
Presence of family and friends

The presence of family and friends acts as a significant social pull factor for immigration. Research suggests that immigrants to Canada typically decide where to settle based on where their personal and family networks are located. And, when they can, newcomers to a region tend to settle in the same neighbourhoods as their social networks.[154] Since the presence of family and friends in a given region will differ by individual, this report uses a proxy to determine attractiveness: the share of recent immigrant population. Provinces are compared based on the proportion of recent immigrants (i.e., persons who obtained landed immigrant or permanent resident status between 2016–2021). The greater the immigrant population in a given region, it is presumed that there are increased social networks through family and friends, which will thus attract more immigrants to that region. Additionally, many Provincial Nominee Programs (PNPs), a provincial stream for immigration, offer additional weightage for having family members in the province, making the draw even greater for attracting skilled workers.[155] The opposite also holds—the smaller the immigrant population, the less likely there will be a social network to attract immigrants.

Overall, larger economic and urban centres offer greater social networks for newcomers. Over 9 in 10 recent immigrants are choosing to live in one of Canada's CMAs.[156] According to the 2021 Census, 92.2% of immigrants in 2021 lived in a CMA or a city with a population larger than 100,000 residents. In comparison, only 67.7% of Canadian-born residents lived in an area with over 100,000 residents.[157] In Canada's 41 largest urban centres, the proportion of immigrants is above the national average of 23%. Of these 41 urban centres, the top 10 with the highest proportion of immigrants are: Toronto, ON (46.65%), Vancouver, BC (41.8%), Calgary, AB (31.5%), Abbotsford-Mission, BC (26.1%), Edmonton, AB (26%), Kitchener-Cambridge-Waterloo, ON (25.8%), Hamilton, ON (25.6%), Winnipeg, MB (25.4%), Montreal, QC (24.3%), and Windsor, ON (23.3%).[158]

As seen in **Figure 11**, Ontario, British Columbia, and Quebec welcomed the largest immigrant population in Canada between 2016 and 2021, with dense and highly urbanized population centres of Toronto, ON, Vancouver, BC, and Montreal, QC serving as the most popular destinations for newcomers.[159] Toronto, ON has the largest proportion of immigrants overall—nearly half (46.6%) of Toronto's population in 2021 were immigrants. Within the Toronto CMA, four municipalities have immigrant populations that make up over half their residents: Markham (58.6%), Richmond Hill (58.2%), Mississauga (53.2%), and Brampton (52.9%). Comparatively, between 2016 and 2021, the Atlantic provinces—Newfoundland, Prince Edward Island, Nova Scotia, and New Brunswick—welcomed the least number of immigrants and had the lowest rates of immigration in Canada.[160] Based on current immigrant distribution and population sizes, this suggests that these provinces may struggle to attract skilled talent in the future without changes in immigration patterns, barring major unforeseen developments outside of the province. However, things have improved recently for Atlantic Canada. The share of recent immigrants settling in Atlantic Canada has almost tripled since 2006, from 1.2% to 3.5% in 2021—a product of provincial immigration strategies like the Atlantic Immigration Program (AIP), the pandemic, and the rising cost of living in major urban centres such as Toronto, ON and Vancouver, BC.[161] This change has been most notable in the large urban centres of the Atlantic provinces, such as Moncton, Fredericton, and Saint John, NB and Halifax, NS, where between one-third and one-half of all immigrants living in these cities arrived between 2016 and 2021.[162]

Figure 11: Geographic distribution (%) of recent immigrants in Canada by province, 2016 to 2021



Source: Authors. Based on Census of Population, 2021. Figure 11 shows the geographic distribution of recent immigrants (i.e., a person who obtained permanent residence or landed between 2016–2021). Percentages represent the portion of the national total in each province.

While identifying the presence of friends and family is a useful proxy, it is an imprecise indicator for determining exactly where a given individual may choose to settle. Ultimately, the factor that determines which regions are more attractive to newcomers to Canada is whether they personally have social networks in the region. This measure will vary based on an individual's nationality, ethnicity, and religious affiliation, amongst other factors. To better understand where different groups of immigrants are settling in Canada, **Appendix 8** shows the diversity of immigrants and non-permanent residents in the top 10 urban centres with the highest proportion of immigrants based on the 2021 Census, as grouped by Statistics Canada. For most urban centres, South Asian (e.g., East Indian, Pakistani, Sri Lankan) was the predominant, or among the largest, visible minority group. Arab immigrants comprise the largest group in Montreal, QC and Windsor, ON, although Montreal's second largest group is Black, and Windsor's is South Asian. The largest group in Vancouver, BC is Chinese, and South Asian is the second largest. The largest visible minority group in Moncton, NB is Black. In Winnipeg, MB Filipino is the largest group, then South Asian. Calgary and Edmonton, AB also have a strong Filipino presence, with Filipino being the second largest group in these two cities.

Despite the popularity of Toronto, ON, Montreal, QC, and Vancouver, BC as leading destinations for immigrants, these cities have recently been losing their appeal against other CMAs. Though these three cities have welcomed, and are continuing to welcome, the greatest number of recent immigrants, they are seeing their share of recent immigrants declining. Instead, areas outside large urban centres are seeing their share of recent immigrants increasing. For example, Montreal, QC's share of the immigrant population declined from 14.8% in 2016 to 12.2% in 2021, whereas the share of recent immigrants in Kitchener-Cambridge-Waterloo, ON almost doubled from 2016 to 2021. Similarly, the share of recent immigrants to Atlantic Canada—concentrated mainly around urban centres in the region such as Moncton, Fredericton, and Saint John, NB and Halifax, NS—has almost tripled, rising from 1.2% in 2006 to 3.5% in 2021.

These trends reflect the tension between the appeal of regions with more affordable housing, typically found outside big urban centres, versus wanting to be near areas with high economic opportunities, typically concentrated in urban centres. The largest real estate markets are losing residents, while smaller CMAs and rural areas are gaining residents who are fleeing big cities

in search of something more affordable. 60,091 more people left cities for other parts of the same province at a rate 59% faster than the year before.[163] Net losses were biggest in Toronto, ON (-64,121 people), Montreal, QC (-39,904), and Vancouver, BC (-12,245).[164] This data shows that while Canada's urban centres might be more attractive to immigrants in terms of career prospects and social networks, the lack of affordable housing is counteracting these factors.

Provincial comparison: presence of family and friends

A	B	C	D
BC ON QC	AB MB	NS SK	NB PEI NL

Grades given represent the share of recent immigrants in each province. Provinces with the highest proportion of recent immigrants are graded A, whereas provinces with the lowest proportion of recent immigrants are graded D.

Ontario, Quebec, and British Columbia have the largest proportion of recent immigrants due to the "MTV" (Montreal, Toronto, Vancouver) effect, all receiving an A. Out of all provinces, Ontario has the highest proportion of recent immigrants, followed by Quebec and British Columbia. With a slightly smaller share of recent immigrants, Alberta and Manitoba score a B. Smaller yet, and thus less attractive, are Saskatchewan and Nova Scotia with C grades. Finally, with the smallest share of recent immigrants and an assumed smaller share of immigrant networks, New Brunswick, Prince Edward Island, and Newfoundland and Labrador each score a D. For these set of provinces, attracting talent may be more challenging; additional supports may be required for these provinces that may not be needed in provinces with larger existing social networks.

Box 5: Ability to immigrate to Canada with family members

For skilled workers, immigrating to Canada becomes all the more attractive when they are able to do so with their families. New permanent residents or citizens of Canada can bring family members—including spouses, dependent children, parents, grandparents, and other select relatives[165]—through the federal government's Family Class Sponsorship Program.[166] Economic immigrants to Canada can also apply to bring along family members, including spouses, common-law partners, children, and grandchildren. Overall, family immigration made up 59% of total permanent resident admissions in 2020. Within this, 27% were through the family reunification program, while the remaining 32% were accompanying family members admitted through economic and refugee streams.[167] These programs not only attract highly skilled economic immigrants to Canada, but also incentivize them to stay in the country for the long term.

Though Canada is considered one of the top countries regarding having a favourable family reunification program,[168] visa processing delays have been a long-term national-level issue which has been highlighted and compounded by the pandemic.[169] According to Immigration, Refugees and Citizenship Canada (IRCC), as of the end of February 2022, the processing time for spousal applications, for example, was between 17 and 20 months.[170] Studies have suggested a range of policy solutions to try and reduce processing times and backlogs.[171] Recommendations include that IRCC ensures consistent delivery standards across all offices, publishes online current average wait times for each immigration processing stream by region, tracks applications in real-time, and creates and publicly offers a clear plan of how they will eliminate the backlog for every category under family reunification.

While the ability to immigrate with family is important for attracting skilled labour, this report does not deeply analyze this factor because, for the most part, family class visas—whether through family reunification or accompanying family—are federally approved and administered and therefore, do not vary regionally. The exception is Quebec which has its own selection certificate (Certificat de sélection du Québec) that operates alongside the federal application process and is necessary to settle in the province.

Population density

According to the gravity model of migration, which is a commonly used model for conceptualizing immigration flows, immigrant flows between two countries are directly proportional to their population size and density.[172] The higher the population density, the more likely a region or city is to attract immigrants and skilled labour. This is because density is often an indicator of the "thickness" of a labour market. Labour markets are considered "thick" when matching between workers and employment opportunities is facilitated. From a worker's perspective, finding a job is "cheaper" in a thicker market, in the sense that it requires fewer resources (i.e., time and money) to identify and pursue an opportunity. Put another way, workers in denser areas would be able to find a better job for the same effort when compared to less dense regions.[173]

Population density was assessed by extracting population data for all 41 CMAs in Canada, including their population density per km^2,[174] from Census 2021. CMA-level population data was weighted based on how much of a province's total population was accounted for by the CMA. CMAs with greater populations were thus given more weight. These weightings were then combined with CMA population density per km^2 to calculate an average PWD. This report looks at PWD because simply looking at population density ignores factoring in the distribution of the population within an area. A region's population could be evenly dispersed throughout the province or clustered in a handful of cities, a nuance that the simple measure of population density cannot capture. Measuring PWD more accurately reflects the density of a region experienced by the average person[175] and captures the true density effect of each province. Further methodological details can be found in **Appendix 7**. It bears noting that the PWD of a province does not reflect the densities of the CMAs within it. It should not be assumed that a province with a high PWD contains population-dense CMAs. For example, the Ottawa-Gatineau region in Ontario and Quebec has a high population but comparatively low PWD.

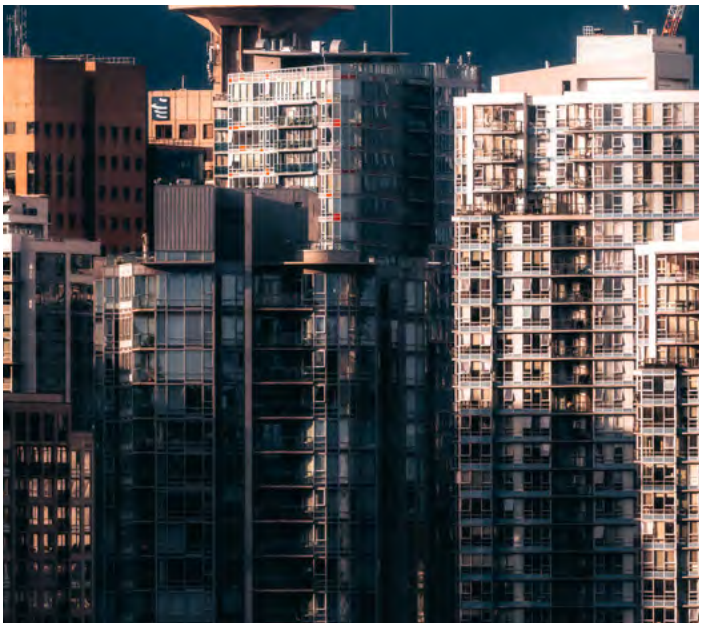
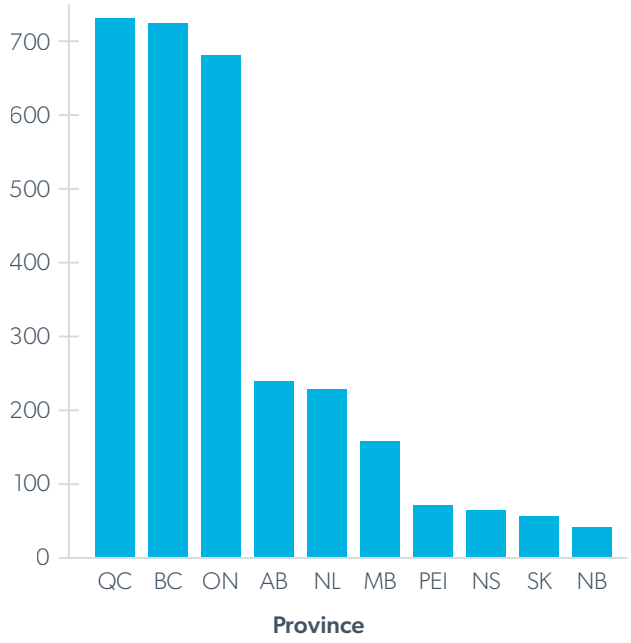


Figure 12: Population density: weighted average by province



Source: Authors. Based on Statistics Canada, 2021 Census of Canada.[176] *Figure 12 shows the population-weighted density for each province. The territories are excluded due to data constraints.*

The findings show that Quebec has the highest PWD out of all provinces, followed very closely by British Columbia and then Ontario. As home to the largest CMAs in Canada, this result is to be expected. However, Quebec has the PWD because out of the six CMAs in the province, 74% of the population is concentrated in and around Montreal. Meanwhile, Quebec's other CMAs are much more sparsely populated. The same can be said for British Columbia, where out of the seven provincial CMAs, 70% of the population lives in and around Vancouver, BC. In Ontario, population densities are less concentrated. Of Ontario's CMAs, 50% of the population lives in and around Toronto, while the remaining population is spread sparsely over 15 other CMAs. Alberta has a much lower average population density due to regions around Calgary and Edmonton accounting for 47% and 45% of the population respectively. PEI, Nova Scotia, and New Brunswick all have lower population-weighted densities as a function of province size and smaller populations. Additionally, Saskatchewan has two CMAs containing less than 30% of the province's population, indicating the population is more spread throughout the region.

Provincial comparison: population density

A	B	C	D
BC ON QC	AB NL	MB PEI	NS SK NB

The grades given reflect PWD, measured as an indicator of labour market thickness. Provinces with the highest densities are graded A, whereas provinces with the lowest densities are graded D.

Quebec, British Columbia, and Ontario score A in regard to population density. Population density in these provinces is more than twice that of Alberta and Newfoundland and Labrador, which both score B. Manitoba and PEI (with PEI's population density less than 1/10th of Quebec's) come next with C grades. Finally, with the smallest population-weighted densities and assumed thinner labour markets, Nova Scotia, Saskatchewan, and New Brunswick all score D grades.

How primed are provinces to attract skilled labour overall?

When assessing where to live, workers do not consider the four factors discussed in this report in isolation—they look at the entire package a region or province has to offer to make their decision. To truly provide a complete picture of the attractiveness of a given region, this summary combines the four factors to produce an aggregate attractiveness grade for each province for clean economy talent. Based on this analysis and when compared to other provinces, provinces that are most attractive to workers are graded A and provinces that are least attractive to workers are graded D.

Box 6: Overview of the Canadian Settlement Services System

For newcomers to Canada, immigration is not only a matter of finding housing and employment but a more involved process of integrating into their chosen local community and network. The presence of friends and family in Canada can help speed up or facilitate this process, but often requires dedicated settlement services. As this report has laid out, housing and job placement are major components of the provincial immigration service. However, many more services are also needed to help support the successful integration of newcomers.[177] Some of these include needs assessments and referrals, often before immigrants arrive in the country; language training programs, especially in Quebec; skills training and certification programs; care for children; transportation; counselling; and disability support.[178]

IRCC is the primary funder of almost all settlement programs within Canada, and they fund an ecosystem of not-for-profit organizations; educational institutions; provincial, territorial, and municipal governments; and private businesses to deliver these programs.[179] A 2019 Senate report on the efficacy of IRCC's settlement programs found that of the 150,000 respondents, 96% reported positive outcomes, and there was almost a 90% employment rate for graduates of enhanced language training programs. Unemployment among core working-age immigrants was only 5.7% in 2018.[180] In terms of how much Canada spends on these services, in 2021–2022, IRCC spent over $1.4 billion CAD on settlement services funding. The largest components of this spending were language assessment training (32%), information and orientation (18%), and needs assessments and referrals (12%).[181] Direct employment-related services are only 8% of federal spending, while housing is not a significant component of settlement services.[182] Adjusted per capita for each province, the majority of provinces have roughly equivalent financial support, with the lowest being British Columbia at $2,671 CAD per capita and the second highest being Newfoundland and Labrador at $3,428 CAD per capita.[183]

Due to the unique nature of the Quebec delivery of reception, linguistic, and cultural services for immigrants under *The Canada-Quebec Accord* (1991), Quebec's system of immigration support services is different from other provinces.[184] Quebec receives a significantly greater share of funding at roughly $13,541 CAD per capita, and its services come mostly from provincial organizations and focus on linguistic capacity and cultural integration for newcomers.[185] Data is limited on the efficacy of this system on measures like identity, language, and cultural acceptance. From an employment perspective however, Quebec's immigrant unemployment rate in 2022 (5.8%) is almost identical to the national rate (5.7%).[186] Furthermore, when we look at the unemployment rate for recent immigrants (5 years or less since immigration) in 2022, Quebec also performs well, with an unemployment rate of 7.9% compared to the national rate of 8.2%.[187] While there are additional metrics for successful settlements beyond unemployment rates, this comparison remains useful for determining whether there are major discrepancies between provinces regarding connecting newcomers with employment opportunities.

Table 6: Grading of provinces on regional readiness

	Career prospects*	Housing affordability	Presence of family and friends	Population density	Overall grade
AB	C	C	B	B	C
BC	B	D	A	A	B
MB	C	C	B	C	C
NB	C	B	D	D	C
NL	C	A	D	B	C
NS	D	D	C	D	D
ON	B	D	A	A	B
PEI	C	B	D	C	C
QC	C	B	A	A	B
SK	B	A	C	D	C

**For specified occupations in the construction and utilities sectors that will grow as a result of climate action by 2030.*

No province scores an overall A grade. British Columbia, Ontario, and Quebec score a B grade. These provinces perform well on two of the four factors (presence of family and friends and population density) but lose out on career prospects and housing affordability. British Columbia, Ontario, and Quebec's high grades on two factors are offset somewhat by the housing affordability gap, particularly for British Columbia and Ontario. In Vancouver, BC, housing affordability is so poor that workers would need their incomes to grow by 48% on average to afford to rent a two-bedroom apartment and by 677% on average to afford to purchase a single-family home. Despite housing affordability concerns, urban centres are still successfully attracting labour, primarily because of their existing immigrant populations and overall population density. For BC and Ontario, their D grade in housing and their B grade in career prospects brings down their overall grade to a B. Quebec's A grades in presence of family and friends and population density offset the B and C grades in career prospects and housing affordability respectively, to give the province an overall B grade.

Alberta, Manitoba, New Brunswick, Newfoundland and Labrador, Saskatchewan, and PEI all score an aggregate C grade on attractiveness to skilled talent, but each for different reasons. Alberta scores relatively poorly on housing affordability and career prospects (primarily on wage opportunities) and relatively well on presence of family and friends and population density. With a C in career prospects and a D in both presence of family and friends and population density, New Brunswick scores poorly on three of the four factors. These low grades are somewhat offset by the province's relatively higher levels of housing affordability, which get a B grade. Of all the provinces, only Newfoundland and Labrador and Saskatchewan receive an A for housing affordability. Newfoundland and Labrador however, scores low C and D grades on career prospects (primarily employment opportunities) and presence of family and friends respectively. On the other hand, Saskatchewan scores a respectable B on career prospects but loses out on presence of family and friends and population density. Career prospects, in terms of both available roles and wage growth, negatively impact PEI, which scores poorly on career prospects, presence of family and friends, and population density. The province however, gets a reasonable B in housing affordability. Nova Scotia is the lowest-scoring province overall, with the lowest grade for three out of the four factors. Increasing home prices in and around the Halifax Regional Municipality, a less favourable outlook for jobs, and lower-than-average expected wage growth all contribute to this score.

Box 7: Barriers to entry within the labour market

When it comes to supporting workers, provinces can look beyond simply creating the right conditions to attract workers and consider making it easier for workers to fill these emerging roles. One way to approach this is to lower barriers to entry for filling new roles. Barriers to entry into the labour market are a significant determinant of employment success and labour market integration for the individual.[188] This report defines a barrier to entry as a high cost or other challenge that prevents a newcomer—whether an immigrant, a new graduate, or an experienced worker seeking a new role following retraining—from taking an opportunity in a labour market. Barriers to entry can include the need for licenses, specific experience, or qualifications, and the cost and time associated with obtaining these.[189]

Two critical barriers faced by occupations examined in this report are the time and monetary costs associated with occupational licensing across different provinces in regulated professions. Occupational licensing requirements are often cited as a significant barrier for new immigrants and workers looking to change occupations to integrate into the labour market.[190] Additionally, costs are often borne by individual workers. This report analyzes the time and monetary costs associated with licensing and accreditation for occupations in the construction and utilities sectors to compare these barriers to entry in each province or territory. This assessment was completed through a review of provincial and territorial policies to determine which occupations are and are not regulated, as well as to identify the costs associated with getting foreign skills and certifications in the skilled trades recognized across Canada. The costs here are monetary ($) and time (expressed in weeks or months from the first application until recipients are certified or accredited). Financial costs for some of these certifications and assessments were available through the respective regulating bodies' websites. The time costs in this report reflect the amount of time required from the beginning to the final steps of being eligible to work in a given occupation. One limitation of this time approach is that it does not fully incorporate opportunity costs (loss of potential benefits associated with selecting one alternative over another) of waiting for certifications, which could also be used to prepare for, or begin, a new career in a different occupation.

Overview of process

Definitions for compulsory trades vary somewhat across provinces, but regulated and compulsory occupations are those that require individuals to challenge (write) the trade exam for their chosen trade and to renew their qualification/certification as often as required by the provincial regulator.[191] For example, a professional engineer in Ontario requires educational accreditation and certification (which consists of practical work experience and passing an examination) to practice their vocation.[192] This is also the case for compulsory skilled trades like plumbing, excluding any trades supported through the Red Seal accreditation program. For Canadians or residents with licenses in one province, national mobility agreements exist amongst provinces to allow them to transfer their accreditation across provinces, thereby simplifying the transfer process.[193] It is worth noting that across these provinces, the requirement for internationally qualified journeypersons or experienced tradespeople is the same process as that of Canadians without an apprenticeship but with years of experience. As such, individuals looking to switch to a specific skilled trade have two options: take the default route by enrolling as apprentices if they have no experience in this trade or apply to challenge the trade exam if they have sufficient work experience in the given designated trade. In regulated but voluntary professions, as well as non-regulated professions, there is no legal need for accreditation, and assessment and recognition of qualifications are at the discretion of employers.[194] As such, practising these as a tradesperson without a trade certification is possible. If a tradesperson in these regulated but voluntary or non-regulated professions takes an exam however, they can become a certified journeyperson.

Comparison between provinces and territories on time and cost

Across all provinces and territories, Quebec (nine occupations) and Saskatchewan (eight occupations) have the most compulsory regulated professions. These occupations include skilled trades such as plumbers and electricians, regulated professions such as electrical engineers, as well as other contractor and consultant occupations. Meanwhile, Nunavut (18 occupations) and the Northwest Territories (13 occupations) have the most voluntary or non-regulated occupations. Nationwide, engineers and powerline workers are the only professions compulsorily regulated in every province and territory of the 19 occupations detailed in this report.

The cost of assessment or certification for experienced foreign workers varies between professions, in part due to costs set by different regulatory bodies. The cost of assessment across provinces and occupations can range from $15 to $700 CAD. Based on available information, licensing for electrical and electronics engineers is consistently higher in cost, ranging from $175 CAD in Alberta[195] to $700 CAD in Ontario (before tax) for applicants without Canadian degrees.[196] Comparatively, costs are consistent across all provinces for professions that are regulated nationally, like Information Systems Analysts ($250 CAD), which are regulated by the Canadian Association of Information Technology Professionals.[197] The Yukon's requirements are the most straightforward, affordable, and clearly set out, with the application to take the trade challenger exam costing $15 CAD for all professions regulated by the Department of Education. Unlike the other provinces and territories, there is no publicly available information regarding the time and cost of certification in Nunavut. Those interested in receiving a certification for their skilled trade experience are directed to contact a regional Career Development Officer.[198] In all provinces and territories, there can be other costs beyond fees associated with licensing and assessment. The initial application fee can cost between $15–$475 CAD.[199] This does not include other expenses, such as the exam fees, thesis submission, final registration fee, or 1-year license fee for engineering occupations. Depending on province, regulatory demands, and occupation, these costs can easily be upwards of $2,000 CAD.[200]

Occupational licensing information on the amount of time it takes to become accredited or certified is not always transparently communicated across all provinces and territories. British Columbia, New Brunswick, Newfoundland and Labrador, Northwest Territories, Nova Scotia, Nunavut, PEI, and Quebec have very little information available on the timelines without directly contacting a government official. For time, the Yukon is the most straightforward, with the application to take the trade challenger exam taking 1–6 weeks to be approved.[201] If approved, a challenger can take an exam (provided monthly) and have their certificate of qualification within a month of taking the exam. In PEI, before writing the exam, the challenger must first submit a form with evidence of having worked the required number of hours and references to verify said work hours. It is also worth noting that the number of work hours trade challengers need often exceeds the hours required of in-province apprentices by at least 2,700 hours.[202] In Saskatchewan, applicants must first apply to be assessed to see if they meet the work experience criteria (measured in hours and with appropriate references) to sit the exam. If found ineligible, the applicant must apply to become an apprentice through the normal route, which can take up to 4 years from the beginning of the apprenticeship to completing the journeyperson exam.

Challenges faced by older workers

Lowering the barriers to entry, or even clarifying criteria for entry, in each province and territory would make it easier for workers to meet growing labour demand. Becoming licensed or accredited is often described as overly long and complicated, and a lack of knowledge of the licensing process presents a significant barrier to finding appropriate employment, particularly for experienced foreign workers.[203] This affects workers of all ages, including older workers looking to transition into clean economy roles. For older workers moving occupations or entering into a new sector, time taken to complete this transition is the most pressing issue, alongside other specific concerns such as pension losses.[204] Costs also might be higher for older workers because of their higher wages, meaning they incur a greater opportunity cost from time spent retraining. The overall benefits of retraining are also proportionally smaller for older workers, since they have a shorter remaining work-life from which to pay off the costs.[205] This was echoed in a Conference Board of Canada report identifying that the 'transition costs' from non-green occupations to green occupations were highest in regions where employment offered the highest salaries, given the associated opportunity cost of taking time off work to retrain and giving up the associated wages.[206]

Conclusion

Canada's clean economy could create tens to hundreds of thousands of new jobs within the next seven years, with many of these new jobs offering an opportunity to advance climate action. These are high-quality jobs that would help create good careers across the country and support clean economic growth. Supporting these roles will require ensuring workers have the required skills to fill open positions, making the need for training, retraining, and education critical. Additionally, regions and industries across the country will need to ensure they have the workforce necessary to fill these jobs. High job vacancies in construction, transportation, and manufacturing compound the additional needs these sectors will have for workers. Additionally, in transportation, manufacturing, and agriculture, there are more workers over 55 years old than workers under 35, indicating that these sectors, in particular, may face even higher labour shortages as retirements grow. Regions will need to ensure they are well-positioned to attract and support new clean economy workers as these sectors grow. They can do so by making their housing more affordable and accessible, making it easier to move with families, better aligning PNPs with regional workforce needs, and removing barriers to workforce participation for equity-deserving groups.

Canada's clean economy workforce has the potential to not only build a future where Canada thrives, but so do they. The key challenge Canada faces in creating this future is building and supporting a workforce large enough to sustain the level of economic growth that will be brought about by climate action and clean growth. The prize is substantive, as ambitious action can help create hundreds of thousands of new careers and position Canada for success in the decades to come. As this report has emphasized, there is nothing innately distinct or special about the needs of workers building climate projects—many will work on green and non-green projects, and their needs are similar to their peers in many other sectors. To support these workers though, collaboration between different levels of government, industry, and civil society is critical. Tackling these skills and labour challenges also require regional policymakers and decisionmakers to be at the forefront. Rural Nova Scotia's challenges vary vastly from suburban British Columbia's in terms of the kind of jobs that might be expected in the future and the regional attractiveness factors that need to be improved to better attract workers. Moving forward, Canada's institutions, private sector, community champions, and regional governments will need to ensure they are prepared to support workers and capture the benefits of economic growth that climate action and the clean economy are expected to bring about.

Recommendations: what do provinces need to change to attract and support their clean economy workforce?

This report offers the following recommendations to address the challenges identified in different sections of this analysis, including supporting job creation across the country, upskilling workers, tackling labour shortages, and making regions more attractive for workers:

Recommendation #1: Canada should remain committed to meeting its 2030 climate target, which will create jobs regardless of what occurs globally.

The analysis in this report clearly shows that no matter what occurs in the world, clean growth can create tens or even hundreds of thousands of new jobs in industries like manufacturing, clean energy, construction, and forestry across the country. Industries like construction and clean energy can serve as the backbone for this job creation across all futures, even in oil and gas-producing provinces. Existing and pledged policies should be developed, implemented, and advanced to ensure Canada can reap these economic benefits, including those not discussed in this report, such as the tax credits announced in the 2023 Federal Budget.[207] Given the potential for the oil and gas sector to create jobs in the coming years, it will also be essential to maintain strict regulations on emissions from the oil and gas sector. Analysis from the Canadian Climate Institute identified that without successfully implementing a stringent oil and gas emissions cap and tighter regulation of methane emissions beyond existing policies, emissions from oil and gas activities risk derailing the country's ability to meet its 40% reduction target by 2030.[208] Canada needs to rigorously implement these two policies and any additional ones needed for the oil and gas sector to align emissions reductions with the GHG reduction pathways outlined in the federal Emission Reductions Plan.

Recommendation #2: Ensure all training and education programs for sectors in this analysis incorporate foundational "green literacy" skills that workers will need.

Findings from this report, and previous analysis from Smart Prosperity Institute (SPI), identify that some skills needs will be common across all industries and scenarios. These include process skills, like critical thinking, active learning, and problem-solving, and cross-functional skills, such as coordination, decision-making, and time management. These skill sets form the backbone of the "green literacy" required to work on clean economy projects. Green literacy is the ability to understand the broad implications of climate action and clean growth on the environment, market infrastructure, and the sectors and processes in which one is employed, and this report treats green literacy as a mix of awareness, knowledge, and skills.[209] Federal and provincial governments, as well as educational and training institutions, should ensure that the foundational skills required for green literacy are included in every training, retraining, and education program developed moving forward for the eight sectors in this analysis. It will not be enough to apply these skill sets to a subset of occupations. Workers are likely to work on a mix of green and non-green projects, meaning that every worker, from parts assemblers in the automotive sector to process engineers at carbon capture facilities, will require at least some foundational green literacy. When identifying which skills should be applied to all training and education programs, the focus should be on social and emotional skills. Social and emotional skills are more broad-based, meaning they are relevant for a wider range of occupations than technical skills, whose importance differs dramatically by role or sector. Focusing on foundational instruction of broad-based skills will therefore be more useful while also making it easier for workers to transition from one industry into another in the future. And moving forward, supporting these transitions will be critical for many employed in emissions-intensive sectors like oil and gas production, distribution and transportation.[210]

Recommendation #3: Develop regionally-based sectoral strategies to help grow the workforce and equip them with necessary skills, centred around an innovative place-based intermediary

Much of the job growth identified in this report will occur in regions that have not supported this level of economic growth in years, if ever. Ensuring regions have the infrastructure, institutions, available labour pool, and capacity to quickly train needed workers will be critical. To support this, federal and provincial governments should develop place-based sectoral strategies to help train their growing workforces. Up until now, this approach has not been tried in Canada. However, it offers significant promise. These strategies could adopt an experimentalist approach, where regional partners from across society are brought together to identify emerging skills needs, implement new training and education programs, ensure existing programs are reformed as needed, and offer supports to workers looking to transition into new opportunities in growing sectors. These regional clusters should involve employers, labour groups, training and education providers, provincial governments, and civil society organizations that support individuals in finding new employment. These sectoral strategies should be aligned with new or emerging industrial strategies to ensure that workers are provided with the skills needed to work on emerging clean growth opportunities across the country, as well as focus on employment impacts of a new technology (or new technologies) throughout the entire value chain.[211] It will also be critical that these strategies take into account the barriers diverse individuals may face in accessing job opportunities and work with regional stakeholders to tackle and lower these barriers. As this report clearly identifies, the clean growth workforce is not a monolith, and ensuring opportunities in the clean economy are accessible for all is a key step towards greater inclusion.

This approach could be employed for future training models. A semi-independent institutional intermediary should be created to achieve this objective. Institutional intermediaries are traditionally conceived as third parties, but many of the functions they undertake (including coordination, advising policymakers,

and working with regional stakeholders) can also be completed by semi-independent government-supported institutions. This new intermediary could serve as these roles, taking the form of a coordinating and funding body that is engaged with regional partners in key sectors to advance training identified as most pressing. In this case, training would be administered by trusted partners in each region and sector, including unions, employers, workforce training providers, and others. This structure would allow stakeholders within the model to focus on selecting the right partners, lowering barriers to accessing training opportunities, and administering the experimentalist approach outlined in this report in sectors across the country. This model could be explored for the upcoming federal Sustainable Jobs Training Centre, as well as other provincial and territorial workforce development initiatives.

Recommendation #4: Investing in place-based clean growth opportunities in regions that will be hit hardest by global trends, building on work done by Regional Energy and Resource Tables.

Governments need to invest more aggressively in clean growth opportunities in regions that will be hit hardest by global trends. Future economic prosperity will come through advancing new zero-carbon projects, the emergence of new industries focussed on reducing GHG emissions, and the development of new clean technologies. By not investing in clean growth opportunities in regions across Canada, the country risks missing out on the enormous economic potential the low-carbon transition offers. Additionally, clean growth opportunities help regions become more attractive to talent by improving the outlook for their career prospects. To participate and share in future economic prosperity, regions need to identify what they are already doing well and develop clean growth opportunities that offer technologically-advanced, cleaner versions of their current products to both enjoy the economic prosperity that a low-carbon transition will bring. This could even include moving into new parts of supply chains these regions are already a part of. To support the development of these opportunities, governments should develop strategies and frameworks to support investment, develop the infrastructure needed, and create a policy environment more conducive for the growth of specific opportunities within that region. Such an approach, known as a "place-based" approach to clean growth, is geared towards leveraging regional strengths such as talent, expertise, natural resources, and infrastructure to advance clean economic growth.

Burgeoning investments in Portage la Prairie's (Manitoba) plant proteins sector are a great example of this. While the region has always been a large producer and exporter of agricultural products, including lentils and peas, it has recently pivoted towards value-added agricultural products such as plant proteins.[212] This move allows the region to build on its unique strengths and cater to the future needs of the global economy, while increasing the number of jobs advancing clean growth projects in its manufacturing and agricultural sectors. Other examples include greater adoption of clean technology in Nova Scotia's agriculture, forestry, and fishing sectors and Alberta's investment and plan to operationalize more than 25 projects related to hydrogen production, transportation, and end-use, alongside carbon capture and storage around the Edmonton region.[213] Investing in place-based clean growth is a particular priority for provinces that, in this report's analysis, scored low on career prospects, including Alberta, Manitoba, Newfoundland and Labrador, New Brunswick, Nova Scotia, Prince Edward Island, and Quebec. These initiatives could be supported through existing federal and provincial programs, such as the Regional Energy and Resource Tables led by Natural Resources Canada. These growth opportunities, once identified, should have their full impacts determined throughout the value chains they will support. This value chain mapping, in turn, can support the development of place-based sectoral strategies outlined in recommendation three. It will also ensure regional groups understand the full opportunities and impacts new clean growth opportunities will present, which can support stronger planning.

Recommendation #5. Structure Provincial Nominee Programs (PNPs), and create other programs, to better align with regional workforce needs.

Immigration accounts for almost 80% of Canada's labour force growth, and this report has identified that many more workers will be needed to help Canada meet its climate goals.[214] PNPs, which are provincially administered, are a powerful policy tool regions have to accommodate their respective labour needs. By gearing PNPs to fill the skills demanded by the market while also ensuring the smooth administration of PNPs, provinces that do not currently score well on the presence of existing social networks and population density can better prepare themselves to meet future workforce needs. However, regions need to ensure that PNPs are attuned to the labour needs of the market. While economic class immigrants (i.e., those selected for their ability to meet labour market needs) represent the largest category of immigrants into Canada,[215] immigration programs designed for workers in the skilled trades have seen reduced intake compared to other economic class immigration streams.[216] This is partly because immigration policies are geared more towards immigrants with post-secondary education and less towards attracting immigrants with a background in the trades.[217] Additionally, depending on the province, immigration through a PNP can cost between $2,300 to $3,800 CAD and exceeds the costs associated with federal immigration programs (Express Entry program) by a fair margin.[218] Regions should ensure that PNPs broaden their focus to grow the number of applicants from the skilled trades and lower costs to align more closely with other skilled immigration programs.

Outside of PNPs, regions can also implement programs like the AIP to address regional labour needs. AIP was launched in 2017 with the goal of attracting more immigrants to the four Atlantic provinces. It has attracted more than 10,000 new permanent residents in only a few years, bringing skilled, young workers to these provinces to work in key sectors like manufacturing.[219] The biggest advantage that the AIP offers over PNPs is its simplicity. Getting a job offer from an eligible employer is the primary requirement. Once you have the job offer, fulfilling the

other requirements and qualifying for permanent residency can be accomplished fairly simply relative to other programs. For provinces of a smaller size and population density, programmes like the AIP can be an innovative and impactful option to help meet future labour needs. Through the AIP, some provinces that scored low on the presence of family and friends and population density, like Nova Scotia, Prince Edward Island, and Newfoundland and Labrador, have taken action to attract more skilled workers. Alongside reforming PNPs, regions should consider designing their own programs to meet their skilled labour needs.

Recommendation #6: Fund more sector and region-specific programs aimed at lowering barriers to accessing jobs for equity-deserving groups.

Increasing workforce participation from under-represented and equity-deserving communities is an important approach to improving inclusivity within the workforce. Programs meant to increase the share of visible minorities, Indigenous peoples, women, and immigrants in the workforce can also offer a particular opportunity to address labour shortages. Provincial and federal governments should offer greater funding to support regional and sector-specific initiatives focussed on inclusion and accessibility. Programs that have tackled some of these barriers include Indigenous Clean Energy's "Generation Power"[220] program and the Auto Parts Manufacturing Association's Equity Diversity and Inclusion Fund.[221] Generation Power supports Indigenous youth to work in clean energy sectors through capacity-building, skills development, career training, and mentorship. The Auto Parts Manufacturing Association's Equity Diversity and Inclusion Fund covers up to $8,000 CAD in automotive skills training expenses for up to 800 workers.[222] Both programs aim to provide financial support and mentorship to help overcome barriers such as cost and lack of access to established professional networks.

Beyond funding training programs and making substantive legislative changes, governments should also ensure they support actions to lower structural barriers to entry faced by specific equity-deserving communities, facilitate talent pipelines, or invest in customized training programs that meet the needs of diverse groups (whether newcomers to Canada, students, or members of a marginalized group). The sectors that would benefit most from these measures include agriculture, mining, oil and gas, construction, and utilities. All of these sectors have substantially lower representation of visible minorities in their workforce as compared to the national average. In agriculture, mining, and oil and gas, visible minorities are less than half the national average.[223] And while female labour participation has increased substantially in the past few decades, the agriculture, construction, manufacturing, utilities, mining, oil and gas, and transportation sectors remain male-dominated, with women occupying less than half of the jobs in these sectors.[224] As these sectors work to fill their existing and future job vacancies, they would significantly benefit from making themselves more accessible to everyone, including equity-deserving communities, especially in provinces that scored low on population density.

Recommendation #7: Create incentives and lower regulatory barriers to build more housing and improve affordability for renting and home ownership.

The lack of affordable housing is already causing a growing number of economic immigrants to move outside big urban cities, such as Toronto, ON, within the first three years of arriving.[225] Experts agree that a shortfall in housing supply combined with high demand is the primary cause of Canada's high housing costs. [226] Provinces will need to ensure additional housing gets built to help improve their region's housing affordability for both purchasing and renting. This challenge is critical to supporting the growth of the workforce, given the need for workers to live in areas that are affordable relative to their incomes. Increasing the housing supply will help alleviate the housing market pressure that workers feel, a factor that workers take into decision-making when determining which jobs to take. Provinces also need to ensure that new housing works for those who need it. This means ensuring that housing is made affordable for those across all income levels and that different housing types are built for different household types (i.e., building units suitable for a family as well as those suitable for a single individual.[227] At the same time, increasing regional housing supply needs to add to, and not take away from, meeting climate targets. This means building more climate-friendly developments and communities that consider how new houses are built, where they are built, and the communities around them. Provinces and municipalities have a huge role to play here. Instead of enabling suburban and exurban sprawl, which are carbon intensive, regions should push for greater high-density housing developments through changes in municipal land use rules. They should also adopt incentives to support the construction of new units, such as reintroducing accelerated depreciation rates.[228] Increasing housing supply should be a particular priority for provinces that, in this report's analysis, scored low on housing affordability, including British Columbia, Manitoba, Nova Scotia, and Ontario. For these provinces, housing availability close to areas where future clean economy jobs will be created is vital if they are going to attract and support workers and hit Canada's 2030 and 2050 climate targets.

Technical Appendix

Appendix 1: List of policies modelled in each scenario

All of the scenarios in this analysis model include already implemented or announced provincial and federal climate policies to assess how Canada will reach its 2030 emissions target. These include the full suite of policies announced in the federal Emissions Reduction Plan (ERP), first announced in 2020. Given that many of these policies have not yet been fully implemented or detailed, the analysis in this report contains assumptions about how they might work in practice. Additionally, given this analysis' stated objective of comparing how global trends could impact clean growth in Canada, an emissions cap of reducing GHGs by at least 40% below 2005 levels by 2030 was added to each scenario. This was added to ensure each scenario showed the level of economic activity required for Canada to meet a 40% reduction of GHG emissions and allow for comparisons of economic activity across scenarios. The representation of the ERP includes the following policies:

- Carbon price rising to $170/t$CO_2$e CAD by 2030 (as a fuel charge or as a credit price in output-based pricing systems).
- An emissions cap on the oil and gas sector at 140 MtCO_2e/yr in 2025 and 110 MtCO_2e/yr in 2030.
- A regulation that reduces methane emissions from the oil and gas sector by 75% below 2012 levels by 2030 and an additional regulation that requires roughly half of all landfills to manage landfill gas emissions.
- A clean electricity standard requiring net-zero GHG emissions from the electricity sector by 2035, with a linear reduction in GHG intensity from levels in 2025 to the 2035 target.
- The Clean Fuels Regulations as legislated.
- A zero-emissions vehicle standard for light-duty vehicles coming into force sometime in 2023, and trending towards 65% sales in 2030 and 100% sales in 2035 (based on policy targets discussed in Québec).
- An emissions standard for medium and heavy-duty vehicles aligned with California's Clean Trucks Regulation, which requires 30–50% zero-emission vehicle sales by 2030, depending on vehicle class.
- A national net-zero emissions building strategy, where new building envelopes must be net-zero energy ready by 2030 (i.e., could potentially produce as much energy as they consume over each year if they developed on-site renewable power generation).
- An investment tax credit for carbon capture and utilization or storage. This is simulated as a $2.6 billion CAD subsidy over four years for carbon capture and storage and direct air capture projects starting in 2023 and a $1.5 billion CAD annual subsidy from 2027 to 2030.
- Canada Infrastructure Bank spending, simulated as a $1.5 billion CAD subsidy for zero-emission buses, $500 million CAD for electric charging and hydrogen refuelling infrastructure, a $5 billion CAD subsidy for renewable electricity generation and storage, and $2 billion CAD for high-efficiency building shells and heating technologies in commercial and institutional buildings over three years.
- Incentives for zero-emission vehicles program (iZEV) and incentives for medium and heavy-duty zero-emission vehicles program (iMHZEV). These are simulated as a $1.7 billion CAD subsidy, additional to historic and remaining iZEV funds for zero-emission light-duty vehicles, and a $547.5 million CAD subsidy allocated equally per year from 2022 through 2026 for medium and heavy-duty vehicles.
- Interest-free home retrofit program and residential efficiency retrofit incentives, simulated as a combined $2.8 billion CAD subsidy available from 2023 to 2030 for efficient residential building shells and heating technologies.
- Community building upgrades and low-carbon economy fund, simulated as a $3.7 billion CAD subsidy available from 2023 to 2030 for efficient commercial and institutional building shells and heating technologies.
- Renewable electricity investments, simulated as a $1.8 billion CAD subsidy over four years for new renewable electricity generation.

Appendix 2: Overview of four scenarios modelled in this report, with assumptions used in each scenario

The four scenarios are differentiated based on how two trends—1) economic disruption due to armed conflict, pandemics, and natural disasters, and 2) changes in global trade and economic cooperation—could impact Canada's economy as it implements the policies outlined in **Appendix 1**. These trends will have an impact by varying the costs and availability of technologies, commodity prices, rates of technology sharing, and the international ambition to reduce GHG emissions, among others. **Table A** below summarises the relative variations of these variables in each scenario and **Table B** summarizes the technology availability and cost assumptions across each scenario.

Table A: Comparison of major trends detailed across each scenario

Factors	Scenario 1: Sunny	Scenario 2: Windy	Scenario 3: Stormy	Scenario 4: Foggy
Climate Policy in Canada	All current and announced climate policies in Canada are included. Notably, this includes the carbon price rising to \$170/tCO_2e across Canada by 2030 and the policies announced in the federal emissions reduction plan. The scenarios also include an emissions cap that ensures Canada at least reaches the low end of the 2030 GHG target (at least a 40% reduction relative to 2005).			
Overall economic prosperity	Highest: Global econ. growth increases Post-COVID recovery settles into sustained growth. Canada's real GDP grows at an average annual rate of ~3% to 2030	Low: Global econ. growth declines somewhat Assume Canada's real GDP growth is consistent with 2022 projection by Parliamentary Budget Officer. Slows to ~1.8%/yr after 2023	Lowest: Global growth declines severely Consistent with continuation of IMF World Economic Outlook from June 2022. Global GDP growth slows to ~2.0%/yr after 2023. Canadian growth slows to 1.5%/yr	High: Global econ. growth increases somewhat Canada's real GDP grows at ~2.5% to 2030
Multilateral climate cooperation	Highest: Most countries on track for 2030 GHG targets, technology sharing Generally low GHG abatement technology costs. US policy consistent with Canada (same % reduction by 2030).	Lowest: Most countries not meeting 2030 GHG targets, little technology sharing Generally high abatement technology costs/low availability. US policy stalls (no GHG cap by 2030), Canada implements border carbon adjustments.	Low (Rebuilding takes priority): Most countries not meeting 2030 GHG targets, some technology sharing "Moderate" abatement technology costs/availability., with exceptions for ZEVs and renewable energy (See below) US policy consistent with Canada (same % reduction by 2030).	High within interested trade blocs: Most countries not meeting 2030 targets, some technology sharing "Moderate" abatement technology costs/availability. US policy consistent with Canada (same % reduction by 2030). However, there is less international climate action and Canada implements border carbon adjustments.
Multilateral trade	Highest: Free flow of raw materials Consistent with lowest abatement costs for ZEVs and renewable generation (e.g., key metal prices remain low).	High: Global trade generally continues No specific adjustment for the cost of ZEVs or renewable generation related to metal prices.	Lowest: Very low global trade, lower access to raw materials High costs for ZEVs and renewable power driven by high metal prices.	Low: Some constraints on trade of raw materials resulting in higher prices "Moderate" costs for ZEVs and renewable power, assuming that regional supplies of key metals are developed.
Energy costs	Lowest: Crude oil prices stabilize at pre-war rates but remain profitable for oil companies. Start to decline mid-decade. WTI Oil price stabilizes at pre-war levels, roughly 60 USD/bbl, and decline to ~50 USD/bbl by 2030.	High: Continue increasing dues to conflict, stabilizing mid-decade. WTI Oil price stabilizes around 85 USD/bbl by 2025	Highest: Impacted by both conflict and regionalization of trade. WTI Oil price stabilizes around 120 USD/bbl by 2025	Low: Prices stabilize, but are higher than in Sunny scenario WTI Oil price stabilizes around 70 USD/bbl by 2025
Food prices (Using the real price of wheat at Chicago (CBOT) as an indicator, where the price of corn and oilseeds follow a similar trend)	Lowest: Prices decline from 2022 peak, becoming consistent with trend in previous decade Wheat price returns to 2015 levels by 2025 (about 185 USD/tonne)	High: Food prices continue increasing, stabilizing mid-decade Wheat price stabilizes around the summer 2022 values by 2025 (about 350 USD/tonne)	Highest: Conflict and constraints on trade result in highest food costs. Wheat price rebounds past the 2022 peak hitting 450 USD/tonne by 2025.	Low: Prices decline from current levels and stabilize at a level higher than in Sunny scenario. Wheat price, stabilizes at pre-war 2020–2021 levels by 2025 (about 250 USD/tonne)

Table B: Technology availability and cost assumptions across each scenario

Technology	Sunny: High cooperation, low disruption	Windy: High cooperation, high disruption	Stormy: Low cooperation, high disruption	Foggy: Low cooperation, low disruption
Direct air capture of CO2	Available by 2030, with moderate costs	Not available by 2030	Available by 2030, with higher costs	Available by 2030, with higher costs
Direct reduced iron, with hydrogen (low GHG steel)	Available by 2030	Available by 2030	Not available by 2030	Not available by 2030
Small modular nuclear reactors for electricity generation	Available by 2030	Available by 2030	Not available by 2030	Not available by 2030
2nd generation bioenergy (gaseous and liquid fuels from biomass)	Lower capital cost assumptions	Higher capital cost assumptions	Moderate capital cost assumptions	Moderate capital cost assumptions
Carbon capture and storage cost (post-combustion for electricity generation and heat)	Lower capital cost assumptions	Higher capital cost assumptions	Moderate capital cost assumptions	Moderate capital cost assumptions
Electric vehicles	Low cost: Battery pack costs may decline as low as $65/kWh (2022 CAD)	Moderate cost: Battery pack costs may decline as low as $80/kWh (2022 CAD)	High cost: Battery pack costs may decline as low as $110/kWh (2022 CAD)	High cost: Battery pack costs may decline as low as $110/kWh (2022 CAD)
Hydrogen production and fuel cell vehicles	Low cost	Moderate cost	High cost	High cost
Renewable electricity generation	Lowest cost: -5 $MWh from baseline value	Low cost: No change from baseline	Highest cost: +10 $MWh from baseline value	High cost: +5 $MWh from baseline value

Appendix 3: Description of the gTech model used for analysis in this report

To better predict the impact of various global events on Canada's future labour needs by sector and region, a computational general equilibrium model developed by Navius Research called gTech was used. Computational general equilibrium models are dynamic models which use complex equations to describe relationships between different sectors of the economy. They calculate and predict the possible impact of different changes within, or to, an economy on variables such as economic growth and employment. For the purpose of this report, gTech utilizes a broad understanding of relationship and transaction of various economic actors such as households, firms across sectors, and the government. Moreover, the model includes for technological changes, governmental policies particularly related to GHG emissions, and developments in the energy markets to estimate economic outcomes. gTech assists in understanding the impact of Canada's global futures on its domestic labour market by adjusting five sets of variables between the four scenarios in which Canada meets its target of reducing GHGs by 40% by 2030. In all four scenarios, Canada meets this target by implementing ambitious climate policy, which includes the full suite of policies outlined in the federal ERP. The gTech has been used by organizations such as Smart Prosperity Institute (SPI), the Canadian Climate Institute, Clean Energy Canada, and OECD and was also responsible for conducting emissions modelling for the federal Conservative climate plan introduced in the 2021 federal election.[229]

Appendix 4: Overview of variables measured in the gTech model

Overall economic prosperity: The economic prosperity in various scenarios is measured using the variation of growth rates for Canada's GDP between 2022 and 2030. The rates range from 1.5%/yr–3%/yr., By 2030, this difference leads to Canada's GDP varying by $310 billion CAD between scenarios (in 2012, about 15% of the current GDP). These GDP assumptions were input into the model as changes in the labour force and labour productivity by province. Furthermore, economic activity can be affected by climate policy.

Multilateral climate cooperation: The level of climate cooperation is represented in the scenarios by varying the cost of emerging GHG abatement technologies. These technologies include direct air capture, carbon capture and storage, low GHG steel, and small modular nuclear reactors. Increased multilateral cooperation reduces the capital costs of abatement technologies while at the same time increasing access to them.

Multilateral trade: Differences in future levels of multilateral trade will impact the price of raw materials that are inputs to technologies such as zero-emissions vehicles and wind and solar electricity generation. These materials include platinum for fuel cells; silicon for solar electricity; lithium, nickel, and cobalt for vehicle batteries; and rare earth metals for the generators in wind turbines. Thus, the free flow of these raw materials will be highest during periods of low disruption and high trade cooperation (i.e., Sunny scenario versus other scenarios). Accordingly, in gTech, multilateral trade is represented by varying costs of these commodities and thereby the cost of GHG abatement technologies.

Energy costs: Oil and gas prices will vary depending on the level of disruption and trade cooperation. For Canada, high energy costs could make decarbonization less fiscally attractive and delay the green transition, which, in turn, would mean fewer jobs in the decarbonizing sectors. It could also impact the uptake of mitigation technologies and the cost of producing decarbonizing technologies since much of industrial Canada still relies on fossil fuels for their energy needs. Energy prices will be highest in the Stormy scenario (high disruption and low trade cooperation) due to the increasing regionalization of trade. In gTech, varying energy costs are represented using different crude oil price forecasts for Canada's various global futures.

Food prices: The future price of agricultural commodities will vary depending on fluctuations in trade cooperation and disruptions to the global economy. Recent changes in food prices because of global conflict, famines, and droughts have been enormously impactful and will possibly have significant impacts on the economics of producing certain energy forms, such as biofuels. gTech varies the cost of four key agricultural commodities—corn, canola, soybean and wheat—between the four scenarios to analyze the impact of changing food prices on domestic labour needs.

Appendix 5: North American Industry Classification System codes for sectors explicitly affected by emissions reductions

Table C: NAICS codes considered under key sector categories

NAICS code	Sector	Description
111, 112, 114, 115	Agriculture	Includes farming; agriculture services; fishing and hunting; and residue for bioenergy feedstock.
113	Forestry	Includes forestry; logging; and wood processing activities.
23	Construction	Includes all construction and related activities, including repairing, renovating, engineering works, and developing land.
31, 32, 33	Manufacturing	Includes hydrogen production; biofuels production from feedstock; metals manufacturing; manufacturing of non-metallic minerals such as cement, lime, and gypsum; chemicals manufacturing; and other advanced manufacturing.
212, 213	Mining	Includes coal and metal mining; mining, and quarrying of non-metallic minerals; and mining services.
211, 213	Oil & Gas	Includes petroleum refining; natural gas and oil production; natural gas extraction; bitumen upgrading; and oil and gas services.
48, 49	Transportation	Includes air, truck, rail and other transportation; transit and ground passenger transportation; and pipeline transportation of natural gas.
22	Utilities	Includes renewable and fossil-fuel electric power generation, transmission, and distribution.

**Agriculture and forestry were further disaggregated within this report.*

Appendix 6: Subset of NOCs in the construction and utilities sectors

Table D: Top 50% of NOCs in construction and utilities sectors by percentage of workforce in the sector

Sector	Profession	NOC
Construction	Construction trades helpers and labourers	7611
	Construction and building managers	711
	Tradesmen	7271
	Heavy equipment operators (except crane)	7521
Utilities	Electrical trades workers	7244
	Plant supervisors and operators	9241
	Utilities managers	912
	Electronic and information systems professionals	2171
	Other customer and information services representatives	6552
	Construction millwrights and industrial mechanics	7311

Appendix 7: Description of methodologies used for regional readiness factors

For comparing the attractiveness of labour in various provinces and regions, the following benchmarks were used: 1) employment opportunities, 2) income opportunities, 3) housing affordability, 4) presence of social networks, and 5) population density.

For comparing employment opportunities between the provinces, the construction and utilities sectors were used. The reason is that both sectors experience job growth in all four scenarios and also contribute towards emissions reductions in all four scenarios as well. The gTech data was used to calculate the percentage difference in job numbers per province for both sectors between 2020 and 2030. The jobs metric used is that of 'full-time equivalent,' which is the total jobs corrected to the full-time equivalents (i.e., accounting for sectors where there are part-time or more than full-time workers). An average of job numbers across all four scenarios was taken.

To compare provinces based on income, the gTech data was used to calculate the percentage difference in wages in key NOCs across all provinces in the construction and utilities sectors between 2020 and 2030. These numbers are compared to get a sense of the income attractiveness of a province. Like the analysis on employment opportunities, wages across all four scenarios are averaged to understand how provinces compare against each other in terms of the income opportunities they present to labour.

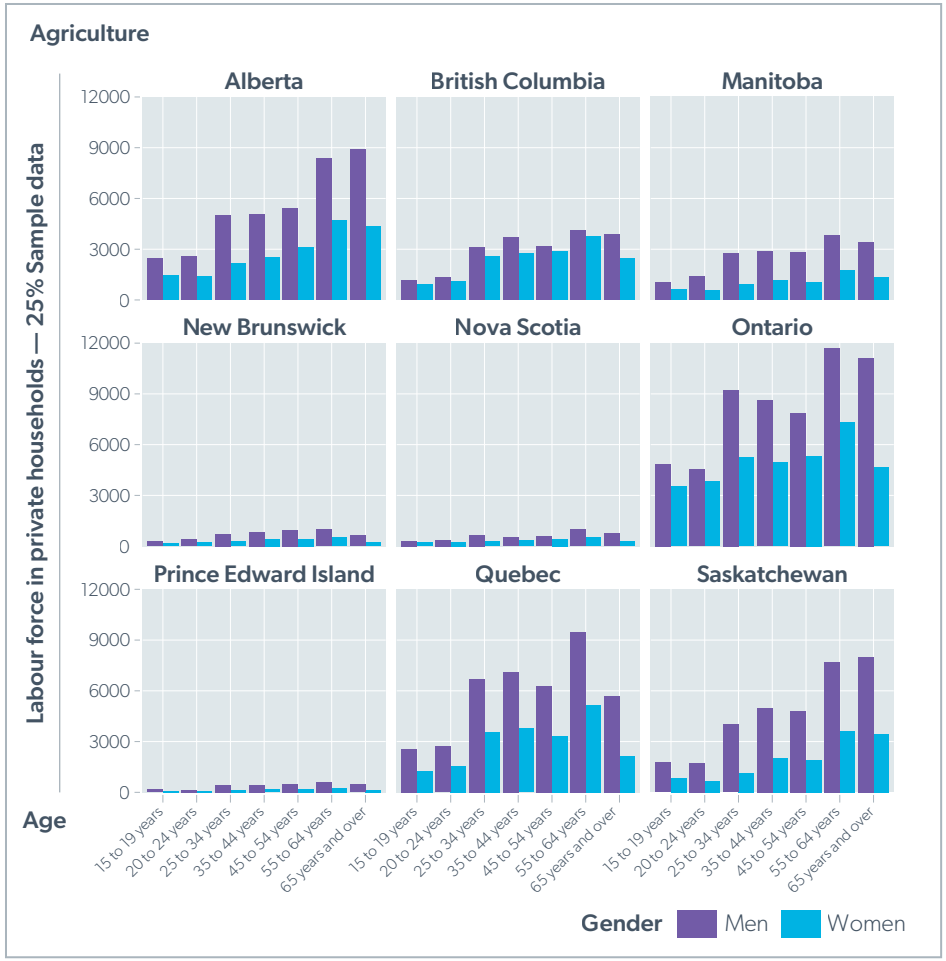
For housing affordability, average wages were obtained again for the key NOCs in the construction and utilities sectors, using the occupations comprising 50% of the workforce in each of the two sectors. These occupations are in **Table C, Appendix 5**. Occupations that shared the same NOC in a sector were combined under a more general name to avoid duplication of results.

The cost of renting a 2-bedroom apartment and purchasing a single-family home were considered benchmarks for the cost of housing. The reason being these are the housing options most popular with recent immigrants. To compute the level of affordability, the 30% affordability rule was used to establish the level of affordable housing per province, whereby housing expenses should not exceed 30% of household income. For rental affordability, the monthly rent of a vacant 2-bed apartment in each CMA of each province was divided by 30% to obtain the minimum pre-tax monthly income for vacant units (based on 30% affordability). For purchase affordability, bills and taxes, maximum mortgage amount (difference between affordable monthly payments and bills), and mortgage loan calculations (based on the interest rate, number of mortgage years, and number of payments) were calculated for each NOC in each province. The maximum affordable purchase price was then calculated from the mortgage loan calculation, assuming a 20% down payment. The difference in income and affordable housing price as a proportion of the affordable housing price was used to calculate the affordability gap for occupations in each province. An average number was taken for each sector in each province to serve as an indicator of how the provinces compare to each other in terms of housing affordability for the construction and utilities sectors.

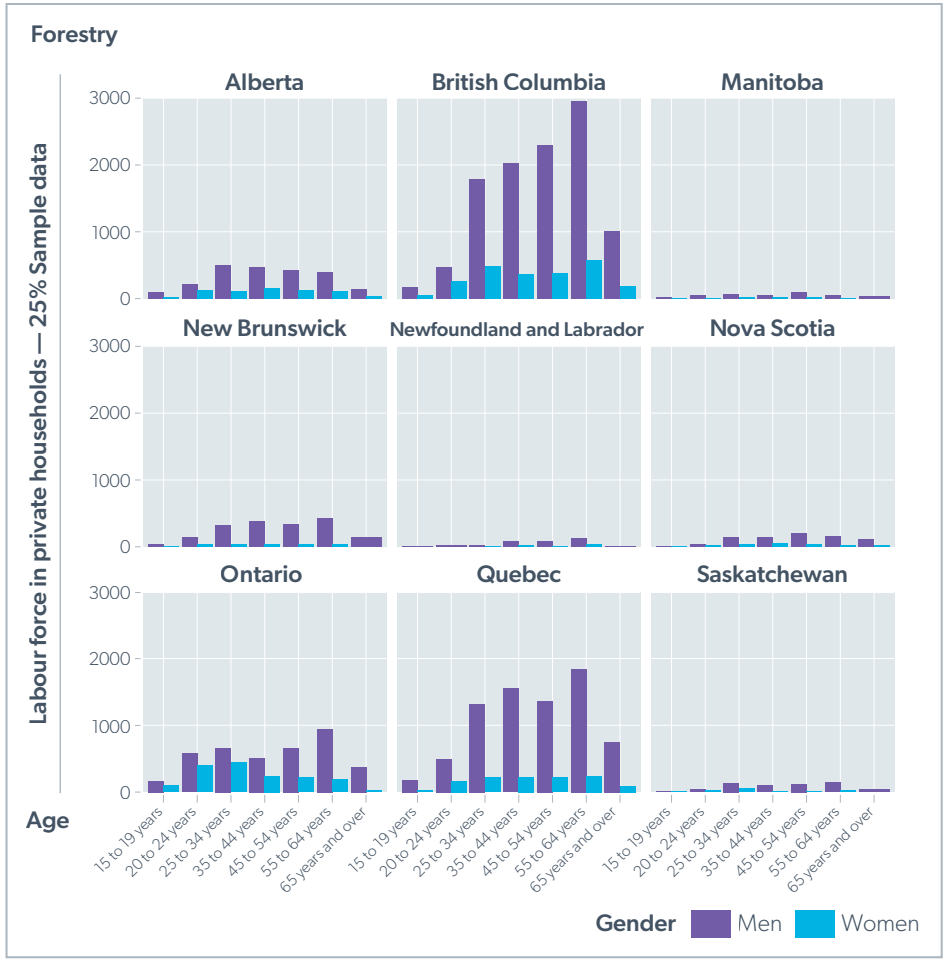
To assess population density, 2021 census data was used for the population size of CMAs and their respective provinces, plus the population density per km^2 of CMAs. 42 CMAs across Canada were given a weighting based on the ratio of CMA population within the corresponding province. CMAs with greater populations are thus given more weight. These weightings were used with CMA population density per km to calculate an average population-weighted density (PWD) using calculation =average. weighted (values, weights) where values are the values to average, and weights are the weights for each corresponding value.

Appendix 8: Analysis of employment demographics by industry and geography

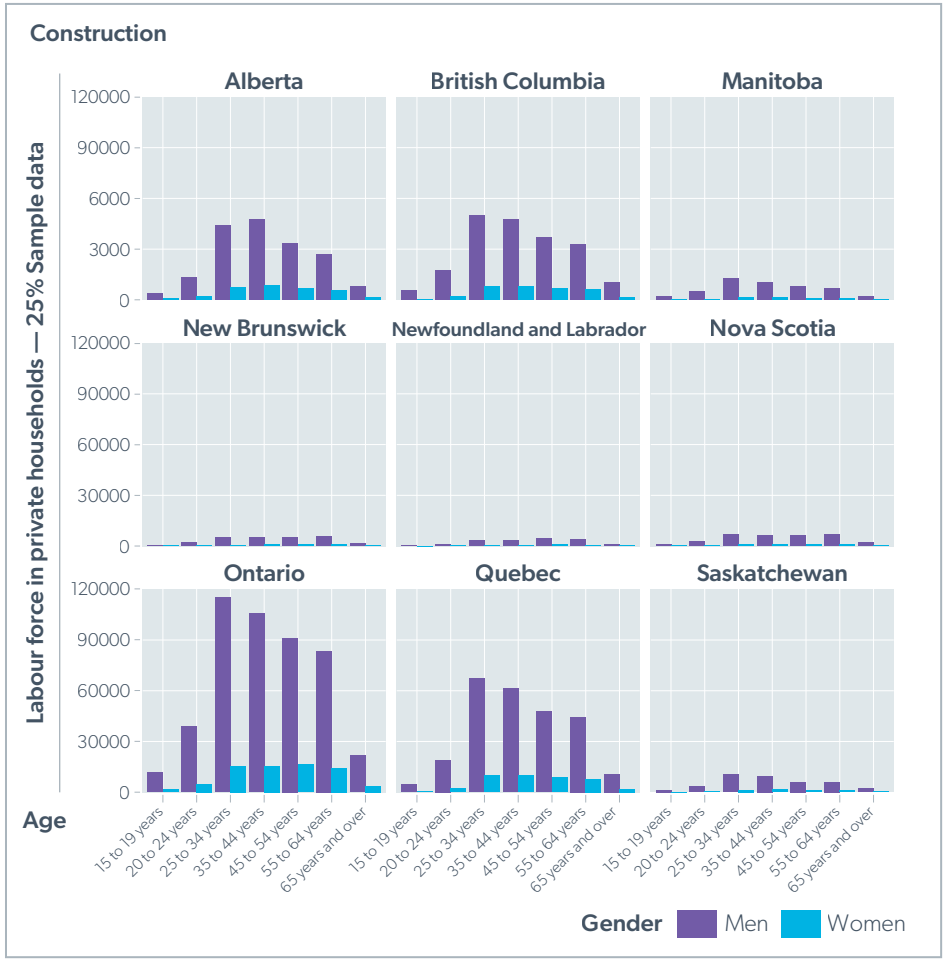
We used data from the 2021 Census to analyze sectoral demographic diversity. Industry groups were combined by class of workers, including job permanency, labour force status, age, and gender. This was compared across provinces to demonstrate relative age and gender gaps in the identified industries.



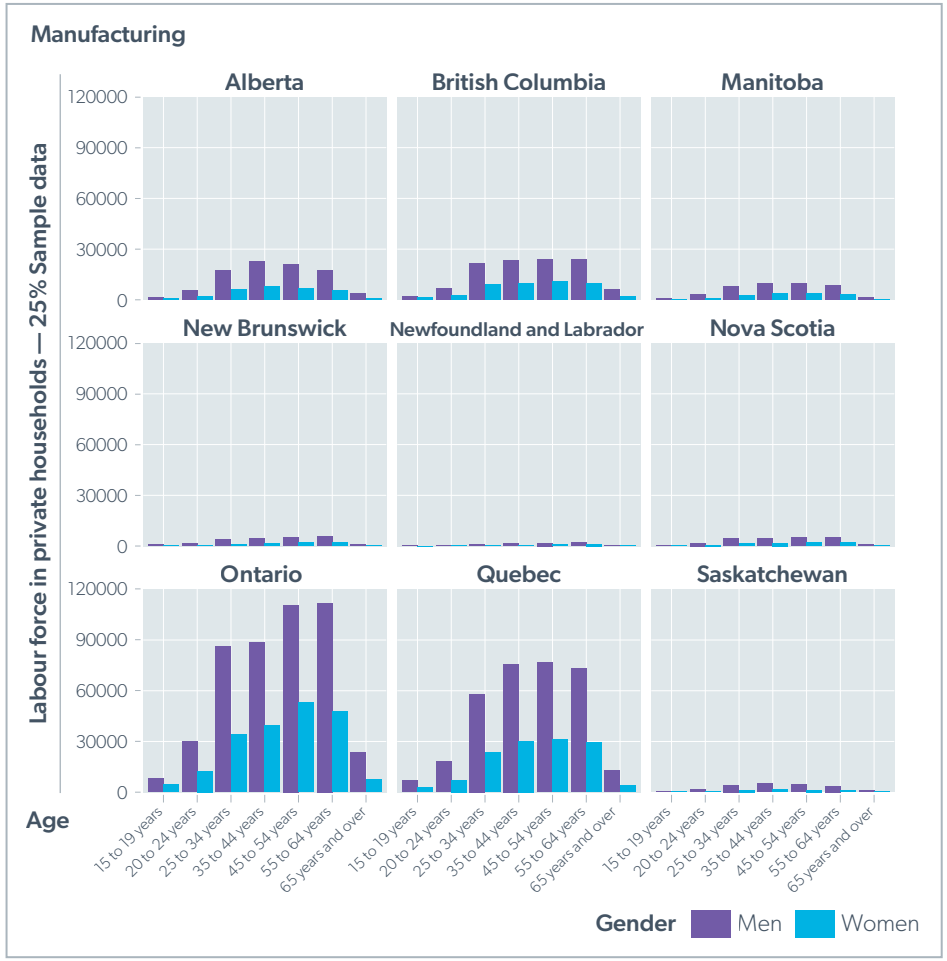
StatsCan 2021 Census. NAICS 111-112 & 1150



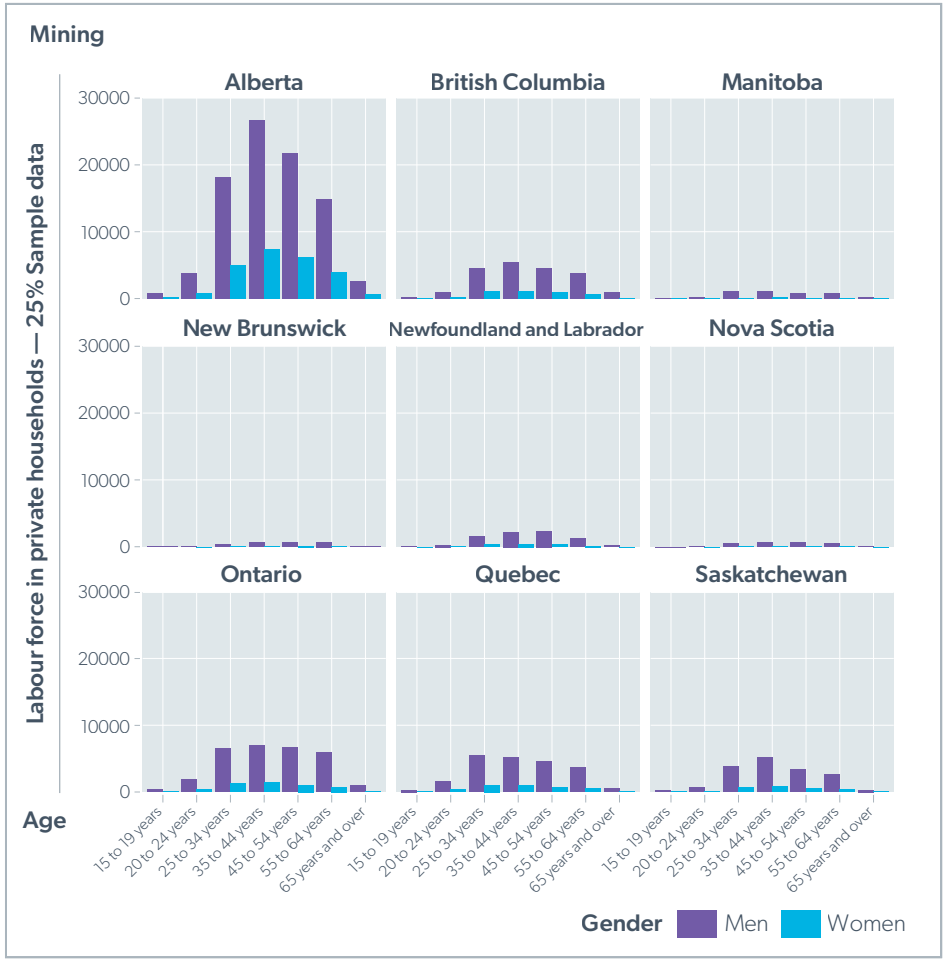
StatsCan 2021 Census. NAICS 113 & 1153



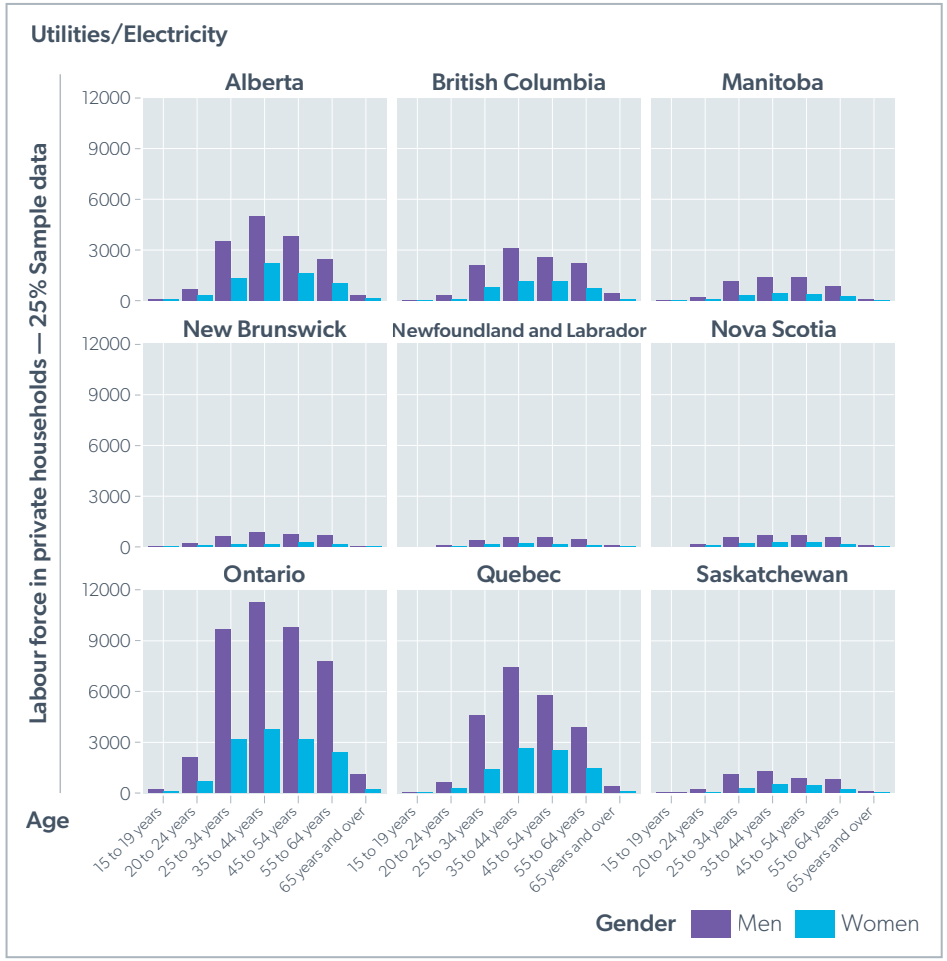
StatsCan 2021 Census. NAICS 23



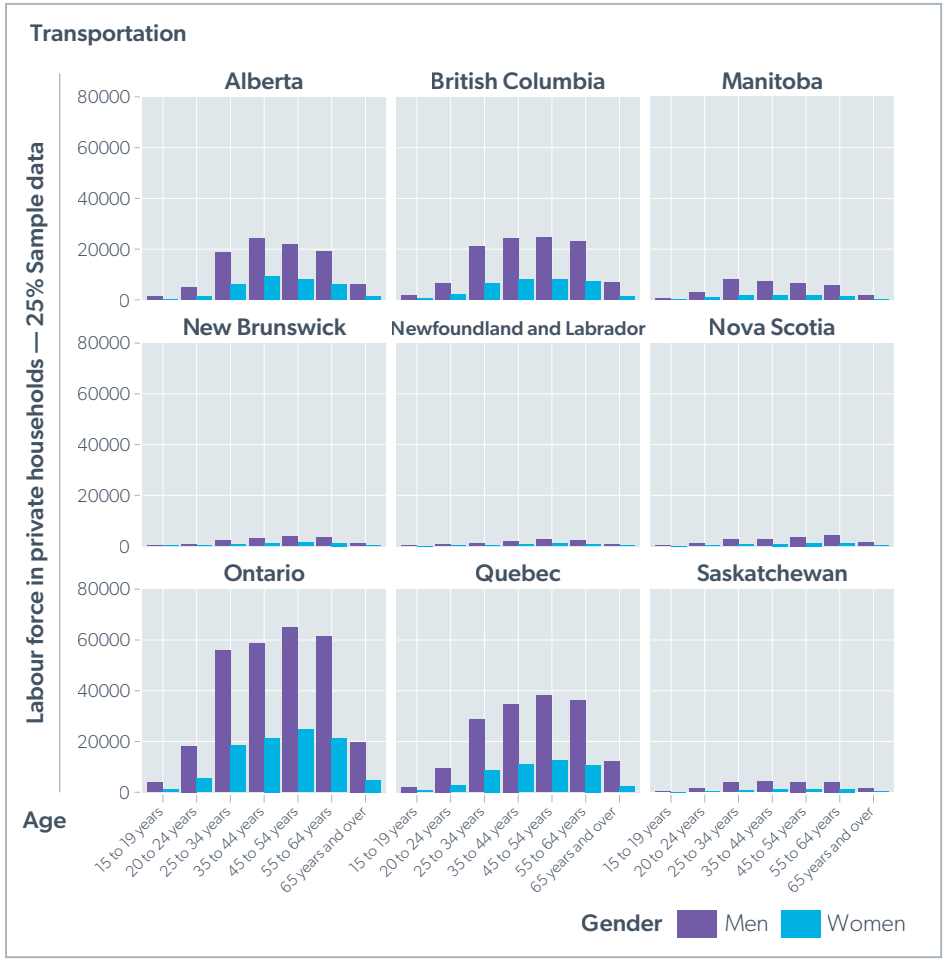
StatsCan 2021 Census. NAICS 31-33



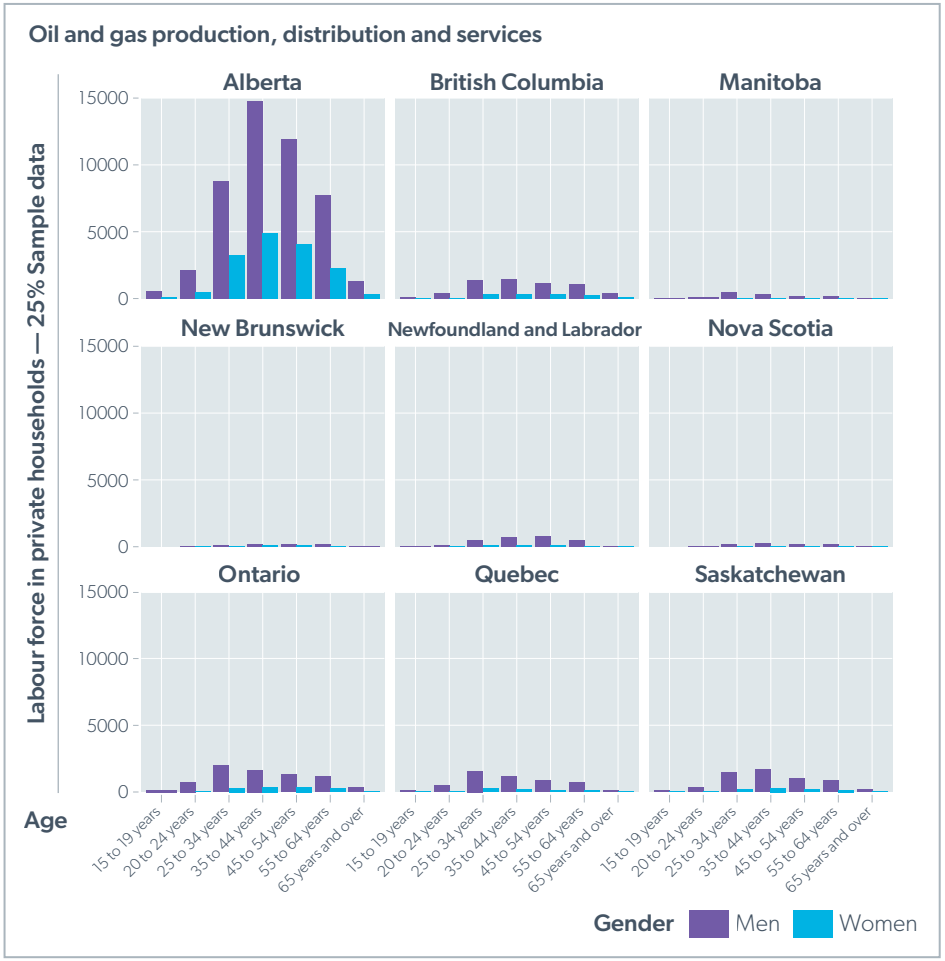
StatsCan 2021 Census. NAICS 21



StatsCan 2021 Census. NAICS 22



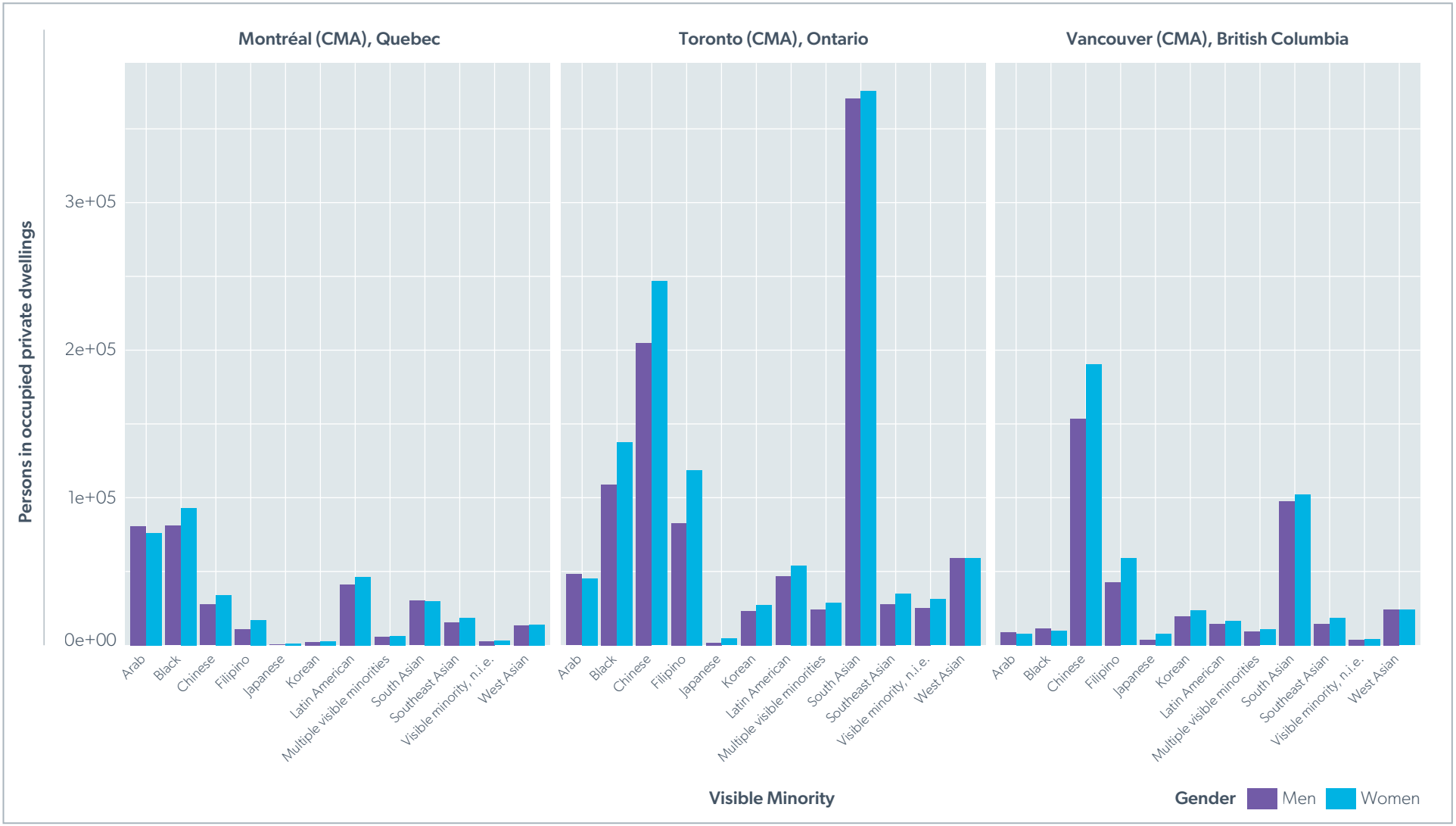
StatsCan 2021 Census. NAICS 48-49



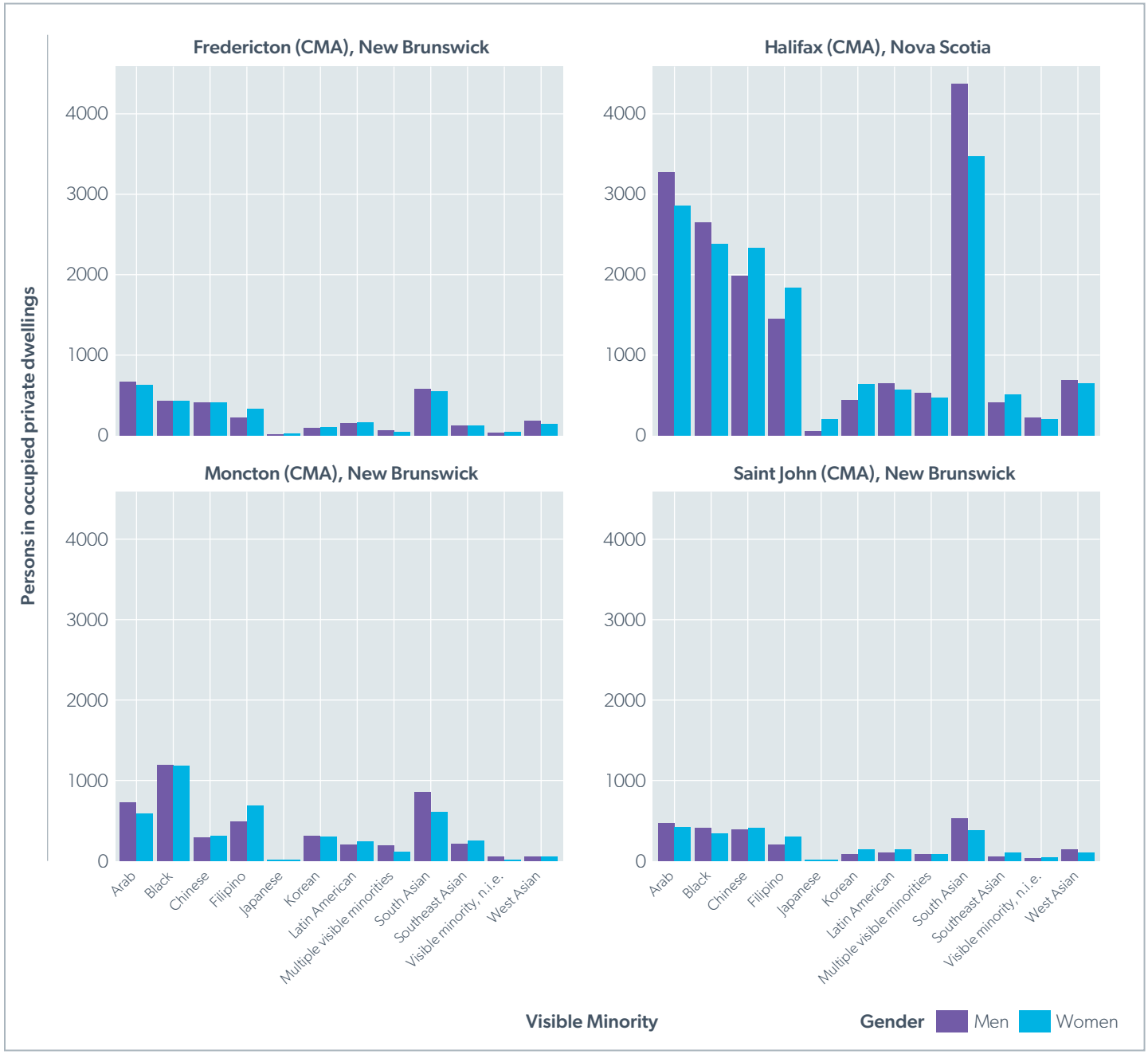
StatsCan 2021 Census. NAICS 211, 213, 2212, 4861 & 4862

Appendix 9: Analysis of visible minorities in CMAs

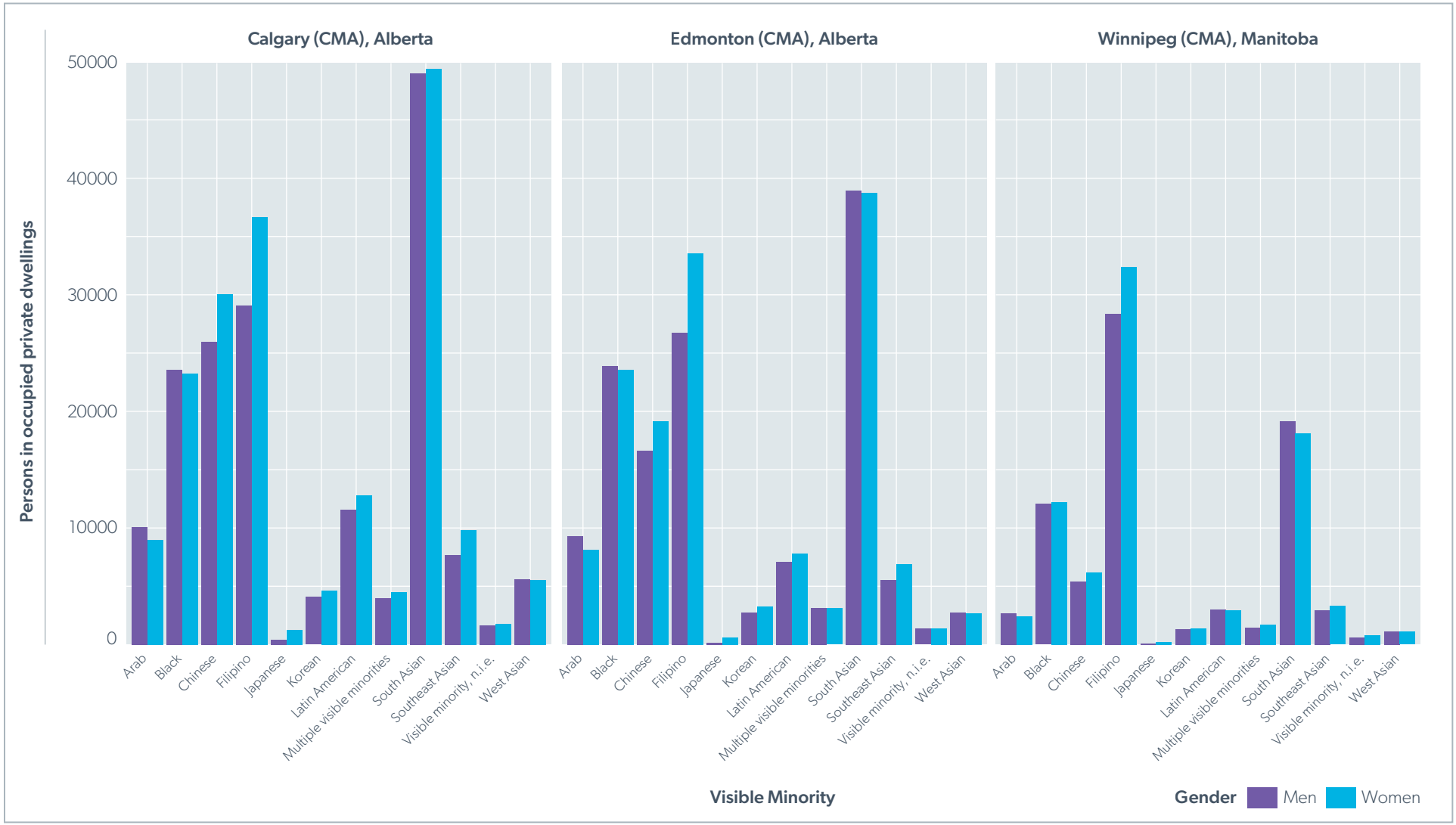
To understand of the placement of friends and family for provincial attractiveness for new immigrants, we compared data from the 2021 Census on immigrants and non-residents, visible minorities, and gender across the identified CMAs.



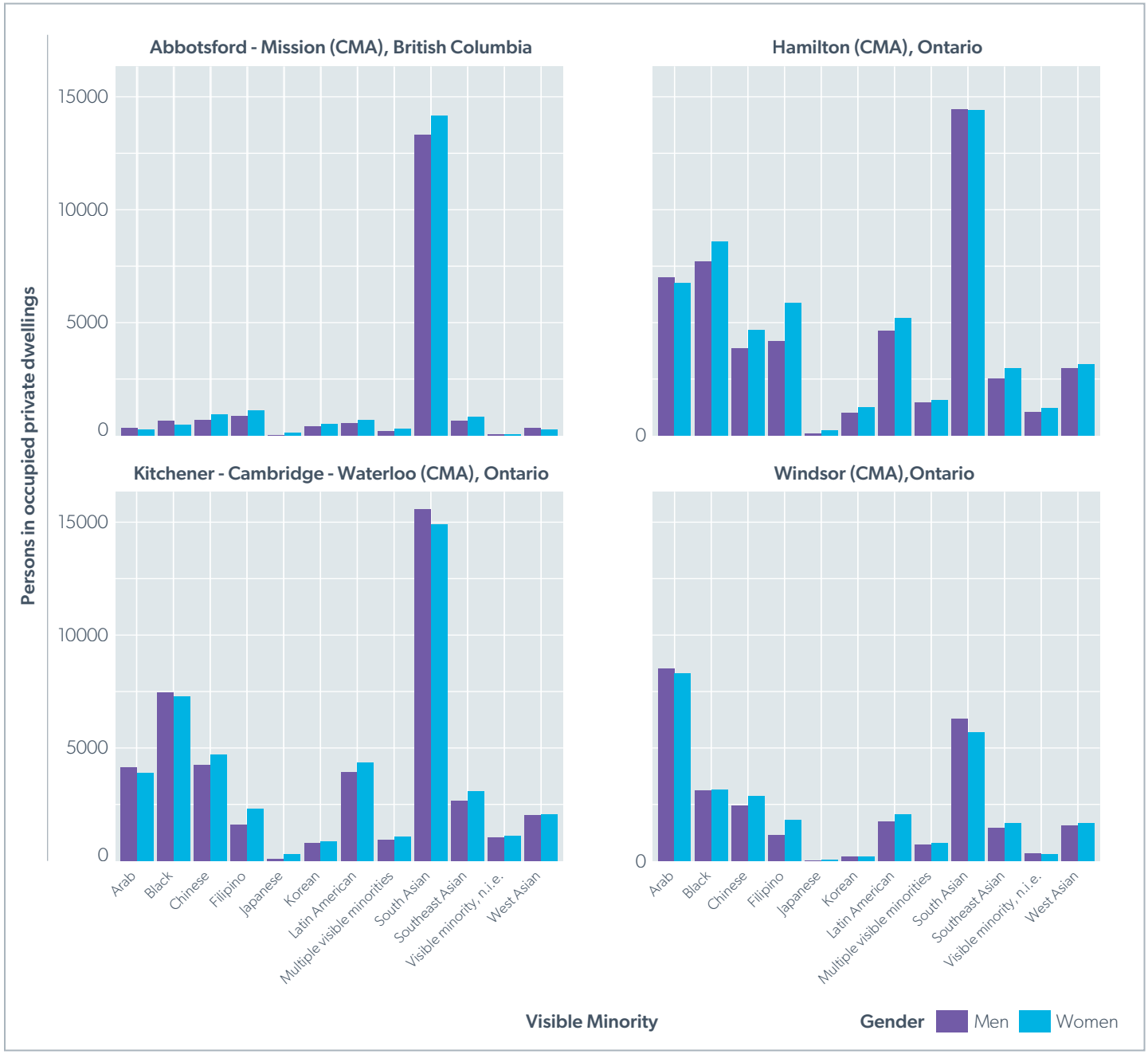
StatsCan 2021 Census. 25% Sample data



StatsCan 2021 Census. 25% Sample data



StatsCan 2021 Census. 25% Sample data



StatsCan 2021 Census. 25% Sample data

References

- Agdaily Reporters. (2021). *The skills needed to manage a farm in the future*. Agdaily. https://www.agdaily.com/lifestyle/skills-needed-manage-farm-future/
- Agriculture and Agri-Food Canada. (2021). Overview of the Sector. https://agriculture.canada.ca/sites/default/files/documents/2022-07/Sector%20Overview%20-%20Sector%20%282022%29%20EN.pdf
- Akbari, S., Lynch, S., Mcdonald, T., & Rankaduwa, W. (2007). *Socioeconomic & demographic profiles of immigrants in Atlantic Canada*. Atlantic Metropolis Centre. https://www.researchgate.net/publication/264891606_Socioeconomic_demographic_profiles_of_immigrants_in_Atlantic_Canada
- Alberta Boilers Safety Association (ABSA). (n.d.). ABSA the Pressure Equipment Safety Authority. https://www.absa.ca/
- Allan, B., Eaton, D., Goldman, J., Islam, A., Augustine, T., Elgie, S., and Meadowcroft, J. (2022). *Canada's Future in a Net-Zero World: Securing Canada's Place in the Global Green Economy.* Smart Prosperity Institute, Transition Accelerator and Pacific Institute for Climate Solutions.
- Altstedter, A. (2022). *Despite falling prices, homes in Canada have never been so unaffordable: RBC*. BNN Bloomberg. https://www.bnnbloomberg.ca/homes-in-canada-have-never-been-so-unaffordable-rbc-says
- Amery, B. (2018, October). *The Future of Work in Canada: Bridging The Gap*. Labour Market Information Council. https://lmic-cimt.ca/publications-all/lmi-insights-report-no-2-the-future-of-work-in-canada-bridging-the-gap/#toc-5
- Amirault, D., de Munnik, D. & Miller, S. (2013). *Explaining Canada's Regional Migration Patterns*. Bank of Canada Review: Spring 2013. https://www.bankofcanada.ca/wp-content/uploads/2013/05/boc-review-spring13-amirault.pdf
- Anderson, T. (2019). *Employment of First Nations men and women living off reserve*. Aboriginal Peoples Survey. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/89-653-x/89-653-x2019004-eng.htm
- APEGA. (n.d.). The Association of Professional Engineers and Geoscientists of Alberta (APEGA). Retrieved March 9, 2023, from https://www.apega.ca
- Association for Canadian Studies. (2006). *Canadian Issues: Immigration and families*. Guest editor: VanderPlaat, M. Canadian Issues/Themes Canadiens (CITC). https://acs-metropolis.ca/wp-content/uploads/2019/05/CITC-2006-Spring-Printemps-2.pdf
- Association of Professional Engineers and Geoscientists of Alberta (APEGA). (n.d.). *Applying to become an APEGA member.* Retrieved on February 16, 2023 from https://www.apega.ca/apply/membership
- Association of Professional Engineers and Geoscientists of New Brunswick (APEGNB). (n.d.). About us. Retrieved on December 19, 2022, from https://www.apegnb.com/
- Atiq, M., Coutinho, A., Islam, A., & McNally, J. (2022, May). *Jobs and Skills in the Transition to a Net-Zero Economy: A Foresight Exercise*. Smart Prosperity Institute. https://institute.smartprosperity.ca/JobsAndSkills
- Atiq, M., Dholakia, H., McNally, J., & Renzetti, N. (2022, November). *As the Weather changes: How Canadian climate action and clean growth could be affected by increased economic disruptions and decreased trade globally*. The PLACE Centre. Smart Prosperity Institute. https://placecentre.smartprosperity.ca/blog/weather-changes
- Automotive Parts Manufacturer's Association (APMA). (n.d.). *Equity, Diversity and Inclusion Fund.* https://apma.ca/edi-fund/
- Deussing, M. (2015). *Attitudes and perceptions of Canadian youth towards careers in the trades: Results from the 2012 Programme for International Student Assessment (PISA)*. Employment and Social Development Canada. https://www.canada.ca/en/employment-social-development/corporate/reports/research/canadian-youth-attitudes-trades-summary.html
- Bascaramurty, D. (2022, October 26). *Smaller cities, Atlantic provinces attracting immigrants, according to 2021 census data*. The Globe and Mail. https://www.theglobeandmail.com/canada/article-immigrants-canadian-population-2021-census/
- Banerjee, R., & Phan, M. (2014). Licensing Requirements and Occupational Mobility Among Highly Skilled New Immigrants in Canada. *Relations Industrielles / Industrial Relations, 69*(2), 290–315. https://www.jstor.org/stable/43187950?seq=1
- B.C. Centre of Training Excellence in Mining. (2022). *Skills Roadmap Project: Final Report.* Government of British Columbia. https://bc-ctem.ca/wp-content/uploads/CTEM_SRMP-Final-Report_Nov-30-2022.pdf
- Béchard, J. (2015). *Immigration: The Canada-Quebec Accord*. Library of Parliament. https://publications.gc.ca/collections/collection_2016/bdp-lop/bp/YM32-2-2011-89-1-eng.pdf
- Beine, M., Noël, R., & Ragot, L. (2014). Determinants of the international mobility of students. *Economics of Education Review, 41*, 40–54. https://doi.org/10.1016/j.econedurev.2014.03.003
- Bell, S., Alves, S., Silveirinha de Oliveira, E., & Zuin, A. (2010). Migration and Land Use Change in Europe: A Review. *Living Reviews in Landscape Research, 4*. https://doi.org/10.12942/lrlr-2010-2
- Bergant, K., Mano, R., & Shibata, I. (2022). *From Polluting to Green Jobs: A Seamless Transition in the U.S.?* IMF Working Paper No. 2022/129. https://www.imf.org/en/Publications/WP/Issues/2022/07/01/From-Polluting-to-Green-Jobs-A-Seamless-Transition-in-the-U-S-520244

- Better Dwelling. (2022, January 13). *Canadians Are Dumping Big Cities By The Tens of Thousands As Locals De-Urbanize*. Better Dwelling Canada. https://betterdwelling.com/canadians-are-dumping-big-cities-by-the-tens-of-thousands-as-locals-de-urbanize/
- Biase, S. D. & Bauder, H. (2005). Immigrant settlement in Ontario: Location and local labour markets. *Canadian Ethnic Studies Journal, 37*(3), 114–136. https://link.gale.com/apps/doc/A145680862/AONE?u=googlescholar&sid=bookmark-AONE&xid=c368bd67
- Bickis, I. (2017, March 1). *Leaner oilpatch emerges from recession as new technology replaces jobs*. CBC News. https://www.cbc.ca/news/canada/calgary/oilpatch-downturn-technology-advances-replace-jobs-automation-1.4004855
- Bleakley, H., & Lin, J. (2012). Thick-market effects and churning in the labor market: Evidence from US cities. *Journal of Urban Economics, 72*(2), 87–103. https://doi.org/10.1016/j.jue.2012.04.003
- Bokat-Lindell, S. (2022, March 16). *What the Ukraine War Means for the Future of Climate Change*. The New York Times. https://www.nytimes.com/2022/03/16/opinion/ukraine-climate-change-russia.html.
- Boston Consulting Group (BCG) Global. (2020, July 17). *Decoding Global Talent 2018*. https://www.bcg.com/publications/2018/decoding-global-talent
- Business Development Bank of Canada. (2021, September 29). *Labour shortage is limiting the growth of most Canadian businesses: BDC study*. BDC. https://www.bdc.ca/en/about/mediaroom/news-releases/labour-shortage-study.
- CareerWise by CERIC. (2021, June 30). *Breaking down barriers to newcomers' success is key to Canada's recovery.* CERIC. https://careerwise.ceric.ca/2021/06/30/breaking-down-barriers-to-newcomers-success-is-key-to-canadas-recovery/
- Canada Green Building Council (CaGBC). (2020). *Trading up – How Alberta's Trades can build a Zero-carbon future*. https://portal.cagbc.org/cagbcdocs/advocacy/Trading_Up_Alberta_Skills_Gap_Study_CaGBC2020_EN.pdf
- Canada Green Building Council (CaGBC). (2019). *Trading up – Equipping Ontario trades with the skills of the future*. https://www.cagbc.org/news-resources/research-and-reports/trading-up-ontario/
- Canada Green Building Council (CaGBC) & the Delphi Group. (2022). *Green Economy Retrofit Study: Summary Report*. https://www.cagbc.org/wp-content/uploads/2022/06/Green-Retrofit-Economy-Study.pdf
- Canada Energy Regulator (CER). (2022). Provincial and territorial energy profiles – Canada. Government of Canada. https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-canada.html.
- Canadian Agricultural Human Resource Council. (2010). *Identifying New or Emerging Markets and Opportunities in Agriculture*. https://cahrc-ccrha.ca/sites/default/files/2021-11/Final%20NEMA%20report%20-%20English%20-%20October%2020%2C%202010.pdf
- Canadian Agricultural Human Resource Council, The Canadian Federation of Agriculture, & Food and Beverage Canada. (2022). *National Workforce Strategic Plan for Agriculture and Food and Beverage Manufacturing: Interim Report*. https://cahrc-ccrha.ca/sites/default/files/2022-12/CAHRC%20-%20NWSP%20Interim%20Report%20-%20Dec%206%2C%202022.pdf
- Canadian Information Centre for International Credentials. (2022). *Find an occupational profile*. Retrieved on March 7, 2023, from https://www.cicic.ca/936/get_more_information_about_the_directory_of_occupational_profiles.canada.
- Canadian Hydrogen and Fuel Cell Association. (2022). *Canadian hydrogen fuel cell and sector profile: Final report*. https://www.chfca.ca/wp-content/uploads/2022/08/CHFCA-Sector-Profile-2022-Final-2.pdf.
- Canadian International Development Platform (CIDP). (2015, March 17). *Migration Flows*. http://cidpnsi.ca/migration-flows/
- Canadian Manufacturers and Exporters (CME). (2022, October 25). *Canada Leaving Almost $13 Billion on the table due to Labour and Skills Shortages in Manufacturing*. Newswire. https://www.newswire.ca/news-releases/canada-leaving-almost-13-billion-on-the-table-due-to-labour-and-skills-shortages-in-manufacturing-814375972.html
- Canadian Mortgage and Housing Corporation (CMHC). (2018). *About affordable housing in Canada*. Retrieved December 19, 2022, from https://www.cmhc-schl.gc.ca/en/professionals/industry-innovation-and-leadership/industry-expertise/affordable-housing/about-affordable-housing/affordable-housing-in-canada
- Canadian Mortgage and Housing Corporation (CMHC). (2022). *Housing Market Information—Canada's Housing Supply Shortages: Estimating what is needed to solve Canada's housing affordability crisis by 2030*. CMHC. https://www.cmhc-schl.gc.ca/en/blog/2022/canadas-housing-supply-shortage-restoring-affordability-2030
- Canadian Real Estate Association (CREA). (2016). *Benchmark home definitions*. MLS Home Price Index. https://www.crea.ca/wp-content/uploads/2016/02/benchmark_home_definitions_for_tableau_en.pdf
- Caranci, B & Fong, F. (2021). *Don't let history repeat: Canada's energy sector transition and the potential impact on workers*. TD Economics. https://economics.td.com/esg-energy-sector.
- Carter, T., Morrish, M., & Amoyaw, B. (2008). Attracting Immigrants to Smaller Urban and Rural Communities: Lessons Learned from the Manitoba Provincial Nominee Program. *Journal of International Migration and Integration / Revue de l'integration et de La Migration Internationale, 9*(2), 161–183. https://doi.org/10.1007/s12134-008-0051-2
- Castelli, F. (2018). Drivers of migration: Why do people move? *Journal of Travel Medicine, 25*(1), tay040. https://doi.org/10.1093/jtm/tay040
- Christiaensen, L. Rutledge, Z., & Taylor, J.E. (2020). *What is the future of work in agri-food?* Brookings. https://www.brookings.edu/blog/future-development/2020/12/11/what-is-the-future-of-work-in-agri-food/
- Canadian Information Processing Society (CIPS). (2022). CIPS Provincial societies. https://cips.ca/provinces/

- Canadian Institute of Public Health Inspection (CIPHI). (n.d.). *Becoming a Certified Environmental Public Health Professional*. https://ciphi.ca/certification/
- Clean Resource Innovation Network (CRIN). (2022). *Cleantech and Transitioning Careers in Oil and Gas: Labour Market Overview*. https://cleanresourceinnovation.com/preview/resource/files/3/CRIN-LabourMarket-Overview-AH-%C6%921.pdf
- Committee Report No. 8—CIMM (42-1)—House of Commons of Canada. (2016). Parliament of Canada. https://www.ourcommons.ca/DocumentViewer/en/42-1/CIMM/report-8/page-69
- Cooper, J. (2021). *Skills Development in Northern Mining Regions: Lessons From Manitoba*. Ottawa: The Conference Board of Canada. https://fsc-ccf.ca/research/skills-northern-regions-manitoba/
- Crossman, E., Hou, F., & Picot., G. (2021). *Are the Labour market outcomes between Immigrants and their Canadian-born counterparts starting to close?* Statistics Canada. https://www150.statcan.gc.ca/n1/pub/36-28-0001/2021004/article/00004-eng.htm
- De Smet, A., Dowling, B., Muguyar-Baldocchi, M., & Schaniger, B. (2021). *How companies can turn the Great Resignation into the Great Attraction*. McKinsey. https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/great-attrition-or-great-attraction-the-choice-is-yours
- Delphi Group. (2022). *Green Retrofit Economy Study – Technical memo: Summary of workforce supply*. https://delphi.ca/wp-content/uploads/2022/10/Technical-Memo-Summary-of-Workforce-Supply.pdf
- Dodd, D. (2022, September 2). *The global war for talent*. Financial Times. https://www.ft.com/content/61cc947c-c44c-4340-897a-8bd947227c05
- Drolet, J., Hamilton, L., Esses, V., & Wright, J. (2016). *Geographies of (im)migration to Canada and Alberta: Improving understanding of social and economic factors driving migration patterns*. https://doi.org/10.13140/RG.2.2.15241.88160
- Edmonton Region Hydrogen HUB. (n.d.). *Edmonton region hydrogen hub – building our clean energy future*. https://erh2.ca/
- Education News Canada. (2022, March 1). *Fleming College offers new intakes of free forestry program through SkillsAdvance Ontario.* https://educationnewscanada.com/article/education/level/colleges/2/947237/college-offers-new-intakes-of-free-forestry-program-through-skillsadvance-ontario.html
- Electricity Human Resource Canada. (2022). *Transitioning from Oil and Gas to Green Energy: Assessing Skills Transferability and Feasibility through an Atlantic Canadian Lens*. The Maritimes Energy Association. https://electricityhr.ca/wp-content/uploads/2023/01/EHRC-MEA-Report-EN-v3-WEB_11aug22.pdf
- Eliasson, K. & Westerlund, O. (2021). *Housing markets and geographical labour mobility to high productivity regions: the case of Stockholm*. The Swedish Agency for Growth Policy Analysis & Department of Economics, USBE, Umeå University. https://www.tillvaxtanalys.se/download/18.7e06da27178d74923768688b/1622632252477/wp_2021_01_Housing%20markets%20and%20geographical%20labour%20mobility%20to%20high%20productivity%20regions_the%20case%20of%20Stockholm.pdf
- Employment and Social Development Canada (ESDC). (n.d.). *Job profiles – Job Bank*. http://www.jobbank.gc.ca/occupationsearch.xhtml
- Engineers and Geoscientists BC. (2019). *Engineers and Geoscientists BC*. Retrieved March 9, 2023, from https://www.egbc.ca/
- Engineers Geoscientists Manitoba. (n.d.). *Engineers Geoscientists Manitoba*. Retrieved March 9, 2023, from https://www.enggeomb.ca/
- Engineers Nova Scotia. (n.d.). *Welcome to Engineers Nova Scotia*. Retrieved March 9, 2023, from https://www.engineersnovascotia.ca/
- Environment and Climate Change Canada. (2002, July 1). *National Inventory Report (NIR) 1990-2020: Greenhouse Gas Sources and Sinks in Canada (2020)*. https://publications.gc.ca/site/eng/9.506002/publication.html
- EY. (2017). Will disruption interrupt the flow or stimulate greater opportunity for power and utilities? Ernst & Young. https://assets.ey.com/content/dam/ey-sites/ey-com/en_ca/topics/power-and-utilities/ey-will-disruption-interrupt-the-flow-or-fuel-the-future.pdf
- Fan, D. & Heminthavong, K. (2022). *Road Transportation; Heavyweight of the Canadian economy*. Library of Parliament. Government of Canada. https://lop.parl.ca/sites/PublicWebsite/default/en_CA/ResearchPublications/202204E
- Fang, T., Gunderson, M., & Lee, B. (2021). *Can older workers be retrained? Canadian evidence from worker-firm linked data*. IZA Institute for Labor Economics. Discussion Paper Series. https://docs.iza.org/dp14282.pdf.
- Food Processing Technology. (n.d.) *Roquette Pea Protein Manufacturing Plant, Portage la Prairie, Manitoba*. https://www.foodprocessing-technology.com/projects/roquette-pea-protein-manufacturing-plant-portage-la-prairie-manitoba/
- Forest Products Association of Canada. (2023). *The Greenest Workforce*. https://www.fpac.ca/areas/workforce
- Franzino, M., Guarino, A., & Binvel, Y. (2021, July 26). *The $8.5 trillion talent shortage*. Korn Ferry. https://www.kornferry.com/insights/this-week-in-leadership/talent-crunch-future-of-work
- Frenette, M. & Frank, K. (2020). *Automation and Job Transformation in Canada: Who's at Risk?* Statistics Canada. https://www150.statcan.gc.ca/n1/pub/11f0019m/11f0019m2020011-eng.htm
- Freestone, C. (2022). *Proof Point: Immigration will fuel Atlantic Canada's population upswing*. RBC Thought Leadership. https://thoughtleadership.rbc.com/immigration-will-fuel-atlantic-canadas-population-upswing/

- George, U., & Chaze, F. (2012). Credential Assessment of Internationally Trained Professionals: How Effective is the Process for the Purpose of Securing Employment? *Journal of Immigrant & Refugee Studies, 10*(1), 124–130. https://doi.org/10.1080/15562948.2012.646529
- Georgieff, A. & Milanez, A. (2021). *What happened to jobs at high risk of automation?* Organization for Economic Cooperation and Development. https://www.oecd-ilibrary.org/social-issues-migration-health/what-happened-to-jobs-at-high-risk-of-automation_10bc97f4-en
- Gien, L. & Law, R. (2009). *Attracting and Retaining Immigrants to Newfoundland and Labrador: Voices from the Newcomers and International Students.* The Harris Centre. https://wayback.archive-it.org/18981/20220704141137/https://www.mun.ca/harriscentre/media/production/memorial/administrative/the-harris-centre/media-library/reports/IRF_Gien_2009_08_31.pdf
- Government of Alberta. (2012, September 1). *Apprenticeship and Industry Training*. Tradesecrets. https://tradesecrets.alberta.ca/home/
- Government of Canada. (2015). *Survival to success: Transforming immigrant outcomes. Report on the panel on employment challenges of new Canadians.* Employment and Social Development Canada. https://www.canada.ca/content/dam/esdc-edsc/documents/programs/foreign-credential-recognition/consultations/FINAL_Transforming_Immigrant_Outcomes_WP-197_EN_V2.pdf
- Government of Canada (2021). Canadian Net-Zero Emissions Accountability Act. S.C. (2021) c. 22. https://laws-lois.justice.gc.ca/eng/acts/c-19.3/fulltext.html
- Government of Canada, S. C. (2015, March 18). *Changes in the Regional Distribution of New Immigrants to Canada*. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/11f0019m/11f0019m2015366-eng.htm#a3
- Government of Canada, S. C. (2017, May 8). *Settlement patterns and social integration of the population with an immigrant background in the Montréal, Toronto and Vancouver metropolitan areas*. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/89-657-x/89-657-x2016002-eng.htm
- Government of Canada, S. C. (2017a, October 25). *Geographic distribution of immigrants and recent immigrants and their proportion within the population of census metropolitan areas, Canada, 2016*. Statistics Canada. https://www150.statcan.gc.ca/n1/daily-quotidien/171025/t001b-eng.htm
- Government of Canada, S. C. (2018, March 28). Industry—North American Industry Classification System (NAICS) 2012 (425), Employment Income Statistics (3), Highest Certificate, Diploma or Degree (7), Visible Minority (15), Work Activity During the Reference Year (4), Age (5A) and Sex (3) for the Population Aged 15 Years and Over Who Worked in 2015 and Reported Employment Income in 2015, in Private Households of Canada, Provinces and Territories, 2016 Census—25% Sample Data. Statistics Canada. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/dt-td/Rp-eng.cfm?LANG=E&APATH=3&DETAIL=0&DIM=0&FL=A&FREE=0&GC=0&GID=0&GK=0&GRP=1&PID=112129&PRID=10&PTYPE=109445&S=0&SHOWALL=0&SUB=0&Temporal=2017&THEME=124&VID=0&VNAMEE=&VNAMEF=
- Government of Canada, S. C. (2019, December 13). *Recent Trends in Over-education by Immigration Status*. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/11f0019m/11f0019m2019024-eng.htm
- Government of Canada, S. C. (2021, April 28). *Are the gaps in labour market outcomes between immigrants and their Canadian-born counterparts starting to close?* Statistics Canada. https://www150.statcan.gc.ca/n1/pub/36-28-0001/2021004/article/00004-eng.htm
- Government of Canada, S. C. (2021). *Internal migration: Overview, 2016/2017 to 2018/2019*. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/91-209-x/2021001/article/00001-eng.htm
- Government Of Canada, S. C. (2022a, October 26). *The Atlantic provinces welcomed higher shares of recent immigrants in Canada than the previous censuses, while Quebec and the Prairies saw their shares decrease*. Statistics Canada. https://www150.statcan.gc.ca/n1/daily-quotidien/221026/mc-a001-eng.htm
- Government of Canada, S. C. (2022b, January 7). *Labour force characteristics by industry, annual*. Statistics Canada. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410002301
- Government of Canada, S. C. (2022c, January 13). *Components of population change by economic region, 2016 boundaries*. Statistics Canada. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710013801
- Government of Canada, S. C. (2022d, February 9). *Canada's fastest growing and decreasing municipalities from 2016 to 2021*. Statistics Canada. https://www12.statcan.gc.ca/census-recensement/2021/as-sa/98-200-x/2021001/98-200-x2021001-eng.cfm
- Government of Canada, S. C. (2022e, February 9). *Population and dwelling counts: Canada, provinces and territories.* Statistics Canada. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=9810000101
- Government of Canada, S. C. (2022f, February 9). *Population and dwelling counts: Census metropolitan areas, census agglomerations and census subdivisions (municipalities)*. Statistics Canada. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=9810000301
- Government of Canada, S. C. (2022g, September 28). *Estimates of interprovincial migrants by province or territory of origin and destination, annual*. Statistics Canada. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710002201
- Government of Canada, S. C. (2022h, October 26). *The Daily—Immigrants make up the largest share of the population in over 150 years and continue to shape who we are as Canadians*. Statistics Canada. https://www150.statcan.gc.ca/n1/daily-quotidien/221026/dq221026a-eng.htm
- Government of Canada, S. C. (2022i, November 4). *The Daily—Labour Force Survey, October 2022*. Statistics Canada. https://www150.statcan.gc.ca/n1/daily-quotidien/221104/dq221104a-eng.htm

- Government of Canada (2021). *Canada welcomes the most immigrants in a single year in its history.* Immigration Refugees and Citizenship Canada. https://www.canada.ca/en/immigration-refugees-citizenship/news/2021/12/canada-welcomes-the-most-immigrants-in-a-single-year-in-its-history.html
- Government of Canada. (2022, July 27). *Government of Canada invests to help Canadians enter skilled trades.* Employment and Social Development Canada. https://www.canada.ca/en/employment-social-development/news/2022/07/government-of-canada-invests-to-help-canadians-enter-skilled-trades.html.
- Government of Canada (2022). *An Immigration Plan to Grow the Economy.* Immigration Refugees and Citizenship Canada. https://www.canada.ca/en/immigration-refugees-citizenship/news/2022/11/an-immigration-plan-to-grow-the-economy.html
- Government of Canada (2023). *A Made-In-Canada Plan: Federal Budget 2023*. https://www.budget.canada.ca/2023/home-accueil-en.html
- Government of New Brunswick. (2014, May 30). New Brunswick Apprenticeship and Trades. https://www2.gnb.ca/content/gnb/en/departments/post-secondary_education_training_and_labour/Skills/content/ApprenticeshipAndTrades.html
- Government of Newfoundland & Labrador. (n.d.). Apprenticeship Wage Subsidy (AWS) Program. Immigration, Population Growth and Skills. https://www.gov.nl.ca/ipgs/lmda/apprenticeship/
- Government of Northwest Territories. (n.d.). Apprenticeship, Trade and Occupation Certification [Service]. Education, Culture and Employment; Government of the Northwest Territories. https://www.ece.gov.nt.ca/en/services/apprenticeship-trade-and-occupation-certification
- Government of Nunavut. (2022). Apprenticeship, trade and occupations certification. Department of Family Services. https://gov.nu.ca/information/supports-apprentices-and-their-employers#How%20can%20I%20receive.
- Government of PEI. (2023). Designated trades in PEI. Department of Economic Growth, Tourism & Culture. https://www.princeedwardisland.ca/en/information/economic-growth-tourism-and-culture/designated-trades-in-pei
- Government of Saskatchewan. (2023). Apprenticeship Information. Saskatchewan Apprenticeship and Trade Commission. https://saskapprenticeship.ca/apprenticeship-information/
- Government of Yukon. (2022). *Get a Yukon Certificate of Qualification in a designated trade.* Retrieved March 7, 2023, from https://yukon.ca/en/education-and-schools/apprentices-and-trades/get-yukon-certificate-qualification-designated-trade#apply-without-a-ticket-or-certificate
- Gresch, D., Thomson, J & Sonmez, Z. (2022). *Green occupation pathways: From vulnerable jobs to rapid-growth careers*. Conference Board of Canada. https://www.conferenceboard.ca/product/green-occupation-pathways-from-vulnerable-jobs-to-rapid-growth-careers/
- Grip, A. de, Fouarge, D., & Sauermann, J. (2010). What affects international migration of European science and engineering graduates? *Economics of Innovation and New Technology*. https://doi.org/10.1080/10438590903434828
- Hewitt, F. (2022, June 20). Hamilton third least affordable city in North America, study shows. *The Hamilton Spectator.* https://www.thespec.com/news/hamilton-region/2022/06/20/hamilton-third-most-unaffordable-city-in-canada-study-shows.html
- Hou, F., Lu, Y., and Schimmele, C. (2019). *Recent Trends in Over-education by Immigration Status*. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/11f0019m/11f0019m2019024-eng.htm
- House of Commons Standing Committee on Natural Resources., & Maloney, J. *The Future of Canada's mining sector : Sustainable growth beyond the global downturn (2017)*. Ottawa. Retrieved from https://publications.gc.ca/site/eng/9.833466/publication.html.
- Hyndman, J., Schuurman, N., & Fiedler, R. (2006). Size matters: Attracting new immigrants to Canadian cities. *Journal of International Migration and Integration / Revue de l'integration et de La Migration Internationale, 7*(1), 1–25. https://doi.org/10.1007/s12134-006-1000-6
- International Labour Office (ILO) – Department of Statistics. (n.d.) *Definitions of green jobs used in the employment and environment policy context.* International Labour Organization. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/presentation/wcms_195740.pdf
- *Immigrants arriving in Canada by province 2022*. (n.d.). Statista. Retrieved December 19, 2022, from https://www.statista.com/statistics/444906/number-of-immigrants-in-canada/
- Immigration, Refugees and Citizenship Canada. (IRCC) (2015, February 3). *Evaluation of the Family Reunification Program* [Assessments]. https://www.canada.ca/en/immigration-refugees-citizenship/corporate/reports-statistics/evaluations/family-reunification-program.html
- Immigration, Refugees and Citizenship Canada. (IRCC) (2018, November 14). *How the Provincial Nominee Program (PNP) works*. https://www.canada.ca/en/immigration-refugees-citizenship/services/immigrate-canada/provincial-nominees/works.html
- Immigration, Refugees and Citizenship Canada. (IRCC) (2021a, June 30). *CIMM - Role of Immigration in Canada's Economic Recovery—Mar 10, 2021*. https://www.canada.ca/en/immigration-refugees-citizenship/corporate/transparency/committees/cimm-mar-10-2021/cimm-role-immigration-canadas-economic-recovery-mar-10-2021.html
- Immigration, Refugees and Citizenship Canada. (IRCC) (2021b, December 23). *Canada welcomes the most immigrants in a single year in its history* [News releases]. https://www.canada.ca/en/immigration-refugees-citizenship/news/2021/12/canada-welcomes-the-most-immigrants-in-a-single-year-in-its-history.html

- Immigration, Refugees and Citizenship Canada. (IRCC) (2021c). *Settlement Outcomes Highlights Report: Summary Findings from IRCC's First Settlement Outcomes Report 2021*. https://publications.gc.ca/collections/collection_2021/ircc/Ci34-6-2021-eng.pdf
- Immigration, Refugees and Citizenship Canada. (IRCC) (2021d). *Immigration, Refugees and Citizenship Canada Departmental Plan 2021-2022*. https://www.canada.ca/en/immigration-refugees-citizenship/corporate/publications-manuals/departmental-plan-2021-2022/departmental-plan.html#s10
- Immigration, Refugees and Citizenship Canada. (IRCC) (2021e). *Immigration, Refugees and Citizenship Canada Departmental Results Report 2021-2022*. https://www.canada.ca/content/dam/ircc/documents/pdf/english/corporate/publications-manuals/drr-2021-2022-en.pdf
- Immigration, Refugees and Citizenship Canada. (IRCC). (2021, December 20). *Successful Atlantic Immigration Pilot Canada Immigration Program To Be Made Permanent—Canada Immigration and Visa Information*. Canadian Immigration Services and Free Online Evaluation. https://www.immigration.ca/successful-atlantic-immigration-pilot-canada-immigration-program-to-be-made-permanent/
- Immigration, Refugees and Citizenship Canada. (IRCC) (2022a, January 25). *IRCC Minister Transition Binder 2021: Family Reunification*. https://www.canada.ca/en/immigration-refugees-citizenship/corporate/transparency/transition-binders/minister-2021/family-reunification.html
- Immigration, Refugees and Citizenship Canada. (IRCC) (2022b, July 13). *CIMM – Inventories and Processing Times – March 24, 2022*. https://www.canada.ca/en/immigration-refugees-citizenship/corporate/transparency/committees/cimm-mar-24-2022/inventories-processing-times.html
- Indigenous Clean Energy (ICE). (n.d.). *Generation Power*. Retrieved December 19, 2022, from https://www.generationpower.ca/
- Industry Canada. (2019). *Canadian Industry Statistics – 236 – Construction of buildings*. https://www.ic.gc.ca/app/scr/app/cis/summary-sommaire/236
- International Labour Organization. (2016). *What is a green job?* https://www.ilo.org/global/topics/green-jobs/news/WCMS_220248/lang--en/index.htm
- Janzen, N., Fan, C., & Powell, N. (2022). *Proof Point: Canada's labour shortages will outlive a recession*. Royal Bank of Canada. https://thoughtleadership.rbc.com/proof-point-canadas-labour-shortages-will-outlive-a-recession/#:~:text=A%20severe%20labour%20squeeze%20is,return%20as%20Canada's%20population%20ages
- Job Bank Canada. (2022a). *Machinery Manufacturing: Ontario 2022-2024 (NAICS 333)*. https://www.jobbank.gc.ca/trend-analysis/job-market-reports/ontario/sectoral-profile-machinery-manufacturing
- Job Bank Canada. (2022b). *Transportation equipment: Sectoral profile 2022-2024 (NAICS 336)*. https://www.jobbank.gc.ca/trend-analysis/job-market-reports/quebec/sectoral-profile-transportation-equipment
- Job Bank Canada. (2022c). *Alberta sector profile: Manufacturing*. https://www.jobbank.gc.ca/trend-analysis/job-market-reports/alberta/sectoral-profile-manufacturing
- Joint Research Centre (European Commission), McMahon, S., Farinosi, F., Tintori, G., Grubanov-Boskovic, S., Cattaneo, C., Migali, S., Kalantaryan, S., Bidoglio, G., Scipioni, M., Barbas, T., Benandi, B., Follador, M., & Natale, F. (2018). International migration drivers: A quantitative assessment of the structural factors shaping migration. *Publications Office of the European Union*. https://data.europa.eu/doi/10.2760/63833
- Leighton, K. (2022, August 25). *Overwhelming backlog of Canadian immigration applications prompts new government action*. Stewart McKelvey. https://www.stewartmckelvey.com/thought-leadership/overwhelming-backlog-of-canadian-immigration-applications-prompts-new-government-action/
- Mayor, L. Lindner, L.F. Knöbl, C.F. Ramalho, A. Berruto, R. Sanna, F. Rossi, D. Tomao, C. Goodburn, B. Avila, C. Leijdens, M. Stollewerk, K. Bregler, M. Koidis, C. Morin, A. Milicic, V. Fadini, G. Lazaro-Mojica, J. Busato, P. (2022). Skill Needs for Sustainable Agri-Food and Forestry Sectors (I): Assessment through European and National Focus Groups. *Sustainability*. https://www.researchgate.net/publication/362527268_Skill_Needs_for_Sustainable_Agri-Food_and_Forestry_Sectors_I_Assessment_through_European_and_National_Focus_Groups#pf16
- Marshal, B. (2020). *Facts and Figures 2020: The State of Canada's Mining Industry.* The Mining Association of Canada (MAC) https://mining.ca/wp-content/uploads/2021/09/FF-2020-EN-Web-1.pdf
- McNally, J. April 26, 2023. *We need better ways to understand the impacts of clean technologies on jobs and workers.* PLACE Centre. Smart Prosperity Institute. https://placecentre.smartprosperity.ca/blog/we-need-better-ways-understand-impacts-clean-technologies-jobs-and-workers
- McNally, J. & Moffatt, M. (2021, May 6). *Climate action is going to create too many jobs*. Maclean's. https://macleans.ca/opinion/climate-action-is-going-to-create-too-many-jobs/
- Melnitzer, J. (2023, April 12). *Critical minerals sector will have to wait on speedier timelines for development.* Financial Post. https://financialpost.com/commodities/mining/critical-minerals-sector-wait-faster-development-timelines
- Migrant Integration Policy Index. (n.d.). *Key Findings: Canada, 2019*. European Union. Centre for Global Development. Retrieved on December 19, 2022, from https://www.mipex.eu/canada
- Mining Industry Human Resources Council (MiHR). (2020). *The Changing Nature of Work: Innovation, Automation, and Canada's Mining Workforce*. https://mihr.ca/wp-content/uploads/2020/05/MIHR_Innovation_Report_EN_WEB.pdf
- Mining Industry Human Resources Council (MiHR). (2021). National Outlook 2021. https://mihr.ca/wp-content/uploads/2021/03/MIHR-National-Outlook-LMI-Report-2021-E-web.pdf

- Misra, T. (2019, April 24). *A bottom-line case for the green new deal: The jobs pay more*. Bloomberg.com. https://www.bloomberg.com/news/articles/2019-04-24/green-jobs-have-higher-wages-lower-entry-barriers
- Moffatt, M. (2021, October) *Baby Needs a New Home*. Smart Prosperity Institute. https://institute.smartprosperity.ca/sites/default/files/Baby-Needs-a-New-Home-Oct-1.pdf
- Moffatt, M. (2022, April 7). *Budget 2022: Canadian Housing Policy - The First Step in a Long Journey*. Smart Prosperity Institute. https://institute.smartprosperity.ca/Budget2022Housing
- Moffatt, M. (2021, May 20) *The Big Shift: Changes in Canadian Manufacturing Employment, 2003-2018*. Smart Prosperity Institute. https://institute.smartprosperity.ca/publications/big-shift#:~:text=can%20unsubscribe%20anytime.-,The%20Big%20Shift%3A%20Changes%20in%20Canadian%20Manufacturing%20Employment%2C%202003%20to,may%20have%20absorbed%20those%20displaced.
- Moffatt, M. & Boessenkool, K. (2023, May 1). *How Canada can create more rental housing*. The Globe and Mail. https://www.theglobeandmail.com/opinion/article-how-canada-can-create-more-rental-housing/
- Moffatt, M., Dudu, A., & Hosseini, M. (2022). *Ontario's Need for 1.5 Million More Homes*. Smart Prosperity Institute. https://institute.smartprosperity.ca/1.5MillionMoreHomes
- Mohino, I. & Ureña, J. M. (2020). Mobility, housing and labour markets in times of economic crises. *Regional Studies, 54*(4), 443–449. https://doi.org/10.1080/00343404.2020.1711879
- Morris, S., Fawcett, G., Brisebois, L., & Hughesm J. (2017). *A demographic, employment and income profile of Canadians with disabilities aged 15 years and over, 2017.* Statistics Canada. https://www150.statcan.gc.ca/n1/pub/89-654-x/89-654-x2018002-eng.htm
- Morrissette, R. (2017). *Barriers to labour mobility in Canada: Survey-based evidence*. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/11-626-x/11-626-x2017076-eng.htm
- Morissette, R. (2022). *Employer responses to labour shortages*. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/36-28-0001/2022007/article/00001-eng.htm
- Mysicka, R., Cutler, L., & Zhang, T. (2020). *Licence to capture: The cost consequences to consumers of occupational regulation in Canada*. CD Howe Institute. https://www.oecd.org/competition/reform/Licence-to-capture-the-cost-consequences-to-consumers-of-occupational-regulation-in-Canada.pdf
- National Aboriginal Economic Development Board. (2016). *Reconciliation: Growing Canada's Economy by $27.7 Billion*. http://www.naedb-cndea.com/reports/naedb_report_reconciliation_27_7_billion.pdf
- Natural Resources Canada. (2022). *The State of Canada's Forests: Annual Report 2022*. https://natural-resources.canada.ca/sites/nrcan/files/forest/sof2022/SoF_Annual2022_EN_access.pdf
- Natural Resources Canada. (2022). *The Canadian Critical Minerals Strategy*. https://www.canada.ca/content/dam/nrcan-rncan/site/critical-minerals/Critical-minerals-strategyDec09.pdf
- Natural Resources Canada. (2019). *Minerals Sector Employment Information Bulletin*. https://www.nrcan.gc.ca/science-data/science-research/earth-sciences/earth-sciences-resources/earth-sciences-federal-programs/minerals-sector-employment/16739
- Niebuhr, A. (2016). *Benefits of dense labour markets—Evidence from transitions to employment in Germany.* VfS Annual Conference 2016 (Augsburg): Demographic Change, Article 145715. https://ideas.repec.org/p/zbw/vfsc16/145715.html
- Nighbor, D. (2019). Opinion | Workforce Diversity – Canada's Forest Sector Branches Out. Forest Products Association of Canada. https://www.fpac.ca/posts/opinion-workforce-diversity-canadas-forest-sector-branches-out
- Nova Scotia Apprenticeship Agency. (n.d.). Nova Scotia Apprenticeship Agency (web page). https://www.nsapprenticeship.ca/
- Nova Scotia Association of Realtors. (n.d.). CREA Statistics. Retrieved December 19, 2022, from https://creastats.crea.ca/board/nsar
- Nunavut Association of Engineers and Geoscientists (NAPEG). (n.d.). Categories (web page). Retrieved March 9, 2023, from https://www.napeg.nt.ca/registration/categories/
- Organization for Economic Cooperation and Development (OECD). (n.d.). *Analytical house prices indicators.* Retrieved 19 December 2022, from https://stats.oecd.org/Index.aspx?DataSetCode=HOUSE_PRICES
- Organization for Economic Cooperation and Development (OECD). (2009). *The Future of International Migration to OECD Countries*. OECD Publishing, Paris. https://doi.org/10.1787/9789264064126-en
- Organization for Economic Cooperation and Development (OECD). (2021). *Earnings and wages—Average wages—OECD Data*. OECD. http://data.oecd.org/earnwage/average-wages.htm
- Ottensmann, J. R. (2021). *The Use (and Misuse) of Population-Weighted Density* (SSRN Scholarly Paper No. 3970248). https://doi.org/10.2139/ssrn.3970248
- Ouellet-Léveillé, B. & Milan, A. (2019). *Results from the 2016 Census: Occupations with older workers*. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/75-006-x/2019001/article/00011-eng.htm
- Pakula, B. & Smith Fowler, H. (2021). *Barriers to employment and training for equity-seeking groups.* Social Research and Demonstration Corporation. https://www.srdc.org/media/553157/training-barriers-for-equity-seeking-groups-final-report.pdf
- Palmer, J. R. B. & Pytliková, M. (2015). Labor Market Laws and Intra-European Migration: The Role of the State in Shaping Destination Choices. *European Journal of Population, 31*(2), 127–153. https://doi.org/10.1007/s10680-015-9341-5

- Parkhill, M. (2022, June 17). *Four of the five most expensive cities on either side of the border are Canadian: Study*. CTV News. https://www.ctvnews.ca/business/four-of-the-five-most-expensive-cities-on-either-side-of-the-border-are-canadian-study-1.5952576
- Professional Engineers and Geoscientists Newfoundland and Labrador (PEGNL). (n.d.). License Holders & Members. PEGNL. https://pegnl.ca/license-holders-members/
- Peri, G. (2020). *Immigrant Swan Song: Can Immigration Solve the Demographic Dilemma?* International Monetary Fund (IMF). https://www.imf.org/en/Publications/fandd/issues/2020/03/can-immigration-solve-the-demographic-dilemma-peri
- Petroleum Labour Market Information (PetroLMI). (2018). *A Workforce In Transition: Oil and Gas Skills of the Future*. https://careersinoilandgas.com/wp-content/uploads/2019/06/A_Workforce_in_Transition_Oil_and_Gas_Skills_of_the_Future.pdf
- Pew Research Center. (2019). *G7 nations stand out for their low birth rates, aging populations*. https://www.pewresearch.org/fact-tank/2019/08/23/g7-nations-stand-out-for-their-low-birth-rates-aging-populations/
- Powell, N. & Richardson, B. (2021). *Powering Up: Preparing Canada's skilled trades for a post-pandemic economy*. RBC Thought Leadership. https://thoughtleadership.rbc.com/powering-up-preparing-canadas-skilled-trades-for-a-post-pandemic-economy/
- Praznik, J. and Shields, J. (2018). *An Anatomy of Settlement Services in Canada: A Guide*. Toronto Metropolitan University. https://bmrc-irmu.info.yorku.ca/files/2018/07/An-Anatomy-of-Settlement-Services-in-Canada_BMRCIRMU.pdf
- Price Waterhouse Cooper (PWC), 2020. *Work transformed: The impact of technology.* Electricity Human Resources Council. https://www.pwc.com/ca/en/industries/power-utilities/ehrc-changing-nature-of-work-report.html
- Rainer, H. & Siedler, T. (2009). The role of social networks in determining migration and labour market outcomes. *Economics of Transition, 17*(4), 739–767. https://doi.org/10.1111/j.1468-0351.2009.00365.x
- Rana, U. (2021, December 2021). *For many newcomers, 'Canadian experience' remains a barrier to meaningful employment*. The Globe and Mail. https://www.theglobeandmail.com/canada/article-for-many-newcomers-canadian-experience-remains-a-barrier-to-meaningful/
- Rendaje, M. (2022, December 19). *15 Canada Income Statistics You Shouldn't Miss in 2022*. https://reviewlution.ca/resources/canada-income-statistics/
- Rentals.ca. (n.d.) *December 2022 Rent Report*. Rentals.ca. https://rentals.ca
- Richardson, K. (2016). Attracting and Retaining Foreign Highly Skilled Staff in Times of Global Crisis: A Case Study of Vancouver, British Columbia's Biotechnology Sector. *Population, Space and Place, 22*(5), 428–440. https://doi.org/10.1002/psp.1912
- Roquette Pea Protein Manufacturing Plant, Portage la Prairie, Manitoba. (n.d.). Retrieved January 4, 2023, from https://www.foodprocessing-technology.com/projects/roquette-pea-protein-manufacturing-plant-portage-la-prairie-manitoba/
- Sawyer D. & Griffin, B. (2022). *Oil and gas emissions will overshoot 2030 goal without tougher regulation*. Canadian Climate Institute. 440 Megatonnes Project. https://440megatonnes.ca/insight/oil-and-gas-emissions-will-overshoot-2030-goal-without-tougher-regulation/
- Schlecht, J. (2020). Precision agriculture for livestock, not just crops. *Agweek*. https://www.agweek.com/business/precision-agriculture-for-livestock-not-just-crops
- Secretariat, T. B. of C. (n.d.). Estimates of interprovincial migrants by province or territory of origin and destination, annual—Open Government Portal. https://open.canada.ca/data/en/dataset/f083ee31-e3b4-4f96-a655-30caf9eab790
- Sharma, K. (2022, August 8). *PNP vs. Express Entry: Which is better for you?* ELAAR Immigration. https://www.elaarimmigration.ca/blog/pnp-vs-express-entry-which-is-better/
- Simone, G. (2015). *How much does it cost to become a professional engineer?* The P.Eng. Applicant. https://pengapplicant.ca/cost-to-become-a-professional-engineer-p-eng/
- SkilledTradesBC. (n.d.). Get Certified. SkilledTradesBC. https://skilledtradesbc.ca/get-certified
- Smith, C. & Winstanley, S. (2022). *Net-Zero Skills: What will Canada need for the coming energy transition?* The Pembina Institute. https://www.pembina.org/reports/net-zero-skills.pdf
- Sonmez, Z., Thomson, J., & Gresch, D. (2022). *Green Occupation Pathways: From Vulnerable Jobs to Rapid-Growth Careers*. The Conference Board of Canada. https://fsc-ccf.ca/research/green-occupations-pathways-from-vulnerable-jobs-to-rapid-growth-careers/
- Stackhouse, J. (2019). *Farmer 4.0: How the coming skills revolution can transform agriculture.* RBC Thought Leadership. https://thoughtleadership.rbc.com/wp-content/uploads/Farmer4_aug2019.pdf
- Statistics Canada. (2011). Catalogue no. 11-402-X. Canada Year Book 2011.
- Statistics Canada. (2020). The Daily. Environmental and Clean Technology Products Economic Account: Human Resource Module, 2020 https://www150.statcan.gc.ca/n1/daily-quotidien/220428/dq220428f-eng.htm
- Statistics Canada. (2021). *Employment characteristics for the oil and gas sector*. Natural Resource Satellite Account. https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2021063-eng.htm
- Statistics Canada. (2022a). Fewer babies born as Canada's fertility rate hits a record low in 2020. https://www.statcan.gc.ca/o1/en/plus/960-fewer-babies-born-canadas-fertility-rate-hits-record-low-2020

- Statistics Canada. (2022b). In the midst of high job vacancies and historically low unemployment, Canada faces record retirements from an aging labour force: Number of seniors aged 65 and older grows six times faster than children 0-14. https://www150.statcan.gc.ca/n1/daily-quotidien/220427/dq220427a-eng.htm
- Statistics Canada. (2022c). Table 14-10-0326-01 *Job vacancies, payroll employees, job vacancy rate, and average offered hourly wage by industry sector, quarterly, unadjusted for seasonality.* https://doi.org/10.25318/1410032601-eng
- Statistics Canada. (2022d). *Job vacancies, second quarter 2022*. The Daily. https://www150.statcan.gc.ca/n1/daily-quotidien/220920/dq220920b-eng.htm
- Statistics Canada. (2022e). *Industry groups by class of worker including job permanency, labour force status, age and gender.* https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=9810044801
- Statistics Canada. (2022f). *Immigration as a source of labour supply.* https://www150.statcan.gc.ca/n1/daily-quotidien/220622/dq220622c-eng.htm
- Statistics Canada. (2022g). *Immigrants make up the largest share of the population in over 150 years and continue to shape who we are as Canadians.* https://www150.statcan.gc.ca/n1/daily-quotidien/221026/dq221026a-eng.htm
- Statistics Canada. (2022h). *Pay gap, 1998 to 2021*. https://www150.statcan.gc.ca/n1/pub/14-28-0001/2020001/article/00003-eng.htm
- Statistics Canada. (2023). *Labour force characteristics by immigrant status, annual.* https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=1410008301
- Statistics Canada. (2023b). *Employment by Indigenous group and industry.* https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410036601
- Statistics Canada. (2023c). *Table 98-10-0448-01 Industry groups by class of worker including job permanency, labour force status, age and gender: Canada, provinces and territories, census metropolitan areas and census agglomerations with parts.* https://doi.org/10.25318/9810044801-eng
- Stephenson, A. (2022). *'It is your new normal': Canada's aging workforce root of national labour shortage*. CBC News. https://www.cbc.ca/news/canada/calgary/alberta-labour-shortage-retirement-wave-1.6682096
- Transport Canada. 2019. *Overview of Canada's transportation sector.* Retrieved March 7, 2023, from https://tc.canada.ca/en/corporate-services/transparency/briefing-documents-transport-canada/20191120/overview-canada-s-transportation-sector
- Tompa, E., Samosh, D., and Boucher, N. (2020). *Skills Gaps, Underemployment, and Equity of Labour-Market Opportunities for Persons with Disabilities in Canada.* https://ppforum.ca/wp-content/uploads/2020/01/SkillsGap-Disabilities-PPF-JAN2020-Feb6.pdf
- Tilo, D. (2021, October 21). *Ontario seeks to reduce 'barriers' for job-seeking immigrants.* Human Resoures Director Canada. https://www.hcamag.com/ca/specialization/employment-law/ontario-seeks-to-reduce-barriers-for-job-seeking-immigrants/313965
- Technical Safety BC (TSBC). (n.d.). *Home* [web page]. Technical Safety BC. https://www.technicalsafetybc.ca/
- Unifor. (2022). *Unifor's submission to labour shortages in the Canadian transportation sector.* https://www.unifor.org/resources/our-resources/unifors-submission-labour-shortages-canadian-transportation-sector
- Vargas-Silva, C. (2020). *The Labour Market Effects of Immigration.* Migration Observatory. https://migrationobservatory.ox.ac.uk/resources/briefings/the-labour-market-effects-of-immigration/
- Floyd, J. (n.d.) *Wage Rates and the Supply and Demand for Labour*. University of Toronto. https://economics.utoronto.ca/jfloyd/modules/sadl.html
- WorkBC. (2017). *BC Value-added Wood Products: Sector Engagement Report.* https://www.workbc.ca/sites/default/files/Manufacturing-BC-Value-Added-Wood-Products-Sector-Engagement-Report-July-2017.pdf
- Whalen, N. (2019). *Improving Settlement Services Across Canada: Report of the Standing Committee on Citizenship and Immigration*. Senate of Canada. https://www.ourcommons.ca/Content/Committee/421/CIMM/Reports/RP10577155/cimmrp26/cimmrp26-e.pdf
- Wilson, A. (2021). *Canadian Cleantech in Action: Agriculture*. ECO Canada. https://eco.ca/blog/canadian-cleantech-in-action-agriculture/
- White, Y., Bradley, T., Packer, B., & Jones, E. (2022). *Skills for a net-zero economy: Insights from employers and young people*. https://www.worldskillsuk.org/wp-content/uploads/2022/06/GreenSkillsReport-2022_v3b.pdf
- Zahid, S. (2021). *Immigration in the Time of COVID-19: Issues and Challenges: Report of the Standing Committee on Citizenship and Immigration*. https://www.ourcommons.ca/Content/Committee/432/CIMM/Reports/RP11312743/cimmrp05/cimmrp05-e.pdf

Endnotes

1 The number of jobs will be heavily influenced by changes in economic growth, trade patterns, and the risk of future supply chain disruptions.

2 Agriculture and Agri-food Canada, 2021; Canadian Agricultural Human Resource Council, The Canadian Federation of Agriculture, & Food and Beverage Canada, 2022; Wilson, A. 2021.

3 Government of Canada 2021.

4 Newswire, 2022.

5 Misra, T., 2019.

6 Atiq, Coutinho, Islam and McNally, 2022.

7 Atiq, Dholakia, McNally and Renzetti, 2022.

8 Environment and Climate Change Canada, 2022.

9 In the coming months, PLACE will release reports detailing current and future skills needs for clean growth opportunities across Canada.

10 Government of Canada, July 2022.

11 Business Development Bank of Canada, 2021.

12 Franzino et al, 2021.

13 Amery, 2018.

14 Statistics Canada, 2022.

15 Statistics Canada, 2022b.

16 Government of Canada, 2023.

17 Bokat-Lindell, 2022.

18 Statistics Canada, 2011.

19 Ibid.

20 Moffatt, M. 2021 (May).

21 House of Commons Standing Committee on Natural Resources, 2017.

22 Melnitzer, J. 2023.

23 Bickis, I. 2017.

24 Atiq, Dholakia et al., 2022.

25 Statistics Canada, 2022g.

26 Ibid.

27 Statistics Canada, 2022f.

28 Hou, F., Lu, Y., and Schimmele, C. 2019.

29 Statistics Canada, 2022e.

30 Ibid.

31 Anderson, T. 2019.

32 Ibid.

33 Statistics Canada, 2023b.

34 Ibid.

35 Morris, S., Fawcett, G., Brisebois, and L., Hughesm, J. 2017.

36 Ibid.

37 Tompa, E., Samosh, D., and Boucher, N. 2020.

38 Ibid.

39 Atiq, Coutinho et al., 2022.

40 Canadian Agricultural Human Resource Council, The Canadian Federation of Agriculture, & Food and Beverage Canada, 2022.

41 Wilson, A. 2021.

42 Canadian Agricultural Human Resource Council, 2010.

43 Agdaily. (2021).

44 Stackhouse, J. 2019.

45 Ibid.

46 Wilson, A., 2021.

47 Agdaily, 2021.

48 Atiq, Coutinho et al., 2022.

49 Ibid.

50 Canada Green Building Council, 2020.

51 Ibid; Canada Green Building Council (CaGBC) & Delphi Group, 2022.

52 Atiq, Coutinho et al, 2022; Canadian Industry Statistics – Construction of building, 236. 2019.

53 Canada Green Building Council, 2020.

54 CaGBC & Delphi Group, 2022.

55 Ibid.

56 Natural Resources Canada, 2022.

57 Education News Canada, 2022.

58 Natural Resources Canada, 2022.

59 Mayor, L. Lindner, L.F. Knöbl, C.F. Ramalho, A. Berruto, R. Sanna, F. Rossi, D. Tomao, C. Goodburn, B. Avila, C. et al., 2022.

60 Nighbor, D., 2019.

61 WorkBC, 2017.

62 Ibid.

63 Ibid.

64 Atiq, Coutinho et al., 2022.

65 Canadian Hydrogen and Fuel Cell Association, 2022.

66 Job Bank Canada, 2022b.

67 Job Bank Canada, 2022a.

68 Atiq, Coutinho et al., 2022.

69 Mining Industry Human Resources Council (MiHR). 2020.

70 Atiq, Coutinho et al., 2022.

71 B.C. Centre of Training Excellence in Mining. 2022.

72 Ibid.

73 Atiq, Coutinho et al., 2022.

74 Mining Industry Human Resources Council (MiHR), 2020.

75 Natural Resources Canada, 2019.

76 Mining Industry Human Resources Council (MiHR), 2021.

77 Mining Industry Human Resources Council (MiHR), 2021.

78 Cooper, J., 2021.

79 B.C. Centre of Training Excellence in Mining, 2022.

80 Mining Industry Human Resources Council (MiHR), 2020.

81 Atiq, Coutinho et al, 2022.

82 Petroleum Labour Market Information, 2018.

83 Electricity Human Resource Canada, 2022

84 Smith, C and Winstanley, S. 2022.

85 Ibid.

86 Electricity Human Resource Canada, 2022

87 Clean Resource Innovation Network, 2022.

88 Smith and Winstanley, 2022.

89 Clean Resource Innovation Network, 2022.

90 Smith and Winstanley, 2022.

91 Ibid.

92 Transport Canada, 2019.

93 Transport Canada, 2019.

94 Atiq, Coutinho et al., 2022.

95 Ibid.

96 Ibid, 2022.

97 Unifor, 2022.

98 Yasmin, W., Bradley, T., Packer, B. & Jones, E., 2022.

99 Ibid.

100 Atiq, Coutinho et al., 2022.

101 Yasmin et al., 2022.

102 EY, 2017.

103 Atiq, Coutinho et al., 2022.

104 Ibid.

105 Price Waterhouse Cooper (PWC), 2020.

106 Atiq, Coutinho et al., 2022.

107 PWC, 2020.

108 Atiq, Coutinho et al., 2022.

109 Ibid.

110 Business Development Bank of Canada, 2021.

111 Statistics Canada, 2022b.

112 Canadian Agricultural Human Resource Council, The Canadian Federation of Agriculture, & Food and Beverage Canada, 2022.

113 Canadian Manufacturers and Exporters (CME), 2022.

114 Job vacancy rate is the number of vacant positions expressed as a percentage of total labour demand.

115 Statistics Canada, 2022b.

116 Ouellet-Léveillé, B. & Milan, A., 2019.

117 Government of Canada, 2021.

118 Castelli, F., 2018.

119 De Smet, A., Dowling, B., Muguyar-Baldocchi, M., & Schaniger, B., 2021.

120 OECD, 2009; de Grip, A., Fouarge, D., & Sauermann, J., 2010.

121 OECD, 2021.

122 Mohino & Ureña, 2020.

123 Eliasson & Westerlund, 2021.

124 Carter, Morrish & Amoyaw, 2008; Drolet et al,. 2016; Gien & Law, 2009; Rainer & Siedler, 2009; Biase & Bauder, 2005.

125 Richardson, K., 2016.

126 Gien & Law, 2009.

127 The modal number of friends and family who follow them (OECD, 2009).

128 Ibid.

129 Hyndman, J., Schuurman, N., & Fiedler, R., 2006.

130 Ibid.

131 Statistics Canada, 2017.

132 Akbari, S., Lynch, S., Mcdonald, T., & Rankaduwa, W., 2007.

133 Hyndman et al, 2006.

134 Canadian International Development Platform, 2015.

135 Statistics Canada, 2022h.

136 Ibid.

137 Statistics Canada, 2022g.

138 Government of Canada, S.C (2021).

139 Statistics Canada 2022c.

140 Rendaje, M., 2022.

141 Beine, Noël & Ragot, 2014; Joint Research Centre (European Commission), 2018; Palmer & Pytliková, 2015.

142 Vargas-Silva, 2020.

143 Morissette, 2022.

144 Ibid.

145 Crossman, Hou & Picot, 2021.

146 Canadian Mortgage and Housing Corporation (CMHC), 2018.

147 Property type definitions were taken from the Canadian Real Estate Association (CREA, 2016).

148 Altstedter, A., 2022.

149 OECD, n.d.

150 Rentals.ca, 2022.

151 Canadian Real Estate Association (CREA), 2022.

152 Rental data for PEI was not available and therefore not considered.

153 Misra, T., 2019.

154 Statistics Canada, 2017.

155 Immigration, Refugees and Citizenship Canada, 2018.

156 Statistics Canada, 2022g.

157 Ibid, 2022h.

158 Ibid.

159 Ibid, Statista, n.d.

160 Statistics Canada, 2022a.

161 Bascaramurty, 2022.

162 Statistics Canada, 2022h.

163 Better Dwelling, 2022.

164 Ibid.

165 Immigration, Refugees and Citizenship Canada, 2015.

166 Under the Immigration and Refugee Protection Regulations (IRPR).

167 Immigration, Refugees and Citizenship Canada, 2022a.

168 Migrant Integration Policy Index, 2020.

169 Leighton, K., 2022.

170 Immigration, Refugees and Citizenship Canada, 2022b.

171 Zahid, S., 2021; House of Commons Canada, n.d.

172 Amirault, D., de Munnik, D., & Miller, S., 2013.

173 Bleakley, H., & Lin, J., 2012.

174 Statistics Canada, 2022e; Statistics Canada, 2022f.

175 Ottensmann, J.R., 2021.

176 Statistics Canada, 2022f.

177 Praznik, J and Shields, J. 2018.

178 Ibid.

179 Immigration, Refugee, and Citizenship Canada, 2021d.

180 Whalen, N., 2019.

181 Immigration, Refugee, and Citizenship Canada, 2021d.

182 Ibid.

183 Immigration, Refugee, and Citizenship Canada, 2021e.

184 Béchard, J., 2015.

185 Immigration, Refugee, and Citizenship Canada, 2021c.

186 Statistics Canada, 2023.

187 Ibid.

188 Morissette, R., 2017.

189 Pakula, B. & Smith Fowler, H., 2021.

190 Banerjee, R. & Phan, M., 2014.

191 Canadian Information Centre for International Credentials, 2022.

192 Mysicka, R., Cutler, L. & Zhang, T., 2020.

193 This excludes any Red Seal trades that are nationally accredited, and therefore do not require provincial transfers.

194 Canadian Information Centre for International Credentials, 2022.

195 The Association of Professional Engineers and Geoscientists of Alberta, 2023.

196 Engineering certification in Canada are regulated by the Professional Engineering associations of respective provinces.

197 Information Systems Analysts are regulated by Canada's Association of Information Technology (IT) Professionals (CIPS) in all Canadian provinces except Yukon, Nunavut and the Northwest Territories. Alberta, British Columbia, Newfoundland & Labrador, New Brunswick, Nova Scotia, Ontario and Saskatchewan all have laws legislating the Association as a regulator (CIPS, 2022.)

198 Government of Nunavut, 2022.

199 Figures collected through authors own research from figures available across provincial ministries' and regulators' websites.

200 Simone, G., 2015.

201 Government of Yukon, 2022.

202 Government of PEI, 2023.

203 George, U., & Chaze, F., 2012.

204 Caranci, B. & Fong, F., 2021.

205 Fang, T., Gunderson, M. & Lee, B., 2021.

206 Gresch, D., Thomson, J. & Sonmez, Z., 2022.

207 Government of Canada, 2023.

208 Sawyer, D., & Griffin, B., 2022.

209 Definition adapted from Canada Green Building Council, 2019, and Atiq, Coutinho et al., 2022.

210 Atiq, Coutinho et al., 2022.

211 McNally, J., 2023.

212 Food Processing Technology, n.d.

213 Edmonton Region Hydrogen HUB, n.d.

214 Government of Canada, 2021.

215 Statistics Canada, 2022h.

216 Powell, N., & Richardson, B., 2021.

217 Hou, Lu and Schimmele, 2019.

218 Sharma, K., 2022.

219 Statistics Canada, 2022h; Singer, 2021.

220 Indigenous Clean Energy, n.d.

221 Automotive Parts Manufacturer's Association, n.d.

222 Automotive Parts Manufacturer's Association, n.d.

223 Statistics Canada, 2023b; Statistics Canada, 2021.

224 Statistics Canada, 2022b.

225 Immigration, Refugees and Citizenship Canada, 2021c.

226 Moffatt, M., Dudu, A. & Hosseini, M., 2022; CMHC, 2021.

227 Moffatt, M., 2022.

228 Moffatt & Boessenkool, 2023.

229 Canadian Climate Institute, 2021; Clean Energy Canada, 2021; Navius Research Inc., 2021; Smart Prosperity Institute, 2022.

Smart Prosperity Institute

PLACE Centre
Smart Prosperity Institute

1 Stewart Street, 3rd Floor
Ottawa, ON K1N 6N5