2023

FROM CLASSROOM TO MINE SITE: A REVIEW OF CANADA'S POSTSECONDARY EDUCATION PIPELINE FOR THE MINING SECTOR

MINING INDUSTRY HUMAN RESOURCES COUNCIL

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HUMAN RESOURCES COUNCIL

For more information, contact:

Mining Industry Human Resources Council
50 Frank Nighbor Place, Unit 105
Kanata, Ontario K2V 1B9
(613) 270-9696
research@mihr.ca

Or visit the website at:

www.mihr.ca

Published October 2023

Canada

This project is funded in part by the Government of Canada.

The opinions and interpretations in this publication are those of the author and do not necessarily reflect those of the Government of Canada.

Thank you to Natural Resources Canada for initiating early discussions and supporting previous research that helped lead to this important study. MiHR is grateful for NRCan's ongoing collaboration and interest in its work. MiHR would also like to thank the Canadian Institute of Mining, Metallurgy and Petroleum's (CIM) Canadian Mining Schools Committee members who provided data and input into this research.

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INTRODUCTION

Over the years, mining has grown increasingly reliant on workers with specialized skills. As the industry has matured and become more technologically advanced, the need for workers with postsecondary education (PSE) has only become more important.

Canada's mining industry is entering a new era of growth following the COVID-19 pandemic. Since 2020, prices of metals and minerals have increased by over 50%, followed by a pronounced rise in capital expenditures and mineral exploration spending. At the same time, acute growth in mining sector employment has resulted in labour shortages for key occupations.

As the world begins to shift to low-carbon technology and infrastructure, demand for critical minerals is expected to increase substantially in the coming decades. To support this expansion and avoid ongoing labour shortages, Canada's mining sector will need a robust pipeline of qualified and skilled workers. Thus, a well-functioning PSE system is vital for the sustainable growth of the industry.

THE FOCUS OF THIS REPORT

It is essential to understand the strengths and weaknesses of the mining talent pipeline. This study seeks to explore the intricate relationship between Canada's mining industry and the PSE sector by utilizing publicly available data as well as the Mining Industry Human Resources Council's (MiHR) own primary research.

This report is organized into five chapters, each focussing on a crucial aspect of the mining industry and its relationship with PSE institutions.

1. Mining's Upward Trajectory
2. Overview of Canada's PSE System
3. Key Challenges for Mining-Centric Programs
4. Barriers to Participation in the Mining Workforce
5. Key Findings and Potential Solutions

METHODOLOGY

MiHR has produced quantitative analysis leveraging publicly accessible data to examine trends in enrolments and the supply and demand of mining occupations. Additionally, surveys and interviews were conducted with individuals actively engaged in the PSE-mining partnership to gather insights from firsthand experiences.

Key Research Questions

The motivation behind this report is to investigate the following research questions:

- What roles does the mining sector need to grow sustainably?
- What are the 'mining-centric' PSE programs that support the industry?
- Can the pipeline of labour sustain mining demand for these roles?
- How will the transition to a clean economy affect this demand?
- Are there points of attrition in the pipeline?
- Are there opportunities to strengthen the pipeline?

Quantitative Analysis

MiHR's quantitative analysis utilizes data from the following sources:

- Statistics Canada Census
- Statistics Canada Labour Force Survey (LFS)
- Statistics Canada Job Vacancy and Wage Survey (JVWS)
- Statistics Canada Postsecondary Student Information System (PSIS)
- Enrolment and Graduation data from Engineers Canada
- Membership data from Colleges and Institutes Canada (CICan)
- Survey of Canadian Mining Engineering Schools from the Canadian Mining Schools Committee
- Mine Location data from Natural Resources Canada (NRCan)

The statistical information presented in this report relies on occupation-level data and industry-level data gathered and aggregated through Statistics Canada. Throughout the analysis, the data are aligned with the North American Industry Classification System (NAICS) to define the mining industry in Canada, and with the National Occupational Classification (NOC) system to define the relevant occupations of interest.

Primary Research

In addition to quantitative data analysis, MiHR undertook primary qualitative research to explore various aspects of the labour supply pipeline as it relates to postsecondary programs. This included examining industry relationships, enrolment targets, supports for students and the transition to the workplace.

Data inputs were collected from several institutions and key stakeholders in the PSE sector. MiHR conducted eleven in-depth interviews with program administrators and educators from mining or mining-related PSE programs to gather valuable insights into the curriculum, industry collaboration, and emerging trends within the PSE sector. Additionally, nine students enrolled in relevant programs were interviewed to gather personal experiences and perspectives. Insights from these interviews are shared throughout this report where appropriate.

CHAPTER ONE:

MINING'S UPWARD TRAJECTORY

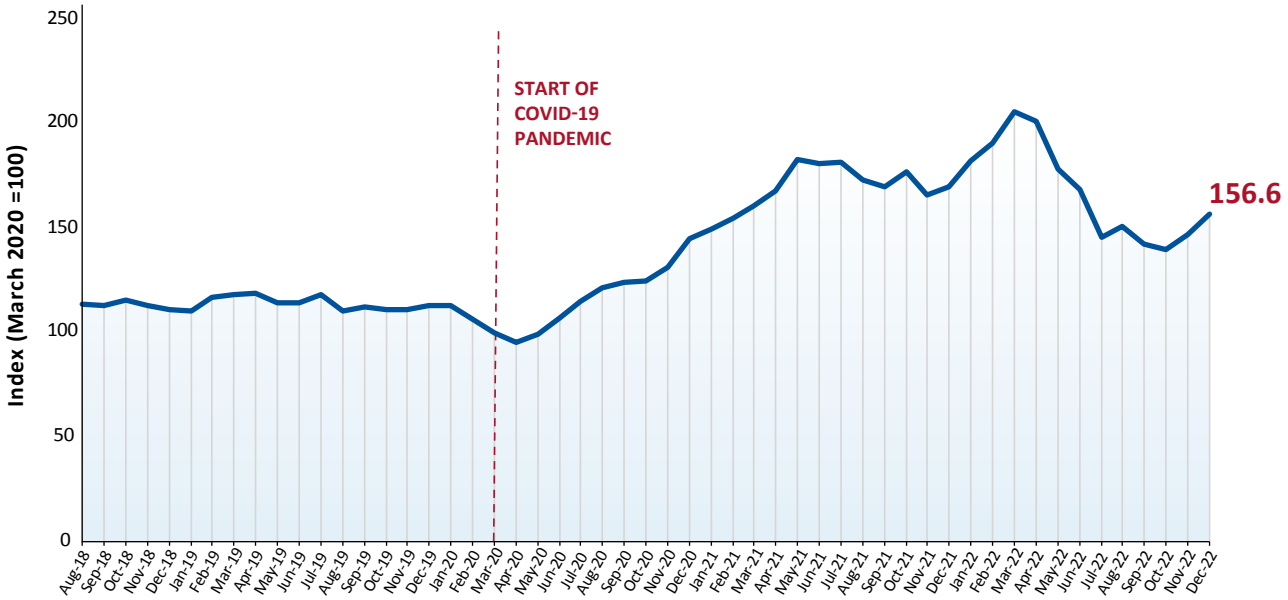
1.1 RECENT INDUSTRY EXPANSION

A variety of factors have led to a significant restructuring of the global economy since 2020, including the COVID-19 pandemic, major supply chain disruptions, the Russia-Ukraine war and widespread inflation. These developments have had a profound impact on mining, with metal and mineral prices increasing substantially during this period. At their peak in early 2022, prices had more than doubled from March 2020 levels, and by the end of 2022 they remained 57% higher (Figure 1).

This combination of events has fueled a hiring boom in the mining industry. Over the course of 2022, employment levels in *Mining and quarrying (NAICS 212)* soared by nearly 50% (Figure 2). Consequently, Canada's mining sector is now grappling with labour shortages and a challenging environment for growth[1].

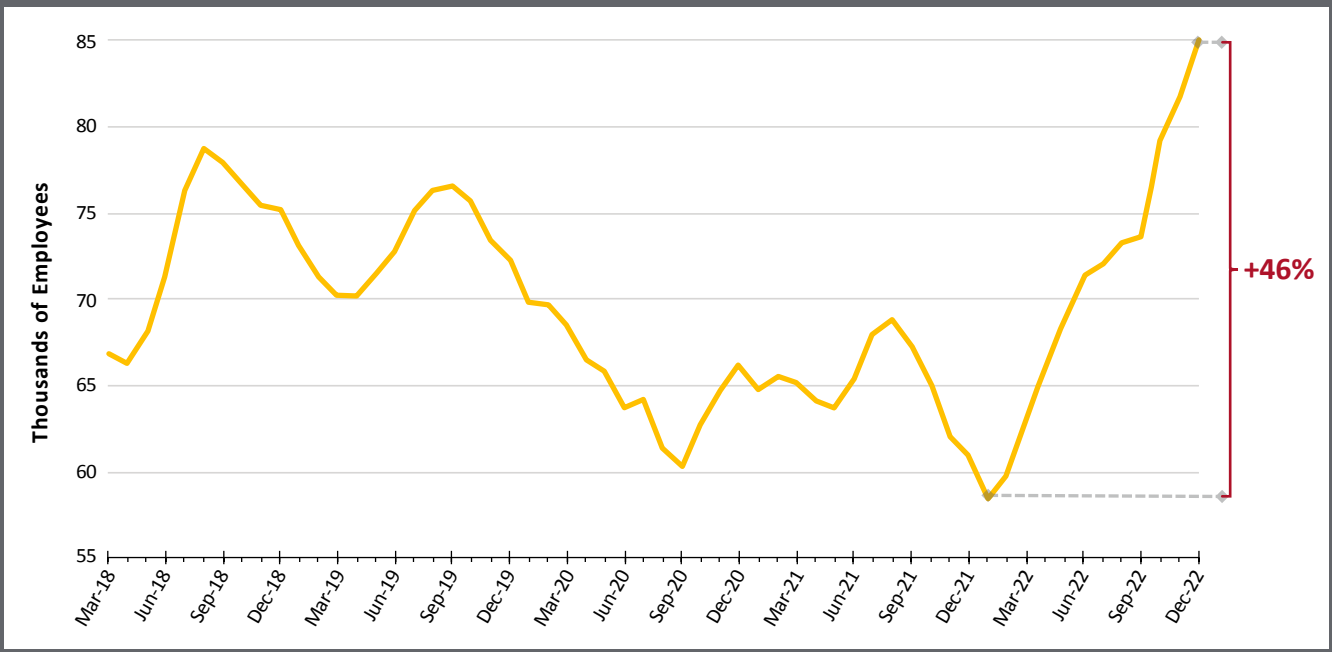
1 MiHR closely monitors a set of six indicators to evaluate labour market tightness, with four of these indicators indicating heightened levels of tightness and labour shortages. Please see MiHR's *2023 Canadian Mining Outlook* report for a detailed explanation.

FIGURE 1: METALS AND MINERALS PRICE INDEX (2018 – 2022)



Source: Mining Industry Human Resources Council, 2023; World Bank, Metals & Minerals Price Index (accessed via Ycharts), 2023

FIGURE 2: EMPLOYMENT (3-MONTH MOVING AVERAGE), MINING & QUARRYING (NAICS 212) (2018 – 2022)



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Labour Force Survey (Custom Data).

1.2 LONG-TERM PROSPECTS FOR THE MINING INDUSTRY

Ongoing labour market issues are expected to endure and potentially intensify for two principal reasons: a growing demand for minerals and an aging workforce.

Higher Demand for Minerals

The shift to a greener, low-carbon global economy promises to drastically increase demand for critical minerals over the coming decades. At the same time, middle class populations will continue to expand in many countries[2] and add to existing mineral requirements.

The Clean Energy Transition

Across the globe, governments and the private sector have embraced the goal of reducing carbon emissions and transforming our economy into a more environmentally sustainable one. Nations have formed multilateral agreements to promote mutual accountability and to confront the detrimental effects of human activities on the environment. This will require mining to play a pivotal role in facilitating low-carbon technologies and infrastructure. To this end, the Canadian government has introduced the Canadian Minerals and Metals Plan (CMMP), an initiative that aims to enhance the competitiveness and sustainability of Canada's mining sector and to position it as a global leader in sustainable and responsible mining practices.

The International Energy Agency (IEA) estimates that by 2040 global mineral requirements will double under currently stated policies (Figure 3), and they would need to quadruple in order for the world to meet the carbon reduction objectives outlined in the 2015 Paris Agreement[3]. Figure 4 illustrates the wide array of minerals necessary to diversify the energy supply as the global community moves towards cleaner and more sustainable energy solutions.

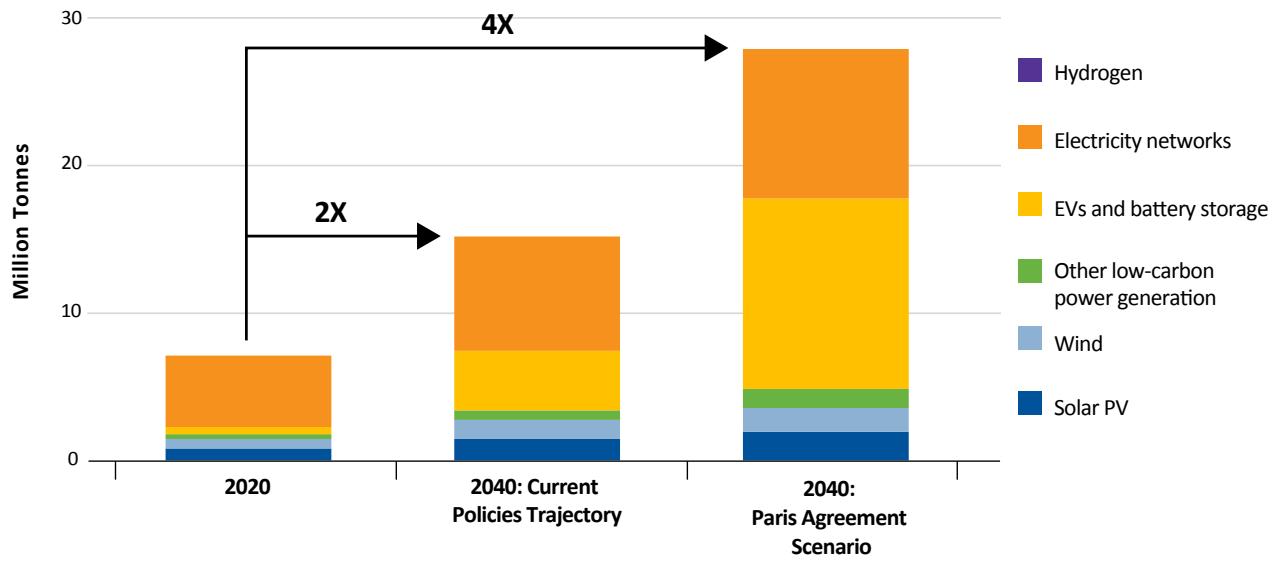
Canada's mining industry is well-positioned to capitalize on the growth opportunities presented by these environmental objectives, given its comparatively strong compliance with emissions regulations, water usage regulations and ESG scores[4]. This favourable position enhances Canada's ability to attract ESG-aligned investments, foster industry expansion and yield positive outcomes for Canadian workers and communities.

2 Fengler, W., Kharas, H., & Caballero, J. *Asia's tipping point in the consumer class*. Brookings, 2022. https://www.brookings.edu/blog/future-development/2022/06/02/asias-tipping-point-in-the-consumer-class/

3 The 2015 Paris Agreement, adopted by 193 countries and the European Union, is an international treaty aimed at combating climate change and limiting global warming to well below 2 degrees Celsius above pre-industrial levels. It sets out various goals and provisions to achieve this objective, including targets for reducing greenhouse gas emissions, promoting sustainable development, and mobilizing financial resources for climate action.

4 ESG scores assess a company's performance in environmental, social, and governance (ESG) factors. They are used by investors, stakeholders and rating agencies to evaluate a company's commitment to sustainability, responsible business practices and risk management.

FIGURE 3: DEMAND SCENARIOS FOR CRITICAL MINERALS (INTERNATIONAL ENERGY AGENCY STUDY)



Source: International Energy Agency (IEA), The Role of Critical Minerals in Clean Energy Transitions, World Energy Outlook Special Report (2022).

FIGURE 4: MINERALS USED IN LOW-CARBON TECHNOLOGIES (2020)

	Hydro	Nuclear	Gas	Wind	Geo-thermal	SP	CSP	Energy Storage
Aluminum		■	■	■		■		■
Chromium	■	■	■	■	■			■
Cobalt			■					■
Copper	■	■	■	■	■	■	■	■
Graphite								■
Indium		■				■		
Iron				■				■
Lead	■	■		■		■		■
Lithium								■
Manganese	■		■	■	■			■
Molybdenum	■	■	■	■	■	■		
Neodymium				■				
Nickel	■	■	■	■	■	■		■
Silver		■				■	■	
Titanium	■	■	■		■			
Vanadium		■						■
Zinc	■	■		■		■		■

Source: World Bank, Climate-smart Mining: Minerals for Climate Action Report, 2020; Mining Industry Human Resources Council, 2023.

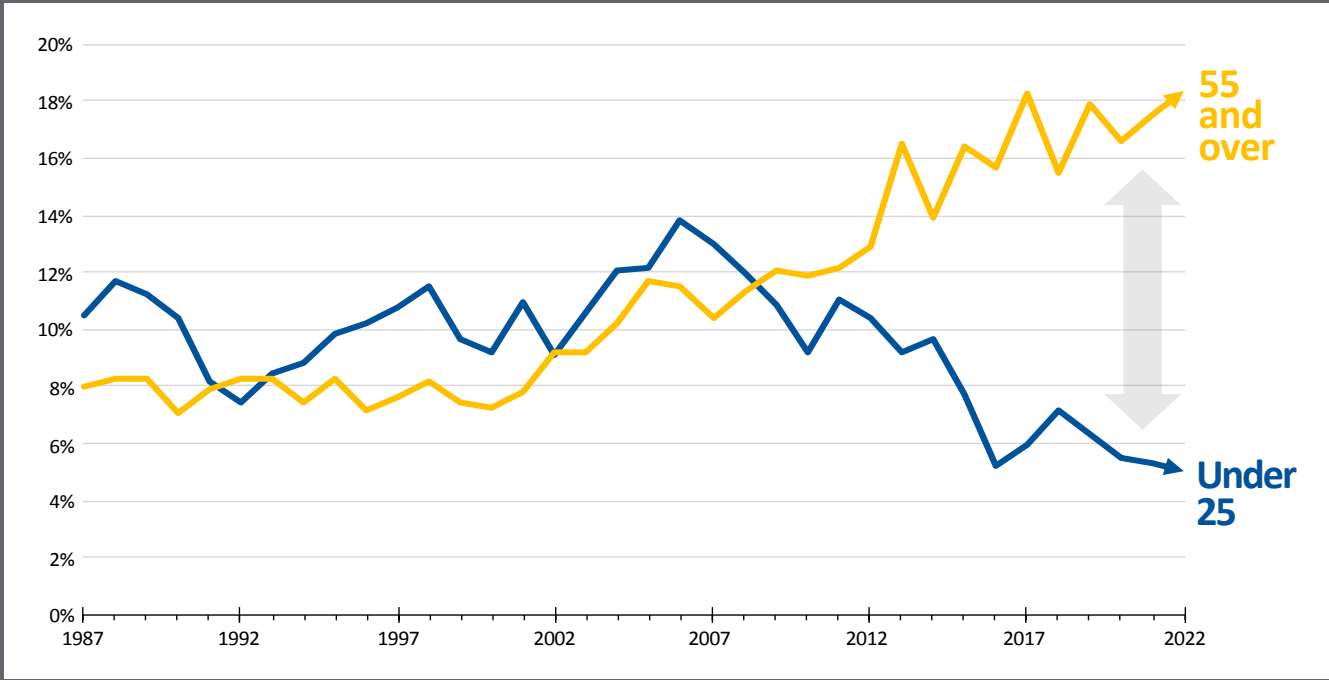
The Retiring Workforce

Canada will need to continually expand its mining workforce and ensure it is sufficiently robust to meet the growing demand for metals and minerals. However, like many other industries in Canada, mining faces the prospect of a labour supply crunch, which threatens to derail the clean energy transition.

A large contingent of Canada's mining workforce is approaching retirement, underscoring the urgent need for younger individuals to enter mining-related fields of study. Over the last few decades, the mining industry has seen a steady rise in the proportion of older workers within its ranks. In 2022, roughly one in every five mining workers was over the age of 55 (Figure 5).

Offsetting the loss of these experienced workers, who possess decades of mining expertise, will be a difficult task, and it will require the mining industry and the PSE system in Canada to develop an effective strategy to replenish the talent pool.

***FIGURE 5:** SHARE OF WORKFORCE BY AGE CATEGORY, MINING, QUARRYING AND OIL AND GAS EXTRACTION (NAICS 21) (1987– 2022)*



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Labour Force Survey (Table 14-10-0023-01).

CHAPTER TWO:

OVERVIEW OF CANADA'S PSE SYSTEM

2.1 ENROLMENT AND GRADUATION TRENDS

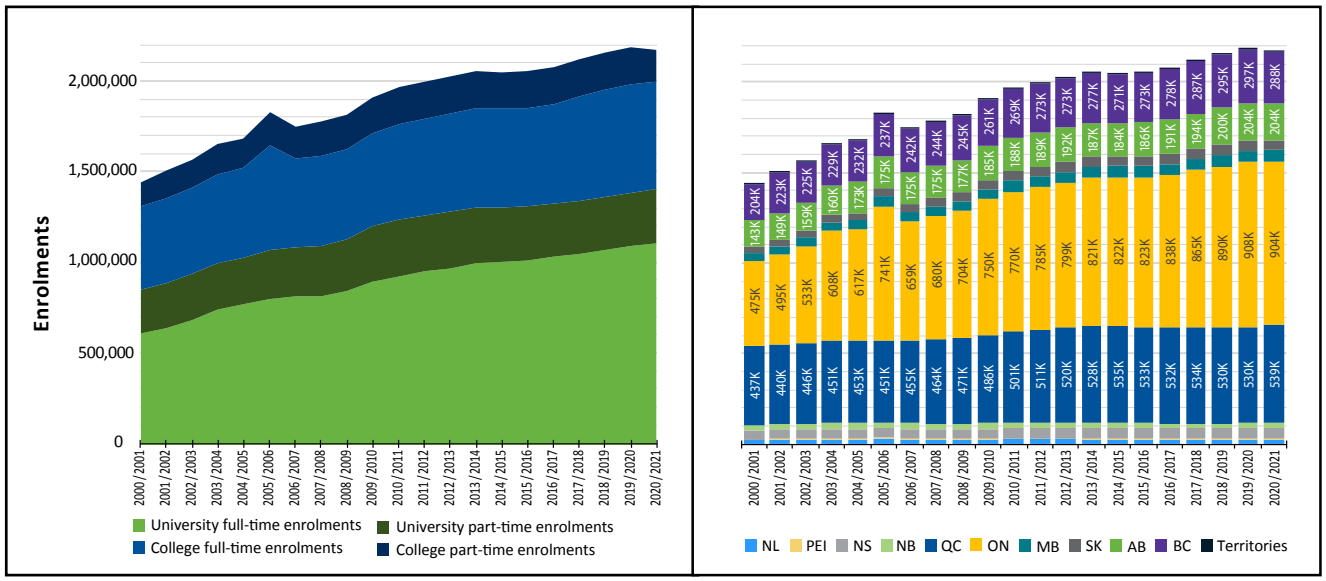
Historically, postsecondary education was reserved for only a small segment of the population. Yet in recent decades, it has progressively become more accessible to a wider array of people. As of 2021, roughly two thirds of Canada's labour force had acquired a postsecondary certificate, diploma or degree, highlighting how mainstream postsecondary education has become. Among Organization for Economic Cooperation and Development (OECD) countries, Canada ranks second in its share of 25–34-year-olds with tertiary education, with 66.4%[5].

Overall, there has been a steady increase in enrolments within the PSE system. During the 2020/2021 academic year, the total number of students enrolled in Canada's PSE system amounted to 2,171,712 across 244 institutions. This represents a rise of 51% from 2000/2001 levels, an additional 731,544 enrolled students (Figure 6).

Most of the upsurge in the number of students has been concentrated in universities. College enrolments have increased by 30% (176,103 students) relative to 2000/2001 levels, whereas university enrolments have grown by 65% (555,441 students). Regionally, Ontario has driven much of this expansion, as the province now accounts for 42% of all enrolments in Canada, up from 33%.

5 *Population with tertiary education (indicator)*. Organization for Economic Cooperation and Development, 2023. doi: 10.1787/0b8f90e9-en

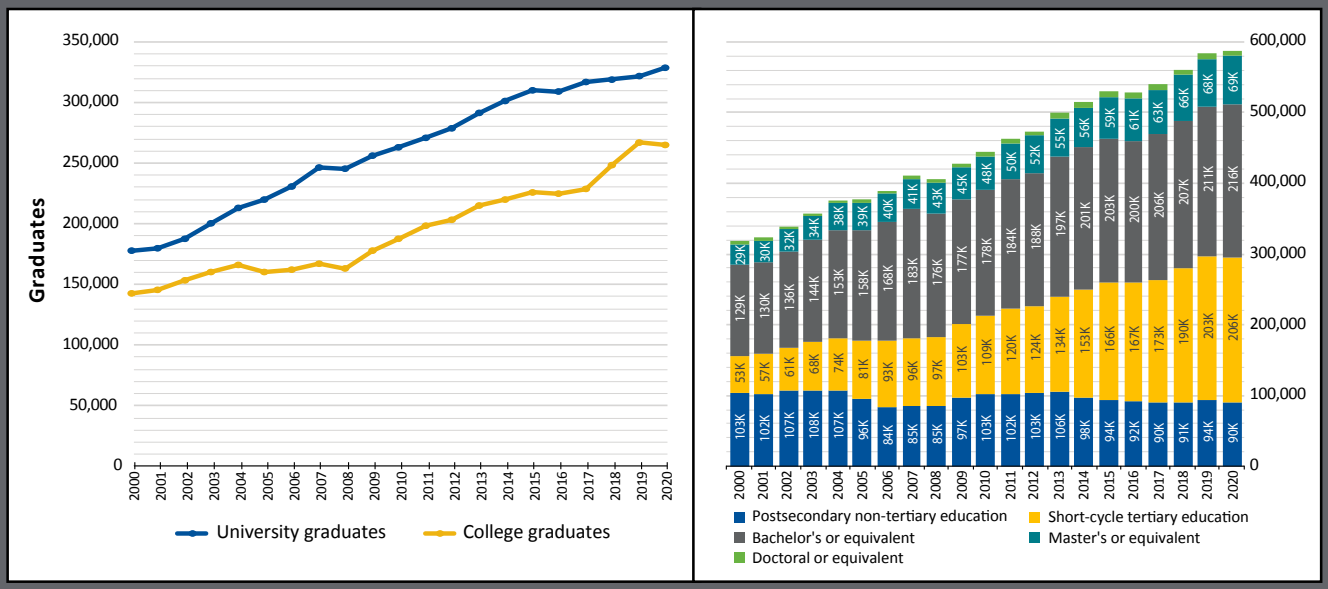
FIGURE 6: TOTAL POSTSECONDARY ENROLMENTS, BY REGION AND INSTITUTION TYPE (2000 – 2021)



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0011-01).

Following a similar trajectory as enrolments, the number of graduates rose substantially between 2000 and 2020, with university graduates growing by 150,435 (85%) and college graduates by 122,064 (86%) (Figure 7). By contrast, the labour force experienced a modest 31% increase over the same timeframe, pointing to the growing prevalence of postsecondary credentials in Canada's labour market.

FIGURE 7: TOTAL POSTSECONDARY GRADUATES, BY INSTITUTION TYPE AND INTERNATIONAL STANDARD CLASSIFICATION OF EDUCATION (ISCED[6]) (2000 – 2020)

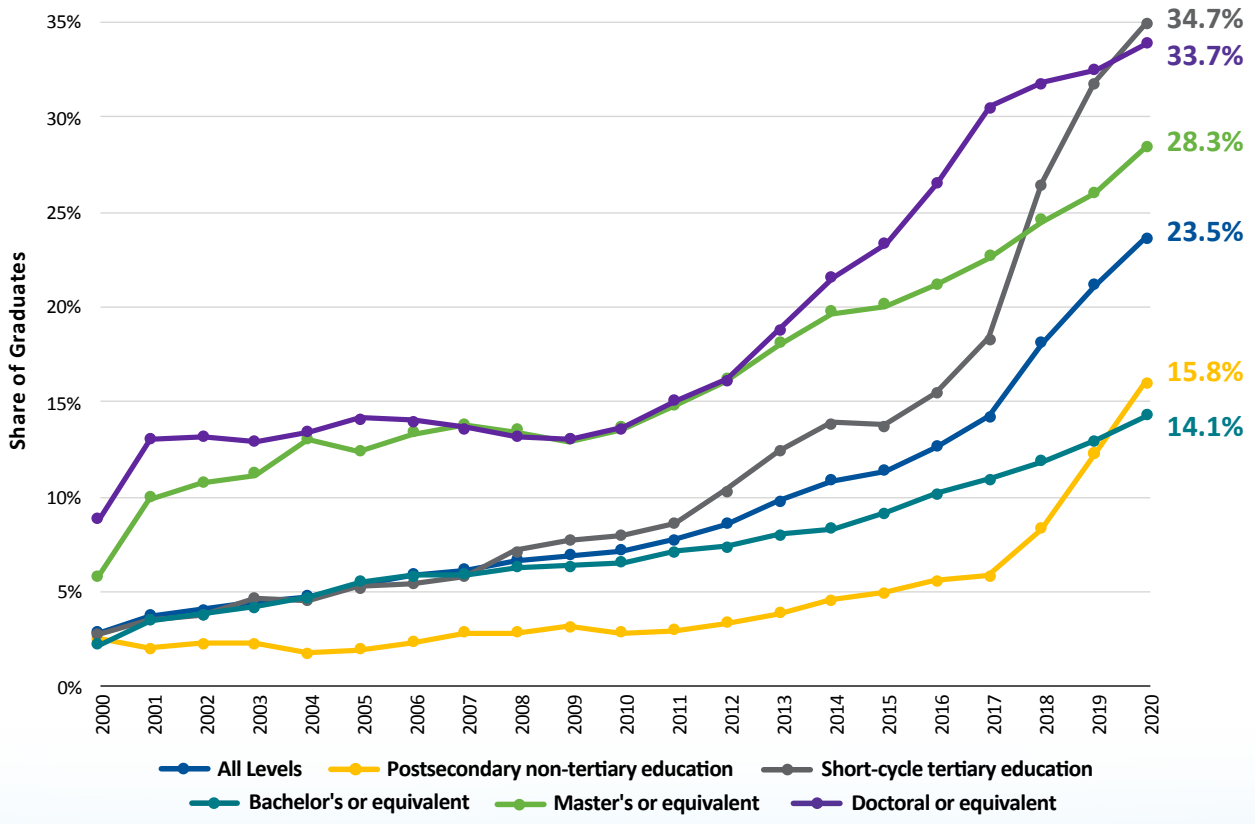


Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0011-01).

6 See the UNESCO Institute for Statistics ISCED-2011 classification: https://www150.statcan.gc.ca/n1/pub/81-604-x/2020001/notes-eng.htm

One significant development within the expansion of the PSE system is the increasing presence of international students. As of 2020, international students accounted for 25% of postsecondary graduates, up from only 3% in the year 2000. (Figure 8). At the master's and PhD levels, international enrolments represented roughly one third of the student population. This dramatic growth highlights the potential for Canada's labour market to leverage this talent pool and mitigate anticipated skills shortages.

***FIGURE 8:* SHARE OF POSTSECONDARY GRADUATES WHO ARE INTERNATIONAL STUDENTS, BY ISCED LEVEL (2000 – 2020)**



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0011-01).

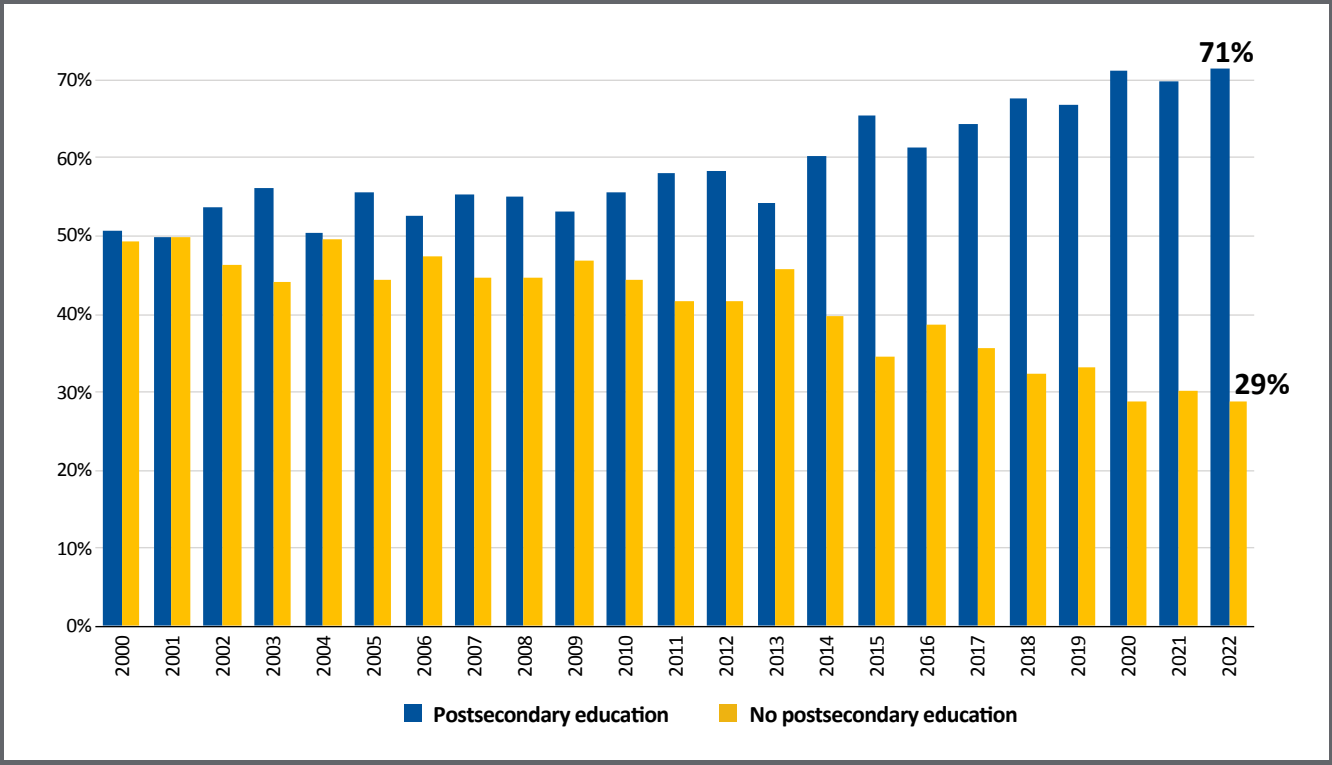
2.2 HOW DOES PSE IMPACT THE MINING INDUSTRY?

The PSE system plays a crucial role in the long-term growth and sustainability of the mining sector, given that it is responsible for ensuring a steady stream of highly skilled entrants into the workforce.

Over the years, the mining sector has increasingly relied on skilled labour with PSE credentials. In *Mining and quarrying* (NAICS 212) the percentage of workers with a postsecondary education certificate or diploma (including university, college, and trades) has steadily increased as the demand for workers without PSE has declined (Figure 9).

As of 2022, workers with trades certificates constituted roughly half of the *Mining and quarrying* workforce, marking a 9% increase since 2000. Likewise, the proportion of workers with university degrees rose from 11% to 22%. Conversely, the percentage of workers without a high school diploma decreased from 23% to 8%. These trends are set to continue as the industry's demand for PSE training is fueled by ongoing advancements in mineral extraction methods.

***FIGURE 9:** EDUCATIONAL BREAKDOWN OF THE LABOUR FORCE, MINING AND QUARRYING (NAICS 212) (2000 – 2022)*



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Labour Force Survey (Custom Data).

2.3 RESOURCES AND SUPPORT FOR MINING PROGRAMS IN CANADA'S PSE SYSTEM

The role of the PSE system extends beyond higher enrolments and degree attainment; it also offers a range of support mechanisms to benefit the mining sector. Recognizing that the journey to the mining workplace is not a straightforward path, colleges and universities devote dedicated resources and supports to help students in mining-related programs. These initiatives are designed to provide guidance, helping students navigate challenges and actively embrace opportunities within the mining industry.

Career Services and Supports

PSE institutions provide an assortment of career services to support students in various programs. These services include interview preparation, assistance with resumé and cover letter writing, subject-specific learning support, guidance on financial aid applications (such as scholarships), and preparation for co-op education opportunities.

Interestingly, in interviews conducted by MiHR, students in mining-related programs generally indicated that they had accessed at least one mining-related support or career service at their institution, though this was largely through faculty support rather than through formal career services. Several students mentioned that they had informally received one-on-one mining-related assistance from their program's instructors.

Students commented on the high level of care and attention that they received from their instructors to prepare them for a career in the mining industry, which was facilitated by comparatively lower enrolment rates in mining programs compared to other disciplines.

This closer relationship between students and instructors was also mentioned by students as a positive factor in terms of program engagement, and it contributed to their continued enrolment in the mining program.

Opportunities Offered Within Mining Programs

In conversations with program administrators and educators, the focus was on fostering students' active involvement in the mining industry through effective teaching methods, which include experiential learning, research initiatives and community-oriented objectives.

Educators highlighted the following approaches to enhance students' learning experience:

- Immersive field trips and tours to mining sites to provide students with firsthand exposure to day-to-day mining operations.
- Guest lectures by industry professionals to share personal experiences of working in the mining sector and give students practical advice for getting started in the industry.
- Research partnerships with industry for students to apply their knowledge to real-world challenges in collaborative research, including capstone design projects.

Also, programs regularly offer students various opportunities to engage with the mining industry beyond their academic studies. These include:

- Speaking engagements and networking events where students have the chance to interact with industry representatives, as well as facilitate career exploration and networking for future opportunities.
- Enlisting the help of alumni to provide mentorship and guidance that will contribute to students' professional development and career preparation.

It is worth noting that some disciplines, such as engineering, expose students to the world of mining for the first time. When asked what attracted them to the mining-related program, one student shared:

> *"I was always interested in engineering in general. I took the general offering in first year, and in second year I chose geological engineering. I don't want to sit behind a desk all day, I want to be out in the field."*

Work-Integrated Learning

Work-integrated learning (WIL) is an educational model that integrates practical industry experience with academic coursework, in which students work with employers for a period as a complement to their regular studies. WIL includes co-op placements, internships and apprenticeships, and it offers benefits for both students and employers. Students learn industry-specific skills, form realistic career expectations and bridge the gap between classroom learning and real-world application while improving their professional readiness. For employers, the benefits include training and development of potential employees, streamlined recruitment and screening, and the ability to bring in talent for short term needs[7].

Among mining-centric programs studied by MiHR, some institutions offer co-op placements within the curriculum, either as an optional component or as an extension to the standard-length program. However, in most cases mining students interested in co-op placements are required to independently search for and apply to external opportunities.

In interviews, students generally indicated that participating in a co-op placement was not a mandatory component of their mining education. Those who did participate reported that the experience gave them practical knowledge and valuable skills that complemented their academic studies, and for many, it positively influenced their decision to pursue a career in the mining industry after graduation.

The importance of WIL is recognized across various sectors and fields of study. According to the 2018 National Graduates Survey, 50% of all postsecondary graduates had participated in some form of WIL[8] (Table 1). In general, college graduates are more likely to take part in WIL than university graduates. It is worth mentioning that the majority (81%) of those who participated in WIL did so as a mandatory requirement of their program.

7 Wyonch, R. *Work-Ready Graduates: The Role of Co-op Programs in Labour Market Success*. C.D. Howe Institute. https://www.cdhowe.org/sites/default/files/attachments/research_papers/mixed/Commentary_590_0.pdf

8 Although apprenticeships are typically also considered WIL, they are excluded from the NGS since graduates of apprenticeship programs are excluded from the survey's target population.

TABLE 1: WORK-INTEGRATED LEARNING (WIL) PARTICIPATION OF POSTSECONDARY GRADUATES (CLASS OF 2015), BY FIELD OF STUDY

Field of Study	All levels of study	College	Bachelor's	Professional	Master's	Doctorate
Education	70%	82%	92%	N/A	24%	9%
Visual and performing arts, and communications technologies	39%	53%	30%	N/A	24%	15%
Humanities	23%	38%	19%	N/A	32%	10%
Social and behavioural sciences and law	46%	82%	28%	30%	42%	41%
Business, management and public administration	38%	50%	30%	N/A	34%	8%
Physical and life sciences and technologies	26%	53%	28%	N/A	19%	11%
Mathematics, computer and information sciences	45%	52%	47%	N/A	32%	18%
Architecture, engineering, and related technologies	45%	42%	65%	N/A	19%	14%
Agriculture, natural resources and conservation	43%	46%	41%	N/A	41%	14%
Health and related fields	84%	88%	83%	92%	74%	18%
Personal, protective and transportation services	51%	52%	47%	N/A	28%	N/A
Other instructional programs	13%	N/A	x	N/A	x	43%
All fields of study	**50%**	**61%**	**48%**	**61%**	**36%**	**19%**

Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0186-01).

x = suppressed to meet the confidentiality requirements of the Statistics Act

The target population for the 2018 National Graduates Survey (NGS) (class of 2015) corresponds to graduates of public postsecondary educational institutions in Canada during the 2015 calendar year who were living in Canada at the time of the interview

CHAPTER THREE:

KEY CHALLENGES FOR MINING-CENTRIC PROGRAMS

Despite broadly positive enrolment trends, significant challenges persist, particularly in mining-focussed programs. While PSE credentials continue to become more prevalent among the overall mining workforce, certain critical roles in the industry are facing dwindling enrolments. This raises legitimate concerns about the PSE system's capacity to meet the labour requirements of a mining sector poised for expansion.

This chapter delves into the significant obstacles that hinder many of the mining-centric PSE programs:

1. Mining programs are small.
2. Mining programs are shrinking.
3. Mining programs are unresponsive to labour demand.
4. Mining programs are geographically concentrated.
5. Mining programs are threatened by capacity issues.
6. Mining programs are struggling with diversity.

Critical Occupations in Focus

The mining industry relies on several highly specialized occupations, which are necessary for its growth and expansion. This chapter will focus on three occupations that play a vital role in mining operations. While there are many other pivotal and industry-specific job positions, the following three have been selected as case studies:

- *Mining engineers*
- *Geologists*
- *Mining technicians*

These fields include professionals as well as technicians, offering a representative view of both university and college mining-centric programs. Importantly, these occupations hold a strong presence in the industry, collectively representing approximately 1 of every 17 workers in Mining and quarrying (NAICS 212). Moreover, they are distinctly mining-focussed, with a considerable proportion exclusively employed within the sector (Table 2).

TABLE 2: CRITICAL OCCUPATIONS IN MINING AND THEIR CORRESPONDING FIELDS OF STUDY

Occupation	PSIS Field of Study	NOC Title	NOC Code	NAICS 212 Prevalence	NAICS 212 Specificity*
Mining Engineers	*Mining and Mineral Engineering*	*Mining engineers*	21330	44% of Professional occupations in engineering	42.2% in *Mining and quarrying*
Mining Technicians	*Mining and petroleum technologies/technicians*	*Geological and mineral technologists and technicians*	22101	44% of Technical occupations in natural and applied sciences	24.2% in *Mining and quarrying*
Geologists and Geoscientists	*Geological and Earth sciences/geosciences*	*Geoscientists and oceanographers*	21102	78% of Professional occupations in natural sciences	11.9% in *Mining and quarrying*

Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0186-01); Statistics Canada, 2021 Census.

**Specificity refers to the percentage of all workers in that occupation that belong to the Mining and quarrying (NAICS 212) sector.*

The aim of this chapter is to identify areas where the PSE system may be ill-equipped to meet the escalating labour demands of the industry, and to shed light on the most salient problems undermining the mining talent pipeline. Subsequently (in Chapters 4 and 5), the focus will shift towards identifying possible causes for these issues and points of attrition in the labour supply chain, as well as exploring potential mitigation strategies.

3.1 MINING PROGRAMS ARE SMALL

Mining-centric programs are relatively small compared to competing disciplines. This low baseline level of enrolments places a hard limit on the growth of the labour pool, and on the future growth of these PSE programs.

Mining engineers, for example, are among the least popular disciplines for undergraduate engineering students in Canada. Table 3 summarizes enrolment popularity in undergraduate engineering programs over a four-year span. The three most popular programs (i.e., Mechanical, Civil and Electrical Engineering) represent roughly half of all enrolments, while mining-related engineering programs (i.e., Mining, Materials and Geological Engineering) are the three least popular with a combined 3% of all enrolments. Mining engineers represent only 1% of the total.

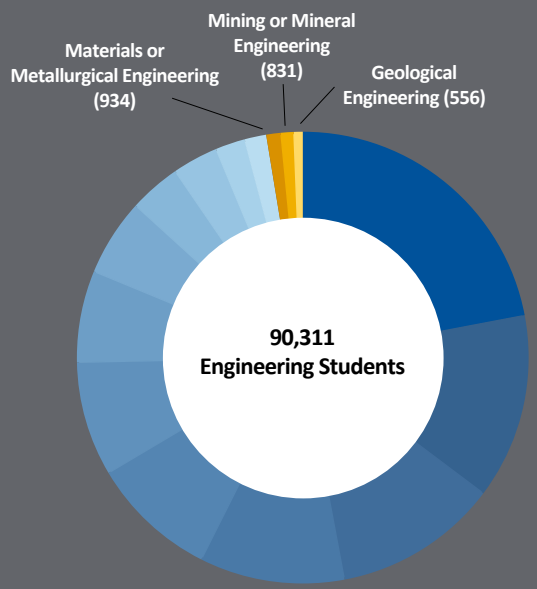
Figure 10 further illustrates the small presence of mining-related engineering programs relative to all other engineering disciplines in 2020. This trend highlights a potential bottleneck for attracting new talent given that other, more competitive programs are the primary destination for students enrolling in engineering.

TABLE 3: TOP THREE AND BOTTOM THREE ENGINEERING PROGRAMS BY ENROLMENT POPULARITY (AVERAGE 2016 – 2020)

Total	All Programs	86,720	100%	100%
Top 3	Mechanical	19,190	22%	49%
	Civil	12,242	14%	
	Electrical	11,235	13%	
Bottom 3	Mining or Mineral	1,020	1%	3%
	Materials or Metallurgical	905	1%	
	Geological	634	1%	

Source: Mining Industry Human Resources Council, Canadian Mining Workplace Profile, 2023; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022.

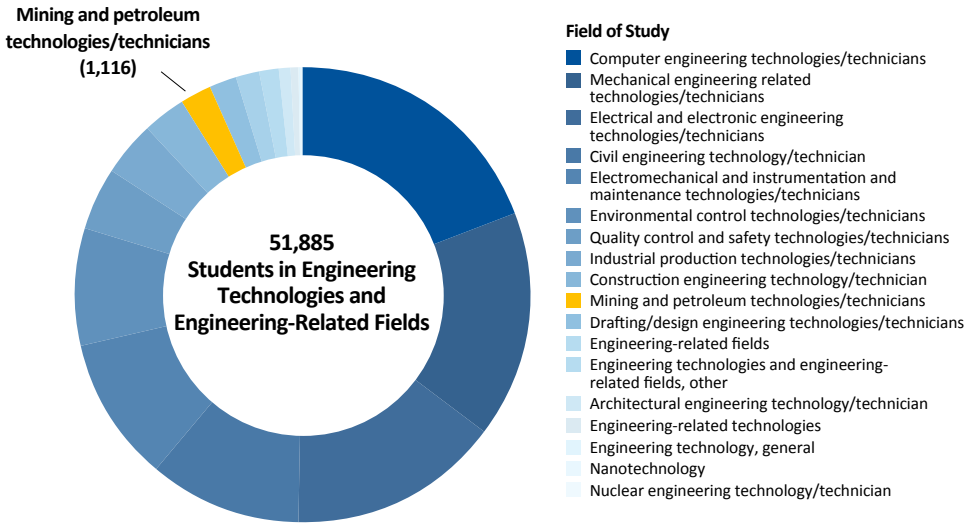
FIGURE 10: UNDERGRADUATE ENROLMENT IN ACCREDITED ENGINEERING PROGRAMS (2020)



Source: Mining Industry Human Resources Council, Canadian Mining Workplace Profile, 2023; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022.

In terms of program enrolment, mining technician programs in Canada demonstrate a similar pattern of relatively small program sizes. More specifically, mining technologies constitutes only 2% of all engineering technologist programs (Figure 11). By contrast, computer engineering technicians make up 19% of enrolments in this category.

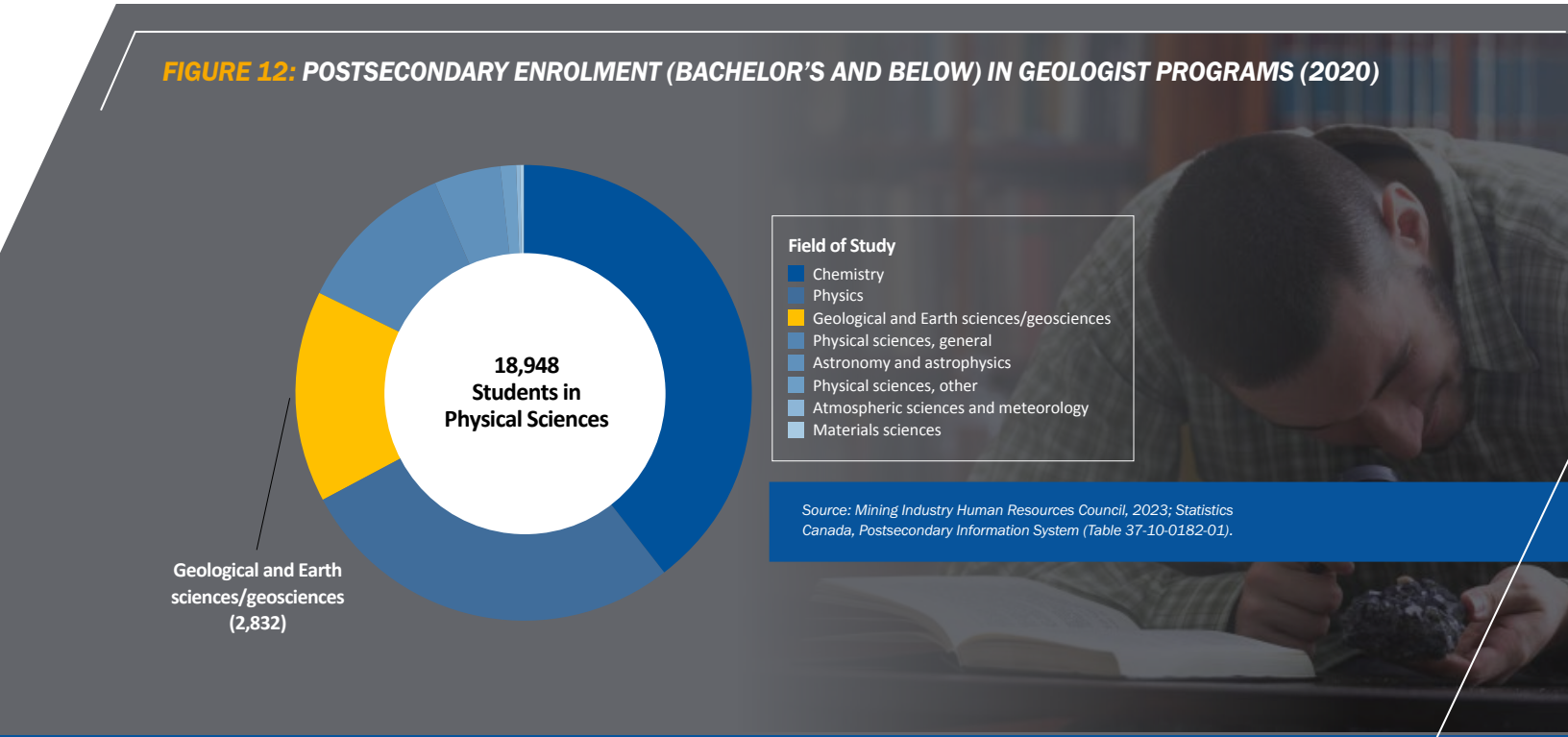
FIGURE 11: POSTSECONDARY ENROLMENT (BACHELOR'S AND BELOW) IN MINING TECHNICIAN PROGRAMS (2020)



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01).

Geosciences garners relatively higher interest among undergraduate students with 15% of students in physical sciences choosing to study this discipline (Figure 12). Only Chemistry and Physics have a larger share of physical sciences enrolments, with 40% and 28% respectively. Degrees in geosciences may benefit from their broader applicability beyond mining. Data from the 2021 Census indicates that 5% of Canadians in this field of study are employed in the *Mining and quarrying* sector (*NAICS 212*), while 6% work in *Support activities for mining* (*NAICS 213*), pointing to a wider range of prospects in other industries.

FIGURE 12: POSTSECONDARY ENROLMENT (BACHELOR'S AND BELOW) IN GEOLOGIST PROGRAMS (2020)



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01).

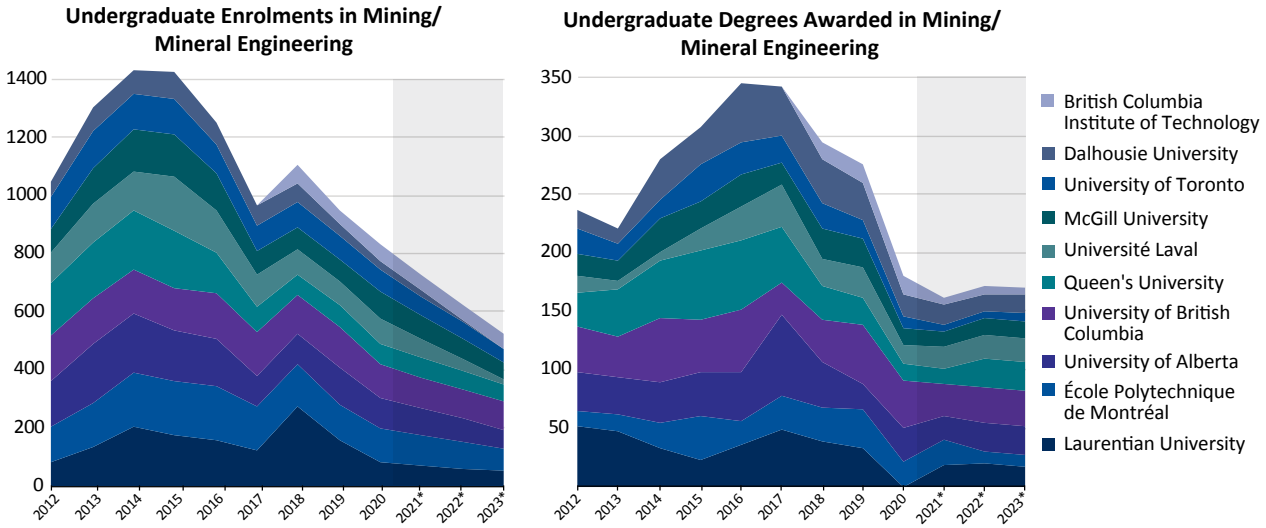
3.2 MINING PROGRAMS ARE SHRINKING

Not only are mining-centric PSE programs small, but they face a shrinking number of students entering their programs. For the industry to grow sustainably, the number of enrolments should rise alongside rising employment. Instead, many critical occupations have seen falling or stalling enrolment trends.

Figure 13 shows a clear downward trend in both undergraduate enrolments and degrees awarded for mining engineering programs from 2012 onwards. The number of enrolments peaked at over 1,400 in 2014, following the end of the commodity supercycle. As of 2020, this number had fallen to roughly 800.

From 2016 to 2020, the decline gathered momentum, with enrolments decreasing 10% annually and degrees awarded decreasing 15% annually. Mining and geological engineering are two of the three engineering disciplines with the worst growth rates in this period (Figure 14).

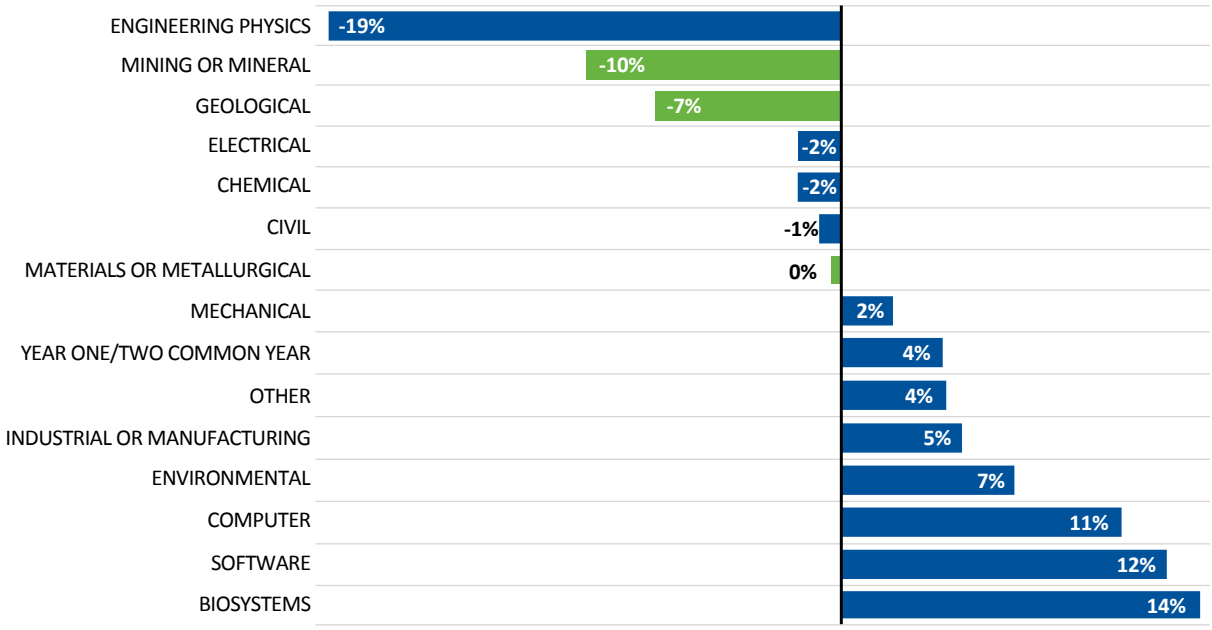
***FIGURE 13:* UNDERGRADUATE ENROLMENTS AND DEGREES AWARDED BY INSTITUTION, MINING ENGINEERS (2012 – 2023)**



Source: Mining Industry Human Resources Council, 2023; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022.

**Forecast assumes present trends continue.*

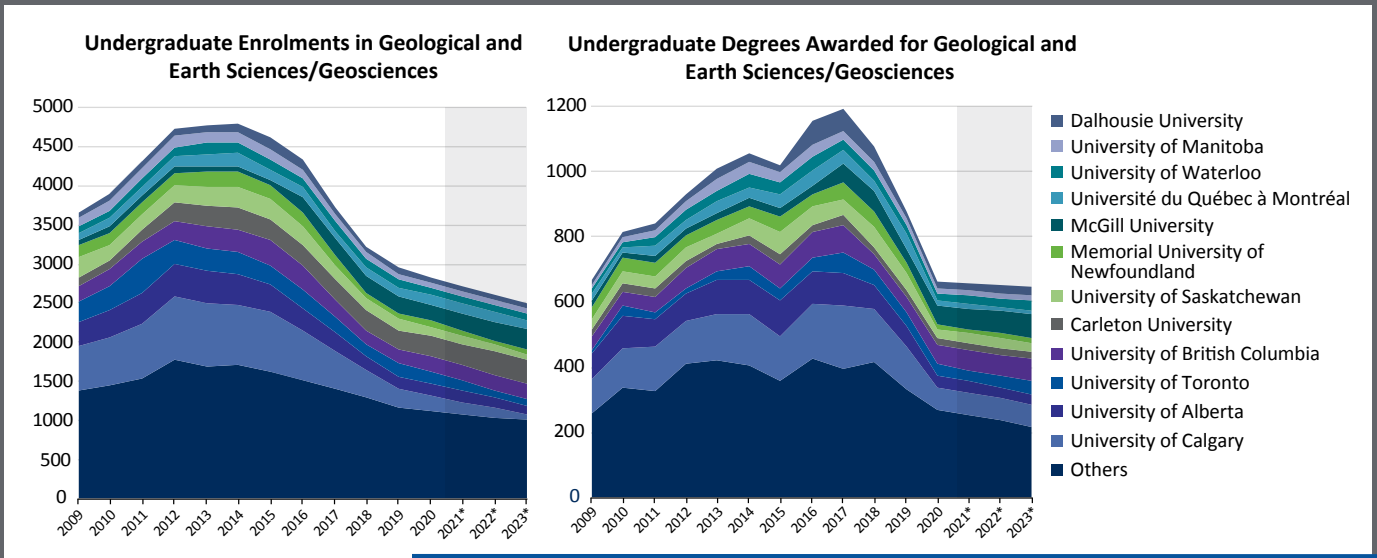
FIGURE 14: ANNUAL ENROLMENT GROWTH (CAGR[9] FROM 2016 – 2020)



Source: Mining Industry Human Resources Council, 2023; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022.

Geologists face a similarly negative trend. Figure 15 shows a breakdown of the top 12 universities with the highest number of geology students. From their peak at around 4,800 enrolments, the number of undergraduate students in *Geological and Earth sciences/geosciences* declined to roughly 2,800 in 2020. From 2016 to 2020, the number of graduates fell by 13% annually and enrolments fell by 10% annually, the worst growth rate among physical science disciplines. (Figure 16).

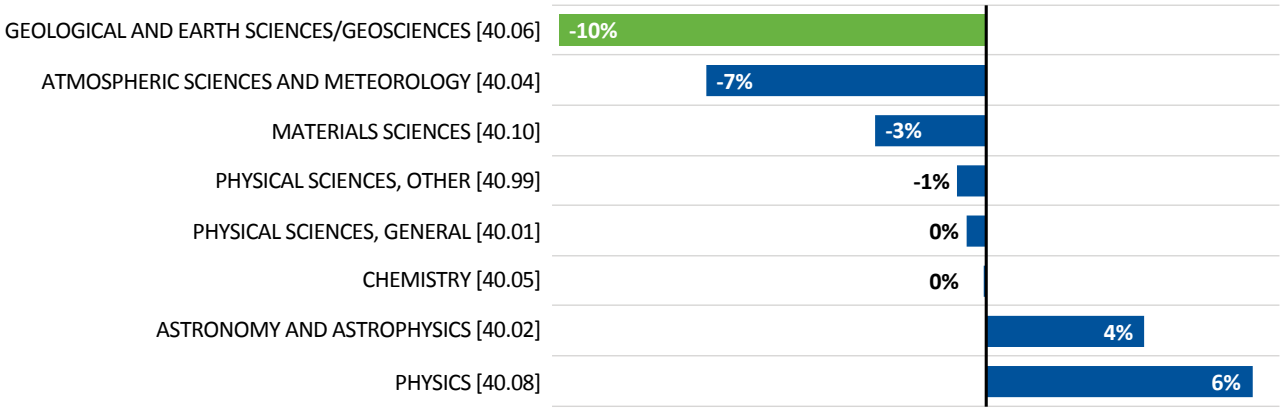
FIGURE 15: POSTSECONDARY ENROLMENT (BACHELOR'S AND BELOW) AND GRADUATES BY INSTITUTION, GEOSCIENCES (2009 – 2023)



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01).

9 CAGR (Compound Annual Growth Rate) measures the average annual growth rate of a variable, such as PSE enrolments, accounting for the cumulative impact of compounding growth.

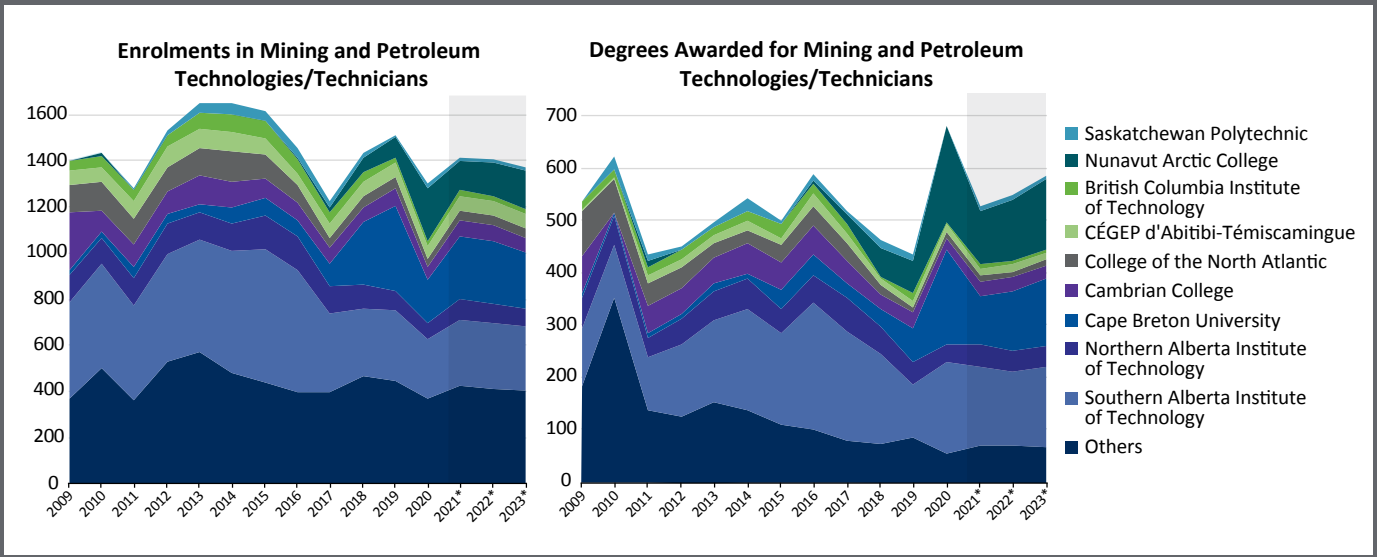
FIGURE 16: ANNUAL ENROLMENT GROWTH (CAGR FROM 2016 – 2020)



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01).

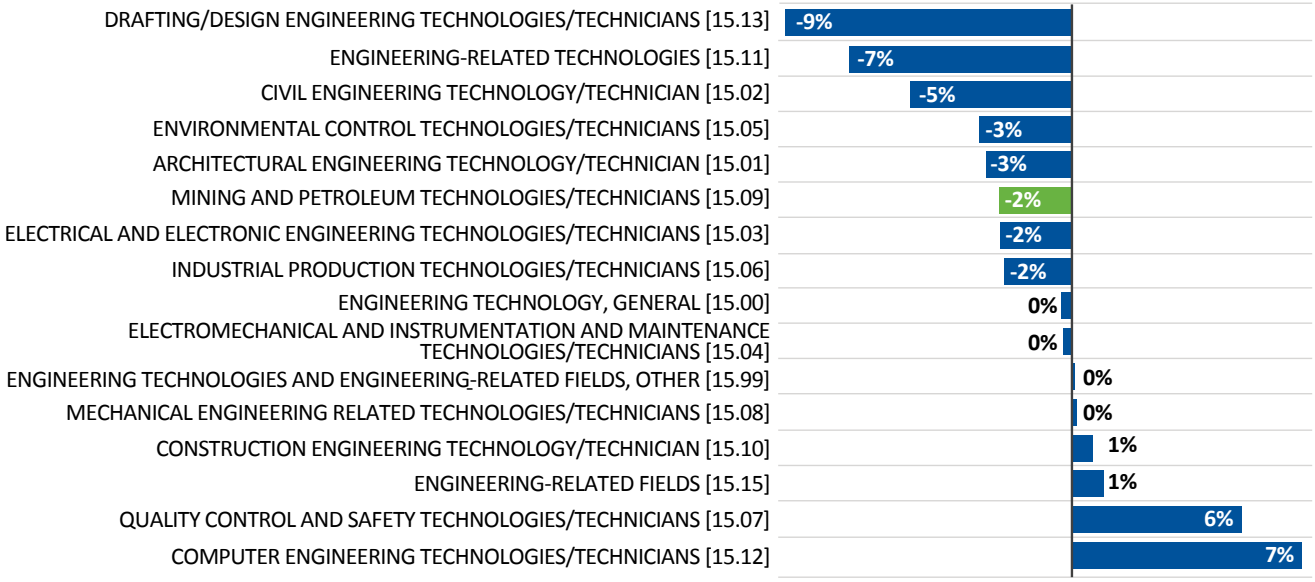
On the other hand, enrolments and graduations among mining technicians have not fallen, though they have not risen either. Enrolments for the past 12 years have fluctuated within a range of 1,200 to 1,600 students, and graduates have also been steady, between 400 and 600 graduates annually, with 2020 being a high point (Figure 17). From 2016 to 2020, enrolments fell by an average of only 2% annually, which was in the middle of the road when compared to other engineering technician disciplines (Figure 18). By comparison, other engineering technicians such as *quality control and safety* and *computer engineering technicians* have been growing much more, at 6% and 7% CAGR respectively. Although enrolments haven't declined considerably, having stalling enrolments is not constructive for growth in the mining sector.

FIGURE 17: POSTSECONDARY ENROLMENT (BACHELOR'S AND BELOW) AND GRADUATES BY INSTITUTION, MINING TECHNICIANS (2009 – 2023)



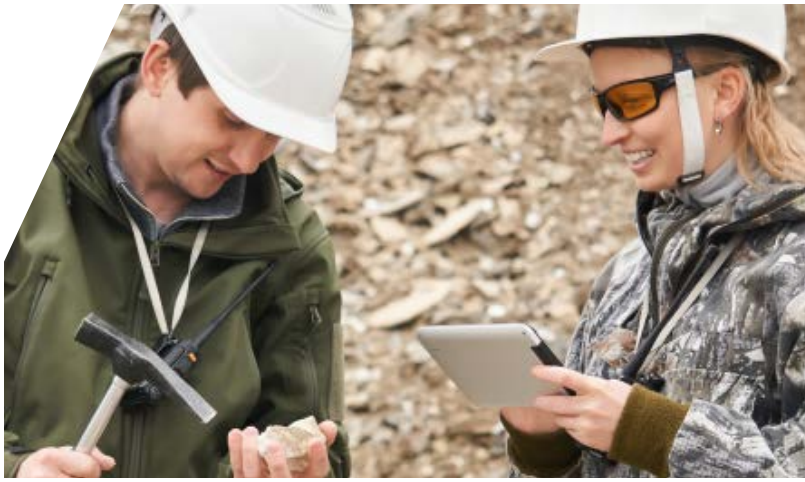
Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01).

FIGURE 18: ANNUAL ENROLMENT GROWTH (CAGR FROM 2016 – 2020)



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01).

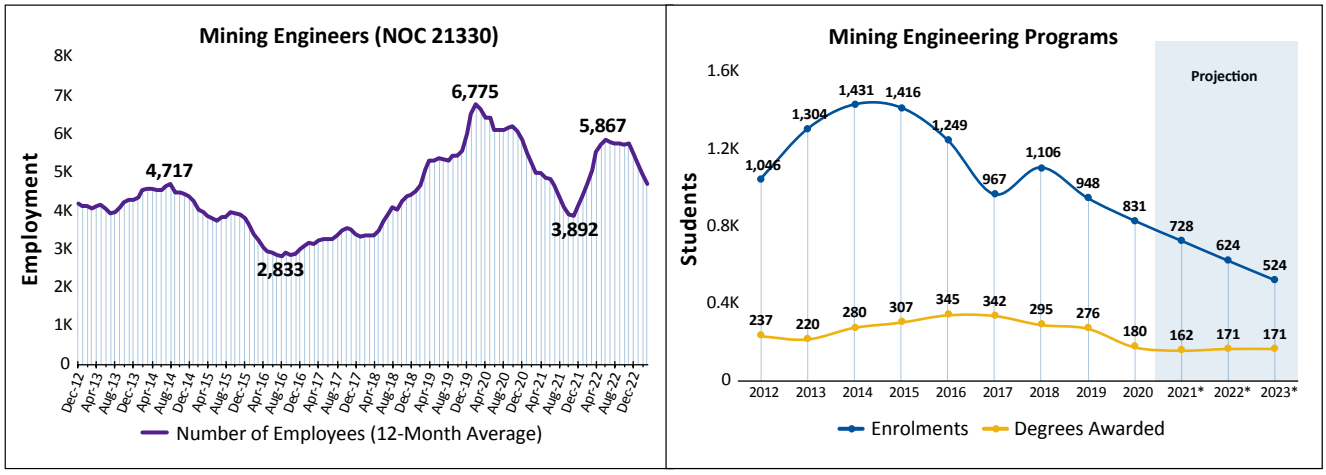
3.3 MINING PROGRAMS ARE UNRESPONSIVE TO LABOUR DEMAND



Mining development is usually cycle-driven, resulting in significant employment volatility. Within a few years, employment can double, or it can be cut in half. At the same time, enrolment in mining-centric programs shows a minimal correlation with the job market, which means it cannot react in step with labour demand in the industry. This disparity creates pressures for mining employers during periods of prosperity, and it places strain on students and recent graduates during industry downturns in the form of unemployment and underemployment. Potential students may be discouraged from considering mining programs due to the high level of uncertainty surrounding their employment prospects.

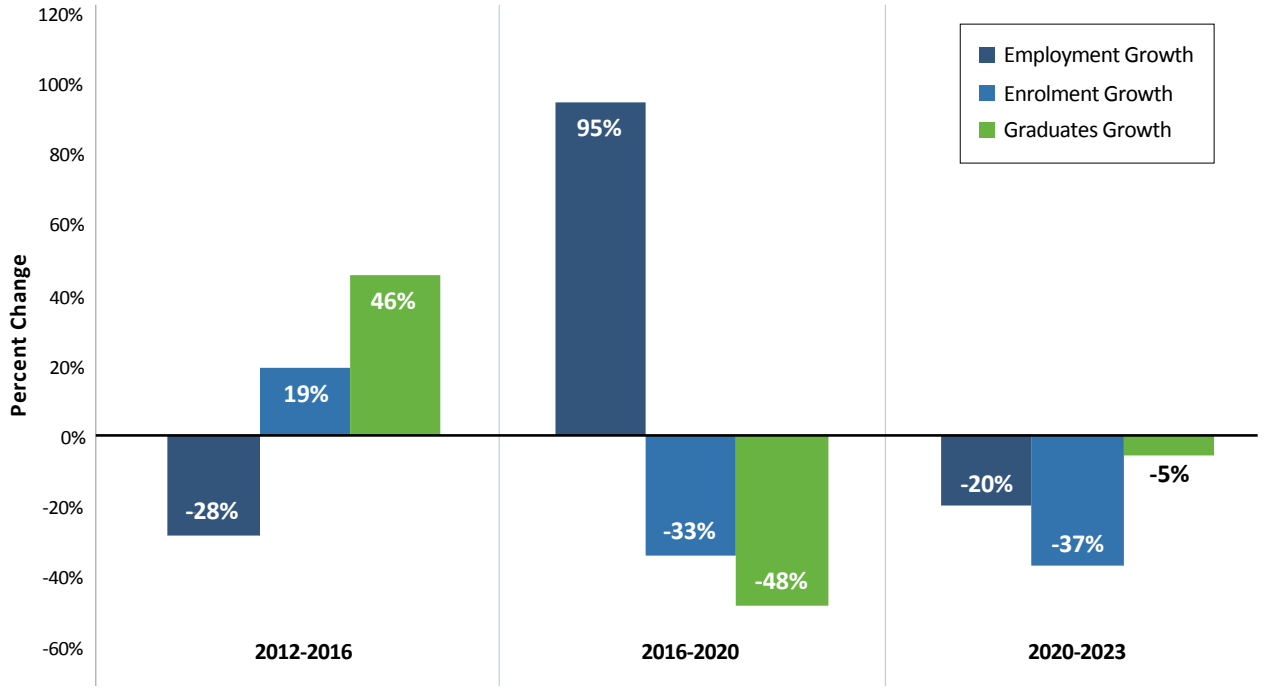
Figure 19 shows a noticeable disconnect between employment trends for *Mining Engineers* (*NOC 21330*) and the enrolment and graduation trends observed in mining engineering programs. From 2012 to 2016, the number of employed mining engineers fell by 28% while enrolments and graduates rose by 19% and 46% respectively (Figure 20). However, the period from 2016 to 2020 exhibited a complete reversal, with employment roughly doubling while enrolments declined by 33% and graduates declined by 48%. This underscores the PSE system's inability to respond to growth signals from the mining labour market.

***FIGURE 19:* EMPLOYMENT AND PSE TRENDS (UNDERGRADUATE AND BELOW), MINING ENGINEERS**



Source: Mining Industry Human Resources Council, 2023; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022; Statistics Canada, Labour Force Survey (Custom Data).

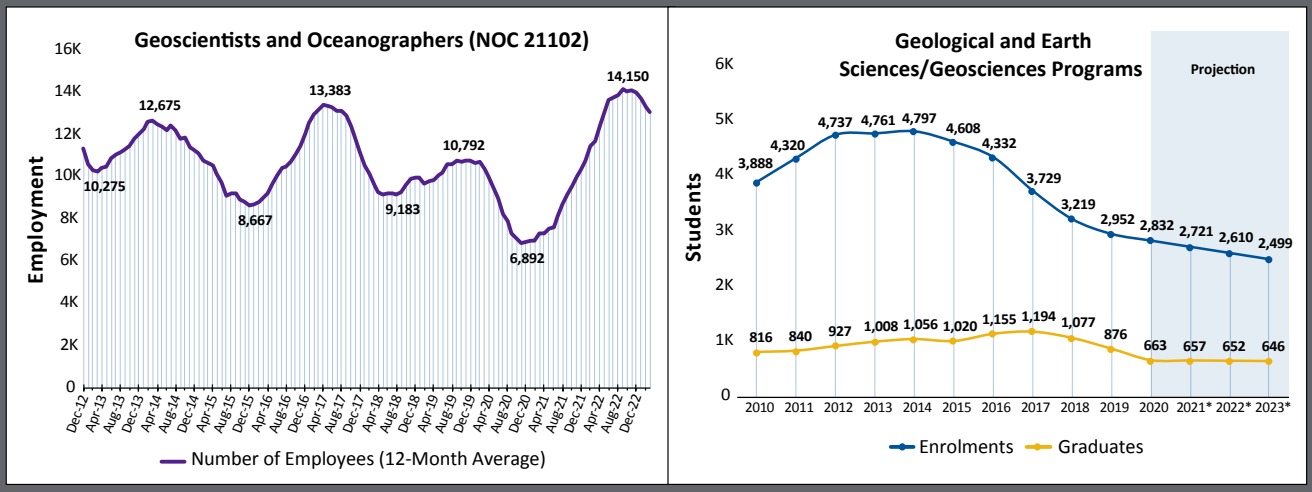
FIGURE 20: GROWTH RATES IN EMPLOYMENT AND PSE TRENDS (UNDERGRADUATE AND BELOW), MINING ENGINEERS



Source: Mining Industry Human Resources Council, 2023; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022; Statistics Canada, Labour Force Survey (Custom Data).

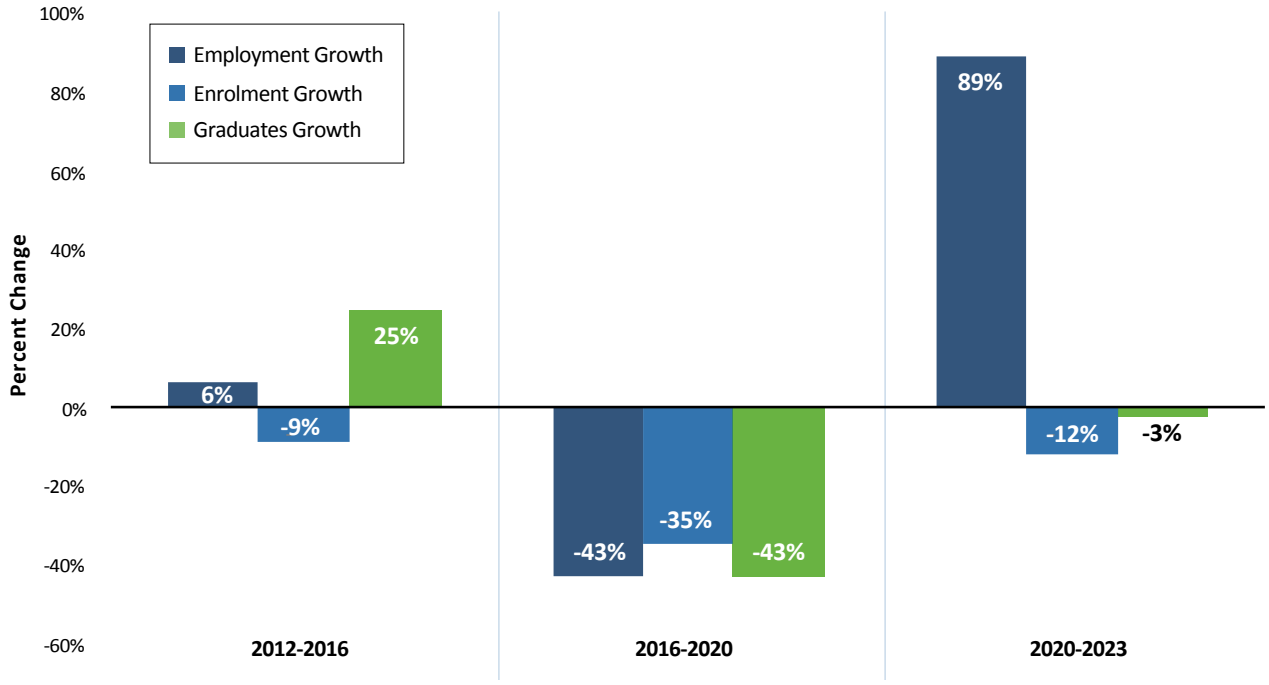
Figure 21 illustrates the cyclical and highly fluctuating nature of employment for Geologists (NOC 21102), contrasting with the comparatively stable decline in enrolment and graduation numbers for geosciences since 2014. From 2016 to 2020, employment levels, enrolments and graduates all declined by roughly 40%. However, over the last three years employment has rebounded by 89%, while projections for enrolments and graduates are not anticipated to respond to this growth (Figure 22).

FIGURE 21: EMPLOYMENT AND PSE TRENDS (UNDERGRADUATE AND BELOW), GEOLOGISTS



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01); Statistics Canada, Labour Force Survey (Custom Data).

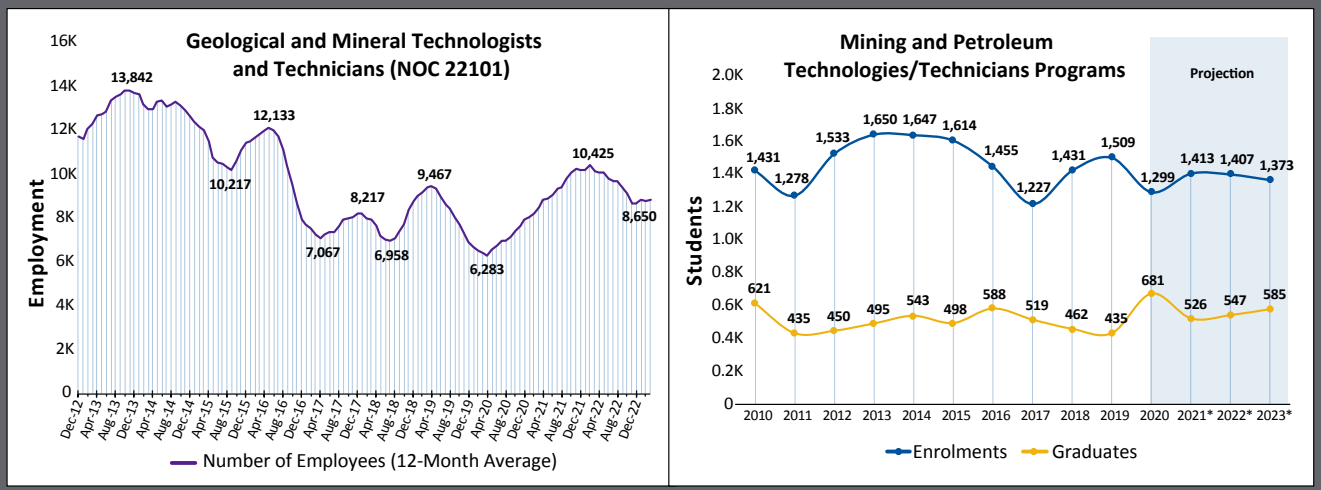
FIGURE 22: GROWTH RATES IN EMPLOYMENT AND PSE TRENDS (UNDERGRADUATE AND BELOW), GEOLOGISTS



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01); Statistics Canada, Labour Force Survey (Custom Data).

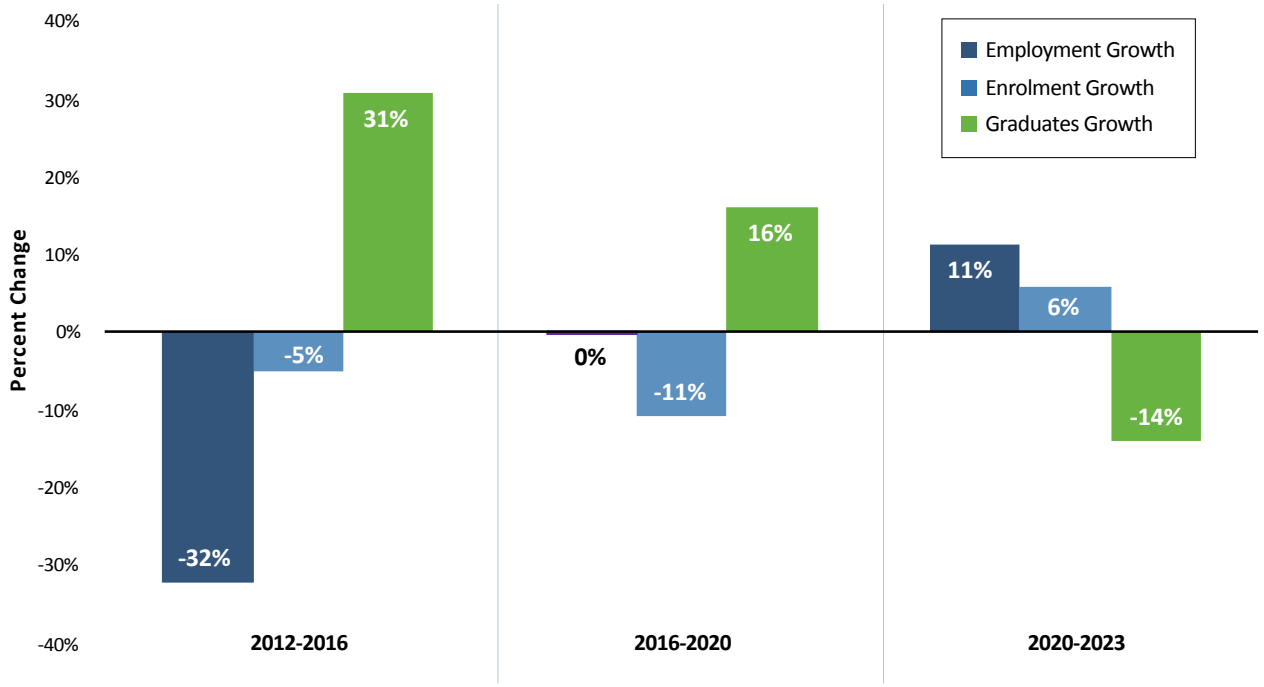
Employment for *Mining Technicians* (*NOC 22101*) appears to be highly volatile (Figure 23). From 2012 to 2016, employment declined by a third, yet the number of graduates increased, also by a third (Figure 24). Over a 10-year period, the number of employees was as high as 14,000 and as low as 6,000. By comparison, PSE trends appear to fluctuate mildly, with enrolment and graduation numbers being very close to what they were a decade ago. This example further emphasizes the divergence between mining employment and PSE trends, underscoring the weak correlation between the two.

FIGURE 23: EMPLOYMENT AND PSE TRENDS (UNDERGRADUATE AND BELOW), MINING TECHNICIANS



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01); Statistics Canada, Labour Force Survey (Custom Data).

FIGURE 24: GROWTH IN EMPLOYMENT AND PSE TRENDS (UNDERGRADUATE AND BELOW), MINING TECHNICIANS



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01); Statistics Canada, Labour Force Survey (Custom Data).

3.4 MINING PROGRAMS ARE GEOGRAPHICALLY CONCENTRATED

Geography and the locations of schools can be a pivotal factor for many incoming PSE students selecting their programs. Program offerings are ideally located (1) near the eventual workplace where students are needed after graduation and, (2) near a population base that can support ongoing PSE demand.

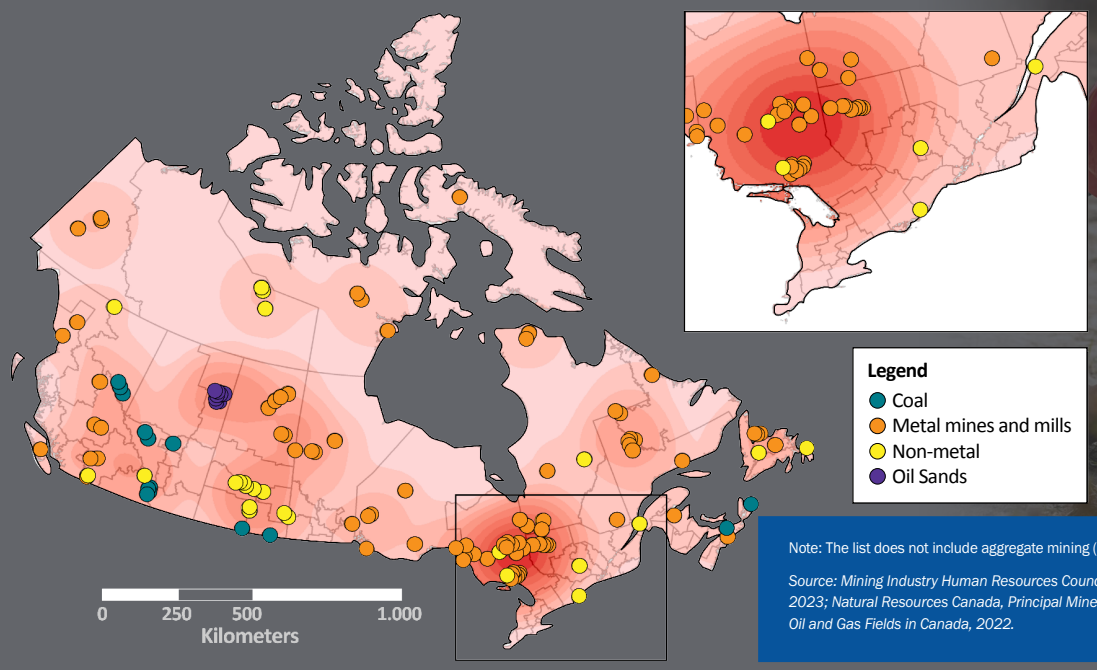
Yet mining projects are commonly found in remote and sparsely populated regions while PSE institutions tend to be located near urban areas and population centres. Most mining regions are therefore not an accessible or visible option for students entering the PSE system. Also, due to the low popularity of mining programs, existing programs are relatively few in number and geographically disconnected from several key mining areas in Canada.

- According to NRCan, there were 135 producing mines in Canada in 2022. Figure 25 shows their geographical distribution by type of operation. It also illustrates where there is a higher density (or cluster) of mines relative to other areas. The figure shows the largest cluster of mining activity is found in Northeast Ontario and Abitibi-Témiscamingue in Quebec.
- Mining engineering: MiHR has compiled a list of 90 universities across Canada,[10] of which only 10 schools had enrolment in undergraduate mining engineering programs in 2020. Furthermore, among the available programs, more than half are found in Ontario and Quebec, leaving a void across most of the country (Figure 26).
- Mining technologies: Of the 159 colleges that MiHR has identified,[11] only 18 offered enrolment in mining technician and technologies programs in 2020/21 (Figure 27). While the number of program offerings is few, there is a relatively closer geographical alignment with mining hot zones in Canada. Nonetheless, mining technician programs are largely not available in many provinces.
- Geosciences: Enrolment in geosciences is comparatively more spread out across the provinces, with more programs available across the country. Of the 90 universities identified by MiHR, 32 offered enrolment in geosciences program in 2020/2021 (Figure 28). Still, most of the programs are exclusively available in the southern regions of Canada.

10 The Postsecondary Student Information System (PSIS) lists 90 Universities across Canada, while Engineers Canada presents data for 46 universities related to engineering programs.

11 The Postsecondary Student Information System (PSIS) lists 144 colleges, while Colleges and Institutes Canada (CiCan) has 143 colleges on its member list.

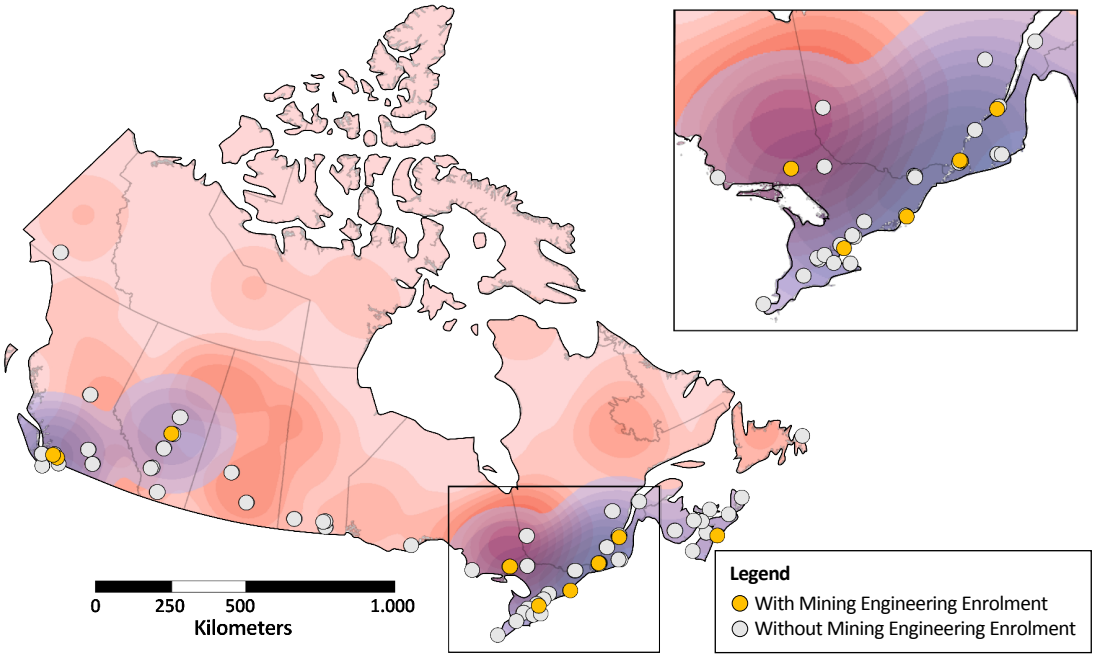
FIGURE 25: MAP OF PRODUCING MINES (2022)



Note: The list does not include aggregate mining (i.e., stone, sand and gravel pits).

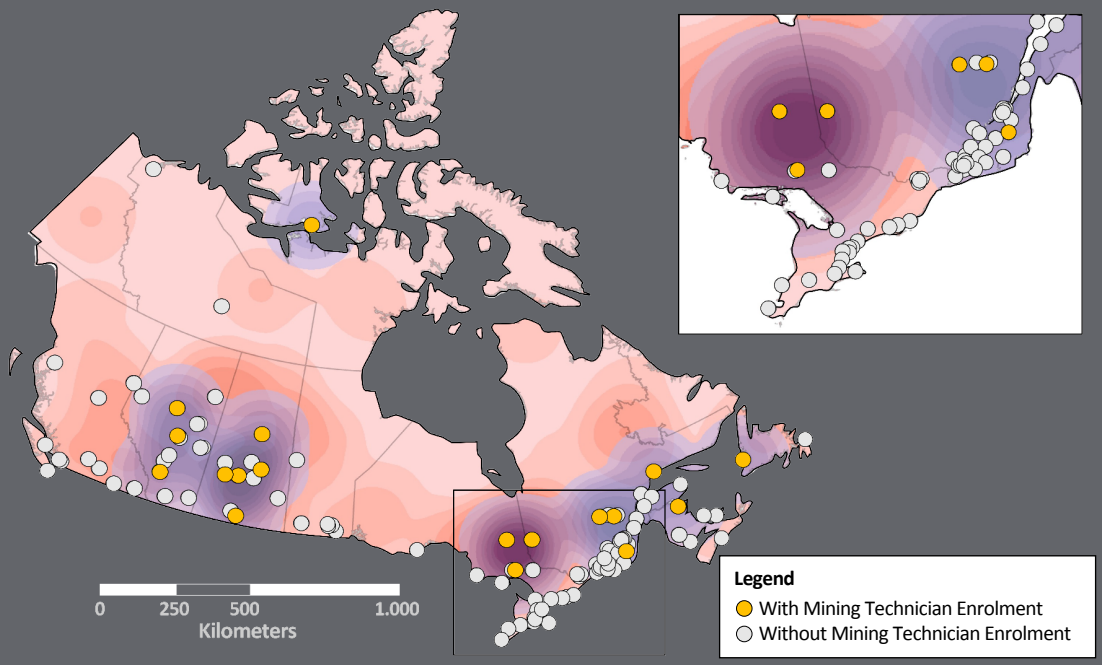
Source: Mining Industry Human Resources Council, Canadian Mining Workplace Profile, 2023; Natural Resources Canada, Principal Mineral Areas, Producing Mines, and Oil and Gas Fields in Canada, 2022.

FIGURE 26: MAP OF UNIVERSITIES WITH MINING ENGINEERING PROGRAMS (2020 – 2021)



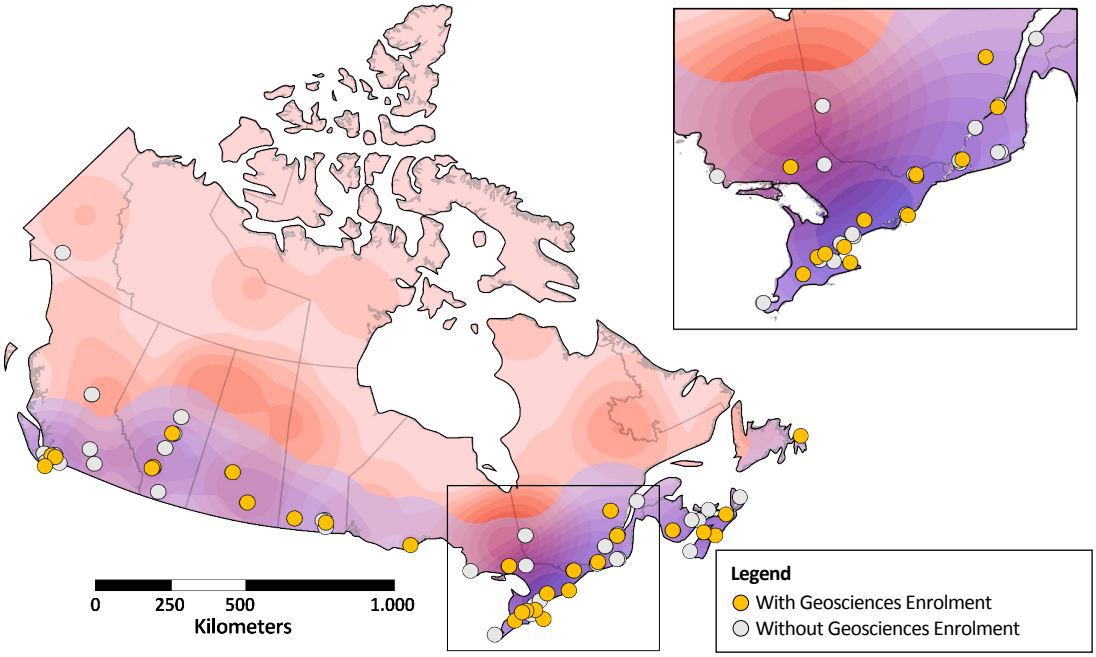
Source: Mining Industry Human Resources Council, 2023; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022.

FIGURE 27: MAP OF COLLEGES WITH MINING TECHNICIAN PROGRAMS (2020 – 2021)



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01).

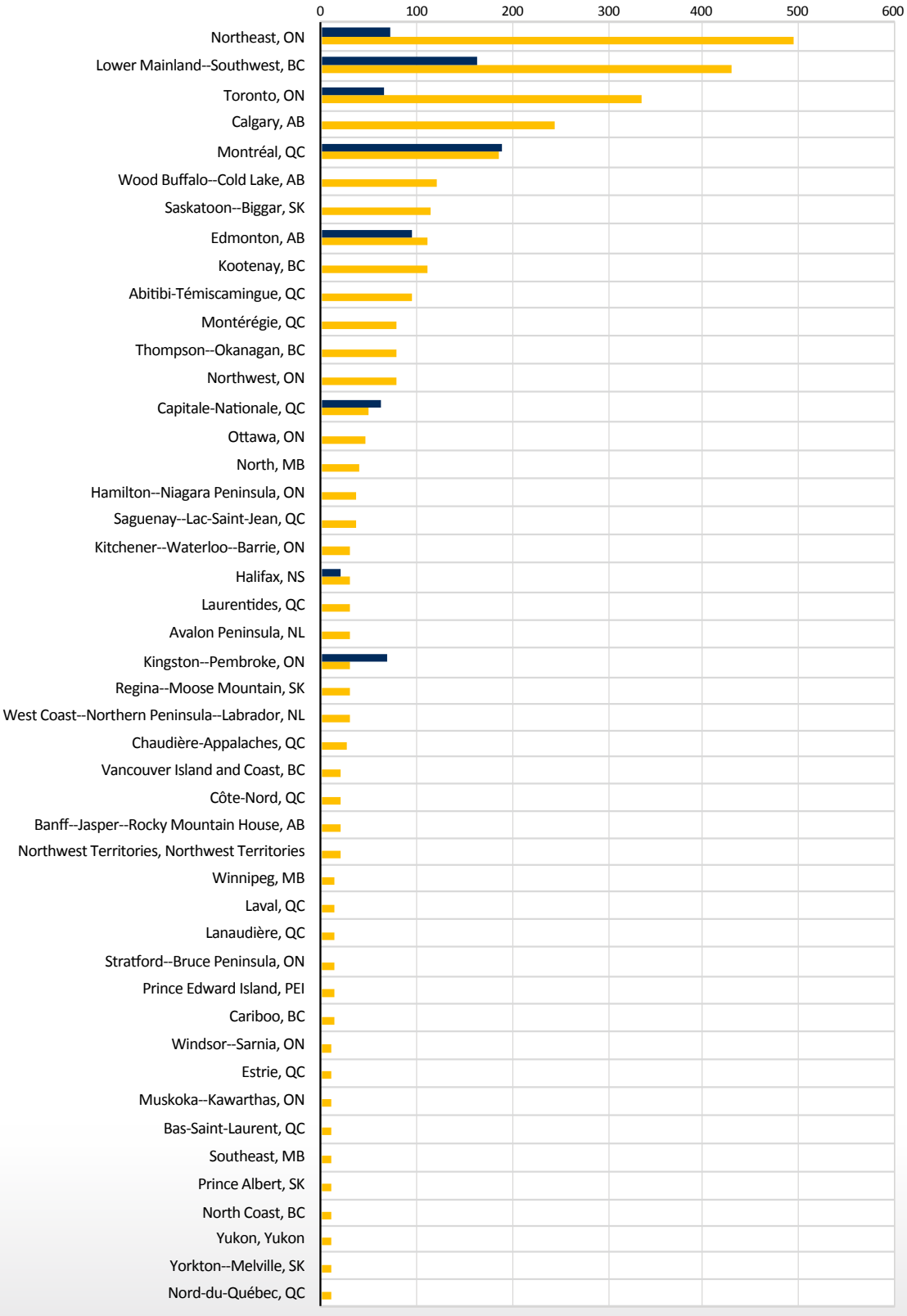
***FIGURE 28:** MAP OF UNIVERSITIES WITH GEOSCIENCES PROGRAMS (2020 – 2021)*



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01).

Not only is geography important for students when considering PSE choices, it is also crucial for graduates searching for employment. The divide between places of study and places of work for prospective mining employees is further illustrated in Figure 29, which shows how the distribution of the mining engineering workforce compares to enrolments in mining engineering programs. Out of 76 economic in regions in Canada, 46 have some level of mining engineering employment, but only eight offer mining engineering programs. In many of the top economic regions where mining engineers work, there are no mining engineering programs offered.

FIGURE 29: EMPLOYMENT (2021) AND ENROLMENT (2020) BY ECONOMIC REGION, MINING ENGINEERS



Source: Mining Industry Human Resources Council, 2023; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022; Statistics Canada, 2021 Census.

3.5 MINING PROGRAMS ARE THREATENED BY CAPACITY ISSUES

For institutions, low enrolments—well below planned capacity—represent an ongoing waste of resources, jeopardizing the long-term viability of mining programs. Maintaining a program involves significant costs, such as hiring qualified instructors, underscoring the importance of attracting a sufficient and steady number of students to sustain this recurring investment.

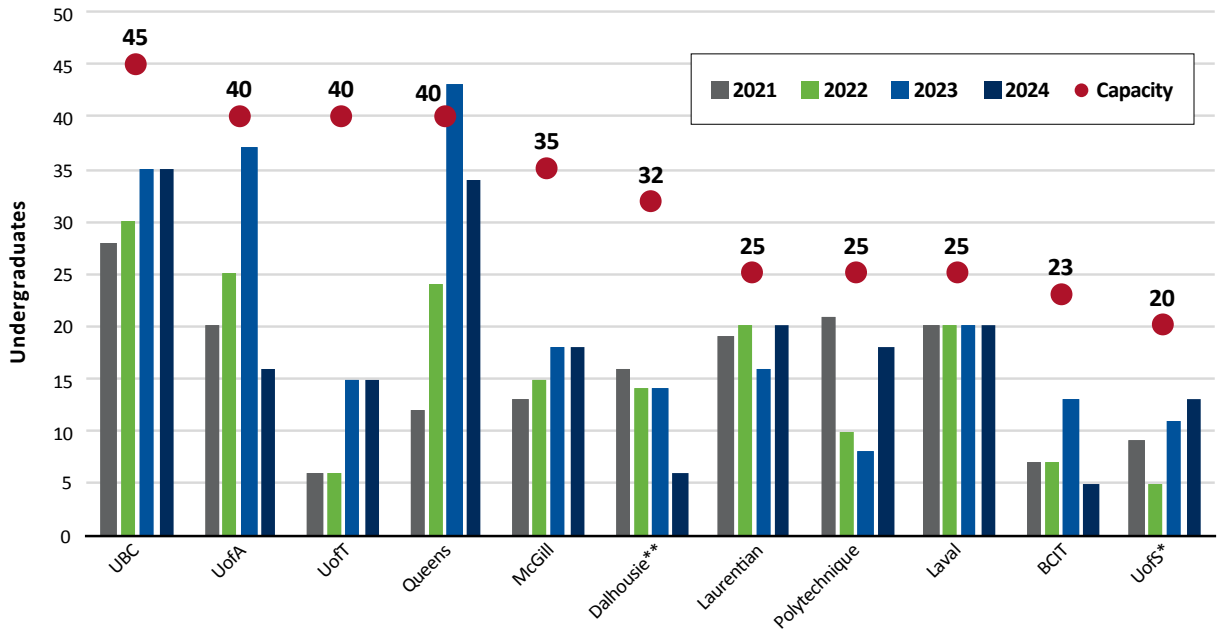
As previously mentioned, the relatively low student-to-instructor ratio in mining programs is often viewed positively by students due to the increased attention they receive from their teachers. However, this presents a potential drawback, as declining tuition revenue can be an incentive for institutions to phase out these programs in favour of more popular and financially lucrative fields of study.

A notable example is Dalhousie University, which recently announced it would be permanently suspending its mining engineering program in 2024. Figure 30 shows the number of graduating fourth-year students across all mining engineering programs from 2021 to 2024, compared to total student capacity (based on the number of instructors hired by these universities). The average capacity utilization rate in this period is 56%, whereas Dalhousie University's utilization rate is only 39%, which likely contributed to the shutdown of the program (Figure 31). The outlook for these programs is uncertain, given that many of them exhibit comparable or even lower rates of capacity utilization.

Lastly, Figure 32 shows the average number of unfilled positions per year in mining engineering programs over the same period, compared to the average number of filled positions per year. Once again, Dalhousie had a strikingly high number of unfilled student seats, though several other programs face a similar situation.

Persistent under-utilization of student capacity can not only threaten the survival of specialized mining programs, but it could also disincentivize deans and program administrators from promoting their growth at a time when the mining sector will need workers in these critical occupations more than ever.

***FIGURE 30:** FOURTH YEAR UNDERGRADUATE CAPACITY AND GRADUATING STUDENTS IN MINING ENGINEERING PROGRAMS (2021 – 2024)*

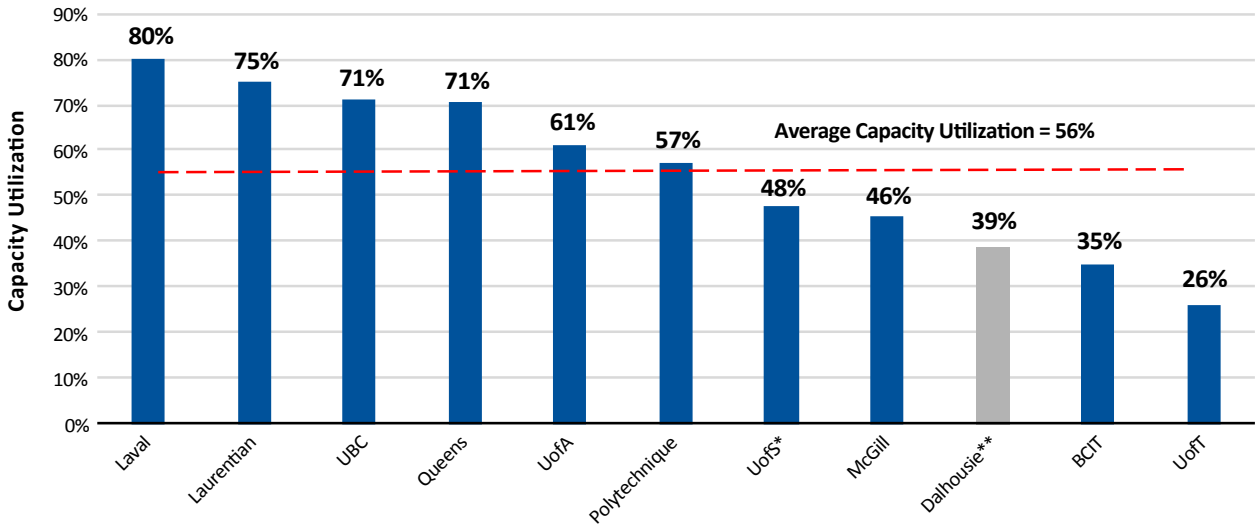


Source: Mining Industry Human Resources Council, 2023; Canadian Mining Schools Committee (CMSC), Survey of Canadian Mining Engineering Schools, 2023.

UoS* - Mining Engineering Option under Civil, Mechanical and Chemical Engineering

Dalhousie** - Program suspension in 2024

FIGURE 31: CAPACITY UTILIZATION IN MINING ENGINEERING PROGRAMS (WEIGHTED AVERAGE OF 2021–2024)

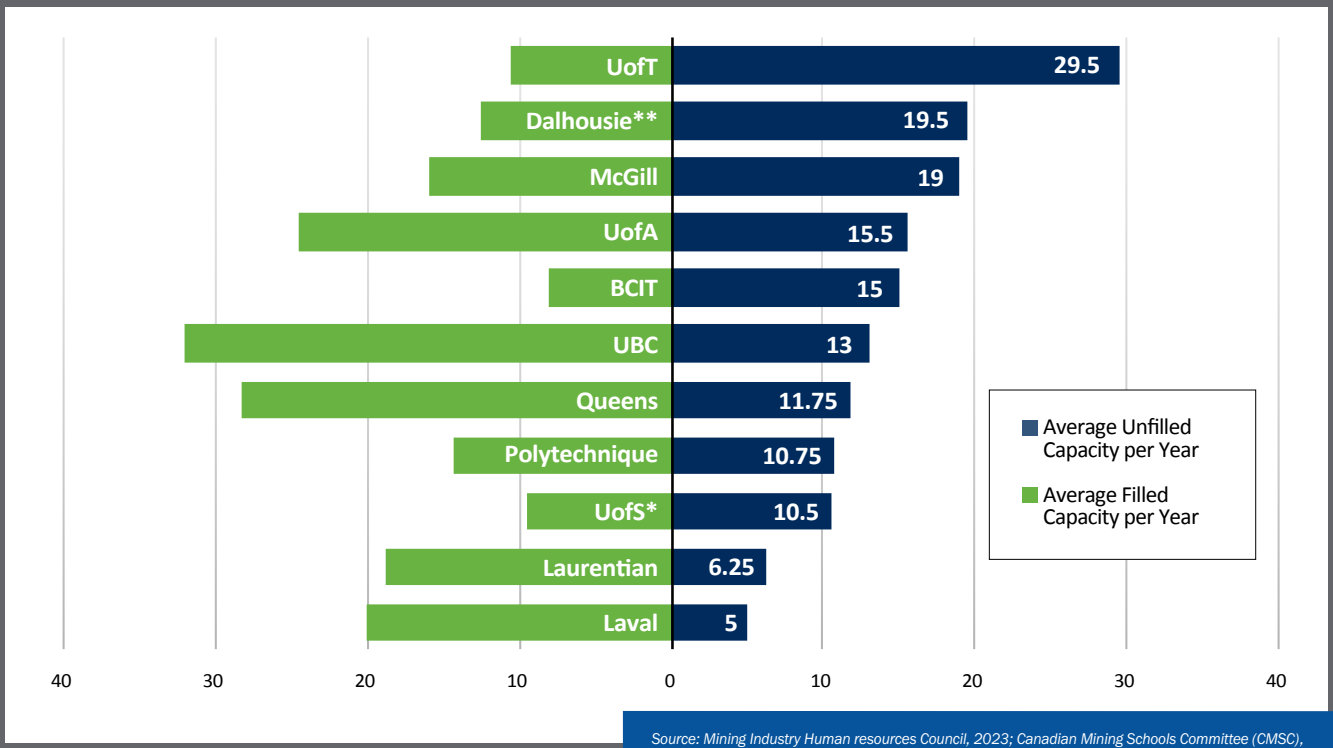


Source: Mining Industry Human Resources Council, 2023; Canadian Mining Schools Committee (CMSC), Survey of Canadian Mining Engineering Schools, 2023.

UoS* - Mining Engineering Option under Civil, Mechanical and Chemical Engineering

Dalhousie** - Program suspension in 2024

FIGURE 32: UNFILLED CAPACITY PER YEAR BY SCHOOL (WEIGHTED AVERAGE OF 2021–2024)



Source: Mining Industry Human resources Council, 2023; Canadian Mining Schools Committee (CMSC), Survey of Canadian Mining Engineering Schools, 2023.

UoS* - Mining Engineering Option under Civil, Mechanical and Chemical Engineering

Dalhousie** - Program suspension in 2024

3.6 MINING PROGRAMS ARE STRUGGLING WITH DIVERSITY

Women

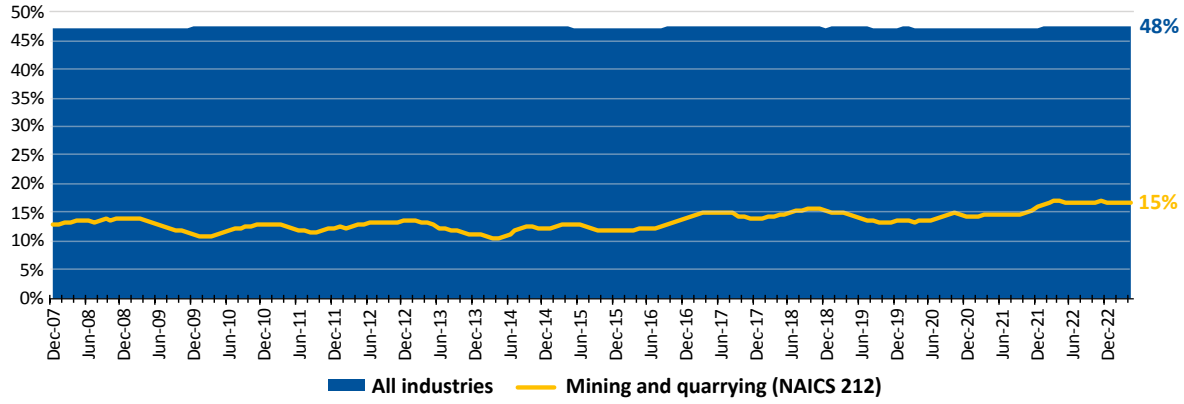
MiHR's previous research has shown that Canada's mining sector has a consistently lower share of women in the workforce when compared to other industries. Women's representation in the *Mining and quarrying* workforce has only improved slightly and remained largely stagnant over the last two decades, at about 15% (Figure 33).

The mining sector's underperformance is largely a function of program choices made by women in the PSE system. Figure 34 compares women's representation in major fields of study (engineering, technicians and physical sciences) with their representation in (1) all industries and (2) the mining industry.

Generally, women's share of the workforce closely reflects their enrolment rates in the corresponding fields of study. This finding implies that program choice is a major factor behind much of the gender imbalance for many occupations within the mining sector and in the rest of the Canadian economy.

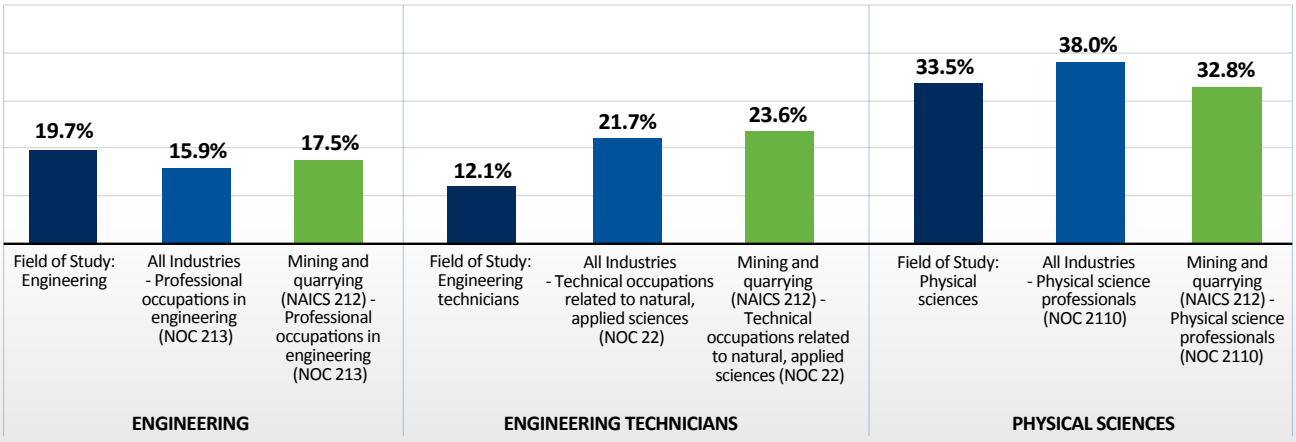
Women's low share of mining enrolments is a challenge to the extent that it limits the industry's ability to raise women's representation after graduates enter the workforce. Consequently, policy interventions seeking to improve women's share of the mining workforce should take place upstream from the labour market, during the PSE stage and earlier in life.

***FIGURE 33:** WOMEN'S SHARE OF THE WORKFORCE (12-MONTH MOVING AVERAGE), MINING AND QUARRYING (NAICS 212) (2007–2022)*



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Labour Force Survey (Custom Data).

***FIGURE 34:** COMPARISON OF WOMEN'S REPRESENTATION IN ENROLMENTS BY MAJOR FIELD OF STUDY (2020) AND EMPLOYMENT IN CORRESPONDING OCCUPATIONS (2021)*

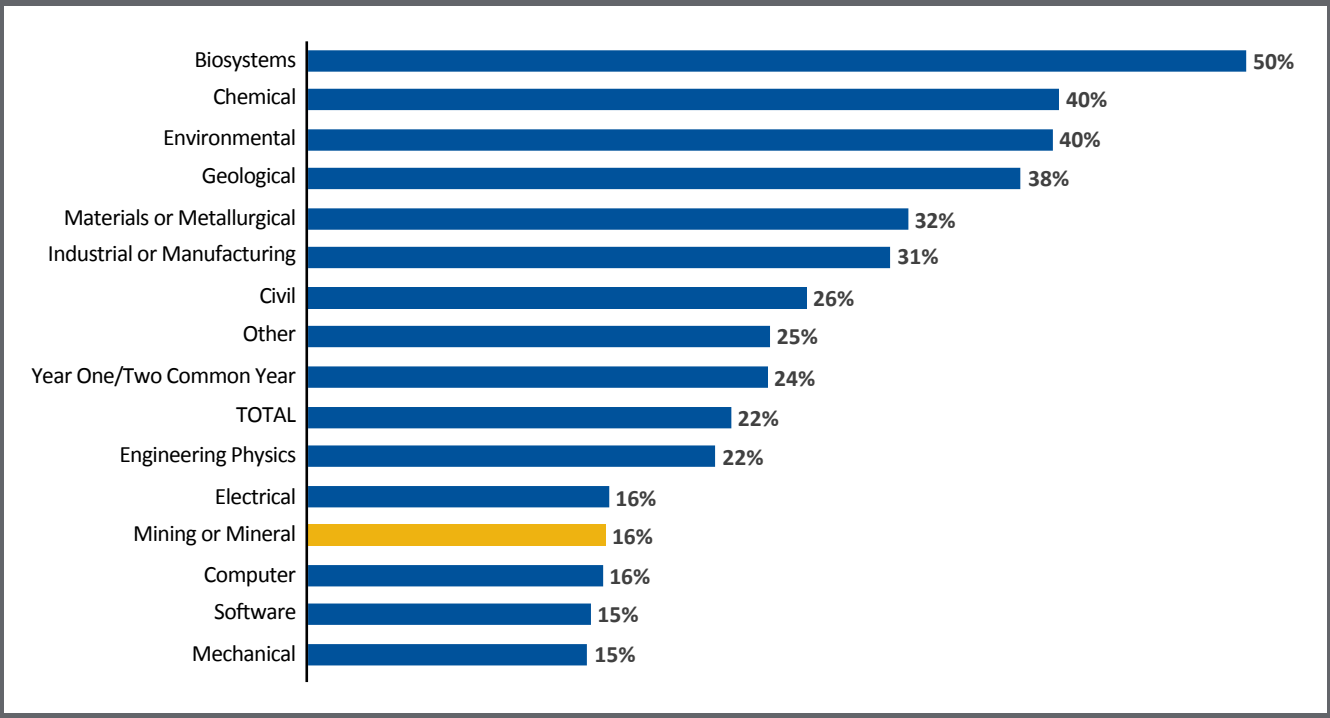


Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

Furthermore, certain mining programs fall short in terms of women's representation when compared to non-mining programs. Figures 35 through 37 show women's representation in *mining engineering*, *mining technologist* and *geosciences* programs, as compared to the proportion of women in related fields of study.

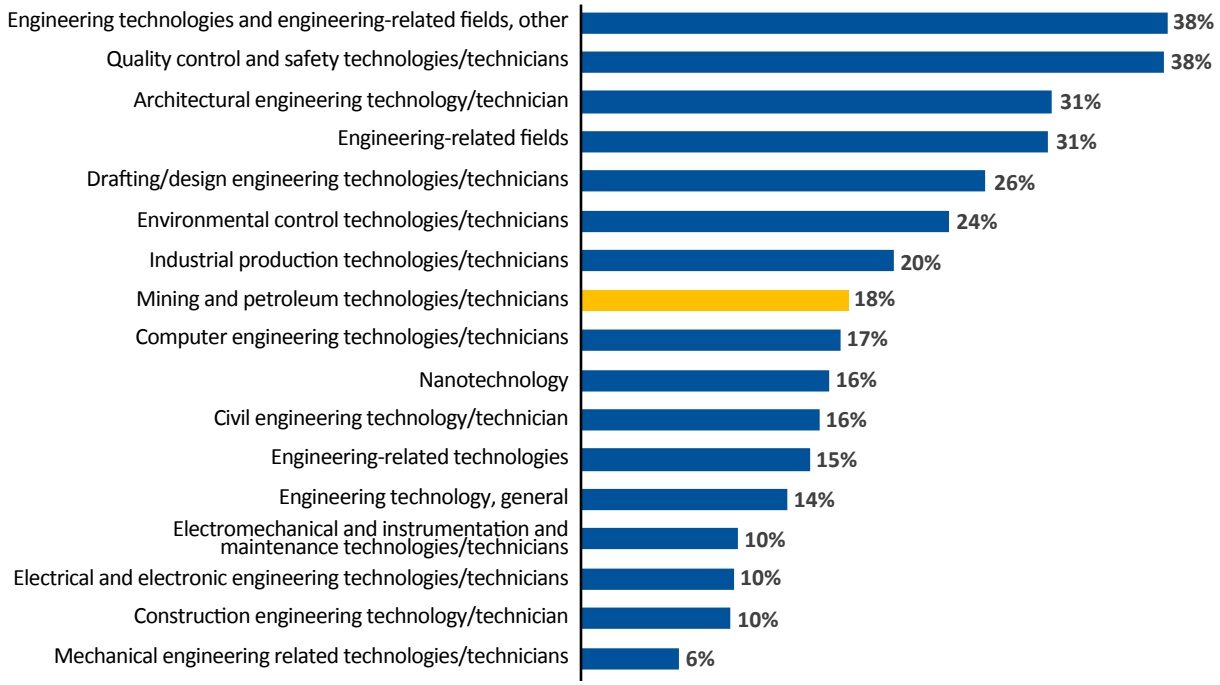
- The share of women in *mining engineering* is among the lowest of all engineering disciplines, at only 16% of enrolments between 2016 and 2020.
- Women's representation in *mining technician* programs (at 18%) is also rather low, though in the middle of the pack compared to other engineering technician programs.
- *Geosciences* programs have a relatively higher proportion of women with 41%, ranked third among the physical sciences.

***FIGURE 35:** PROPORTION OF WOMEN (%) IN UNDERGRADUATE ENGINEERING PROGRAMS (2016 – 2020 AVERAGE)*



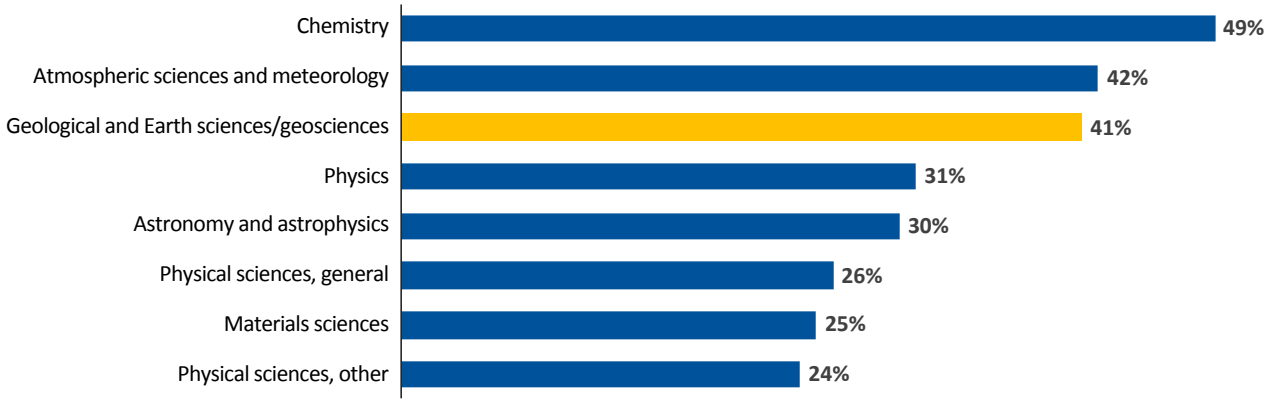
Source: Mining Industry Human Resources Council, Canadian Mining Workplace Profile, 2023; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022.

FIGURE 36: PROPORTION OF WOMEN (%) IN COLLEGE ENGINEERING TECHNOLOGIST AND TECHNICIAN PROGRAMS (2016 – 2020 AVERAGE)



Source: Mining Industry Human Resources Council, Canadian Mining Workplace Profile, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01).

FIGURE 37: PROPORTION OF WOMEN (%) IN UNDERGRADUATE PHYSICAL SCIENCES PROGRAMS (2016 – 2020 AVERAGE)



Source: Mining Industry Human Resources Council, Canadian Mining Workplace Profile, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0182-01).

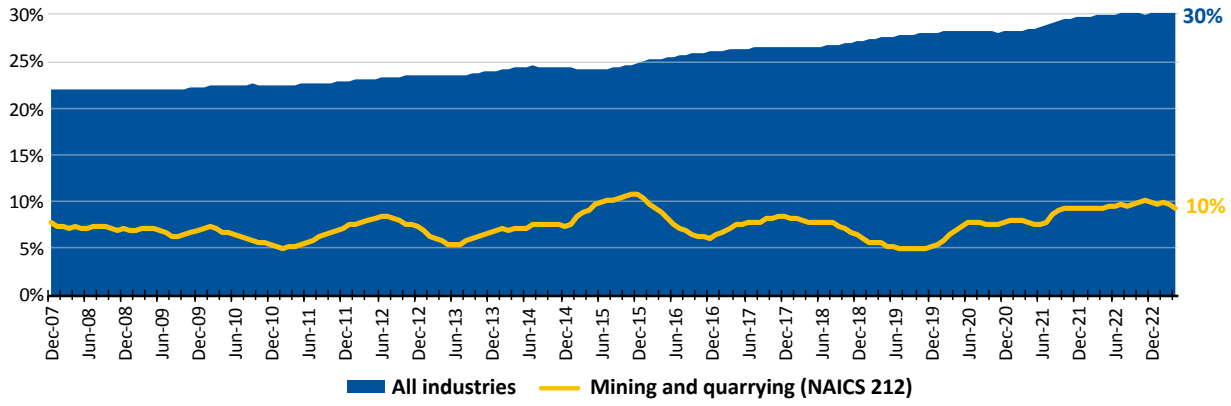
Immigrants

Immigrants[12] also show a consistent underrepresentation in the mining workforce (at 10%) relative to the overall Canadian workforce (at 30%) (Figure 38).

In this case, the lack of immigrants in the mining sector does not stem from their program choices. Figure 39 contrasts the share of immigrants in major fields of study (*engineering*, *technicians* and *physical sciences*) with their representation in (1) all industries, and (2) the mining industry. While the share of immigrants in these occupations across all industries mostly aligns with the field of study, there is a significant drop in representation within the mining workforce. This suggests that immigrants' underrepresentation is rooted in other challenges unique to the mining sector.

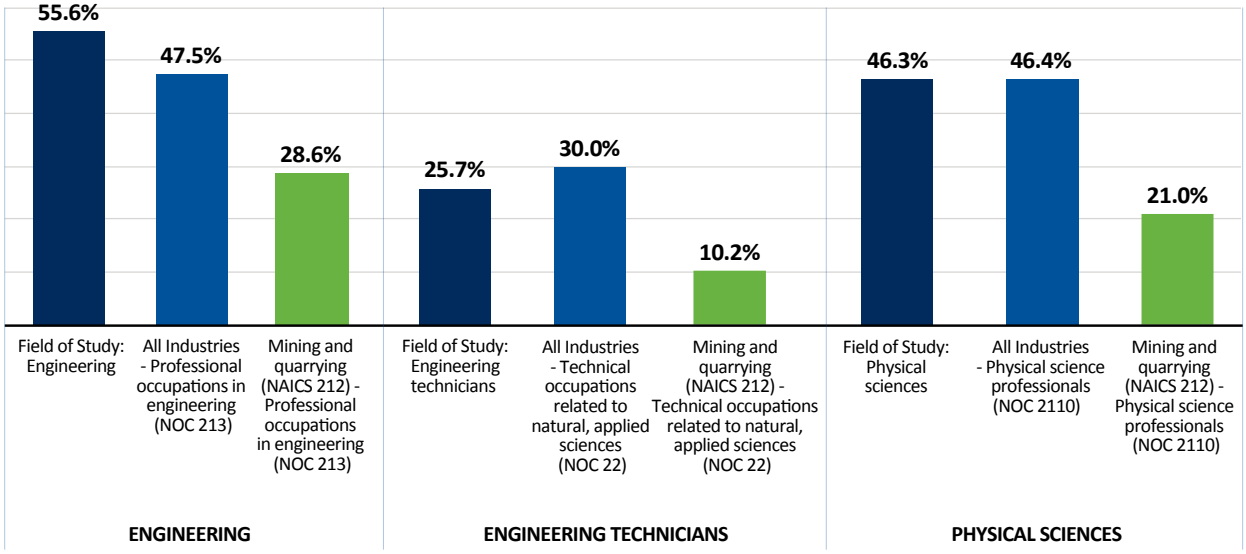
12 Statistics Canada's definition of immigrants encompasses those not born in Canada, including naturalized Canadian citizens, permanent residents and non-permanent residents. Non-permanent residents are persons who have claimed refugee status (asylum claimants), or persons who hold a work or study permit and their family members living with them, provided they have a usual place of residence in Canada.

FIGURE 38: IMMIGRANTS' SHARE OF THE WORKFORCE (12-MONTH MOVING AVERAGE), MINING AND QUARRYING (NAICS 212) (2007 – 2022)



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Labour Force Survey (Custom Data).

FIGURE 39: COMPARISON OF IMMIGRANT REPRESENTATION BY MAJOR FIELD OF STUDY (2020) AND LABOUR FORCE IN CORRESPONDING OCCUPATIONS (2021)



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

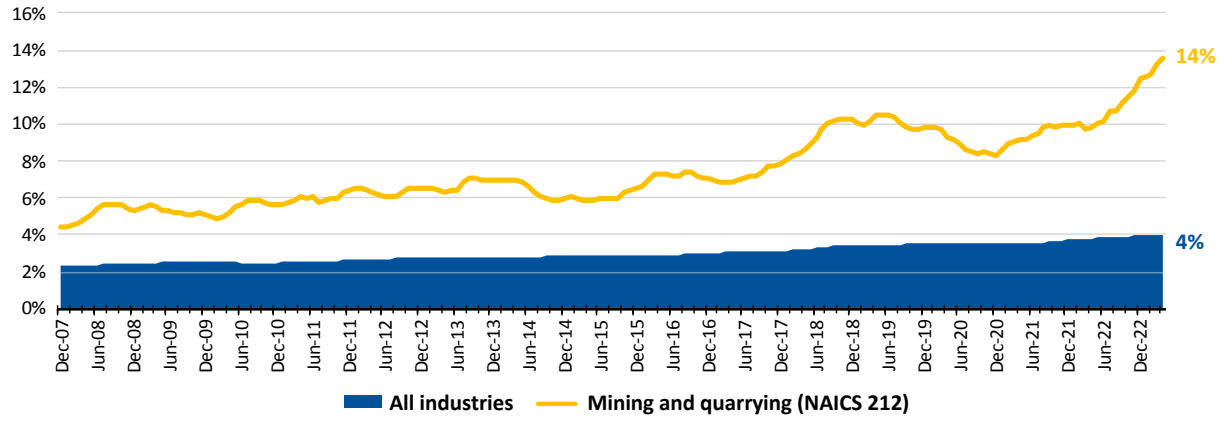
Indigenous Peoples

Indigenous[13] workers in the mining sector have had more favourable outcomes in terms of workforce representation, especially when compared to other industries. Over the last decade, Indigenous peoples have significantly increased their workforce numbers. Since 2013, the share of Indigenous workers in mining has roughly doubled from 7% to 14% (Figure 40).

Notably, Indigenous representation in important major fields of study (engineering, technologists, and physical sciences) is also outstripped by their share of the workforce in corresponding occupations. For example, about 11% of engineering technicians in the mining industry are Indigenous, compared to only 3% of engineering technicians in the PSE system (Figure 41).

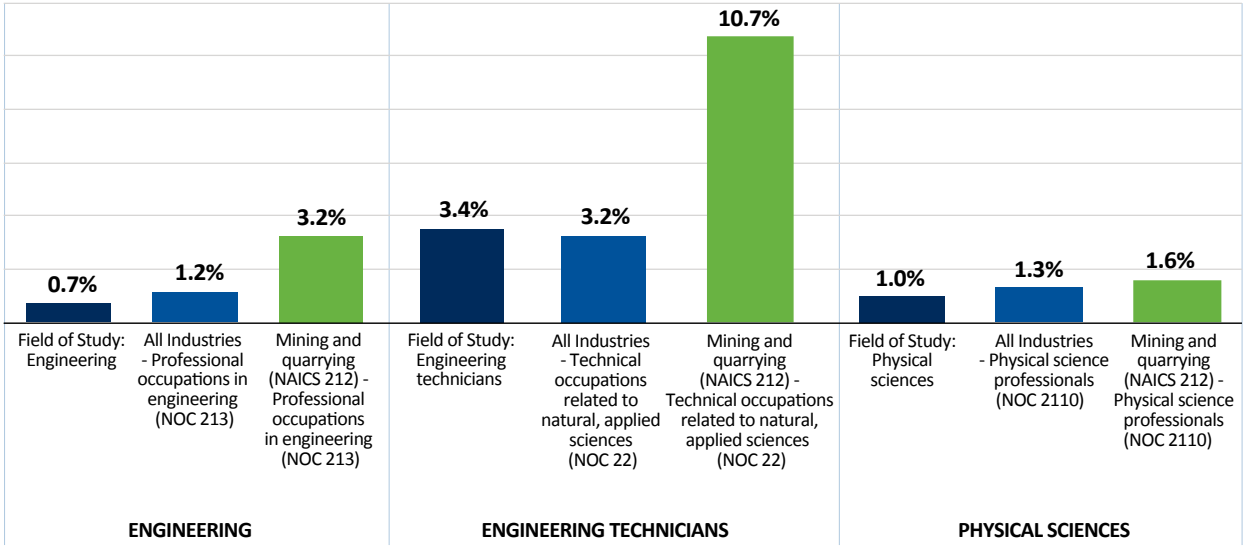
13 Indigenous Peoples comprises First Nations, Métis, and Inuit populations; however, the data obtained from Statistics Canada does not provide the level of granularity required to present detailed statistics for each distinct group.

FIGURE 40: INDIGENOUS SHARE OF THE WORKFORCE (12-MONTH MOVING AVERAGE), MINING AND QUARRYING (NAICS 212) (2007 – 2022)



Source: Mining Industry Human Resources Council, Canadian Mining Workplace Profile, 2023; Statistics Canada, Labour Force Survey (Custom Data).

FIGURE 41: COMPARISON OF INDIGENOUS REPRESENTATION BY MAJOR FIELD OF STUDY (2020) AND EMPLOYMENT IN CORRESPONDING OCCUPATIONS (2021)



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, 2021 Census.

CHAPTER FOUR:

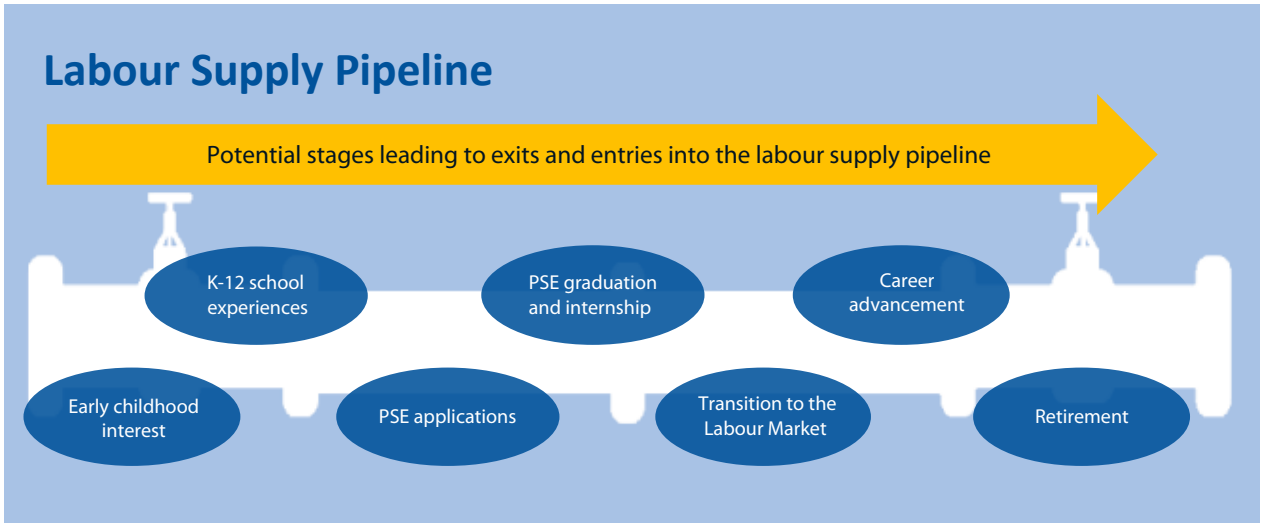
BARRIERS TO PARTICIPATION IN THE MINING WORKFORCE

Strengthening the labour pool, which also includes diversifying it, will require a long-term approach to ensure a steady influx of candidates with both an awareness of and a genuine interest in mining-related roles. A key aspect of achieving this goal involves convincing a growing number of students with diverse talents, skills and experiences to enrol in mining-relevant PSE programs.

Starting from childhood, a student's educational journey is the outcome of countless decisions made throughout their lifetime, setting them on a path towards a specific discipline. It is therefore crucial for industry planners to take a broad perspective and consider all students (including from K-12 education) as potential future mining employees to foster the long-term growth of the mining workforce.

To this end, MiHR considers the various critical stages from early life to the labour market, where people make pivotal choices throughout their career progression (Figure 42). This chapter explores the main points of attrition along the mining talent pipeline, and the barriers that prevent or dissuade students from pursuing a career in mining.

***FIGURE 42:** THE MINING EDUCATION PIPELINE: TRACING THE STEPS FROM K-12 TO INDUSTRY*



Source: Mining Industry Human Resources Council, 2023.

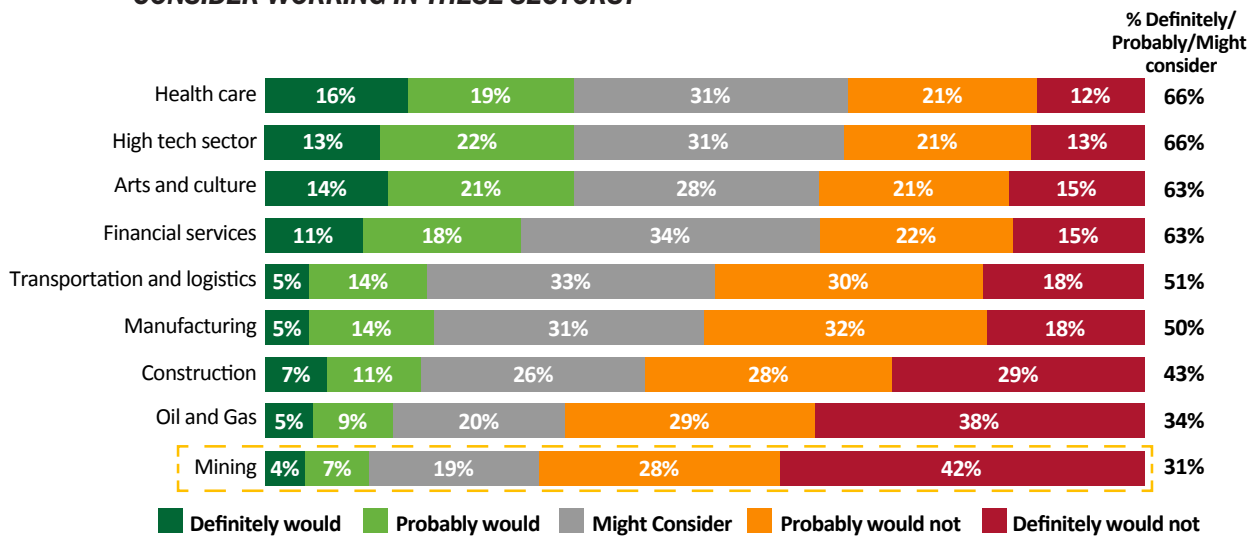
4.1 NEGATIVE PERCEPTIONS OF MINING

The first hurdle to participation in the mining workforce is that of prevailing negative perceptions about mining, which are often formed at an early age. Unfavourable opinions surrounding the industry are deeply entrenched among young people and can prevent them from considering mining as a viable career option. Also, the experiences of different groups have a significant influence on perceptions of mining and willingness to consider it in the PSE stage.

A poll of young Canadians commissioned by MiHR in 2020, shown in Figure 43, reveals the extent of this issue. When asked if they would consider working in various sectors, mining emerged as the least popular choice among Canadian youth, even more unpopular than the much-maligned oil and gas sector. Remarkably, 42% of respondents stated that they *definitely would not* consider working in mining, while an additional 28% expressed that they *probably would not* consider it. Altogether, 70% of Canadians under the age of 30 express a reluctance toward pursuing a career in mining.

Reaching young people and promoting more positive attitudes about mining is essential in addressing the urgent need to attract a new generation of talent.

***FIGURE 43:** RESPONSES OF YOUNG CANADIANS (AGES 15 TO 30): HOW LIKELY, IF AT ALL, WOULD YOU CONSIDER WORKING IN THESE SECTORS?*



Source: Mining Industry Human Resources Council; Abacus Data, 2020.

** Total may not add up due to rounding*

The Influence of Community on Students

Negative views are shaped by the people, education and media that contribute to the worldview of young students. During interviews, PSE program administrators and educators indicated that perceptions of mining among the youth are significantly influenced by parents, community elders or teachers, who themselves may hold negative views of the industry:

- Some program administrators reported on their experiences at career fairs, where they witnessed parents who perceived mining to be an undesirable career choice, labeling it "dirty" and "unsafe" work and discouraging students from learning more about mining or enrolling in a mining program. One administrator spoke of an engineering student whose family advised them to choose any engineering specialization they wished except for mining engineering. This was due to a family member's history with mining from decades ago, which left them with negative impressions about the industry's boom and bust cycles, the remoteness of the work sites and the harmful effects on the environment.
- Immigrants, depending on their previous exposure to mining, may view mining disinterestedly, as a niche and lesser-known field or as a thriving industry with opportunities for wealth creation. Opinions may also be shaped by familiarity with mining based on an individual's country of origin. In many instances, immigrants and international students do not take into account mining-centric fields at all, opting instead for what their families perceive to be safer career paths that are more conducive to financial success. On the other hand, mining is more frequently seen as a viable and promising career path by students whose countries of origin have a strong mining presence.

> *"I'm from Chile, which is a big mining country, so I was exposed to mining at a young age […] I became very interested in the Earth and rocks, so mining seemed like the best fit." – Mining Student*

- The influence of high school teachers in promoting certain career paths over others was also mentioned; the typical high school curriculum generally places little emphasis on Earth sciences, and mining is seldom discussed. Moreover, many teachers may themselves have very little exposure to mining and may simply describe it as an environmentally damaging industry.

These findings imply that efforts should go beyond targeting students; mining programs must also garner support from their entire network, including parents, teachers and friends.

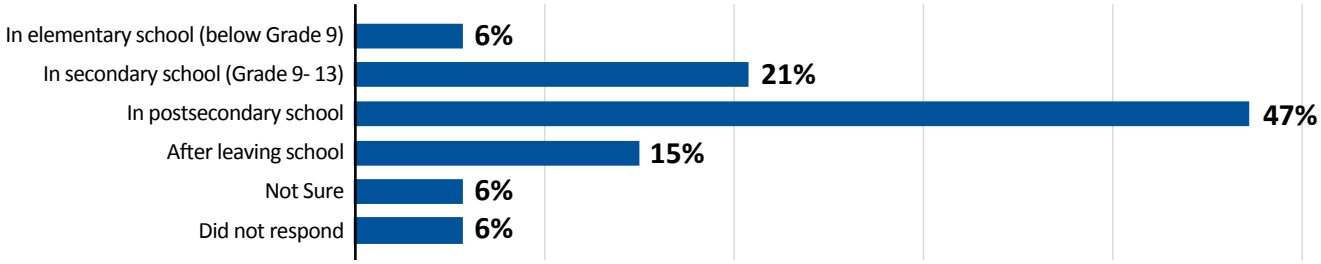
> *"[The mining program] is struggling more. Students don't know what mining is, what it entails, there is negative perceptions surrounding mining… we need to target youth at the high-school level." – Mining Program Administrator*

4.2 LACK OF AWARENESS OF MINING OPPORTUNITIES

"I didn't know about mining until my third year of university [...] I was exposed to mining through my previous degree in geology." – Mining Student

When entering the PSE system and choosing a program, many students are simply not aware of mining as an option. Figure 44 shows results from a survey conducted at the 2023 PDAC Convention, which polled a sample of students in mining-relevant programs, who had attended the convention to learn about career opportunities in mining. Fifty-three students were asked 'When did you first learn about careers in mining or mineral exploration?'; 47% stated they had learned about mining in postsecondary school, and an additional 15% had learned about mining after PSE graduation. Overall, close to two thirds of students who were successfully brought into the mining labour pool and were highly interested in mining (as evidenced by their attendance at PDAC) did not even know about mining when originally choosing their PSE education path. This highlights an opportunity for the industry to reach students at earlier stages of their education, prior to entering the PSE system.

FIGURE 44: RESPONSES OF STUDENTS AT THE 2023 PDAC CONVENTION: WHEN DID YOU FIRST LEARN ABOUT CAREERS IN MINING OR MINERAL EXPLORATION?



Source: Mining Industry Human Resources Council; MiHR PDAC Survey of Students, 2023.

"There is not enough exposure to what mining is, there needs to be more promotion and outreach, students have no idea what a mine is." – Mining Program Administrator

In general, exposure to mining was very limited in students' early education, suggesting it is not often featured in school curricula. As a result, students may not be aware of what the industry can offer in terms of pay, occupational roles, opportunities to travel and work outdoors, and other benefits.

- One administrator stated that youth may decide not to pursue a postsecondary education in mining simply because they have not been exposed to mining and may not know what a mining career entails.

"My family works in mining, so I was exposed to [mining] at a young age. The familiarity attracted me [to pursue an education in mining]." – Mining Student

On the other hand, early familiarity with the industry played a positive role for students who opted for mining-related programs.

- Many of the students interviewed indicated having family members who worked in mining or a related sector, which shaped their view of it as a potential career option.
- Other students recalled their impressions of visiting an underground mine as part of a school trip, describing it as a remarkable experience. A sense of familiarity with the mining industry appeared to help make these students more comfortable when considering it as a possible career path.

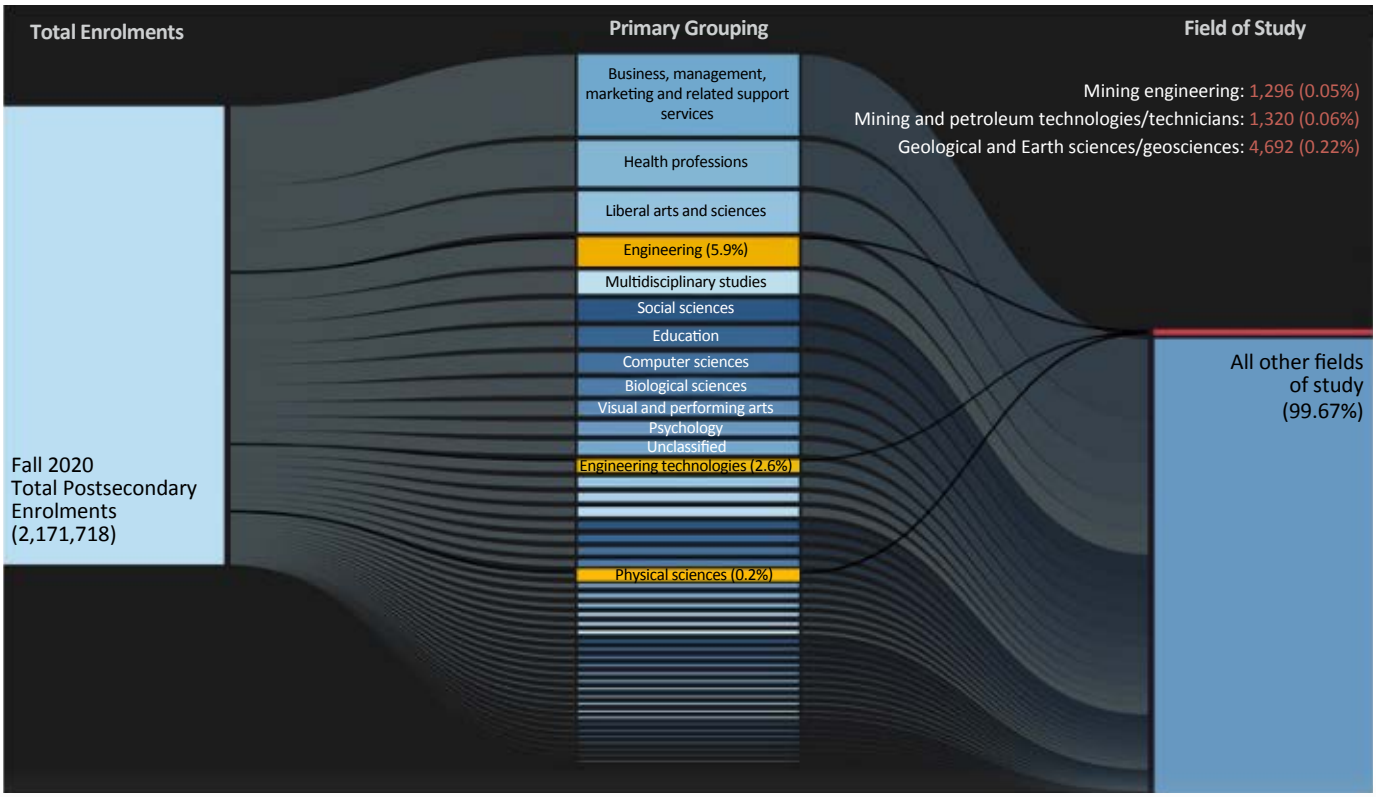
Increasing familiarity with the industry among younger students (alongside parents and teachers), organizing events such as field trips to mine sites, emphasizing the various perks and positive aspects of mining careers, and boosting awareness among the general public will be crucial in attracting more PSE entrants to the industry.

4.3 COMPETITION WITH OTHER PSE PROGRAMS

The Crowded PSE Landscape

As evidenced by the small and shrinking enrolment numbers, mining programs are not among students' most popular choices. The postsecondary landscape is a highly competitive space, with a wide array of program choices vying for the attention of students. In 2020, the three previously examined mining-centric programs accounted for a mere 0.33% out of 2.2 million postsecondary enrolments (Figure 45). Thus, for certain programs, there is a risk of becoming lost in the crowd, underscoring the need to continually strengthen their brand and increase their visibility among potential pupils.

***FIGURE 45:** RELEVANT MINING PROGRAMS AS A SHARE OF TOTAL PSE ENROLMENTS (2020)*



Source: Mining Industry Human Resources Council, 2023; Statistics Canada, Postsecondary Information System (Table 37-10-0186-01).

Mining is Often a Student's Last Choice

Mining programs are frequently the least preferred option when compared to related fields of study, as reflected in their relatively small program sizes. For example, program administrators have observed that when engineering students choose a specialization, mining engineering tends to be their last choice.

The lack of student attraction may be related to the process of PSE program selection:

- After a first year of general studies, engineering students often choose a specialization, and disciplines like mechanical, civil, and electrical engineering are usually the top choices. Mining, metallurgical and geological engineering are consistently the three least popular among engineering disciplines.
- It was discussed by some program administrators and educators during interviews that the engineering curriculum generally lacks sufficient mining-related content in the common first year, which hampers student interest in selecting mining as a specialization in second year. Possible solutions include revising the curriculum and incorporating more mining material to provide better exposure and heighten student interest.
- A program administrator mentioned that personal views about the mining industry from faculty and deans at universities may significantly impact mining engineering enrolments. The extent of support from people in leadership can affect how an entire engineering department prioritizes different specializations.
- Grades play a critical role in the process of selecting a specialization. The first choice is given to students with the highest grades. For the most popular disciplines, like mechanical engineering, the minimum first-year grade required is typically 95% or higher. As a result, the least popular programs will usually enrol students whose preferences are considered later in the selection process, often because of lower grades. This means that these students may choose mining as a specialization not because of interest, but as a fallback option. Ultimately, the inclusion of students with lower grades and lower levels of interest weakens the talent pool of mining engineers, and likely their attachment to the industry.

> *"My grades were not so good, so mining became a viable option. It is not competitive to get into the program."*
> *– Mining Student*

- One program administrator noted that mining and geological engineering are frequently a student's seventh, eighth or ninth choice, implying that the overall number of mining enrolments is an imperfect gauge of the health of the pipeline. Alternatively, the administrator suggested examining the number of students who choose mining as one of their top choices.

> *"What happens in disciplines like mining is that you have those who have it as their first choice, and those who were dumped in there, who want to get the hell out of there. The population of mining engineers will fluctuate year after year, but the number of people who really want to be there is always very low."*
> *— Program Administrator*

- It was also noted that the growing presence of international students in mining-related programs could potentially mask the severity of dwindling enrolment trends in mining engineering. A PSE administrator observed that, in some instances, international students opted for the mining specialization as a last choice to obtain an engineering degree, without intending to pursue a career in the industry. Consequently, the actual level of interest in mining engineering may be even lower than indicated by enrolment figures.
- Program prestige plays a crucial role in students' decision-making process. The perceived value of mining programs is not only influenced by personal opinion or exposure to mining, but it is also shaped by the educational choices of peers. Among engineering disciplines, programs with high prestige such as mechanical or electrical engineering are more competitive and attract the best students, cementing their reputation and making them more attractive to incoming students.

- According to one student, even if there is a genuine interest in a less popular option (such as mining), students are drawn to mechanical engineering due to its reputation as a discipline for highly intelligent individuals. The "pull" of prestigious engineering disciplines often overshadows less esteemed alternatives, leaving mining engineering with a smaller pool of prospective students. This trend highlights the importance of enhancing the reputation and prestige of mining engineering programs to generate greater interest and address the declining enrolment trends.
- Although attrition rates for mining programs were not tracked specifically by those interviewed, educators generally did not consider enrolment attrition (i.e., students dropping out) to be a major problem for mining engineering. They further stated that students who abandon the mining program usually do so early on, once they discover that it is not suitable for them.
- Administrators also stated that many students have no interest in mining but will choose the mining specialization for a period of time, as a means of continuing in the engineering track before moving on to another program or dropping out. The students who remain in the mining program have a high conviction in the mining specialization and are likely to have plans to work in the industry following graduation.

"Some [students] drop out usually early on in the program and leave for other engineering programs such as mechanical, civil, electrical, biomedical. [The university] used to have a general first year engineering followed by four years specialization. Students typically choose the most popular programs after first year. Some students are rejected from popular programs, possibly due to low grades, and then added to low-enrolment programs like mining. These students may not want to be in mining and may enrol for a short period of time as a steppingstone to another program or will drop out." – Mining Educator

Students who remain committed to mining programs exhibit a strong intrinsic drive to pursue mining careers, driven by their genuine passion and interest in the industry, rather than external factors like family expectations or grades. A survey conducted at the 2023 PDAC Convention asked students who had chosen mining-related programs about their reasons for picking their field of study (Figure 46). 83% of respondents considered their interest in the field as a *very important* or *extremely important* factor when choosing their program of study, by far the top reason cited by students. On the other hand, factors such as family input or grades were rated as the least important.

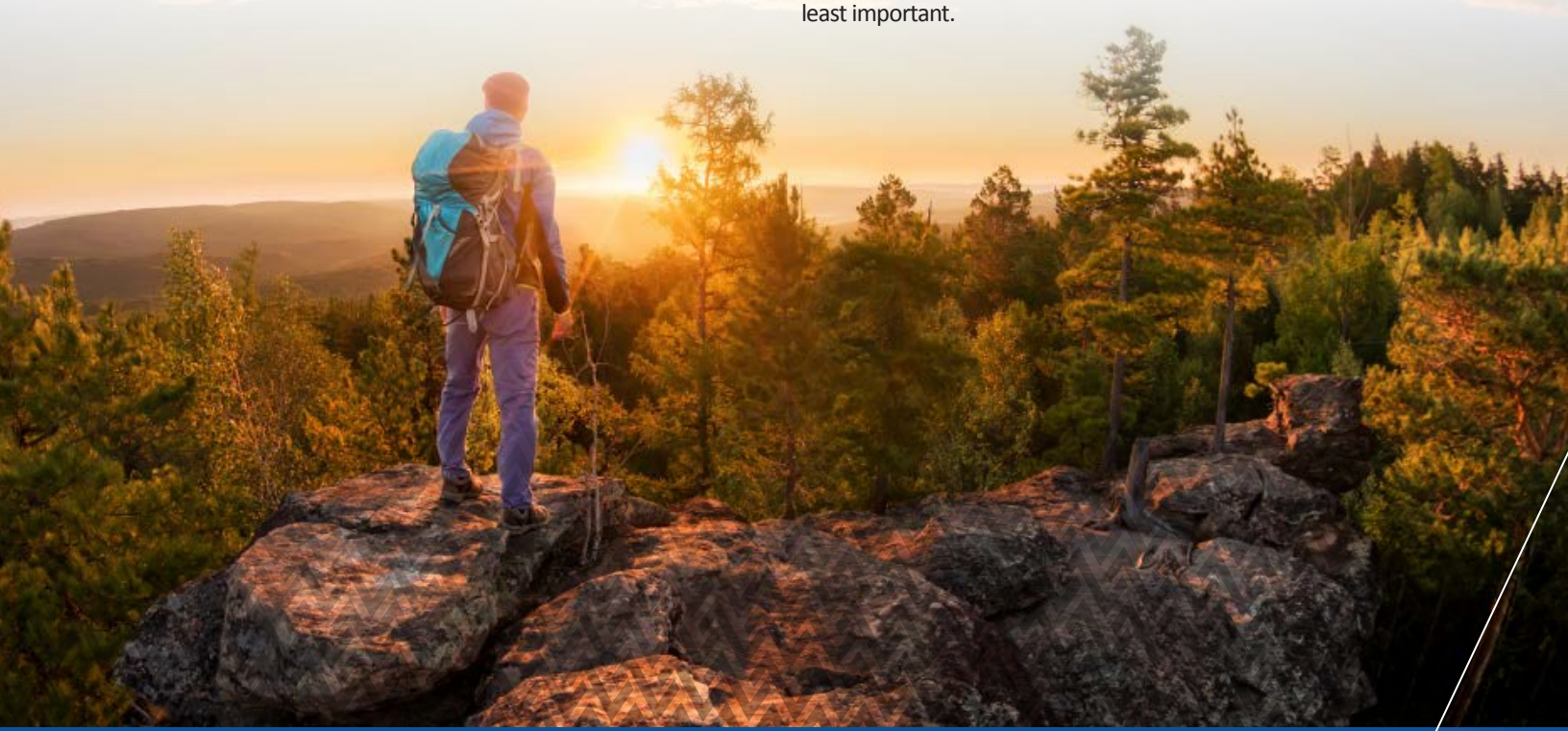
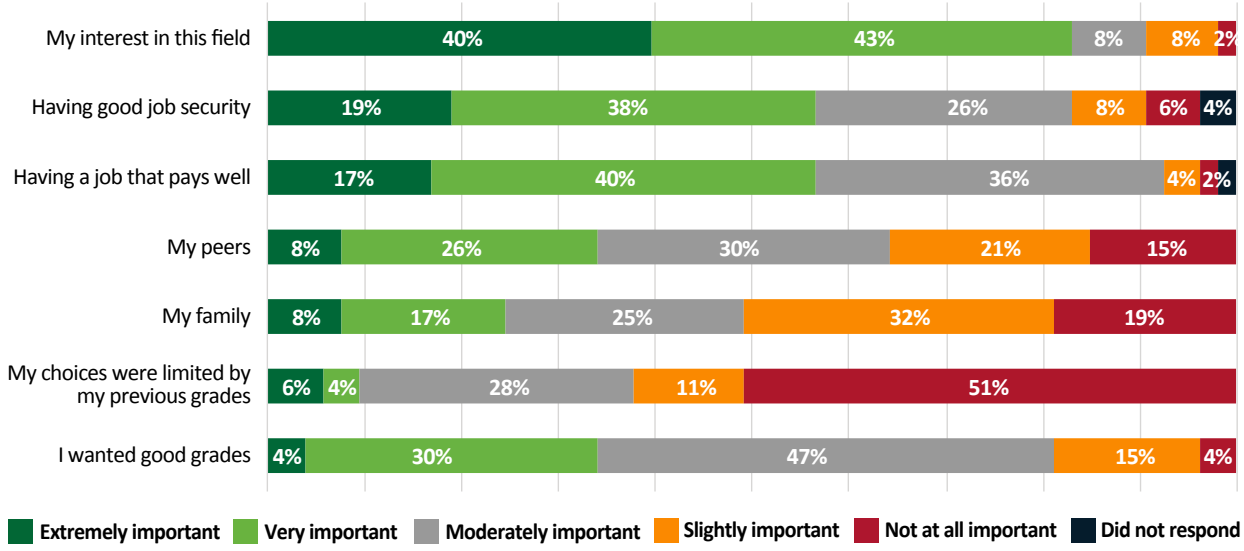


***FIGURE 46:* RESPONSES OF STUDENTS AT THE 2023 PDAC CONVENTION: WHEN CHOOSING YOUR PROGRAM OF STUDY, HOW IMPORTANT WERE THE FOLLOWING FACTORS?**



Source: Mining Industry Human Resources Council; MiHR PDAC Survey of Students, 2023.

What Other Programs Offer

Mining programs face stiff competition for enrolments from other programs, as students often find the offerings and opportunities of those programs more appealing and better aligned with their interests.

- Labour market prospects and job security were cited in interviews as important factors that students consider when choosing a program. The cyclicality of the mining industry, characterized by fluctuating demand and volatile market conditions, can also deter students from pursuing mining programs, as they may perceive the field as less stable and secure compared to other disciplines. This can result in a vicious cycle, where enrolments decline during periods of low demand and economic downturn, resulting in program erosion that makes it more difficult to ramp up enrolments in times of prosperity.
- Co-op experiences are highly valued by students seeking practical work experience and increased competitiveness in the job market. The number and nature of co-op spots available in mining programs often depends on the commodity cycle, which can lead to inconsistent availability and impact students' ability to secure co-op placements. While some educators suggest anticipating the cyclical nature of the industry in planning co-op programs, not all institutions have made co-op experiences mandatory. Limited co-op opportunities in the mining industry may discourage students from selecting mining programs.
- Having a degree that is highly demanded across many industries is an important consideration for students when choosing a PSE program. By committing to a "mining" program, students limit their future career options outside of the mining industry, unlike competing fields of study that offer more versatile career prospects.

4.4 CHALLENGES WITH GEOGRAPHY

The majority of Canada's population lives near large metropolitan areas close to the border, leaving several northern and remote areas with limited access to students, and students in remote areas with limited PSE options. Geography therefore has a major influence on the mining industry's ability to attract incoming students.

Geography Matters to Students

Remoteness makes mining nearly invisible to students living far away from mining-centric places, the majority of whom lack the exposure required to help make mining careers a serious consideration for their futures. Geographic barriers also have varying impacts on different groups. For example, immigrants, often residing in urban areas in Canada, may have limited exposure to the country's often remote mining industry and may not consider it as a viable educational path as a result. Thus, geography affects career choices to the extent that it influences the visibility and availability of different career paths.

> *"We don't see attrition [in the mining program] because we are surrounded by three mines, so the students are aware of the possibility of working in a mine after graduation." – Mining Program Administrator*

Yet living in a mining-centric area does not necessarily lead to enrolment in a PSE mining program. Students from such regions often face limited options when it comes to accessing specialized mining programs. Paradoxically, they may need to move away from their area to acquire the necessary PSE training, where they find many more options to choose non-mining careers.

Furthermore, a program administrator pointed out that students from mining areas may be offered mining jobs at attractive rates of pay immediately after high school. This can cannibalize mining PSE programs, as the industry absorbs potential participants from higher education pathways.

> *"Students leave [the mining program] because they are young, in their early twenties and can easily earn around 60k as their first salary. There is not much incentive to continue studying for three to six years when 60k [a year] is enough [for the student]." – Mining Program Administrator*

Remote and Hybrid Learning

Remote and hybrid learning represents one possible solution to providing PSE training to students who live far from institutions with mining programs. This strategy combines online and in-person components, offering students flexibility by allowing them to access resources and participate in classes remotely, while also giving valuable hands-on experiences during occasional in-person sessions. This approach aims to strike a balance between the convenience of online learning and the necessity of hands-on experiences.

However, the implementation of remote and hybrid learning comes with benefits as well as disadvantages. In interviews, educators expressed concerns about the limitations of online lessons, specifically mentioning the issue of insufficient hands-on experiences and site visits as well as emphasizing that in-person classes offer a more enriching learning experience.

Nonetheless, online access offers flexibility for students, particularly those with full-time or part-time jobs or residing in remote locations.

Expanding this approach may particularly benefit First Nations, Métis and Inuit communities in mining regions and could increase their participation in mining-related training and employment. Remote communities have a greater awareness of the industry, though their access to higher-paying positions is often restricted by the limited range of PSE programs in these areas.

While a few mining programs have adopted remote and hybrid learning, most still do not offer these options, potentially discouraging enrolment from students seeking flexible learning arrangements. One program administrator noted that distance delivery had a positive effect on their enrolment numbers, which was a welcome development given declining enrolments across many rural areas.

> *"The [institution's] mining program's enrolment has been better supported because of flexibility in distance delivery and support for varied work schedules. In general, the in-person programming has struggled with declining demographics… province-wide but accelerated in Northeastern Ontario." – Mining Program Administrator*

4.5 BARRIERS TO EQUITY, DIVERSITY AND INCLUSION (EDI)

As in many male-dominated sectors, the mining industry has historically struggled to integrate people from diverse communities into its workforce. Systemic barriers to diversity in the PSE mining education system may influence underrepresentation and inequities in the mining workforce. During interviews, one PSE administrator remarked on the relative lack of diversity among students in mining engineering programs, suggesting the presence of systemic barriers that make it difficult to attract students from diverse backgrounds. Women, Indigenous peoples, immigrants, 2SLGBTQIA, people with disabilities, and members of racialized and other equity-deserving groups experience a range of barriers when participating in mining programs and the sector.

Mining students were interviewed as to their view of the potential barriers that equity-deserving groups could be facing:

- Several factors may contribute to a negative reputation of mining work, which may deter women from joining mining-related programs and pursuing a career in mining. Students cited the prevalence of harassment on the job site, stereotypes associating mining with male work, and challenges related to fly-in and fly-out (FIFO) work arrangements (particularly for caregivers and their families) as potential disincentives for women to join the industry.

> *"It is not an easy industry for women. It is intimidating and you have to be resilient. Working in operations is more challenging [for women], women can work in head offices or more corporate environments. Harassment is a problem at [my institution] ... Women are afraid to report due to the culture surrounding reporting harassment..." – Mining Student*

- Immigrants, particularly newcomers[14] and international students, may lack the in-roads to community which can make for a positive and fulfilling integration into Canadian society. Specifically for international students, it was discussed during interviews that navigating a different set of social norms, mores and communication styles important for job searching and networking in Canada produced apprehensions regarding the completion of their postsecondary education as well as finding a job after graduation.

> *"It is really who you know and how to network that gets you into the industry. Relationship-building and attending events is very important to secure a career in the industry." – Mining Student*

14 In acknowledging the particular needs associated with immigrating to Canada, the term 'newcomer' is increasingly used to refer to people who have immigrated within the last five years.

- Other barriers discussed by international students were the cap to maximum working hours potentially making it difficult to obtain employment/WIL opportunities, as well as the higher costs associated with living in Canada and studying as an international student.

- Given their growing presence in mining-related programs, there is a critical opportunity to improve supports for international students in their pursuit of a postsecondary education in mining. As one program administrator shared, "*[International students] are the most attentive, they are the most engaged, I can't give them enough information. And they're probably gaining a lot more from the program because they are also learning the Canadian culture, communication of networking, [and about] the Indigenous peoples in Canada…*".

- Barriers experienced by racialized groups, 2SLGBTQIA and persons with disabilities were not specifically identified by student and educator interviewees. However, they also face barriers in the PSE system. For example, harassment and discrimination can be a prevalent factor for these groups as well[15][16][17][18]. Further research is needed to examine systemic barriers that exist within the mining PSE system and when making the transition into the mining workforce.

Aside from reputation and negative perceptions, many of the factors previously mentioned in this chapter could also impact the PSE choices of members of equity-deserving groups and consequently affect representation and inclusion in the mining workplace.

15 *Exploring Aboriginal Inclusion*. Mining Industry Human Resources Council, 2020. https://mihr.ca/wp-content/uploads/2020/03/MiHR_Aboriginal_Report_EN_WEB.pdf

16 *Exploring Immigrant Inclusion*. Mining Industry Human Resources Council, 2020. https://mihr.ca/wp-content/uploads/2020/03/Strengthening-Minings-Talent-Alloy-Exploring-Immigrant-Inclusion-NewLogo.pdf

17 *Exploring Gender Inclusion*. Mining Industry Human Resources Council, 2020. https://mihr.ca/wp-content/uploads/2020/03/MiHR_Gender_Report_EN_WEB.pdf

18 *Report into Workplace Culture at Rio Tinto*. Elizabeth Broderick & Co, 2023. https://www.riotinto.com/-/media/Content/Documents/Sustainability/People/RT-Everyday-respect-report.pdf.

CHAPTER FIVE:
KEY FINDINGS AND POTENTIAL SOLUTIONS

This report examines Canada's PSE system and its ability to support Canada's growing mining labour market. Following qualitative findings from one-on-one interviews and quantitative data from public sources, MiHR identified several issues facing mining-centric PSE programs.

These challenges include the small size of mining programs, their declining enrolment numbers, geographical concentration, unresponsiveness to labour demand, and struggles with accommodating and achieving diversity. Three critical occupations in the mining industry—mining engineers, geologists, and mining technicians—are particularly affected by these challenges.

The analysis also discusses the barriers that limit participation in PSE mining programs and ultimately in mining sector employment. In order to meet the growing demand for skilled professionals and maintain an equitable, inclusive and diverse workforce, it is important for the industry to identify, implement and monitor solutions that strengthen the mining-PSE partnership.

Negative Perceptions of Mining

Findings show that negative connotations surrounding the mining industry, shaped throughout people's formative years, discourage PSE entrants from considering mining-related programs. According to a 2020 poll, young Canadians view mining as the least desirable industry in which to work. These negative views are often reinforced by parents, teachers, academic and community leaders, and the media, who may themselves hold an unfavourable opinion of the industry. It is important to recognize and understand these dynamics to effectively engage and attract individuals from diverse backgrounds to the mining sector.

Recommendations Based on Interviews

- Provide elementary and high school students, as well as youth involved with diverse community organizations, with mine visits and interactions with professionals to better understand what the mining industry entails and generate interest in the industry.
- Actively promote the mining industry's significance and Canada's place as a mining nation, ensuring teachers' enthusiasm and knowledge about mining as well as related careers through changes in the curriculum.
- Organize career fairs and information sessions with mining companies to highlight the benefits of choosing mining as a career.
- For engineering programs, collect data on the number of students who choose mining as their first choice and prioritize efforts to make mining the preferred option among top-performing students.
- Develop a multi-faceted outreach strategy that promotes mining and mitigates unfavourable views by going beyond students, focussing on their networks, including teachers, parents and elders. This should include formal and informal influences, particularly as they serve to support young women, Indigenous youth, 2SLGBTQIA, international students, newcomer youth, young people with disabilities and/or who are racialized.

Lack of Awareness

Many students are not aware of mining as a career option when entering the PSE system. Limited exposure to mining in early education and the lack of current information about the industry contribute to this lack of awareness. On the other hand, familiarity with mining through family members or school trips positively influences students' interest in pursuing mining-related programs.

Recommendations Based on Interviews

- Improve the industry's visibility among younger students, parents, teachers and the general public by facilitating events like field trips to mine sites or by leveraging VR technology, particularly for those living far from mining regions.
- Arrange speaking opportunities involving diverse industry ambassadors able to engage various groups and showcase the sector, including the potential for outdoor work, field experiences and problem-solving.
- Develop and implement focused campaigns directed at particular groups to promote the industry's high level of pay and strong demand for workers, to attract students who value financial stability and career prospects.
- Emphasize the practical and hands-on aspects of mining-related programs, highlighting the variety of opportunities available and the dynamic nature of careers in the industry.
- Incorporate preliminary courses or exposure to mining in common first-year engineering programs (and other fields of study such as earth sciences, computer sciences etc.) to introduce students with diverse interests and skills to the field and gauge their interest.
- Develop "workforce readiness" courses specifically tailored for mining programs to provide students with a realistic understanding of what a career in mining entails.

Competition from Other Programs

Mining programs face tough competition from other PSE programs that offer more attractive opportunities and promising career prospects. The cyclical nature of the mining industry and limited co-op opportunities and related supports can discourage students from choosing mining programs. Additionally, mining programs' reputation and lack of prestige compared to other disciplines have a major impact on students' decision-making process. While attrition among mining students is not a major concern, a poor reputation coupled with the lack of mining-related material in the curricula fails to generate sufficient interest among secondary school and first-year PSE students. Therefore, it is crucial to enhance industry engagement between public educators, PSE institutions and the mining sector to make mining programs more appealing to prospective students.

Program administrators and educators mentioned some of the positive exposure students receive thanks to industry support, including guest lectures, co-op and internship opportunities, fieldwork, and summer jobs. However, almost all program administrators and educators indicated that industry could "always do more" in terms of supporting a sustainable mining program. As one program administrator stated, "*[Mining] companies have the money, but they don't always have the time.*"

Recommendations Based on Interviews

- Revamp the curriculum to incorporate more mining material in secondary school as well as among first year PSE students, providing increased exposure to mining-related topics.
- Develop a strategy to appeal to top students, which could include offering robust scholarships or entrance bursaries to attract students to mining programs.
- Continue to promote a positive perception of mining to the public, i.e., develop videos and advertising that highlight to diverse audiences the innovations and the rewarding careers to be had within the mining industry.
- Provide incentives for industry professionals with practical mining expertise to participate in developing and updating mining program curricula. Engaging qualified individuals was mentioned as a challenge, as their skills are in high demand, and they may not have the capacity or interest to assist with curriculum development.
- Develop a strategy for WIL to be incorporated into mandatory program requirements, for it to be maintained during down times in the economic cycle.
- Develop systemic approaches and supports to ensure that safety and positive experiences are the norm during WIL placements in the mining sector.

- Provide funding to mining programs to ensure economic viability and independence from funding cuts.
- Develop a sectoral strategy to facilitate the attraction, recruitment and retention of engineers from civil, mechanical and electrical programs into the mining sector, by, for example, offering mining engineering streams, concentrations and specializations.
- Analyse the requirements for civil, mechanical and electrical engineering programs in terms of those of mining, metallurgical and geological engineers to understand transferability, complementarity, and ways to address skills gaps.

Geographic Challenges

Attracting students to mining programs can be challenging due to geography, as it affects the visibility and availability of different career paths. Mining is nearly invisible to most students attending PSE institutions near urban centres. Even residing in mining-centric regions does not necessarily lead to enrolment in mining programs, as students in these areas have limited PSE options locally and often move to more highly populated areas to pursue higher education.

Recommendations Based on Interviews

- Collaboration between industry and PSE organizations to expand capacity for remote and hybrid learning within mining programs, with a view to supporting rural and Indigenous learners in remote areas.
- Adapt the curriculum to incorporate and make accessible virtual reality (VR) technology to provide immersive experiences of mines, overcoming geographical barriers for learners in urban areas.
- Explore opportunities for multi-modal learning (e.g., remote/hybrid, segmented, intensive) to meet the needs of learners juggling multiple responsibilities.

Barriers to Equity, Diversity and Inclusion

In the mining industry, as in the broader PSE system, achieving equity, diversity and inclusion poses significant challenges. Much of the lack of representation and diversity within the mining industry is downstream from the issues prevalent in the PSE system. The interviews indicated that experiences of harassment, lack of inroads to Canadian employment networks and unfamiliarity with cultural norms in Canada, as well as a lack of remote/hybrid and other forms of learning, hampered access and success in PSE programs. Systemic and geographic barriers in mining further compound the underrepresentation of these groups in the sector. Finally, negative perceptions surrounding workplace culture, experiences of harassment, and the unique obstacles presented by fly-in and fly-out work arrangements discourage different constituencies from pursuing careers in mining. Addressing these challenges is essential to strengthening the mining labour pool.

Recommendations Based on Interviews

- Develop evidence-based objectives to support the representation of diverse students in PSE programs along with a plan, implementation and monitoring strategy for evaluating the effectiveness of stated objectives.
- Provide resources to integrate diverse student-led groups and associations into school life.
- Offer supports for members of equity-deserving groups during their studies and in the workplace, including access to relevant mentors with experience in the sector.
- Implement trustworthy and effective reporting mechanisms and encourage bystander intervention to mitigate the incidence of harassment while improving safety, generally.
- Foster a culture of respect and accountability (i.e., via trainings) to prevent harassment in PSE programs and in the mining workplace.
- Remove restrictions on working hours for international students and implement pilot programs that facilitate integration into the labour force and contribute to a more inclusive and diverse labour pool. A promising pilot program was recently introduced by the Government of Canada to temporarily remove the 20-hour cap and will be in place until December 2023.[19]
- Implement further resources for international students in terms of financial supports (i.e., accessible scholarships), mentorship initiatives, and assistance navigating Canadian approaches to job searching to support professional networking and career development.

19 *International students to help address Canada's labour shortage*. Immigration, Refugees and Citizenship Canada, 2022. https://www.canada.ca/en/immigration-refugees-citizenship/news/2022/10/international-students-to-help-address-canadas-labour-shortage.html

Overall, the mining-PSE partnership requires significant improvements to better serve the needs of Canada's mining industry. Through extensive stakeholder engagement and data analysis, MiHR has highlighted the critical issues that pose a risk to the talent pipeline and ultimately to the growth of the industry.

This report serves as a resource, providing guidance on how to strengthen the mining-centric programs that supply the labour pool. As mining gears up for a new era of growth in the coming decades, developing an effective PSE strategy will be instrumental in creating a thriving and sustainable future for the industry.