Environmental scan for the Engineers Canada Strategic Plan 2025-2029

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Introduction

In support of the 2025-2029 Strategic Plan, Engineers Canada undertook this environmental scan to provide an overview of the foreseen factors that will have an impact on the engineering regulators, Engineers Canada, and the profession.

To generate this scan, a literature review of internal and external reports, articles, and regulator strategic plans was conducted. Engineers Canada staff were interviewed, and regulators' presentations and strategic plans were consulted. This draft environmental scan was also circulated to the following groups for consultation:

- Canadian Engineering Accreditation Board (CEAB)
- Canadian Engineering Qualifications Board (CEQB)
- Chief Executive Officers Group (CEO Group)
- Engineering Deans Canada (EDC)

This final environmental scan incorporates received feedback for the groups above.

About Engineers Canada

Engineers Canada works on the following ten purposes on behalf of the provincial and territorial associations that regulate engineering practice and engineering license holders:

1. Accrediting undergraduate engineering programs.
2. Facilitating and fostering working relationships between and among the regulators.
3. Providing services and tools that enable the assessment of engineering qualifications, foster excellence in engineering practice and regulation, and facilitate mobility of practitioners within Canada.
4. Offering national programs.
5. Advocating to the federal government.
6. Actively monitoring, researching, and advising on changes and advances that impact the Canadian regulatory environment and the engineering profession.
7. Managing risks and opportunities associated with mobility of work and practitioners internationally.
8. Fostering recognition of the value and contribution of the profession to society and sparking interest in the next generation of professionals.
9. Promoting diversity and inclusivity in the profession that reflects Canadian society
10. Protecting any word(s), mark, design, slogan, or logo, or any literary, or other work, as the case may be, pertaining to the engineering profession or to its objects.

Status of 2022-2024 strategic priorities

As per Board Policy 1.4., Engineers Canada has a three-year strategic plan, which includes the following strategic priorities[1]:

Figure 1: 2022-2024 strategic priorities, by themes

1. Advance the engineering regulatory framework	2. Champion an equitable, diverse, inclusive, and trustworthy engineering profession	3. Uphold our commitment to excellence
1.1. Investigate and validate the purpose and scope of accreditation 1.2. Strengthen collaboration and harmonization 1.3. Support regulation of emerging areas	2.1 Accelerate 30 by 30 2.2 Reinforce trust and the value of licensure	3.1 Uphold our commitment to excellence

These priorities are well-aligned and support the similar objectives and themes that a majority of regulators are tackling, when compared against their own strategic priorities. A review of regulators' strategic plans was performed, when available.

Figure 2: Engineering regulator's strategic priorities and associated themes (as of October 2022)

	Regulatory excellence	Legislative framework	Public trust/ relevance	Public protection	Organizational excellence	EDI (mainly women, may include other groups)	Indigenous partication/ representation	Climate change	Partnerships	Governance
APEGA	■	■	■	■	■					
APEGNB	■	■	■	■	■	■	■			■
APEGS	■		■		■	■				■
EGBC				■	■	■	■	■	■	
EGM	■					■	■	■	■	
ENS	■	■	■		■	■				
EY	■		■	■	■	■	■			
OIQ	■		■	■	■	■		■	■	■
PEO	■				■	■				■

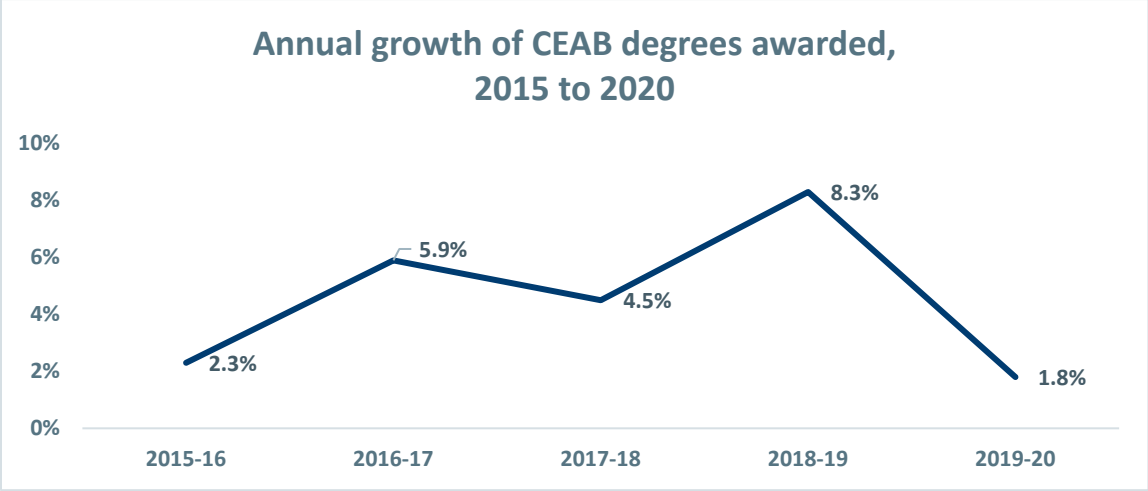
Future trends and projected progress on each of the 2022-2024 strategic priorities

The following section provides an overview of issues foreseen in 2025 and beyond. These trends are not mutually exclusive but rather reinforce each other. Given that current strategic priorities are expected to be completed by the end of 2024, this document includes an overview of the work expected to be completed before the 2025-2029 Strategic Plan commences.

Trends in engineering education and accreditation

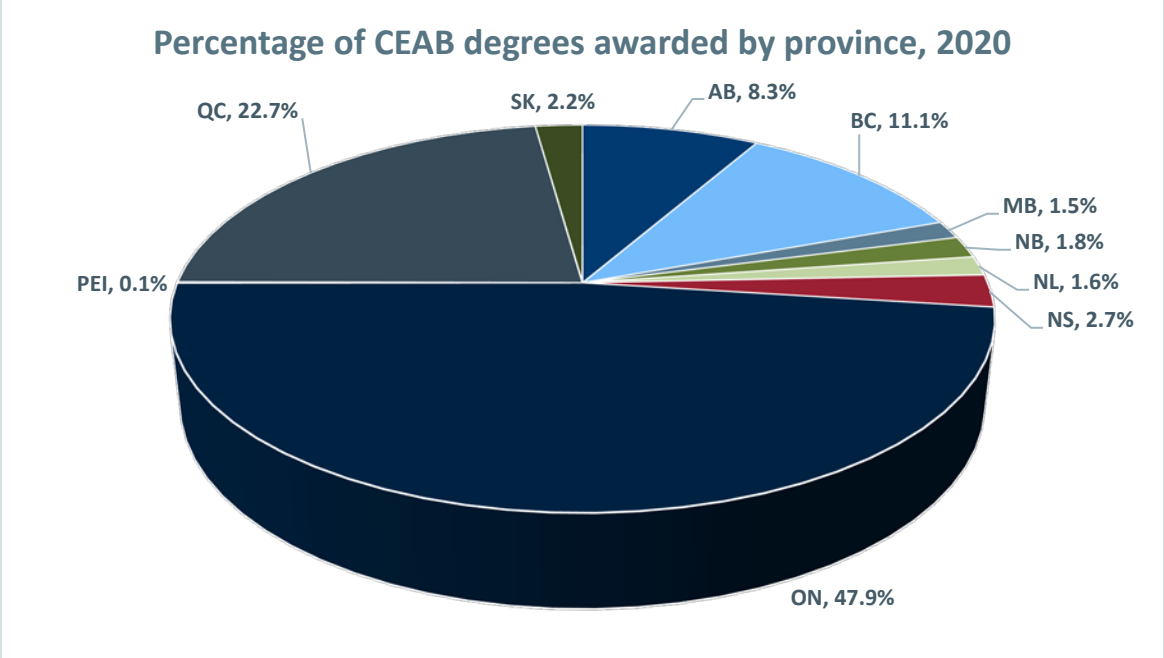
Undergraduate student enrolment in accredited engineering programs totalled 90,311 in 2020. The number of CEAB degrees awarded continues to grow from year to year:

Figure 1: Annual growth of awarded CEAB degrees



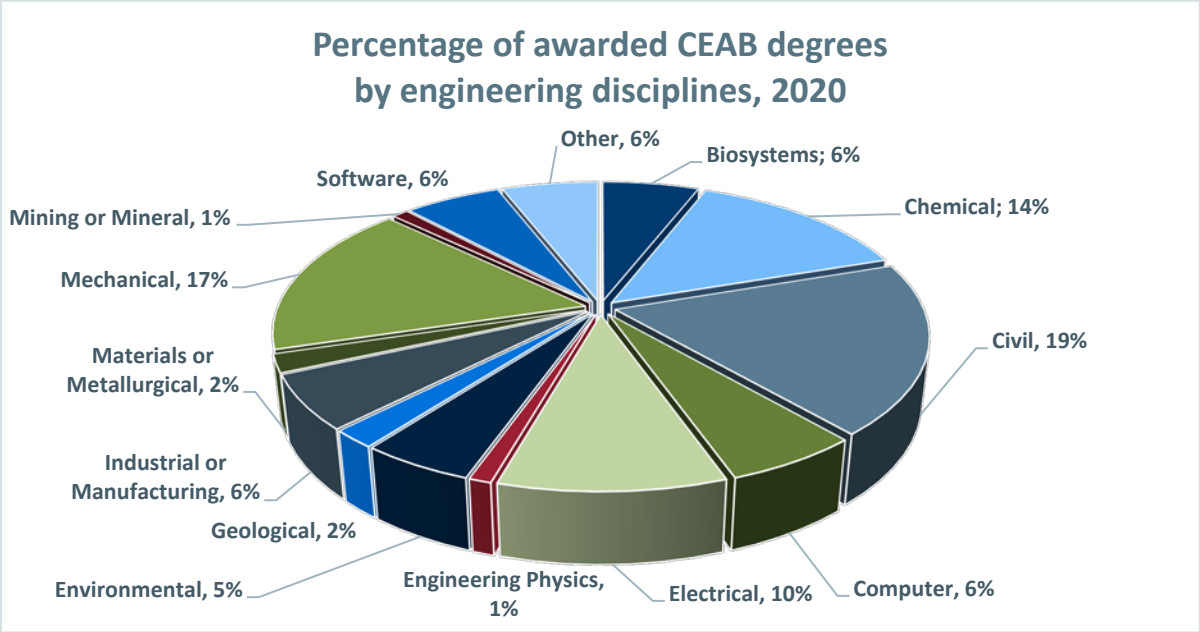
In 2020, Ontario was home to almost half of the CEAB awarded degrees, followed by Québec:

Figure 2: Percentage of CEAB degrees awarded by province, 2020



Civil engineering continues to be the most popular engineering degree, followed by mechanical and chemical engineering.

Figure 3: Percentage of awarded CEAB Degrees by engineering discipline, 2020



Benchmarking against other accreditation systems

In 2022, Higher Education & Beyond[2] conducted a benchmarking exercise of the Canadian engineering accreditation system against similar jurisdictions (Australia, France, Malaysia, and Poland) and similar regulated professions within Canada (information technology and processing professionals, nursing, and social work). Main findings indicate the Canadian engineering accreditation model is similar to others. Differences found indicate that other models include some experimental learning requirement, and the Canadian model is the only one with a minimum path requirement and a time-length input requirement for degree length. It also has less industry involvement than similar accreditation systems.[3]

Offer personalized program delivery and path

Higher education institutions (HEIs)' programs are still designed for full-time students, "going away to college". This model was designed at a time when a small elite accessed higher education. More and more, HEIs are offering a flexibility for students sequentially going from high school to college to university, recognizing prior learning as part of their credits. Digital tools can now be leveraged to verify and keep track of work experience, degrees, disciplines of study etc.[4]

Institutions are increasingly tailoring their programs to attract a variety of students by allowing students to personalize their pathway to obtaining their degrees. Institutions that can leverage technology to be more accessible, efficient, and offer a more personalized form of education will have a comparative advantage.[5] Block teaching delivery can also help make programs more flexible and inclusive to students from varying backgrounds.[6]

Use of competencies in measuring individual attainment of educational objectives

Qualifications frameworks are used by 150 countries to scaffold education and training systems at each level. While their objectives vary, this approach provides various levels to measure individuals' ability to perform a certain job. Focussing on competencies (knowledge and skills) rather than qualifications (awarded education or training documents) to enter programs can also help include learners without formal education. It also allows individuals to take micro credentials or shorter training programs to have these credentials recognize as part of their competency progression.[7]

Some Canadian HEIs are also demonstrating an interest in adopting competencies in the education system. Queen's University,[8] the University of Saskatchewan,[9] and the University of Calgary[10] have successfully piloted two initiatives that used competencies,[11] which required students to demonstrate a certain level of mastery of some tasks before proceeding to the next level.[12]

Offer continual learning and micro credentials for lifelong education

In alignment with continuing professional development obligations, HEIs are also expected to offer more flexibility in education pathways and develop students who will seek lifelong learning opportunities. Increasingly, HEIs are expected to form partnerships with other education providers, companies, or others to deliver tailored information that can be used for varying engineering disciplines.[13]

Increasing proportion of under-represented groups in CEAB degrees

Between 2009 and 2015, the number of Canadians pursuing post-secondary education in Canada went from 1,119,679 to 1,202,765, a 7 per cent increase. During that same period, the number of immigrants pursuing post-secondary education grew from 84,582 to 166,242, a 97 per cent increase.[14]

In 2012, female representation in engineering was 11.3 per cent[15] and 14.2 per cent in 2020.[16] The number of equity, diversity and inclusion (EDI) initiatives offered by HEIs has risen across the country. To attract a more diverse student population, education institutions are also offering more flexible and personalized entry points into their programs. Some are also seeking to address:

- Vertical barriers, which is the ability to join the engineering program, such as removing calculus requirements, or providing formal transfers from technology to engineering programs.
- Horizontal barriers, which is the ability to enter popular engineering fields.
- Internal barriers, such as socio-economic status, caregiving duties, disability(?), which can be overcome by providing additional supports.

Other measures can also include removing biases in engineering design and offering more culturally adapted elements and engineering problems.[17] Engineering education can also include culturally responsible pedagogy, which "refers to teaching diverse students through their ethnic, linguistic, racial, experiential, and cultural identities." [18] Culturally responsible pedagogy can encompass tackling issues specific to under-represented groups or offer different teaching styles such as learning through community rather than in the classroom.[19]

The Truth and Reconciliation Commission's Calls to Action 62 to 65 calls for the acknowledgement that education is typically conducted through a colonial lens, and for the inclusion of Indigenous people in design and delivery of curriculum, and educate students on the history, colonial legacy, and worldview of Indigenous peoples.[20] While some grassroots movements in engineering education are seeking to be more inclusive of Indigenous perspectives, the opposing worldviews between the methods of teaching and learning, and ways to apply science, requires an in-depth look at the assumptions posed by the colonial engineering perspective, which goes beyond the typical work done under the EDI lens.[21]

Increase focus on non-technical skills

HEIs are expected to go beyond teaching technical skills to develop students who solve complex problems within multidisciplinary teams (challenge-based learning), manage and mitigate risks associated with the development and deployment of technology, and master non-technical skills (e.g., communications, leadership, teamwork, and critical thinking). Broadening admission criteria to include non-technical skills can help prepare students for the future while potentially increasing access to targeted diversity groups.[22] A 2022 survey conducted by the Ontario Society of Professional Engineers highlights that while a majority of respondents felt that university prepared them well for technical skills, less than half felt that enough was done by HEIs regarding softer skills, negatively impeding their successful transition in the workforce.[23]

Address students' mental health issues

Engineering programs are also expected to address mental health issues affecting students and to change the culture of excessive workload as a badge of honour or rite of passage.[24] This "superhero" culture of meritocracy[25] can prevent engineering programs from being nurturing environments that attract individuals from diverse backgrounds.[26]

What Engineers Canada is currently doing to address trends in engineering education and accreditation

Accreditation improvement

As part of the 2019-2021 Strategic Plan,[27] the Canadian Engineering Accreditation Board (CEAB) adopted the Accreditation Improvement Program (AIP), which is a coordinated effort aiming to improve the delivery of accreditation and the Enrolment and Degrees Awarded Survey by improving stakeholder communication and consultation, providing training, implementing an improved data management system (the Tandem web application), and introducing a continual improvement process. The objectives of AIP are to improve the performance of the:

- Accreditation management process
- Enrolment and Degrees Awarded Survey process
- Stakeholder consultation process associated with accreditation management and Enrolment and Degrees Awarded Survey

- User experience(s) associated with accreditation management and the Enrolment and Degrees Awarded Survey
- Technical reliability of accreditation and the Enrolment and Degrees Awarded Survey
- Adoption by users when there are changes to the accreditation management and Enrolment and Degrees Awarded Survey processes
- Methods to ensure operationalization of continual improvement[28]

The CEAB also implemented an annual evaluation process to inform continual improvements. The CEAB struck the Accountability in Accreditation Committee and approved the Accountability in Accreditation Evaluation Strategy in 2020. Evaluation results were published in 2021 and 2022. Also, as per Engineers Canada's first purpose, accrediting undergraduate engineering programs, CEAB continues to grant accreditation to HEIs and fulfill its international commitments. This also happened during the COVID-19 pandemic, which required that HEIs and CEAB commit a significant level of resources to deliver engineering education and accreditation through virtual and remote methods.[29]

Reduction of the number of accredited units

To alleviate the workload of HEIs and students, in May 2020 the Engineers Canada Board approved a reduction of the number of accreditation units (AUs) from 1,950 AUs to 1,850 AUs.[30]

2022-2024 Strategic Priority 1.1: Investigate and Validate the Purpose and Scope of Accreditation

This strategic priority includes an assessment of current and future realities of engineering education and a benchmarking analysis of the accreditation system against others, to understand the context. Then, an investigation of a minimum academic requirement for licensure will be conducted that will result in the development of a new or confirmed purpose of accreditation and recommendations to the Engineers Canada Board on a path forward. To alleviate the workload of CEAB volunteers, the Engineers Canada Board assigned this strategic priority to the CEO. It is expected that the Board will adopt recommendations resulting from this project into the 2025-2029 Strategic Plan.

Feasibility study on alternative methods of academic assessment for non-CEAB candidates

The Canadian Engineering Qualifications Board (CEQB) was also directed by the Board to conduct a feasibility study on alternative methods for the academic assessment of non-CEAB applicants for engineering licensure. It is likely that this study will be completed in 2023 and will provide information on options for the academic assessment of non-CEAB applicants.

Trends in addressing barriers and under-representation of marginalized groups in engineering

Barriers to access or the practice of engineering include, but are not restricted to, a lack of:

- Knowledge of the licensing process and what being a professional engineer entails

- Availability of engineering programs locally (e.g., northern communities)
- Employers with staff and leaders from the same under-represented group
- Incentivization by employers to encourage their recent graduates to become licensed
- Mentors from the same under-represented group
- Relevant work in their engineering discipline[31]

The length of time required to become a licensed engineer can be a deterrent, especially for those with limited financial resources, those who are balancing parental leave, [32] or those who are experiencing other life circumstances. In addition, expected but unspoken professional standards tend to favour one group of people over other under-represented groups.[33]

Women's representation in engineering

In 2020, the number of licensed engineers in Canada was 300,605, a decrease of 1.37 per cent since 2019.[34] Women represented 14.2 per cent of the engineering members in 2020. In 2019, women represented 17.9 per cent of all the newly licensed engineers in Canada,[35] whereas in 2020 they represented 20.6 per cent.[36] This is lower than the percentage of female engineers in Europe (41 per cent) .[37]

A survey conducted by APEGA found that female engineers are not promoted at the same rate as their male counterparts (3 per cent compared to 6 per cent), which results in only 24 per cent of female engineers achieving more senior positions. Women are also more likely to leave the engineering profession than men.[38]

A similar trend was seen with salaries, where female engineers earning the same as men at the entry level, but only earning 95 per cent of men's earnings after five to ten years of experience, and only 88 per cent after 20 to 25 years of experience. Across all experience levels, female engineers make 86.7 per cent of the base salary of their male counterparts.[39]

Research shows that lower representation of women in positions of power and authority is not due to an inability to achieve a work-life balance but rather that, in cultures of overwork, they are encouraged to use accommodation measures to achieve a work-life balance while men are not. This results in slower career development or derailment for women and prevent the workplace from providing better work-life balance for all employees.[40]

Representation of Indigenous peoples in engineering

Indigenous engineers earn 5.6 per cent less than their non-Indigenous counterparts across all position levels. Indigenous engineers are disproportionally represented in lower-level jobs.[41] Barriers to Indigenous engineers' entry into the engineering profession include:

- Existing low Indigenous representation in engineering discourages entry into the profession
- Racism
- Lack of pre-existing professional connections
- Lack of support from their engineering regulator to engage in concerted efforts to address systemic racism and discrimination

- Systemic barriers make it difficult managing a work-life balance[42]
- Lack of mentors
- Tokenism
- Lack of commitment from their employers to support their integration and career progression[43]

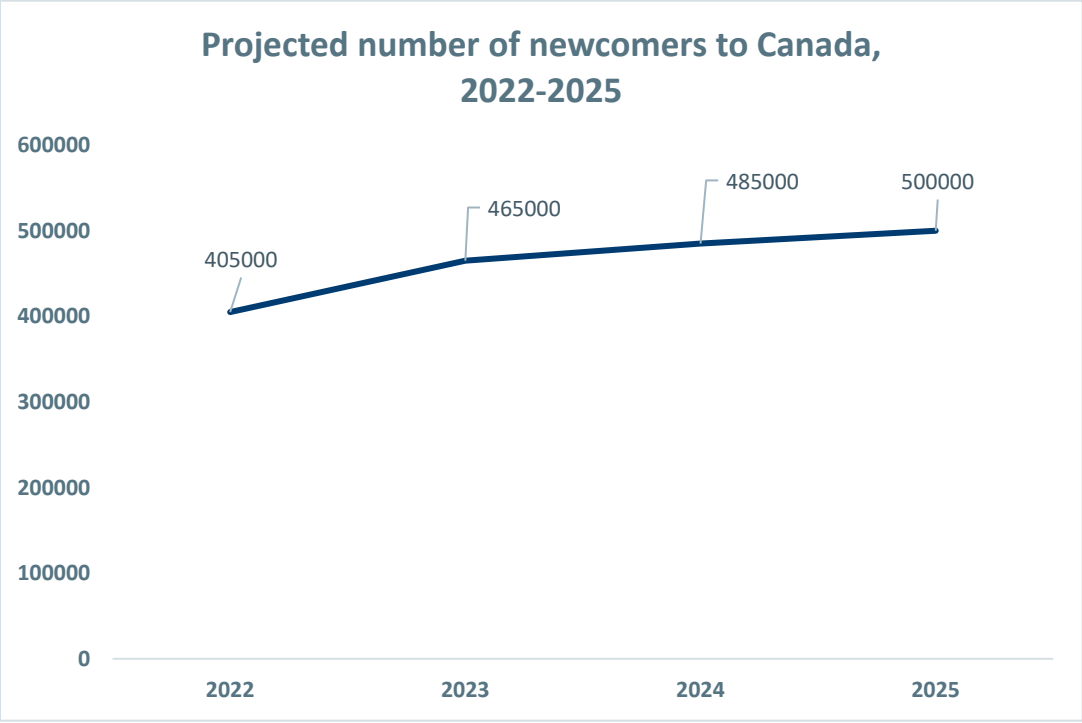
Some individuals report hiding their Indigenous identity in fear of experiencing racism in their workplace.[44]

Representation of immigrants in engineering

Note: The following sections present data from various Government of Canada methodologies and surveys. This report reuses the terminology used by the federal government to ensure accuracy of information. As a result, statistics should not be put in relation one to another unless the same terminology is used.

Canada has been experiencing an increasing number of newcomers, and it is projected to rise steadily from 405,000 in 2022 to 500,000 in 2025.

Figure 4: Projected number of newcomers, 2022-2025[45]



Currently in Canada, immigration accounts for 100 per cent of the increase in labour force and it is projected that newcomers will also be responsible for 100 per cent of the Canadian population growth in 2032.[46] As part of the Global Skills Strategy, Canada has targeted individuals that already have a job awaiting them in Canada (Category A) as well as other occupations including computer and software

engineers (Category B).[47] As the Canadian population ages, the intake of immigrants and a diversity of engineering candidates will be needed to ensure the long-term sustainability of the profession.[48]

In 2016, the percentage of Canadian-born individuals and immigrants working in a STEM field with at least a bachelor's degree in a STEM field was similar (48 per cent and 46 per cent, respectively). However, for those with a STEM degree working specifically in engineering, the difference was much greater, with 66 per cent of Canadian-born individuals compared to 48 per cent for other individuals.[49]

According to an Ontario Society Professional Engineers (OSPE)survey, in 2022, 20 per cent of international engineering graduates in Ontario were not working as engineers nor a field requiring engineering training. 50 per cent of international engineering graduates reported that the licensing process was too expensive, and 71 per cent found schooling too costly. Only 43 per cent of international engineering graduates are working as engineers, compared to 61 per cent for those trained in Canada.[50] Foreign-trained individuals can face the following barriers when seeking to have their experience and education recognized in Canada:

- Cost
- Process length
- Being paid lower than Canadian-educated individuals
- Lack of knowledge about the Canadian engineering regulatory system
- Lack of coordination among federal and provincial organizations[51]

Representation of LGBTQ2S+ people in Engineering

Individuals who are lesbian, gay, bisexual, transgender, and queer/questioning (LGBTQ2S+) are more likely to experience harassment and professional devaluation.[52] Sexual minority Canadians were two times more likely to experience inappropriate public behaviors at work (44 per cent) compared to heterosexual Canadians (22 per cent). Sexual minority Canadians are also more susceptible to declare having poor menta health compared to heterosexual Canadians[53].

Focus on equity and belonging

While representation is an important metric for understanding the current state of the profession, EDI also seeks to increase a sense of equity and belonging among marginalized groups, as defined by them. A focus on equity and belonging can better identify who is being underserved, the points at which this occurs during their career, and the factors and systems that may be responsible for limiting their success in the profession.[54]

Intersectional frameworks must be adopted to understand how all systems of oppression inform one another. For example, not all women have the same experience of womanhood. Some women must also navigate racism, homophobia, transphobia, ableism, etc. The goal of equity and belonging must be achieved through intersectional means.[55]

What Engineers Canada is currently doing to address barriers and under-representation of marginalized groups in engineering

2022-2024 Strategic Priority 2.1: Accelerate 30 by 30

In 2014, the Engineers Canada Board adopted the priority to increase the number of newly licensed engineers who are women to 30 per cent by 2030. Efforts have been ongoing ever since. As part of the 2019-2021 Strategic Plan, under Strategic Priority 3: Recruitment, Retention, and the Professional Development of Women in the Engineering Profession, Engineers Canada published national baseline data, established goals, and created and implemented action plans to address under-representation of female engineers in the profession.

Under this strategic priority, external expertise was hired to conduct research on the perceptions of female engineering graduates and/or women eligible for engineering licensure to identify the barriers that they encounter. Engineers Canada also provide a 30 by 30 report card and needs assessment to interested regulators, and continue to organize a national, annual 30 by 30 conference. It is expected that the Board will continue supporting this work as part of the 2025-2029 Strategic Plan, with a potentially broadened scope that would include other under-represented groups.

Ongoing operational work

As part of purpose 9, promoting diversity and inclusivity in the profession that reflects Canadian society, a strategy was created to raise the profile of the 30 by 30 initiative. A strategy was also developed to increase the representation of Indigenous people in engineering. The collection and release of data is continuing as part of the National Membership Report. Engineers Canada is also continuing to facilitate the work of the Indigenous Advisory Committee and participating in Canadian Indigenous Advisory Council (CIAC) as a voting member at the American Indian Science and Engineering Society (AISES, CIAC/AISES), and as the chair of the Decolonizing and Indigenizing Engineering Education Network (DIEEN) working group. Work is also continuing to implement the Indigenous Inclusion and Reconciliation in Engineering Plan and establishing partnerships on research on women in engineering. Engineers Canada has partnered with several regulators to offer free EDI training. PEGNL reached the threshold of 30 per cent of newly licensed engineers being women in 2021.

As part of purpose 8, sparking interest in the next generation of engineers and fostering recognition of the value of the profession to society, all existing kindergarten to grade 12 outreach programs are being evaluated to ensure that they are supporting our long-term EDI objectives, post-secondary engineering student federations are receiving financial support to provide training at student conferences related to EDI, and new strategic partnerships are being explored with STEM-based organizations that use intersectionality as a framework for youth engagement and engineering career awareness.

The CEQB is also developing a new public guideline for engineers and engineering firms on the topic of Indigenous consultation and engagement and the new public guideline for engineers and engineering firms on the topic of Indigenous consultation and engagement.

Trends in regulatory affairs

The following section provides an overview of trends related to the regulation of engineers, engineering businesses, and the practice of engineering.

Ensuring career-long continuing professional development

The final two provincial jurisdictions that did not have mandatory continuing professional development (CPD), British Columbia[56] and Ontario,[57] have adopted, or will be adopting, requirements, by January 2023.

An increasing number of engineering companies are starting to offer career-long continuing professional development options to their employees, especially in disciplines that evolve rapidly such as software engineering.[58] Canadian HEIs are also promoting life-long continuing education as part of their engineering programs, as well as offering micro credential refreshers. Regulators, educators, associations, and continuing professional development organizations can establish partnerships to deliver continual learning.[59]

To respond to the increasing learning demand, some organizations have adopted learning management systems (LMS), which are software platforms specifically designed to create, distribute, and manage learning content over the internet.[60]

Use of competency-based assessment

As of writing, all engineering regulators (except for PEO) have adopted, or are committed to adopting, pan-Canadian competencies.[61] Canadian engineering are HEIs increasingly interested in adopting competencies in their curriculum.[62]

Regulation of engineering entities

All engineering regulators, except for OIQ, regulate engineering businesses. A review of engineering acts demonstrates that the regulation of entities is typically similar to individual licenses where regulators can set admission, practice, and discipline requirements. Ethics continue to be at the center of discipline matters[63] and setting clear ethical expectations for individuals and entities can help address public and government expectations.[64]

Increased mobility of engineering work

In a post-COVID-19 world, employees will continue to expect the flexibility of working remotely or at the office. As real wages will decrease due to inflation, employers will explore the option to reduce work hours and maintain status quo for salaries. Remote work will increasingly become the norm for knowledge workers, which might not necessarily result in increased retention rates as lower social interactions and the expanding pool of job candidates might increase mobility of staff[65].

Some countries are issuing long-term visas to attract “digital nomads”, individuals residing in a country but working in another one.[66] To lower operating costs, some engineering businesses are transferring

tasks to other Canadian jurisdictions, or other countries.[67] The practice of Canadian engineers is increasingly conducted across provinces, territories, and other countries.[68] Engineering regulation is provincially and territorially defined, requiring regulators to remind license holders of their personal and entities' ethical and professional obligations[69]. Increasingly, the regulation of engineering must consider national and international perspectives to remain effective and relevant.[70]

While it does not currently include engineering, the European Union set up a European Professional Card (EPC), an electronic procedure where members of certain professions can get their documents certified and validated ahead of time so you can work more easily in EU members.[71]

Increasing oversight of regulatory functions

Media articles sometimes question regulators' relevance and requirements as they are perceived as negatively impacting internationally trained applicants.[72] Provincial governments are implementing fairness commissioners to oversee and standardize professions among the regulators within their jurisdictions. First was Ontario (2006),[73] followed by Nova Scotia (2008),[74] Manitoba (2009),[75] Alberta (2020),[76] New Brunswick (2022),[77] and Saskatchewan (2022).[78] In 2022, Newfoundland and Labrador introduced the proposed Fair Registration Practices Act.[79] Relatedly, in 1973[80] Québec created the Office des professions to oversee the standardization of requirements across professions in the province.[81]

There has also been a standardization of oversight and complaints, standards of practice, and codes of ethics across professions being implemented across the country. Prior to the adoption of the Professional Governance Act,[82] replacing the Engineers and Geoscientists Act,[83] British Columbia had adopted the Health Professions Act that regulates 26 health professions and had adopted a proposal to amalgamate oral health professions.[84] A similar path was also taken in Alberta with the adoption of the Health Professions Act, which regulates 29 professions.[85] This was followed by Bill 23, the Professional Governance Act. This bill passed its second reading in May 2022[86] but was postponed after a change in political leadership. If passed, it could replace the Engineering and Geoscience Professions Act.[87]

While it is not clear if this trend will continue in the other provinces, the Manitoba Regulated Health Professions Act, which came into force in June 2022 regulates 20 health professions[88] and the PEI Health Regulated Professions Act[89] came into force in 2021.

Requiring public representation on engineering councils is increasingly being expected and sometimes imposed by the government. Evaluation of regulatory and governance effectiveness is increasing. Competency profiles for boards, metrics to measure regulator effectiveness, and public reporting requirements are increasingly implemented by regulators to demonstrate competence and accountability.[90]

Support public safety

The purpose of self-regulation is to protect the public from a system that otherwise would pose a risk to them.[91] Public interest should be considered as plural, as society is diverse, and citizens have varying interests.[92] The concept of safety is more than physical; it includes psychological and cultural safety.[93]

To counter misinformation and fulfill their duties to protect the public, engineers need to be effective communicators. Engineers' duties go beyond building infrastructure; they need to consider, incorporate, and protect the public in their practice.[94]

Ambiguity of the definition of engineering

The definition of engineering is broad in scope with some variation between regulators. This ambiguity can make it challenging to communicate to the public and governments why an engineer should be hired to perform certain types of work. It also makes it more difficult for engineering regulators to defend themselves when other professions seek to encroach on the exclusive scope of practice of engineers.

For instance, in 2022 New Brunswick Technologists were granted the exclusive right to title and right to practice engineering technology.[95]

As of writing, APEGA is enforcing on the right to title and right to practice of software engineering.[96] The technological sector in Alberta is pushing back arguing that it is not aligned with international job titles and that it is unnecessary red tape hindering its competitiveness.[97].

Eco Canada was pushing for an environmental engineering designation, outside the engineering legislative framework.[98]

Meanwhile, within the next 12 months, new legislation is expected to be tabled in New Zealand that would introduce:

- Mandatory registration for all engineers that would ensure that they meet professional standards and continuous learning.
- Mandatory licensing that assesses a competency that registered engineers will need to practice in high-risk areas, as identified in regulation.[99]

Leverage risk-based or "right-touch" regulation

With limited resources, increasing regulatory obligations, and an ever growing need to demonstrate how their work protects the public, regulators are increasingly turning to risk-based or "right-touch" procedures, processes and policies.[100] According to the UK Professional Standards Authority,[101] right-touch regulation should follow these principles:

- **Proportionate**: Regulators should only intervene, when necessary, remedies should be appropriate to the risk posed, and costs identified and minimized.
- **Targeted**: Regulation should be focused on the problem and minimize side effects.
- **Transparent**: Regulators should be open and keep regulations simple and user friendly.
- **Accountable**: Regulators must be able to justify decisions and be subject to public scrutiny.
- **Agile**: Regulation must look forward and be able to adapt to anticipate change.

These principles need to be aligned with how regulators protect the public[102] and efforts should be focussed on the ethical obligations of engineers of protecting the public.[103] PEO has adopted these principles as part of its 2019 Action Plan to Implement the External Regulatory Performance Review.[104]

Leveraging national or international standards, like the Pan-Canadian Framework for the Assessment and Recognition of Foreign Qualifications,[105] the Lisbon Recognition Convention,[106] or ensuring that jurisdictional requirements match other engineering regulators, can help regulators demonstrate why and how requirements were selected.

What Engineers Canada is currently doing to address regulatory affairs trends

New vision of collaboration and Strategic Priority 1.2: Strengthen Collaboration and Harmonization

In 2022, the Board adopted a new vision for Engineers Canada to advance Canadian engineering through national collaboration. In addition, under Strategic Priority 1.2: Strengthen Collaboration and Harmonization of the 2022-2024 Strategic Plan, the Engineers Canada Board created the Collaboration Task Force, which is leading a national effort to clarify Engineers Canada's mandate for harmonization and collaboration and to develop a national statement of collaboration with all engineering regulators.

In parallel with these efforts, staff are also working with regulators to identify the barriers and opportunities for collaboration. If Engineers Canada received a mandate from all regulators to collaborate, the Chief Executive Officers Group will identify one or more areas of collaboration by 2024.

Ongoing operational work

Engineers Canada has partnered with Geoscientists Canada and Engineers & Geoscientists British Columbia to offer free EDI training.[107] Engineers Canada, in collaboration with Polytechnique Montréal, is also offering free training through the massive open online course (MOOC) on Sustainability in Practice.[108] In addition, work is continuing:

- Purpose 2, facilitating and fostering working relationships between and among the regulators through the national officials groups. Some officials groups have started forming subgroups of five to six regulators to advance certain topics requiring a collaborative approach such including the Software Engineering Collaboration Group, the Competency-Based Assessment Group and the Time-Based Experience Group.
- Purpose 3, providing services and tools that enable the assessment of engineering qualifications, foster excellence in engineering practice and regulation, and facilitate mobility of practitioners within Canada through the staff's work on the National Membership Database (NMDB) and the following upcoming CEQB products:
    - New feasibility study to identify alternative academic assessments for non-CEAB applicants
    - New public guideline on duty to report / wrongdoing
    - New public guideline on fitness to practice
    - Review of the public guideline on good character, the public guideline on conflict of interest, and the public guideline on the code of ethics
    - Review of the agricultural/biosystems/bioresource/food complementary studies, chemical, electrical, mechanical and mechatronic engineering syllabi.

- Purpose 6, actively monitoring, researching, and advising on changes and advances that impact the Canadian regulatory environment and the engineering profession, through the development of research papers and monitoring the regulatory environment.
- Purpose 7, managing risks and opportunities associated with mobility of work and practitioners internationally through the International Institutions and Degrees Database (IIDD), the international accords, and the Engineers Canada Mobility Register, providing tools to regulators to assess non-CEAB applicants, and to engineers seeking to work abroad.

In July 2022, the chief executive officers of all Canadian engineering regulators and Engineers Canada co-signed a statement reinforcing the protected use of software engineer and related technology titles highlighting that there is no jurisdiction in Canada where unlicensed individuals or companies are permitted to engage in software (except Québec) or computer engineering or use titles implying the right to do so (including Québec). A working group of officials was also struck to advance the issue across jurisdictions. The CEQB is also working on updating the Engineers Canada Paper on Software Engineering. Staff, along with regulator's experts, are also developing papers on energy and multidisciplinary engineering. The CEQB has also recently released papers on qualified persons[109] and environmental engineering.[110]

Trends related to value of engineering licensure by the public and government

The following section provides an overview of trends related to the engineering labour force as well as the perception and trust of the public and governments on engineering.

Ongoing media scrutiny

Engineering failures continue to make headlines, such as the Dyck Memorial Bridge collapse in Saskatchewan,[111] the Coquihalla highway collapse in British Columbia,[112] and the Boeing 737 MAX flight system failure.[113] While the media cycle is fast, the requirement of regulators to apply due diligence, and the lengthy process this may entail, can negatively impact their ability to demonstrate how they protect the public. A good example is the Mount Polley tailings dam failure, the largest environmental disaster in Canadian history. The investigation conducted by Engineers & Geoscientists British Columbia took nearly eight years and resulted in two engineers being fined $226,500 and one having a brief suspension and being required to take training.[114]

Ongoing public communication by regulators

Engineering regulators approach public communication with a variety of strategic goals, ranging from notices of significant discipline and enforcement actions, public service announcements regarding how engineering is regulated for the protection of the public, promoting engineering to youth audiences, and showcasing the role of engineers in society.

Several engineering regulators have been executing marketing strategies to raise the profile and trust in engineering regulation. To increase the public's trust, marketing strategies should be focussed on telling a story, align with the values of the target audience, and be tailored to the channel that is used.[115]

Public perceptions of the engineering profession

As part of the research component of the 2022-2024 Strategic priority 2.2: Reinforce Trust and the Value of Licensure, Engineers Canada conducted public opinion research, focussing on understanding the perspectives of opinion leaders and parents. Overall, the findings from this research present a positive picture. Respondents expressed high levels of trust, recognized that engineering is a profession in the same sense as law, medicine, and nursing, and felt strongly that engineers contribute to safe structures, infrastructure, transportation, and the safe delivery of electricity. Indeed, when asked if they've ever met an engineer, almost all parents and opinion leaders say they have. This is more likely to happen in their personal life than their work life. While some might feel that engineering is an "invisible profession", the reverse is true: engineers are a well-known group of professions who are intelligent, disciplined, and command respect.[116]

The challenge is not to introduce Canadians to engineers, but rather to provider a richer picture of the impacts that engineers make. When asked what engineers do, respondents focus on elements related to the process of engineering: planning, design, project management, and construction. There is much less recognition of the societal contribution of that process. In comparison, when people are asked what nurses do, answers revolve around the outcome of their work—they help people—not the process of their work—they insert IVs and monitor vital signs. Future communications work can advance the profession by raising the awareness of the societal impacts and contributions of engineering.[117]

What Engineers Canada is currently doing to address trends related engineering licensure

2022-2024 Strategic priority 2.2: Reinforce Trust and the Value of Licensure

The Engineers Canada Board approved a three-year marketing and outreach project as part of the 2022-2024 Strategic Plan. Strategic Priority 2.2: Reinforce Trust and The Value of Licensure involves working alongside communication and marketing specialists to identify the target audience, develop key messages, and execute a multi-million-dollar, two-year marketing campaign in partnership with regulators.

As campaigns take a long time to change perceptions and require continual efforts to be successful, it is expected that the Board will continue this work as part of the upcoming 2025-2029 Strategic Plan.

Ongoing operational work

As part of purpose 8, fostering recognition of the value and contribution of the profession to society and sparking interest in the next generation of professionals, staff continue to work with partners, such as regulators, the Canadian Federation of Engineering Students, Scouts Canada, Girl Guides and DiscoverE to spark the interest of future generations. On behalf of engineering regulators, advocacy efforts are also targeted toward raising the profile of engineers and their role in protecting public safety with the federal government as per purpose 5, advocating to the federal government.

Market and demographics trends related to engineering

The following section provides an overview of trends related to the engineering labour force as well as the perception and trust of the public and governments on engineering.

Engineering's economic value

In 2022, 36.9 per cent of all Canadian businesses reported difficulty in recruiting skilled employees. That number was 49.5 per cent in construction and 47.4 per cent in manufacturing. The unemployment-to-job vacancy ratio is at a historical low.[118]

Inflation is on the rise as governments' economic stimulation measures due to COVID-19 are reduced, consumer demand increases, international conflict disrupts global markets, and the supply chains remain disrupted. The rise of interest rates to reduce inflation will also slow down Canada's economic growth, projected to be 2.2 per cent in 2022 and 1.3 per cent in 2023.[119] Inflation is expected to return between the targeted per cent before the end of 2024.[120] The war in Ukraine has resulted in higher commodity prices, fueling the Canadian economy. As a result, Canada's real gross domestic product is expected to rise by 3.5 per cent in 2022 and 2.6 per cent in 2023.[121] On the other hand, increasing interest rates and reduced exports to the U.S. might negatively impact the Canadian economy.[122]

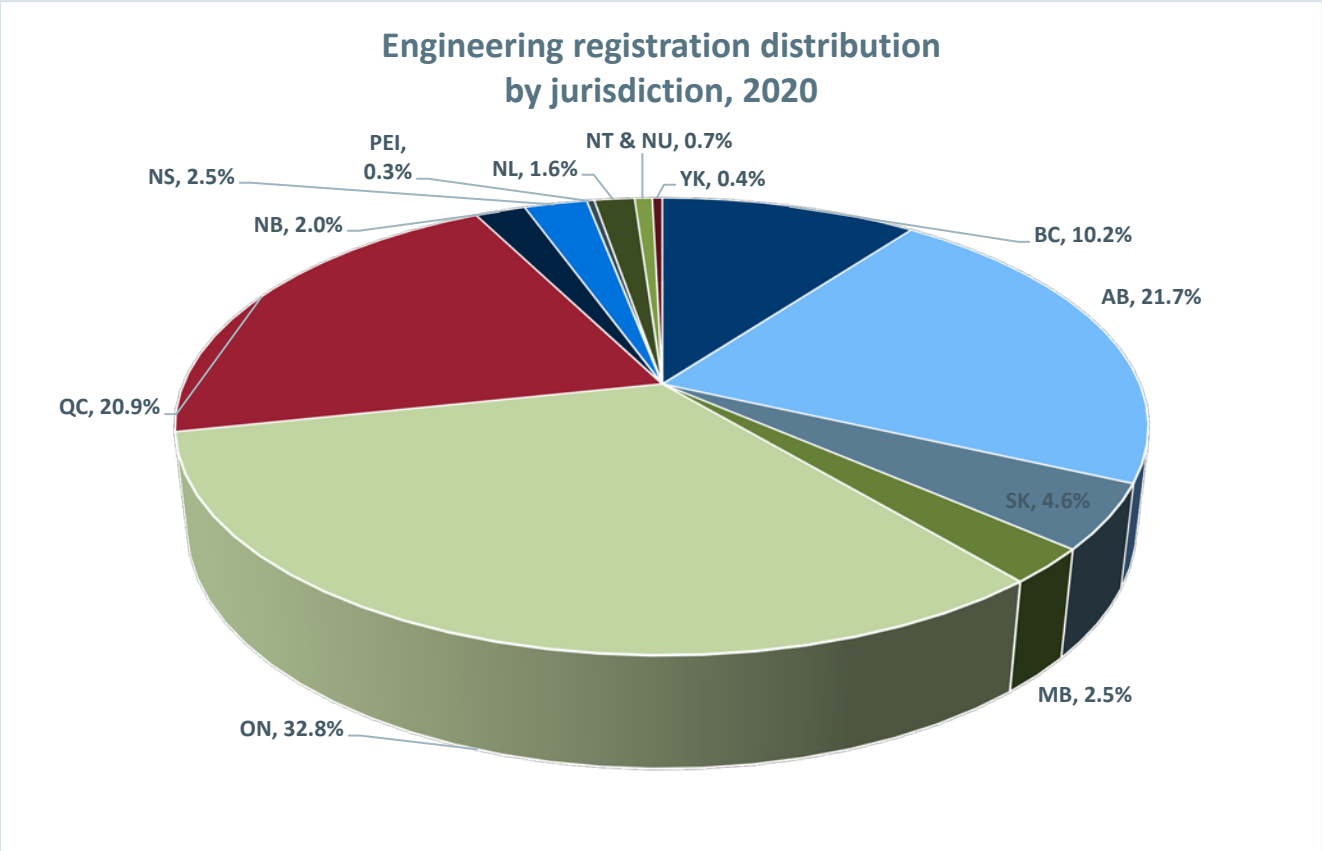
The Canadian economy is expected to continue experiencing labour shortages, which were exacerbated by the COVID-19 pandemic by reducing immigration and increasing retirement rates. While the overall labour turnover is smaller than before the pandemic, organizations will have to hire individuals from other sectors or those with less experience and have to invest more time and money training them.[123]

In 2020, 85.5 per cent of engineering small and medium enterprises were profitable, with an average revenue of $369,000.[124] In 2021, the median salary of an engineer-in-training (EIT) in Atlantic Canada was $65,000, and $85,000 for an engineer,[125] compared to between $56,900 to $59,000 for the general population. [126] By comparison, the median salary for an EIT was $70,050 and $114,000 for an engineer in Saskatchewan,[127] compared to $67,700 for the overall population of that province.[128]

In 2019, in the Canadian population at large, there was one worker aged 25-34 for every worker older than 55 years old, (0.96 women aged 25-34 for one woman aged 55 and older, and 0.86 for men). In Ontario, 29 per cent of employed engineers and engineering graduates were aged between 50-64.[129]

Ontario is home to almost one-third of all licensed engineers in Canada, while Alberta and Québec hold one-fifth of them.[130]

Figure 5: Engineering registration distribution by jurisdiction, 2020



Engineering remained stable from 2015 to 2020 (an increase of 2 per cent) while the number of degrees awarded by CEAB-accredited HEIs increased by 25 per cent during the same period.

A survey conducted by OPSE highlighted that in 2022, 57 per cent of respondents were unsure or disagreed that the engineering field is in touch with the needs of engineering graduates. Female, younger, internationally trained engineering graduates were more hesitant and more likely to think that engineering was not aligned with modern society. While 68 per cent of Canadian respondents said they intended to obtain an engineering license, that number was only 45 per cent for internationally trained engineering graduates.[131]

Figure 6: Number of registrants by regulator, 2015-2020[132]

	BC	AB	SK	MB	ON	QC	NB	NS	PEI	NL	NAPEG	YK	Total	Variation from Year to Year
2015	28643	67476	11815	7617	98818	64045	6503	6336	943	4706	2786	850	**300538**	**N/A**
2016	29503	66668	12142	7598	96333	64912	5691	6575	715	4713	1743	895	**297488**	**-1,0%**
2017	30696	67707	12220	8080	99149	65990	5731	6809	736	5013	1818	965	**304914**	**2,5%**
2018	31233	65190	12618	8101	98866	65533	5742	6937	787	4861	1947	1061	**302876**	**-0,7%**
2019	33387	63049	13304	7764	100783	64664	5911	7228	839	4763	1927	1166	**304785**	**0,6%**
2020	30614	65291	13787	7586	98488	62843	5890	7466	841	4679	1973	1147	**300605**	**-1,4%**

What Engineers Canada is currently doing to address market and demographic trends

Under the 2022-2024 Strategic Plan, Strategic Priority 2.2: Reinforce Trust and The Value of Licensure, in partnership with regulators, Engineers Canada will develop key messages and execute a multi-million, two-year marketing campaign that will include looking into attracting new individuals to the engineering profession.

Trends in addressing a changing climate and ensuring long-term sustainability

Seventy-nine per cent of Canadians voice their concerns regarding the impact of climate change, with 85 per cent certain that it is indeed happening.[133] The Royal College of Psychiatrists in the UK reported that 57 per cent of children and teenagers were distressed about the environment, which is sometimes referred to as "eco-anxiety."[134]

The United Nations (UN) has adopted seventeen (17) sustainable development goals, which lay out a path for areas of focus. One of these sustainability goals is the electrification of the world. New regulation, increasing consumer demands and companies' innovation are driving this increasing market demand.[135] The International Engineering Alliance has updated its Graduate Attributes and Professional Competencies (GAPC) framework to include the UN's sustainability goals.[136] Showing linkages with

human activities and building the UN's sustainable development goals into education curriculum can help.[137]

Several aspects are part of engineering practice, including gender equality, clean water and sanitation, affordable and clean energy, industry innovation and infrastructure, sustainable cities and communities, responsible consumption and production, climate action, and life below water and on land.[138] In response, Engineering Deans Canada has adopted six Canadian Engineering Grand Challenges:

- Resilient infrastructure
- Access to affordable, reliable, and sustainable energy
- Access to safe water in all communities
- Inclusive, safe, and sustainable cities
- Inclusive and sustainable industrialization
- Access to affordable and inclusive STEM education[139]

Canada has aging infrastructure.[140] This provides an opportunity to modify designs to consider a changing climate and make them more efficient.[141] Setting expectations for engineers tied to the sustainable development goals could have a significant impact on addressing climate change.[142]

As per their code of ethics, engineers are responsible for holding paramount the safety, health, and welfare of the public and the protection of the environment.[143] Many professional associations are highlighting what their governments can do, including incorporating climate change in decision-making, sharing best practices, clarifying professional obligations in that area of practice and in their code of ethics, and working in partnership with other professional associations to address impact.[144]

Engineering failures can have a significant ecological impact.[145] There is a need to assess the impact of engineering on nature and instill that in engineering education.[146] Sustainable development should be incorporated in engineering practice and the workplace.[147] Some organizations intend to become carbon neutral to meet the UN 2050 target.[148]

Several organizations are implementing environmental, social, and governance (ESG) tactics and reporting on them in support of sustainability. Over 92 per cent of Canadian companies now report on sustainability with leading sectors being financial services, industrial, manufacturing and metals, and utilities.[149] In Europe, the "flight shame" movement seeks to push travelers to adopt more ecologically friendly practices such as using the train instead of air transportation to travel and decision-makers are considering adding taxes to fund eco-friendly alternatives to air transportation.[150]

What Engineers Canada is currently doing to address climate change

Support for sustainable practice of engineering

Engineers Canada, in collaboration with Polytechnique Montréal, is also offering free training through the massive open online course (MOOC) on Sustainability in Practice.[151] The CEQB has also published the following papers and guidelines that apply to the environmental field:

- Paper on environmental engineering

- Principles of climate adaptation and mitigation for engineers
- Site remediation for engineers
- Sustainable development and environmental stewardship for engineers.

Trends in technological changes

Technological changes, artificial intelligence, new practices, and emerging engineering disciplines happen faster than regulation can adapt.[152] The use of personal assistive technology is increasing, which requires a focus on ensuring it works properly and is safe in a home environment.[153] Digital tools can help validate and keep track of credentials.[154] Engineering is not one of the professions most likely to be replaced by robots in the future.[155] It is expected that the automation of tasks will enable managers to focus on the people management, and wellness will be at the center of performance metrics for organizations.[156]

Engineers need to be more than the designers of technology, but also be its stewards.[157] Engineers can help combat fake news with fact-checking tools.[158] Ensuring that individuals developing safety-critical software are registered, bounds individuals to a code of ethics that can help protect the public.[159] This includes licensing and enforcing software engineers.[160] Offering licensing paths adapted to emerging engineering disciplines and entrepreneurial practice and setting up forums to discuss technological advancements could help ensure that regulators remain relevant.[161]

Updating legislative requirements to meet new demands is another solution that can be pursued by regulators. They could also develop a regulatory framework (such as demand-side legislation) that allows for the regulation of non-traditional engineering disciplines[162] while fulfilling their mandate to protect the public by ensuring that engineers and engineering entities meet their ethical and practice obligations and sanctioning those that do not.[163] Engineers & Geoscientists British Columbia has released a guideline on the development of safety-critical software.[164]

What Engineers Canada is currently doing to address technological changes

2022-2024 Strategic Priority 1.3: Support Regulation of Emerging Areas

This strategic priority will identify and investigate new and overlapping areas of engineering practice that will have a long-term impact on the public. The CEQB is also updating its Paper on Software Engineering.[165]

These two areas of work fall under ongoing operational work and the Board decided to make it a strategic priority to raise its visibility. Whether the Board decides to carry the work forward in the 2025-2029 Strategic Plan or not, this work will continue under purpose 6, actively monitoring, researching, and advising on changes and advances that impact the Canadian regulatory environment and the engineering profession.

Long term financial viability

Engineers Canada has two main sources of revenues, a per capita fee for each registrant of the member regulators and the TD Insurance affinity program. To a lesser extent, Engineers Canada also receives revenues from its investment funds.

- **Per capita fees** are adopted by Members two years in advance. Over the last few years, per capita fees have been gradually reduced.
- **TD Insurance** has partnered with Engineers Canada and several regulators to provide insurance products to engineers. In the past, The Engineers Canada portion of profit from each policyholder was split between Engineers Canada receiving 51 per cent and regulators receiving 49 per cent. The current agreement stipulates that for every new policyholder, Engineers Canada receives 10 per cent and the regulator 90 per cent. This is expected to lead to a decrease of 1 per cent in revenues per year over time. In addition, every year, PEO makes a decision whether or not to join the agreement and receive its revenue share. So far, it has chosen to not avail itself of the revenue, which is returned to Engineers Canada and held in its reserve funds (due to the time of the year when the decision is made). The TD Insurance contract is due for renewal in 2030. The Finance, Audit, and Risk Committee (FAR) has decided to conduct a long-term financial viability study in 2026, prior to Engineers Canada starting the negotiation process with TD Insurance.

Conclusion

This environmental scan presented trends that could impact Engineers Canada, engineering regulators, and the profession. This document also highlighted ongoing work that is conducted as part of the 2022-2024 Strategic Plan. It is expected that this information will support the development and strategic priorities selected as part of the upcoming 2025-2029 Strategic Plan.

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