Path Forward Report

Futures of Engineering Accreditation

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In partnership with: Coeuraj

Introduction letter

The Futures of Engineering Accreditation (FEA) Path Forward Report contains the 18 recommendations of the FEA project. The recommendations account for the needs of diverse interest holder groups, all of whom share an interest in a Canadian accreditation system that preserves what makes it exceptional while embracing new opportunities and addressing evolving realities within the Canadian engineering ecosystem.

The FEA Path Forward Report presents a case for change gathered from research and engagement with interest holders and proposes shifts to the accreditation system aimed at addressing the opportunities that were identified throughout these engagements. Readers of this Report will note that some recommendations propose changes to the engineering accreditation system itself, while others describe approaches to support lasting change or to institute baseline evolutions to enable success. By striking this balance, the FEA project aims to establish a way forward that is focused above all on achieving the right outcomes.

The Report's publication is the final deliverable in the Engineers Canada strategic priority 1.1 'Investigate and Validate the Purpose and Scope of Accreditation' and provides a template of possibilities for the move into the next Strategic Plan. Should the Engineers Canada Board decide to proceed by accepting all or some of the recommendations, work remains to develop the details of the proposals and determine how they could be implemented. This work would be carried out through further collaboration with interest holders.

Engineers Canada and the FEA Project Team, including the FEA Project Steering Committee, would like to thank all the people from across the Canadian engineering ecosystem who have contributed to this Report.

Sincerely,
The FEA Project Steering Committee

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Abbreviations and Acronyms

AinA	Accountability in Accreditation
APEC-EA	Asia-Pacific Economic Cooperation – Engineer Agreement
APEGA	The Association of Professional Engineers and Geoscientists of Alberta
AU	Accreditation Unit
CBA	Competency-based assessment
CEAB	Canadian Engineering Accreditation Board
CEQB	Canadian Engineering Qualifications Board
CPD	Continuing professional development
EDC	Engineering Deans Canada
EIT	Engineer-in-training
FEA	Futures of Engineering Accreditation
FSCP	Full Spectrum Competency Profile
GA	Graduate Attributes
HEI	Higher education institution
IEA	International Engineering Alliance
IPEA	International Professional Engineers Agreement
JTA	Job task analysis
MEL	Measurement, evaluation, and learning
NARL	National Academic Requirement for Licensure

Executive summary

The Futures of Engineering Accreditation (FEA) project is an initiative by Engineers Canada, and part of its 2022-2024 Strategic Plan. The objective of the FEA project is to leverage the insights, perspectives, and expertise of members of the Canadian engineering ecosystem to examine the current accreditation system, understand how it is serving contemporary needs, and consider how it can chart a new path for the future of the engineering profession in Canada.

A pivotal milestone in the FEA project, this Path Forward Report describes the work undertaken since 2021 to investigate and validate the purpose and scope of accreditation. Drawing on the research conducted by the Engineering Education and Benchmarking Task Forces, engagement with interest holders, insights from the Purpose Task Force and the Academic Requirement Task Force, and the Steering Committee's expertise, this Report presents recommendations to the Engineers Canada Board to guide the evolution of the accreditation system. It recommends actionable plans for closing the gaps between the current system and the envisioned future state.

This Path Forward Report is a strategic blueprint for the future of engineering accreditation. It proposes a revised purpose of accreditation and scope statement with associated parameters for a revitalized accreditation system, anchored in a recommendation to transition to a fully outcomes-focused model. The Report also recommends the development of a Full Spectrum Competency Profile (FSCP) to serve as a national framework for assessing all licensure applicants, a subset of which forms a National Academic Requirement for Licensure (NARL). The Report marks the beginning of a transformative journey, the ultimate effects of which remain to be determined. A clear vision has emerged through the years of the FEA project work, although many of the specific implementation details remain to be defined.

The Path Forward Report is broken down as follows:

- The first section includes a list of consolidated recommendations.
- About the FEA project introduces the project, including its objectives, development phases, and key milestones. It also details the collaborative (co-design) approach that has served as the guiding framework for this project. It unpacks five core principles behind this approach, including the concept that people love what they design and own what they create.
- What the future of engineering could look like envisions the potential future landscapes for the profession to prompt reflection on how the engineering ecosystem should evolve.
- Strengths of the current accreditation system explores how these can be leveraged and built upon to inform future system enhancements.
- Purpose of accreditation reflects the work of the Purpose Task Force. It covers the pressing challenges necessitating a system change and outlines the revised purpose and scope statements, as below:

  The purpose of accreditation

  > *Accreditation provides assurance that an engineering program is designed and delivered such that its graduates meet the academic requirements to be licensed as professional engineers in Canada.*

  The scope of accreditation

  > *The accreditation review process includes evaluation of the curriculum as well as those factors which enable the design and delivery of the program, including human and financial resources, the learning environment and facilities, and quality control mechanisms.*

  This section also emphasizes more balance among the three focuses of accreditation: engineering programs, students, and regulators. It proposes design parameters for the future accreditation system, integrates insights from project engagement and research to support the system changes, and provides recommendations for building the envisioned future accreditation system.
- The next section builds on the Academic Requirement Task Force's work to define the Full Spectrum Competency Profile (FSCP) and its potential to promote equitable access to the engineering profession. As a competency framework, the FSCP outlines the essential knowledge, skills, and attributes required for successful engineering practice throughout an engineer's career. Encompassing 34 competencies across eight domains, it spans the entirety of an engineer's career journey, from undergraduate studies through post-graduate experience to post-licensure. To illustrate the progressive nature of competency acquisition, the section also references Miller's Pyramid of Clinical Competence, which maps the learning journey from foundational knowledge ("knows") to expert-level application ("does").

- The National Academic Requirement for Licensure (NARL) focuses on a subset of competencies from the FSCP that engineering graduates should possess at the "knows-how" level of Miller's Pyramid upon program completion. The section includes insights from project engagement research supporting the FSCP, and outlines strategies for refining the FSCP to meet the needs of the accreditation and licensing systems.
- Developing a competency framework outlines how to advance the FSCP using a Job-Task Analysis (JTA) approach.
- The FSCP Pilot Study and its associated Terms of Reference describe a pilot study that will select a subset of the FSCP competencies, develop assessment processes, and make recommendations for future implementations of the FSCP and NARL. To ensure a well-rounded perspective, a diverse working group will be established.
- The implementation approach. This multifaceted section covers essential components to propel the project forward, including:
    - Change management: Strategies to effectively navigate the complexities of such a large-scale transformation.
    - Governance: Principles for evolving towards a more inclusive and accountable model.
    - Core values: To guide implementation of the recommendations in this Path Forward Report.
    - Short-term actions: For early 2025.
    - Long-term actions: For later in 2025 and beyond.

Consolidated recommendations

The complete recommendations appear below. Page references in square brackets indicate where the recommendations can be found in the report.

ACCREDITATION SYSTEM STRENGTHS

1. Identify and strategically integrate the system's current strengths into the future framework. [page 18]

PURPOSE AND SCOPE OF ACCREDITATION

2. Endorse the revised purpose and scope of accreditation statements. [page 23]

DESIGN PARAMETERS FOR THE FUTURE ACCREDITATION SYSTEM

3. Adopt the outlined design parameters as a fundamental framework for the future accreditation system. [page 27]

OUTCOMES

4. Mandate a shift to an outcomes-focused accreditation as a cornerstone for future system change. [page 29]
5. Remove criteria related to the measurement of curriculum content with Accreditation Units (AUs). Focus on Graduate Attributes until a transition to the Full Spectrum Competency Profile can be completed. [page 29]

MINIMUM PATH

6. Retire the concept of the "minimum path". [page 30]

FACULTY LICENSURE

7. Accept some of the recommendations presented by the Canadian Engineering Accreditation Board (CEAB) to address faculty license requirements, including:
    a. The CEAB should endorse the principle that engineering programs must have substantial and meaningful involvement of licensed professionals in the education of future professionals.
    b. The CEAB and visiting teams should interpret existing accreditation criteria related to the role of the professional engineer in the instruction of students in a manner that allows HEIs to have more flexibility with respect to mechanisms to facilitate

substantial and meaningful involvement of licensed professionals in the engineering education process.

c. The CEAB must require Higher Education Institutions (HEIs) to demonstrate that graduates have developed the expected level of understanding of, and commitment to, professionalism.

d. The CEAB remove the Specific AUs criteria and the requirement for the significant design experience to be conducted under the professional responsibility of licensed faculty. [page 31]

8. Explore the development of alternate ways for HEIs to demonstrate that students enrolled in engineering programs have substantial and meaningful involvement with licensed professionals. [page 32]

PROGRAM EXCHANGE

9. Formalize the CEAB's Temporary Exemption for Students Going on International Exchange by permanently integrating its core principles into accreditation policy. [page 33]

EDUCATIONAL CURRICULUM AND LEARNING ENVIRONMENT

10. Evaluate the feasibility of accepting HEI evaluations from provincial quality assurance bodies to streamline CEAB processes while maintaining compliance with the Washington Accord. [page 33]

RETURN ON INVESTMENT

11. Maximize the return on investment for all interest holders by incorporating new core values into the accreditation system, including co-design, collective stewardship, and more representative governance. [page 35]

FULL SPECTRUM COMPETENCY PROFILE (FSCP) PILOT STUDY

12. Initiate a pilot study to evaluate the feasibility of the FSCP according to the proposed Terms of Reference. [page 56]

SUBSTANTIAL EQUIVALENCE

13. Ensure that the FSCP, including the National Academic Requirement for Licensure (NARL), is substantially equivalent to the International Engineering Alliance (IEA) Graduate Attributes and Professional Competencies benchmark. [page 57]

CHANGE MANAGEMENT

14. Establish a dedicated task force to develop a change management plan for the strategic implementation of outcomes-focused accreditation. This plan should encompass the sequence of tactical steps to move from the current state to the desired state and address the potential emotional and psychological experience of change. [page 60]

GOVERNANCE

15. The Engineers Canada Board should establish two distinct bodies in accreditation: a policy body responsible for setting strategic direction, and an operational body focused on execution of policies. [page 61]
16. Establish a new dedicated oversight body for the FSCP. [page 61]

INDUSTRY ENGAGEMENT

17. Establish regular engagement opportunities with industry, leveraging existing mechanisms to gather ongoing feedback and insights. [page 63]

CORE VALUES

18. Adopt the outlined core values to guide implementation of these recommendations. [page 66]

1. About the Futures of Engineering Accreditation

The Futures of Engineering Accreditation (FEA) project is an initiative by Engineers Canada and is part of its 2022-2024 Strategic Plan, specifically to investigate and validate the purpose and scope of accreditation (Strategic Priority 1.1).

The objective of the FEA project is to leverage the insights, perspectives, and expertise of members of the Canadian engineering ecosystem to examine the current accreditation system, understand how it is serving contemporary needs, and consider how it can chart a new path for the future of the engineering profession in Canada.

The strategic priority aimed to bring together the diverse perspectives of the Canadian engineering ecosystem to create an accreditation system that moves everyone forward together. Expected project outcomes included:

1. All interest holders understand the **purpose of accreditation.**
2. Regulators have an **academic requirement for licensure**, applicable to all.
3. Engineers Canada, including the Canadian Engineering Accreditation Board (CEAB) and Canadian Engineering Qualifications Board (CEQB), have **direction to implement systems** aligned with the purpose and the academic requirement for licensure.

This project was undertaken in partnership with Coeuraj, a design and facilitation consultancy. The "project team" included Engineers Canada staff and Coeuraj personnel.

The FEA Steering Committee presents this Path Forward Report to capture the key learning from the project and offer recommendations to the Engineers Canada Board to shape the evolution of the accreditation system in 2025 and beyond.

Project participants

The FEA project engaged a dynamic group of volunteers from across Canada with a range of expertise. Both organized groups and individual contributors from the engineering ecosystem provided invaluable knowledge to inform and guide the project.

Organized groups included:

- Academic Requirement for Licensure Task Force
- Benchmarking Accreditation Task Force
- Engineering Education Task Force
- Purpose of Accreditation Task Force
- Regulator Advisory Group
- FEA Steering Committee

In addition to the organized groups, more than 700 interest holders participated in FEA activities through more than 35 engagements across Canada.[1] Each contributor brought a unique perspective to the project and strengthened the research and insights about the accreditation system.

Project journey

FEA was a multi-year project with different phases. Key activities included:

- Benchmarking the Canadian accreditation system and investigating a minimum academic requirement for licensure.
- Conducting a fundamental review of the current accreditation system and re-examining its purpose in the context of the overall licensure system.
- Gathering the different perspectives of the Canadian engineering ecosystem to shape future evolutions of accreditation to best meet society's needs.
- Delivering this Path Forward Report, which provides direction to Engineers Canada, including the CEAB and the CEQB, on implementing systems aligned with the purpose of accreditation and the academic requirement for licensure. This Report explains the future direction and presents recommendations to close the gaps between the current and envisioned future state.

Figure 1 is the FEA journey which graphically represents the project's progress since 2022. A version of this journey map expanding on the major activities, learnings, and decisions is in [Appendix A](#).

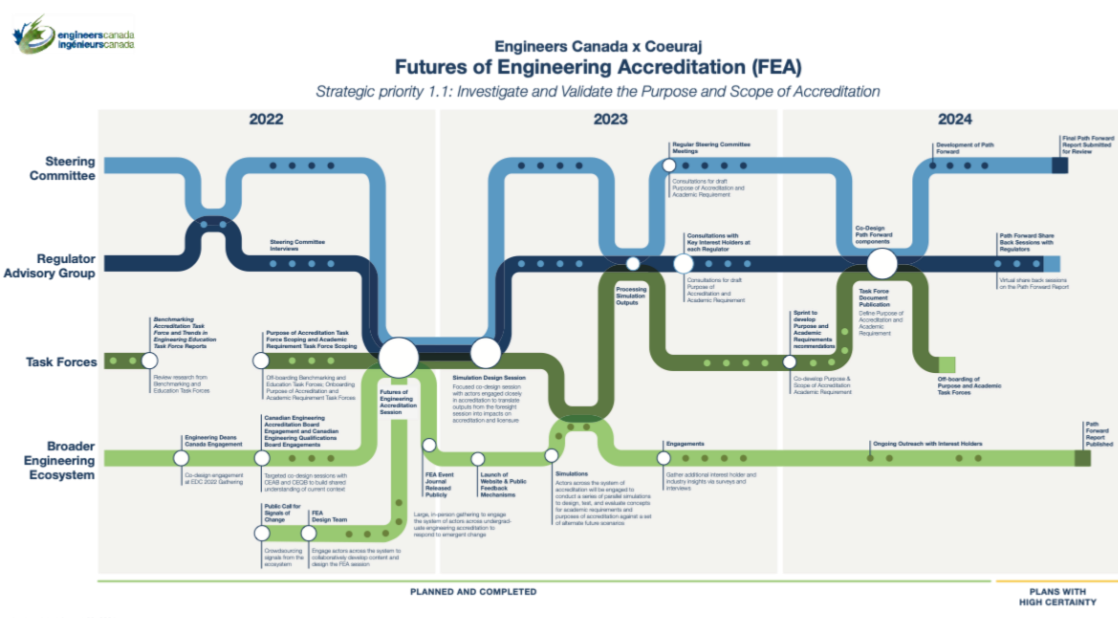

Figure 1: The FEA journey map representing project progress since 2022.

[1] The participation of more than 700 participants does not represent a unique count of individuals, as participants at one event may have participated in others.

The main phases of the project were as follows:

PHASE 1 – RESEARCH

In May 2021, Engineers Canada's members (the engineering regulators) approved a new strategic priority to investigate and validate the purpose and scope of accreditation. To begin this work, members of the engineering ecosystem gathered perspectives on the current context in which the accreditation system functions. The Benchmarking Accreditation Task Force was created to conduct research to compare the Canadian engineering accreditation system with national and international comparators. The Engineering Education Task Force was created to understand current and emerging trends in engineering education. In a workshop with educators and regulators, the current realities of engineering education were explored with those who experience them daily. The two task forces compiled their findings in their respective reports, Benchmarking the Canadian Engineering Accreditation System and Current and Emerging Practices in Engineering Education. The reports were published in March 2022 and subsequently discussed with regulators to set the context for all future work. This upfront work served as the foundation for the project pathway.

PHASE 2 – UNDERSTANDING THE EXISTING SYSTEM

Members of the Canadian engineering ecosystem were engaged to share their unique perspectives, including their experiences and expertise in the overall licensure process and accreditation system.

In May 2022, the project team facilitated a collaborative session with Engineering Deans Canada (EDC) to map out responses to four key questions pertaining to the purpose and scope of accreditation. In September 2022, the project team convened separate meetings with the CEAB and CEQB and collected their perspectives on the purpose and structure of the accreditation system.

In November 2022, the project team hosted more than 70 individuals from the engineering community at a two-day strategic foresight session to imagine "the engineer of the future" and the prerequisites for their success. One of the central messages emerging from the event, as documented in the Foresight Session Event Journal, is that "participants saw a need for engineers who are values-based leaders, who are technically excellent and actively collaborate across disciplines, are mindful of the future, and maintain curiosity and a desire for lifelong learning."

PHASE 3 – INTRODUCING NEW VOICES

Over six weeks during Spring 2023, the FEA project team led a series of virtual simulations, a structured form of brainstorming and exercises which invited 80 participants from the engineering community to explore the accreditation and licensure systems. The simulation experience was designed to bring together a variety of perspectives for envisioning who the engineer of the future is and what they need, and to understand how the systems might react to different purposes of accreditation and to potential national academic requirements for licensure. The virtual simulations unlocked key learnings about the collective work needed to evolve the engineering accreditation system. The data synthesized from the simulations indicated that:

- Participants are aligned in thinking that accreditation should have a role in the engineering ecosystem to ensure quality control and professional integrity, but it needs significant change to be fit for purpose.
- There is value in having clearly defined, transparent standards for engineering knowledge and competence at a national level. The data also suggests that this requirement should address a general, baseline level of technical knowledge complemented with professional competencies and an understanding of the ethical responsibilities of an engineer.
- The relationship between accreditation and the academic requirement for licensure is not yet clear and requires further work.

The Purpose Task Force and the Academic Requirement Task Force used the data from the virtual simulations to build viable options for the future. In Fall 2023, the project team conducted 13 in-person consultations with regulators, the EDC, the CEAB, and the CEQB to discuss draft concepts for a renewed purpose of accreditation and a national academic requirement for licensure.

Also in late 2023, the project team conducted four interviews with leadership from Canadian accreditation and/or regulatory bodies for the professions of nursing, accounting, and architecture. The findings underscored the shared challenges and approaches among these professions in accrediting programs for interest holders with different needs and objectives, evaluating foreign-trained practitioners, and offering diverse pathways into the profession.

During the same timeframe, the FEA project team launched a survey aimed at actively engaging specific interest holders, including current and former students of CEAB-accredited programs, international engineering graduates, applicants for engineering licensure, and individuals with or without an engineering license working in engineering. Participants were asked to share their insights and experiences related to accreditation, competencies, and the process of obtaining an engineering license in Canada. The survey responses contributed to the ongoing work and validation around development of the purpose of accreditation and a national academic requirement for licensure.

CURRENT PHASE (PHASE 4) – NURTURING AN EMERGENT SYSTEM

Relying on data gathered in previous project phases, in early 2024 the Purpose Task Force and Academic Requirement Task Force worked to define the future purpose of accreditation and a national academic requirement for licensure and created two guiding documents. *The Purpose Task Force document* and *Academic Requirement document* produced in March 2024 served as a springboard for discussion, and the project has advanced significantly since then.

In April 2024, a two-day Path Forward Co-Design Session brought together more than 40 representatives from the CEAB, CEQB, EDC, the Regulator Advisory Group, Engineers Canada Board Directors, and other interest holders. This collaborative session explored the proposed concepts, insights, gaps, and recommendations from the Purpose and Academic Requirement

Task Forces as well as the work done to date. Participants strengthened their collective understanding of potential system changes and provided ideas and guidance to enable implementation.

The collaborative design (co-design) approach

Given how long aspects of the current system have been in place, the diverse individuals within the system, and the uneven success of previous changes to the system, a collaborative design (co-design) approach to transformation was purposely chosen as a methodology for engagement on this project.

Co-design offers a framework for people to come together, explore new ideas and possibilities, and design the solutions that reflect the diverse ways of knowing and being within the system in which they operate. Co-design is a tool that can be very useful in situations where there is a diverse set of perspectives and a requirement for alignment across a varied, and complex, system.

The co-design approach for the FEA project was based on five principles:

1. **People love what they design and own what they create.** Co-design does not rely on "buy-in", instead focusing on active collaboration to foster collective ownership that enables relationships and shared decision-making to have lasting impact.

2. **Requisite variety.** The principle of requisite variety is the notion that addressing complex challenges necessitates a diverse range of perspectives. A co-design approach seeks varied input by fostering collaboration among individuals with different experiences, worldviews, and knowledge systems. This inclusive process ensures that solutions are responsive to the system's complexity and effectively address its challenges.

3. **Design from the future state.** When looking back in time from a place of imagined success, it's easier to focus on what enabled it. When looking to the future from today, barriers tend to dominate the view. A co-design approach shifts the focus to an ideal future and then identifies the necessary steps to bridge the gap.

4. **Embrace conflicts and power differences.** Any group of people working together experience conflict, from families through to large organizations. All organizations have hierarchy, either implicitly or explicitly. Co-design creates a space for participants to embrace conflict and "be tough on the ideas, not on people". Surfacing and working through tension in the system increases trust and builds new relationships.

5. **A different kind of conversation creates different results.** A co-design process takes participants out of their daily contexts and invites them into a new dynamic of interaction. It creates conditions where participants can focus on common interests instead of differences. A scan-focus-act process invites participants to explore new ideas and possibilities without constraint, before refining options into potential solutions.

Throughout the FEA project, the co-design approach considered what the engineer of the future needs to know and do, and how to ensure today's system is moving toward supporting those engineers of the future. Consulting and listening to voices in the system, playing back what was heard, and moving new concepts forward through co-design have created new ways of working, building and re-building relationships in the engineering ecosystem.

THE NEXT PHASE – REALIZING ACCREDITATION AND ACADEMIC ASSESSMENTS IN 2025 AND BEYOND

The Path Forward Report marks a significant milestone in the FEA initiative outlined in Engineers Canada's 2022-2024 Strategic Plan. It is the culmination of more than three years of research, findings, and multiple interactions with diverse interest holders in the Canadian engineering profession and beyond. Drawing on the insights and expertise gleaned from these engagements, it serves as a strategic blueprint for implementing changes to the accreditation system, prioritizing timely and resource-efficient transformation. Leveraging the in-depth understanding of current challenges in the system, the Path Forward Report presents recommendations to chart a course towards the envisioned future state for Canadian engineering accreditation.

This is just the beginning of transformation for the accreditation system. The upcoming Engineers Canada 2025-2029 Strategic Plan includes a strategic direction "Realizing accreditation and academic assessments". Its implementation will employ a co-design approach and be guided by the FEA recommendations, including the definition of the specific steps required to transition the current accreditation system to an outcomes-focused one and exploration of the FSCP as a potential competency framework for the engineering profession.

2. What the future of engineering could look like

Envisioning potential future landscapes for the engineering profession was a critical step at the onset of the FEA project. The Foresight Session conducted in November 2022 was instrumental in developing a shared understanding of the current engineering ecosystem and encouraging critical and creative thinking to explore what the future of engineering in Canada might look like.

During the session, three unique, plausible scenarios for the future were presented. The three scenarios presented a variety of changes that could impact the environment in which engineering is taught, practiced, and regulated.

The first scenario depicted a relatively stable continuation of current trends in the engineering ecosystem, in which Canada remains increasingly urbanized, populous, and multicultural, with rapid technological advancement. The hiring landscape is primarily driven by reputation and skillset, mirroring the status quo. The second scenario presented an engineering ecosystem affected by continuous change, volatility, and instability in the broader environment, where self-regulation has been replaced by a national regulating board and the quality of engineering services has diminished. The third scenario projected a partial defunding of higher education, deregulation for many professions including engineering, and more migration towards northern Canada.

Overall, there was consensus that the engineer of the future would be operating in a complex world of constant and rapid change. The uncertainty and unpredictability of the future would create environmental, social, and political challenges that demand engineers to be:

- Ethical, inclusive, and values-based leaders
- Mindful and aware of their roles in shaping and contributing to the future of humanity
- Fostering collaboration across multidisciplinary teams
- Incurably curious, showing up with creativity and empathy
- Technically excellent and focused on their lifelong learning journeys

Drawing on insights from interest holders regarding future engineering needs, the engineering ecosystem must:

- Diversify pathways to becoming an engineer
- Foster continuous learning and technology adaptation
- Empower engineers to work seamlessly in diverse and multidisciplinary teams
- Engage in cross-disciplinary collaboration
- Instill a culture of collaboration, integrity, and ethical outcomes
- Balance innovation and risk in designs and projects
- Continue to safeguard the public and uphold safety measures

The scenarios and insights of the strategic foresight exercise are intended to help inform and clarify the design of the future engineering system to meet the demands of a rapidly changing world.

3. Strengths of the current accreditation system

Since its creation in 1965, the Canadian engineering education accreditation system has supported Canadian engineering regulators, been recognized as substantially equivalent under international mutual recognition agreements,[2] and has mentored accreditation bodies across the globe. Significant changes in engineering practice and engineering education have occurred over this same period. From technological advancements to the emergence of new and alternative educational delivery methods, the learning context for today's engineers is far different from that of the past.

The FEA project is an evolutionary step for the accreditation system, not a revolutionary overhaul. While the FEA project modernizes accreditation to meet the evolving education setting and profession, the core principles remain strong. Importantly, not everything requires change. The Canadian engineering accreditation system will continue to assess programs through external evaluation and ensure graduates of accredited programs are academically qualified to begin the process for licensure.

Building on the accreditation system's successes and progressive changes since 1965, the FEA project seeks to create a future-proof framework that aligns with evolving societal needs while maintaining the system's credibility. The transformative shift necessitates a deliberate approach.

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[2] Specifically, the Washington Accord under the International Engineering Alliance.

A phased implementation can leverage the current system's strengths while seamlessly integrating essential improvements. It ensures a smooth transition that captures the best and maintain continuity of service.

> **Recommendation one for the future direction:**
> **Identify and strategically integrate the current accreditation system's strengths into the envisioned future framework.**

4. Purpose of accreditation

Mandate of the Purpose Task Force

For the accreditation system to successfully evolve, it is essential to critically examine its purpose and determine whether the rationale for accreditation remains valid in the context of emerging realities, or if it requires adaptation.

The Purpose Task Force was mandated to either validate the current purpose of accreditation or establish a revised purpose. The purpose statement is intended to be a foundational statement about why accreditation exists, what it must achieve, and for whom.

The need for change in accreditation

a. Education and pedagogy

Engineering education has changed significantly since accreditation was introduced in 1965. While there have been updates and adaptations since then, most notably with the introduction of Graduate Attributes in 2008, there are widely held perceptions that the accreditation system has not kept pace with the rapid changes in HEIs. As the Current and Emerging Trends in Engineering Education Report noted, trends affecting engineering education include advancements in pedagogical practices, available technologies for instruction (such as the internet and remote learning), ongoing impacts of the COVID-19 pandemic, experiential learning opportunities, and the emergence of new engineering disciplines, especially in niche areas.

b. Perceived rigidity in accreditation criteria

There is a perception that the current accreditation criteria impose a rigid framework which restricts program delivery, overly values outdated forms of teaching (e.g., lectures versus tutorials or laboratories over project-based learning or independent learning), limits instructors' pedagogical choices, and constrains students' ability to select courses of personal interest. This structured approach prioritizes the impartation of technical skills over the cultivation of lifelong skills such as teamwork and collaboration. Consequently, the emphasis on meeting accreditation criteria often results in a narrow focus on technical proficiency, neglecting the holistic development of students as budding professionals who are charged with mastering their own learning following graduation. Rigid program structures, perceived to be a result of accreditation, make it more challenging to address timely societal issues such as Reconciliation, equity, diversity, and inclusion.

Compared to similar accreditation systems both within and outside of Canada, the engineering industry has less involvement in the Canadian engineering accreditation system. Yet, there is push from industry leaders and the broader engineering community to equip engineering graduates with interdisciplinary skills to keep up with changing engineering practices. These preparations are seen as essential for tackling more complex challenges of the future.

To address the evolving environments, industry demands, and societal impacts, engineering programs are striving to incorporate competencies, non-technical skills, and personalized program delivery paths. However, the current accreditation system was not originally designed to accommodate these changes and has been slower to keep pace with these needs, making it more challenging for HEIs to adjust effectively.

c. Accreditation workload

The Canadian engineering accreditation system is rigorous, and its specific requirements can lead to a demanding workload. The introduction of the Graduate Attributes (GA) criteria in 2008, which are mandatory requirements for Engineers Canada to remain part of the International Engineering Alliance's (IEA) Washington Accord, has increased the workload for the HEIs to prepare for and maintain accreditation, and for the volunteer visiting team members. Some HEIs assumed the introduction of the GA criteria would eliminate the need for input measures – currently measured in Accreditation Units (AUs) – and they continue to suggest that the input measures (AUs) should be de-emphasized or removed altogether. Currently, this results in parallel administrative processes for both input measures, quantified by AUs, and output measures like Graduate Attributes.

Statement of the purpose of accreditation

The Terms of Reference for the Purpose Task Force were to either "validate the current purpose of accreditation or establish a revised purpose".[3]

a. Validating the current purpose of accreditation

The current purpose of accreditation is to:

> *Identify to the member engineering regulators of Engineers Canada those engineering programs whose graduates are academically qualified to begin the process to be licensed as professional engineers in Canada*.[4]

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[3] FEA Purpose Task Force Terms of Reference.

[4] Engineers Canada. CEAB 2023 Accreditation Criteria and Procedures, page 6.

The accreditation criteria examine the engineering curriculum (and the continual improvement thereof) as well as processes related to the admission, promotion and graduation, academic advising of students, as well as the overall environment in which the program is delivered.

For engineering regulators this means that graduates of accredited programs are not required to write confirmatory technical examinations; it is accepted that graduates of accredited programs meet the academic qualifications for licensure. This benefits graduates, reducing the time and financial impact of seeking licensure and benefits regulators by streamlining their licensure processes. Applicants seeking licensure without a degree from a CEAB-accredited program usually undergo confirmatory technical examinations.

The patterns of engineering licensure are changing in Canada. There is a declining number of graduates from CEAB-accredited programs who are applying for licensure, and an increasing number of applications from candidates who do not hold CEA-accredited degrees (non-CEAB applicants). The most recently published Membership Report from Engineers Canada estimates that only 44.3 per cent of recent graduates proceeded along the path to licensure.[5] In some Canadian jurisdictions, the number of non-CEAB applicants makes up more than 50 per cent of the applications received.

While regulators have traditionally been seen as the primary beneficiaries of the accreditation system, they now face an increasingly complex operation maintaining objective, transparent, equitable, and fair assessment procedures. Those responsible for delivering engineering programs and their students are also impacted by the accreditation system, yet they often perceive the system as prioritizing the interests of regulators above all others. From an HEI perspective, continuously investing time, energy, and resources into accreditation that ultimately serves fewer and fewer graduates is becoming an increasingly questionable “investment”. The expansion of accreditation criteria over time, including areas such as learning environment, have increased workload and are perceived as more difficult to assess. Educators invest significant time, personnel, and dollars into accreditation, and they are wondering if the benefit is worth the cost.

The changing educational context in which accreditation operates, paired with the current narrow purpose statement and seemingly broad accreditation criteria, presents other challenges for HEIs. These challenges include, but are not limited to, recognizing alternative forms of teaching and learning and constraints imposed by the accreditation criteria on the engineering licence status of educators.

While accreditation has traditionally been perceived as a tool to support regulators, there is a growing need for these perceptions to evolve into a broader and more comprehensive framework that fosters co-design, collaboration, and open communication among the various groups within the engineering ecosystem. These genuine partnerships will be fundamental for adapting to the evolving landscape of accreditation and the future of the profession.

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[5] Engineers Canada. 2023 National Membership Information, page 7.

Accreditation touches many parties, and their needs and constraints must be considered. In their report, the FEA Benchmarking Task Force identified that the purpose of accreditation statements of comparators included more interest holders and multiple objectives. That Task Force recommended reviewing and considering the breadth of Engineers Canada's current purpose of accreditation. In the Fall 2023 consultations on the potential focus of the purpose of accreditation, interest holders were clear that focusing on one interest holder (regulators or programs or students) is a non-viable option.

Based on findings from the foundational research conducted by the FEA Benchmarking and Engineering Education Task Forces and from consultations with nearly 170 interest holders about what they need and want from accreditation in the future, the Purpose Task Force was not able to validate the current purpose of accreditation.

b. Establishing a revised purpose of accreditation

To address the identified challenges and establish a solid foundation for the future accreditation system, the Purpose Task Force transitioned from validating the current purpose statement to establishing a revised one. The Steering Committee reviewed the revised statement carefully and accepted the following:

The purpose of accreditation

> *Accreditation provides assurance that an engineering program is designed and delivered such that its graduates meet the academic requirements to be licensed as professional engineers in Canada.*

It is important to understand two key points about the terminology in this statement:

1. Firstly, "engineering program" should be interpreted broadly to extend beyond the offerings of traditional undergraduate curricula at an HEI. The term denotes a framework that may include a diverse range of courses, activities, or experiences, strategically designed to achieve specific learning outcomes or objectives.
2. Secondly, the term "academic requirements" encompasses the various educational qualifications that serve as prerequisites for licensure and directly links to the NARL. The Steering Committee deliberately chose this because it reflects the established terminology used in relevant legislation outlining the educational prerequisites for engineers to be licensed.

The revised purpose statement embraces a new approach that recognizes the different needs of engineering programs, the students, and the regulators within the accreditation system and strives to balance their interests without prioritizing one group over another. It also maintains a linkage between accreditation and licensure.

It should be noted that, while the statement as worded has been recommended above for the reasons given, they also recognize that the continued evolution of the accreditation system because of future phases of the FEA project may require additional modifications. As such, the statement can be reviewed when the Full Spectrum Competency Profile (FSCP) is fully implemented and periodically thereafter to ensure its continued relevance

c. Three focuses of the revised purpose of accreditation

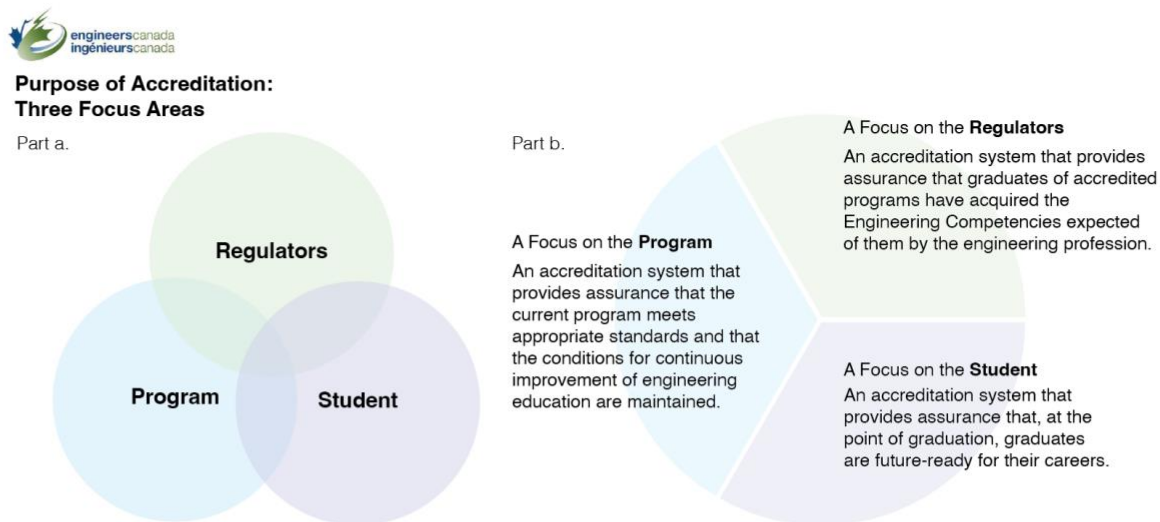

Figure 2: The three focuses of the revised purpose of accreditation.

Part a: Illustrative of the intersecting needs of the three distinct interest holders.
Part b: Illustrative of the equitable needs of the three distinct interest holders, originated from the 2022 Foresight Session and garnered support from regulators during the Fall 2023 consultations.

ENGINEERING PROGRAMS

Engineering programs seek accreditation based on the curriculum content they offer. The key verbs of “design” and “deliver” in the revised purpose statement imply support for flexibility and innovation. The program design ensures long-term efficacy, while program delivery focuses on the present, ensuring compliance with standards and preparing and evaluating current students.

The statement deliberately omits specifying that accreditation is solely for engineering programs at the undergraduate level. This flexibility allows for the definition to encompass existing accredited engineering programs while leaving space for potential future programs beyond the traditional undergraduate degree.

STUDENTS

While not every student will seek licensure after graduation, accreditation of engineering programs helps ensure graduates are (1) equipped with the necessary skills and knowledge to thrive in their future careers, and (2) have a clear path toward licensure, should they choose to pursue it. Accreditation is an acknowledgement that they have satisfactorily completed a program that has academically prepared them for the profession. For those who choose to pursue licensure, accreditation helps expedite the process.

REGULATORS

Regulators maintain confidence that graduates from CEAB-accredited programs have acquired the foundational knowledge and skills expected of them for entry into the profession. Accredited programs facilitate regulators' assessment of applicants' academic qualifications, which constitute just one of the five criteria typically examined by regulators for licensure.

d. The scope of accreditation

To clarify the scope of accreditation criteria, the Steering Committee recommends adding the following statement after the purpose of accreditation statement:

> *The accreditation review process includes evaluation of the curriculum as well as those factors which enable the design and delivery of the program, including human and financial resources, the learning environment and facilities, and quality control mechanisms.*

The Purpose Task Force's recommendation to address learning environments noted, "These factors should be subject to review, but they should not unduly influence the final accreditation decision unless they directly impact program outcomes."[6]

The influence of program environment on outcomes varies. An outcomes-focused approach can help identify the most impactful factors. Research suggests, for example, that learning environment, notably student engagement, has a positive impact on student learning.[7]

Additionally, Engineers Canada's commitment to the Washington Accord necessitates continuous evaluation of program learning environments to ensure compliance with the Accord's criteria.

> **Recommendation two for the future direction:**
> **Endorse the revised purpose and scope of accreditation statements.**

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[6] Purpose Task Force document, p.24

[7] Shernoff, D. J., Ruzek, E. A., & Sinha, S. (2016). The influence of the high school classroom environment on learning as mediated by student engagement. *School Psychology International*, *38*(2), 201–218. https://doi.org/10.1177/0143034316666413

Thai, N. T. T., De Wever, B., & Valcke, M. (2017). The impact of a flipped classroom design on learning performance in higher education: Looking for the best "blend" of lectures and guiding questions with feedback. *Computers and Education/Computers & Education*, *107*, 113–126. https://doi.org/10.1016/j.compedu.2017.01.003

Cheng, L., Ritzhaupt, A. D., & Antonenko, P. (2018). Effects of the flipped classroom instructional strategy on students' learning outcomes: a meta-analysis. *Educational Technology Research and Development*, *67*(4), 793–824. https://doi.org/10.1007/s11423-018-9633-7

Design parameters for the future accreditation system

These design parameters to ensure the future accreditation system operates at an acceptable level were first developed by the Purpose Task Force and embraced by the Steering Committee.

i. The future accreditation system must be simple, flexible, and adaptable over time.

The rapid pace of change in engineering education (including knowledge and pedagogical practice), engineering practice, and societal trends underscores the importance of maintaining an agile and responsive accreditation system. The system must not only be able to prepare today's engineering graduates to perform as required in the engineering ecosystem but also stay abreast of dynamic shifts (both anticipated and emergent) to effectively prepare tomorrow's graduates. This approach to accreditation not only sustains the relevance and efficacy of CEAB-accredited programs in the present but also positions them at the forefront of engineering education, poised to effectively meet the evolving needs of the profession.

Simplicity, flexibility, and adaptability are essential to ensure the continued relevance of accreditation and to make space for innovation in education, with the goal of streamlining and enhancing the educational experience of students. Engineering programs must remain adaptable – both in program content and mode of delivery – to integrate emerging disciplines and methodologies into their curricula, and to equip graduates with the knowledge and skills required to address increasingly complex challenges. The accreditation system must also remain versatile enough to accommodate diverse and non-traditional pathways to knowledge acquisition.

ii. The future accreditation system must be outcomes-focused.

The 2022 reports, *Benchmarking the Canadian Engineering Accreditation System* and *Current and Emerging Practices in Engineering Education*, collected information about the practices and trends of accreditation and education for various professions and jurisdictions. The reports revealed that Engineers Canada's accreditation system relies heavily on inputs, including a 'minimum path' requirement and a time-length input requirement for degree duration. The findings suggest that the current Canadian engineering accreditation system does not align with global practices, which place stronger emphasis on outcomes.

The current combination of input (i.e. AUs) and outcome measures (i.e. Graduate Attributes) complicates assessments and contributes to perceptions that accreditation is burdensome for HEIs. Transitioning to a more outcomes-focused model would align Canadian accreditation practices more closely with the trends observed in other professions and jurisdictions, while also complementing the growing regulatory shift towards CBA licensure processes.

iii. The future accreditation system must achieve alignment between the educational approach and the accreditation criteria.

As education content and pedagogy evolve, accreditation must evolve as well. Accreditation criteria must be updated to align with the current trends in educational design and delivery. The accreditation system should not be seen to impede innovation in education but rather align with the principles of programmatic design and delivery outlined in the revised purpose statement.

iv. The future accreditation system must consider the equity of application across all institutions, taking into consideration local context and different levels of access to resources.

The accreditation criteria must be focused on assessing the core requirements of engineering programs and not serve as a comparative assessment of the HEIs' services, which will inevitably vary from institution to institution based on geographic, demographic, or resource constraints.

v. The future accreditation system must value experiential learning.

Experiential learning should be recognized as a valuable component of the educational preparation of students. This could be bolstered by a definitive statement emphasizing its value and allowing for the exploration and implementation of alternative forms of program delivery. Experiential learning includes, but is not limited to, project-based learning, interaction with practicing professionals, domestic and international student exchanges, and cooperative or internship experiences.

vi. The future accreditation system must be based on defensible evaluation processes.

Defensibility means that the accreditation criteria, methods, and resulting decisions are supported by evidence – whether it be quantitative or qualitative – and can be clearly justified, contributing to transparency and legitimacy within the process. These attributes promote trust in the accreditation process and its outcomes.

vii. The future accreditation system must balance evolving criteria.

As the accreditation system continues to evolve to remain current, new criteria will inevitably be introduced. However, to maintain the focus and alignment of accreditation's scope with its intended purposes, it is essential to remove outdated criteria. This proactive measure prevents the scope from expanding uncontrollably. Managing the criteria judiciously is key to maintaining feasibility, ensuring a favourable return on investment in terms of resources and costs incurred, and preventing programs from growing unnecessarily. A process that systematically and predictably reviews, revises, and deploys criteria must be developed to ensure stability and sustainability for all interest holders. Ad-hoc and piecemeal criteria revision must be avoided.

viii. **The future accreditation system must optimize the use of peers to conduct evaluations.**

Accreditation evaluations depend on peer-review processes, which involve experts from various fields, both academic and non-academic, to ensure a thorough assessment of programs' adherence to established standards. Engaging peers with varied backgrounds and expertise cultivates a diverse and inclusive perspective during evaluations. The accreditation criteria must be written such that programs can demonstrate compliance to a peer and a peer can evaluate compliance without requiring specific deep knowledge that is not broadly held by peer volunteers. These peers should undergo training and instruction to ensure that evaluations are conducted fairly and effectively, within the scope of accreditation, and meet the desired objectives.

ix. **The future accreditation system must incorporate and recognize content of 'feeder' programs.**

The statement on the purpose of accreditation emphasizes that engineering programs are "*designed and delivered*" such that its graduates [emphasis added] meet the academic requirements to be licensed as professional engineers in Canada." This implies that HEIs can demonstrate through the accreditation process that all graduates of their programs, regardless of their starting point, have either met or exceeded the established academic requirements for licensure.

x. **The future accreditation system must provide value to regulators and expedite the licensure process for graduates.**

Engineering regulators have confidence that graduates of CEAB-accredited programs are academically prepared for licensure, allowing them to streamline their academic review procedures accordingly.

Graduates have confidence in the quality of their program, knowing it has met rigorous standards that are nationally recognized. They benefit from expedited acceptance of their academic qualifications without the need for further confirmatory processes. The continued development of the FSCP, which defines all the competencies required of an engineer at the various points in their career development – from learner to graduate to licence holder – that is aligned with Graduate Attributes introduces students to Pan-Canadian Work Experience Competencies at an early stage. This early exposure offers a distinct advantage to graduates pursuing licensure.

xi. **The future accreditation system must avoid the duplication of other processes of evaluation of programs.**

The accreditation system must prioritize the distinctive aspects of engineering education and adhere to the standards outlined in the evaluation criteria, while avoiding redundancy with other program evaluation processes and quality standards assessments legislated and overseen by provincial governments and agencies. This will prevent unnecessary burdens and redundancies on HEIs.

Where possible, trusted third party reviews and approvals should be assessed with respect to whether they fulfill accreditation requirements for program environment, leadership, human and financial resources, progression, and other such criteria that do not require the specialized engineering education knowledge of peer reviewers.

xii. The future accreditation system must prepare graduates to demonstrate their competencies and skills to employers.

Accreditation ensures that prospective employers can have confidence in graduates from CEAB-accredited programs, knowing they possess the knowledge and skills expected of new entrants to the engineering profession.

xiii. The future accreditation system must enable national and global mobility of students and graduates.

Accreditation significantly enhances the mobility and portability of learning opportunities and the recognition of qualifications. By attesting to the reputational quality of a program, accreditation facilitates access to educational opportunities not available at students' home institutions, such as co-ops or national and international exchanges. As well, mutual recognition agreements, like the Washington Accord, enhance international credential recognition and promote the mobility of engineering professionals across borders.

xiv. The future accreditation system must communicate its value and enhance public perception of undergraduate engineering education.

The public must have confidence that graduates from accredited programs have received a high-quality education that prepares them to contribute effectively to society through their chosen profession.

> Recommendation three for the future direction:
> Adopt the outlined design parameters as a fundamental framework for the future accreditation system.

Insights from project engagement and research supporting the revised purpose and scope statements

i. Value of accreditation

A fundamental question for this project was whether accreditation retains its value for interest holders. Throughout the project, regulators, students, and engineering programs have affirmed that they derive substantial benefits from accreditation and recognize its enduring value. Regulators have confidence that the accreditation system ensures that graduates from CEAB-accredited programs possess the academic qualifications needed to initiate the licensing process. HEIs uphold their reputation through the recognition and quality of their engineering programs. Students receive support in attaining their educational and career aspirations, along with streamlined licensing processes.

ii. Modernization

After confirming the value of the accreditation system, interest holders agree on the need for modernization to remain relevant amid the rapidly changing, complex world. This process starts by emphasizing equity among accreditation's interest holders and building stronger relationships to tackle the changes effectively.

iii. Skills and competencies of the engineering profession

Accreditation remains pivotal in preparing future engineers to navigate the complexities of a rapidly changing world. When FEA interest holders adopted a longer-term perspective, there was significant consensus on the future direction of the engineering profession. Engineers need to be values-based leaders, who are technically excellent and actively collaborate across disciplines, are mindful of the future, and maintain curiosity and a desire for lifelong learning. By instilling these qualities, accreditation ensures that graduates are not only technically adept but also equipped to handle ethical dilemmas, collaborate across disciplines, and contribute meaningfully to society's well-being.

iv. Program flexibility and adaptation

Currently, accreditation upholds the quality of engineering programs, but there is a perception that it does not keep pace with evolving pedagogical and student needs. Introducing greater flexibility and adaptability into the accreditation process would enrich the overall educational experience for students. A more dynamic system would support innovations and provide students with a broader range of learning opportunities. Administratively, enhanced flexibility and adaptability would reduce bureaucracy and barriers, leading to improved governance and a more streamlined and effective accreditation process.

v. Linkage to academic requirements and pathways to licensure

The future system must maintain the linkage between accreditation and an academic requirement for licensure. This entails developing an academic requirement that promotes more equitable access to the profession by ensuring fairness for all applicants and applying standards consistently, irrespective of their academic background or chosen pathway to licensure.

Building the envisioned future accreditation system

To align with a revised purpose and scope of accreditation and prepare for a resilient future system, the current accreditation system must undergo a transformative shift. There is perceived rigidity and inflexibility in the current system's structure and requirements. Accreditation needs to innovate more, adapt efficiently, and stay relevant in a rapidly evolving landscape of engineering education and practice.

To shape the future and resolve the current gaps, the following recommendations are proposed:

i. Mixed inputs and outcomes measures

CURRENT GAP

The current accreditation system emphasizes the measurement of both program inputs and program outcomes.

The current accreditation system relies on a mix of inputs (i.e. AUs) and outcome measures (i.e. Graduate Attributes). An engineering program must meet certain minimums for different curriculum components, including mathematics, natural sciences, engineering science, engineering design, and complementary studies. The comprehensive nature of the required AUs is reported to restrict curricular flexibility, limiting both the range of subjects offered and students' elective choices.

Findings from the *Benchmarking the Canadian Engineering Accreditation System* and *Current and Emerging Practices in Engineering Education* reports suggest the Canadian engineering accreditation system does not align with global practices which place stronger emphasis on outcomes only.

> **Recommendation four for the future direction:**
> **Mandate a shift to an outcomes-focused accreditation as a cornerstone for future system change.**

> **Recommendation five for the future direction:**
> **Remove criteria related to the measurement of curriculum content with Accreditation Units. Focus on Graduate Attributes until a transition to the FSCP can be completed.**

RATIONALE

The CEAB accreditation system transitioned to include outcomes measurement via the Graduate Attributes starting in 2008. The accreditation system has evolved to a point where interest holders can have confidence in outcomes measurement as a way of fulfilling the revised purpose of accreditation.

Practical efficiencies and maintaining interest holders' confidence are critical gaps in the current system. Transitioning to an outcomes-focused approach has the potential to bridge these gaps by streamlining processes and fostering trust and will likely resolve many other interconnected issues in the system. For example, outcomes-focused accreditation can empower faculty to explore innovative teaching methods and students to explore diverse learning pathways, which fosters a more flexible and autonomous learning environment. This transition would also align Canadian accreditation practices more closely with the trends observed in other professions and jurisdictions, while also complementing the growing regulatory shift towards Competency Based Assessment (CBA) licensure processes.

The transition to outcomes-focused accreditation, paired with the revised purpose of accreditation, provides a foundation upon which revised accreditation criteria can be built to maintain regulator confidence in the academic preparedness of graduates from accredited programs and provides flexibility to HEIs in curriculum design and delivery. Significant effort will need to be undertaken to revise the accreditation criteria, policies, and processes in support of an outcomes-focused accreditation system. Continuing to assess Graduate Attributes as a bridge until full implementation of the FSCP is a valuable stepping stone towards a completely outcomes-focused accreditation system.

ii. Minimum path

CURRENT GAP

In the current accreditation system, the "minimum path" identifies the set of courses in an undergraduate engineering program which provide the least number of AUs within each curriculum content category (math, natural science, engineering science, engineering design, and complementary studies). The minimum path ensures that every individual student is exposed to the minimum number of AUs in each curriculum category throughout their years of study. This is a key component of the input measurement of curriculum content of an engineering program.

> **Recommendation six for the future direction:**
> **Retire the concept of the "minimum path".**

RATIONALE

The "minimum path" principle is a tool of an input-based system. With the retirement of input-based measures, the "minimum path" concept can logically also be retired. This would then empower faculty to explore innovative teaching methods and students to explore diverse learning pathways, which fosters a more flexible and autonomous learning environment.

iii. Faculty licensure qualifications

CURRENT GAP

The current accreditation criteria require a portion of engineering science and/or engineering design to be delivered by faculty members holding or progressing toward professional engineering licensure. This restricts who can teach within these programs and limits the pool of potential educators.

In other countries, the licensure requirements for faculty in engineering education systems are less stringent. Metric 1.3.5 "Licensure requirement for faculty" in the Benchmarking the Canadian

Engineering Accreditation System highlights this variation.[8] It indicates that Australia, France, and Poland do not mandate licensure for faculty. In Malaysia, 30 per cent of actively teaching engineering faculty need to be registered.

> **Recommendation seven for the future direction:**
> **Accept some of the recommendations presented by the CEAB to address faculty license requirements, including:**
>
> a. The CEAB should endorse the principle that engineering programs must have substantial and meaningful involvement of licensed professionals in the education of future professionals.
> b. The CEAB and visiting teams should interpret existing accreditation criteria related to the role of the professional engineer in the instruction of students in a manner that allows HEIs to have more flexibility with respect to mechanisms to facilitate substantial and meaningful involvement of licensed professionals in the engineering education process.
> c. The CEAB must require HEIs to demonstrate that graduates have developed the expected level of understanding of, and commitment to, professionalism.[9]
> d. The CEAB remove the Specific AUs criteria[10] and the requirement for the significant design experience to be conducted under the professional responsibility of licensed faculty.[11]

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[8] Benchmarking the Canadian Engineering Accreditation System, page 13

[9] Professionalism is defined in the CEAB 2023 Accreditation Criteria and Procedures as "an understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest." (page 8).

[10] The specific AUs criteria refers to accreditation criteria 3.4.4.1 and 3.4.4.4 of the CEAB 2023 Accreditation Criteria and Procedures.

3.4.4.1 A minimum of 600 AUs of a combination of engineering science and engineering design curriculum content in an engineering program shall be delivered by faculty members holding, or progressing toward, professional engineering licensure as specified in the Interpretive statement on licensure expectations and requirements.

3.4.4.4 A minimum of 225 AUs of engineering design curriculum content in an engineering program shall be delivered by faculty members holding professional engineering licensure as specified in the Interpretive statement on licensure expectations and requirements.

[11] The requirement for the significant design experience to be conducted under the professional responsibility of licensed faculty refers to accreditation criteria 3.4.4.6 of the CEAB 2023 Accreditation Criteria and Procedures:

The engineering curriculum must culminate in a significant design experience conducted under the professional responsibility of faculty licensed to practise engineering in Canada. The significant design experience is based on the knowledge and skills acquired in earlier work and it preferably gives students an involvement in team work and project management.

RATIONALE

The CEAB's thought paper, *Reconsideration of Specific AUs in the Assessment of Engineering Programs,* addresses the subject of faculty licensure (Appendix B).

Currently, the accreditation criteria require a specific number of AUs in engineering science and engineering design must be taught by faculty members holding or progressing towards a professional engineering licensure in Canada. These AUs are designated as "specified AUs".

The quantitative approach is not well-suited to accommodate the evolving pedagogies and learning environments. There are many challenges in recruiting faculty who meet the licensing requirements, one being the proliferation of emerging and interdisciplinary engineering fields. The requirements demanding exposure to Canadian professional engineers or engineers-in-training (EITs) hinders program exchanges and limits access to valuable global and emerging education opportunities.

As the CEAB's thought paper notes, cultivating professionalism in students does not have to be anchored in contact hours and could be achieved using different activities, indicators, and assessments. The transition away from input measures to an outcomes-focused system is not congruent with the specified AU criteria.

> **Recommendation eight for the future direction:**
> **Explore the development of alternate ways for HEIs to demonstrate that students enrolled in engineering programs have substantial and meaningful involvement with licensed professionals.**

RATIONALE

The CEAB's thought paper introduced this recommendation. The elimination of Specific AUs addresses the faculty licensure requirement, however defining and implementing "substantial and meaningful involvement with licensed professionals" still requires further development. The new policy group could be tasked with developing these concepts using a co-design approach beginning in early 2025.

iv. Experiential learning and program exchanges

CURRENT GAPS

There is a perception that the current accreditation system restricts the range of experiential learning opportunities available to students, and that it also restricts the range of domestic and international learning opportunities available to students and undervalues the significance of such experiences. Minimum curricular pathways and faculty licensing requirements can hinder program flexibility and limit students' opportunities for experiential learning and program exchanges.

Recommendation nine for the future direction:
Formalize the Temporary Exemption for Students Going on International Exchange[12] by permanently integrating its core principles into CEAB policy.

RATIONALE

Transitioning to an outcomes-focused accreditation system should expand and validate experiential learning opportunities. Revised accreditation criteria linked to the NARL should create a clear structure for assessing learning outcomes from these opportunities and can enhance recognition for the educational value they offer. Other countries have successfully integrated experiential learning into accreditation standards, as reported in *Benchmarking the Canadian Engineering Accreditation System*.[13]

Program exchanges are one specific type of experiential learning. Students gain exposure to different cultures, cultivating global mindsets and developing intercultural competencies that are essential for success in today's interconnected world. At the request of regulators, the CEAB implemented a temporary exemption policy to remove barriers for students going on international exchange in 2023. However, a permanent solution is necessary to ensure continued access to these educational experiences.

v. Educational curriculum and learning environments

CURRENT GAP

Compared to other accreditation systems, Engineers Canada's purpose of accreditation statement is narrower in scope. While learning environment factors are not formally included in the current purpose statement, aspects such as the quality of faculty, morale of students, and suitability of leaning facilities are evaluated. Evaluation of these aspects of the learning environment is a requirement of all signatories to the Washington Accord.

Recommendation 10 for the future direction:
Evaluate the feasibility of accepting HEI evaluations from provincial quality assurance bodies to streamline CEAB processes while maintaining compliance with the Washington Accord.

A comparative analysis between the CEAB accreditation criteria and those of the provincial quality assurance bodies should be undertaken as a means of determining the degree of overlap between assessments.

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[12] Engineers Canada. CEAB 2023 Accreditation Criteria and Procedures, page 118.
[13] Benchmarking the Canadian Engineering Accreditation System, p.33

The methodology for such a comparative analysis involves the following steps:

1. **Data collection:** Gathering assessment criteria from relevant quality assurance bodies, such as the Ontario Universities Council on Quality Assurance (OUCQA).
2. **Criteria categorization:** Classifying and comparing the types of criteria and procedures across organizations.
3. **Coding and identification:** Assigning unique descriptive codes to each criterion and procedure for efficient analysis.
4. **Comparative analysis:** Identifying similarities and differences between the criteria and procedures across organizations.
5. **Data analysis:** Using thematic analysis to uncover patterns and trends.
6. Duplication identification: Counting instances of overlapping criteria and procedures.

The methodology will also consider the following:

1. There are various interpretations for key terminology across CEAB and the provincial quality assurance frameworks. This work aims to reduce confusion and develop a consistent understanding of that language.
2. The comparison can accommodate data for a specific criterion or procedure, even when it is categorized or structured differently. Reformatting might be necessary for accurate analysis.
3. There is diversity across Canadian HEIs and provincial quality assurance processes, so a representative sample of provincial quality assurance bodies will be selected to ensure an accurate assessment is made. If variety across the sample is substantial, all provincial quality assurance bodies will be included.
4. There are varying scopes of provincial quality assurance audits. This work aims to identify potential areas for overlap while respecting their distinct purposes.
5. This comparative analysis can be established as a cyclical occurrence (possibly aligned to the accreditation cycle) to monitor changes in provincial quality assurance practices over time.

The comparison of CEAB accreditation criteria with those of provincial bodies can help determine the extent of overlap between engineering accreditation and other quality assurance systems, replacing anecdotal evidence with data-driven insights.

If the comparative analysis uncovers duplication, the CEAB can take steps to prevent unnecessary burdens and redundancies on HEIs. Criteria adequately assessed by other quality assurance bodies and not requiring specialized engineering expertise may be either eliminated from CEAB's purview or accepted through external verification.

The Canadian engineering accreditation system will continue to gather information about students and the program environment to maintain Washington Accord signatory status. Non-curriculum criteria may be reframed to enhance alignment with an outcomes-focused approach. This may involve transitioning from quantitative counts to broader descriptive narratives, potentially drawing on models employed by organizations such as Engineers Australia.

RATIONALE

The review of non-curriculum accreditation criteria will address three key aspects:

- Ensuring that accreditation only evaluate the aspects of a program that impact its design and delivery as per the proposed purpose and scope statements.
- Enhancing efficiencies by reducing overlap with other quality assurance systems.
- Maintaining compliance with Washington Accord expectations for signatories to evaluate program environment elements in their accreditation processes.

vi. Return on investment

CURRENT GAP

Throughout the FEA project, interest holders strongly affirmed their support for the value of accreditation; however, their continued support hinges on perceiving a commensurate return on investment.

- HEIs are mindful that the considerable resources allocated to accreditation are diverted from other initiatives or priorities, which is especially problematic in their resource-constrained environments.
- Students desire a program that adequately prepares them for their future careers.
- Regulators' academic qualification processes may not be adequately equipped to handle the increasing demand from graduates of non-CEAB institutions, leading to potential inefficiencies and resource strain.

> **Recommendation 11 for the future direction:**
> **Maximize the return on investment for all interest holders by incorporating new core values into the accreditation system, including co-design, collective stewardship, and more representative governance.**

RATIONALE

As the Purpose Task Force document states, a modernized accreditation process should aim to strike a balance between rigorous standards and practical efficiencies. The system must retain its tangible benefits for all interest holders while avoiding excessive burdens. Reviewing existing accreditation criteria and transitioning to an outcomes-focused approach has the potential to significantly enhance the efficiencies and effectiveness of the system. The need to undertake this evaluation is supported the results of the annual CEAB *Accountability in Accreditation (AinA)* report which reveals a recurring concern about inefficiencies in the accreditation process.[14]

[14] Accountability in Accreditation. Annual evaluation results.

vii. Collective stewardship

CURRENT GAP

The current accreditation system is narrowly focused on meeting the needs of regulators. However, as the revised purpose statement aims to balance the needs of regulators with HEIs and students, it is imperative that the criteria reflect and respond to the needs of all interest holders.

> **Recommendation for the future direction**
> **Covered by recommendation 11: Maximize the return on investment for all interest holders by incorporating new core values into the accreditation system, including co-design, collective stewardship, and more representative governance.**

RATIONALE

To ensure that the future accreditation system truly represents those it serves, it is imperative that all interest holders actively participate in shaping its development and management. This involves acknowledging their input and establishing a formal method for their contributions across various aspects of the system, including shaping criteria, policies, and procedures. The contribution mechanism should embody the principles of co-design, collaboration, and open communication to foster a sense of stewardship and inclusivity among the involved parties.

5. The Full Spectrum Competency Profile (FSCP)

Mandate of the Academic Requirement Task Force

A critical foundation for the future accreditation system lies in transitioning to a competency-based system and establishing a clear definition of the academic requirements for licensure. The Academic Requirement Task Force was mandated to investigate the establishment of an academic requirement for licensure that applies to all applicants for engineering licensure.

The need for a National Academic Requirement for Licensure (NARL)

As a regulated and licensed profession, engineers must exhibit the requisite academic and experiential credentials to practise. Canada's 12 provincial and territorial engineering regulators are responsible for establishing admissions standards to the profession, which aim to safeguard the public by issuing licenses only to those deemed competent.

Academic qualifications are one of five criteria for licensure, with each regulator establishing and conducting its own processes for evaluating these qualifications. Currently, regulators rely on CEAB's accreditation framework to ascertain that graduates from CEAB-accredited programs meet the academic prerequisites. The CEAB's criteria encompass five broad input categories and twelve

Graduate Attributes, while leaving individual engineering programs to shape their own curricula and determine teaching content.[15]

Regulators rely on syllabi created by the CEQB as part of the assessment process for evaluating the academic credentials of applicants for licensure who have not graduated from a CEAB-accredited program (referred to herein as “non-CEAB applicants”). These syllabi are meticulously structured based on the curricula of accredited programs. Intended to serve as a benchmark to maintain consistency in academic standards, regulators use the syllabi as an indicator about whether non-CEAB applicants have had exposure to similar content and inputs as the graduates of CEAB-accredited programs.

While the accreditation system and syllabi endeavour to establish an academic standard, a significant risk persists due to the absence of a clear definition of the essential components of an academic requirement for licensure. This gap introduces vulnerabilities into both the accreditation and licensure systems, raising concerns about robustness and defensibility. Without a precise definition, the current system cannot transparently delineate the necessary knowledge for safe practice.

The Association of Professional Engineers and Geoscientists of Alberta (APEGA) commissioned a 2019 study, An Evaluation of Assessment Processes for Engineering Licensure in Alberta: Implications for a National Entry-to-Practice Examination, which strongly underscored the need to create and adopt a national engineering competency profile.[16] The report highlighted that establishing such a profile is the most important step for integrating the various phases of an engineer’s professional journey by ensuring the quality and comprehensiveness of evaluation processes across all stages. A clear framework of the knowledge and abilities of a competent practitioner enhances the validity and transparency of evaluations and creates a standardized benchmark against which to assess foreign trained applicants. Furthermore, the adoption of this competency profile establishes the expectations for evaluations at every stage of an engineer's career, including defining content requirements for program accreditation, evaluating academic qualifications of graduates from non-accredited programs, evaluating work experience, and setting expectations for continuing professional development.

The implementation of a NARL has the potential to bolster the accreditation and licensure systems’ defensibility and could foster greater consistency in the assessment of academic qualifications. It could promote greater accessibility to the profession by contributing to streamlined evaluation procedures that are less dependent on the origin of an applicant’s education and facilitate professional mobility. It could also enhance the integrity of the engineering profession and inspire trust from provincial governments, fairness commissioners, and human rights tribunals.

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[15] As described in the *CEAB’s 2023 Accreditation Criteria and Procedures*

[16] Prepared for APEGA: Sadesky, G. (2019). An Evaluation of Assessment Processes for Engineering Licensure in Alberta: Implications for a National Entry-to-Practice Examination.

The significance of substantial equivalency

The need for substantial equivalency in the accreditation system is rooted in ensuring equitable access to the profession. With the growing number of internationally trained graduates and increased attention on government-led fairness reviews, it is essential to ensure the assessment of all CEAB and non-CEAB graduates are founded on similar standards that follow principles of equity and fairness.

The provincial/territorial regulators are responsible for ensuring only qualified applicants are granted licensure. However, the absence of a NARL means that they have adopted their own individual academic requirements. The lack of a common framework across all 12 Canadian engineering regulators can lead to confusion for applicants, industry groups, and the public, potentially influencing where applicants initially seek licensure.

In 2022, the CEQB released the *Feasibility Study: Methods of Academic Assessment for Non-CEAB Applicants for Licensure*. The report proposed "expanding the current Core Engineering Competencies into a full competency profile that covers academic and experience entry-to-practice requirements".[17] The full competency profile would provide increased flexibility and fairness for non-CEAB applicants for licensure, improving transparency and confidence that applicants are evaluated against a common entry-to-practice standard.

Implementing a NARL would promote substantial equivalency by providing a cohesive framework for the 12 provincial and territorial engineering regulators to conduct assessments, irrespective of applicants' academic backgrounds. It would satisfy the need to balance regulators' mandate to protect public safety while maintaining flexibility in licensing qualified applicants without subjecting them to unnecessary barriers.

The establishment of a NARL can support fundamental principles outlined in Engineers Canada's policy guideline, *Regulators Guideline on the Academic Assessment of Non-Canadian Engineering Accreditation Board Applicants*:[18]

1. Assessment processes must be individualized.
2. Assessment processes must be fair.
3. Education documents must be authenticated and verified.
4. Assessment of breadth and depth of education (of the program and institution) should be primarily quantitative and partly qualitative.
5. Confirmation of breadth and depth of education is a requirement for all applicants.
6. Flexibility should be allowed between breadth and depth, so long as a minimum threshold is met.

[17] Prepared for the CEQB: Johnson, K. and Johnson G. (2022). Feasibility Study: Methods Of Academic Assessment For Non-CEAB Applicants For Licensure. (p.34).

[18] Note this guideline is only accessible on the Engineers Canada website for members only.

Feedback in support of equitable access to the profession

FEA's 2023 Virtual Simulations brought together 80 participants for a multi-day, structured brainstorming session to explore potential directions for the future accreditation and licensing system.

During these simulations, participants indicated support for a NARL. They emphasized the value in having a national set of clearly defined and transparent standards for engineering knowledge and competence. Responses also suggested that this requirement should address a general, baseline level of technical knowledge complemented with professional competencies and an understanding of the ethical responsibilities of an engineer.

The participants carefully evaluated three distinct models of academic requirements, including Graduate Attributes, foundational technical and social competencies, and discipline-specific technical knowledge. However, there was no clear decision emerging regarding which model would be most appropriate. Regardless of how the academic requirement was defined, it seemed that it would continue to be difficult to evaluate internationally trained applicants' competencies.

Without consensus on a preferred model, the FEA project team explored developing a tailored academic benchmark to advance the participants' shared goal of improving equitable access to the profession for all applicants for engineering licensure.

What is a competency framework?

Competence is an individual's ability to perform a task, function, or role to a set of prescribed standards. Competence itself is not readily observable, but engineering competency is inferred from the engineer's activities. It encompasses the spectrum of knowledge, decisions, judgments, perceptions, procedures, and values that engineers employ while executing their duties.

Competency is an explanatory model that considers how engineers engage in their professional responsibilities, duties, and tasks. Competency is also a pragmatic notion: it demonstrates an engineer's aptitude to operate within a designated learning or work environment and leverage diverse resources to achieve desired outcomes. An engineer will draw on a combination of knowledge, skills, and attributes acquired through training and experience to adapt to changing, unforeseen, or constraining circumstances.

While attributes and competencies may seem interchangeable, they have distinct roles in describing an individual's readiness to practise. Attributes represent the desired qualities of a skilled professional. They are aspirational goals that focus on the characteristics (the "what") possessed by a well-rounded engineer. Competencies are how it is known the "what" has been attained (the "how").

Current national standards and documents, such as the CEAB Graduate Attributes, the Pan-Canadian Work Experience Competencies, and the benchmarks established by the International Engineering Alliance's Graduate Attribute and Professional Competencies Framework for engineering graduates and professionals, frame competencies as observable and demonstrable actions. This approach is intended to allow for their measurement and evaluation in a concrete manner.

A competency framework, while not an assessment tool on its own, helps define the standard against which the observable and demonstrable actions of all applicants can be measured and evaluated. This practice enhances transparency and ensures consistency throughout the assessment process and promotes greater accessibility to the profession for those with diverse backgrounds and experiences.

The activities of a competency framework are determined by a community of practitioners and serve as the benchmark against which other learning and work activities are assessed. This approach fosters the expectation that a competent engineer, within a specific context, would exhibit aptitudes akin to their peers at a similar stage of development. Consequently, evaluating a prospective engineer's competencies must be done in context of the knowledge, skills, and attributes acquisition phase, so that evaluators may ascertain if the prospective engineer "knows how" to accomplish the task and can "do" the task in the pre-licensure work environment.

Many regulated professions, including engineers, have adopted a competency framework to help harmonize admission requirements and facilitate enhanced labour mobility. It serves to anchor the profession's other core standards and can be used by regulators for a variety of purposes, including, but not limited to:

- Academic program approval/recognition/accreditation
- Assessment of internationally educated applicants
- Continuing competency requirements
- Input into the content and scope of entry-to-practice exams
- Policy and standard development and decision making
- Reference for professional conduct matters
- Public and employer information regarding the practice expectations of professional engineers

The Full Spectrum Competency Profile (FSCP)

The FSCP (**Figure 3**) is a working model of a competency framework with the potential to enhance the accreditation review processes and support engineering regulators in licensing professional engineers.

In the initial stages of the FSCP's development, the FEA project team aimed to identify a set of competencies that would be common to all engineers, regardless of discipline. The premise was that early in their careers, there is a strong emphasis on knowledge acquisition in academic settings. As they progress, engineers apply this knowledge and deepen it as they focus on a specific area of practice.

Based on prior research, the project team established a competency framework consisting of 34 competencies organized into eight domains: six for core competencies and two for cross-functional competencies.

Core competencies are common to all engineers regardless of disciplines and areas of practice. They are mandatory for all engineering graduates, newly licensed engineers, and experienced practitioners. The six domains for core competencies of the FSCP were compared to the IEA's Graduate Attributes and Professional Competencies Framework. There was alignment to all the Graduate Attributes, except with "tool usage", and among all professional competencies **(Figure 4)**.

The core competencies were also compared to the CEAB Graduate Attributes and Pan-Canadian Work Experience Competencies. Again, there was near complete alignment except with "use of engineering tools" from the CEAB Graduate Attributes and with "technical competence" in the Pan-Canadian Work Experience Competencies **(Figure 5)**.

Appendix C provides a single illustrative comparison of the FSCP to these established benchmarks.

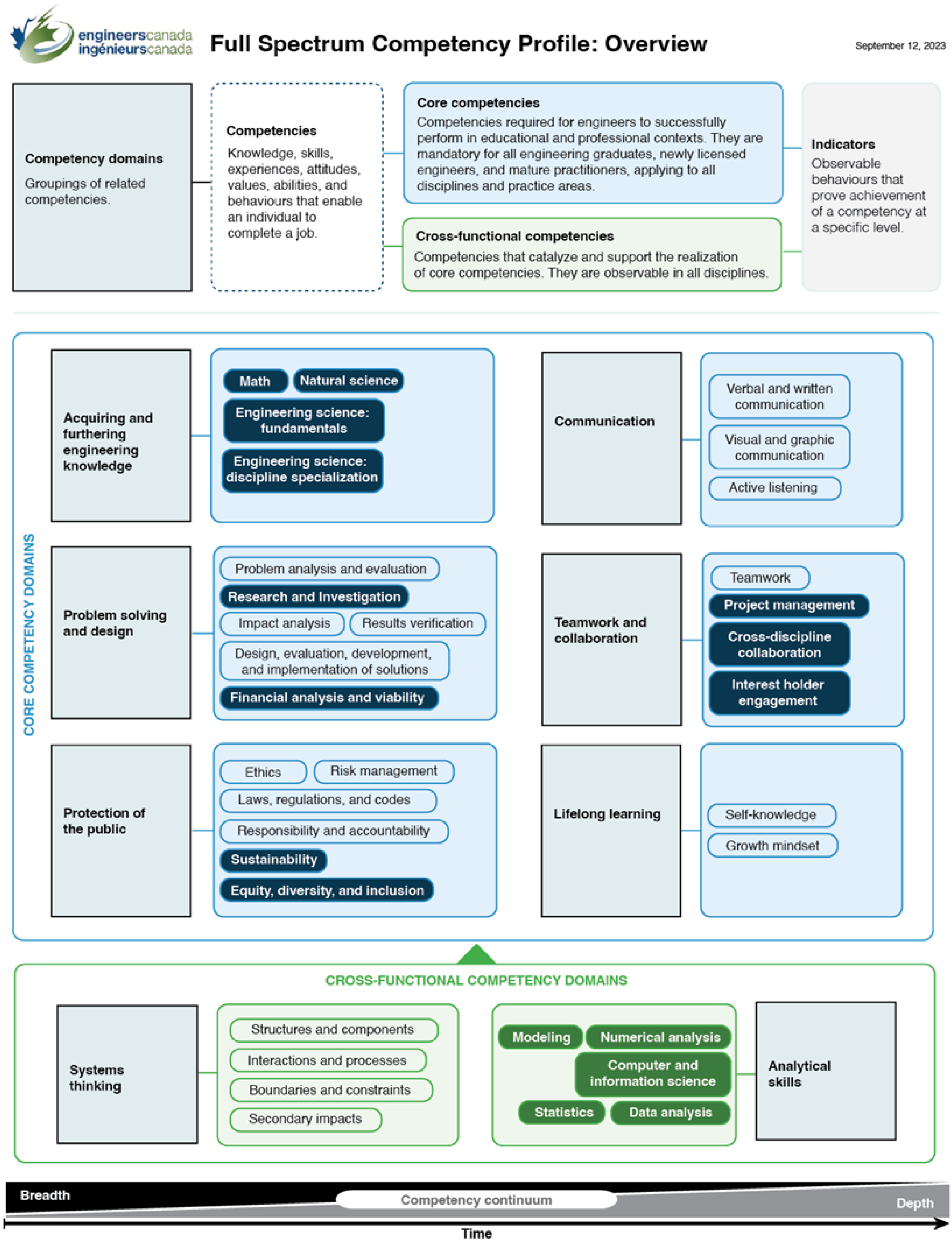

Figure 3: The FSCP competencies are organized into eight domains. The subset of competencies that constitute the proposed NARL are shaded in dark blue and dark green.

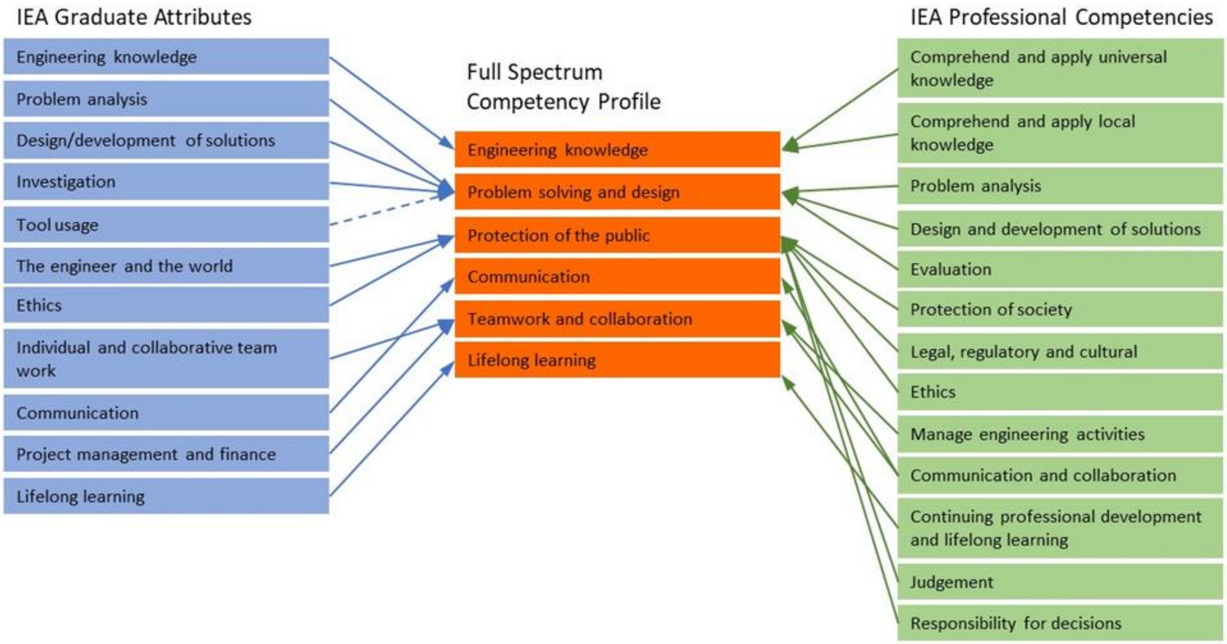

Figure 4: Mapping the FSCP Core Competencies to the IEA's Graduate Attributes and Professional Competencies Framework.

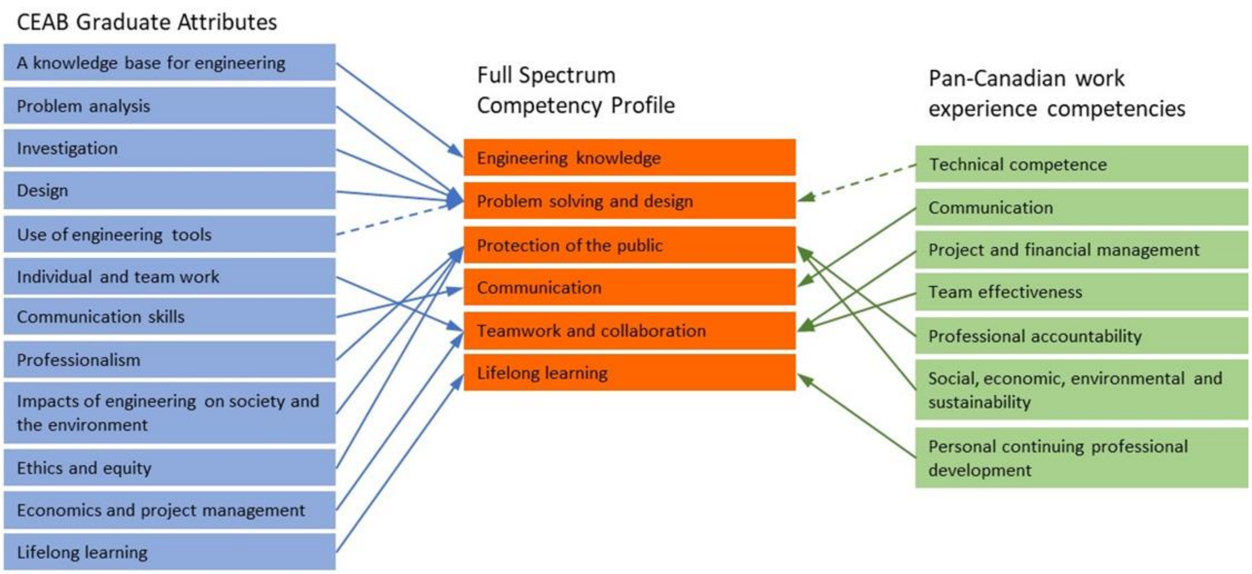

Figure 5: Mapping the FSCP Core Competencies to the CEAB Graduate Attributes and the Pan-Canadian Work Experience Competencies.

As a "full spectrum" competency framework, the FSCP is intended to identify the competencies that all engineers need to develop during their career journey on a continuum, from undergraduate education to post-graduation experiential learning to post-licensure practice (**Figure 6**). In undergraduate education, competency development is foundational and emerging; in post-graduation and through experiential learning, the competency continues to develop and consolidate; and in post-licensure, the competency becomes more focused and refined.

While the current focus of FSCP development is on pre-licensure competencies, its ultimate scope could encompass the entire engineering career spectrum. The post-licensure stage involves continuing professional development (CPD). By aligning with CPD requirements, the FSCP can provide a structured approach to ongoing professional development, ensuring engineers maintain and enhance the competencies essential for safe and effective practice.

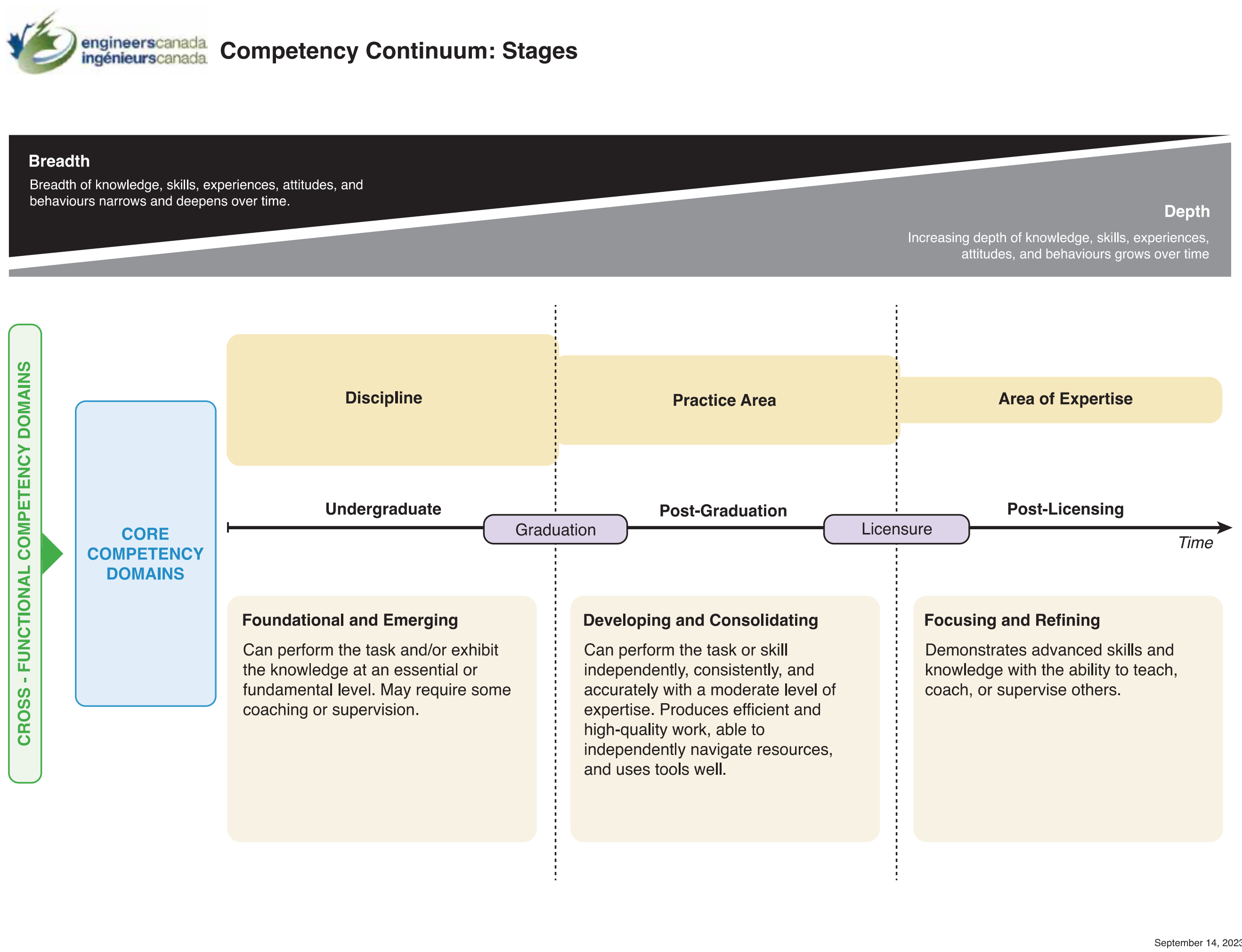

Figure 6: Competency stages. An engineer's journey from undergraduate through post-graduation and post-licensure.

The FSCP model is aligned to Miller's Pyramid of Clinical Competence **(Figure 7).**[19] The pyramid was developed specifically for assessing the clinical competency of learners in health care settings. Influenced by concepts from Bloom's Taxonomy of Educational Objectives, Miller's Pyramid was

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[19] Miller, G. E. (1990). The assessment of clinical skills/competence/performance. Academic Medicine, 65, S63-S67.

established in 1990 and has been used in medical education for nearly as long.[20] Like engineering, medicine is a high stakes regulated profession requiring rigorous evaluation.[21]

Miller's Pyramid aims to define education and training by outputs rather than inputs. Ultimately, it is focused on what learners can do, which is not the same as what they have been taught. The model's higher levels require greater professional and assessment authenticity.

The model is useful for assessing learning outcomes (competencies) at various stages of the learning process. The pyramid illustrates the expected learner progression from novice (bottom) to expert (top). Novice learners should be able to recall facts, but as their competency develops, they should be able to interpret and apply, demonstrate, and perform required knowledge, skills, and attitudes in authentic practice settings. Competency assessment should also evolve from recall-based multiple-choice questions to more authentic, workplace-based assessments.

Throughout the socialization and expert consultation of the FSCP, most of the feedback has focused on the implementation details and practical considerations, rather than questioning the core concept of the framework as a working competency model. Questions have revolved around issues like defining and interpreting competencies and ensuring applicability to non-CEAB graduates. This suggests strong initial validity of the FSCP, and further evidence will be necessary as the development progresses.

Figure 7: Miller's Pyramid of Clinical Competence

[20] Bloom, B. S. (1956). Taxonomy of educational objectives: Cognitive and affective domains. New York: David McKay.

[21] Norcini, J. J. (2003). ABC of learning and teaching in medicine: Work based assessment. *BMJ. British Medical Journal*, *326*(7392), 753–755. https://doi.org/10.1136/bmj.326.7392.753

6. The National Academic Requirement for Licensure (NARL)

What is the NARL?

Competency-based academic requirements are a key feature of outcomes-focused accreditation systems. This approach ensures graduates possess the essential competencies for safe engineering practice, regardless of their educational pathway. By assessing competencies instead of academic backgrounds, the system fosters a fairer and more flexible accreditation process.

The NARL has the potential for establishing a national standard of assessment for regulators and streamlining licensure for graduates of non-CEAB programs. However, the Path Forward Co-Design Session in April revealed participant concerns regarding certain aspects including:

- the process of selecting competencies and indicators;
- the optimal number of competencies;
- potential complexities of implementation;
- the defensibility of assessment strategies;
- potential methods to integrate the competency framework into accreditation criteria; and
- the applicability to non-CEAB graduates and alternative licensure pathways.

The Steering Committee acknowledges the importance of these concerns, recognizing that some solutions may only emerge as the FSCP Pilot Project and/or the actual implementation of the FSCP progresses.

NARL competencies

The Academic Requirement Task Force was tasked with identifying the specific competencies from the FSCP that graduating engineers would need to demonstrate at least at the "knows how" level upon completing their academic studies. In an iterative process over several weeks, the Academic Requirement Task Force proposed an initial subset of competencies which they expect to be acquired during academic training and which they further expect will be demonstrated at least at the "knows how" level upon completion of the engineering program **(Figure 8)**. This number was not predetermined but emerged organically through the process and is still subject to confirmation as this work proceeds

When used in the accreditation system, these competencies are expected to be developed and assessed by CEAB-accredited engineering programs, ensuring graduates can demonstrate them at the "knows-how" level of Miller's Pyramid by graduation. This "knows-how" level signifies the graduates' ability to apply their knowledge and skills in a practical setting. These competencies serve as the foundation of an engineer's career path and are expected to be further developed and honed to the "does" level of Miller's Pyramid during the post-graduate and post-licensure phases of their career **(Figure 7)**.

At the point of licensure, the applicant is assessed to determine if they:	KNOW	KNOW HOW	SHOW	DO
Acquiring and furthering engineering knowledge				
Math		✓		
Natural science		✓		
Engineering science: fundamentals		✓		
Engineering science: discipline specialization		✓		
Problem solving and design				
Problem analysis and evaluation				✓
Research and investigation		✓		
Impact analysis				✓
Results verification				✓
Design, evaluation, development and implementation of solutions				✓
Financial analysis and viability		✓		
Protection of the public				
Ethics				✓
Laws, regulations and codes				✓
Risk management				✓
Responsibility and accountability				✓
Sustainability		✓		
Equity, diversity and inclusiveness		✓		
Communication				
Verbal and written communication				✓
Visual and graphic communication				✓
Active listening				✓
Teamwork and collaboration				
Teamwork				✓
Project management		✓		
Cross-discipline collaboration		✓		
Stakeholder engagement		✓		
Lifelong learning				
Self-knowledge				✓
Growth mindset				✓
Systems thinking				
Structures and components				✓
Boundaries and constraints				✓
Interactions and processes				✓
Secondary impacts				✓
Analytical skills				
Numerical analysis		✓		
Data analysis		✓		
Statistics		✓		
Computer and information science		✓		
Modelling		✓		

Figure 8: The competencies of the NARL assessed at the "knows-how" level and the other competencies of the FSCP assessed at the "does" level for CEAB graduates. Applying this mapping to alternative licensure pathways requires further development that may be explored in the FSCP pilot study.

Focusing on exit-level competencies streamlines accreditation for HEIs and provides confidence to regulators that CEAB graduates are well-prepared for the next step towards licensure. The remaining competencies of the FSCP which do not comprise the NARL will be assessed by the regulator before an applicant is granted licensure. Applicants must demonstrate these competencies at the "does" level of Miller's Pyramid.

While accreditation focuses on developing and assessing NARL competencies, HEIs still have the autonomy and flexibility to go beyond these in their curriculum design. It is likely that HEIs will choose to offer courses that build foundational knowledge for the other competencies. HEIs may also evaluate all competencies of the FSCP at a level exceeding "knows" on Miller's Pyramid, if they choose to do so. This allows for program innovation and caters to specific industry needs or graduate specializations.

It is important to emphasize that the NARL, as proposed in this report, is a concept / working draft that is expected to evolve with further refinement, exploration, and development. If this initiative is to proceed, it is plausible that the number and selection of competencies which make up the NARL may change. For example, the design competency is part of the FSCP, although it is not included in the current NARL. While engineering programs may introduce students to design concepts ("knows"), the practical application ("doing") often occurs after graduation during the engineer-in-training period. However, design remains part of the IEA Graduate Attributes which must be met to achieve compliance with the Washington Accord. Additional studies will explore how to best integrate design considerations into the NARL or future accreditation processes to bridge this gap and maintain alignment with international expectations.

There may be opportunities to integrate other competencies not currently included in the NARL. The possibility of expanding HEI assessment beyond the initial NARL competencies may potentially reduce the regulators' assessment workloads. Although not in scope for the current proposed FSCP pilot study, further development of the NARL should examine the composition and optimal number of competencies, as well as appropriate levels of HEI assessment.

All these details will need to be determined at a later stage and clear communication of NARL competencies and assessment procedures will be essential for HEIs, students, accreditation visiting teams, and regulators.

Definitions of the proposed NARL competencies

DOMAIN: ACQUIRING AND FURTHERING ENGINEERING KNOWLEDGE

1. Math

Mathematics is an extension of language and is used to describe, analyze, and predict scientific and engineering principles and phenomena. It includes, but is not limited to, elements of linear algebra, differential and integral calculus, differential equations, probability, statistics, numerical analysis, and discrete mathematics.

2. Natural science

Natural sciences include the exploration of the interactions and processes of the natural world and the systematic observation and understanding of natural phenomena through analytical and/or experimental techniques.

3. Engineering science: fundamentals

Engineering science fundamentals involve the application of mathematics and natural science to practical problems. They lay the foundation for discipline specific engineering science while also providing a knowledge base to ensure an understanding of the broader scope of engineering practice. Engineering Fundamentals may include, but are not limited to, engineering mechanics, materials, fluid mechanics, thermodynamics, and basic electric circuits and power.

4. Engineering science: discipline specialization[22]

Engineering science subjects involve the application of mathematics and natural science to practical problems. Topics are determined by the specific discipline of specialization and will include the applied aspects of the essential science relevant to problem-solving within that discipline.

[22] It may be impossible to define Engineering Science: Discipline Specialization more precisely while still maintaining its generic applicability. As with all working definitions presented in this report, additional recommendations for refining this competency definition may be included in the Path Forward report and validated in subsequent stages of the project.

DOMAIN: PROBLEM SOLVING AND DESIGN

5. Research and investigation

An ability to identify, formulate, research, and conduct investigations of complex engineering problems, by methods that include appropriate experiments, analysis, and interpretation of data, and synthesis of information using principles of mathematics, natural science, and engineering science to reach substantiated conclusions.

6. Financial analysis and viability

An ability to appropriately use financial principles to determine the economic viability of proposed engineering projects and to select between independent alternatives. Engineering economic principles include the importance of finance in business decisions, project cash flows, time value of money, depreciation, present worth analysis, rate of return analysis, and risk analysis.

DOMAIN: PROTECTION OF THE PUBLIC

7. Sustainability

Sustainability is a long-term goal. Sustainable development is a strategy employed to meet the economic, environmental, and social needs of the present without compromising the ability of future generations to meet their own needs.[23] Sustainable engineering requires:

- consideration of economic efficiency and profitability for investors,
- navigating the tension between technical constraints and the need to broaden the design space to include ecological and environmental impact,
- meaningful consideration of design processes and outcomes that can preserve or improve social equity, and
- intergenerational equity, an emerging area for consideration, arising from non-Western knowledge systems that consider the impact of our actions seven generations into the future.

8. Equity, diversity, and inclusiveness

Equity is the promotion of fairness and justice for each individual that considers historical, social, systemic, and structural issues that impact experience and individual needs. Elevating equity in a good way removes barriers for the entire population.

Diversity is a measure of representation within a community or population that includes identity, background, lived experience, culture, disciplinary expertise, and many more.

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[23] This definition is provided in part from the UN. https://www.un.org/en/academic-impact/sustainability

Inclusion is the creation of an environment where everyone shares a sense of belonging, is treated with respect, feels heard, and is empowered to participate.

It is important to note that while an inclusive group is by definition diverse, a diverse group is not always inclusive. An inclusive working environment or team strives for equity and respects, accepts, and values differences.[24]

DOMAIN: TEAMWORK AND COLLABORATION

9. Project management

Project management involves the comprehension of a project at various levels from full ownership at a coordination level to being knowledgeable about a project at a level of day-to-day tasks. Project management involves a set of principles that span the planning, implementing, and executing stages, and involves necessary attributes such as relationship building, budgeting, and resourcing, as well as considerations for safety, sustainability, and regulatory requirements.

10. Cross-discipline collaboration

An awareness of the importance of working effectively on projects that may involve collaboration across different disciplines and practice areas of engineering, including other professions.

11. Interest holder engagement

Interest holder engagement is the process by which an organization embarks on meaningful collaboration with key groups/individuals who may be impacted by actions and decisions being made. Meaningful engagement involves the recognition that all engineering work has an impact and that those affected should be provided with accessible and appropriate information and be given the opportunity to voice those concerns.

DOMAIN: ANALYTICAL SKILLS

12. Numerical analysis

The use of algorithms and numerical approximation techniques in mathematical analysis as applied to engineering problems. Topics include direct and iterative methods, conditioning and discretization, and generation and propagation of errors.

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[24] This definition is from the University of Toronto. https://research.utoronto.ca/equity-diversity-inclusion/equity-diversity-inclusion

13. Data analysis

The knowledge and skills required to ask and answer a range of questions by analyzing data, including developing an analytical plan; selecting and using appropriate statistical techniques and tools; and interpreting, evaluating, and comparing results with other findings. An ability in data analysis implies knowledge in data awareness, cleaning, discovery, ethics, exploration, tools, and visualization.[25]

14. Statistics

Ability to use statistical principles to summarize data and draw conclusions from it. Important concepts include probability, frequency distributions, mean, standard deviation, propagation of errors, hypothesis testing, sample size determination, and regression.

15. Computer and information sciences

The knowledge and skills to use computer systems to store and manipulate large quantities of information. Topics include programming theory, computer system architecture, data repositories (e.g., databases, cloud storage, data lakes), and computation theory.

16. Modelling

Modelling is the purposeful development of an analytical, numerical, or empirical description of a real system. These models can be mathematical or physical in nature and are created with the specific intent of describing, analyzing, testing, demonstrating, and/or predicting behaviours, properties, or other characteristics of the system.

Insights from project engagement and research supporting the FSCP

i. Mapping the FSCP to existing benchmarks

As part of the analysis about the suitability of the FSCP, Engineers Canada conducted a mapping exercise to compare it with established benchmarks, including the CEAB's Graduate Attributes, the Pan-Canadian Work Experience Competencies, and the IEA's Graduate Attributes and Professional Competencies Framework. This mapping was presented to interest holders during the 2023 Fall Consultations to showcase the FSCP's alignment with the existing frameworks and bolster its credibility and reliability (Appendix C).

[25] This definition is provided from Statistics Canada. https://www.statcan.gc.ca/en/wtc/data-literacy/compentencies

ii. Alignment with competency-based assessment

The 2022 report *Current and Emerging Practices in Engineering Education* highlighted the increasing interest in CBA methods among educators. Most Canadian engineering regulators have already implemented CBA, comprising 34 competencies across seven different categories. The adoption of the FSCP represents a formalization of this assessment approach. Furthermore, competencies can be clearly defined, which facilitates transparent communication to interest holders regarding expectations for fulfillment and the evaluation processes.

Educators have also been expressing increased interest in CBA. Certain engineering programs have begun implementing CBA techniques, which enable students to effectively demonstrate their competencies on targeted tasks, facilitating their successful completion of courses.

iii. Alignment with other professions

In the 2022 report *Benchmarking the Canadian Engineering Accreditation System*, all eight of the accreditation systems under study, comprising five engineering and three other professions, are characterized as outcomes-focused accreditation systems. A combination of graduate attributes, experience examples, and competencies are used as part of the accreditation system measures of student outcomes.[26] Preparing the FSCP and its subset of competencies that comprise the NARL would be consistent with these established models of accreditation.

The 2023 interviews with leadership from the Canadian nursing, accounting, and architecture professions revealed a shared reliance on competency profiles. Notably, all academic programs within these professions follow a competency-based approach, alongside national exams for licensure/certification.

In the case of internationally trained applicants, nursing employs a competency-based review for assessing academic qualifications. As well, internationally trained architects with seven or more years of experience are not subjected to academic assessment; rather, their licensure process centers on a comprehensive competency review of their extensive professional experience.

iv. Versatility

The FSCP represents versatility, accommodating the varying timeframes that make up the engineer's career journey. Its competencies can be tailored to suit the needs of diverse user groups, ranging from undergraduate learners to post-graduation trainees and post-licence practitioners. The approach allows for seamless adjustments in measuring and evaluating proficiency in competencies at each stage, ensuring appropriate assessments of both breadth and depth based on the stage of development. Additionally, the competencies are not limited to a specific discipline and encompass all areas of engineering practice equally.

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[26] See Metric 1.4, page 15.

v. Readiness for the future

During FEA's Foresight Session and virtual simulations, interest holders were invited to reflect on the anticipated future landscape of the engineering ecosystem. An emerging consensus suggests that engineers will operate in environments marked by heightened uncertainty and rapid change. Acknowledging this evolving reality, the FSCP provides a clear method for preparing tomorrow's engineers to effectively confront multifaceted and interdisciplinary challenges. The FSCP itself is intended to be adaptable, ensuring its continued relevance in an ever-changing professional environment. By encompassing not only technical knowledge and abilities but also analytical, interpersonal, and social skills, the FSCP offers a comprehensive framework to ensure that engineers emerge as well-rounded and adaptable professionals equipped to navigate diverse professional contexts.

vi. Engineering education

The FSCP encourages flexibility and innovation within engineering programs, aligning closely with the core purpose of accreditation. By embracing the FSCP, programs can tailor their educational offerings to meet the evolving needs of the engineering profession while maintaining the standards expected by accreditation bodies.

The FSCP also represents an outcomes-focused approach, which reflects the pedagogical practices of many other jurisdictions covered in the 2022 report, *Benchmarking the Canadian Engineering Accreditation System*. The use of outcomes-focused approaches bolsters the credibility and effectiveness of engineering education.

vii. Increased diversity and inclusion

The FSCP presents a significant opportunity to address diversity and foster inclusion within the engineering profession. By embracing the FSCP, engineering programs and regulators can adapt their approaches to accommodate diverse learning styles and offer multiple pathways to licensure. This inclusive approach ensures that individuals from various backgrounds and experiences have greater opportunities for access to, participation in, and success within the engineering field.

Refining the FSCP to meet the needs of the accreditation and licensing systems

The Academic Requirement Task Force identified key concerns related to FSCP and NARL that centered on maintaining momentum and interest holder engagement. Specifically, the task force highlighted:

i. Urgency to complete the NARL

CURRENT GAP

There is an urgent imperative to thoroughly develop and implement a NARL that is universally adopted by all regulators. This imperative contrasts with the longer development timelines needed to meticulously outline the FSCP. While the FSCP and NARL are complementary, the anticipated differences in their development timelines may complicate how they are received, adopted, and accepted.

> Recommendation and Rationale:
> See An Imperative for National Adoption and resulting Recommendation 12 (p.56)

ii. Continued development of the FSCP

CURRENT GAP

Interest holders must maintain their focus on the long-term development of the FSCP and actively work towards its widespread adoption across the entire system. Achieving a comprehensive assessment as intended by the FSCP would require significantly more effort from all involved parties, which may not align with regulators' current priorities. The ongoing government pressures to expedite applications for entry to practice stand in contrast to the requirement for heightened assessment efforts.

To foster adoption of the FSCP, it is essential to ensure that the FSCP:
- Is easily understood and applied.
- Enhances existing rigorous standards.
- Adopts efficient procedures to optimize outcomes.
- Emphasizes a comprehensive assessment of competencies, including public safety, accountability, and liability.
- Balances the evaluation of both academic and experiential competencies effectively.
- Supports diverse approaches to flexibility and innovation within the system.

> Recommendation and rationale:
> See An Imperative for National Adoption and resulting Recommendation 12 (p.56)

iii. An Imperative for National Adoption

CURRENT GAP

Historically, Canadian engineering regulators adopt new licensure approaches at different stages, influenced by a variety of regulator-specific factors. At the April 2024 Co-Design Session, regulator representatives were keen to collaborate on this initiative but identified considerations such as legislative realities, competing priorities, and change fatigue as potential barriers to synchronized national adoption. However, there is an emergent desire across all regulators to collaborate and harmonize. The 2024 signing of the National Statement of Collaboration is a tool that could be leveraged to catalyze on upcoming opportunities and achieve shared goals.

> **Recommendation 12 for the future direction:**
> **Initiate a pilot study to evaluate the feasibility of the FSCP according to the proposed Terms of Reference.**

RATIONALE

The urgency to complete the NARL and continue development of the FSCP, as well as an imperative for national adoption of both, are interrelated aspects which may be collectively addressed through initiating the FSCP pilot study.

Achieving nationwide adoption of the FSCP and NARL by all interest holders immediately is not realistic and, like other large-scale transformative initiatives, it would be more reasonable to expect regulators to adopt the initiative on a staggered approach. There will be early adopters who embrace the framework in its initial stages, followed by others who join later.

As part of the FEA project, it has been determined that Engineers Canada should initiate the FSCP pilot study to test and refine the concepts of the FSCP and its NARL subset. The system's rollout will likely unfold at a pace determined by the interest holders, and the pilot study will play a crucial role in assessing the FSCP and NARL's feasibility and demonstrating their value to interest holders, convincing them of the long-term viability and encouraging wider adoption.

iv. Substantial equivalence with IEA Graduate Attributes and Professional Competency Framework

CURRENT GAP

While the FSCP has been mapped onto existing frameworks such as CEAB's Graduate Attributes, the Pan-Canadian Work Experience Competencies, and the IEA's Graduate Attributes and Professional Competencies benchmarks, there are still gaps that need to be addressed to improve alignment with these models.

> **Recommendation 13 for the future direction:**
> **Ensure that the FSCP, including the NARL, is substantially equivalent to the IEA Graduate Attributes and Professional Competencies benchmark.**

RATIONALE

As a signatory to the Washington Accord and member of the APEC-EA and IPEA agreements, Engineers Canada must demonstrate that the competency framework applied to the accreditation system and the evaluation of work experience remains substantially equivalent to the IEA's Graduate Attributes and Professional Competencies Framework.

7. Developing a competency framework

To advance the FSCP development and address known gaps, further refinement of the competency framework is required. A Job-Task Analysis (JTA) approach may facilitate this process **(Figure 9)**. A JTA has three main tasks:

1. **Define the competency:**
    a. Develop **competency statements** that provides a wholesome description of the area of competence (for example, what is meant by 'math'?).
    b. Develop a **description** of what it means to be competent in the area (what does it mean to be competent in 'math'?) using a four-part structure:
        i. Performance of an action (verb)
        ii. The action to whom or what (the object of the verb)
        iii. To produce something (an expected outcome or why the action is necessary)
        iv. Using what tools, equipment, work aids, processes, standards.
2. **Validation Survey:** The fully articulated competencies need to be socialized and validated in the engineering ecosystem. The validation process solicits the opinions of a large, wide-ranging group of subject matter experts to rate each competency on two dimensions:
   (1) Frequency: How often does a practicing licensed engineer use this competency?
   (2) Criticality: How critical is the competency to safe practice? Typically, for each articulated competency, the "Frequency" rating is multiplied by the "Criticality" rating to produce a validation score. The higher the score, the greater the evidence of validity.
   In other words, the higher the score, the greater the evidence that the competency belongs in the FSCP as a sample of activities that all engineers do.
3. **Define indicators:** These are discrete, observable outcomes of actions that demonstrate competence. Each FSCP competency will need to be defined with indicators using Miller's Pyramid at both the "knows how" level for HEIs and at the "does" level for regulators assessing CEAB and non-CEAB applicants. The indicators should clearly outline how an individual demonstrates they "know how" to complete an action and how they demonstrate they can "do" the action.

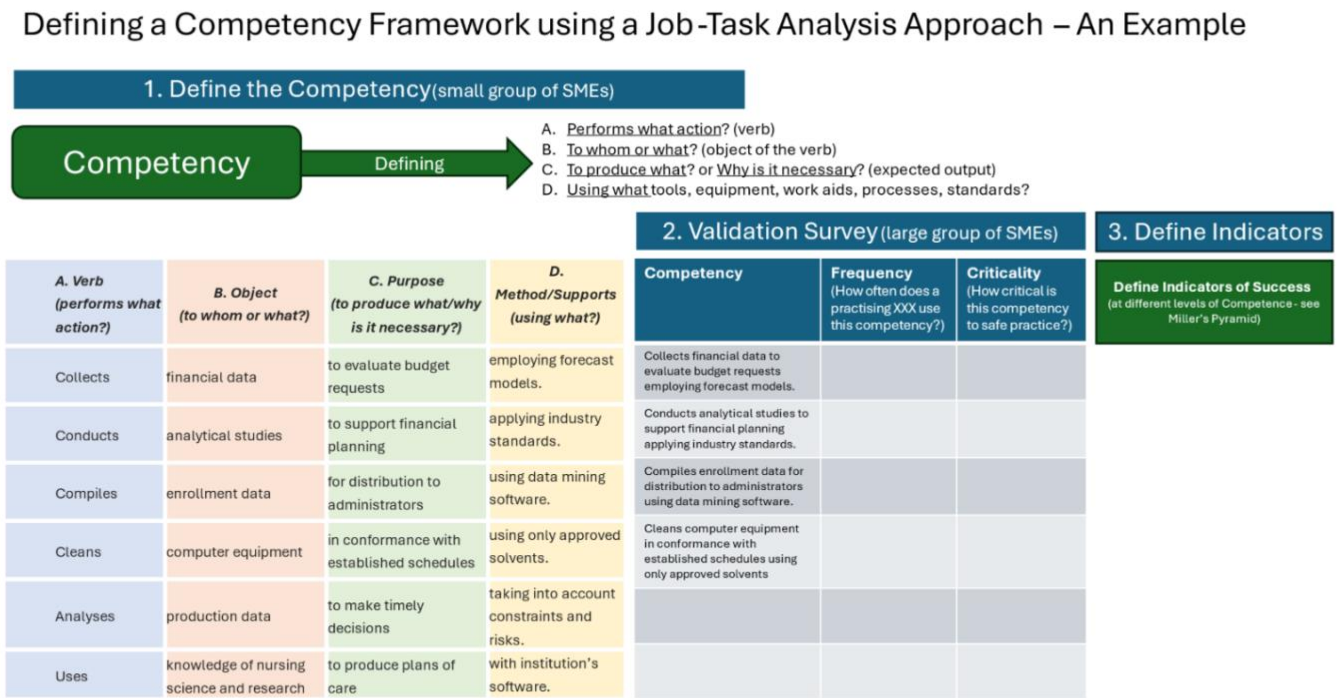


Figure 9: Defining a competency framework using a Job-Task Analysis Approach.[27]

8. Full Spectrum Competency Profile (FSCP) pilot study

At the Path Forward Co-Design Session, participants believed that a pilot study would be needed to demonstrate the feasibility of implementing the FSCP concepts across the engineering licensure and accreditation systems. It was suggested that the pilot study could involve selecting a small subset (3-5) of the FSCP competencies, developing the competencies and the associated indicators, and applying the resulting framework in both the accreditation and licensure environments. The pilot study should involve a range of interest holders, including engineering regulators and HEIs, and be advanced quickly. The pilot study could help inform the process of fully developing the NARL and the FSCP and demonstrate their applicability in the engineering ecosystem.

Following the session, Terms of Reference were drafted for an FSCP pilot study Working Group (Appendix D). A pilot study is a small-scale, short- to medium-term study that helps an organization learn how a large-scale project might work in practice. It is an opportunity to test the design, functionality, and feasibility of a solution before committing significant resources to a full-scale implementation.

[27] Prepared by Sid Ali, member of the FEA project team for Path Forward Co-Design Session in April 2024.

The purpose of the FSCP pilot study is to understand the effort required to define the FSCP competencies and explore the appropriate processes to assess them. It is intended to begin after the publication of this Path Forward Report and its acceptance by the Engineers Canada Board and is expected to conclude in late 2025 and is designed to provide initial insights into the application of the competency framework all licensure pathways.

The FSCP pilot study Working Group will have diverse representation, including members from Engineers Canada staff, the Academic Requirement Task Force and Purpose Task Force, the CEAB and CEQB, HEIs, engineering regulators, a psychometrician, and potentially industry and recent engineering graduates. The assessment of competencies within the pilot study will be conducted by both HEIs and engineering regulators to assess both CEAB and non-CEAB applicants across a geographic diversity of Canadian jurisdictions.

There are six objectives for the working group, including:

1. selecting the competencies to pilot,
2. defining the competencies and associated indicators such that they can be assessed in a defensible manner and in a way that establishes competence,
3. creating assessment processes,
4. developing a plan to pilot the selected competencies and processes,
5. overseeing the execution of the pilot study, and
6. reporting recommendations.

While the attendees of the Path Forward Co-Design Session originally suggested piloting 3-5 competencies, including at least one technical competency and one professional competency, it will be up to the working group to decide which subset of competencies to include in the pilot study. The aim is to include competencies which are highly relevant to all professional engineers (i.e. they are both used frequently and are critical to safe practice).

A follow-on task will be to apply learnings of the pilot to all FSCP competencies to define the competencies and associated indicators. The FSCP will then need to be fully validated.

> **Recommendation for the future direction:**
> **Covered by recommendation 12: Initiate a pilot study to evaluate the feasibility of the FSCP according to the proposed Terms of Reference.**

9. Implementation approach

The FEA project has been a multi-year initiative requiring sustained effort from a core team and input from hundreds of interest holders. Creating a shared vision for the future and fostering collaboration have been essential foundations for this work.

The next phase of the work will require ongoing broad support across the engineering ecosystem. A change management plan informed by diverse perspectives will be vital for navigating this complex transition, considering both operational and emotional factors. Appendix E provides detailed considerations and principles to guide future changes in the accreditation system and FSCP, along with a framework for measuring interest holder support during the changes.

> **Recommendation 14 for the future direction:**
> **Establish a dedicated task force to develop a change management plan for the strategic implementation of outcomes-focused accreditation. This plan should encompass the sequence of tactical steps to move from the current state to the desired state and address the potential emotional and psychological experience of change.**

Governance

The transformative shift towards outcomes-focused accreditation necessitates a revamped governance structure. Just as collaborative stewardship and co-design underpin this new accreditation model, these principles must permeate the governing body itself.

The new governance model should prioritize fairness, transparency, and increased equality for all interest holders – HEIs, accreditors, regulators, and students. By fostering a sense of collective involvement, interest holders are more likely to perceive a favourable return on their investment in the accreditation process.

The adoption of FSCP will also create a change in the roles and procedures of all interest holders. New protocols for communication, data sharing, and decision-making will be essential. Development of the new governance model should be centered on the key considerations detailed in the following recommendations and supporting information.

CEAB: Separate policy setting from operational delivery.

The current CEAB is responsible for both policy development, including oversight of accreditation criteria and procedures setting, as well as for the operational tasks of conducting site visits and issuing accreditation decisions.

The new governing model should separate these functions. The *Benchmarking the Canadian Engineering Accreditation System* report, explains that Poland and Australia have separated the oversight body setting accreditation standards from the body that implements accreditation processes and makes accreditation decisions. In France, the accreditation body sets the standards and makes the initial decision, although the final decision is made by a government ministry.[28]

This separation could be achieved by establishing two separate committees, one of which would focus on the policy aspects (including establishing accreditation criteria) and the other would be operational. It should be noted that it was clear from all interest holders input that future policy development should be co-designed and, as such, a new policy committee should have this as a core foundational tenet. With the responsibility for policy development removed, the remaining operational committee would have a focus on the accreditation process itself, including visits and decisions.

> **Recommendation 15 for the future direction:**
> **The Engineers Canada Board should establish two distinct bodies in accreditation: a policy body responsible for setting strategic direction, and an operational body focused on execution of policies.**

> **Recommendation 16 for the future direction:**
> **Establish a new dedicated oversight body for the FSCP.**

The FSCP roll-out significantly impacts the roles and responsibilities of various interest holders within the entire engineering ecosystem in Canada. It will impact how HEIs teach students to prepare them for licensure, the eligibility of international applicants based on substantial equivalency, and how regulators assess applicants of any background.

This new landscape necessitates oversight of the FSCP and the subset of competencies which will comprise the NARL, ensuring it stays current and is applied effectively. This is an essential task that requires a dedicated body composed of individuals with the necessary expertise and representation to critically consider the full spectrum of competencies required by future engineers, encompassing both technical and non-technical skills.

The oversight committee's focus on the competency profile also intersects with various regulatory functions, including accreditation, entry-to-practice requirements, and post-licensure continued learning. To ensure a comprehensive perspective, the committee should be separate from other bodies and have diverse representation covering all these aspects.

CEQB: Continue to provide guidance on engineering issues.

The CEQB develops national guidelines, papers, and examination syllabi to serve the needs of the engineering community, including regulators, licence holders, and applicants for licensure.

[28] *Benchmarking the Canadian Engineering Accreditation System*, p.18

The FSCP pilot study is intended to explore its applicability to non-CEAB graduates and may potentially reduce the reliance on input-based syllabi reviews. Nevertheless, the transition to the FSCP will significantly affect admissions processes, and CEQB's expertise remains instrumental for developing standards, processes, and criteria for non-CEAB applicants and alternative licensure pathways.

The CEQB should continue to provide guidance on practice issues and adapt its approach to admissions. To ensure their valuable insights continue to shape the future, the CEQB should actively participate in the new FSCP oversight committee.

Representation:

The new governance model should foster a more inclusive environment by incorporating a wider range of voices. This includes more equitable representation from regulators, HEIs, CEAB, CEQB, industry, and students. This diverse mix is crucial for capturing the perspectives of all interest holders and fosters a shared sense of ownership and responsibility for the system's outcomes.

Interest holders

Shifting to an outcomes-focused accreditation system will necessitate specific adjustments for some interest holders' roles and activities in the engineering ecosystem. The following assumptions will warrant further validation in future stages of work.

CEAB

CEAB will continue to lead the accreditation process, conducting visits and issuing decisions. It is suggested that policy and criteria development will be informed by a separate body comprised of diverse representation. The CEAB's established expertise in defining accreditation requirements will be represented on this new policy body, and future policy development should be co-designed.

The CEAB's expertise will be essential for the new FSCP oversight body to ensure alignment with accreditation criteria. The CEAB remains a key partner for equipping HEIs and regulators with the resources they need to understand accreditation. Applying lessons learned from the rollout of Graduate Attributes from 2008 to 2015 can help develop clear communications and a well-defined action plan to assist HEIs and regulators during transition.

CEQB

The implementation of the FSCP would necessitate a shift in the CEQB's role regarding admissions issues and syllabi reviews. The syllabi reviews may become redundant with the FSCP, but CEQB's expertise positions it well to contribute to the broader FSCP oversight process. In particular, CEQB's experience with issues encompassing the entire career continuum, from entry to practice to ongoing professional development, equips them to assess how effectively the FSCP aligns with the “full spectrum” career journey it aims to cover. Additionally, the CEQB is well-suited to ensure the FSCP effectively addresses non-CEAB graduates and alternative licensure pathways.

Regulators

The NARL is intended to give regulators continued confidence in the quality of HEIs’ programs while necessitating adjustments to their licensing practices. The implementation of standards-based assessments may contribute to expedited procedures and enhances the defensibility. Engineers Canada and the new FSCP oversight body will engage with each regulator directly to gauge their receptivity for the FSCP’s evolving framework and to provide tailored support that would facilitate a smooth adoption process.

HEIs

Shifting from Accreditation Units (AUs) to outcomes-focused accreditation will provide greater flexibility and innovation in program design, particularly for emerging disciplines. This, in conjunction with clear guidance from CEAB, should allow HEIs to tailor their programs with a sharper focus on student success.

Students

By shifting to outcomes-focused accreditation, students may gain access to a wider range of learning opportunities through flexible and diverse educational pathways. Students can be confident that their engineering program is preparing them effectively to meet the licensure requirements and pursue successful engineering careers.

Industry

Historically, the Canadian engineering accreditation system has had less industry involvement as compared to other countries. As the Engineers Canada Board considers this report’s recommendations, opportunities to continue to involve industry in its initiatives should be leveraged. industry expertise can support Engineers Canada by informing accreditation criteria and contributing to the development of competencies for applicants for licensure. The Terms of Reference for the FSCP pilot study recognize this potential and leaves room for industry participation for these very reasons.

> **Recommendation 17 for the future direction:**
> **Establish regular engagement opportunities with industry, leveraging existing mechanisms to gather ongoing feedback and insights.**

RATIONALE

The specific nature of industry engagement requires further refinement. Industry needs vary across sectors and geographic regions. While establishing a dedicated Engineers Canada industry group may not be necessary, leveraging the HEIs' existing industry advisory groups would be beneficial. Reconsidering previous industry polling methods and exploring additional engagement strategies will be crucial for effectively gathering industry input.

Engineering scholars

System changes present an opportunity to leverage the expertise of engineering scholars. Their years of dedicated research on accreditation and engineering practice can provide invaluable insights for a smooth transition and the development of a robust future system.

The public

The public may not notice the direct impact of changes from the FEA project. However, the goal to ensure graduates are equipped to practice safely and protect the public remains paramount. This indirect benefit to society must be preserved throughout any system adjustments and it behooves Engineers Canada and other interest holders to market the benefits achieved through these advancements within the engineering ecosystem.

Core values for implementation of the Path Forward recommendations

i. Co-design

The FEA project's progress exemplifies the power of co-design. By embracing a co-design approach, the project tapped into diverse perspectives and experiences, fostering the creation of innovative ideas and new possibilities that authentically reflect the complexities of the accreditation system.

This collaborative methodology, characterized by committed individuals, diverse viewpoints, a focus on shared goals, and a willingness to navigate conflicts, must become the cornerstone for the successful development and evolution of the future accreditation system and the development of the FSCP.

Accepting the core principles of co-design will bring tangible benefits to all interest holders. A more collaborative environment should increase efficiency, effectiveness, and a stronger sense of worthwhile investment from all parties involved. The future accreditation system relies on interest holders being willing to engage in authentic partnerships and embrace a vision that promotes shared goals and national alignment.

ii. Collective stewardship

Interest holders are empowered to contribute to and shape the accreditation system. Shared commitment, decision-making, and accountability fosters resilience, adaptability, and a strong sense of shared purpose. A refreshed governance model and other formal mechanisms for incorporating diverse perspectives will ensure the system remains responsive and relevant to the needs of all. This also contributes to an increase in efficiency, effectiveness, and a strong sense of worthwhile investment from all parties involved.

iii. Transformative change

Interest holders foster a culture of continuous transformation and are active agents of innovation. They must be agile and adaptive to respond to the rapidly evolving engineering landscape. By embracing experimentation, learning, and a willingness to explore new approaches, interest holders can guide the system to evolve and improve over time, building on its strengths while effectively addressing emerging challenges.

iv. Outcomes-focused

Interest holders are committed to an outcomes-focused accreditation system. Decision-making focuses on ensuring that graduates possess the competencies required to begin the licensing process, while maintaining the balance between rigorous standards and practical relevance.

v. Proactive support

Interest holders have the necessary resources, guidance, and support to fulfill their roles effectively. This includes clearly defined responsibilities, comprehensive training, and ongoing support mechanisms to facilitate meaningful contributions to the system's success.

vi. Fairness

Interest holders must uphold fairness and equity for all system participants. This includes equitable treatment of programs in the design and application of accreditation criteria. There should be particular attention to ensuring fairness for those engaged in the FSCP Pilot Study and other initiatives undertaken to build the future system, recognizing their contributions and mitigating any potential risks or disadvantages for their involvement.

vii. Communication

Transparent and inclusive communication is vital for aligning all interest holders with the future system’s opportunities. By proactively sharing information, actively seeking and listening to feedback, and using diverse communications channels, interest holders can foster a shared understanding that drives collaboration and innovation to create a system that effectively meets evolving needs.

Recommendation 18 for the future direction:
Adopt the outlined core values to guide implementation of these recommendations.

Short-term actions: Early 2025

Contingent upon approval by the Engineers Canada Board of the direction laid out in the Path Forward Report and the accompanying recommendations, Engineers Canada should swiftly launch some early initiatives in early 2025 to sustain momentum and pave the way for later implementation stages. Early initiatives include:

i. Commit to outcomes-focused accreditation by eliminating AUs and minimum path.

The first step towards an outcomes-focused accreditation system is to remove use of the current input measures of curriculum content. This includes removing the use of AUs and transitioning to a temporary period relying on Graduate Attributes exclusively, until such time as the NARL is ready to take over completely.

The Graduate Attributes profile lacks specific definitions and expectations for foundational knowledge in mathematics, natural sciences, and engineering sciences. In the short-term, this gap can be addressed by building on the current definition of Graduate Attribute 1: Knowledge Base by using the existing definitions of these concepts as described in the CEAB Accreditation Criteria and Procedures book.

In the longer term, accreditation criteria related to Students (Section 3.3.) and Program environment (Section 3.5) must be reframed to focus less on inputs and more on desired outcomes. Engineers Australia, who emphasize outcomes and institutional flexibility to achieve compliance, provides a potential model.

Transitioning away from AUs may require meticulous planning and engagement with HEIs and regulators to ensure a smooth transition that maintains their trust in the accreditation system.

ii. Remove the faculty licensing requirements.

The removal of all AUs includes specified AUs, which removes the need for licensed engineers to teach engineering science and engineering design. HEIs can be given flexibility regarding the development of alternate ways for students to gain substantial and meaningful involvement with licensed professionals.

iii. Separate CEAB's policy-making functions from operational activities.

In keeping with best practices as well as bringing us in line with other jurisdictions, the policy and operational functions of the CEAB should be separated. A new policy committee should be created with a mandate to co-design all future policy as strongly promoted throughout the FEA project. The remaining operational taskings should be maintained by a separate committee.

iv. Initiate a pilot study to evaluate how interest holders can leverage FSCP.

There was strong support for the concept of a pilot study from interest holders during the April Path Forward Co-Design Session. Engineers Canada should launch the FSCP pilot study in a timely and prudent manner to demonstrate the feasibility of integrating FSCP and NARL concepts within the accreditation and licensure systems for both CEAB and non-CEAB graduates. Guided by the FSCP Pilot Study Working Group Terms of Reference, the pilot study will evaluate various scenarios to inform the full development and implementation of the FSCP and NARL within the engineering ecosystem.

v. Create a co-design policy to guide transformation in the accreditation system.

To capitalize on the success of the co-design approach in advancing the FEA project, Engineers Canada should codify it into a formal policy. This policy would define the ongoing collaboration norms for interest holders, ensuring a consistent and inclusive approach moving forward.

The next steps of the project will require substantial planning. Detailed workplans for the other recommendations for system advancement will be developed starting in early 2025.

Long-term actions: 2025 and beyond

The Path Forward Report is not the end of the FEA initiative. In fact, it sets up the next phase of work to transition the accreditation system in 2025 and beyond. The Engineers Canada 2025-2029 Strategic Plan sets this work up under the strategic direction of:

> **Realizing accreditation and academic assessments**
> As part of the 2025-2029 strategic plan, we will support regulators in implementing a new national academic requirement for licensure. We will also transition Engineers Canada's associated tools as required. We will work with key interest holders to build an improved accreditation system that is flexible, adaptable, and valued by regulators, educators, students, and accreditation volunteers. In collaboration with regulators, we will develop a business case for a national intake and academic assessment process for internationally educated applicants for licensure.[29]

A high-level operational plan with key milestones was prepared in May 2024. This plan will become more detailed with specific tasks and timelines starting in early 2025.

[29] Engineers Canada, 2025-2029 Strategic Plan

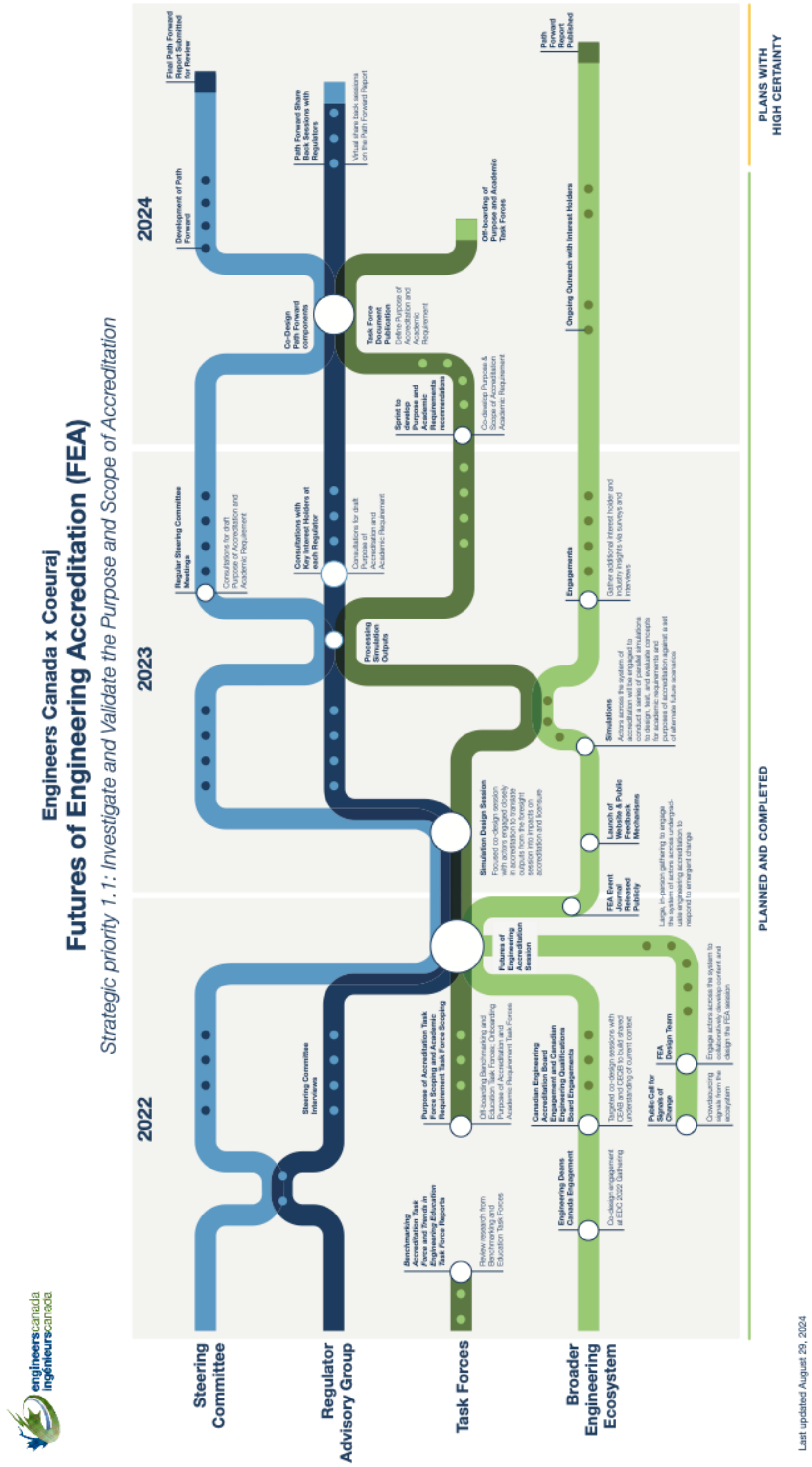
Glossary

Accreditation Unit (AU)	An academic credit granted for activities in which the associated number of hours corresponds to the actual contact time between the student and the faculty members, or designated alternates, responsible for delivering the program.
Co-Design	A framework and tool for situations where there is a diverse set of perspectives and a requirement for alignment across a varied, and complex, system. Encompasses five core principles, including the concept that people love what they design and own what they create. Also referred to as Collaborative Design.
Competence	The ability to perform a task, function, or role to a set of prescribed standards. Competence itself is not readily observable; it is inferred from the engineer's activities.
Competency	A demonstration of the knowledge, skills, experience, attitudes, values, abilities, and behaviours that enable an individual to complete a task.
Competency-based assessment	A methodology used to assess an applicant's readiness for engineering licensure. Applicants must demonstrate they have progressed to a professional level of competency in their field through engineering work experience.
Competency framework	An explanatory model that considers how engineers engage in their professional responsibilities, duties, and tasks. While not an assessment tool on its own, it helps define the standard against which the observable and demonstrable actions of all applicants can be measured and evaluated.
Engineering program	A framework strategically designed to provide students with the knowledge and competencies required to begin the process to be licensed as professional engineers in Canada, which may include a diverse range of courses, activities, or experiences. It is not exclusive to traditional undergraduate curricula at HEIs.
Experiential learning	An educational approach that emphasizes learning through direct experience and reflection. It involves actively engaging learners in real-world activities, challenges, and problem-solving to develop practical skills, knowledge, and critical thinking abilities.

	Experiential learning in engineering includes, but is not limited to, project-based learning, interactions with practising professionals, student exchange programs, and cooperative or internship experiences.
Full Spectrum Competency Profile (FSCP)	A competency framework with the potential to enhance Engineers Canada's accreditation review processes and support regulators in licensing professional engineers.
Iterative change	A process involving breaking down projects and goals into small steps and using repeated cycles of planning, implementation, evaluation, and adaptation to contribute to the cumulative outcome.
National Academic Requirement for Licensure (NARL)	A subset of competencies in the FSCP which CEAB graduates are expected to demonstrate upon completion of their programs.
Outcomes-focused accreditation	A quality assurance process that evaluates engineering education programs based on their demonstrated ability to produce graduates with specific competencies.
Peer Review	A quality assurance process that depends on experienced professionals to evaluate an engineering program against established standards. These peers provide complementary expertise to thoroughly assess the program's adherence to accreditation criteria. The process involves rigorous reviews, site visits, and feedback to promote continuous improvement and ensure the program meets the expectations for accreditation.
Program environment	The overall conditions, resources, and cultural factors that enable the quality of an engineering program. It encompasses elements such as faculty qualifications and morale, student engagement, administrative support, facilities, curriculum design, and pedagogical approaches.
Specified Accreditation Unit (AU)	Undergraduate engineering curriculum content that must be delivered by faculty members holding, or progressing toward, licensure as a professional engineer in Canada.
Standards-based assessments	An assessment method that evaluates applicants against predetermined standards and criteria. Note: This is not the same as "standardized assessment" which uses a consistent format, administration, scoring, and interpretation according to a specified plan.

Student exchange program	Engineering students enrolled at a CEAB-accredited HEI may complete a portion of their degree requirements at another institution.
Substantial equivalency	Achieving outcomes that whilst not individually identical to those of the standard or exemplar of that standard, taken cumulatively achieve the same overall outcome.
Transformative change	A dynamic, ongoing process that fundamentally restructures a system by building upon existing strengths and incorporating innovation. It involves an evolution driven by continuous adaptation and improvement, ultimately leading to more resilience, sustainability, and effectiveness. This process necessitates a departure from the status quo and demands a profound shift in mindset, values, and behaviours across the entire system.

Appendix A: FEA project journey map with milestones



Appendix B: CEAB thought paper – Reconsideration of specific AUs in the assessment of engineering programs

May 10, 2024

Annette Bergeron
Steering Committee Chair
Futures of Engineering Accreditation
via email: annettebergeron@gmail.com

Dear Annette,

RE: CEAB Thought Paper – Reconsideration of Specific Accreditation Units (AUs) in the Assessment of Engineering Programs

On behalf of the Canadian Engineering Accreditation Board (CEAB), I submit to the Futures of Engineering Accreditation (FEA) Steering Committee a thought paper titled "Reconsideration of Specific AUs in the Assessment of Engineering Programs" for consideration. The Paper was approved at the CEAB's April 13th meeting and was supported in principle by members of Engineering Deans Canada's (EDC) Deans' Liaison Committee (DLC) at their April 28th meeting.

EDC, a major interest holder in the accreditation system, has pointed to the specific AU criteria - the accreditation criteria requiring a minimum amount of curriculum content in Engineering Science and Engineering Design be instructed by licensed faculty - as a problematic constraint on curriculum design and delivery. Additionally, in their final report to the FEA Steering Committee, FEA's Benchmarking Task Force highlighted key differences between the Canadian undergraduate engineering accreditation system and the selected comparators. The Task Force concluded that other systems are less restrictive regarding licensure requirements of faculty and suggested that the necessity and reasoning for faculty licensure in accredited undergraduate engineering education be reviewed. Furthermore, FEA's Purpose of Accreditation Task Force identified 'Faculty qualifications' as a known gap between the current accreditation system and the desired future system under the revised purpose of accreditation and associated design parameters (Purpose of Accreditation Task Force document, pgs. 24-25). This issue was also explored at the April 17-18 Path Forward Report Co-Design session which I, along with other members of the CEAB Executive Committee, attended.

While the CEAB has paused all major accreditation policy-related work while the FEA initiative is underway to not duplicate efforts, the CEAB submits the Thought Paper to the Steering Committee as a potential way forward in the short-, medium-, and long-term as the project's final Path Forward Report is developed. The CEAB undertook this work in the absence of clear indication from the engineering regulators as to whether the importance of the interaction between engineering students and licensed faculty is still a relevant principle nor is there a clear understanding as to the outcome(s) that these interactions seek to achieve. Given the collective experience of CEAB members in evaluating engineering programs, applying criteria, and discussing the challenges experienced by interest holders in the system, members felt they were in a position to contribute to a reasonable and sustainable solution to this particular issue.

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Please do not hesitate to contact me should you have any questions or wish to discuss the Thought Paper's contents and recommendations.

Regards,

J.Pemberton Cyrus, PhD, P.Eng., FEC
Chair, Canadian Engineering Accreditation Board

Cc: Nancy Hill, President, Engineers Canada
Trina Hubley, Vice President, Regulatory Affairs, Engineers Canada
Mya Warken, Manager, Accreditation and CEAB Secretary, Engineers Canada

Attachment: Thought paper- Reconsideration of Specific AUs in the Assessment of Engineering Programs

RECONSIDERATION OF SPECIFIC AUs IN THE ASSESSMENT OF ENGINEERING PROGRAMS

CURRENT SITUATION

Accreditation Criteria

The current accreditation criteria (Criterion 3.4.4) require a minimum of 900 AUs combined of Engineering Science (ES) and Engineering Design (ED). Of these 900 AUs, 600 AUs must be taught by instructors holding a license (P.Eng., LL) or pursuing licensure (EIT), as per criterion 3.4.4.1. Of these 600 AUs, a minimum of 225 AUs of ED must be taught by instructors who are licensed (P.Eng., LL) as per criterion 3.4.4.1. The AUs that must be taught by instructors holding, or progressing toward, a license are referred to as Specific AUs.

The minimum path criteria noted above have existed for many years, albeit with some refinements over time. The requirement for licensed instructors to teach ES and ED predates the introduction of the Graduate Attributes and Continual Improvement criteria (criteria 3.1.and 3.2), in particular the Professionalism graduate attribute which is defined as

> *Professionalism: An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.*

While all instructors teaching ES and ED do not need to be licensed, in terms of Specific AU requirements, roughly 2/3 of the instructors need to be licensed (or pursing licensure) to meet current accreditation criteria. No Specific AUs are counted for courses that do not include ES and ED taught by individuals holding, or progressing toward, licensure, including courses that may discuss engineering Professionalism in a complementary studies course. Criterion 3.4.4.6 requires that the capstone design experience be completed under the supervision of a licensed project supervisor.

The HEI is given considerable latitude in defining Indicators and Assessment Tools that they will use to guide the development and assessment of the Professionalism graduate attribute.

Approaches to Teaching and Learning and the Role of Professional Engineer

The COVID pandemic accelerated innovations in approaches to teaching and learning, and the pandemic has significantly shifted thinking about traditional modes of teaching and learning, leading to questions about the continued use of instructor-student classroom and lab hours as an appropriate quantitative basis for curriculum content assessment. The Specific AUs follow from the traditional contact-hour based quantitative approach.

While not stated in the criteria nor in any official CEAB materials, one perspective advanced when the concept of Specific AUs is challenged is that by prescribing a set number of contact hours (on which AUs are based) between a professional engineer and student in the context of courses, that the students will develop a greater understanding of professional engineering and they will have a more professional outlook upon graduation.

If this perspective about the rationale for Specific AUs is reasonable, interactions between the licensed engineers and the students, in the context of the innovative approaches to teaching and learning, could be achieved in different ways, rather than relying on a measure that is anchored around contact hours. For example, an HEI could approach the Professionalism graduate attribute, with appropriate activities, indicators and assessment tools to ensure that a program is effective in developing the expected level of understanding of professional engineering among students and developing a culture of Professionalism among graduates.

Emerging Disciplines and Licensure

For some institutions, the nature of some of their programs, particularly those associated with emerging disciplines, does not align with conventional or more established engineering disciplines where licensure uptake is significant. In emerging disciplines, or in disciplines that intersect significantly with other professional disciplines, the individuals who can offer students the best education in areas that the CEAB considers engineering science and engineering design may be from disciplines for which licensure is difficult or impossible. The requirement that the instructors of capstone project courses be licensed (P.Eng., LL) may not lead to students having the most appropriate capstone project supervisor who may be an expert from an adjacent discipline.

This issue is likely to become more significant since major contemporary technological challenges (e.g., artificial intelligence, climate change, energy transition) and their technology solutions are multidisciplinary and beyond the traditional focus of engineering regulators.

Provincial Variations in Licensure of Faculty Members

Section 4.a of the Interpretative Statement on engineering licensure expectations and requirements (Appendix 3 of the Criteria and Procedures) states:

> *Faculty members who fall under criteria 3.4.4.1 and 3.4.4.4, and are within five years of their initial appointment to a faculty position at an academic institution in Canada are expected to:*
>
> *• Initiate an application for professional engineering licensure, or engineer-in-training/ing. jr. status, upon starting their faculty position.*
>
> *• Demonstrate continuing progress in meeting any conditions associated with achieving professional licensure (completing assessed examinations, obtaining experience, etc.).*

In some provinces, the teaching of engineering and university-based engineering research isn't considered to be the practice of engineering. As a result, faculty members who join HEIs in these jurisdictions directly from their Ph.D. studies or from outside of Canada face challenges in getting licensed. While some jurisdictions provide mechanisms for faculty members in disciplines adjacent to engineering to obtain a LL which qualifies them to teach Specified AUs in ES and ED, some jurisdictions do not provide for the LL designation.

Ontario, which has 17 HEIs offering accredited engineering programs, has discontinued using the EIT mechanism. Applications for licensure can only be initiated once the applicant has 4 years of professional experience. This precludes the faculty from teaching engineering science content during the time that they are acquiring the required professional experience. In addition, regardless of post graduate education or experience, only applicants with an undergraduate degree in engineering are eligible to apply for licensure which may preclude many faculty from ever being able to obtain licensure.

The accreditation criteria allow for faculty members to be licensed in any provincial jurisdiction. Professional engineering licensure in Canada, however, does not allow for practice across jurisdictions and doing so could lead to intervention by the regulator and potentially discipline of the individual practicing in a province without a license from the provincial regulator. Engineers Canada, through the CEAB Criteria, does not apply such a restriction or expectation in terms of licensure of faculty members. While there were reasons why such language was adopted in the criteria, having criteria that allow faculty members to register outside of their provinces to meet accreditation criteria, including for HEIs in provinces with regulators that consider the teaching of engineering to be the practice of engineering, is an odd provision to be promoted by Engineers Canada on behalf of the regulators. If part of the motivation for the criteria related to licensure is to have faculty model professional behaviour through licensure, it sets up a "do as I say, not as I do" type of role modelling.

Faculty members who unwillingly become licensed or who seek licensure outside of jurisdiction in which their HEI is located because of challenges in getting registered in their province, are unlikely to be evangelists for professional licensure in their interactions with students. In such cases, the issue of professional licensure likely works against the assumed objective of the existing criteria to develop a level of understanding of professional engineering among students and developing a culture of Professionalism among graduates.

The regulators asked the CEAB to affect changes in the accreditation process to facilitate international exchanges. These changes resulted in a pause on considering the students on international exchange as part of the minimum path assessment for the criteria related to Specific AUs. In effect, the licensure status of faculty members teaching students ES and ED on international exchanges was not an appreciable risk factor from the perspective of the regulators. If the temporary exemption is successful in terms of the measures used to assess the effectiveness of the exemption (i.e., the number of students going on international exchange significantly increases), a growing number of students in accredited programs will not have the previous levels of interaction with licensed faculty members. Furthermore, internationally educated applicants for licensure are not educated in the context of Specific AUs.

Accuracy of Visiting Team Assessments of Specific AUs

The tools provided to HEIs to present their case for accreditation do not effectively deal with the matter of Specific AUs in a way that is consistent with the criteria. As a result, the visiting teams do not get an accurate accounting of the Specific AUs.

Section 7 of the Interpretative Statement on engineering licensure expectations and requirements (Appendix 3 of the Criteria and Procedures) states:

> *For duplicate sections all instructors must meet the licensure requirements in order for the AU to be counted. If the course is team-taught then it must be clear that the engineering science and engineering design components are delivered by faculty holding professional engineering licensure. In some cases, for team-taught courses, a fraction of the total AU could be claimed.*

The instructions to institutions with respect to the individuals to list in the CIS forms, which drives all other tables in the accreditation documentation, states *"Please list the most appropriate instructor to act as course contact"* and the licensure status of this instructor is taken to determine whether the ES and ED AUs for the course will be considered to be Specific AUs. All other instructors are listed below the course contact but the Specific AU columns in the data tables are generated solely based on the licensure status of course contact without regard for the licensure status of these other instructors, even when these other instructors are considered to be teaching on the minimum path (i.e., they have their own dedicated sections of the course and the students in their section have no involvement with a licensed instructor).

In order to reflect the accurate minimum path, the HEI needs to list the unlicensed instructor as the *"most appropriate instructor".* Furthermore, in the case of team-taught courses (as per Section 7), there isn't a mechanism for the HEI to apportion the ES and ED AUs among licensed and unlicensed instructors.

These limitations will not be addressed in the new Tandem implementation. While work-arounds may present a more accurate accounting of Specific AUs, these work-arounds are time consuming for the HEIs. Also, the verification of individual ES and ED course instructor's status, is not a good use of program visitor time for an issue that does not appear to be an appreciable risk factor for the regulators.

Finally, the drop down box on the CIS which registers the licensure 'status' only provides the following options: P.Eng., EIT, ing, ingJr, LL, P.Geo, and None. No option is available to indicate and demonstrate that progress toward licensure is taking place. If the regulator database is checked, which would identify individuals who have some form of license, individuals who have applications in process would not appear. In short, the HEI cannot generate and the visiting teams cannot assess AU tables that reflect individuals who are progressing toward licensure except where they hold EIT status.

As a result of these issues with tools provided to the HEI, inaccurate AU tables are being generated and reviewed by the visiting teams and the conclusions drawn about compliance with Specific AUs criteria are not reliable. While a visiting team can cross-validate the AU tables (i.e., verify the Specific AUs using Sheet 4.1 in Spreadsheet 6C), this is a time-consuming process that brings a visiting team into conflict with an HEI which has prepared the materials in accordance with the instructions and using tools provided. For example, visiting teams often encounter the misperception that as long as the capstone course coordinator, who may have no involvement with students, is licensed, the licensure status of the project supervisors does not matter. When the HEI prepares a CIS for the capstone course and indicates the licensed faculty member as the "course contact", the Specific AUs for that course are automatically populated on the overall AU tables in Spreadsheet 6C counting the AUs as Specific AU. In doing so, the HEI is following the instructions provided. If the work of the visiting team determines that the named course instructor on the CIS for the capstone was merely 'coordinating' the course and not interacting with the students in a manner that supported the Specific AUs claim there would need to be manual adjustments to the AU tables at the visit.

LOOKING FORWARD

In light of the current situation, reconsideration of the Specific AUs as a means to measure exposure to professional engineers is appropriate. The CEAB should endorse the principle that engineering programs must have substantial and meaningful involvement of licensed professionals in the education of future professionals.

Given the confluence of factors that are working against the status quo for Specific AUs, namely changes at regulators with respect to pathways for licensure of faculty members who are educated outside of Canada, the lack of recognition of faculty members' research and teaching as engineering practice, new programs that are outside of the conventional disciplines where there is a culture of licensure, a lack of understanding of the regulation of emerging disciplines, and innovations in approaches to teaching and learning that have been accelerated by the pandemic, the existing accreditation criteria related to the role of the professional engineer in the instruction of student should be interpreted by visiting teams and the CEAB in a manner that allows HEIs to have more flexibility with respect to mechanisms to facilitate substantial and meaningful involvement of licensed professionals in the engineering education process.

The HEIs should be given an opportunity to be creative and innovative in how they use this flexibility on a minimum-path basis for their programs. The onus would be on the HEI to provide convincing evidence of the outcome to visiting teams. Such mechanisms must be auditable by visiting teams and demonstrate, on a minimum path basis, that the graduates have developed the expected level of understanding of, and commitment to, Professionalism.

Given the issues outlined above with respect to increased challenges for faculty members to achieve licensure, as well as the limitations of the accreditation tools for the presentation and assessment of Specific AUs in the context of accreditation visits, enforcement of the Specific AUs criteria and the requirement for the capstone experience to be supervised by a licensed instructor should be temporarily suspended. These criteria could be reconsidered when there is clarity from the FEA process with respect to the role of the licensed engineer in the education of students and when the visit materials are adjusted to address known deficiencies.

RECOMMENDATIONS TO THE CEAB

(1) The CEAB should endorse the principle that engineering programs must have substantial and meaningful involvement of licensed professionals in the education of future professionals.

(2) The CEAB and visiting teams should interpret existing accreditation criteria related to the role of the professional engineer in the instruction of student in a manner that allows HEIs to have more flexibility with respect to mechanisms to facilitate substantial and meaningful involvement of licensed professionals in the engineering education process.

(3) The CEAB must require HEIs, on a minimum path basis that is auditable by visiting teams, to demonstrate that graduates have developed the expected level of understanding of, and commitment to, Professionalism. The current criteria Specific AUs criteria (3.4.4.1, 3.4.4.4, 3.4.4.6) is one way to achieve this requirement.

(4) The CEAB should temporarily suspend enforcement of Specific AUs criteria (3.4.4.1 and 3.4.4.4) and the requirement for the significant design experience to be conducted under the professional responsibility of licensed faculty (3.4.4.6).

(5) The CEAB should recommend to the FEA Steering Committee that the Committee include recommendations in their Path Forward Report regarding the license requirements of faculty in criteria 3.4.4.1, 3.4.4.4, and 3.4.4.6, and regarding the development of alternate ways for HEIs to demonstrate that students enrolled in engineering programs have substantial and meaningful involvement with licensed professionals.

(6) The CEAB will re-evaluate recommendations 2, 3 and 4 by June 2027 with a view to making a recommendation on its future status to the Engineers Canada Board, unless otherwise instructed to do so at an earlier date. Any re-evaluation will take into consideration the outcomes of Engineers Canada's 2022-2024 Strategic Priority 1.1.

Endorsed by the CEAB: April 13, 2024

Appendix C: Mapping the FSCP

Mapping the Full-Spectrum Competency Profile

- - - - - Dashed border indicates a weaker link.

September 14, 2023

FSCP Competencies	CEAB Graduate Attributes	IEA Graduate Attributes	IEA Professional Competencies	Pan-Canadian Work Experience Competencies
Acquiring and Furthering Engineering Knowledge	A Knowledge Base for Engineering	Engineering Knowledge	Comprehend & Apply Universal Knowledge	
			Comprehend & Apply Local Knowledge	
Problem Solving and Design	Problem Analysis	Problem Analysis	Problem Analysis	Technical Competence
	Investigation	Design/Development of Solutions	Design & Development of Solutions	
	Design	Investigation	Evaluation	
	Use of Engineering Tools	Tool Usage		
Protection of the Public	Professionalism	The Engineer & the World	Protection of Society	Professional Accountability
	Impacts of Engineering on Society & Environment	Ethics	Legal, Regulatory, & Cultural	Social, Economic, Environmental, & Sustainability
	Ethics & Equity		Ethics	
			Judgement	
			Responsibility for Decisions	
Communication	Communication Skills	Communication	Communication & Collaboration	Communication
Teamwork and Collaboration	Individual & Team Work	Individual & Collaborative Team Work	Manage Engineering Activities	Project and Financial Management
	Economics & Project Management	Project Management & Finance		Team Effectiveness
Lifelong Learning	Lifelong Learning	Lifelong Learning	Continuing Professional Development & Lifelong Learning	Personal Continuing Professional Development
Systems Thinking	Not specifically called out as a distinct competency in any framework.			
Analytical Skills	Not specifically called out as a distinct competency in any framework.			

Appendix D: Terms of Reference - Full Spectrum Competency Profile Pilot Study Working Group

Draft Terms of Reference - Full Spectrum Competency Profile Pilot Study Working Group

Mandate

The Mandate of the Full Spectrum Competency Profile (FSCP) Pilot Study Working Group will be to complete a pilot study examining a subset of the competencies from the proposed FSCP, including some from the National Academic Requirement for Licensure (NARL). The pilot is being proposed as one of the next steps in the Futures of Engineering Accreditation (FEA) project, and these Terms of Reference will be included in the FEA Path Forward Report.

For context, a pilot is a small-scale, short- to medium-term study that helps an organization learn how a large-scale project might work in practice. It is an opportunity to test the design, functionality, and feasibility of a solution before committing significant resources to a full-scale implementation. The results of a pilot study are used to identify any adjustments needed to improve the project's efficiency and feasibility at full-scale implementation. It's a crucial step in project management to ensure the success of the larger, full-scale project.

Purpose

The purpose of the pilot study will be to:

- Understand the effort required to the define FSCP competencies,
- Explore appropriate process(es) to assess the FSCP competencies, and
- Document learnings and recommendations for future full-scale implementation of the NARL and FSCP.

Working Group Objectives

1. **Identify** a subset of competencies from the proposed FSCP to be further defined and piloted through implementation. Competencies shall be selected across the core competency domains, and at least one of the identified competencies should fall outside of the sixteen competencies proposed within the NARL. It is suggested that the working group make use of tools such as a Job-Task Analysis Approach to select competencies that are highly relevant to all professional engineers (i.e. – they are both used frequently and are critical to safe practice). Document and report the rationale used in selecting the competencies.

2. **Define** the identified competencies such that they can be assessed in a fair and defensible manner and in a way that meets the needs of the engineering practice in Canada, as proposed by the FSCP. Each identified competency will need to be defined such that it can be assessed according to Miller's Pyramid of Assessing Competence, per Figure 1:

Figure 1: Miller's Pyramid of Assessing Competence[1]

The following steps will be used in defining each identified competency:

- First, develop a **competency statement** that provides a wholesome description of the area of competence (for example, what is meant by 'math'?).
- Next, develop a **description** of what it means to be competent in the area (what does it mean to be competent in 'math'?).
- Thirdly, develop a list of **indicators**: discrete, observable outcomes of actions that demonstrate competence (how will an individual demonstrate competence at each of the 'knows how' and 'does' levels?).

Document and report the considerations made in defining the competencies and provide an overview of the level of effort and amount of time required to complete the definition of each competency.

3. **Create** assessment process(es) for the selected competencies. The process(es) must be clear, output-based and must be implementable by higher education institutions (HEIs) and engineering regulators to assess an individual at both the 'knows how' and 'does' level of Miller's Pyramid of Assessing Competence. The process(es) must include what information is to be provided by applicants for assessment. Demonstrate how the process(es) establish that the individual is ready for practice (if assessing at the 'knows how' level) and licensure (if assessing at the 'does' level). Document and rationalize the considerations undertaken in establishing the assessment process(es) and describe the level of effort required to develop the process(es).

4. **Build** a plan to pilot the identified competencies and indicators in a manner that:
   - will assess both CEAB and non-CEAB applicants,
   - will be conducted by both HEIs and engineering regulators (as applicable),
   - assesses enough applicants to enable outcomes testing, and
   - includes geographical diversity across Canadian jurisdictions.

[1] Miller, G. E. (1990). The assessment of clinical skills/competence/performance. Academic Medicine, 65, S63-S67.

- The plan must also include an estimate of resources required to complete the pilot project.

Document and rationalize the considerations made in designing the pilot study, the parameters of individuals to be considered for assessment, how the selection of the test population enables the testing of outcomes, describe how outcomes are to be tested, summarize the level of effort required to design the pilot, and make a prediction of how much effort would be required to develop a full-scale trial for a given Canadian jurisdiction.

5. **Oversee** the execution of the pilot study. Ensure that it is completed such that objectives 1-4 can be met. Ensure that the amount of time and level of effort required to assess the selected competencies used is documented.

6. **Report** the pilot findings. Provide a Pilot Study Report to the FEA steering committee (or its successor), using the following format:
   - Part 1: Introduction and Background
   - Part 2: Selection of Competencies for Piloting (see objective 1)
   - Part 3: Defining the Competencies (see objective 2, include the definitions of the selected competencies and indicators as an appendix)
   - Part 4: Assessment process(es) (see objective 3, the processes for both engineering regulators and HEIs shall be included as an appendix)
   - Part 5: Pilot design (see objective 4)
   - Part 6: Results of Outcomes Testing
   - Part 7: Analysis and Findings
   - Part 8: Recommendations
   - Part 9: Conclusions

Authority and Decision-Making

In fulfilling its mandate, the Working Group is tasked with the six objectives defined above. In completing their objectives, the Working Group will be required to make decisions in:

- selecting the competencies to pilot,
- defining the competencies and associated indicators such that they can be assessed in a defensible manner and in a way that establishes competence,
- creating assessment processes, developing a plan to pilot the selected competencies and processes,
- overseeing the execution of the pilot study, and
- reporting recommendations.

To assist in decision-making, the following levels of responsibility will be assigned:

- The FSCP Pilot Study Working Group is deemed to be **responsible** to make decisions on the above topics while rationalizing and documenting their considerations.
- The FEA Steering Committee (or its successor) is **accountable** for the pilot study. As such, the FSCP Pilot Study Working Group is accountable to the FEA Steering Committee (or its successor). When the working group proposes that an objective has been completed, it

shall report to the FEA Steering Committee (or its successor) for approval prior to documentation being disseminated to interest holders.

- However, additional interest holders may be **consulted** at the discretion of the working group in achieving their objectives.
- Engineers Canada leadership, the Canadian Engineering Accreditation Board (CEAB), the Canadian Engineering Qualifications Board (CEQB), and the Canadian engineering regulators will be kept **informed** of the pilot progress throughout the project.

Working Group Membership

The composition of the FSCP Pilot Study Working Group is intended to encompass the majority of interest holders of the FEA project but remain limited in size so as not to slow progress. Therefore, the following members will be engaged in the FSCP Pilot Study Working Group:

- Engineers Canada Staff
- At least one representative from the FEA Academic Requirement Task Force
- At least one representative from the FEA Purpose of Accreditation Task Force
- A psychometrician
- One representative from each of the CEAB and the CEQB
- If not already represented through the task forces and boards, a minimum of two representatives from HEIs must be included
- If not already represented through the task forces and boards, a minimum of two representatives from engineering regulators must be included
- If possible, at least one Industry representative
- Optional: a representative of recent engineering graduates

Time Commitment

It is expected that the work of the FSCP Pilot Study Working Group will begin after the publication of the Path Forward report and will conclude in **late 2025**. During this period, the working group will be required to meet at least monthly and be asked to review materials between meetings. The working group will participate in its own meetings, ongoing communications, and discrete events. Requests for additional resources or time extensions will be communicated as early as possible.

Appendix E: Change management considerations

What is change management?

Change management is the intentional process through which an individual or group shepherds a system through the experience of change in service of a specific intended outcome. Change management tools and principles can be applied both in the context of planned change (e.g., restructuring an organization or rolling out a new technology platform) or more emergent change (e.g., responding to external shifts in a market or operating environment). Change management is a broad field of practice with a diverse range of perspectives, strategies, approaches, and tools suited for different kinds of organizational and change contexts.

Focus of change management: Operational processes and human processes

There are two main areas that require focus and investment during a change process—the sequence of tactical steps that **move from the current state to the desired future** state (e.g., design and deployment of new policies and procedures, design and roll-out of new roles), and the **emotional and psychological experience of change**. Effective change processes must simultaneously engage in both aspects to achieve meaningful and sustainable results.

Moving toward the desired future state: This aspect of change management is the most familiar to many people. It entails considering the operational aspects of the planned change, which can begin by answering a series of basic questions **(Figure 2)**. Many change management models, like Prosci's ADKAR model, are designed to support this aspect of a change process.

PLANNING FOR OPERATIONAL CHANGE

1. What is the vision of the future we seek to achieve, and what impact will it have on our system?
2. What steps will we take, and in what order?
3. Who is responsible for what?
4. What resources do we need?
5. How will we know we are on the right track?
6. How will we adapt and pivot as the work unfolds?
7. What do we need to learn as the process unfolds?
8. What do we need to learn as the process unfolds, and how will those learnings be applied?
9. Who are the different interest holder groups who are affected by this change? How will we engage them and communicate with them?

Figure 2: Questions to plan for operational change[2]

[2] Developed by Julia Monaghan, Coeuraj.

Managing the emotional and psychological experience of change

Equally important to managing change effectively is recognizing and supporting the individual emotional and psychological experiences of change that will occur throughout your system. People within a system exhibit varying tolerances for and responses to change. Ignoring these individual experiences is a major driver of resistance and ultimately undermines change efforts. The William Bridges Transitions model addresses the human experience of change by acknowledging and respecting the spectrum of emotions it can trigger, including grief, loss, anxiety, uncertainty, confusion, fear, hope, and excitement.

Doing this work effectively requires a different approach and skillset than managing the operational aspects of change. Instead, this work requires organizational and change leaders to demonstrate empathy, vulnerability, and openness, and be willing to create space for open dialogue and acknowledgment of the real human impacts of change as the work unfolds.

Principles for effectively managing the change ahead

Building on the co-design process used during the FEA project, the following are a series of core principles that can underpin the change management work that will come next.

i. Participation, shared ownership, and individual agency

One of the five core principles of a co-design approach is that people love what they design and own what they create. This concept is as relevant for the change management process as it has been for the co-design process. Having a highly participatory change management process where interest holders from across the engineering ecosystem can meaningfully influence change processes and outcomes means:

- The people closest to the work and who know it best can inform how the change unfolds, leading to more responsive solutions.
- Individuals can influence the changes that impact them, resulting in less change resistance, anxiety, and ambiguity.
- Contributors are building shared ownership in the outcomes of the work, fostering more effective implementation and sustained success.

ii. Equity and inclusion

Many of the systems and structures that exist today do not serve all interest holder groups equitably—either by design, or because key voices (e.g., Indigenous Peoples, other people of color, members of the LGBTQ community) were not engaged in their development. Large-scale systemic changes, like the one the Canadian engineering ecosystem is about to embark on, are an important opportunity to address these imbalances and create systems that serve everyone. As part of a change process, it is therefore important to understand the ways that current systems and structures uphold or perpetrate harm, and to be intentional about inviting voices that have been underserved or marginalized to be part of shaping how the work unfolds.

iii. Ongoing, open, and transparent communication

In the absence of information, the human brain will create its own narratives to fill in knowledge gaps. Often, these narratives are more reflective of fears and anxieties than hopes and aspirations—meaning that lack of information can be a key driver in escalating change resistance. Consistent, transparent, and robust communication about what is being done, and why, results in:

- Overall awareness and engagement: When considering how to move different cohorts of interest holders along the FEA Commitment Framework **(Figure 2)**, effective communication is an important way to ensure various groups are primed to engage in their piece of the change process.
- Reduced anxiety due to ambiguity: Greater certainty by change leaders about the process strengthens resilience in the face of other, more uncertain aspects of the work.
- Trust in decisions: Understanding the rationale behind a decision, even if it differs from personal preferences, can foster acceptance and support.

iv. Iteration, adaptation, and measurement, evaluation, and learning

Any change effort can benefit from an iterative approach, and this is even more critical for large-scale, system-wide changes like the one ahead of the engineering ecosystem in Canada. Such transformative change requires continuous adaptation and evolution to account for the interplay of various system components. Working iteratively is also one way to build momentum in a change process by delivering early successes to interest holders.

No matter how meticulous and inclusive the planning process, unforeseen challenges and complexities are inevitable when implementing new processes, policies, or roles. Working in cycles or sprints, piloting ideas before rolling them out at scale, and gathering feedback along the way is critical to ensuring that the change effort achieves its intended outcomes by creating space to learn and adapt.

Using measurement, evaluation, and learning (MEL) processes in complex, multi-interest holder projects provide a structured approach to tracking progress, identifying areas for improvement, and fostering collaboration. Effectively measuring, evaluating, and learning from interest holders throughout each phase of a project is imperative to success because it ensures that all perspectives are considered and addressed. Relationships, knowledge, and support between interest holders in complex projects are not linear and therefore require flexibility and adaptability. Ongoing observation and evaluation of qualitative aspects, such as an interest holder's knowledge, attitude, and position, can offer nuanced insights into their perspectives. This enables the project team to be responsive and shift plans and activities accordingly, ensuring interest holders are included and consulted throughout a project's journey. Measurement and evaluation can assess what has been done, what still needs to be done, and how to do it better. By maintaining strong, adaptive relationships and continuously integrating interest holder feedback, MEL supports long-term adoption of change and helps to build the trust and cooperation necessary for sustained success.

Measurement, evaluation, and learning for FEA

The engineering ecosystem comprises diverse interest holders, and the FEA project engaged hundreds of participants, each with unique perspectives on engineering education, accreditation, and licensure.

The FEA's 2022-2024 Commitment Framework **(Figure 3)** guided ongoing observational analysis and data collection processes throughout the project stages until now, facilitating continuous learning and evaluation. This framework was developed by the project team to:

- determine if engagement activities and efforts were being directed efficiently and in alignment with the engagement strategy.
- assess how an interest holder might have moved up or down the commitment framework.
- identify any changes to the current project strategy and inform the detailed designs for engagements with specific interest holders.

A new framework will need to be developed to measure progress based on what the work in 2025 and beyond will need to achieve. A similar commitment framework will be critical for understanding interest holder support as the Path Forward Report's recommendations are implemented. The commitment levels and corresponding indicators will need to be updated based on the needs of the project team and their metrics for success.

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FEA's 2022-2024 Commitment Framework

Commitment Statement: Each stage of the commitment framework represents an Interest holder's evolving sentiment with the respect to the following statements:

1. We believe that a national academic requirement is necessary for licensure as a professional engineer.
2. We acknowledge that the current system of establishing academic qualifications requires change to appropriately reflect needs of engineers of the future.
3. We recognize the need for the purpose of accreditation to evolve, reflecting the alignment of all interest holders.
4. We are ready to co-create, and take ownership of, practical recommendations for changes to the system of establishing academic qualifications.

COMMITMENT LEVEL	DESCRIPTION	EXAMPLE INDICATORS
Introduction "Something is happening"	Interest holder has been reached out to and communication is established. They are introduced to the existence of the project but do not understand much about its aims or scope.	• Initial meetings with interest holder is requested and accepted. • Interest holder groups have received information concerning the project through appropriate channels and a corresponding increase in website traffic is observed.
Awareness "I get what is happening"	Interest holder is aware that a project is underway to examine and consider the role of academic requirement in licensure for professional engineers.	• Interest holder has attended introductory engagement and shows interest in further conversations/meetings. • Interest holder is reaching out via the website survey, contact email, or other channels. • Increase in subscriptions for "Accreditation Matters"
Understanding "I understand the change and the impacts for myself and others"	Interest holder is aware of the project's aims and scope, that it may result in changes to the current system of accreditation, and how those changes may impact their work.	• Interest holder can speak to their understanding of key elements of the project scope and goals. • Interest holder does not require much "context setting" discussions at this point • Interest holder (via appropriate channels) is asking "probing" questions regarding the project's aims and process, e.g. asking questions that refer to specific messages and statements in our communications. • Asking questions that question assumptions or ask about "roles and responsibilities" or "workloads" • "how will that work", "who will do it", "what's in it for us", etc.
Attraction "I like this idea"	Interest holder sees potential benefits for themselves, and/or others. Their perception of the project and process is open and positive.	• Interest holder can speak to a value proposition they see within the project and often appear to focus on it. • Interest holder advocates for the project and process in conversations with other interest holders. • Interest holder is eager to provide time/resources to participate with the project engagements.
Intent "I support this"	Interest holder has expressed alignment with the project goals and express a desire to contribute towards the development and implementation of path forward recommendations.	• Refer to and express support of the process and/or the Path Forward recommendations in their own documents and meetings (i.e., not "project" meetings)
Partnership "We will make this happen"	The interest holder is working in collaboration with other groups to co-develop policies and processes to implement on path forward recommendations.	• Interest holder is independently reaching out to other groups to arrange meetings and discuss ideas related to the project and implementation of the Path Forward report.

Figure 3: FEA's 2022-2024 Commitment Framework. It will be refreshed for the work in 2025 and beyond.