



1 & 2 October 2024
Menara Felda, Platinum Park KLCC

GLOBAL PERSPECTIVES IN ENGINEERING: INSIGHTS FROM THE IEA GOVERNING GROUP

Em Prof Elizabeth Taylor AO

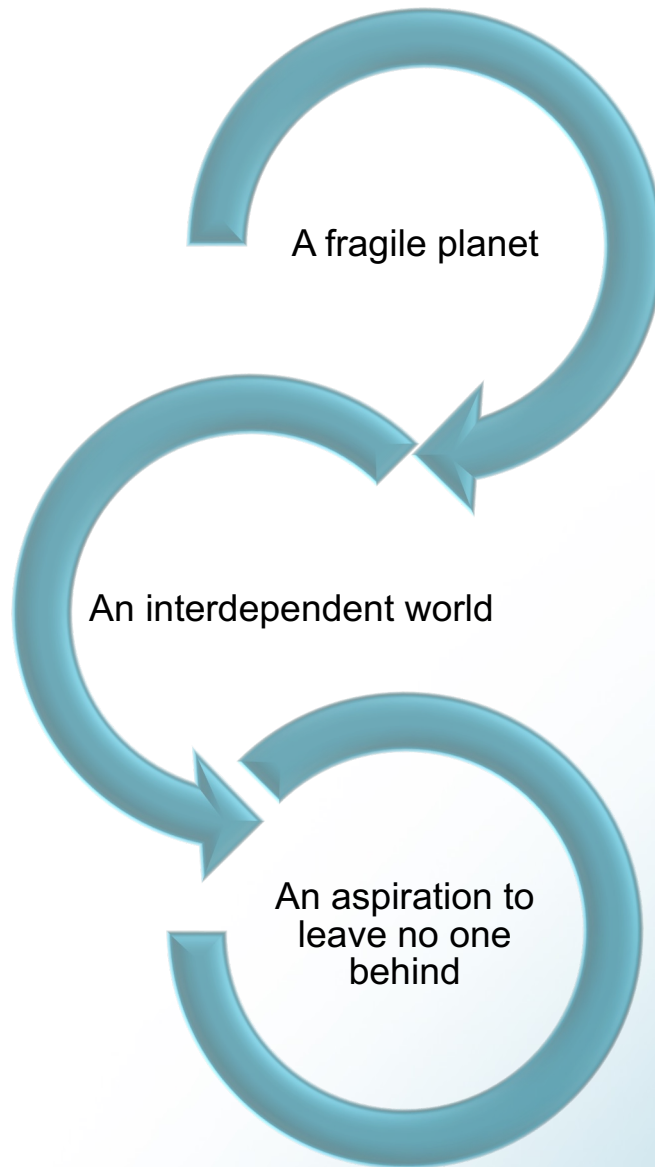
HonFIEAust CPEng EngExec NER APEC Engineer IntPE(Aus)

Chair, Governing Group, International Engineering Alliance

Deputy Chair, Sydney Accord

Past Chair, Washington Accord

The global context



An aspiration for this BEM Convention 2024 is to highlight the important roles of the engineering teams and their contributions in bringing progress while ensuring sustainability



The United Nations Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all.

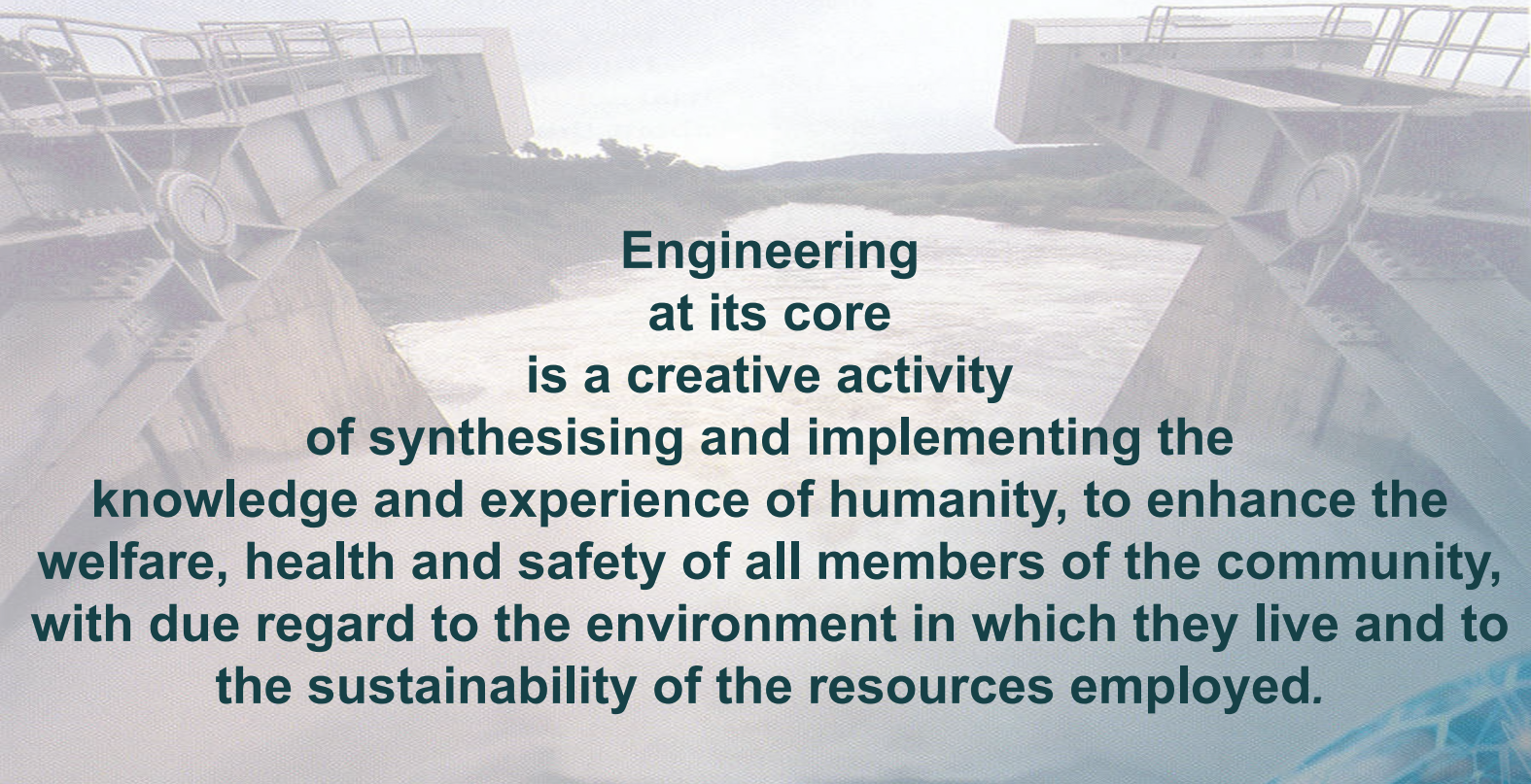
They address the global challenges we face:

poverty,
inequality,
climate,
environmental degradation,
prosperity, and
peace and justice.

**Engineers are vital
contributors to
making progress
towards these
goals**

**IEA role empowering engineering
to contribute to bringing progress while ensuring sustainability**

Engineering within the global context



**Engineering
at its core
is a creative activity
of synthesising and implementing the
knowledge and experience of humanity, to enhance the
welfare, health and safety of all members of the community,
with due regard to the environment in which they live and to
the sustainability of the resources employed.**

We engineers have constructed ourselves in terms of grand and noble narratives for the greater common good.

There is an expectation within our communities that we will put the 'welfare, health and safety of the community before all else'.

Engineering is never static

always on the cusp of a new technological revolution.

We detail grand and noble visions for our technological marvels as we drive successive Technology Revolutions:

Quantum Computing and Nanotechnology

Modelling power from climate to economics

Big data analytics capacity

Data encryption depth

Biointelligence and Synthetic Biology

Organism redesign

Biological security

Living systems digital twins

BUT

While we recognise there are negatives our focus is generally on the technical challenges of accommodating the new:

Applied anthropomorphism in AI evolution

Cyber Security and Privacy

Genetic engineering/modification/manipulation

**Academician Dato Ir. (Dr) Lee Yee Cheong, Malaysia
2018 Global Engineering Congress**

I would further argue that the 4th Industrial Revolution is but the latest Phase of the same Industrial Revolution that started with steam and mechanical power in 1784.

The Key Driver has been Economic Growth through Consumption in industrialised countries, leading to colonisation or semi colonisation of less developed countries and regions for raw materials and cheap labour, the competition for markets resulting in two world wars. The exploitation of the developing world has continued and even worsened since the maturing of the Internet and ICT during the past three decades.

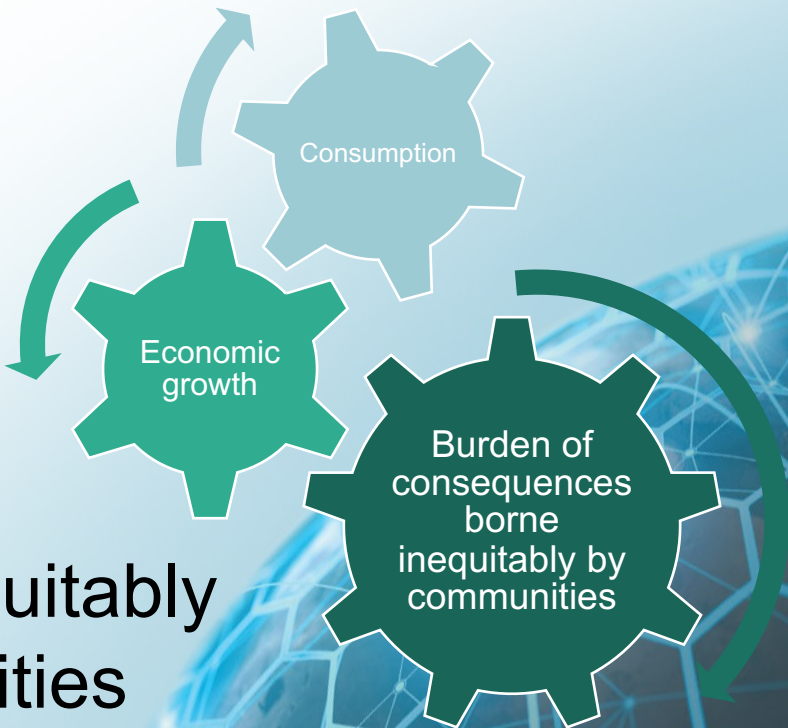
The majority of the world population have been and are still the victims of the Industrial Revolution.

We
engineered
the present



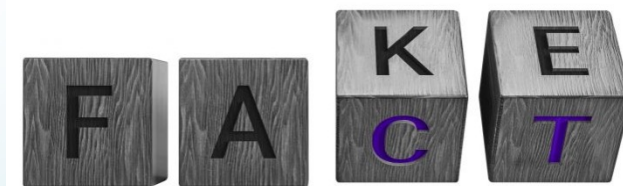
prosperity,
peace and
justice
(for some)

poverty, inequality,
climate, and
environmental degradation
borne heavily and inequitably
across our communities



The reality is the engineering team has been ill equipped to
consider the social, environmental, political consequences
of our grand and noble narratives
recognise whose interests we serve

Our social licence to operate is eroding.



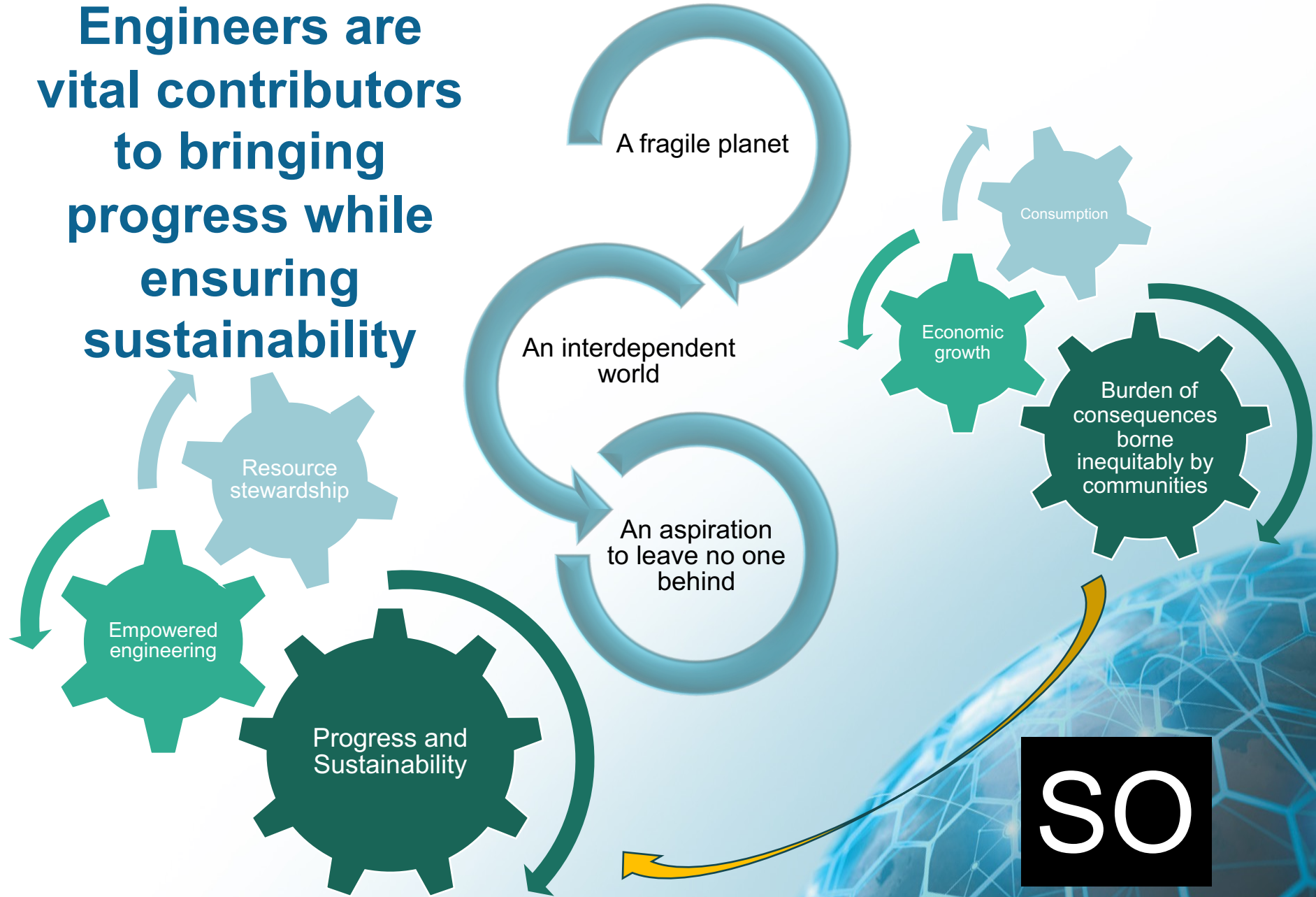
Legitimacy: the extent to which we reflect the expectations of our community, be they legal, social, cultural, formal or informal in nature.

Credibility: our capacity to provide true and clear information to the community and fulfil any commitments made.

Trust: our willingness to be vulnerable to the actions of another. High quality of relationships that take time and effort to create.

<https://ethics.org.au/ethics-explainer-social-license-to-operate/>

**Engineers are
vital contributors
to bringing
progress while
ensuring
sustainability**



SO

Global signals for change

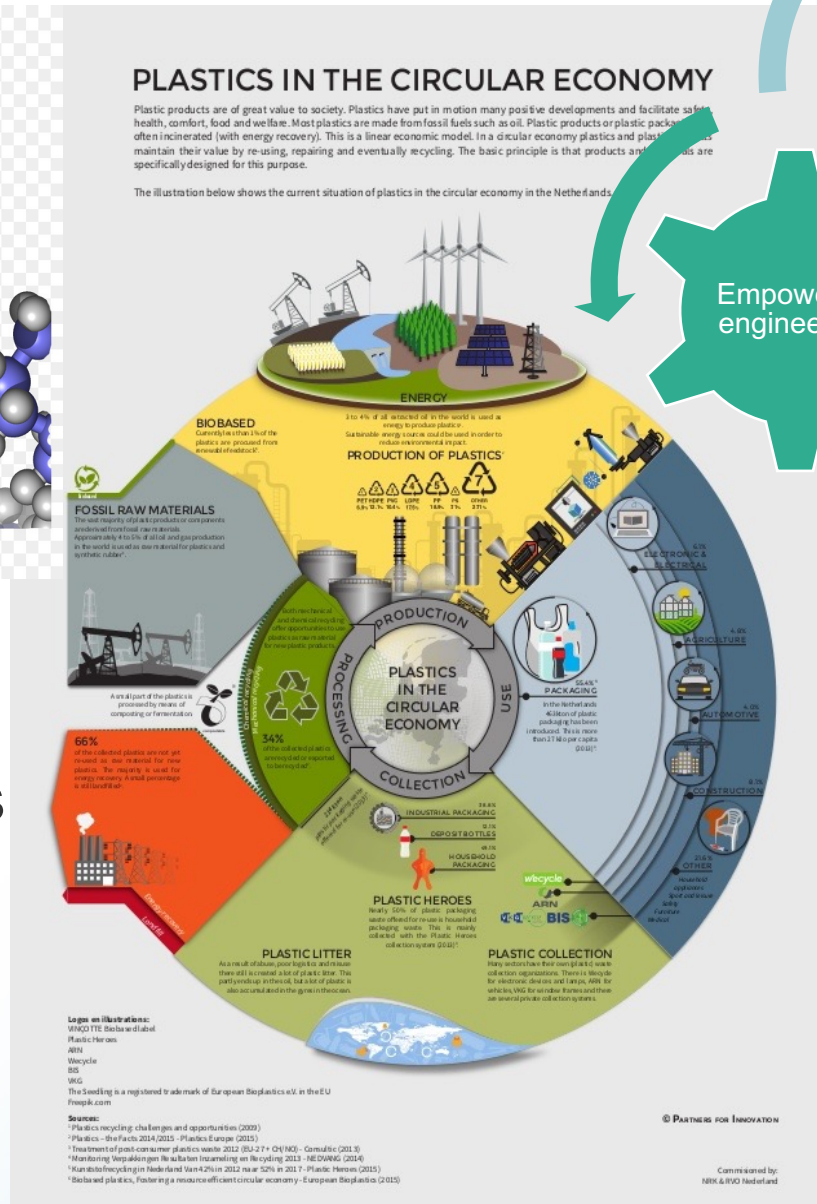
Industry 5.0 is understood to recognize the power of industry to achieve societal goals beyond jobs and growth, to become a resilient provider of prosperity, by making production respect the boundaries of our planet and placing the wellbeing of the industry worker at the center of the production process.

The introduction of Industry 5.0 is based on the observation or assumption that Industry 4.0 focuses less on the original principles of social fairness and sustainability but more on digitalization and AI-driven technologies for increasing the efficiency and flexibility of production. The concept of Industry 5.0, therefore, provides a different focus and point of view and highlights the importance of research and innovation to support the industry in its long-term service to humanity within planetary boundaries.



July 2019

EU and ASEAN
commit towards
a circular
economy for
plastics in the
ASEAN Region



What future
focused education
and practice will
empower
engineering to
make this happen?

International Engineering Alliance

Facilitating engineering mobility and quality – creating networks, sharing ideas

The International Engineering Alliance (IEA) is a global not-for-profit organisation, which comprises members from 42 jurisdictions within 31 countries, across seven international agreements.

	Professional	Technologist	Technician
Education - entry to practice	Washington Accord (1989) 25 full, 6 provisional	Sydney Accord (2001) 11 full, 2 provisional	Dublin Accord (2002) 9 full
Registration/ Chartered	International Professional Engineer Agreement (IPEA) (1997) 15 full, 4 provisional	International Engineering Technologist Agreement (IETA) (2001) 7 full, 1 provisional	Agreement for International Engineering Technicians (AIET) (2015) 6 full, 1 provisional
	Asia-Pacific Economic Cooperation (APEC) Engineers Agreement (2000) 14 full, 2 provisional		

MUTUAL RECOGNITION OF SUBSTANTIAL EQUIVALENCE

These international agreements govern the multi-lateral recognition of engineering educational qualifications and professional competence and facilitate quality and engineering mobility.

**IEA is an
ecosystem
driving
engineering
quality and
mobility**



It empowers engineering to contribute to progress while ensuring sustainability through the following levers:

- 1. IEA membership**
- 2. GAPC benchmark standards**
- 3. Accreditation of engineering education & recognition of professional competence**
- 4. Relationships**

Lever 1: Membership

Korea
Russia
Malaysia
China
Singapore
Sri Lanka
Japan
India
United States
Türkiye
United Kingdom
Costa Rica
Mexico
Pakistan
Peru
Indonesia

IEA Membership 2024



South Africa
New Zealand
Australia
Canada
Ireland
Hong Kong China
Chinese Taipei
Chile
Thailand
Bangladesh
Philippines
Myanmar
Saudi Arabia
Nigeria
Mauritius



IEA covers more than 60% of the world population

International Engineering Alliance Meetings (IEAM)

Facilitating engineering mobility and quality – creating networks, sharing ideas

Developing strategies to support prospective Members, such as mentoring and on-line training



Ensuring the future focus and effectiveness of the IEA benchmark standard Graduate Attributes and Professional Competencies (GAPC)



Peer review by 3 members

Quality assurance that articulated standards are achieved, and processes and procedures followed



Establish equivalence of Jurisdictional Competency Standards with GAPC

Provisional and full membership

Developing and implementing strategies to support each other through challenges, such as COVID

Continuous process improvement

International collaboration and partnerships



Harnessing diversity and collaboration

Sociological, anthropological and ecosystem studies suggest that diversity in our systems drives innovation and capacity to meet complexity, disruption and change.

Whenever a system is captured by one culture, by one world view, or one intellectual tradition and iterates to one metric (standard) of success, its capacity for intellectual flexibility and agility is significantly reduced.

The IEA Accords and Agreements are a living compact made by each signatory/member that they will approach deliberations with **confidence**:

- ✧ we can gain insight from our different cultural, socio-political and legal environments.
- ✧ we can find common ground and build a strong network from our collective understanding.
- ✧ we can negotiate, learn and transform in good faith as we create the terms of our engagement.



IEA is a community of equals with trust built through nurturing high quality relationships that take time and effort to create.

It is hard work

It requires continuous maintenance and nurturing and close interaction.

To misunderstand across our language nuances in our haste to make things happen.

It can be easy to slip into actions derived from unintended, subtle claims about 'our way' superiority.

To deploy 'short-cut' metrics, pro-formas, standards and other tools that draw us away from the uncertainty and energy of continuous relationship building and close interaction.

Active engagement by all results in more sophisticated understanding of the relationship between engineering and poverty, inequality, climate, and environmental degradation and what education models / curriculum and practice will empower engineering to bring progress while ensuring sustainability.



© CanStockPhoto.com

IEA Graduate Attributes and Professional Competency Benchmark Standards (GAPC)

As with all things in life, IEA accreditation **cannot remain static**.

Constant care is required to maintain quality while ensuring that benchmark standards and systems are capable of meeting present and future challenges:

- ❖ coverage of emerging technologies.
- ❖ coverage of emerging engineering disciplines.
- ❖ aligning engineering with the UN Sustainable Development Goals.
- ❖ coverage of diversity and inclusion and ethics to reflect current and emerging thinking.
- ❖ expectations regarding the intellectual agility, creativity and innovation required of engineering decision making and professional judgement to meet constantly evolving community needs.



IEA/WFEO Working Group: Graduate Attributes and Professional Competencies Review

Prof Dr A. Bülent Özgüler (MUDEK Turkey) (Chair)

IEA working group members

Prof A. Bulent Ozguler (MUDEK) (Chair), Turkey

Prof Mitsunori Makino and Ms Akiko Takahashi (JABEE), Japan

Prof Barry Clarke (ECUK), UK

Ms Bernadette Foley (Engineers Australia), Australia

WFEO working group members

Dr Marlene Kanga – (WFEO President, 2017-2019), Australia

WANG Sunyu (Vice Director General, ICEE Tsinghua University), China

Dr Charlie Than, (President, Myanmar Eng. Council), Myanmar

Dr Michael Milligan (ABET) – representing IFEEES, USA

Mr KANG Jincheng, Strategic Specialist, ICEE, China

Mr QIAO Weifeng, Asst Professor Inst. of Education Tsinghua University
and ICEE, China

Mr XU Lihui, Research Associate, Inst. of Education Tsinghua University
and ICEE, China



INTERNATIONAL ENGINEERING ALLIANCE

GRADUATE ATTRIBUTES & PROFESSIONAL COMPETENCIES

PROUDLY SUPPORTED BY:



PREAMBLE

The International Engineering Alliance is pleased to announce that all Accords and Agreements have approved revisions to its Graduate Attributes and Professional Competencies (GAPC) international benchmark. The review, supported by UNESCO, was undertaken by a joint IEA-WFEO Working Group who engaged extensively with IEA signatories, WFEO members and WFEO partners representing academics, industry and women globally. They reflect requirements for new technologies and engineering disciplines, new pedagogies and values such as sustainable development, diversity and inclusion and ethics. They are well positioned to support the engineering role in building a more sustainable and equitable world.

Our thanks to UNESCO and WFEO for their constant support and endorsement and to the GAPC Working Group members, who commenced this work three years ago and who have worked tirelessly to bring this to fruition.

VERSION: 2021.1

The documents presented in this compendium are current as of 21 June 2021.

<https://www.ieagreements.org/>

Approved at IEA Annual meeting in June 2021 and presented at WFEO General Assembly in March 2022.

The International Centre for Engineering Education (ICEE) at Tsinghua University, a member of the joint IEA - WFEO Working Group, undertook translations of the GAPC into the five other official UNESCO languages: French, Spanish, Arabic, Russian, Chinese.

[NOTE: the official language of the IEA is English. Translations assist the work of IEA members but are not the basis for IEA decisions]

All signatories/members agreed that, by 2024, they would have a road map for implementation across their jurisdiction. In line with our aspirations for our profession and the communities we serve, we are working together to develop firm deadlines that minimise the time to implementation.

The contents of this document are solely for the use of IEA members. Any statement of equivalency to the criteria described herein by any party other than the IEA or without consent of the IEA constitutes an infringement. No part of this document may be copied, reproduced or transmitted in any form or by any means without the permission of the IEA

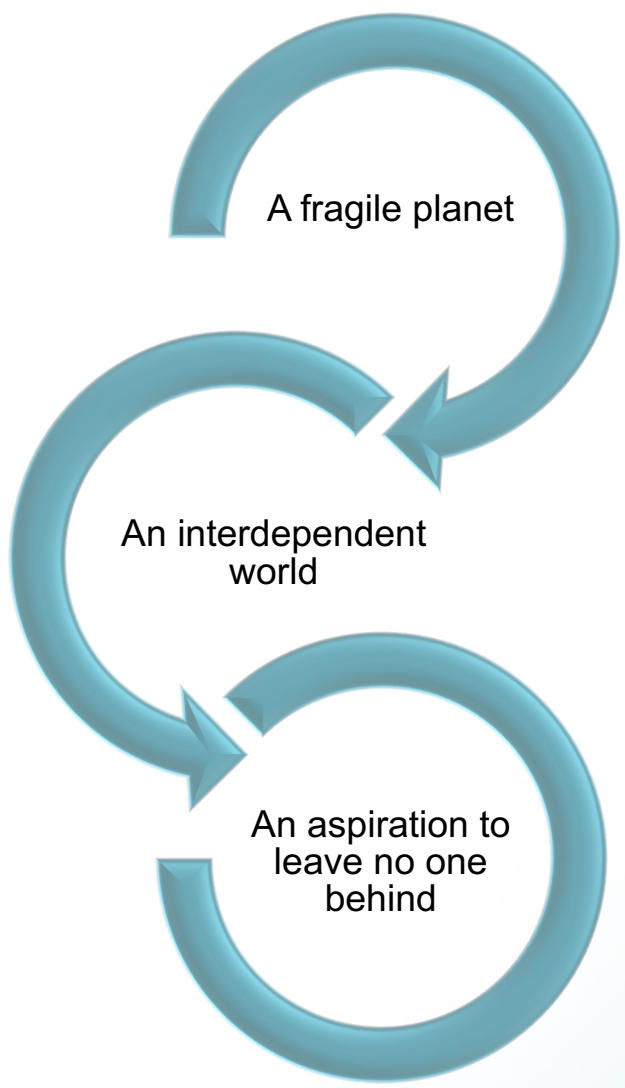


The imperative for system integrity

Regulatory/quality assurance systems are the subject of intense interest as governments and international organisations grapple with the tension between trade liberalisation/mobility and meeting the public interest.

As consistently reported by APEC - OECD and others such as ABD, WTO, BRICS, AMRO, 'best practice' organisational and institutional characteristics of regulatory bodies include:

- The importance of regulator independence and accountability, which facilitates transparency, predictability and quality of decision-making.
- Separation of the entity providing services and the entity regulating the market.
- Must be outside the chain of command of executive power.
- Ensure that the public interest is not subordinated to those of regulated entities and stakeholders (ie it must not be beholden to vested interests).
- Strong social networks to avoid fear and distrust.
- Must result in a "fair level playing field".



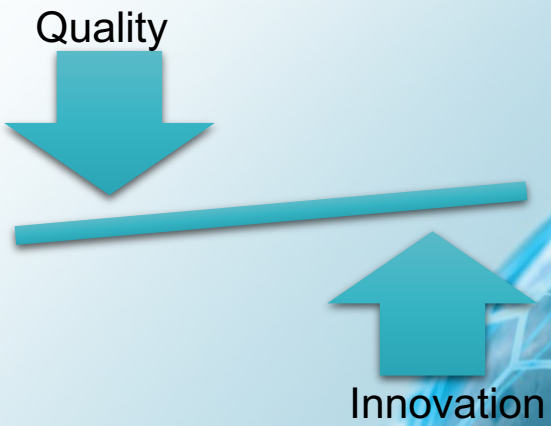
Achieving Progress and Sustainability will require very different engineering capability to that which has underpinned our past.
It will require:



a metamorphosis in engineering thinking

transformed engineering practice

innovative educational models



IEA Mutual Recognition of Substantial Equivalence

The IEA Accords validate the substantial equivalence of jurisdictional accreditation systems.

The IEA Agreements validate the substantial equivalence of jurisdictional processes by which the competence of an applicant for undertaking independent practice is determined.

Peer review by 3 members

Quality assurance that articulated standards are achieved, and processes and procedures followed

Establish equivalence of Jurisdictional Competency Standards with GAPC

Provisional and full membership

Establishing a peer review team

Signatory members provide one or more names of persons considered competent to form part of the panel from which Review Teams may be drawn.

A team is set up to encompass

- complementary technical expertise
- cultural diversity
- avoidance of conflict of interest
- (Accords) a minimum of one academic and one industry member



<https://pixy.org/619753/>

A learning community of peers.



IEA Professional Competencies (extract *IEA GAPC 2021*)

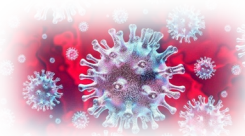
Differentiating Characteristic	Professional Engineer	Engineering Technologist	Engineering Technician
Problem analysis: Complexity of analysis	EC3: Define, investigate and analyze complex problems using data and information technologies where applicable	TC3: Identify, clarify, and analyze broadly-defined problems using the support of computing and information technologies where applicable	NC3: Identify, state and analyze well-defined problems using the support of computing and information technologies where applicable
Design and development of solutions: Nature of the problem and uniqueness of the solution	EC4: Design or develop solutions to complex problems considering a variety of perspectives and taking account of stakeholder views	TC4: Design or develop solutions to broadly-defined problems considering a variety of perspectives.	NC4: Design or develop solutions to well-defined problems



Activities undertaken by the Peer Review Team.

- ❖ Review (including verification and validation) of background data provided by the member being reviewed.
- ❖ Determination of the substantial equivalence of jurisdictional standards against the relevant IEA GAPC.
- ❖ Observation of accreditation (Accord) / assessment (Agreement) activities.
- ❖ Observation of meetings at which accreditation / assessment outcomes are discussed and decided.
- ❖ Preparation of a report, including recommendations, for consideration by the other Accord/Agreement members.





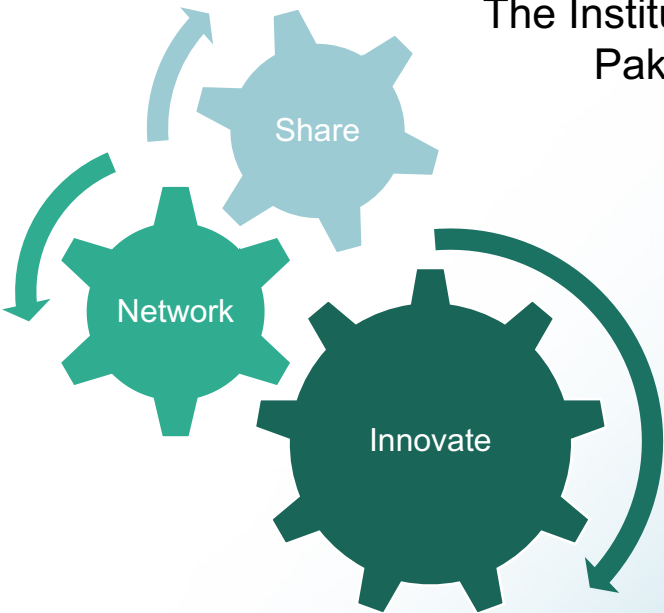
COVID disruptor – IEA Response

Welcome to the IEA **Accreditation in a Virtual World** Basecamp site
set up 30 April 2020

Washington Accord Workshop – Sharing Best Practices and Policies for Online Teaching Learning and Assessment System and Virtual/Remote Accreditation Process

Organized by

The Institution of Engineers Singapore, IES and
Pakistan Engineering Council, PEC.
Saturday 13 June 2020



Symposium
Conferences
Discussion Groups
Seminars
Meetings
Collaboration



<https://pixy.org/019753/>

Proactive engagement
by all mitigated COVID
risk to quality
engineering education
and accreditation

Working together to create a shared and better future



Engagement with International Engineering Entities

In 2019 UNESCO, WFEO and IEA signed a Declaration on “Global Engineering Education Standards and Capacity Building for Sustainable Development”.

Commitment to work together on actions to “progress the supply of competent professional, technologist and technician engineers, in order to help achieve the Sustainable Development Goals.”

In June 2018 the World Federation of Engineering Organisations (WFEO) and IEA established a project to address the needs of its members in the developing world, referenced to IEA standards.

=>Two working groups were established.

Recently approved 2023 review of the 2015 IEA/ENAAEE publication: “Best practice in Accreditation.”



Federation of Engineering Institutions in Asia and the Pacific (FEIAP) is developing pathways to facilitate IEA Accord signatory status. Its facilitation of better engineering solutions through the work of its standing committees is highly regarded.

Participation in the WFEO Academy

This training platform has been developed in collaboration with UNESCO, the International Engineering Alliance, the International Federation of Engineering Education Societies, the Global Engineering Deans Council and WFEO members to provide an education training platform in the spirit of Open Science Principles and as part of the WFEO Engineering 2030 Plan to enable more countries to have more engineers with the right skills for sustainable development.

<https://wfeoacademy.com/>

Peace and prosperity continues to be fragile. For all of us, but especially for those whose lands lie in the confluence of history and resources, geopolitical manoeuvrings have a significant impact on opportunities to create a better future.

There is no easy or singular path to address this, but one powerful tool we can leverage is our openness to working together across our diversity. Our willingness to gain insight from the ways in which our different cultural, socio-political and legal environments inform our work, to find common ground and build a strong network from our collective understanding, and to negotiate, learn and transform in good faith as we create a better sustainable future for the world.



