



WFEO / FMOI



The International Engineering Alliance Meeting 2021 Plenary Sessions

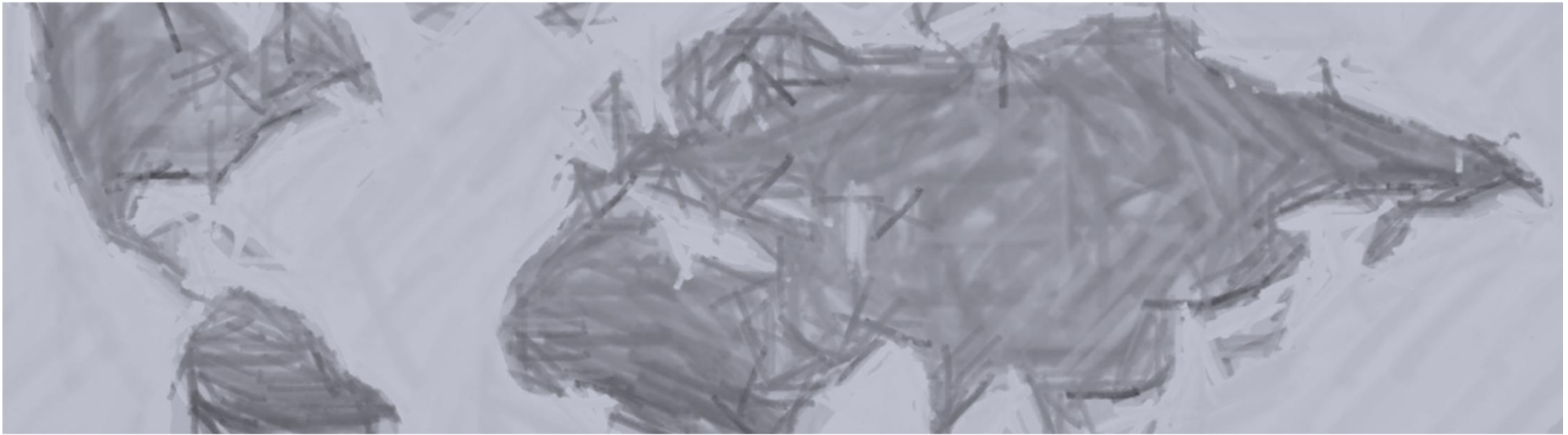
WFEO – IEA Working Group Progress and Outcomes



***Dr. Marlene Kanga AM
WFEO President 2017-19***

21 June 2021 and 25 June 2021

www.wfeo.org



The World Federation of Engineering Organizations (WFEO):

- **The peak international body for professional engineering institutions**
- **Founded in 1968, under the auspices of UNESCO**
- **100+ national professional engineering institutions, 12 international and continental/regional professional engineering institutions, representing 30 million engineers**
- **Co-Chair - Major Science and Technology Group at UN**
- **Representation at major UN Organisations**



WFEO – UNESCO
Declaration, signed on March 7, 2018



WFEO / FMOI

Paris Declaration

**Advancing the United Nations
Sustainable Development Goals
through Engineering**



The World Federation of Engineering Organizations (WFEO) is the main body for engineering globally, representing nearly 100 nations and some 30 million engineers.

The members of WFEO are the national and regional professional engineering institutions of the world. WFEO is a member of the United Nations Scientific and Technological Community (UN STC) Major Group and has an official Associate status with UNESCO.

UNESCO, as the United Nations agency for education, science and culture, supports engineering through its Natural Sciences Sector, and acknowledges engineering as a powerful means to achieve sustainable development, capacity-building in engineering education and gender equality in developing countries, as well as the safeguarding of world heritage.

CELEBRATING 50 YEARS OF INTERNATIONAL ENGINEERING LEADERSHIP

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Increase the number and quality of engineering graduates...

Accordingly, we declare:

1. WFEO, a recognized member of the UN STC Major Group and UNESCO, through its Natural Sciences Sector, will work together and in cooperation with other UN organizations, including UNEP, UNFCCC and UNISDR towards achieving the SDGs through engineering.

Inform global standards for engineering education, support the development of a range of engineering education systems to comply with agreed standards...

2. WFEO and UNESCO are committed to the following principles for action through engineering to achieve the SDGs:

- Increase the numbers and quality of engineering graduates that meet the needs of sustainable development with rapidly changing technologies, in collaboration with educators, government and industry;
- Inform global standards for engineering education, support the development of a range of engineering education systems to comply with agreed standards and facilitate the mobility of engineers;
- Support capacity-building through strong institutions for engineering education and the development of accreditation bodies for the recognition of professional credentials;
- Establish policy frameworks and best practices, notably through WFEO Standing Technical Committees, as digital technologies, data sciences and artificial intelligence have ethical and social implications.

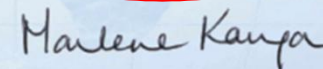
Support Capacity Building through strong institutions for engineering education...

3. WFEO is committed to playing a key role in leading and coordinating projects to achieve the SDGs through engineering. WFEO can bring together its

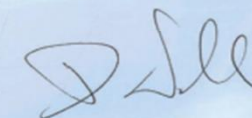
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stage in bringing together the WFEO members and partners to develop the *WFEO Engineering 2030 Plan*.

Signed in Paris, 7 March 2018



Marlene Kanga
President
World Federation of Engineering Organizations



a.i. Flavia Schlegel
Assistant Director-General for Natural Sciences
UNESCO

Note: "standards" used in 2018, Since 2019, using "benchmarks" to align with IEA definitions





Marlene Kanga

209 Tweets



Marlene Kanga @MarleneKanga · 1m

Agree @antonioguterres as Immediate Past President of @wfeo I proudly led the proposal for #WorldEngineeringDay and delighted to see it celebrated globally as every #Engineer especially #women engineers strive to contribute to advance the #UNSDGs. It's our Day!



António Guterres ✓ @antonioguterres · Mar 5

As a trained engineer, I am passionate about the potential of engineering to help solve the most pressing challenges facing our world.

But to truly maximize that potential, we must ensure women & girls have equal opportunities & representation in this field.
#WorldEngineeringDay



The UN Secretary General agrees, Twitter, 4 March 2021, World Engineering Day,

“As a trained engineer I am passionate about the potential of engineering to help solve the most pressing challenges facing our world”

UNESCO WFEO IEA Plenary on Engineering Education @ WEC2019, Melbourne Nov. 2019, Declaration and committing to working together

1. **Recognise the Current IEA Graduate Attributes and Professional Competencies Framework** as international engineering benchmark standards;
2. **Support IEA review of the IEA Graduate Attributes and Professional Competencies** to ensure that they meet the requirements for new technologies and engineering disciplines, new pedagogies and include contemporary values such as sustainable development, diversity and inclusion and ethics;
3. **Extend the global reach of the IEA Agreements and Accords through capacity building efforts**, such as mentoring and training, that support the development of engineering accreditation and professional competence/registration/licensure systems, appropriate to each jurisdiction;
4. **Support the development of professional engineering institutions through capacity building efforts** to ensure engineering quality and standards are maintained;
5. **Support the development of national, regional and international registers** and liaise with governments for the regulation of engineers to ensure their competence, performance, integrity and accountability throughout their careers, and
6. Facilitate the international mobility of engineers.



UNESCO WFEO IEA Plenary on Engineering Education @ WEC2019 – Declaration committing to working together

Signing of MoU between IEA and WFEO, WEC2019, Melbourne



Engineering for Sustainable Development



Dr Peggy Oti-Boateng, Director, Capacity Building Section, Natural Sciences Sector UNESCO, speaks at Plenary, WEC2019, Melbourne



WFEO IEA Agreement, re-signed Melbourne, Nov. 2019

- **2nd term 2019-2023**
- **Purpose:**
 - Raise awareness of the importance of accreditation of engineering qualifications and competence assessment to global standards
 - Build the capacity of national accreditation and assessment agencies and underlying facilities
 - Build the capacity of national accreditation and competence assessment bodies to facilitate their joining the Accords and Agreements
 - Build political and financial commitment to the development of national engineering accreditation and competence assessment bodies
 - Seek partners and resources to achieve these aims



Engineering 2030 – Principles for Action, March 2018

1. **Encourage young people** – To consider engineering as a career
2. **Graduate Outcomes** - Agree with educators, government, industry
3. **Global standards** - for engineering education and professional development
4. **Partnerships** – with international standard setting organisations for consistent international framework
5. **Support** – development of national engineering education systems to comply with agreed standards
6. **Capacity Building** – for accreditation of engineering education and accreditation bodies
7. **Capacity Building** – for professional engineering institutions
8. **Develop professional competency pathways** – so graduates meet employer needs
9. **Support national and international registration** – for recognition of qualifications and experienced of practising engineers
10. **Liaise with governments** – to establish consistent regulation policies for engineers
11. **Establish an international platform for engineering standards** – Education and professional development, under auspices of WFEU and UNESCO
12. **Report on progress** - to UNESCO and other international organisations

WORKING
GROUP 1 -

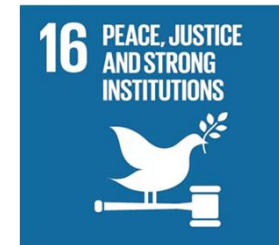
WORKING
GROUP 2

Note: “standards” used in 2018, Since 2019, using “benchmarks” to align with IEA definitions

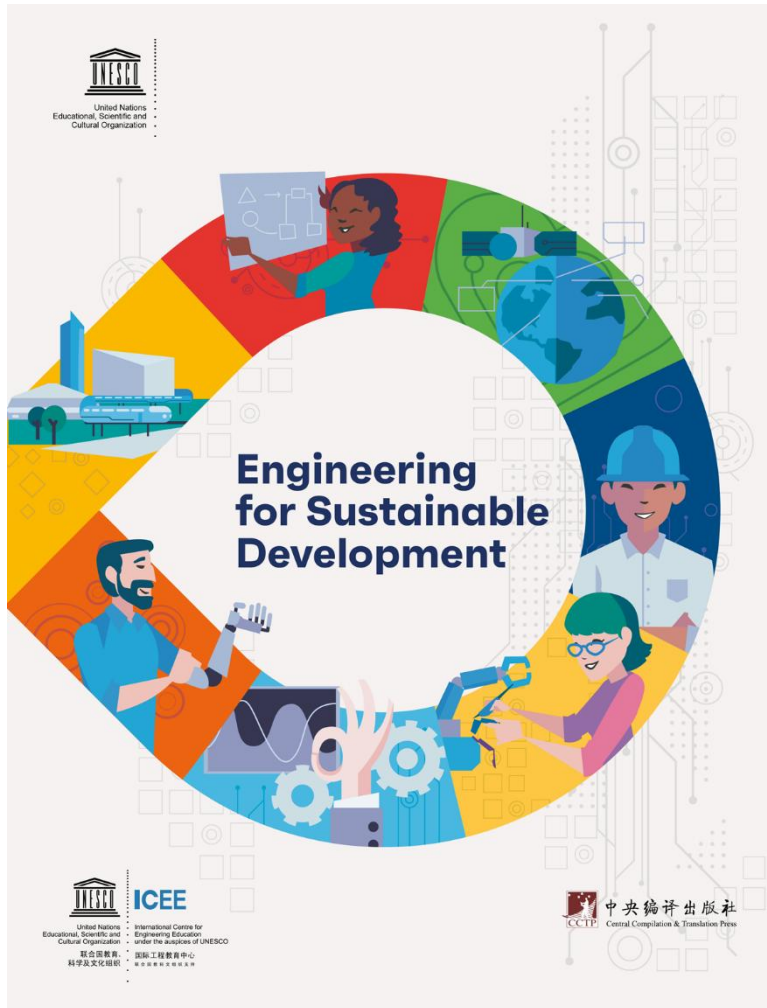


These projects:

1. Engineering education for the right skills – Goal 4
2. Develop institutional capacity – Goal 16 accreditation bodies and professional engineering institutions
3. Working in partnership – Goal 17
UNESCO, WFEO members, International Engineering Alliance and signatories, international engineering organizations



UNESCO Engineering Report – Engineering for Sustainable Development, 4 March 2021



The second UNESCO Engineering Report – “Engineering for the SDGs”, Chapter 1, author Dr Marlene Kanga recommends:

1. *“Government, engineering educators, industry and professional engineering institutions need to collaborate to increase the number and quality of engineers.”*
2. *There is also a need to work in partnership to develop the necessary international engineering education benchmarks for sustainable development.*
3. *These need to be recognised across the world and form the basis of national engineering education systems for engineers with the right skills especially Asia, Africa and Latin America.”*

EN <http://on.unesco.org/Eng2021>, FR: <http://on.unesco.org/Ing2021>

ES <http://on.unesco.org/Ingen21>

Engineering for Sustainable Development

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UNESCO Engineering Report – Engineering for Sustainable Development, 4 March 2021, Chapter 1 and Executive Summary

SDG 16



16 PEACE, JUSTICE AND STRONG INSTITUTIONS

How engineering can make it happen

Engineering practice that is diverse and inclusive, sustainable and ethical is essential for advancing the SDGs. Engineers are partnering to develop strong institutions for engineering education, accreditation and regulation, which are essential for ensuring high standards of engineering education and the competency of engineers everywhere. The WFEO Model Code of Ethics for engineers is guiding other professional engineering institutions. Engineers are also improving standards to address corruption in engineering to maximize the benefit of infrastructure investments that support sustainable development for all.

Engineers from around the world discuss strong institutions for engineering education at the International Engineering Alliance Meeting, Hong Kong, June 2019. © Marlene Kanga

WFEO-IEA Project partnership and photo showing Prof Wu Qidi Director International Centre for Engineering Education (ICEE) Tsinghua University, presenting to IEAM2019, Hong Kong, ICEE is also participating in WFEO-IEA WG1

EN <http://on.unesco.org/Eng2021>, FR: <http://on.unesco.org/Ing2021>

ES <http://on.unesco.org/Ingen21>

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UNESCO is a key partner for the review of engineering benchmarks for Graduate Attributes and Professional Competencies

Recognition by UNESCO will ensure that the IEA GAPC will be the pre-eminent international benchmark for engineering education.



WFEO IEA Working Group #1 – Review of Graduate Attributes and Professional Competencies (GAPC)



WFEO IEA Working Group #1 – Review of Graduate Attributes and Professional Competencies (GAPC)

- **Chair:** IEA Nominated – Prof. Arif Bulent Ozguler MUDEK , Turkey
- **IEA Members (all signatories)**
 - Prof Mitsunori Makino and Ms Akiko Takahashi (JABEE), Japan
 - Prof Barry Clarke (Engineering Council UK) , UK
 - Ms Bernadette Foley (Engineers Australia), Australia
- **WFEO Members –**
 - Dr Marlene Kanga – WFEO President 2017-2019, Australia
 - Mr WANG Sunyu (Vice Director General, ICEE Tsinghua University), China
 - Prof. Dr Charlie Than, (President, Myanmar Engg. Council) , Myanmar
 - Dr Michael Milligan (Chief Executive, ABET) – representing IFEEs, USA

Others from ICEE China:

- Mr KANG Jincheng, Strategic Specialist, ICEE
 - Mr QIAO Weifeng, Asst Professor Inst. Of Education Tsinghua University and ICEE
 - Mr XU Lihui, Research Associate, Inst. Of Education Tsinghua University and ICEE
- **Schedule:**
 - Review current frameworks, draft discussion document for consultation Oct-2019 - June 2020, continuous support from WFEO
 - Draft presented to IEA Annual meeting in June 2020
 - Consultation: July 2020 – March 2021
 - Revise and Present to IEA Annual meeting June 2021 and WFEO General Assembly 2021



Consultation July 2020 - March 2021 on Graduate Attributes and Professional Competencies (GAPC) Framework

Webinars by WFEO – July 2020 - Feb. 2021:

1. WFEO Members- Professional Engineering Inst. (Ozguler, Kang, Than, Milligan, Kanga)
2. Engineering Educators and Universities, IFEEES (Kanga)
3. Women, INWES (Ozguler, Than Milligan, Kanga)
4. Industry, FIDIC (Than, Kanga)

Webinars hosted by others:

1. Peru, 6th ICACIT Symposium, 7 November 2020, (Ozguler)
2. Philippines Technological Council, ACE Accreditation Conference in Engineering, 18 Nov 2020 (Kanga)
3. China, International Centre for Engineering Education (ICEE) *Engineering Education for Sustainable Development*, 4 December 2020 (Kanga)
4. Myanmar, Myanmar Engineering Council, *International Conference on Engineering Education Accreditation (ICEEA 2021)*, 14-16 January 2021 (Kanga)
5. Jakarta, UNESCO Jakarta AAESAP and PII (Indonesia) *Engineering Value Chain*, 4 March 2021 (Kanga)
6. 3rd Deans Conference, Pakistan Engineering Council, 7 April 2021 (Ozguler, Than, Kanga)
7. APEC Meeting Taipei, *Regional Industry-Academia Collaboration*, 7 May 2021 (Kanga)



Consultation to March 2021 on Graduate Attributes and Professional Competencies (GAPC) Framework

- **932 attending, 60 countries**
- **Survey – responses from every continent**
- **15 Detailed submissions, every continent**
- **Submissions from signatories 18+, some more than once**

Continent	No.	%
Africa	75	8%
Asia	665	71%
Americas	96	10%
Europe	54	6%
Middle East	29	3%
Oceania	13	1%
Total	932	100%

- See:
- WFEO: <https://bit.ly/3fg8Fdh>
- IEA: <https://www.ieagreements.org/about-us/iea-unesco-and-wfeo-collaboration>



Feedback to March 2021 has been overwhelmingly positive

“The GAPC framework is truly transformative in outlook for engineering education, and of major importance.”

Professor Tim Ibell FEng

Professor of Structural Engineering, Associate Dean of the Faculty of Engineering and Design
BRE Centre for Innovative Construction Materials, Department of Architecture and Civil Engineering, University of Bath, Bath, United Kingdom



Our Impact ▾

Our Work ▾

Get Involved ▾

The coalition of EWB's including Engineers Without Borders International, **Australia**, **UK Canada** and its research offshoot **Engineering Change Lab**, **Brazil**, **India**, the Netherlands, the **Philippines**, and **USA**, are calling for three core competencies to be universally incorporated into the benchmark values. They are:

1. Emphasis on critical thinking as a fundamental cornerstone of engineering competence – critically analysing and critiquing the role of engineering, its relationship with humanity, and its impact on our past and potential futures.
2. Deeper comprehension of the ethical issues inherent in engineering due to the relationship between engineering, people and the planet, and greater focus on developing the skills necessary to navigate these complex issues.
3. Broader appreciation for the knowledge needed to make effective engineering judgements, including explicitly acknowledging the value of the social sciences in helping engineers understand the implications of their work.

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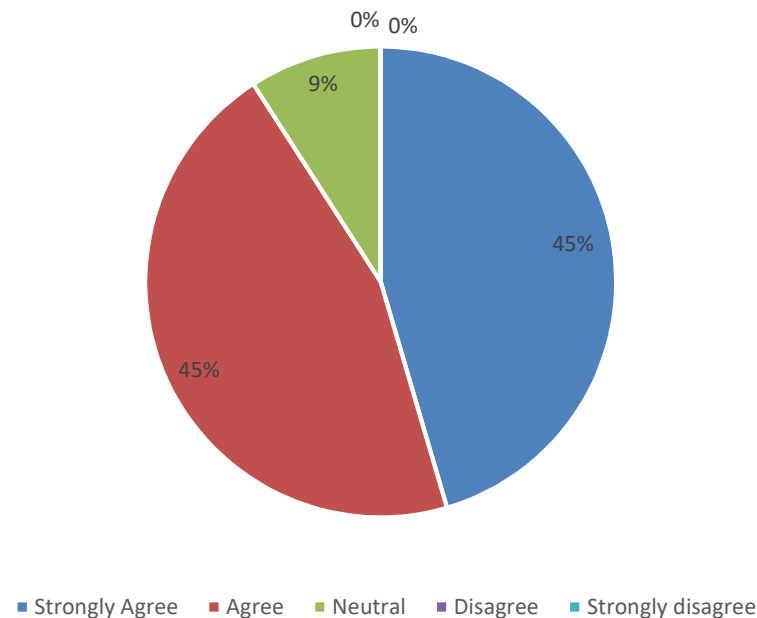
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Feedback Received - Survey

Q1: What was your first reaction to the Proposed Revised Graduate Attributes and Professional Competencies (GAPC) Framework?

Q1: Overall Response to Proposed Changes to GAPC Framework



A total of **90% of respondents were positive** about the proposed changes and either “Strongly Agreed” or “Agreed” with the proposed changes. 9% were neutral. There were no negative responses.

Full details of survey and responses at: **WFEO:** <https://bit.ly/3fg8Fdh>



Announcement of approval of the revised GAPC Framework 21 June 2021- WFEO home page



Approval of the revised GAPC Framework 21 June 2021

The decision by IEA signatories to approve the reviewed GAPC Framework is of great importance to engineers and to the world.

The implementation of this Framework will result in a transformation of the engineering profession, with graduates who are critical thinkers, thoughtful about the impact and outcomes of their work, capable of working in diverse and inclusive teams and are committed to lifelong learning.

It will strengthen the achievement of the aspirations in the preamble of the GAPC:
“Engineering therefore must be carried out responsibly and ethically, use available resources efficiently, be economic, safeguard health and safety, be environmentally sound and sustainable and generally manage risks throughout the entire lifecycle of a system. The United Nations Sustainable Development Goals present targets for 2030. Engineers are vital contributors for making progress towards these goals.”

WFEO and its members and partners are absolutely delighted with this outcome and congratulate Prof. Ozguler for his leadership of this project and the IEA Governing Group for their foresight in supporting this project and thank all IEA signatories, especially the members of the working group for their contributions.



Feedback on Approval of the revised GAPC Framework

21 June 2021

Feedback from WFEO partners:

"This is one of the most wonderful emails I've received in my time with EWB. A big congratulations to you for this truly important outcome and to the IEA signatories for their leadership at this critical time in our planet's history. I know how hard you've worked to bring everyone on this journey and the legacy you leave for this and future generations, cannot be overstated. EWBs around the globe will be rejoicing with this news and are ready to support the practicalities from here"

**Eleanor Loudon, Chief Executive Officer
Engineers Without Borders Australia), 25 June 2021**

"We're keen to support where we can with implementation with many EWBs well-positioned and experienced in supporting engineers to develop the skills and mindsets recognised in the GAPC. "

George Goddard, Policy Director, EWB Australia, 25 June 2021

"Thank you for this information. I am cc'ing this info to members of the Executive Board and the chair of the EMC for their information. I propose that we discuss at an upcoming ExBo meeting how to distribute this info to our members and/or include it in our activities."

Hannes Trier WFEO Committee Switzerland, , Chair, National member Forum, Federation of Engineering Institutions in Europe (FEANI), 25 June 2021



WFEO IEA Working Group WG2: Capacity Building in Engineering Education



The need for more engineers with the right skills - Comparison of numbers of engineers – South Africa, USA, UK

The engineering numbers

CATEGORY \ NUMBER	TOTAL IN THE WORKFORCE	REGISTERED		GRADUATES		GRADUATES AS A % OF THE WORKFORCE
		REGISTERED	% REGISTERED	IN 2015*	% FEMALE	
Engineers	114 579	34 722	30%	9 875	22.0%	9%
Technologists and technicians**	114 281	12 746	11%	15 607	24.7%	14%
TOTAL	228 860	47 468	21%	25 482	23.7%	11%

* Totals are understated as graduation data from some countries is incomplete – see Figure 23
 ** Technologist and technician categories are not recognised in all countries – see Table 24

- 68 engineering practitioners per 100,000 population in SADC – ranging from 531 to 18
- 850 engineering practitioners per 100,000 population in the USA
- 1 160 engineering practitioners per 100,000 population in the UK

Source: <http://www.eiz.org.zm/wp-content/uploads/2019/11/Engineering-Numbers-Needs-in-the-SADC-Region-Allyson-Lawless.pdf>

Reach of Current Mutual Recognition Systems



Source: <https://www.engc.org.uk/international-activity/international-relationships-map/>



WFEO and IEA: Proposals for Action – Capacity Building

1. **Capacity Building** – development of national engineering education systems to comply with agreed benchmarks
 1. Training for mentoring and support for development of education assessment systems and accreditation of programs
 2. Training for educators – complementary programs by partners e.g. IFEEES
2. **Capacity Building** – Build institutional capacity for accreditation bodies and professional engineering institutions
 1. Governance for accreditation bodies and PEIs
 2. Support development of regulatory framework for engineering appropriate to the country's national systems and priorities
 3. Training and development for leadership, governance and systems
 1. Training in and Assessments in country
 2. Supported and facilitated by WFEO national and international members



WFEO – additional facilitation activities that support IEA Global Reach Initiative

1. **Leverage** – WFEO national and international members and their relationships with government and policy makers
 - Develop the needs for various skills in a country
 - Country led process mapping for education institutions and PEIs to achieve the global standards
 - Facilitate support from members that are IEA signatories
2. **Liaise with governments** – to establish consistent regulation policies for engineers
3. **Facilitate support structures** – Access funding arrangements to support projects
4. **Support national and international systems and agreements** – for recognition of qualifications and experienced of practising engineers and mobility
 - Development of regional and national registers
 - Facilitate mutual recognition between regional registers
 - Work towards an international register for International Professional Engineers Agreement and Int. PE credentials
5. WFEO will bring together all national and international members for a consistent standard and approach for global mobility of engineers
6. Extend Global Reach of IEA Accords and Agreements to:
 - South America and Spanish and Portuguese speaking world
 - French and Portuguese speaking nations in Africa



WFEO IEA Working Group WG2: Capacity Building in Engineering Education

WFEO working group members

Prof. Dr Charlie Than, Chair CEIE, MEngC,
Myanmar

1. Dr. Marlene Kanga – WFEO President 2017-2019
2. Prof. Doris Rojas, CIP, Peru
3. Prof. Sarath Abayakoon, IESL, Sri Lanka
4. Prof. Wang Xue, CAST, China

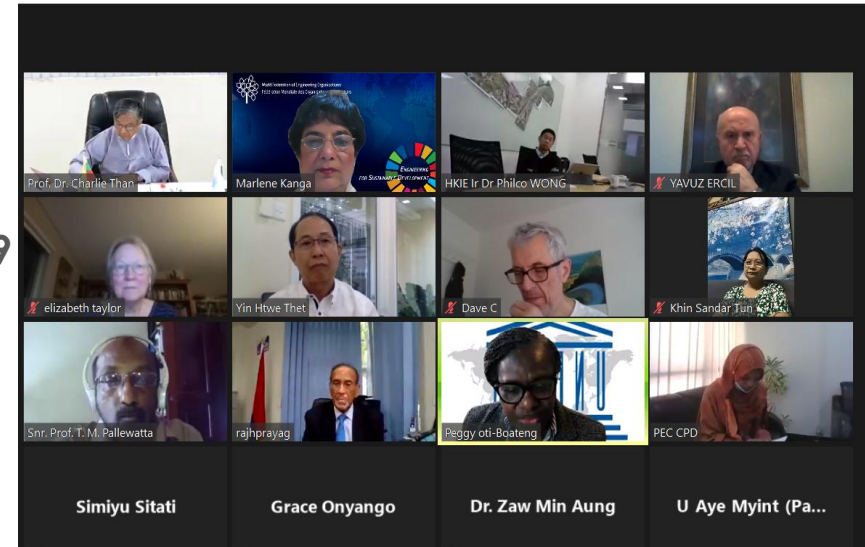
IEA Nominated members

1. Dr. Yavuz Ercil, MUDEK , Turkey
2. Dr. Dave Clark, ECUK, UK
3. Dr. Philco Wong, HKIE, Hong Kong
4. Mr. Sipho Madonsela ECSA, South Africa

WFEO approved Host of WG2 Oct 2020 (Executive Council) and 26 March 2021
(Special General Assembly)

Formal meeting of WG 2 – 26 February 2021, attended by:

- Em. Prof. Elizabeth Taylor, Chair of the Washington Accord and
- Dr. Peggy Oti-Boateng, Director, Capacity Building Section, Natural Sciences Sector, UNESCO Paris



WG2 Virtual meeting 26 Feb 2021



WG2: Capacity Building in Engineering Education Nov 2019 – June 2021

IEAM 2020 approved mentoring support, Jun. 2020:

- Mauritius (IEM) mentored by India (NBA – National Board of Accreditation) and South Africa (ECSA Engineering Council of South Africa)
 - Kenya (EBK) mentored by Pakistan (PEC- Pakistan Engineering Council) and Malaysia, (BEM - Board of Engineers Malaysia)
1. Checklist based on Schedule B1 and B2, by Prof. Elizabeth Taylor, used to structure and guide the first meetings between mentor and mentees, February 2021.
 2. Mentors and mentees - training workshop 31 March 2021, hosted by IEA.
 3. Monthly meetings with Kenya (EBK) Mauritius (IEM) (March-June 2021)
 4. Plan to support institutions in Africa, Asia and Latin America
 5. Funding support being sought, 5 year plan to be developed
 6. Planning for training portal and training virtual/ face to face



Ms Grace Onyango, Registrar EBK presenting to PEC, BEM, MEngC and WFEO at mentoring meeting



WG2: Capacity Building in Engineering Education Nov 2019 – June 2021

Deep appreciation for support for this important project to:

Em. Prof. Elizabeth Taylor, Chair of the Washington Accord and the IEA Signatories that have generously agreed to provide mentoring support:

- **Pakistan Engineering Council – Dr Nasir Khan, Dr Ashfaq Ahmed Sheikh, Dr Fazal Khalid and others**
- **National Board of Accreditation –Dr K.K. Agarwal, Dr Sanjay Agarwal and others**
- **Board of Engineers Malaysia – Dr Abdul Aziz**
- **Engineering Council of South Africa**

The Myanmar Engineering Council, President Prof Dr Charlie Than, Secretary Mr Yin Htwe Thet and others provided all the meeting and secretariat facilities despite a difficult working environment.

I have personally attended all meetings and will continue to support the mentoring program and the development of training support materials in collaboration with IEA to ensure good progress and success of this project.

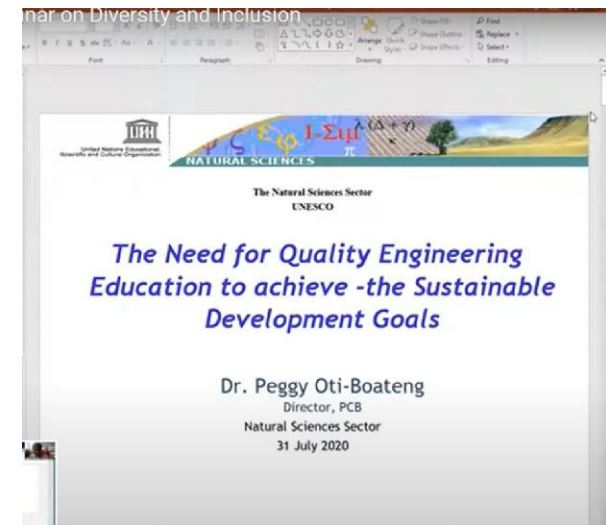


UNESCO Support



Dr Peggy Oti-Boateng, Director, Capacity Building Section, Natural Sciences Sector UNESCO, speaks at WG2 Meeting 26 Feb 2021 (left) and WFEO IEA Benchmark Webinar 31 July 2020 (right)

- Review and endorse the Graduate Attribute-Professional Competency Framework
- Support the capacity building effort to enable funding to cover mainly travel costs for mentors
- Recognise this Project as a UNESCO Engineering Initiative for capacity building in engineering





WFEO / FMOI



**Thank you for the opportunity to
collaborate with you – we look forward
to continuing the journey...**





Engineering for Sustainable Development

- Participation
- Influence
- Representation



**The world's engineers
united in rising to
the world's challenges.
For a better, sustainable
world.**



The World Federation of Engineering Organizations
Fédération Mondiale des Organisations d'Ingénieurs

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