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World
Engineering Day

World Federation of Engineering Organizations

Launch of the Second UNESCO Engineering Report

Engineering for Sustainable Development

Dr Marlene Kanga, Immediate Past President WFEO
Prof Gong Ke, President, WFEO
Prof Jose Vieira, President Elect, WFEO

World Engineering Day
4 March 2021

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Engineering to advance the UN Sustainable Development Goals

Marlene Kanga

Immediate Past President, WFEO

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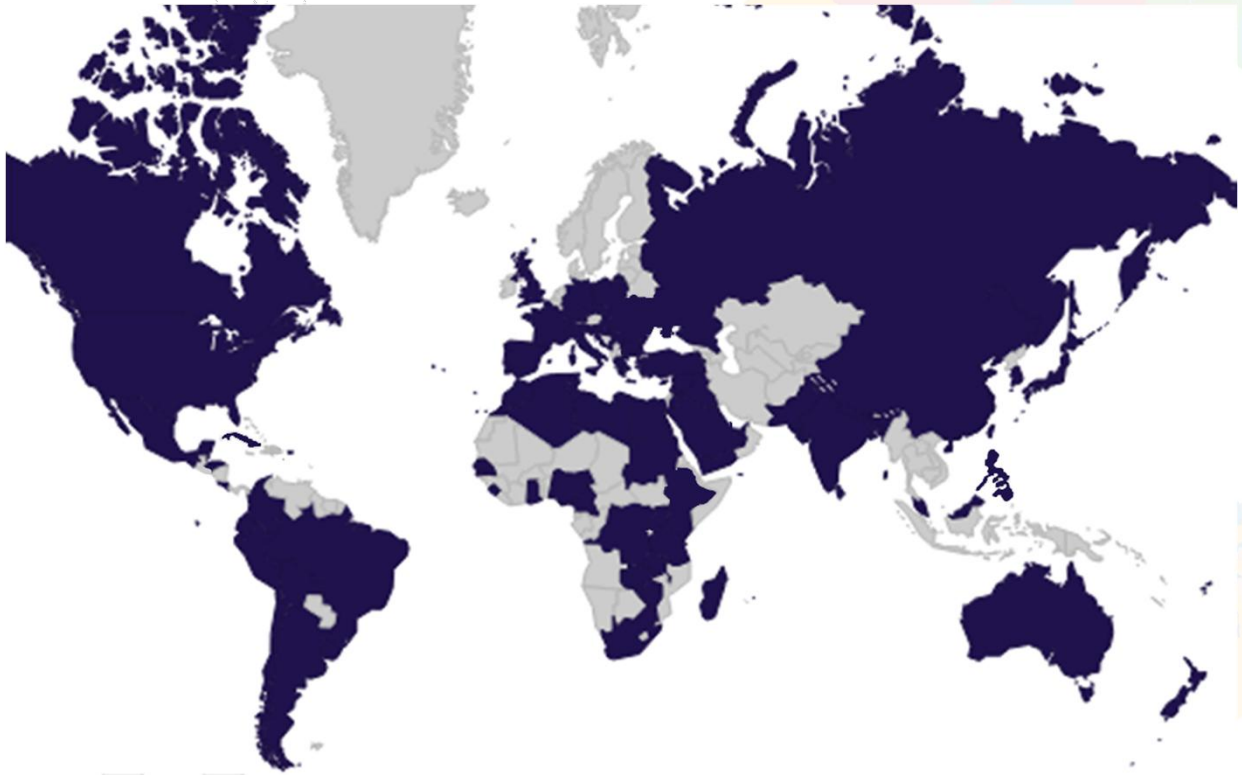

The World Federation of Engineering Organizations:

- 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

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- A key objective of the World Federation of Engineering Organizations, since 2018, is to advance the UN SDGs through engineering.
- Another objective is collaboration: WFEO is working with UNESCO and other international engineering organizations to advance the 2030 Agenda which resulted in the declaration of World Engineering Day for Sustainable Development in November 2019.
- The UNESCO Engineering Report – Engineering for the Sustainable Development Goals, aligns with this vision and shows the important work that needs to be done by engineers and “how engineering can make it happen”.
- In addition the report shows that we need to build capacity for more engineers, especially women, with the right skills to advance sustainable development.

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Engineers are essential for sustainable water supply and sanitation systems for the world

Advanced engineering technologies using laser scanning at for monitoring the Cahorra Bassa Dam, Mozambique, one of the largest in the world. © Antonio Berberan, Eliane Portela and João Boavida

- More than one billion people lack access to clean water and two billion lack access to basic sanitation.
- This is the urgent and unfinished work of engineers.
- Civil and environmental engineers have saved billions of lives through clean water and sewage treatment systems and eradicated waterborne diseases in developed countries, such as cholera and typhoid.
- Electrical and mechanical engineers ensure reliable operations of these systems 24/7.
- Engineers are developing low cost, low energy solutions such as smart sensors to assess groundwater availability, and innovative materials for low-energy water treatment.
- Engineered integrated water management systems, are essential in both developed and developing countries, especially in arid areas.

6 CLEAN WATER AND SANITATION

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Engineers are essential for designing, building and maintaining power infrastructure. © Courtesy China Society for Electrical Engineering, Chapter 1, UNESCO Engineering Report

Engineers have developed conventional energy generation and are now innovating low cost solutions from renewable sources

- **Nearly one billion people, mainly in sub-Saharan Africa and South Asia, still lack access to a reliable source of electricity. More unfinished business for all engineers!**
- **20 per cent of the world now has access to solar power, with a consequent reduction in greenhouse gas emissions, including in remote regions, potentially leaving no one behind.**
- **Electrical, electronics, mechanical and telecommunications engineers are transforming access to energy while reducing environmental impacts.**
- **Clean renewable energy is supporting agriculture, better health through refrigeration for food and medicine, and providing power for households for lighting.**
- **Low-cost, accessible, solar technology in developing countries, especially in remote rural areas, is having a significant impact on the social fabric and economies of these nations.**

7 AFFORDABLE AND CLEAN ENERGY

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Engineering drives economic growth and alleviates poverty

Engineering can address extreme urban poverty.
© Marlene Kanga. Chapter 1, UNESCO Engineering Report

- **There is a positive relationship between economic growth and the number of engineers in a country.**
- **Engineers design, develop and maintain basic infrastructure such as water supply and electricity systems, roads, railways and telecommunications that underpin modern economies.**
- **However, many developing countries lack basic services and traditional approaches are expensive.**
- **Engineers are innovating for low cost technologies that are needed so no one is left behind.**
- **In India, for example, more than 100 million low-income users, mainly in rural areas, have access to mobile phones that cost less than US$ 25, enhancing communication, farming and small businesses.**
- **Similarly in Africa, low cost mobile phones and cash less payment systems like M-Pesa, encourage entrepreneurship and small business that create jobs and incomes.**

1 NO POVERTY

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Engineering has transformed food production through mechanized agriculture, fertilizers and pesticides

Manual farming practices in India are being replaced by engineering innovations. © Marlene Kanga. Chapter 1, UNESCO Engineering Report.

- **Agricultural, mechanical and chemical engineers** have been responsible for **mechanized agriculture and innovation in fertilizer and pesticide** production.
- **Electronics and software engineers** are developing innovations like **automated sensors for soil moisture monitoring** to optimize the delivery of scarce water and fertilizers, robotics for the application of pesticides and fertilizers and for weeding and planting.
- **Engineers** are developing weather monitoring, forecasting and warning on natural disasters, and informing farmers on harvest potential.
- **Software engineering** and Artificial Intelligence will become integral to achieving food security for all.

2 ZERO HUNGER

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Engineers need to ensure that women benefit from new technologies and also participate in the technology revolution so no one is left behind

Women engineers working on high voltage electrical systems. © Chinese Society for Electrical Engineering, Chapter 1, UNESCO Engineering Report.

- **We need more engineers especially women engineers!**
- **Engineers have developed technologies with enormous transformative potential in the digitally connected future workforce - including advanced automation, telecommunications, robotics and artificial intelligence.**
- **Women engineers are needed to contribute as diversity of thought is vital for innovation and the development of solutions that reflect community standards, values and aspirations for sustainable development.**
- **New technologies empowering women - mobile communications and the internet, have facilitated access to banking, encouraged entrepreneurship and improved outcomes for health, education and childcare.**

5 GENDER EQUALITY

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Engineering Innovations Responding to pressing Challenges

Ke Gong
President, WFEO

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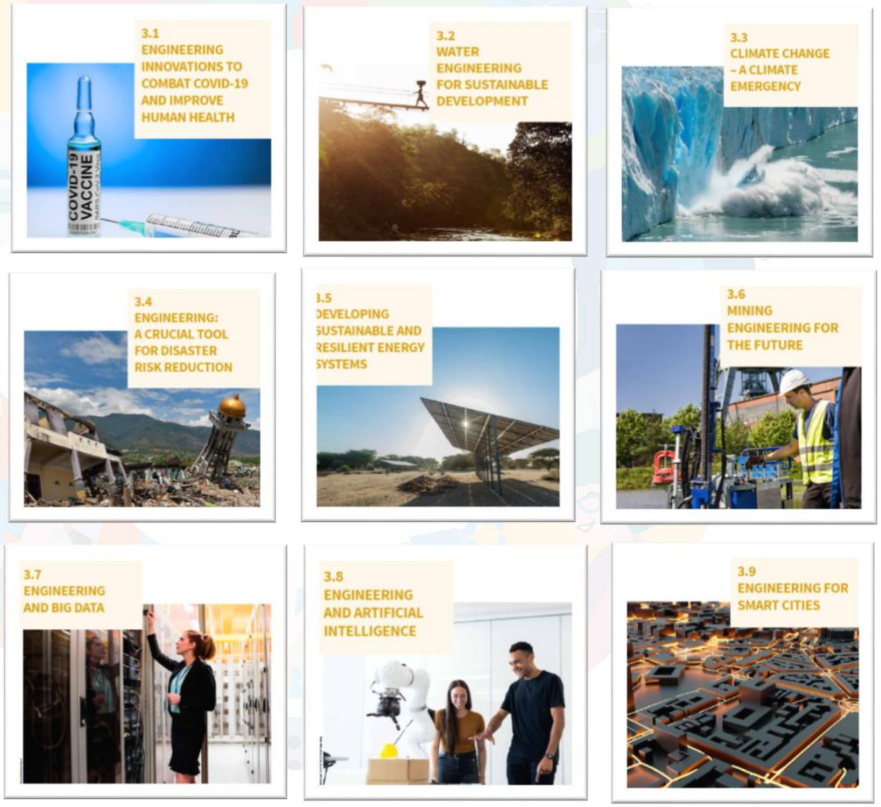
Engineering Innovations and the Sustainable Development Goals



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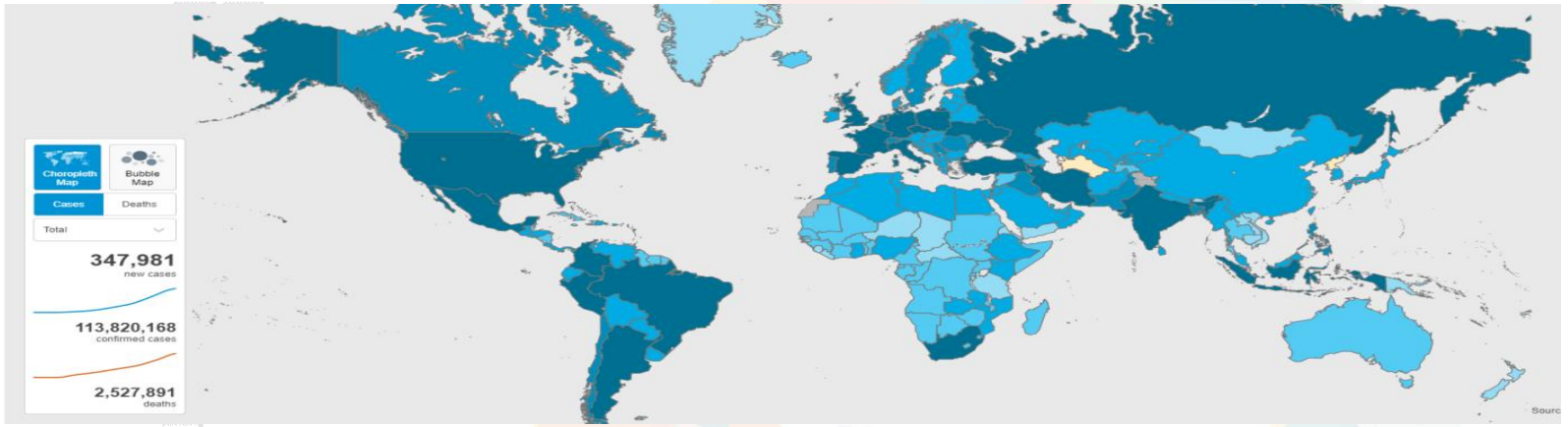
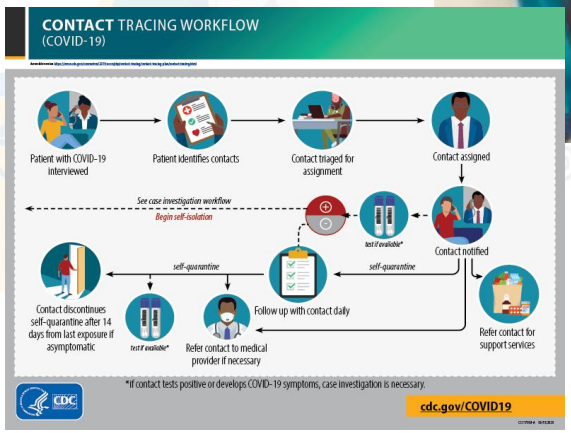
Combating COVID-19 and Improving human health





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Actions to climate emergency

Box 1. Commitment of WFEO and the world engineering community in climate action

1. Continue to raise awareness of the climate emergency and the urgent need for action.
2. Extend the sharing of knowledge and research to promote and incentivize capacity-building in climate change mitigation and adaptation.
3. Strive for an engineering community where a diverse and inclusive membership can work collaboratively towards innovative climate mitigation strategies.
4. Support developing countries on engineering knowledge in climate change mitigation and adaptation best practice.
5. Use WFEO's global influence and connections to gather evidence to illuminate the effect of climate change on women and disadvantaged groups worldwide.
6. Apply and further develop climate mitigation and adaptation principles as key measures of the engineering industry's success.
7. Upgrade existing built infrastructure systems when that is the most efficient solution for whole-life carbon and inclusive social outcomes.
8. Include, life cycle costing, whole-life carbon modelling and post-construction evaluation to optimize and reduce embodied, operational and user carbon
9. Adopt more regenerative design principles in practice with the aim of providing engineering design that produces complete infrastructure systems to match the goal of becoming net zero economies by 2050.
10. Increase current levels of collaboration between UNFCCC, WFEO and its members, associates and partners, and all other professionals involved in the design and provision of complete infrastructure.
11. Work with our members, associates and partners in making this commitment real.

The Code of Practice on Principles of Climate Change Adaptation for Engineers

Model Code of Practice:
Principles of Climate Change Adaptation for Engineers

This Model Code of Practice provides further amplification and explanation to engineers and national engineering organizations to interpret and implement principles of climate change adaptation at a practical level.

It is intended for practicing engineers who are members of one or more of the national organizations who are members of WFEO.

The Code of Practice on Principles of Climate Change Adaptation for Engineers

The WFEO Model Code of Practice on Principles of Climate Change Adapdation for Engineers was adopted at the December 2015 General Assembly. It has been prepared as a complement to the WFEO Model Code of Ethics for Engineers and the Model Code of Practice for Sustainable Development and Environmental Stewardship.

The Model Code of Practice is provided as guidance to engineers to consider the implications of climate change in their professional practice and that they create a clear record of the outcomes of those considerations. It consists of nine principles that constitute the scope of professional practice for engineers to initiate climate change adaptation actions, particularly for civil infrastructure and buildings.

The principles are summarized into three categories:

- Professional Judgment
- Integrating Climate Information
- Practice guidance

Professional Judgment	Integrating Climate Information	Practice Guidance
Model Code Principle # 1:	Model Code	Model Code Principle # 7: Plan

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Building Smart Cities with Big Data and Artificial Intelligence

Area	Technology/ Engineering Applications	Impact
Faster, secure and affordable commute	• Use of digital signage and mobile apps • Intelligent traffic management • Congestion pricing • Real time information • Predictive maintenance of transportation infrastructure • Autonomous vehicles	• Commute time saved by 15-20% • Commuting time for healthcare/ government work reduced by 45–65%
Smarter, affordable and sustainable access to energy	• Reducing consumption/shifting load to off-peak periods • Smart meters to reduce losses, theft, better demand prediction and load forecasting	• Reduce usage of carbon intensive 'peak plants' • Increased use of green energy • Reduced power outage
Improved public safety and information security	• Predictive policing, real-time crime mapping, and gunshot detection • Optimized dispatching and synchronized traffic lights • E-hailing and reduced impaired driving	• Incidents of assault, robbery, burglary lowered by 30–40% • Cut emergency response times by 20–35% • Reduce traffic fatalities by > 1%

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Building Smart Cities with Big Data and Artificial Intelligence

SECURITY

- Predictive policing
- Real-time crime mapping
- Gunshot detection
- Smart surveillance
- Emergency response
- Body-worn cameras
- Disaster early-warning systems
- Personal alert
- Home security
- Data-driven building inspections

ECONOMIC DEVELOPMENT

- Digital business licensing and permitting
- Digital tax filing
- Online retraining programs
- Personalized education
- Local e-career center
- Digital land-use and building permitting
- Open cadastral database

HEALTHCARE

- Telemedicine
- Remote patient monitoring
- Lifestyle wearables
- First aid alert
- Real-time air quality information
- Infectious disease surveillance
- Data-based population health interventions: Maternal and child health; Sanitation and hygiene
- Online care search and scheduling
- Integrated patient flow management systems

MOBILITY

- Real-time public transit information
- Digital payment in public transit
- Predictive maintenance of transport system
- Intelligent traffic signals
- Congestion pricing
- Demand-based micro transit
- Smart parking
- E-hailing
- Car sharing
- Bike sharing
- Integrated multi-modal information
- Real-time road navigation

ENERGY

- Building automation
- Home energy automation
- Home energy consumption tracking
- Smart lights
- Dynamic electricity pricing
- Distribution automation

COMMUNITY

- Local citizen engagement
- Local connection platforms
- Digital administrative citizen services

WATER

- Water consumption/ quality tracking
- Leakage detection
- Smart irrigation

WASTE

- Digital tracking/ payment for waste disposal
- Route optimization

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Strengthening engineering innovations to accelerate the delivery of the SDGs

A great deal needs to be done by engineers to provide solutions to the world's most pressing problems: climate change, water and sanitation for all and reduction in greenhouse gas emissions and sustainable energy sources.

Interdisciplinary, inter-sector and international collaboration are therefore needed to invest and strengthen the capacity of engineering innovations across the world, especially in developing countries.

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Engineering Education and Capacity - Building

José Vieira

President Elect, WFEO

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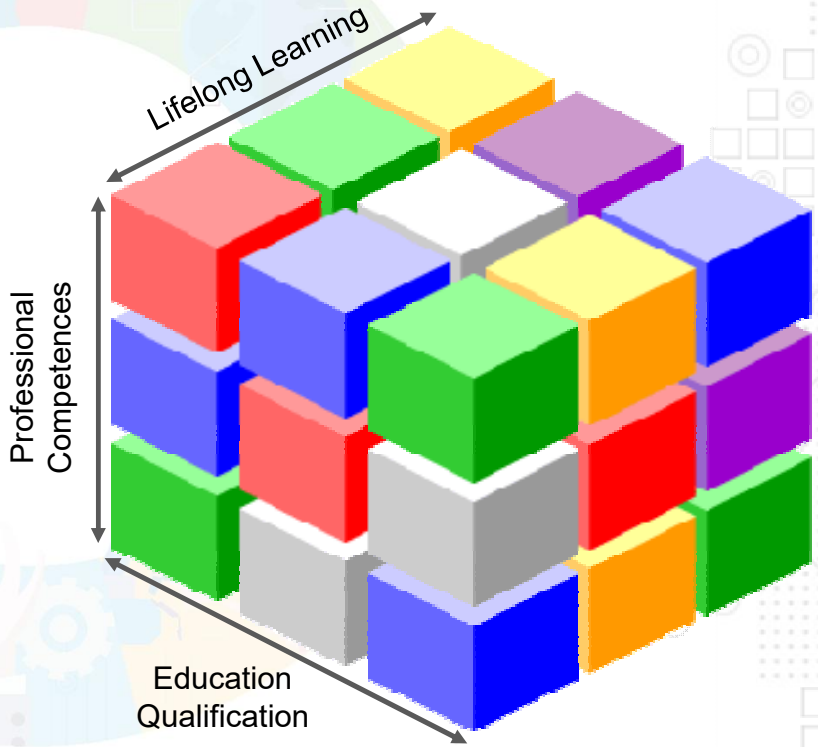
Engineering education and capacity-building: The key to enable engineering for the SDGs



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Engineering education for the future

- Trends and Challenges for Engineering Education
  - Globalisation of labour markets
  - Mobility of students and workers
  - Increased migration
  - Automation
  - Digitalization
  - Polarisation of labour market
  - Skills mismatch

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Engineering education for the future

New approach to learning, switching from a teacher-centric focus to one that is more student-centred and problem-based

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Lifelong learning to meet changing demands of sustainable development

- Trends foreseen for the future of engineering work
  - The lifespan of a working engineer has increased dramatically as human beings live and work longer
  - Engineers are switching jobs in the same organization or moving to another more frequently, thus requiring continuous reskilling and upskilling
  - New knowledge is being created at an increasing rate and technology is evolving rapidly
  - Engineers are working on projects that increasingly span the globe or have worldwide implications, often while working for global organizations in local settings
  - While automation is and will be able to perform many human actions, soft skills such as interpersonal communication and emotional intelligence are unlikely to be replaced by machines. Engineers need to learn these skills to remain relevant and employable

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Continuing professional development

- Capacity building for sustainable development :
  - Engineering education and professional experience combine to a required level of engineering capacity
  - The initial education of engineers typically takes place in formal education in universities and universities of applied sciences
  - Professional competence does not describe the learning process of the individual but it assumes that learning has taken place
  - Learning outcomes and competences integrate lifelong learning and must be assessed and verified

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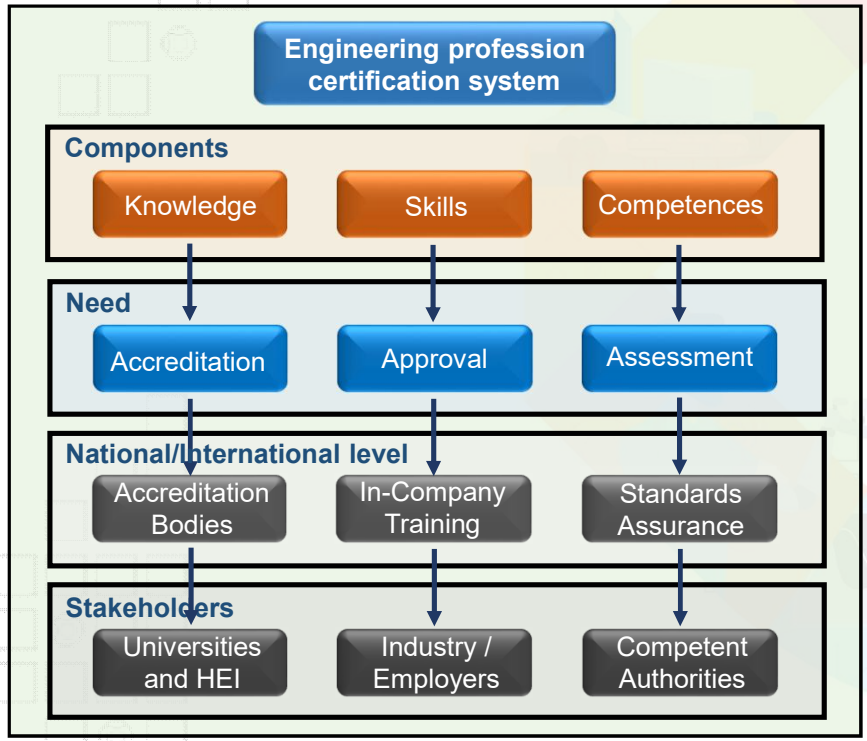
Continuing professional development



- Engineering profession certification systems
  - Establish a generic basis of minimum requirements of knowledge, skills and competences for the engineering profession
  - Contribute for a global mutual recognition of engineering education and engineering professional capacity at a global scale
  - Facilitate mobility for professionals under a shared and accepted system in a ever-increasing economic globalisation scenario
  - EPCS imply partnerships with educators, government, industry and professional engineering institutions

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Engineers for sustainable development

Engineers are essential to achieve the SDGs:

A successful sustainable development agenda requires partnerships between governments, the private sector and civil society. These inclusive partnerships built upon principles and values, a shared vision, and shared goals that place people and the planet at the centre, are needed at the global, regional, national and local level.

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