



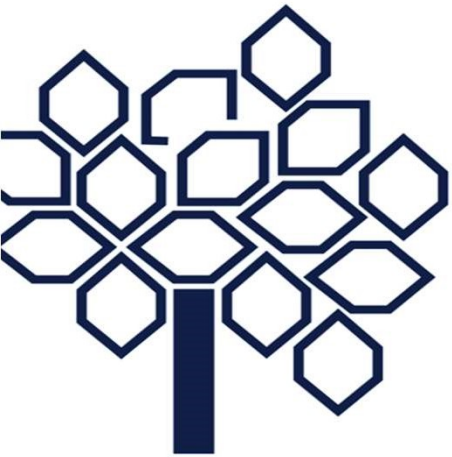
LISBON CES

CIVIL ENGINEERING SUMMIT

2019

24 - 28 SEPTEMBER 2019, LISBOA, PORTUGAL

The Future of Engineers and Engineering
Dr Marlene Kanga AM

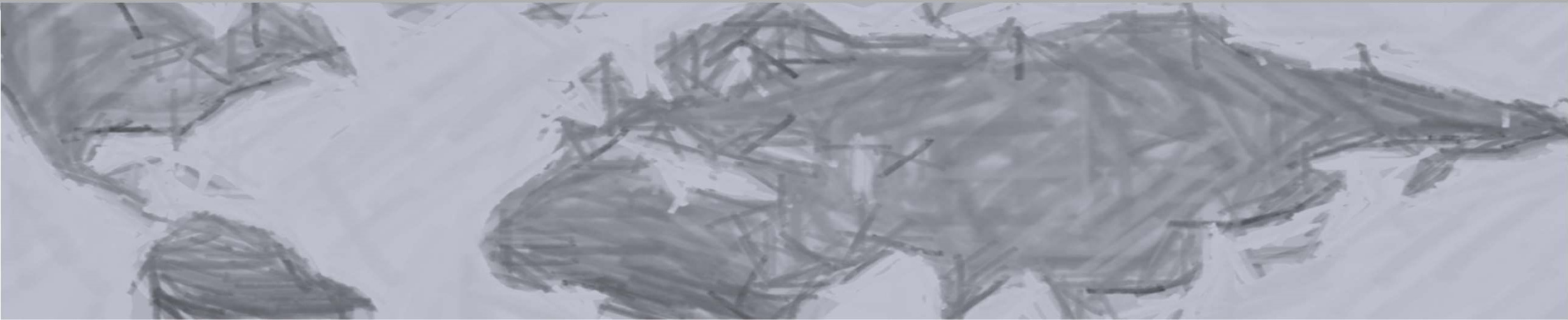


The Future of Engineers and Engineering

***Dr. Marlene Kanga AM
President,***

***World Federation of Engineering Organisations
27 September 2019***





- **The peak international organization for the engineering profession**
- **Founded in 1968**
- **Under the auspices of UNESCO**
- **100+ members - national, international and regional engineering institutions**
- **Representing 30 million engineers**

Engineering for Sustainable Development

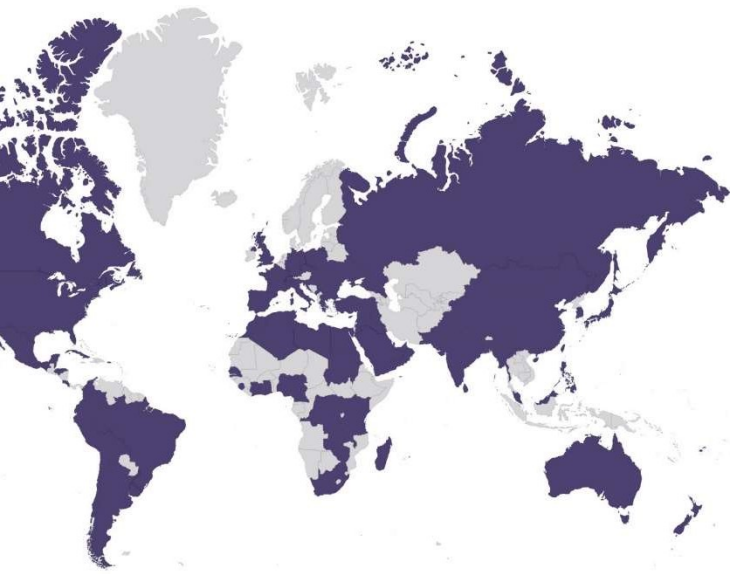


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ORDEM
DOS
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**Engineering
for
Sustainable
Development**

Algeria
Argentina
Australia
Bahrain
Bangladesh
Belize
Bolivia
Brazil
Bulgaria
Cameroon
Canada
Chile
China
Chinese Taipei
Colombia
Costa Rica
Croatia
Cuba
Cyprus
Czech Republic

Ecuador
Egypt
Ethiopia
Fiji
France
Germany
Ghana
Greece
Honduras
Hong Kong, China
Hungary
India
Iraq
Italy
Ivory Coast
Japan
Jordan
Kenya
Korea
Kuwait

Lebanon
Libya
Macedonia (FYROM)
Madagascar
Malawi
Malaysia
Malta
Mauritius
Mexico
Moldavia
Mongolia
Montenegro
Morocco
Nepal
New Zealand
Nigeria
Pakistan
Palestine
Peru
Poland

Portugal
Puerto Rico
Qatar
Romania
Russia
Rwanda
Saudi Arabia
Senegal
Serbia
Sierra Leone
Singapore
Slovakia
Slovenia
South Africa
Spain
Sri Lanka
Sudan
Switzerland
Syria
Tanzania

The Philip
Tunisia
Turkey
Uganda
Ukraine
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Yemen
Zambia
Zimbabwe



 **SUSTAINABLE DEVELOPMENT GOALS**
17 GOALS TO TRANSFORM OUR WORLD

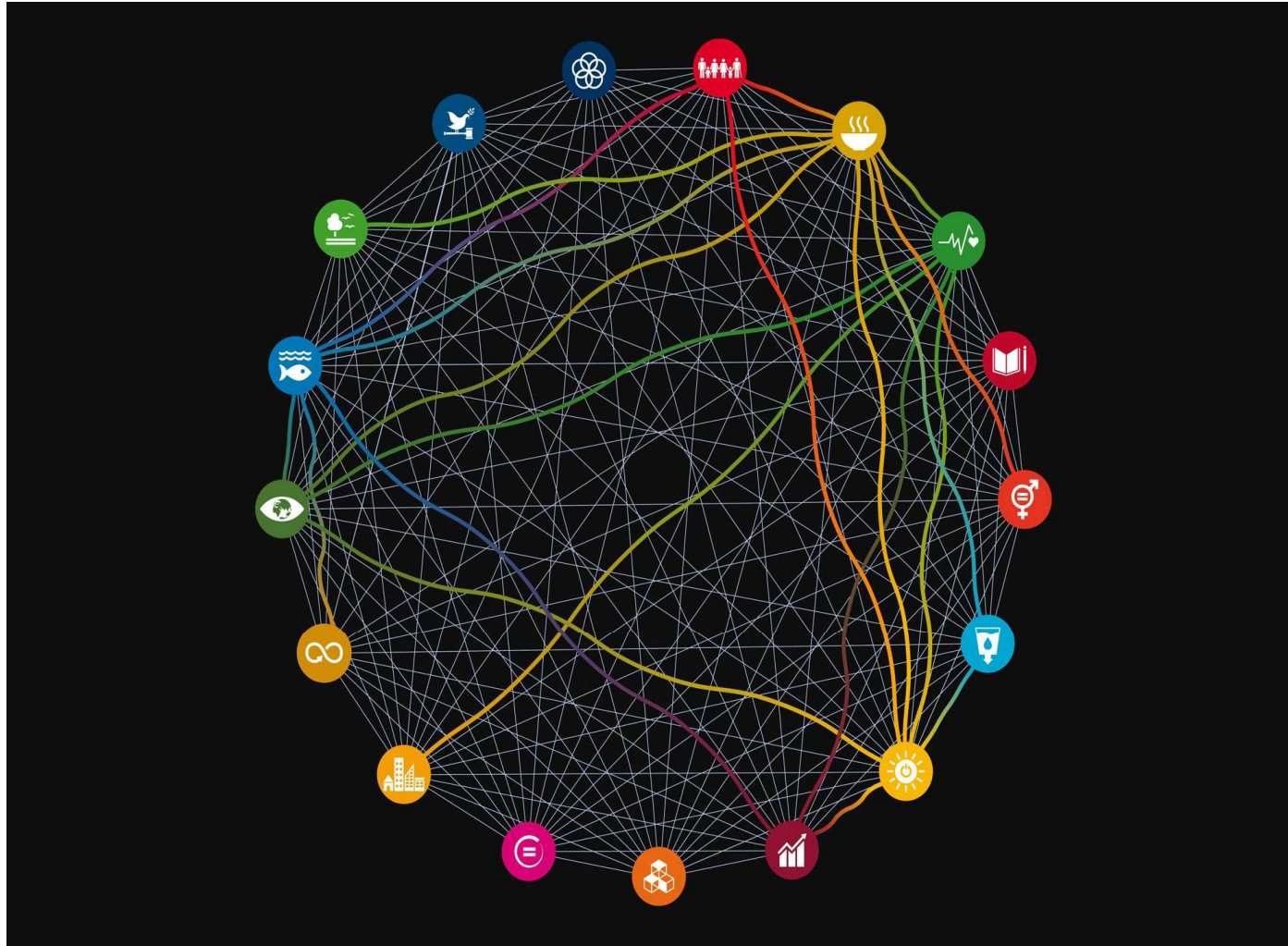




WFEO has an imperative – a pressing need to step up and lead engineers to develop solutions for sustainable development.



Engineering is essential to achieve the UN SDGs



Source: Image from International Science Council

Engineering for Sustainable Development



Message from UN Secretary General H.E. Antonio Guterres to the Global Engineering Congress, 22-26 October 2018

The United Nations will continue to count on your engagement and support as we strive to achieve the 17 Sustainable Development Goals – the world's blueprint for building a future of peace and prosperity for all on a healthy planet. **Every one of the Goals requires solutions rooted in science, technology and engineering.** ”



Engineering for Sustainable Development



Engineering : Top issues that are transforming our work

Global Shortage of engineers with the skills to deal with current and future challenges – the war for talent

Climate Change – green technologies

Industry 4.0 – Robotics, IoT, Sensors, Block Chain, Augmented Reality

Data – Machine learning Artificial Intelligence

Quantum Computing

3D Printing

Cyber Risks

The challenge to the mandate for engineering by a more demanding society

***Engineering* for Sustainable Development**



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ORDEM DOS ENGENHEIROS

Civil Engineering : The Future

“..with the global construction market forecast to grow more than 70 per cent by 2025, the sector must focus its efforts on:

- longer-term talent acquisition,
- remedying its poor public image
- ..housing crisis,
- the future of digital construction,
- building technologies,
- sustainable design..”

Source: Sunday Times UK

Engineering for Sustainable Development

Independent publication by

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FUTURE of CONSTRUCTION

- 03 Satisfying UK housing supply and demand
- 05 Sustainable buildings are green and beautiful
- 07 Ten innovations to watch in construction
- 08 Capital city that is looking up to the sky

Constructing an industry for 21st-century UK

The construction industry is replenishing the UK's housing stock, building new infrastructure and helping restore the economy, but challenges remain if it is to attract and retain a forward-looking workforce

OVERVIEW
JIM MCCLELLAND

Many folks, but people count. Construction contributes 4.96 per cent to the UK's economic output. However, to appreciate the true scale of the industry, it pays to think instead in terms of people and jobs, all 21 million of them.

Being construction to work, every day would require 262,000 double-decker buses, full to standing. That would be enough to join a two-lane highway, lane to lane, for almost 600 miles.

The same data, however, also explains why construction is unloved about investment and investment of talent going forward, making the skills gap a hot topic.

Taking growth in markets to sustainability, as an example, construction, for all its environmental and social issues and impacts, is fast set to become a preferred option, says Steve Lewis, head of environment and sustainability at Taylor Houslow. "The simple fact is that sustainability professionals are not considering construction as a viable career choice. The industry still has an image issue and the innovative work we do doesn't seem to make the headlines. Most sustainability professionals get into construction by accident," he says.

Being on happy accidents is precisely not a healthy business plan. There are, though, signs of progress, according to Mr Lewis. "My hope and vision is that the work done on the diversity agenda, which has involved top-down, inclusion and respect," helps to change the culture of construction. He says, "I've seen a long way in the last 20 years, however, we have a long way to go in the next 20 to make it somewhere to attract young, young talents from all walks of life and retain them."

Discarding one thing to only build the story, however, though, is not all about pay and promotion. It is a modern industrialised working environment, social and cultural integration, such as mental health, plus flexibility around personal and family commitments, are key markers of long-term employment. It is, how, in construction progressing to a stable and approach to looking after the health and wellbeing of existing staff?

In January, the Collaborative Construction Scheme introduced invited banks agreement into to check, with positive feedback

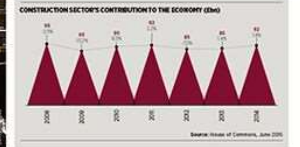


such a workforce, with global capacity and capability, is good for business, says John Akbar, director of policy and communications at the UK Green Building Council. "Cross-border collaboration and sharing of best practice are key. The UK is a global leader in sustainable design and construction, and exporting its knowledge and expertise not only helps other countries with low-carbon development, but is the case of commercial buildings, could contribute an estimated £2.7 billion to UK GDP," he says.

Financial trends is not the only potential hurdle to be considered. "The industry is still suffering on the LEED Platinum - UK green building certification design for business Middle East HQ is also crucial. Also, though, a partner or cheaper solution, the surplus the will with sustainable products."

Multiple environment metrics are also influencing a bigger picture, people-centred. The Living Building Challenge (LBC), as well as setting stringent standards for water and energy use, also tackles issues including equality, health and happiness, beauty and education, which is a novel clearly adds to today's markets, according to UK LBC ambassador Mattia Lorenz. "The building challenge is being measured on social outcomes, in addition to financial performance. For many clients, especially, utility costs are a major competition to start with, as creating buildings that provide healthy and happy places, few of which matters, but makes good sense," he says.

Transition provides not just to be another kind of a whole new world of construction. The future is being and starting.



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Civil and Construction Engineering : Disruptive technologies

Artificial Intelligence: using building codes for automated design

Building Information Management (BIM): Design, project management, construction and maintenance

3D Printing: Building models and services

Cloud collaboration/Automation for teams: shared information on project plans, drawing, specifications, procurement

Data: predictive analytics: construction, condition monitoring, maintenance

Energy: Kinetic Roadways – harnessing the energy of vibration

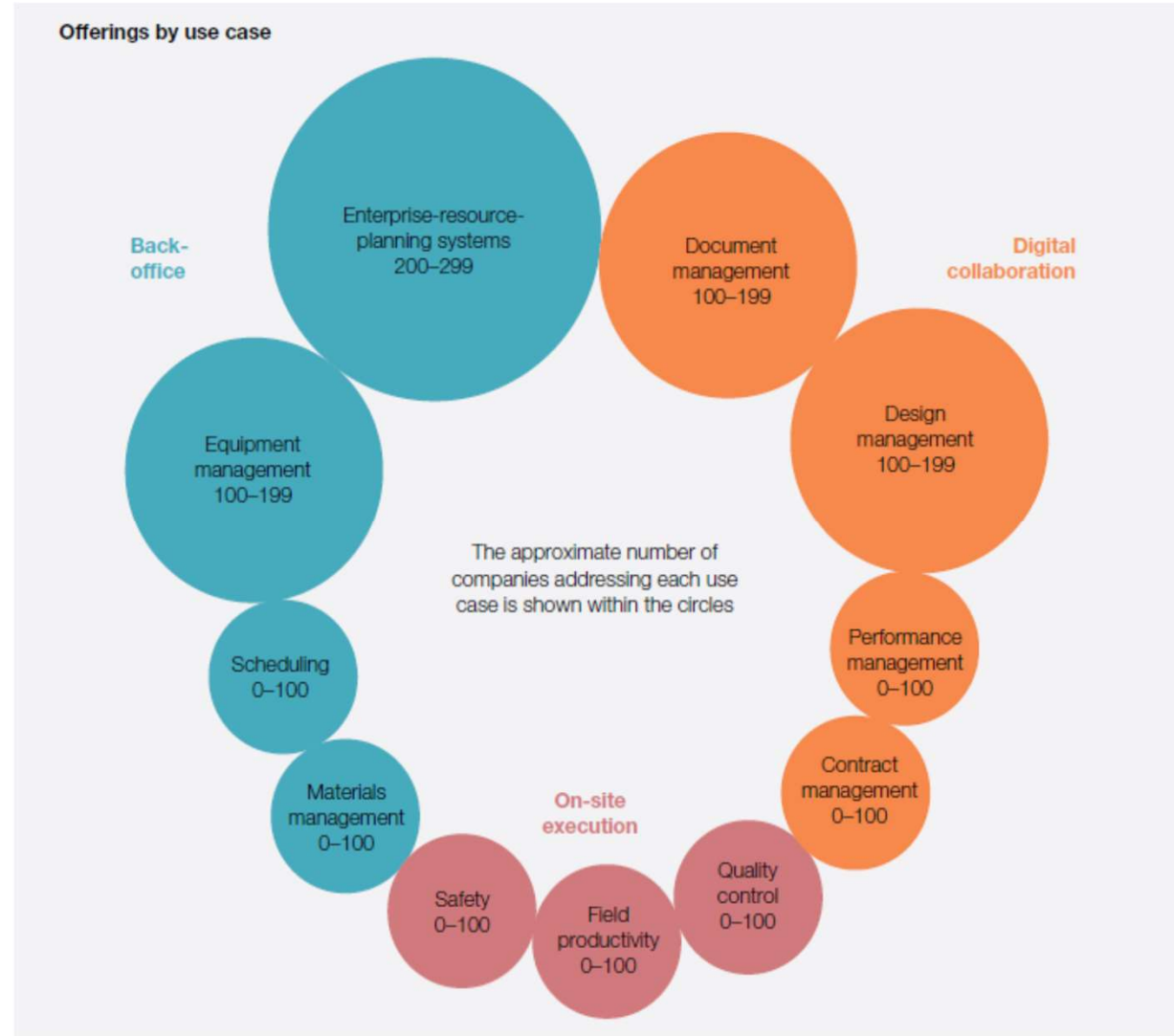
PV Glazing/Tiles: using passive structures for energy generation



Engineering for Sustainable Development



Civil and Construction Engineering : Disruptive technologies



McKinsey: The new age of engineering and construction technology, July 2017

Engineering for Sustainable Development

Engineering : Keeping the promise

Lock the Gate Community action has suspended coal seam gas exploration and fracking in New South Wales and Queensland

Community complaints on wind farm noise have resulted in new noise requirements in Victoria, audited independently

National Office of Wind Farm Noise Commissioner established

Engineering for Sustainable Development



www.lockthegate.org.au



Global Climate Strike 20 September 2019

Millions of people from Sydney to Manila, Dhaka to London and New York marched for urgent action on climate breakdown

Across the globe, millions join biggest climate protest ever

Young and old alike took to the streets in an estimated 185 countries to demand action

Source: www.theguardian.com

Engineering for Sustainable Development





Engineering : The Change we need

Engineering for Sustainable Development



Engineering Education – a key enabler to advance the SDGs



- Engineering education needs to transform to ensure engineers have the skills to implement sustainable development by applying their specialised knowledge, exercise judgement, and act ethically.
- Teaching and learning modes are appropriate to a rapidly changing technological world
- Engineering graduates meet the current needs of industry
- Professional development sustains career-long training and competency



Engineering for Sustainable Development



The Diversity Imperative – an Inclusive Profession is needed now for innovative and sustainable solutions

Women engineers are contributing to engineering around the world in increasing numbers to deliver inclusive and sustainable solutions for the pressing problems facing the world.

We need the world's best intellects for engineering and women are essential for a sustainable world reflect community standards, values and aspirations

Some successful actions:

- The Athena SWAN project (UK, Australia), leveraging government funding for universities to achieve gender diversity.
- The UNESCO STEM and Gender Advancement Project (SAGA) funded by the Swedish Development Agency (SIDA) – policy tool kit for nations to address gender equality in STEM

Engineering for Sustainable Development



Integrity and ethics in Engineering is more important than ever

Engineers are developing tools like Hyper Anna to analyse data.

The problem is not the data but the analysis

- Who owns the data?
- What biases are built into the analysis?
- How will this impact on the owners of the original data and others who are affected by the insights and decisions that follow?
- What is the role of engineers?

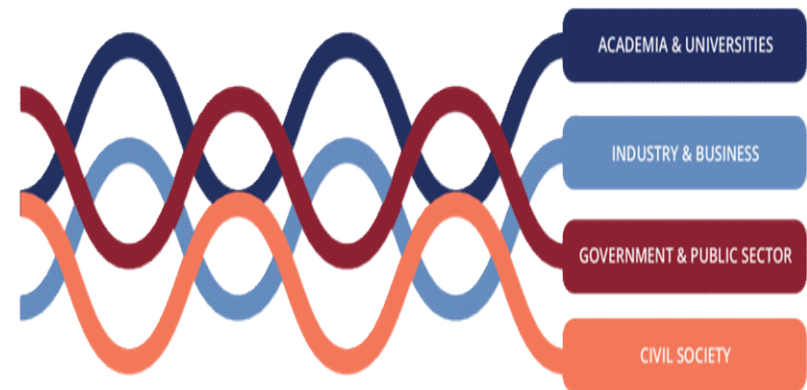


Partnership in Engineering is essential to achieve the UN SDG

World Federation of Engineering Organizations –
collaboration with leading engineering organizations
for global standards on engineering education and
professional competencies

10 Resilient Cities network: a collaborative network
that shares best practices to achieve SDG 11 for
Sustainable Cities

WASH Agenda for Change: NGOs for cost-effective,
sustainable delivery of water, sanitation and hygiene
(WASH) services in Africa and Asia



Partnerships for change

Engineering for Sustainable Development





Engineering : The Work we need to do

Engineering for Sustainable Development



Feeding the world through Engineering innovation

beyond conventional fertilisers –

Engineering technology innovators that are supporting farmers for sustainable development:

mobile communications,

the use of sensors to monitor soil conditions to optimise the delivery of scarce water for irrigation and fertilisers

robots for planting and weeding

***Famine Early Warning Systems Network*, a network of satellite and Earth-based monitoring and remote-sensing technologies**



FarmerLink, is an innovative mobile-based farmer advisory service

Engineering for Sustainable Development




Engineering advances in bio-medical technologies is improving health outcomes



Engineering has improved global health by eradicating many diseases like typhoid and cholera with improved water and sanitation.

Biomedical engineering advances continue to improve the quality of life with:

- medical prostheses for the disabled,
- improved hearing and sight
- Improved heart health and brain functioning.
- Robotics for surgery
- Diagnostics technologies

 Aravind Eye Care



	Aravind Eye Care	UK/US Average
Cataract Surgery	\$30	\$1,000
Lens	\$12	\$100
Complication Rate	1.5%	3%
Surgery time	6 minutes	21 minutes



Integrated water management is essential in a world challenged by climate change and increasing population

One –sixth of the world's population lacks access to clean water

One third of the world's population lacks access to basic sanitation.

Climate change will make accessibility to water more important in developed and developing countries.

Technologies for low cost sustainable use of water, capture and storage of rainwater, management of catchments, bio waste management etc. are needed



Banka BioLoo sustainable small-scale approach to eliminating open defecation and managing solid bio-waste



Engineers are at the heart of sustainable renewable energy solutions

- The availability of affordable energy is a key sustainable development goal as one-sixth of the world's population does not have access to a reliable source of energy
- Engineers have developed wind, solar, wave and geothermal energy solutions



Technology and Engineering enhances decent work and economic growth

Approximately half the world's population lives on less than US\$ 2 per day and access to reliable work remains uncertain.

Engineering is now recognized as an essential enabler of economic growth.

There is a positive relationship between economic growth and the number of engineers in a country on a global basis



Solar energy increases productivity for farmers in remote Mongolia



Engineering is an essential part of industry Innovation and infrastructure development

Engineers are at the heart of innovation, bringing new ideas to fruition from the laboratory to our factories and homes.

Innovation in engineering and technology is boosting economic growth around the world.

The youthful populations of China and India are technology savvy and are producing innovations at a rapid rate.

Information and communications, artificial intelligence, robotics, cloud computing, and new technologies involving satellite communications are transforming our world.

Engineering for Sustainable Development



Engineering sustainable cities – essential in an increasingly urbanised world

Engineering is at the core of solutions for smart cities

More than two-thirds of the world will live in cities by 2050

Housing, roads, transport, water and energy will be key to sustainability and liveability of cities.

India has announced that it will build 100 smart cities by 2022, providing homes, clean water and sanitation facilities, transport and other infrastructure. All this will require engineering.



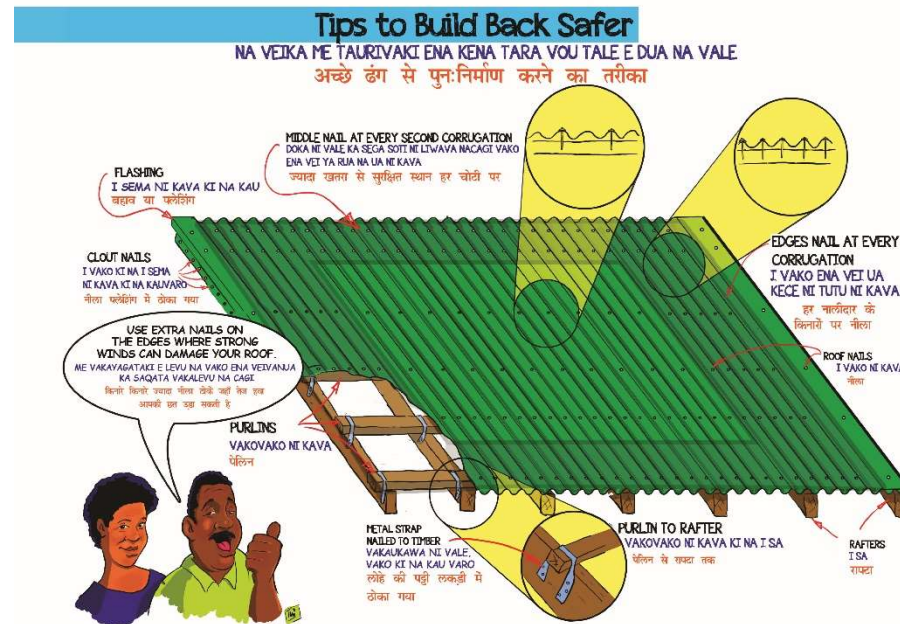
LED Lighting in Bhubaneswar Smart City India



Engineering is needed to mitigate the impacts of climate change and for resilient infrastructure

Engineers are at the forefront of tackling climate change through the development of a wide range of technologies that mitigate the impacts of climate change and ensure resilient infrastructure.

The World Federation of Engineering Organizations Committee for the Environment has developed a *Model Code of Practice on the Principles of Climate Change Adaptation for Engineers*.



Capacity Building after cyclone disaster in Fiji





Engineering : Maintaining The Social License

Engineering for Sustainable Development



Inclusive Engineering for everyone

The goal for the future is to ensure equitable and inclusive innovation in engineering that leaves no one behind.

Rugal innovation enables the development of affordable and reliable technologies that are accessible to low-income users

- Low cost mobile phones
- Motor vehicles



Engineering for everyone – so no one is left behind

Ensuring that the latest innovations are accessible especially in countries with low incomes is essential to reduce inequalities around the world.

Inclusive engineering innovation includes examples like the development low cost tablet device which enables access for students to the internet and to educational opportunities.



Low cost Aakash Table (India)

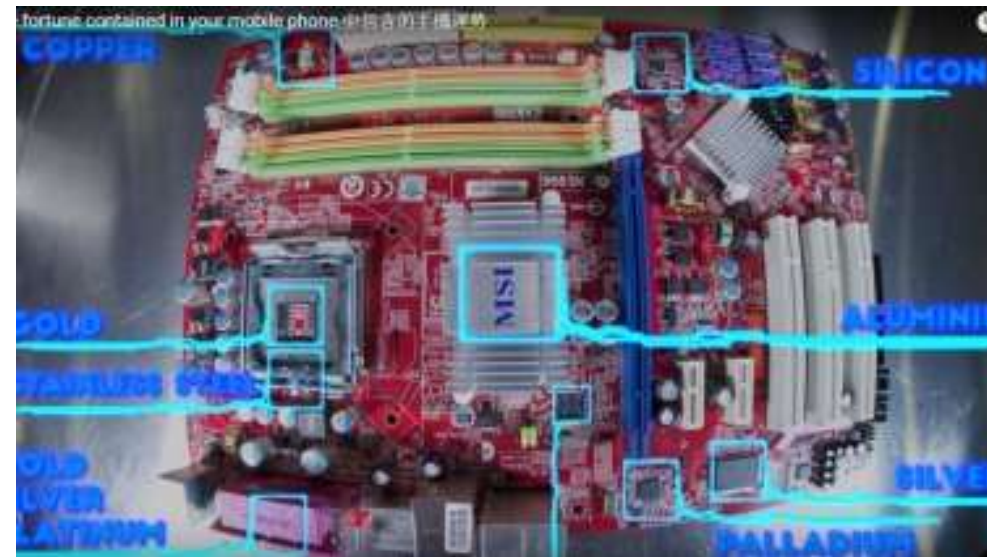


Engineering the responsible consumption of resources

Engineers play critical roles in managing resources efficiently from mining, processing essential minerals, generating energy from renewable sources, ensuring the effective use of water resources, agricultural production and the management of biodiversity.

Engineers are developing solutions for resource management and responsible consumption through the concept of the circular economy where outputs and products can become inputs into other processes and products thereby conserving the earth's resources.

12 RESPONSIBLE CONSUMPTION AND PRODUCTION



Recoverable mineral resources in the mobile phone



Engineering is essential for the responsible management of our ocean resources

Oceans are a vital resource for the planet. They make possible the supply of water and marine-based foods and modes of transport, while also regulating the climate. Preserving and protecting the oceans and seas and the life within them is a vital role for engineers.

Marine engineers are working with scientists and other engineering disciplines to implement solutions to address the degradation of fisheries, the pollution of oceans and the use of resources, including wave energy.



The Australian Institute of Marine Science is innovating engineering solutions to mitigate climate change impacts at the Great Barrier Reef

Engineering for Sustainable Development

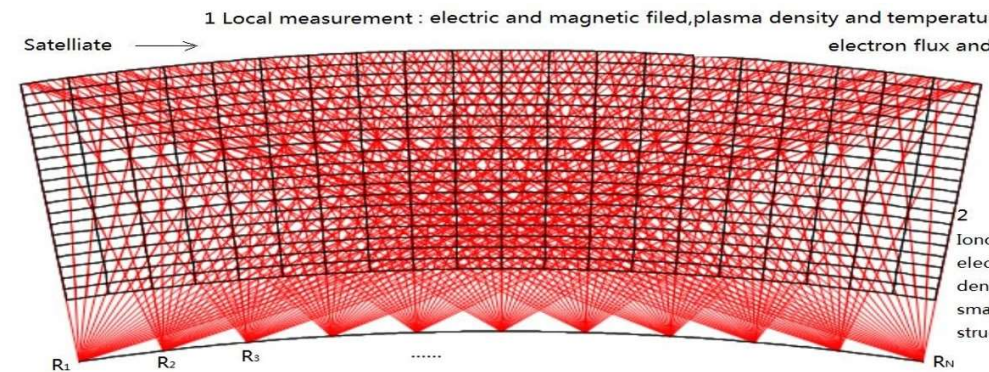


Engineering the appropriate resources of our forests, flora and fauna is an essential task

Forests cover 30% of the Earth's surface, and are vital to combat climate change and protect biodiversity, both flora and fauna, and preventing desertification, ensuring food supplies.

Engineers are using innovative technologies to monitor the earth for agriculture, and for predicting natural disasters such as earthquakes.

Mapping technologies are being used globally. An example is the WFEO Committee for Engineering and Innovative Technologies International Meridian Circle Project



WFEO CEIT International Meridian Circle Project



Communicating the impact of Engineering

- **World Engineering Day for Sustainable Development**
- **4th March 2020 and every year thereafter**
- **Declared by UNESCO as an international day**
- **An opportunity to engage with people, government, policy makers, students on the importance of engineering in our societies**
- **Every engineering institution, every university campus every engineering company should have an event to mark the Day!**
- **Its our celebration of engineering!!**



**WORLD
ENGINEERING
DAY** FOR SUSTAINABLE
DEVELOPMENT

Engineering for Sustainable Development





WFEO / FMOI

Engineering for Sustainable Development



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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