



Sustainable Development:
How can engineering make
it happen?

PROSES INDUSTRI KIMIA 1



Sustainable development



1987 Brundland statement

“development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs”



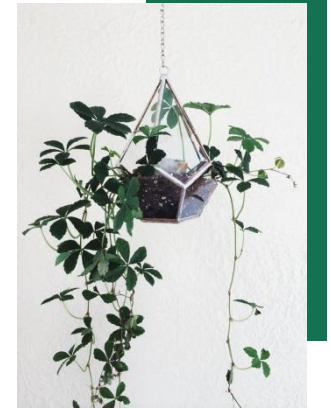
1992 Earth summit

- ❖ The concept of sustainable development was formally introduced
- ❖ World leaders adopted Agenda 21, a comprehensive plan of action to build a global partnership for sustainable development.

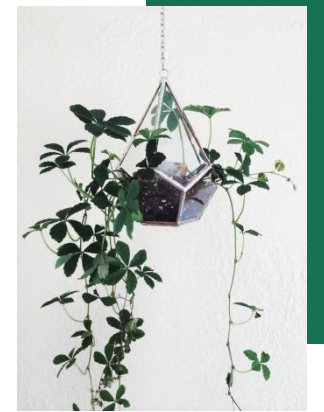
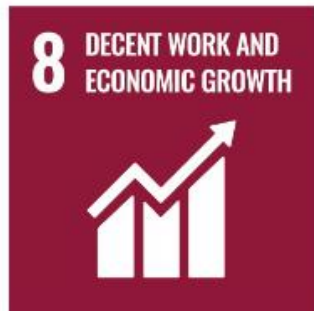


2015 United Nations General Assembly

- ❖ United Nations General Assembly adopted the Sustainable Development Goals (SDGs)
- ❖ SDGs is a set of 17 goals and 169 targets aimed at promoting economic, social, and environmental sustainability around the world



SUSTAINABLE DEVELOPMENT GOALS



Sustainable development: How engineering can make it happen?



Engineering is about the knowledge and practice of solving problems.



Engineers as a profession play a vital role in addressing basic human needs, alleviating poverty, promoting secure and sustainable development, responding to emergency situations, reconstructing infrastructure, bridging the knowledge divide and promoting intercultural cooperation.



Engineers connect social needs with appropriate technological innovation and commercial applications.



Engineering is a major driver for sustainable socio-economic development and contributed to our ability to survive disasters and public health challenges, to secure food and water, to communicate and transport, and to innovate and create new products and services.



**WHEREVER THERE IS A PROBLEM,
THERE IS A NEED FOR ENGINEERING SOLUTIONS**

ENGINEERING AND SDGs

SDG 1

GOAL 1
NO
POVERTY



| | | | | |
|-------------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Policy Direction 2020-2024 | Strategies | High quality social protection and basic services <ul style="list-style-type: none"> Stabilization of comprehensive and adequate social security for the poor and vulnerable. Integration of well-targeted subsidy and social assistance that increases the financial inclusion. Improvement of basic services quality through a reliable and responsive minimum standard services management. | Strengthening the synergy of governance and institutions <ul style="list-style-type: none"> Strengthening Regional Coordination Team to accelerate poverty alleviation and SDGs achievement. Stabilization of Integrated Database management that is connected to population and JKN (National Health Insurance) database. Development of data system and one-door service for regional and national programs' synergy in poverty eradication. Increasing regional government capacity in analysis, planning, and budgeting to accelerate poverty alleviation. | Sustainable economic empowerment for society <ul style="list-style-type: none"> Promoting collaboration in family economic improvement through training, assisting, counselling, and mentoring. Enhancing productive assets for the poor and vulnerable through provision of access to land ownership and management (social debt and Agraria Reform) Appropriate technology utilization and innovation to increase value added of community's productive business. Development of social entrepreneurs to eradicate social economic issues. |
| | | High quality social protection and basic services <ul style="list-style-type: none"> Stabilization of social assistance that is integrated with financial inclusion, especially for the poor and vulnerable. Development of technology-based innovation in basic services in all Indonesia. Synergy and cooperation among stakeholders (government, private sector, NGOs) in improving quality of basic services. | Strengthening the synergy of governance and institutions <ul style="list-style-type: none"> Promoting regional government innovation in accelerating poverty alleviation. Development of replication strategy in difficult regions to promote poverty alleviation. | Sustainable economic empowerment for society <ul style="list-style-type: none"> Enhancing capacity for the vulnerable and middle-class through trainings, business assistance, and mentoring. Ensuring capital and market for local economic entrepreneurs. Technology utilization and innovation to enhance productive business. Creating harmonic business climate supported by the equal and fair policy. |

- ❖ Engineering drives economic growth and alleviates poverty through basic infrastructure such as roads, railways and telecommunications.
- ❖ Engineering work to develop technologies that improve access to basic services such as clean water and sanitation, reliable energy and clean cooking fuels.
- ❖ Large populations in low-income countries are demanding access to the latest technologies for communication, education and health.



ENGINEERING AND SDGs

SDG 2

GOAL 2
ZERO
HUNGER



- ❖ Agricultural, mechanical and chemical engineers have engineered mechanization for agriculture and food production, and increased productivity through the use of fertilizers and pesticides.
- ❖ Ongoing innovations by electronics and agricultural engineers include sensors for soil moisture and condition monitoring that optimize delivery of scarce water and fertilizers.
- ❖ Other innovations include robotics for the application of pesticides and fertilizers, weeding and planting, and communications technology for weather monitoring, forecasting and natural disaster warning, all of which are crucial to achieving global food security.



ENGINEERING AND SDGs

SDG 3

GOAL 3
GOOD HEALTH
AND WELL-BEING



- ❖ Engineering has been crucial with advanced technologies deployed, for example, in the search for a vaccine, through advanced manufacturing processes, logistics and transportation systems, and in 3D-printing for personal protective equipment.
- ❖ Engineering has eradicated diseases such as typhoid and cholera through clean water and sanitation.
- ❖ Biomedical engineering has developed medical devices for limbs, and improvements have been made in hearing, heart health and brain functioning.
- ❖ Robotics, computer vision and Artificial Intelligence (AI) are revolutionizing diagnosis, detection and surgical procedures, and improving accessibility for low-income countries



ENGINEERING AND SDGs

SDG 4

GOAL 4
QUALITY
EDUCATION



- ❖ Engineers facilitate the delivery of education at primary, secondary and tertiary levels by employing new technologies, such as online learning tools and rapid communication systems.
- ❖ These improve accessibility and reduce costs for students.
- ❖ Wi-Fi is implemented in more than 40 billion devices worldwide, underpinning advances in education and enabling other applications.
- ❖ Software and telecommunication engineers are fast expanding access to the internet through low-cost satellites and other aerial devices to deliver information and services to remote and low-income communities.



ENGINEERING AND SDGs

SDG 5

GOAL 5
GENDER
EQUALITY



- ❖ Ensuring women's access to technology and engineering will close many gender gaps, ensuring that women benefit from and participate in the technology revolution, which is critical to achieving the SDGs.
- ❖ Diversity of thought is vital for innovation and the development of solutions that reflect community standards, values and aspirations.
- ❖ New technologies developed by engineers are increasingly empowering female users in work and entrepreneurship, including mobile communications and the internet, which facilitate women's access to banking and financial and information services.



ENGINEERING AND SDGs

SDG 6

GOAL 6
CLEAN WATER
AND SANITATION



- ❖ Civil and environmental engineers have saved millions of lives through clean water and sewage treatment systems, eradicating waterborne diseases like cholera and typhoid.
- ❖ Chemical engineers develop new methods for clean water production and also waste treatment
- ❖ Every day, electrical and mechanical engineers ensure reliable system operations.
- ❖ Innovations in water treatment and recycling ensure clean water for all, even in arid zones.



ENGINEERING AND SDGs

SDG 7

GOAL 7
AFFORDABLE AND
CLEAN ENERGY



- ❖ Engineering has been essential for the generation and supply of electricity, which is vital for economic growth and better living standards.
- ❖ Electrical, mechanical, chemical and environmental engineers have been central to the development of low-cost, zero carbon, renewable energy solutions, including wind, solar, wave and geothermal energy, making energy accessible in remote regions, while mitigating the impacts of climate change..



ENGINEERING AND SDGs

SDG 8

GOAL 8
DECENT WORK AND
ECONOMIC GROWTH



- ❖ Engineering is now recognized as an essential enabler of economic growth, evidenced by the positive relationship between economic growth and the number of engineers in a country.
- ❖ Roads, railways, airports, telecommunications, and the supply of water and electricity are essential infrastructure underpinning all economies.
- ❖ This infrastructure is designed, developed and maintained by civil, mechanical, electrical and environmental engineers.
- ❖ Engineers are also responsible for such basic amenities as clean water, energy and housing, enabling citizens to maintain healthy and therefore productive lives, and to engage in decent work



Growth rate of real GDP per capita

| Year | Baseline | Intervention |
|------|----------|--------------|
| 2015 | 3.5% | 3.5% |
| 2019 | 3.9% | 4.1% |
| 2024 | 4.2% | 5.1% |
| 2030 | 4.4% | 5.4% |



ENGINEERING AND SDGs

SDG 9

GOAL 9
INDUSTRY, INNOVATION
AND INFRASTRUCTURE



- ❖ A modern economy cannot exist without engineering.
- ❖ Engineers design, build and maintain infrastructure.
- ❖ Roads, ports, railways, communications, water supply and energy systems are the work of civil, mechanical and electrical engineers.
- ❖ Industry needs engineers in sectors such as mining, petroleum, chemicals and food processing, and all manufacturing is underpinned by mechanical, electrical, chemical and environmental engineers.
- ❖ Engineering innovations in AI, robotics, cloud computing and big data will drive future economic growth and employment



ENGINEERING AND SDGs

SDG 10

GOAL 10
REDUCED
INEQUALITIES



- ❖ Through sustainable infrastructure and new technologies and innovations, engineers and engineering create jobs and opportunities, enabling access to housing, food, health and a decent living, all of which are crucial to reducing inequalities.
- ❖ Ensuring access to low-cost communications and mobile phones, information and education, medical diagnostics and treatment, especially in low-income countries, is also essential to addressing basic needs.
- ❖ Technologies that empower women to increase their participation in the workforce and that address chronic genderbased economic inequalities are being developed by engineers



ENGINEERING AND SDGs

SDG 11

GOAL 11
SUSTAINABLE CITIES
AND COMMUNITIES



- ❖ Civil, structural, electrical, mechanical, environmental, software and telecommunications engineers are contributing to safe, inclusive and resilient cities, facilitating access to affordable housing and public transport, clean air, water and energy, as well as the protection of natural and cultural heritage assets and greater resilience against natural disasters.
- ❖ Advanced engineering technologies are used in energy and resource efficient buildings, smart city lighting, efficient transportation systems, renewable energy sources, integrated water resource management, geospatial engineering.
- ❖ Building Information Modelling and data analytics, making cities more livable and sustainable



ENGINEERING AND SDGs

SDG 12

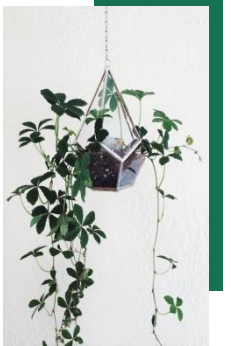
12 RESPONSIBLE CONSUMPTION AND PRODUCTION



- ❖ Mining, civil, mechanical, electrical, chemical and environmental engineers play critical roles in managing the Earth's resources efficiently through processing essential minerals, generating energy from renewable resources, using water resources sustainably, supporting agricultural production and managing biodiversity.
- ❖ Engineering innovations support resource management and responsible consumption through the 'circular economy' where outputs and products can become inputs into other processes and products.
- ❖ Innovations to recycle or reuse waste materials, including plastics, are being developed by materials and chemical engineers



Biogas from treated sewage used to generate electricity at North Head Wastewater Treatment Plant, Sydney, Australia. © Marlene Kanga



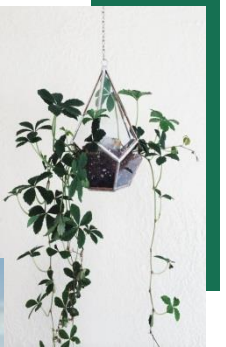
ENGINEERING AND SDGs

SDG 13

GOAL 13 CLIMATE ACTION



- ❖ Engineering is now recognized as an essential enabler of economic growth, evidenced by the positive relationship between economic growth and the number of engineers in a country.
- ❖ Roads, railways, airports, telecommunications, and the supply of water and electricity are essential infrastructure underpinning all economies.
- ❖ This infrastructure is designed, developed and maintained by civil, mechanical, electrical and environmental engineers.
- ❖ Engineers are also responsible for such basic amenities as clean water, energy and housing, enabling citizens to maintain healthy and therefore productive lives, and to engage in decent work

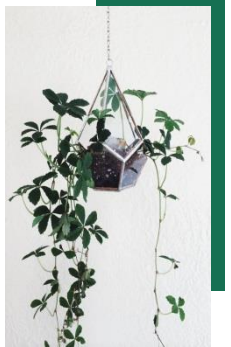
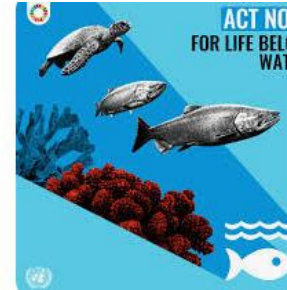


ENGINEERING AND SDGs

SDG 14



- ❖ Engineers have a vital role in preserving and protecting oceans and seas, and the life within them.
- ❖ Marine engineers are working with scientists and other engineering disciplines to address the degradation of fisheries, the pollution of oceans and the use of resources, including wave energy.
- ❖ Engineers are addressing solutions such as plastic pollution in oceans and managing ocean assets that are threatened by the impacts of climate change



ENGINEERING AND SDGs

SDG 15

GOAL 15 LIFE ON LAND



- ❖ Environmental and chemical engineers are managing biodiversity through the responsible use of forestry resources and the preservation of habitats.
- ❖ Innovative technologies map the Earth's surface to provide geospatial information for agricultural monitoring and infrastructure design, and to predict natural disasters.
- ❖ Sensor and drone technologies can map forests and identify diminishing animal populations.
- ❖ DNA sequencing and microchips are used to track endangered species



ENGINEERING AND SDGs

SDG 16



- ❖ 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.



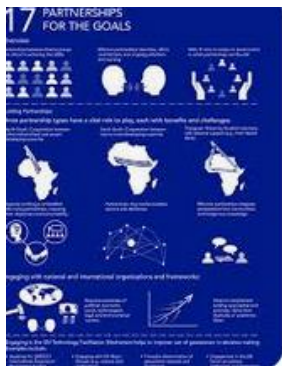
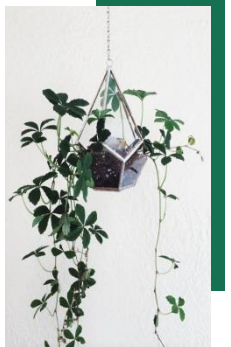
ENGINEERING AND SDGs

SDG 17

17 PARTNERSHIPS FOR THE GOALS



- ❖ Partnerships in engineering are essential to advance the goals of sustainable development, whether within engineering disciplines or across national and international engineering institutions, involving government, industry and universities.
- ❖ These partnerships are developing solutions and roadmaps to implement technologies, to build capacity and knowledge transfer mechanisms, and to establish inclusive approaches to sustainable development. World Engineering Day for Sustainable Development, celebrated annually on 4 March, is a collaborative international effort to bring engineering and the community together to achieve these goals



THANK YOU