ORDEM DOS ENGENHEIROS

WORLD ENGINEERING DAY FOR SUSTAINABLE DEVELOPMENT

WFEO / FMOI

In support of UNESCO World Engineering Day

unesco

Com o Alto Patrocínio de Sua Excelência

Under the High Patronage of the President of the Portuguese Republic

O Presidente da República

A Just Transition to Sustainable Energy and a Net-zero Future in Emerging Markets: the Case of Africa.

Lisbon

March 4th 2024

Eng. Martin Manuhwa Pr. Eng (Z)

Chair – WFEO Committee Capacity Building

Engineering Solutions for a Sustainable World

Ordem dos Engenheiros

Presentation Outline

Lisbon
arch 4th 2024
olutions for a Sustainable World

What is your Carbon Footprint?

Introduction

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

Africa is bursting with ***possibilities*** and a vast endowment of natural resources. The continent's ***renewable energy potential is 50 times greater than the anticipated global electricity demand for the year 2040.***

The continent also has over 40% of the global reserves of key minerals for batteries and hydrogen technologies.

Africa, also, has the largest tracts of arable land, and the continent is young, ***with 70% of the people under 30 years of age.*** It is time to tap these riches to achieve the aspirations of the people.

"Africa has demonstrated that ***climate change, energy access, poverty, development, and conflict are all tightly connected and are different dimensions of the same phenomenon.*** I believe by becoming more assertive and pursuing a climate and development agenda through unified approaches, Africa will be able to mitigate the climate emergency and propel itself to prosperity." - ***William S. Ruto*** President of the Republic of Kenya Chair of the Committee of African Heads of State and Government on Climate Change

Introduction

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

- The ***energy sector* is crucial for the *socio-economic development*** of countries, particularly in Africa. However, Africa, as an ***energy-poor*** region, needs ***to balance economic development with access to modern energy forms through a just and equitable energy transition.***

- Net-zero transitional pathways in Africa should reflect ***local resources, viable development paths***, and other ***local-specific requirements.***

- There is need for ***contextualised and tailored strategies for Africa to accelerate renewable energy based on each country's specific needs and resources.*** Collaboration, political commitment, and long-term planning are essential for ***a successful transition to clean and sustainable energy in Africa.***

- We ***must prioritise the importance of focusing on a just energy transition hinged on net-zero obligations and carbon neutrality pathways***, as well as ***policies and institutional frameworks for energy efficiency and sufficiency to eliminate energy poverty.***

- ***Regarding Africa's energy transitions***, there is a need for urgent ***support and international cooperation to achieve both climate and development goals.***

Introduction

***Sustainable Development** Goals (SDGs)* **should be prioritized as key pillars of a just and *inclusive energy transition* (especially *Goal 7*- that ensures affordable, reliable, sustainable, clean and modern energy and universal access for all by 2030).**

The earlier phase of the *net-zero initiative in developed countries focused on enhancing economic performance and decommissioning thermal power stations due to CO_2 regulations*.

Background and Context

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

- It is important to acknowledge that ***Africa has abundance in unutilized energy resources*** and has the smallest share ***of CO2 emissions*** globally. ***Africa's contribution to global CO2 emissions is small compared to other countries.***

- As of 2015, ***China and USA contributed about 44%*** of the world's CO_2 emissions with Russia and India being the top four emitting countries that contributed about ***55% of the world's GHG*** emissions.

- ***Africa with a total of 54 countries contributed less than 3.8% through to 2020. In 2015, Africa registered a nominal GDP of about US$2.7 trillion (2.84%) of the world GDP for the 3.8% of world GHG emissions.***

- This only serves to emphasize the depth of ***under-development*** and the associated energy growth headroom from the economic growth potential.

- The underdevelopment and the associated potential for economic growth in Africa ***make energy access a priority, while also considering and balancing with climate change actions.***

Background and Context

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

A global scan of successful energy policies in Africa have shown the following focus:

(a) Climate Change Mitigation and ***Adaptation***.

(b) Energy Transition, Carbon Neutrality and ***Net Zero.***

(c) Energy Poverty and ***Access Issues.***

(d) ***Renewable*** and ***Green Energy.***

(e) Battery Energy Storage Systems (BESS).

(f) ***Generation, Transmission*** and ***Distribution of Safe, Sound, Affordable*** and ***Sustainable Energy.***

(g) Demand Side Management, Energy Efficiency and ***Conservation.***

(h) Energy Projects Financing.

The above ***Energy fundamentals*** involve the principles and goals of a country's energy policies and the methods for implementing them. These are mainly guided by the ***17 Sustainable Development Goals (especially SDG 7).***

Challenges Affecting the Effective Implementation of Energy policies

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

In spite of the vital role of the energy sector in the economic and social development of the region, ***the sector has been faced with several challenges affecting its contribution to sustainable development.***

<u>These challenges are:</u>

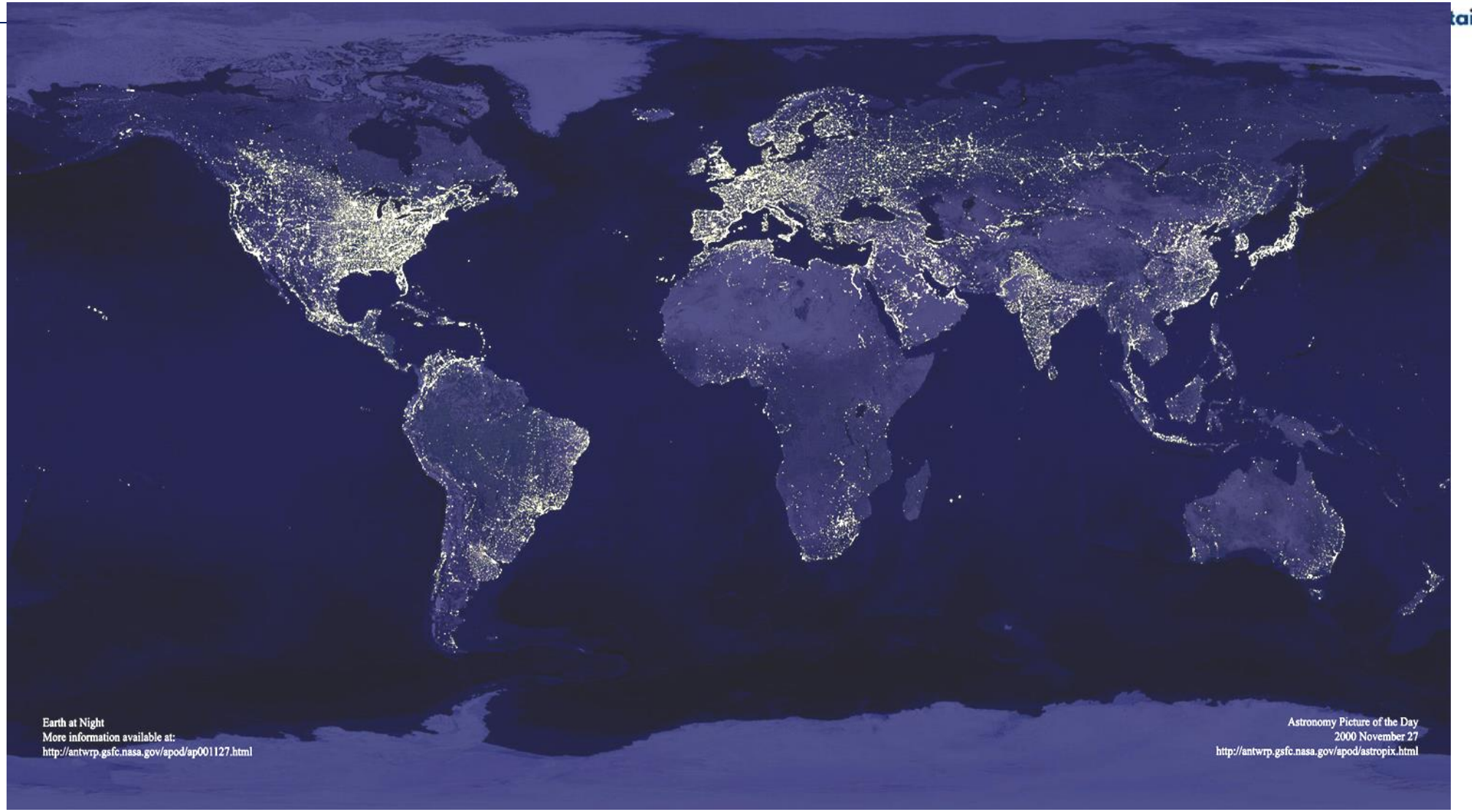
- ***First***, energy accessibility to some segments of the poor and rural population,
- ***Secondly***, is the large disparity in per capita energy consumption and energy intensity among those countries, and
- ***Thirdly***, the challenge of relying heavily on fossil fuels to energy demand, this challenge further affects Climate Change and delays the attainment of net-zero and carbon neutrality in Africa.

In recognition of the above challenges, countries in the region have been continuously revising their policy framework aiming at promoting sustainable management of the energy sector.

The World at Night! Africa easily the darkest

Lisbon
March 4th 2024

ainable World



Why is Energy Critical?

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

Energy systems are the engine of economic and social development.

The Sustainable Development Goals (SDGs) are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity among others.

SDG 7 aims to "Ensure access to affordable, reliable, sustainable and modern energy for all."

Additionally, access to energy has a direct correlation to HDI (Human Development Index).

Major Options for Reducing Greenhouse Gas Emissions

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

"Energy efficiency" means economically efficient reductions in energy intensity.

Need to reduce energy intensity,

(the amount of energy used to produce a unit of GDP or to perform some desirable service.)

Sustainable Development (Integrated Approach)

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

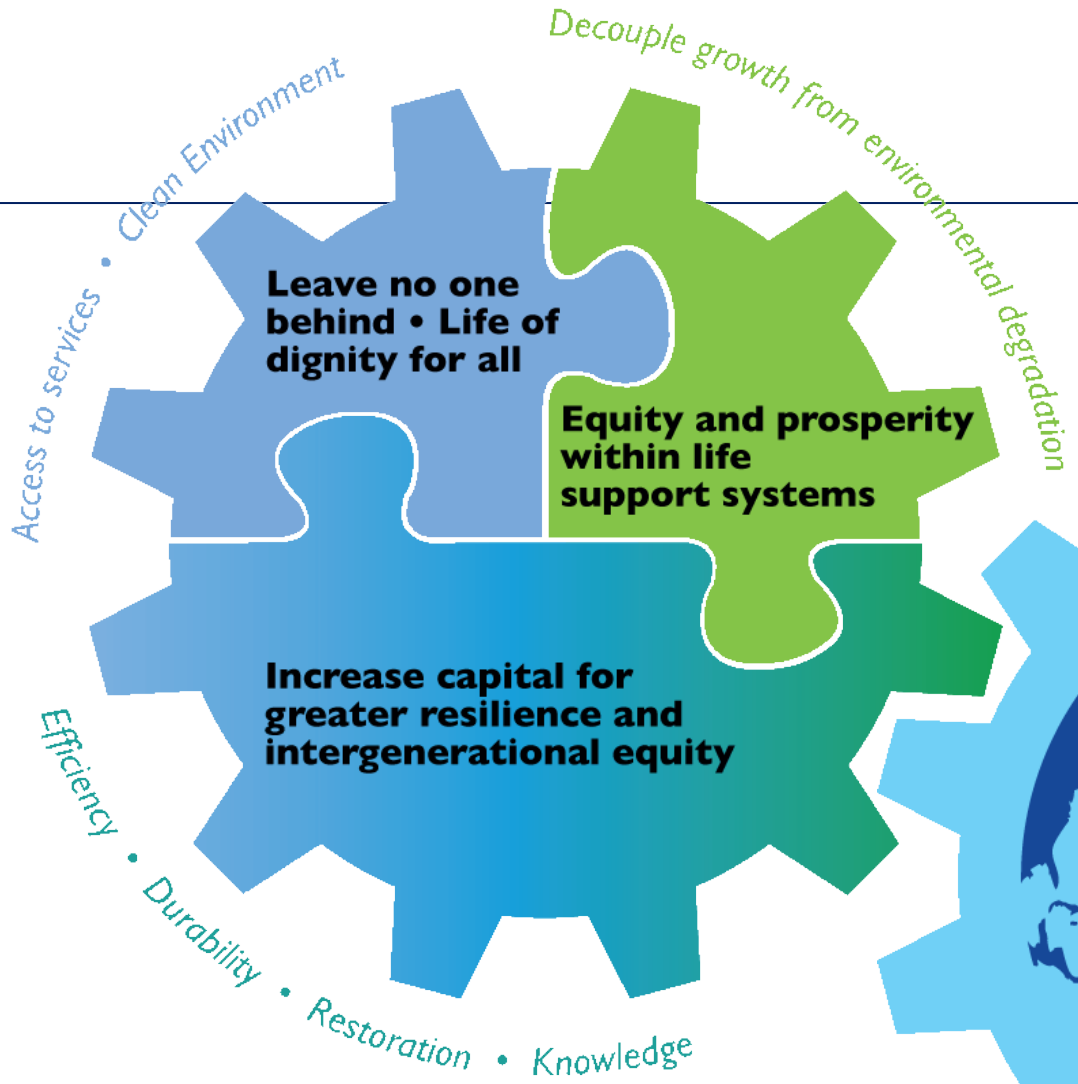
Sustainable Development:is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

An integrated approach provides for ***strategic decisions and actions*** aimed at meeting the objectives of sustainable development and poverty eradication. Former UN Secretary-General Ban Ki-moon makes a strong case for integration in his 2014 Synthesis Report on the post-2015 Agenda and SDGs, highlighting the need for ***a people-centred and planet-sensitive*** agenda and stressing:

"This integration provides the ***basis for economic models that benefit people and the environment****; for* ***environmental solutions that contribute to progress****; for* ***social approaches that add to economic dynamism*** *and allow for the* ***preservation and sustainable use of the environmental commons; and for reinforcing human rights, equality, and sustainability.*** *Responding to all goals as a* ***cohesive and integrated whole will be critical to ensuring the transformations needed at scale."***

The complexity, magnitude and the interconnectedness of environmental change does not mean that decision-makers are faced with the stark choice of "***doing everything at once in the name of integrated approaches or doing nothing"*** in the face of complexity

INTEGRATION: 3 principles



An **integrated approach** implies that **all aspects of sustainable development have to be taken into account when addressing certain issues** that may initially seem to be only about one dimension.

Delivery of Agenda 2030 requires us to have an Action Oriented Outlook to plan for the future!

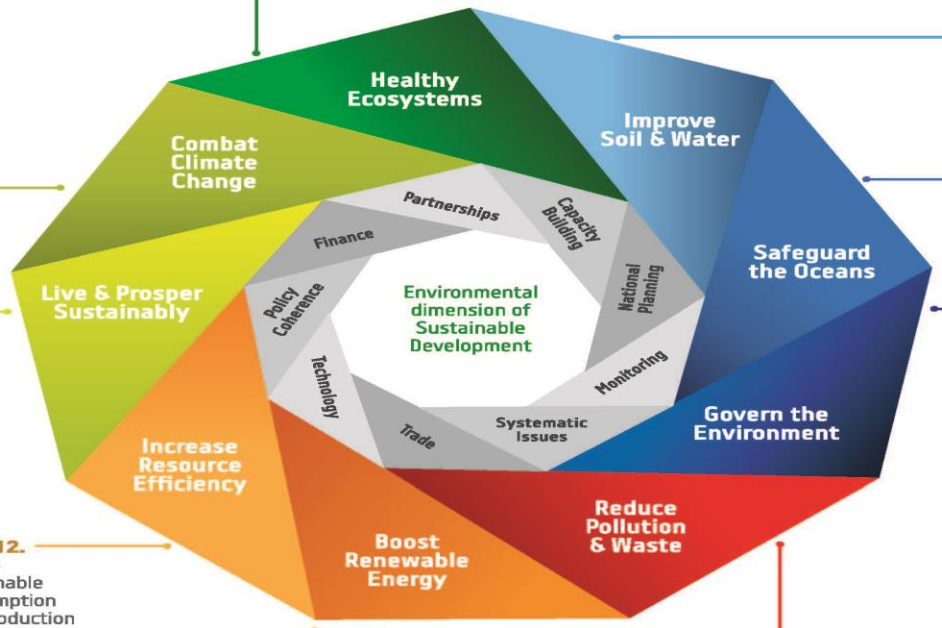
Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

Delivery of Agenda 2030 requires us to have an Action Oriented Outlook to plan for the future!

Environmental sustainability for the Sustainable Development Goals in the 2030 Agenda

In September, the 2030 Agenda for Sustainable Development is expected to be adopted at the United Nations summit held in New York. The 17 Sustainable Development Goals build on the eight Millennium Development Goals and aim to end poverty, protect the planet, and ensure peace and prosperity for all.

⊗ = related goal



Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
1 3 6 8 9 11 12

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
1 5 10 11 12 14

Goal 6. Ensure availability and sustainable management of water and sanitation for all
1 12 15

Goal 13. Take urgent action to combat climate change and its impacts
1 7 8 11 12

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development
1 2 8 15

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
1 10 12

Goal 10. Reduce inequality within and among countries
1 12 14 15

Goal 1. End poverty in all its forms everywhere
5 10 12 16

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
1 10 12

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
1 2 3 8 9 12 13

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
1 8 12

Goal 12. Ensure sustainable consumption and production patterns
1 2 8 11 14 15

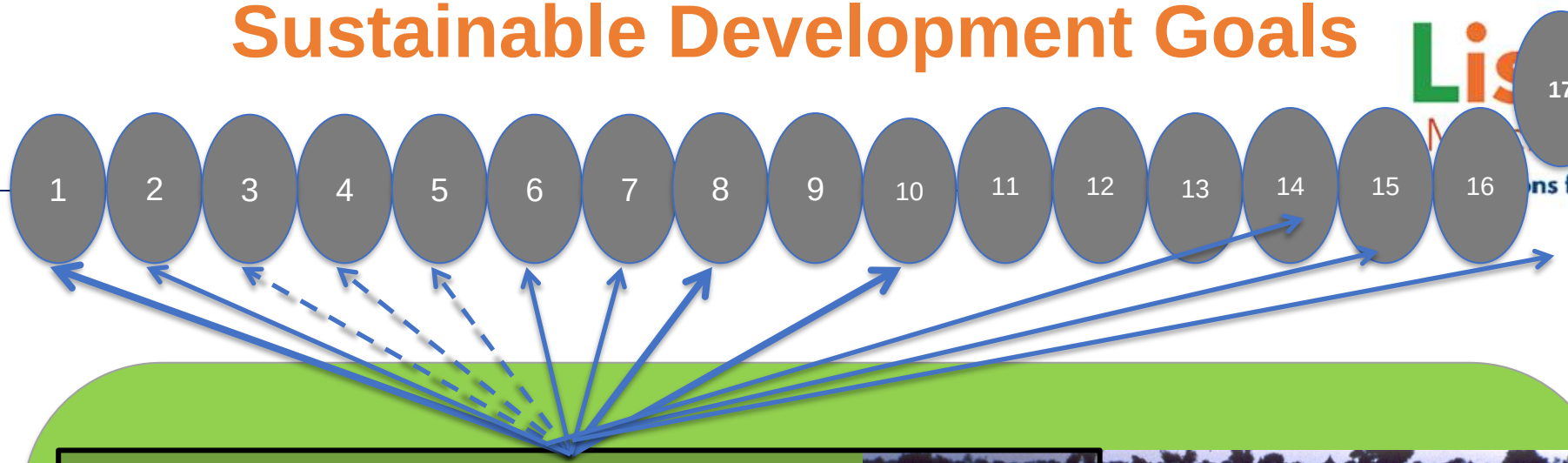
Goal 5. Achieve gender equality and empower all women and girls
1 2 3 4 6 7 8 9 10 11 12 13 14 15 16

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
1 2 4 8 10 12 13

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all
1 2 3 4 6 10 12 14 15

Goal 3. Ensure healthy lives and promote well-being for all at all ages
1 8 10 11 14 15

Sustainable Development Goals



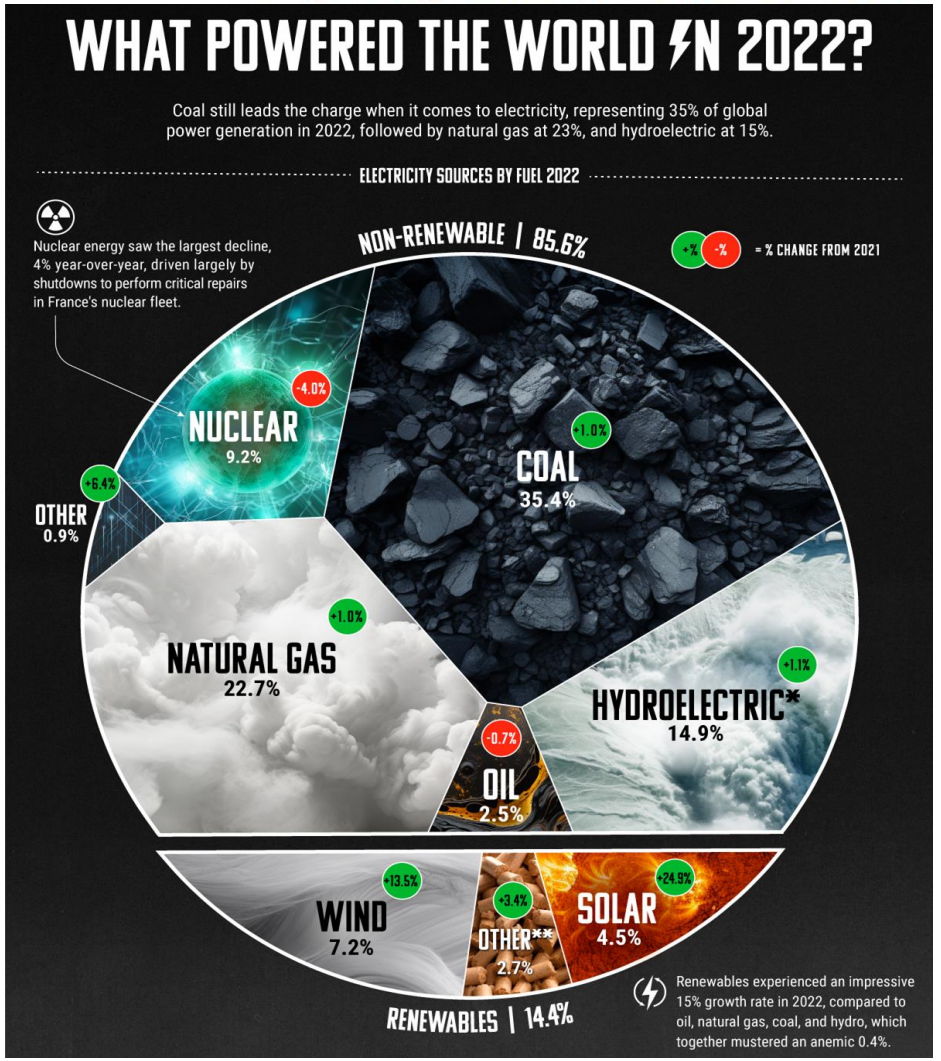
POVERTY ERADICATION THROUGH AN INCLUSIVE GREEN ECONOMY

- Redefine poverty
- Redefine economic growth
- Green, decent jobs and equal opportunity
- Social protection and
- Universal services

Dinka women in Abyei. Photo credit: M. Niamir-Fuller 1981

Global Energy Sources

- In 2022, ***29,165.2 terawatt hours (TWh)*** of electricity was generated around the world, an increase of 2.3% from the previous year.
- ***Coal still leads the charge when it comes to electricity, representing 35.4%*** of global power generation. Over three-quarters of the world's total coal-generated electricity is consumed in just three countries. ***China is the top user of coal, making up 53.3% of global coal demand, followed by India at 13.6%, and the U.S. at 8.9%.***
- ***Renewables represented 14.4%*** of total electricity generation with an annual growth rate of 14.7%, driven by big gains in solar and wind.
- For ***Nuclear power, Disruptions at the Zaporizhzhia in Ukraine and shutdowns in France's nuclear fleet to address corrosion found in the safety injection systems of four reactors led to a 4% drop in global use***, year-over-year.



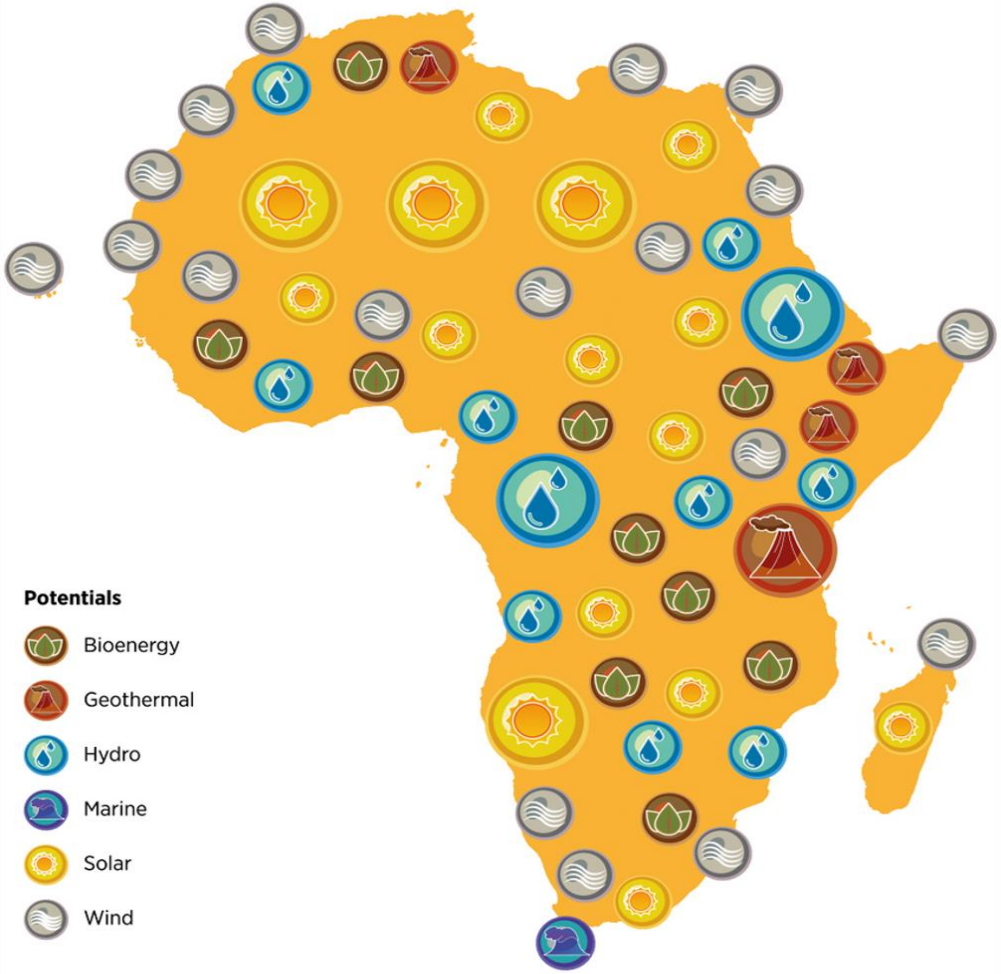
Energy Potentials:-Renewable Energy

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

It's sometimes said that if the Industrial Revolution had taken place in Africa, the world would now run entirely on solar energy.

Africa's renewable energy resources are diverse and enormous in quantity including:

Unlimited solar potential (10 TW)	Abundant hydro (350 GW)	Wind (59 TW)	Geothermal energy sources (15 GW)



Source: https://geographical.co.uk/climate-change/african-energy

Example of a Solar Farm (PV Technology)

20

Africa Energy Potentials - Critical Minerals

Lisbon
March 4th 2024

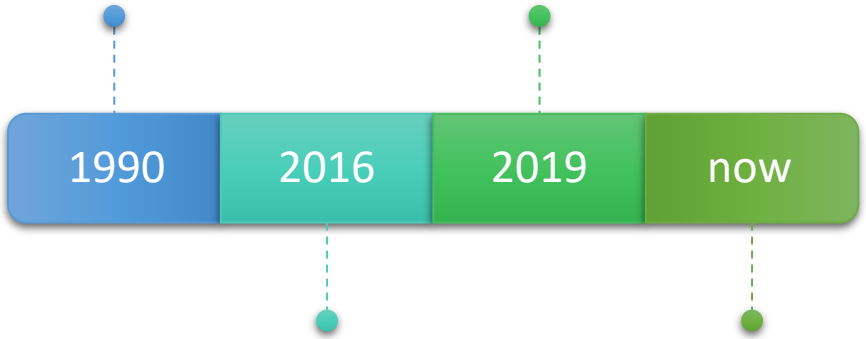
- The ***renewable energy momentum*** in recent years have become synonymous with ***clean energy revolution.*** But while we focus on the advanced technologies and innovative designs that drive these solutions, we often overlook what makes it all possible: ***critical minerals.***
- Africa's ***vast resources of minerals*** that are critical for ***multiple clean energy technologies*** are set to create new export markets but need to be managed well.
- Africa accounts for over ***40% of global reserves of cobalt, manganese and platinum – key minerals for batteries and hydrogen technologies.***
- South Africa, Democratic Republic of the Congo and Mozambique have a significant share of ***global production*** today, but many other countries may hold undiscovered deposits.
- ***Lithium*** deposits are also abundant in Africa especially in the Democratic Republic of Congo and Zimbabwe, . We need to value add and play our part in the ***renewable energy space.***

Access to Electricity

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

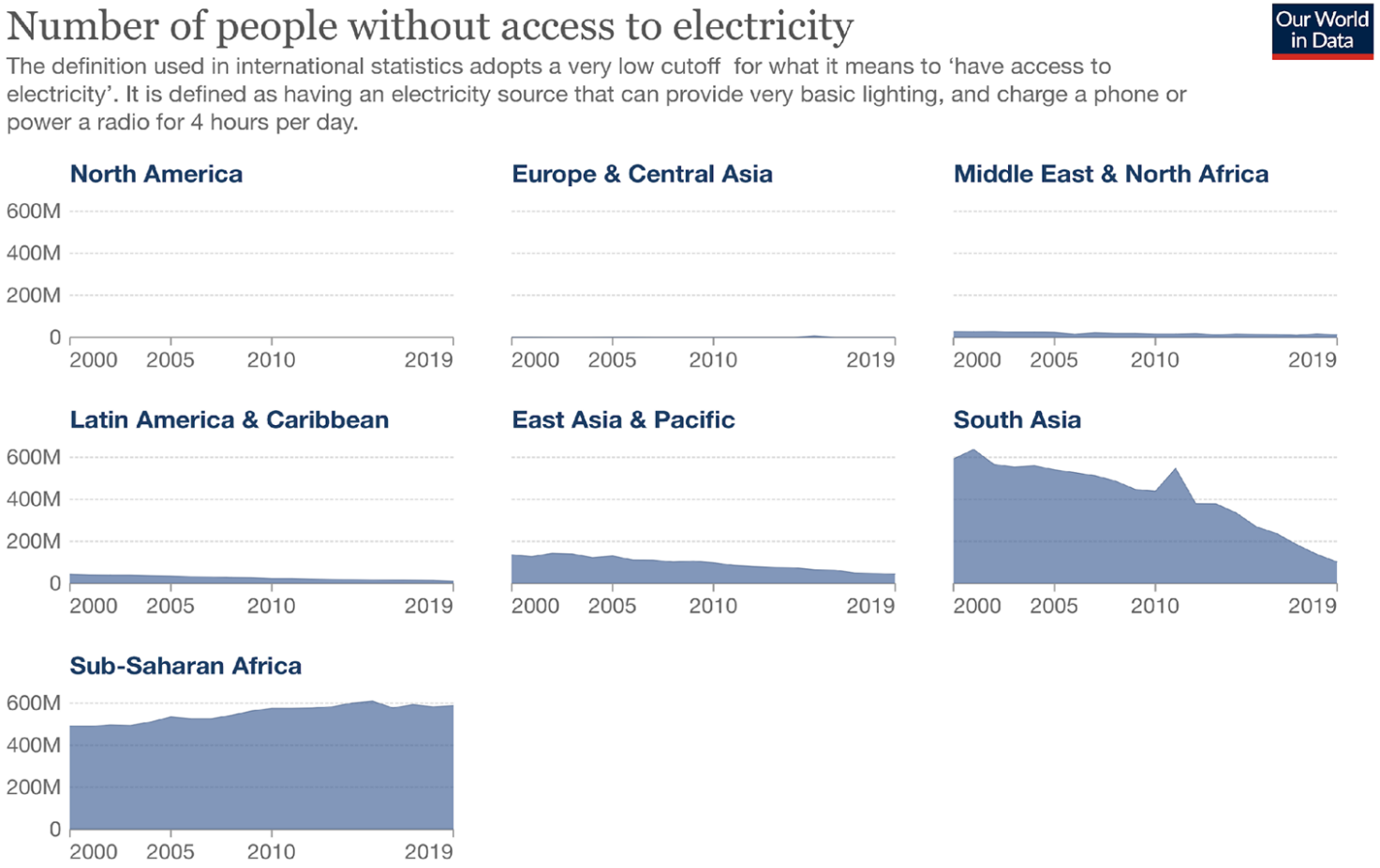
In 1990, nearly half (45 percent) of people in the world without access lived in South Asia.

Despite the share of the population with electricity rising steadily, population growth meant that the total number of people without access remained at 2016 levels.



By 2016 this had shifted significantly: the largest share lived in Sub-Saharan Africa (which is now home to nearly two-thirds of the world population without electricity access).

Accelerated progress will be needed to ensure this number now continues to fall.



The Role of Nuclear in Energy Transition

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

- The role of nuclear in the energy transition, for ***decarbonizing both the electric grid and industrial facilities should be enhanced.*** This comes after a decade of low investments, accumulating nuclear waste, an aging fleet of reactors, public opposition, and regulatory mandates that stalled nuclear's growth globally and led to declines in production.

- Meanwhile we note, the nuclear industry has maintained its ***safety record, made remarkable progress in fusion and advanced nuclear reactors, and improved operating safety and efficiency.***

- The ***Future of Nuclear in the Energy Transition should address how headways in advanced nuclear reactors, fusion, and waste management can overcome the challenges of economic feasibility, efficient and safe waste disposal, and build public and regulatory support*** for the ***increased deployment of nuclear energy Africa***.

- African countries or regions should consider ***nuclear energy as it generates significant energy without emissions.*** This can be either ***large scale nuclear plants that can serve regional power pools*** or innovative technologies such as ***Small Modular Reactors (SMRs), Micro Modular Reactors (MMRs),*** and ***Nano Modular Reactors (NMRs)*** which are small, flexible, and require less infrastructure compared to large-scale nuclear plants.

Wake Up Call to Africa

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

- In a report released at COP27, the rush for ***Africa's oil and gas has nothing to do with increasing energy access for Africans*** with around 89 per cent of the new LNG infrastructure being built for export, mainly to Europe and Asia.
- The IEA's 2022 projection predicted that, even if Africa developed all its known gas reserves, the ***continent's contribution to global emissions would rise from 3% to 3.5%*** – the equivalent of a small European economy such as Greece.
- The cost of the transition to ***Net zero is significant for already prosperous and dominant economies.*** What of Africa? We need to create a just framework to energy transition and net-zero transition which leaves no place and no one behind.

Way Forward

Lisbon
March 4th 2024
Engineering Solutions for a Sustainable World

- We believe the future of energy is ***low carbon*** and to achieve this African countries should first industrialize and then gradually utilize ***portfolio carbon intensity (PCI)*** systems that encompasses the ***full value chain carbon intensity of the products and services used***.
- In attempting to address Africa's energy gap, ***unconventional solutions and innovation must be employed.***
- Africa must be ***open to all solutions and options available*** on the table ***to achieve developmental aspirations that secure the lives and livelihood of its population.***
- A comprehensive strategy for the transformation of the ***African energy system also requires large-scale deployment of advanced coal technologies with carbon capture and storage (CCS)*** in order to address adequately both climate and energy security concerns.
- ***Mini grids can be employed in provision of energy to rural areas and small towns while conventional systems with some renewable solutions*** that will not disrupt stability can be used for cities and industrial areas.
- The role of nuclear in the energy transition, for decarbonizing both the electric grid and industrial facilities should be ***An all-inclusive global policy framework*** is required ***to facilitate the flow of finance, capacity, and technologies between countries.***
- The ***polluter must pay principle*** and the implementation of the ***Paris Agreement*** by all countries will go a long way to improve the ***carbon footprint of the world.***

RECOMMENDING A JUST ENERGY TRANSITION FOR AFRICA

Lisbon March 4th 2024
Engineering Solutions for a Sustainable World

Energy plays a fundamental role across multiple sectors. The choices Africa makes about energy systems will determine many other aspects of development. ***Fit for purpose, modern and low-carbon, a new model of energy provision must address a number of important factors.*** The ***system must provide accessible, affordable, reliable and sustainable energy to around 600 million Africans that currently lack access to electricity as an overriding priority for development.***

To achieve this goal, Africa will need to move away from outmoded models based on centralised infrastructure, towards more modern, integrated energy solutions that take advantage of Africa's massive renewable energy potential. The new energy system will embody a number of key principles and approaches that underpin a new African energy vision, including:

- Ensuring ***African ownership and agency*** in energy initiatives and plans
- ***Integrating energy systems design*** into wider development objectives and planning
- ***Establishing clear policy priorities, such as support for clean cooking and diversification of energy generation and ownership***
- Provide scope for the delivery of energy as a common good and to ***genuinely foster energy democratisation***
- ***Ensuring stakeholder participation, equity and sufficiency in terms of energy use***

ORDEM DOS ENGENHEIROS

WORLD ENGINEERING DAY FOR SUSTAINABLE DEVELOPMENT

WFEO / FMOI

In support of UNESCO World Engineering Day

unesco

Com o Alto Patrocínio de Sua Excelência
Under the High Patronage of the President of the Portuguese Republic

O Presidente da República

Recommendations & Takeaways

- ***The Sustainable Energy Roadmap with climate stewardship must align the climate change and current developmental Aspirations of Agenda 2063 of the Africa we want and should further identify financial, funding, or incentive mechanisms needed to best position Africa to meet the energy challenges of the future.***
- ***We have noted that the net-zero transition model was initiated by developed countries with established and diverse energy systems*** and that the top four emitting countries (USA, China, Russia and India) contributed about ***55% of the world's GHG emissions compared to Africa (with a total of 54 countries) 's 3.5%.***
- ***Africa has stayed very long*** without meeting its energy needs, there is now a growing awareness among African leaders that the ***solution*** to the problem can only be sought when the continent looks at the peculiarity of its problem and take action from that perspective. In that respect all options (energy sources) need to be considered.
- Africa's energy ***policies*** should follow a ***just pathway informed by international best practices and lessons learned elsewhere.***
- ***"The continent need to have enough energy to industrialize first, before it can fully join the industrialized countries in the 'energy transition' journey".*** – Engr. Mustafa Shehu – WFEO President.
- ***"We cannot transition in darkness"–*** His Excellency Paul Mashatile, the Deputy President, Republic of South Africa.

CONCLUSION REMARKS

It can be concluded that some emerging key ***considerations for energy transition policies*** for Africa include:

- ***Security of supply*** - ensuring a reliable and affordable supply of energy to meet demand and avoid shortages
- ***Environmental sustainability*** - minimizing the negative impact of energy production and use on the environment, particularly with regards to climate change
- ***Accessibility and affordability*** - ensuring that energy is available and affordable to all members of society, including those who are economically disadvantaged
- ***Innovation and research*** - investing in new technologies and research to develop cleaner, more efficient, and less expensive sources of energy
- ***Market competition*** - promoting competition among energy providers to ensure fair prices for consumers and encourage innovation and efficiency.

IN CONCLUSION

African's contribution to the emission of ***Carbon dioxide (CO_2) is by far the lowest with only 3 to 4% of the global emissions*** and Africa is a continent with vast unexploited energy resources. As Africans, our ***focus on issues regarding Energy Transition should consider the women in the villages, the vast unemployed, intelligent and vibrant youths and that little boy and girl on the street without food. We should focus on economic and human development of the African continent*** and again balance with the ***carbon reduction, net-zero emission or reduction to net-zero emission issues with due care to energy access.***

ORDEM DOS ENGENHEIROS

WORLD ENGINEERING DAY FOR SUSTAINABLE DEVELOPMENT

WFEO / FMOI

In support of UNESCO World Engineering Day

unesco

Com o Alto Patrocínio de Sua Excelência
Under the High Patronage of the President of the Portuguese Republic

O Presidente da República

African Proverb

If you want to go **FAST**
Go **Alone**,
If you want to go **FAR**,
Go **Together**

Thank you.