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Energy Advancement A new Energy Transition Redefinition

Dr Sami Alnuaim, SPE 2019 President

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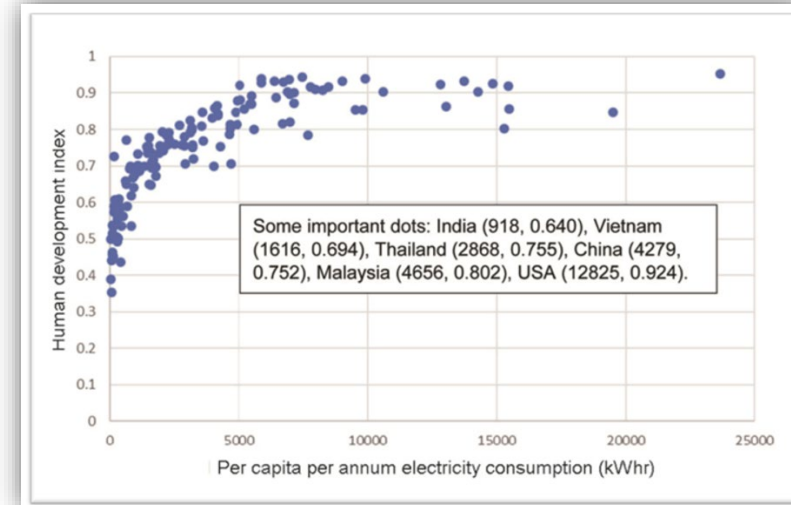
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Dr Sami Alnuaim

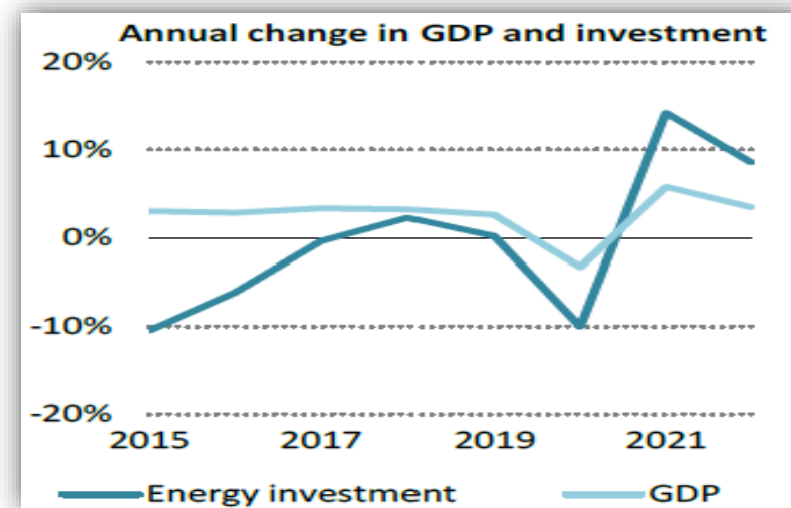
Energy Sustainability and Human Development



- There is a direct relationship between Energy Intensity and Human Development Index (HDI).
- The global energy demand, led by O&G (~55%) has been rising in quantity & % proportionately to human prosperity, global economic & population growths.
- Energy Intensity is a vital catalyst for wider social development, including better health and education.
- Energy Sustainability and consumption are crucial components of any economic growth (GDP).



HDI vs electricity consumption (Source: R. B Grover)



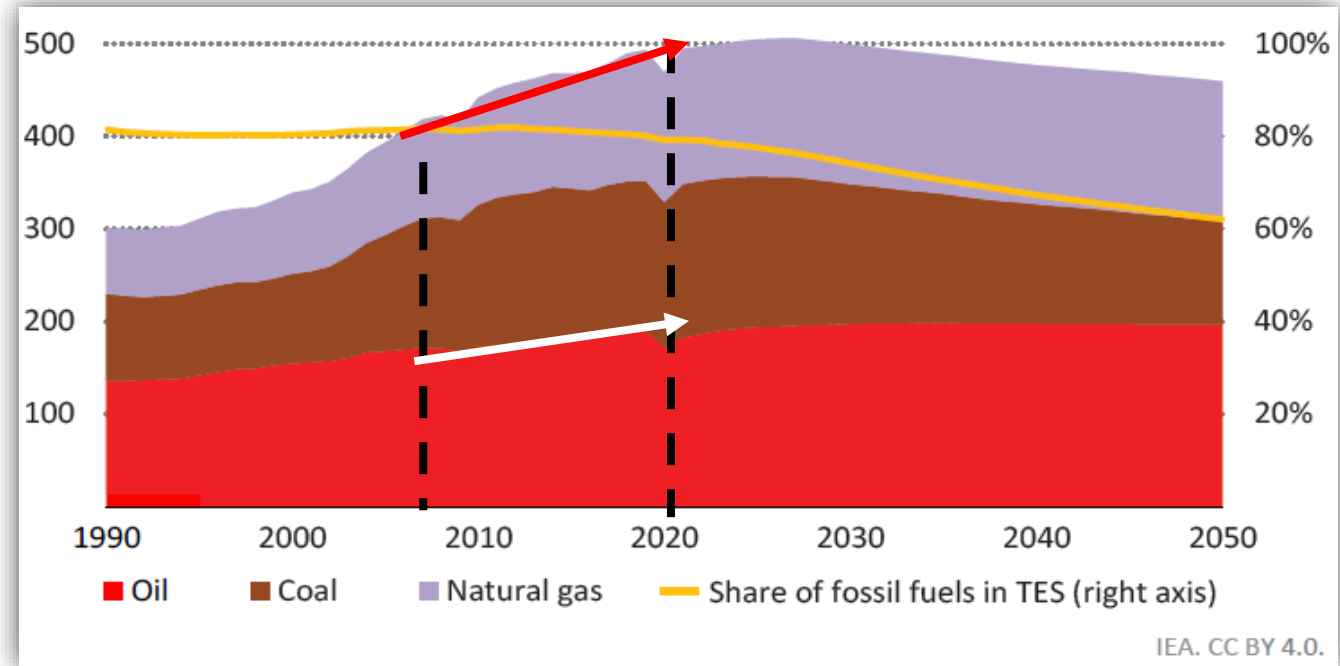
Source: IEA 2022 World Energy Outlook

Energy Sustainability and Human Development



- According to the 2022 United Nations Global Multidimensional Poverty Index report, 415 million people exited poverty between 2005 and 2019.
- During this period, Energy Demand led by O&G have increased by >100% for Gas and 10-15% for Oil.

Fossil fuel demand 1990-2050 (EJ)



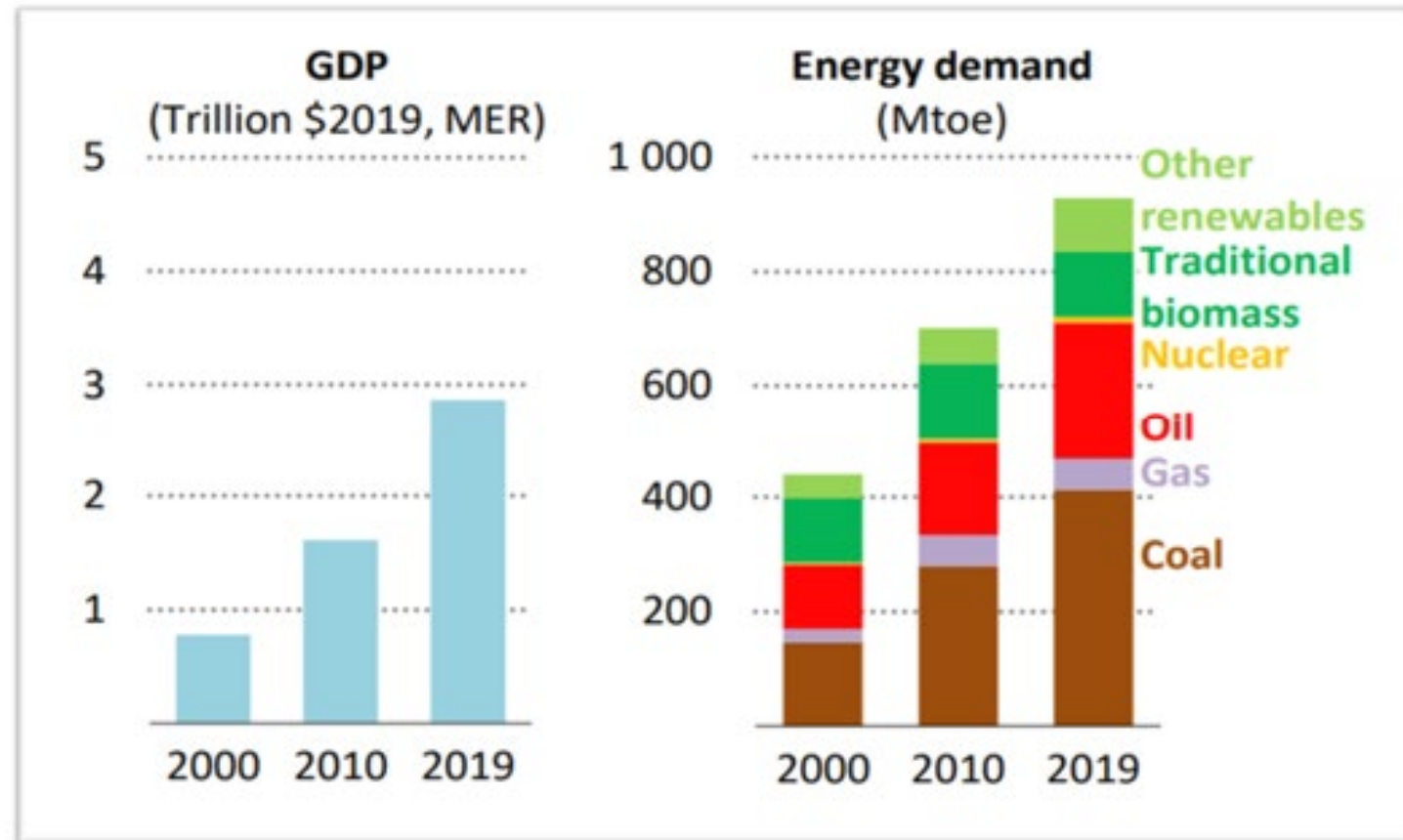
IEA. CC BY 4.0.

Source: IEA 2022 World Energy Outlook

Energy Sustainability and Human Development - India



- India's GDP tripled from years 2000 to 2019 while doubling its Energy Intensity.
- Over the same period, Indian HDI has increased by a factor of 21% while its Poverty Index dropped from 39% to only 10%.

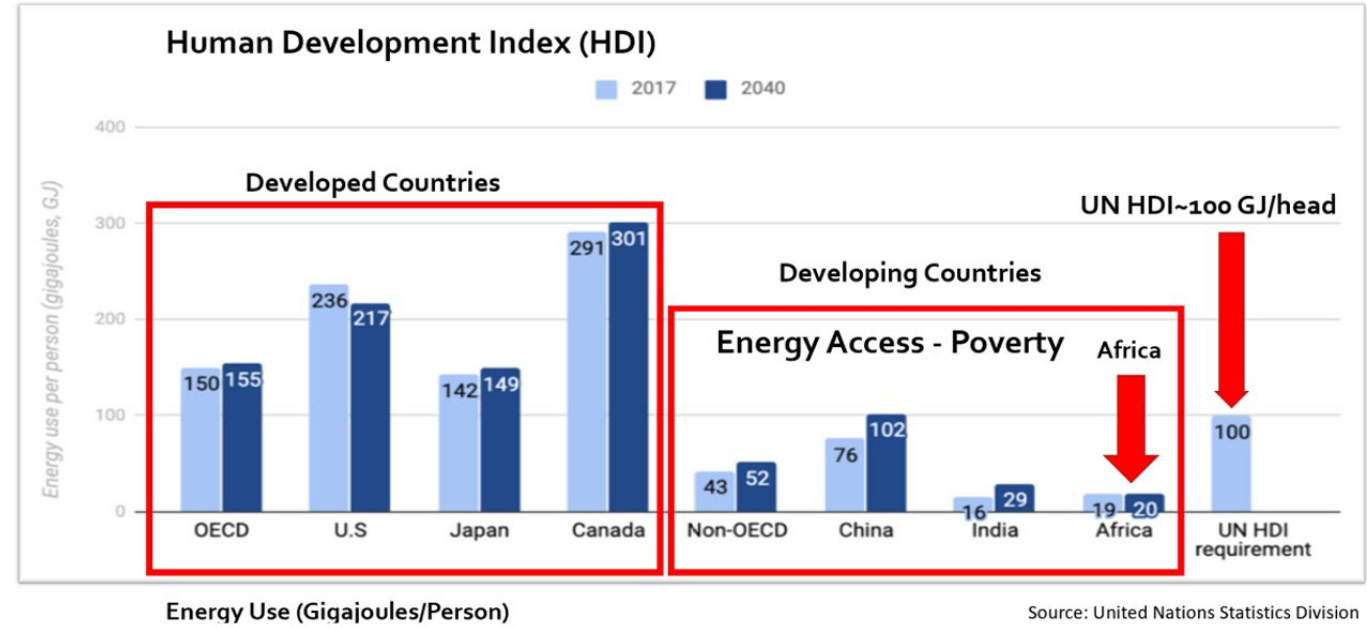


India Energy Outlook 2021 (Source: IEA)

Current Reality of Energy Transition Narrative - HDI



For Africa, its fast-growing population is expected to suppress the increasing prosperity pace of its people, thus energy use per capita rises by one-unit up to 20 giga-joule per head by 2040, 80% below today's global UN min. needed standard (100 giga-joule).



Human Development Index (Source: UN HD Report)

Unfortunately, Non-OECD, Africa and India will never reach the UN minimum HDI standard by 2040. Imagin the situation under the accelerated Energy Transition Scenario!!!!



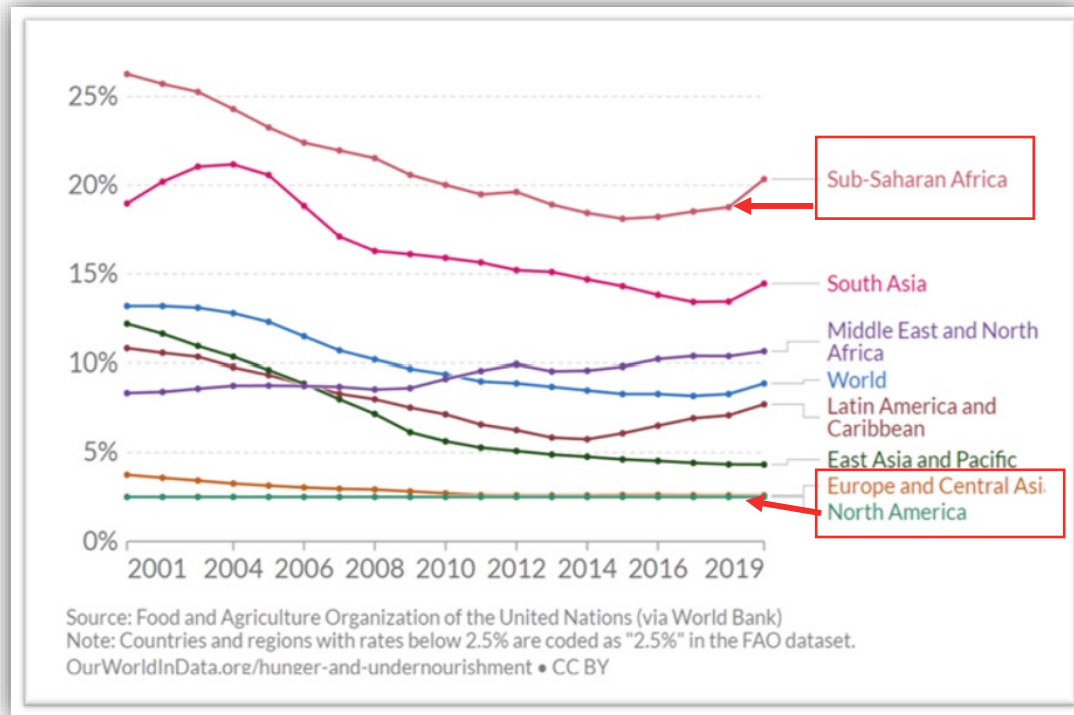
Current Reality of Energy Transition Narrative – Energy Poverty

In 2018, the UN reported:

- 620 million in Africa did not have access to electricity.
- 730 million depended on solid biomass for cooking.
- 75 million people who recently gained access to electricity are likely to lose the ability to pay for it.
- Number of people worldwide without electricity access has started to rise for the first time in the last two decades.
- 100 million people may be pushed back into reliance on firewood for cooking.
- Finally, the UN SDG#7, Global Energy Poverty Index target is to reach 0 by 2030 will never be achieved.



Energy Sustainability and Human Development - OECD vs Sub-Sahara Africa



Undernourished Population (sgd-tracker.org)



Energy Intensity (Source: NASA 2019)

Energy Intensity & GDP of OECD countries is 12 times, HDI is 40% greater, Life Expectancy is 24% higher and School index is 37% less than Sub-Sahara.

Current Reality of Energy Transition Narrative



- Today's Energy Transition narrative is trying to solve a global env problem while causing much bigger ones.
- It ignores Energy Security which was apparent during Russian Ukraine war. Europe would have gone back to dark ages if Coal & Shale Gas were not increased.
- Today's Energy Transition reality illustrates its unforgettable ignorance of the Global Energy Poverty and Human Prosperity & Development's needs.
- The probability is high for the world to get poorer, the global economy & social challenges to be bigger*.



Europe's energy crisis: A switch back to coal is on the cards

UK among nations facing a 'bleak winter' with consumers at risk of being unable to heat their homes

U.S. Efforts to Support European Energy Security



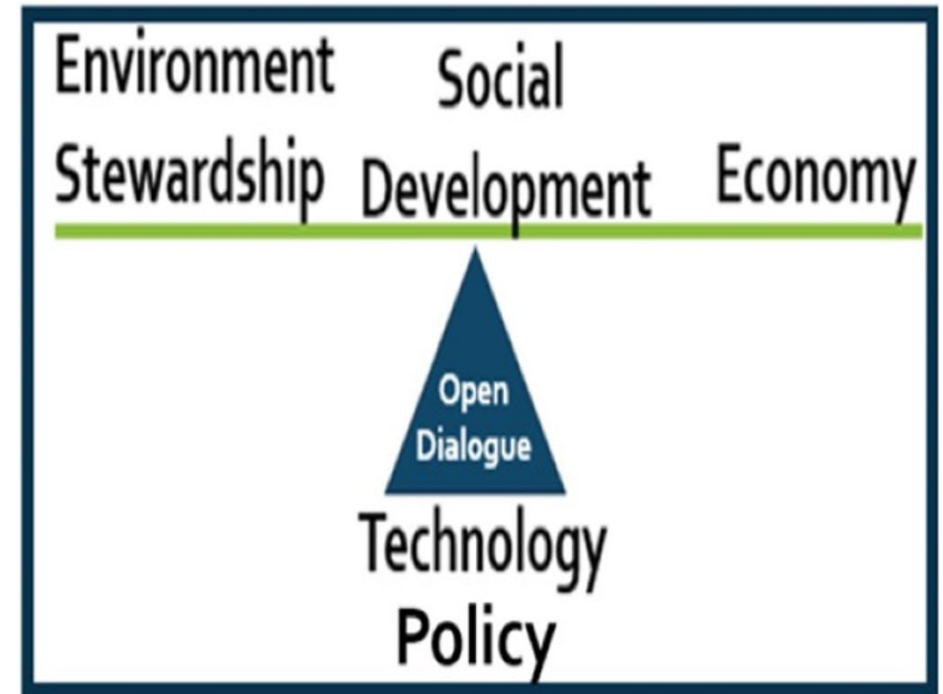
* UN 2021-2022 HDI report

Current Reality of Energy Transition Narrative



Hence, the world must change the current Energy Transition narrative by introducing a new narrative to force the must-to-meet ideal balance between the global ever-increasing Economical, Social and Environmental challenges.

Energy Balanced Model



Source: Alnuaim 2023

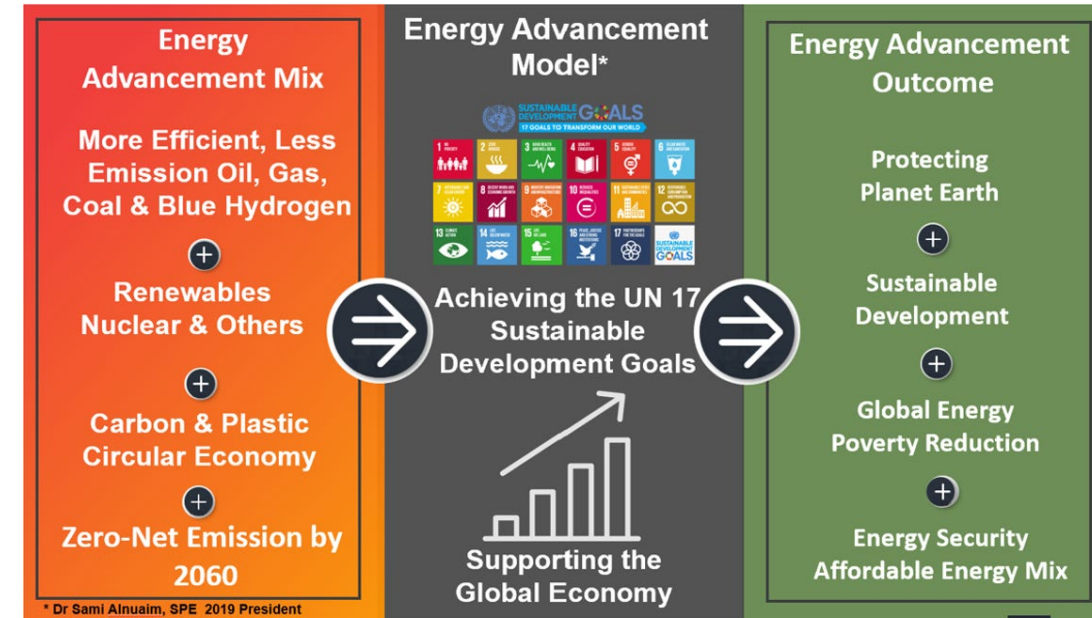
Proposed Energy Advancement Narrative*

Energy Advancement**:

Cleaner and more efficient energy portfolio that includes all energy sources with solid environmental accountability, strategized around helping the world becoming more

- Economically prospered
- Sustainably developed
- Environmentally protected

with near zero energy poverty and net-zero Carbon & Methane emission targets by 2060, using effective dialogue, international collaboration, technology, R&D and best practices.



Source: Alnuaim 2023

* To be presented during 2023 SPE ATCE

** Dr Sami Alnuaim, SPE 2019 President

Proposed Energy Advancement Model*



Energy Advancement Mix

More Efficient, Less Emission Oil, Gas, Coal & Blue Hydrogen



Renewables
Nuclear & Others



Carbon & Plastic
Circular Economy



Zero-Net Emission by
2060



Energy Advancement Model*



Achieving the UN 17 Sustainable Development Goals



Supporting the
Global Economy

Energy Advancement Outcome

Protecting
Planet Earth



Sustainable
Development



Global Energy
Poverty Reduction



Energy Security
Affordable Energy Mix

Energy Advancement Roadmap & Strategy



1- Decarbonization thru Green Power Energy Mix

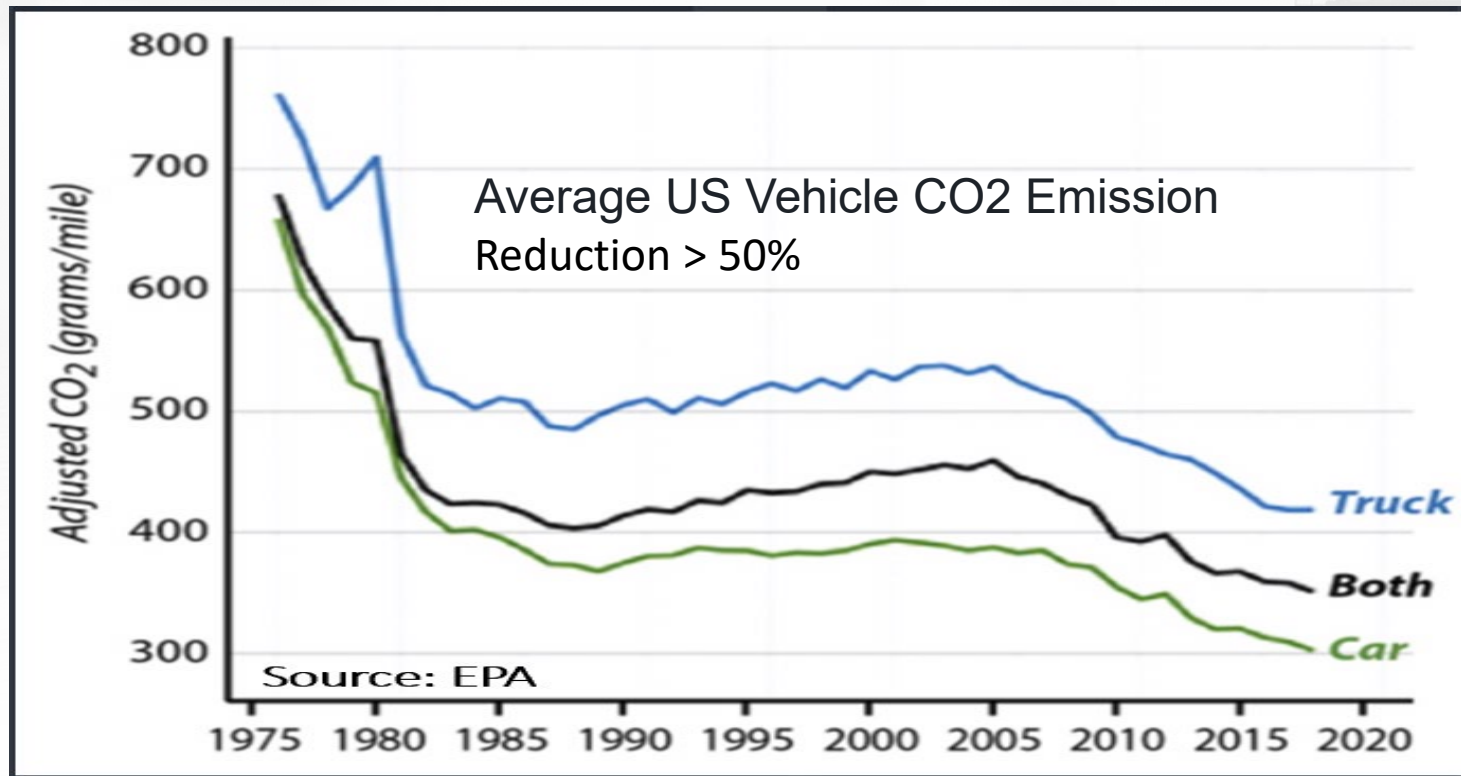
- In the 1st half of 2022, Renewables met all the growth in global electricity demand, halting the rise in fossil fuels (ember-climate.org).
- IEA:
 - Wind and solar reach a record 12% of global electricity in 2022.
 - Gas has increased in Power by +116% in the last 10 years.
 - 28% drop in US CO₂ emission from power generation between 2015-2017. This is due to Shale Gas use in lieu of Coal in Power Generation.
 - The share of renewables in the global power generation mix is forecasted to rise from 29% in 2022 to 35% in 2025. As a result, emissions of global power generation will plateau on 2025 and its CO₂ intensity will further decline in the coming years.

Energy Advancement Roadmap & Strategy

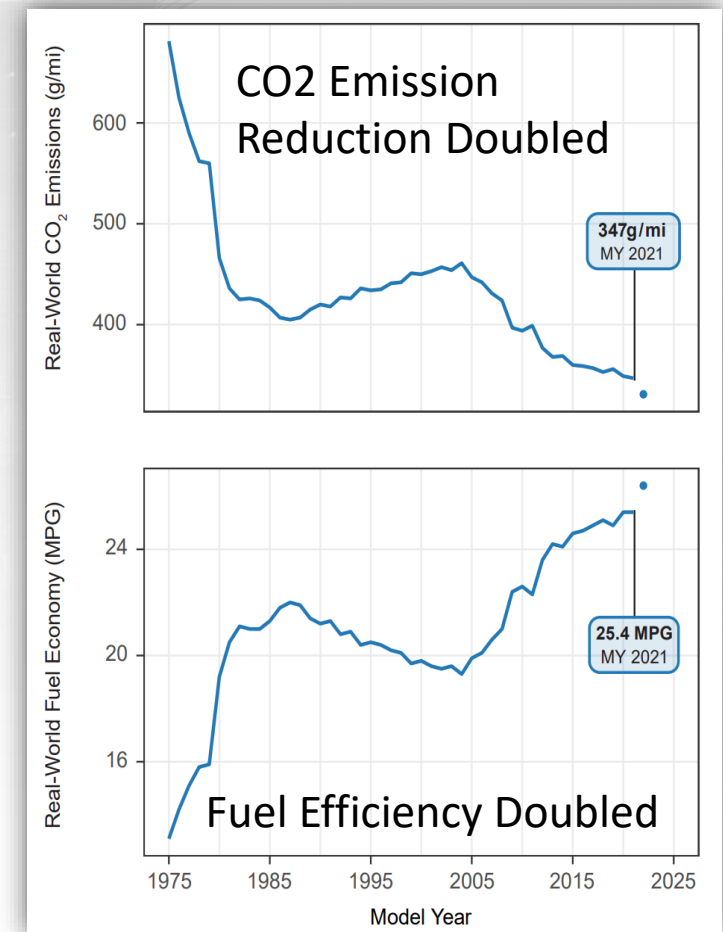


2- Decarbonization thru Energy Efficiency

US



World



Source EPA).

Energy Advancement Roadmap & Strategy



3- Decarbonization thru Technology Development Oil & Gas Climate Initiative (OGCI)

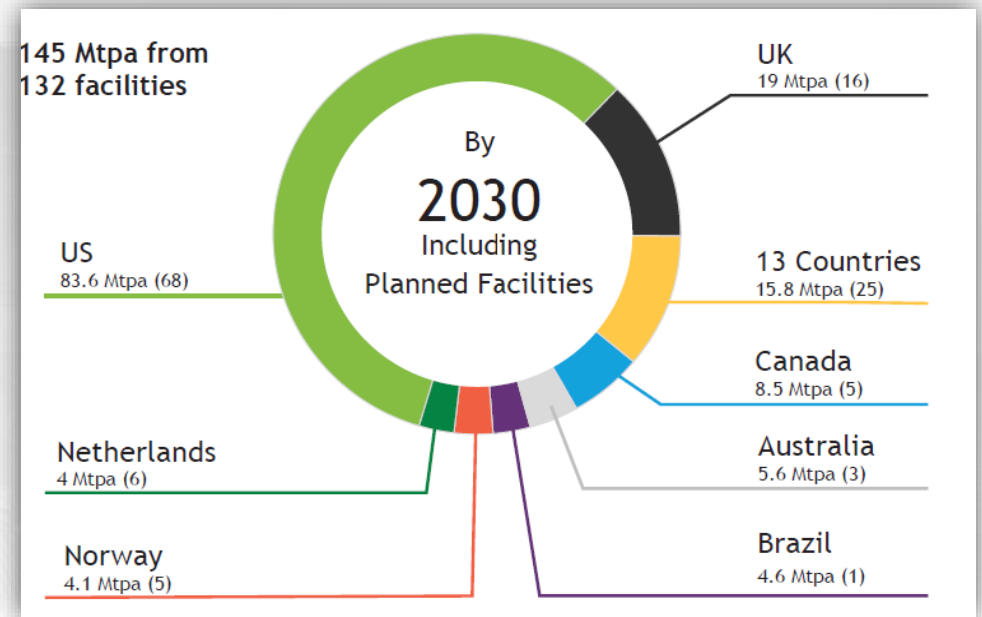
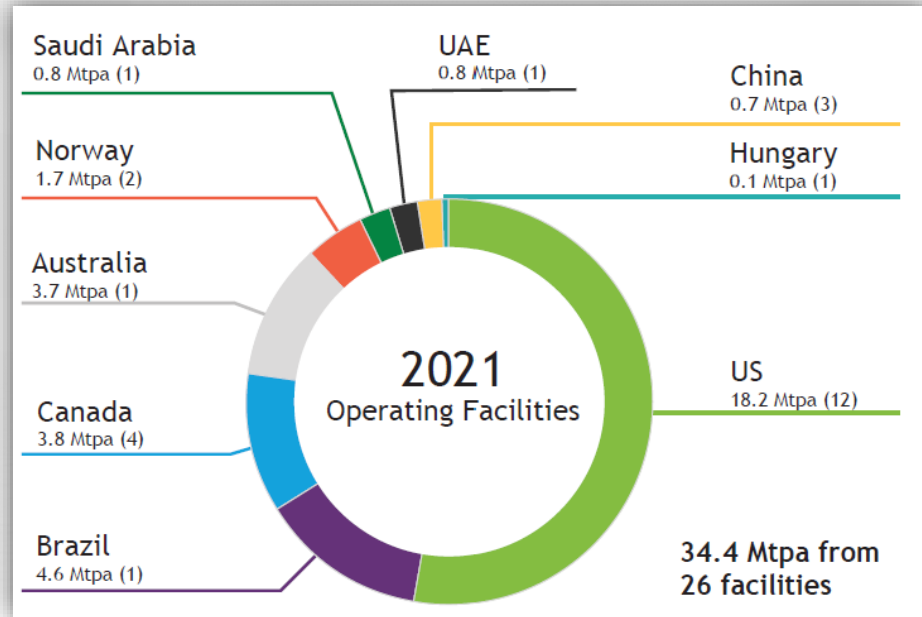


- OGCI is a consortium of 12 major oil and gas companies (covering 30% of the global oil production) that was established in 2014 to invest \$1B to accelerate the decarbonization of the industry, helping it to achieve the Net-zero CO₂ and Methane emission targets.
- In addition, \$14B investment in low Carbon technology and R&D in 2021 from ten OGCI member companies.

Energy Advancement Roadmap & Strategy



4- Decarbonization thru Carbon Capture & Storage Existing & Planned CO2 Storage and EOR Projects



CCS facilities under development has grown 44% year on year to 244 million tonnes per annum in the past 12 months, with 61 new facilities added to the project pipeline in 2022, growing to 132 facilities by 2030.

Source: Commercial CCS Facilities 2021–22. Source: 2022 CCS Institute Status Report.

Energy Advancement Roadmap & Strategy



5- Decarbonization thru Carbon Circular Economy

- KSA has developed and started implementing a comprehensive Carbon Circular Economy initiative with 4 pillars:
 - Reduce
 - Reuse
 - Remove
 - Recycle
- The initiative has transferred the challenge into economic opportunities.
- The G20 Countries have adopted the KSA Carbon Circular Economy initiative.



Energy Advancement Roadmap & Strategy



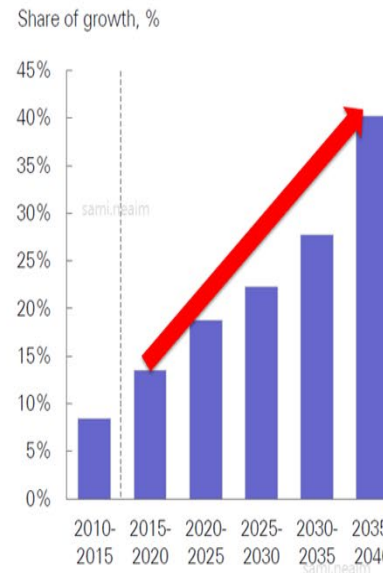
6- Decarbonization thru Crude to Chemicals

- According to a recent (July 2022) report by Market Research Future, this market is estimated to grow at a 7.34% CAGR to reach \$800 Billion by 2030.
- Saudi Aramco is to increase Crude-to-Chemicals up to 50% of the barrel by 2030.

Increasing Crude to Chemicals: Game Changer

By 2040, Non-combusted use of Oil & Gas will increase by 20%+, 2/3 from Oil.

Non-combusted share of total oil & gas consumption growth



2018 BP Energy Outlook

Crude oil to chemicals project moves forward

HOUSTON, Texas, U.S., July 22, 2018

Latest news

Saudi Aramco appoints Khalid H. Al-Dabbagh as senior vice president of Finance, Strategy & Development

SHARJAH, August 16, 2018

Read more >

Camp extends teachers' geology knowledge

HOUSTON, Texas, U.S., August 09, 2018

Read more >

Saudi Aramco, Mazda Motor Corporation and AIST collaborate to develop the

Source: www.saudiaramco.com

Saudi Aramco signed Crude-Chemicals technology agreement and project for 50% conversion rate by 2030.

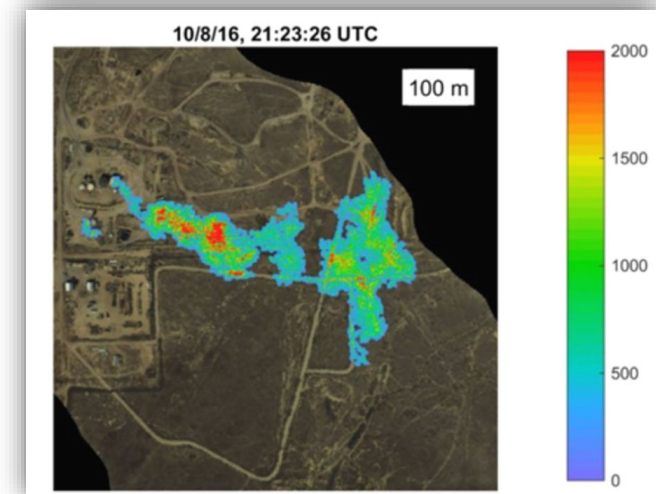
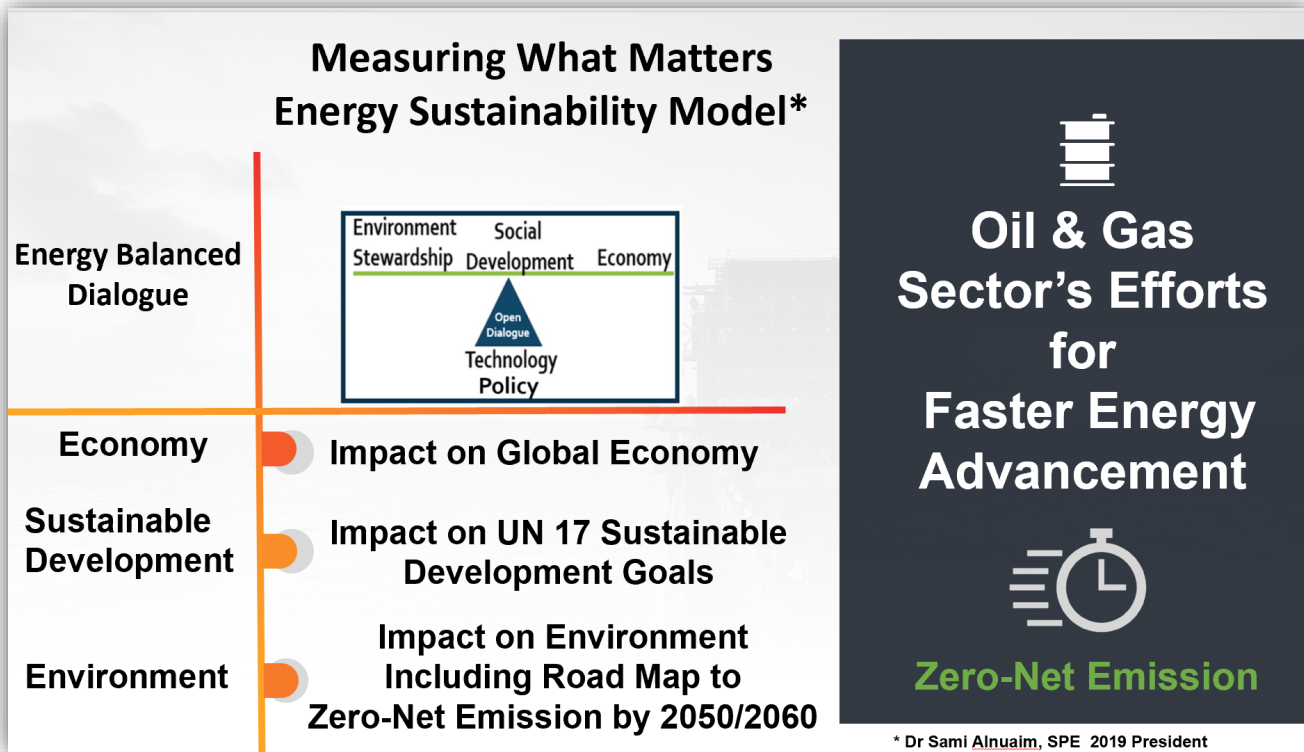
Crude-to-Chemicals projection and some major announcements

Energy Advancement Roadmap & Strategy



7- Decarbonization thru Measuring What Matters

- Detection: Technology, Satellite, Drones, AI.
- Reporting Progress thru live KPIs.



Energy Advancement Sustainability Model (Alnuaim, 2023)

Detecting Gas leak above California by NASA Gas Detectors (Source: Doan Lynn, Bloomberg, Nov 7, 2019).

Energy Advancement Roadmap & Strategy

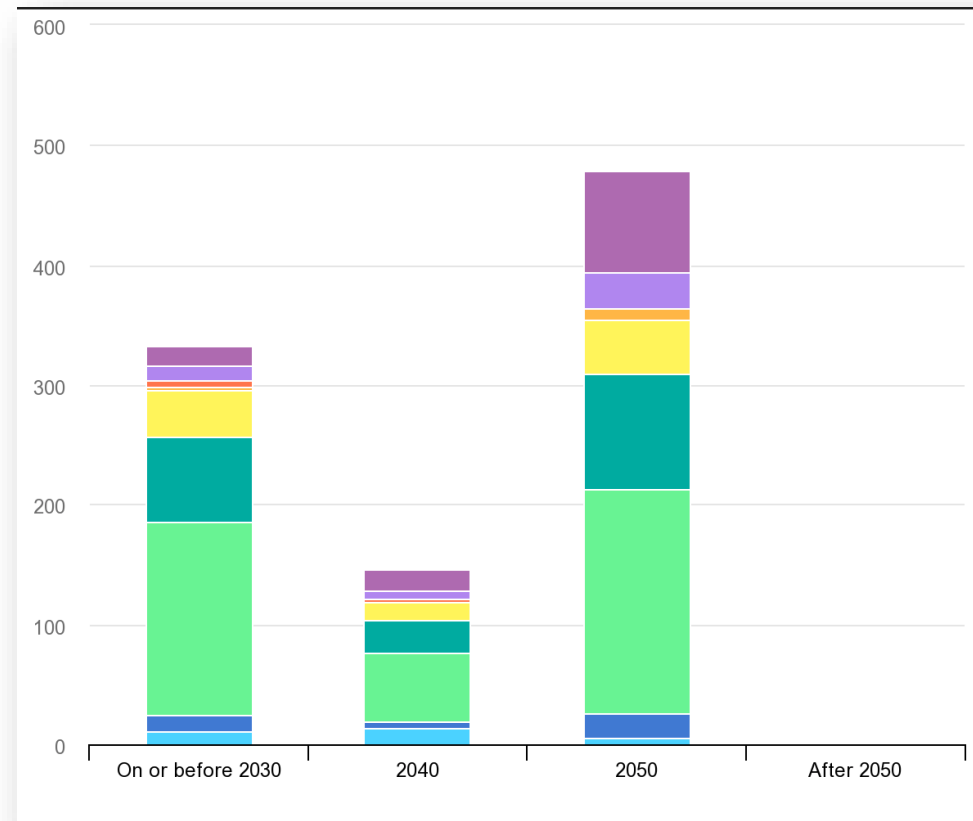


8- Decarbonization thru Commitment towards Net-Zero Emission

Example of Oil Companies:

- Saudi Aramco
- Chevron
- Shell
- ConocoPhillips
- BP
- ExxonMobil
- Equinor
- ADNOC
- TotalEnergies

Number of Companies with Net Zero Targets



Services: ICT Services: Finance Services Manufacturing Chemicals and pharmaceuticals
Cement and non-metallic minerals Construction Mining and metals Fossil fuels and electricity

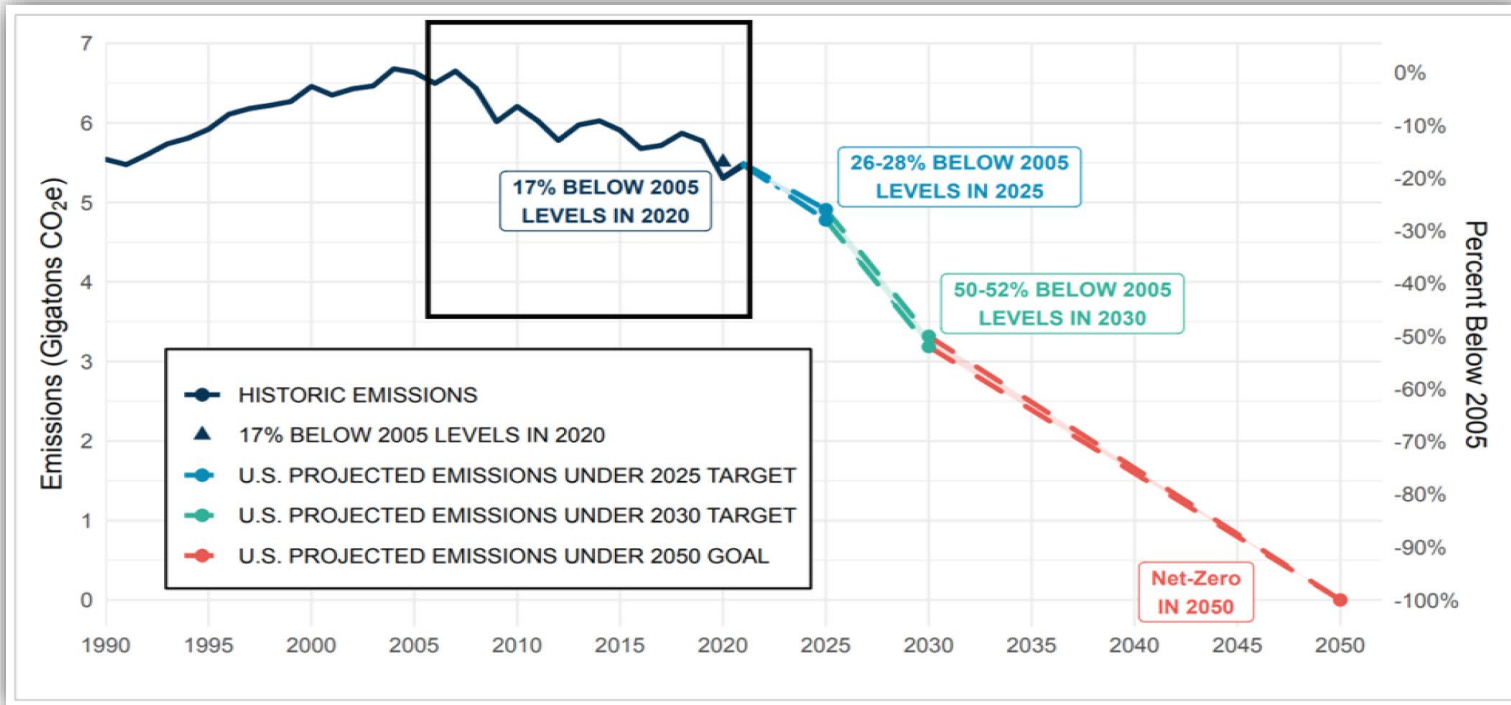
Source: IEA Nov 2022

Energy Advancement Roadmap & Strategy



9- Decarbonization thru Commitment towards Net-Zero Emissions Countries

US Historic & Projected Emission - 2050 Net-Zero



Source: United States Department of State and the United States Executive Office of the President, Washington DC. November 2021

KSA Net Zero CO₂ by 2060

- * National Gas Network
- * Renewables for Power + Shale Gas Development
- * Energy Efficiency Program
- * Carbon Circular Economy
Reduce, Remove, Recycle & Reuse
- * Kingdom Green Initiative
- * Strong R&D Program

Source: Alnuaim 2023

Energy Advancement Roadmap & Strategy



10- Decarbonization thru forestation

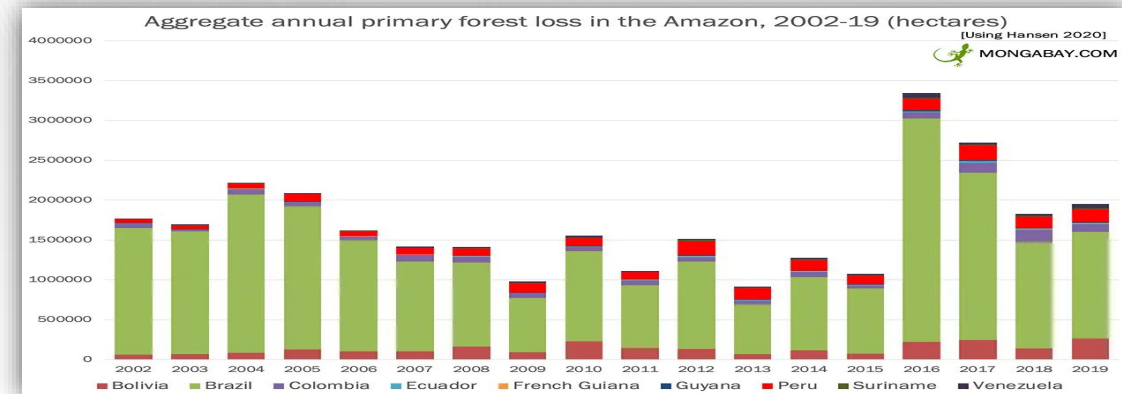
- Kingdom Green Initiative (10 billion tree by 2030).
- The Middle East Green Initiative (50 billion tree by 2030).
- Global rainforest deforestation control (e.g. Brazil Gov promise).



Deforestation impact!

- In less than 10 years, 22 million Trees and 12.9 million hectare were lost in Brazil alone.
- If Tropical deforestation is a country, it would be ranked 3rd in net CO2 emission after China and US (more than EU together).

Source: World Resource Institute



Source: [The Amazon Rainforest \(mongabay.com\)](http://The Amazon Rainforest (mongabay.com))

Energy Advancement Roadmap & Strategy



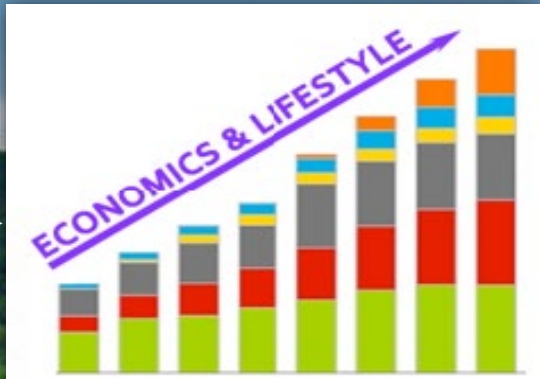
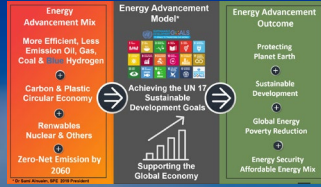
What is needed?

- Large Scale Adoption of this new narrative & deployment of the Energy Decarbonization strategy.
- More R&D investment & efforts including technology transfer to low-income countries.
- Deploying live tracked KPIs of the impact of Energy Advancement narrative on all UN 17 SDGs.
- The use of standard reporting framework such as IPECA.
- CO2 Footprint & International standard tags for all products.
- More accountability on all of us including our social behavior and all emitting industries, including passive industries.
- Finally, all energy forecasted scenarios must map their projected impact on UN 17 SDGs including Energy Poverty.



Energy Advancement

A new Energy Transition Redefinition



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“Cleaner and more balanced/efficient energy portfolio that includes all energy sources with solid environmental accountability, strategized around helping the world becoming more Economically prospered, Sustainably developed and Environmentally protected with near zero energy poverty and net zero Carbon & Methane emission targets (all emitting industries) by 2060”.