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THE ENERGY TRANSITION: EXPECTATIONS AND REALITIES FOR INDUSTRIAL TRANSFORMATION IN AFRICA

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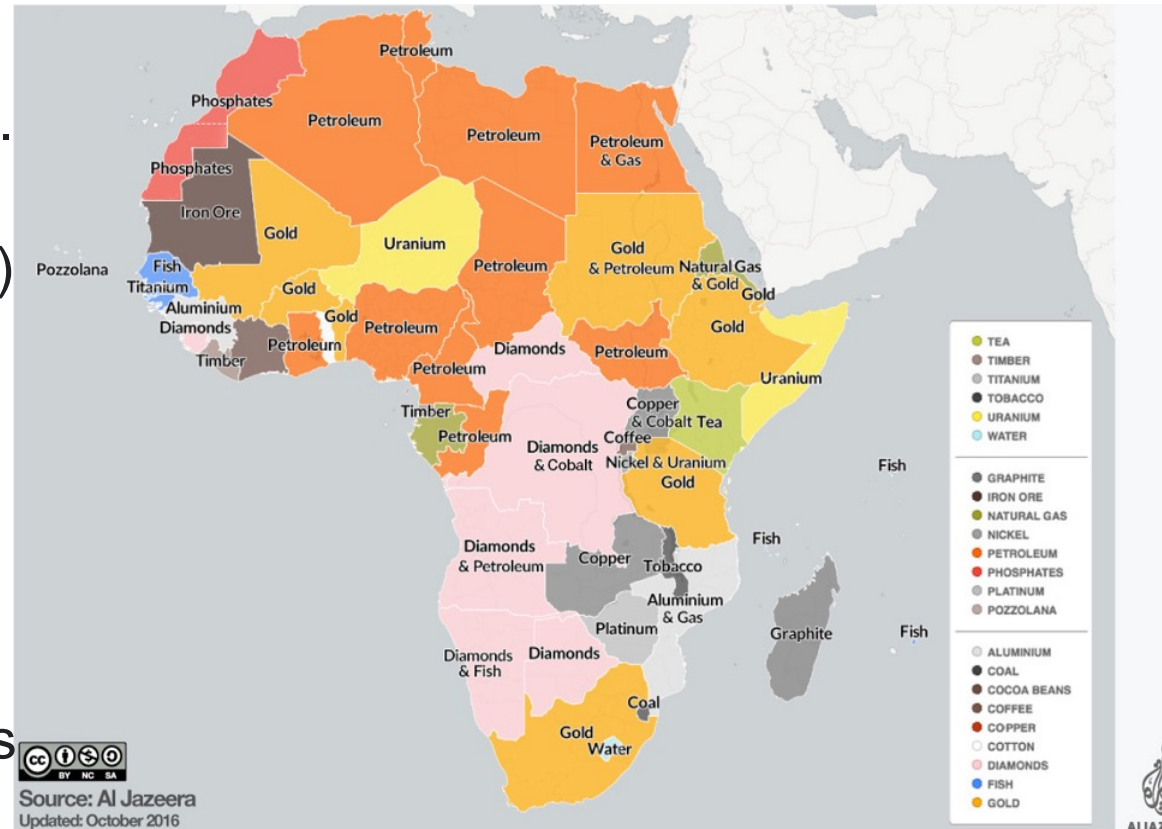
6th June 2023



Natural Resources in Africa

- Diamonds, gold, platinum, copper, cobalt, iron ore, phosphate, bauxite, copper, silicon, titanium among others.
- Very rich agricultural land suitable for all year-round farming (meat and crop) capable of feeding the entire continent and for export.
- The land also produces cash crops - timber, rubber, cotton, coffee, Cocoa tobacco, etc.
- All the energy required for adding value to these resources also abounds on the continent.
 - Hydro, petroleum, natural gas, uranium, coal, biomass and solar

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Energy Resources In Africa

- Africa has all it takes to be self-sufficient in providing sustainable energy for the development of Africa.
- **Hydropower** – has the potential to provides cheap electricity to support industrialization and value addition to our natural resources.
 - Indeed, most industries in Africa have depended on cheap electricity from hydropower – Akosombo Dam (Ghana), Kainji Dam (Nigeria), Aswan Dam (Egypt) among others.
 - Africa has the highest untapped hydropower potential in the world with only 11% utilized compared to 85% in Europe and America.
 - The grand Inga in the DR Congo has the potential to generate 40GW of cheap electricity to support energy access for the entire continent.
 - Yet, the DPs will not support further development of large hydropower plants in Africa.
 - Interestingly DPs Partners most often do not even acknowledge large hydropower as Africa's renewable energy contribution to climate change mitigation.

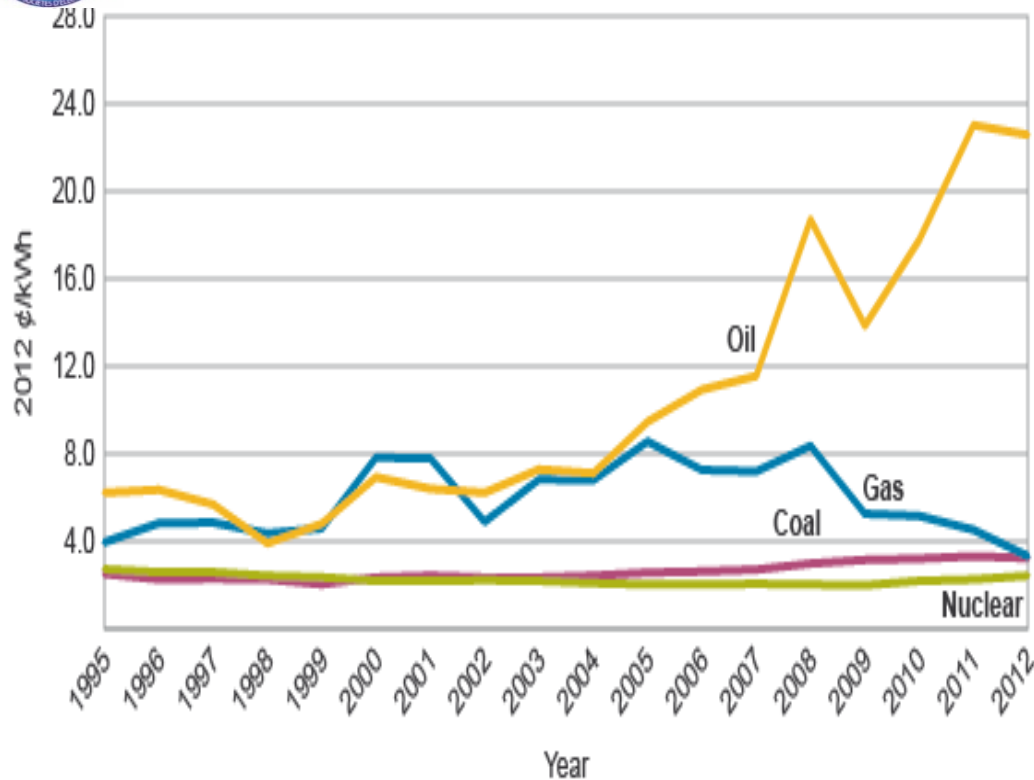


Energy Resources In Africa

- **Natural Gas** resources across Africa is approximately 100 trillion cubic meters which is largely untapped.
 - With the development of the continent's natural gas resource and value chain, adequate energy could be obtained for electricity and heating for industries and household cooking.
 - Production of fertilizer to boost agriculture to eliminate hunger on the continent
- **Uranium** – Africa has adequate uranium to fuel nuclear power plants for providing cheap electricity.
- **Petroleum** – Africa, home to five top 30 oil-producing countries in the world and accounts for more than 7.9 million barrels per day in 2019, which is about **9.6%** of world output. Total crude oil reserves in Africa in 2019 stood at 125.3 billion barrels.
- **Biomass (Woodfuel)** accounts for 61-86% of primary energy consumption in Africa – produced internally and can be made sustainable with modern technologies.



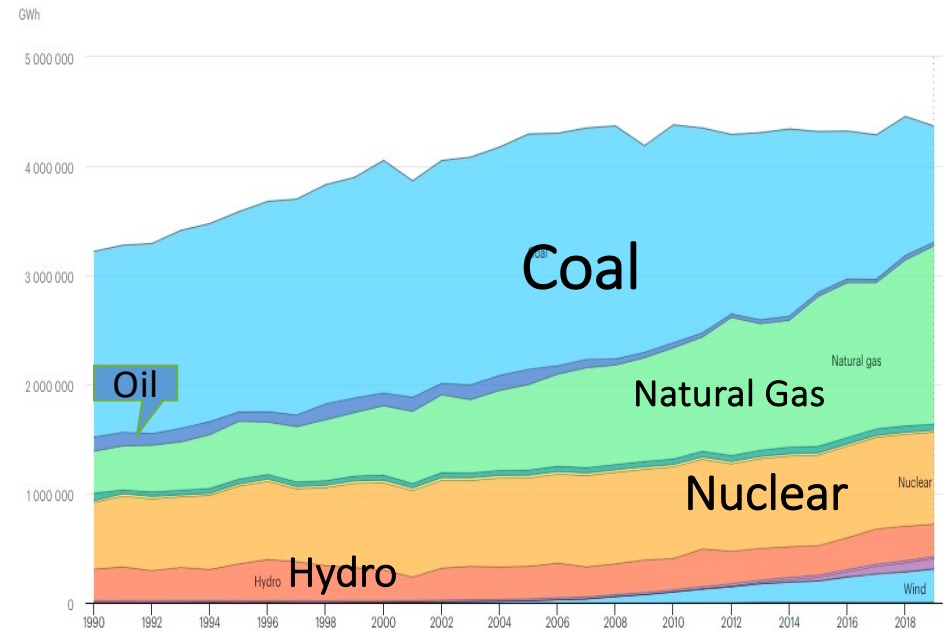
U.S. Electricity Production Costs, 1995-2012



Production costs = operation & maintenance + fuel. (excludes indirect costs and capital)
 Source: Ventyx Velocity Suite / NEI, May 2013

Electricity generation by source, United States 1990-2019

USA



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Coal, Nuclear, Natural Gas and Hydro offers lower electricity production cost

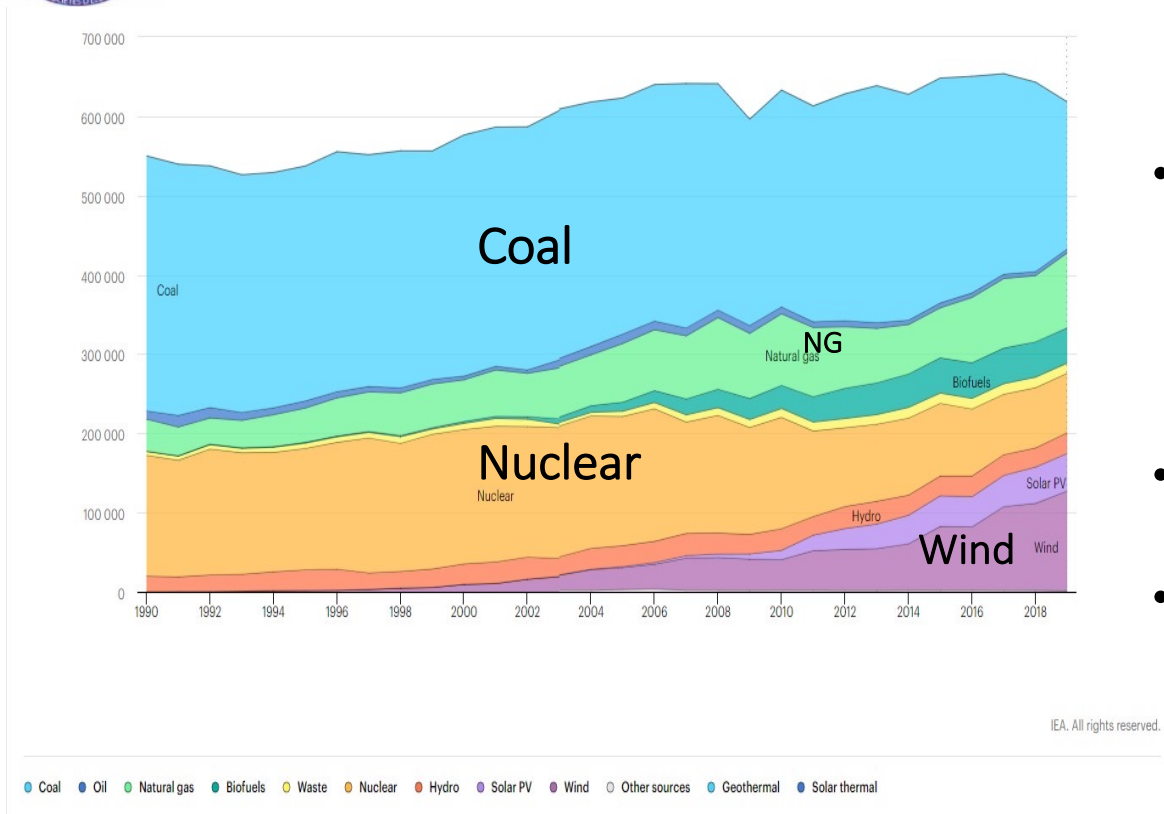
No country can industrialize on the backbone of electricity from Oil

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source, Germany 1990-2018

Electricity Generation in Germany 1990-2018



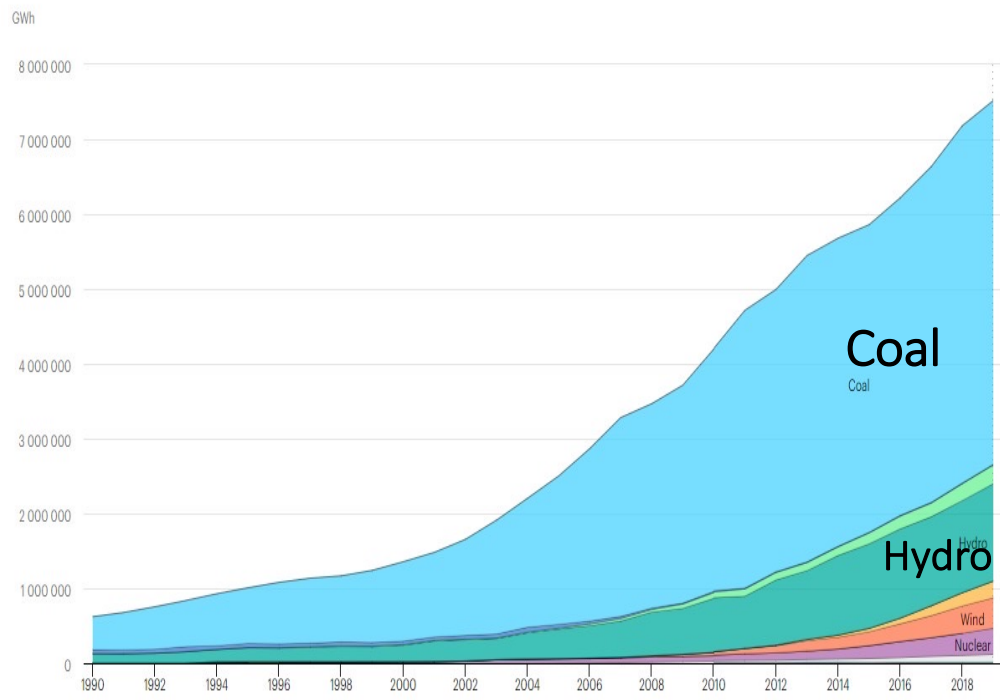
- Germany imports Coal, Uranium and Natural Gas to provide cheap power for industrialization.

- Germany has over the years depended mainly on Coal, Hydro and Nuclear to support industrialization.
- No significant increase in power demand in Germany because most of the power consuming industries have moved to Asia (cheaper electricity and labour)
- Germany took a decision to gradually phase out Nuclear in their energy mix.
- To guarantee energy security, Germany has invested in Natural Gas pipeline from Russia to Germany (Nord Stream 2) and also in under-sea powerline from Norway hydro Power (NordLink).
- Investing in RE sources
- Buy Nuclear power from France.

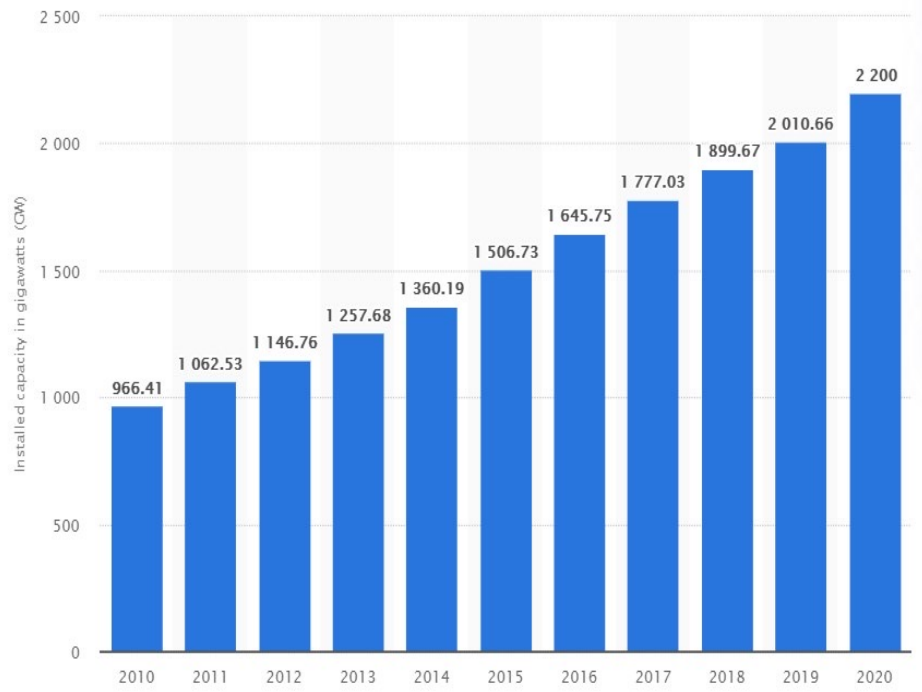


Elect... ple's Republic of China 1990-20...

Electricity Generation in China 1990-2018



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● Coal ● Oil ● Natural gas ● Hydro ● Geothermal ● Solar PV ● Wind ● Tide ● Nuclear ● Biofuels ● Waste ● Solar thermal

China imports Coal and Uranium from Africa to provide cheap power for industrialization and value addition

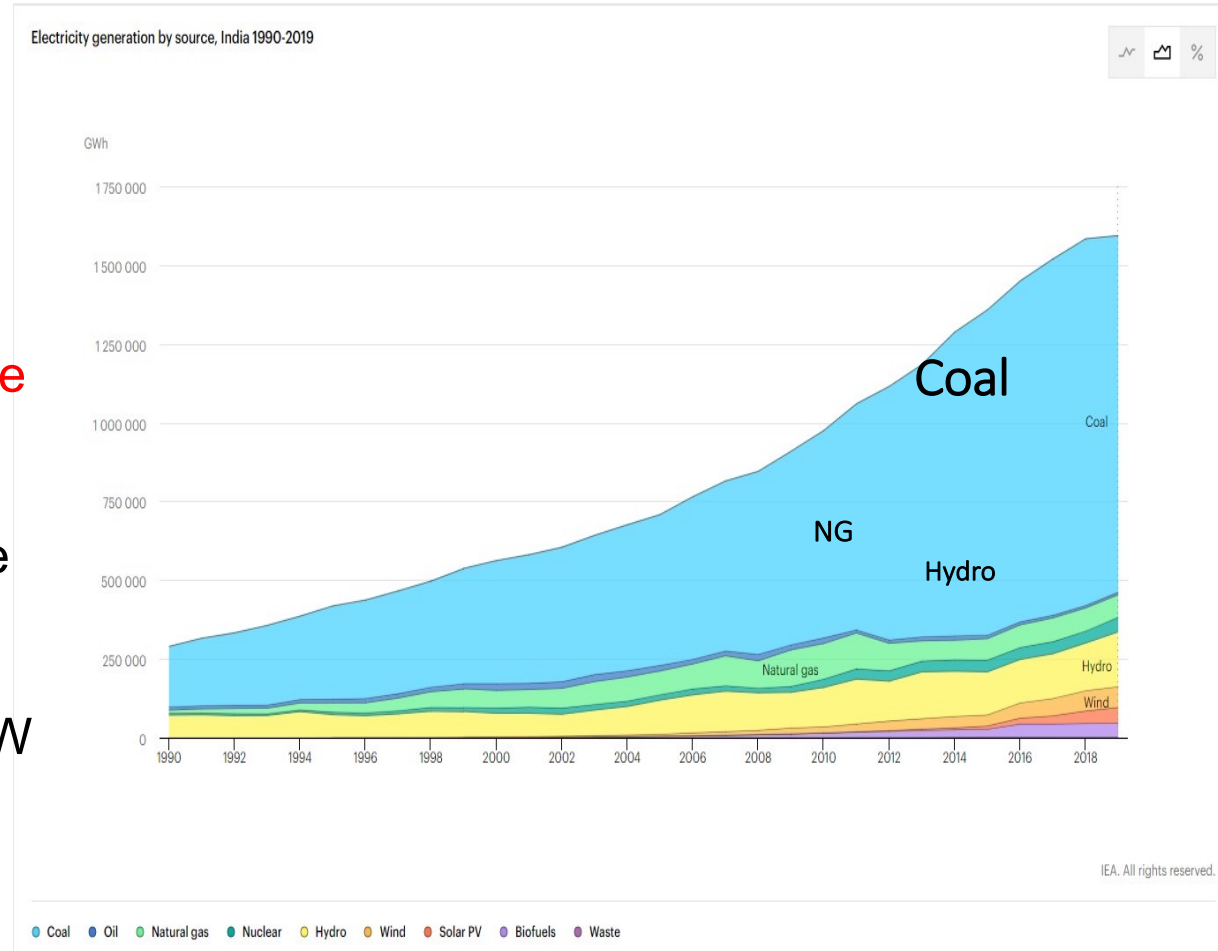
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- Generation increased by more than 1,200% 550TWh in 1990 to 7,500TWh in 2020
- China in 2020 alone added 34.8GW Capacity of Coal power plants
- Nuclear Capacity- 49.6GW, target to achieve 120-150GW by 2030



Electricity Generation in India 1990-2018

- India imports coal from Africa to provide cheap electricity to support industrialization
- Also imports Uranium to provide cheap nuclear power to support value addition
- Power generation increased by more than 600% from 220TWh in 1990 to 1,547TWh by 2018
- 22 operational nuclear plants 6.78GW
- 10 additional nuclear plants with capacity of 8GW under construction

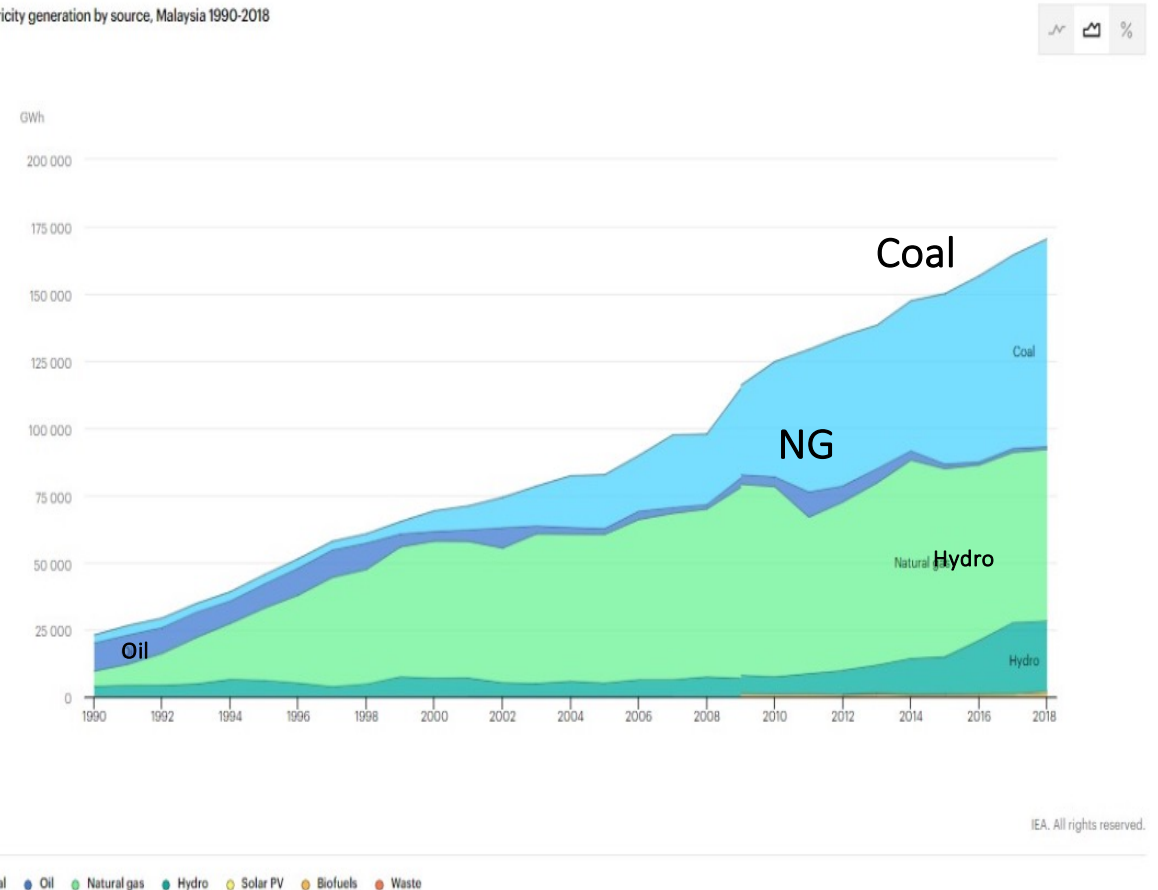




Electricity Generation in Malaysia 1990-2018

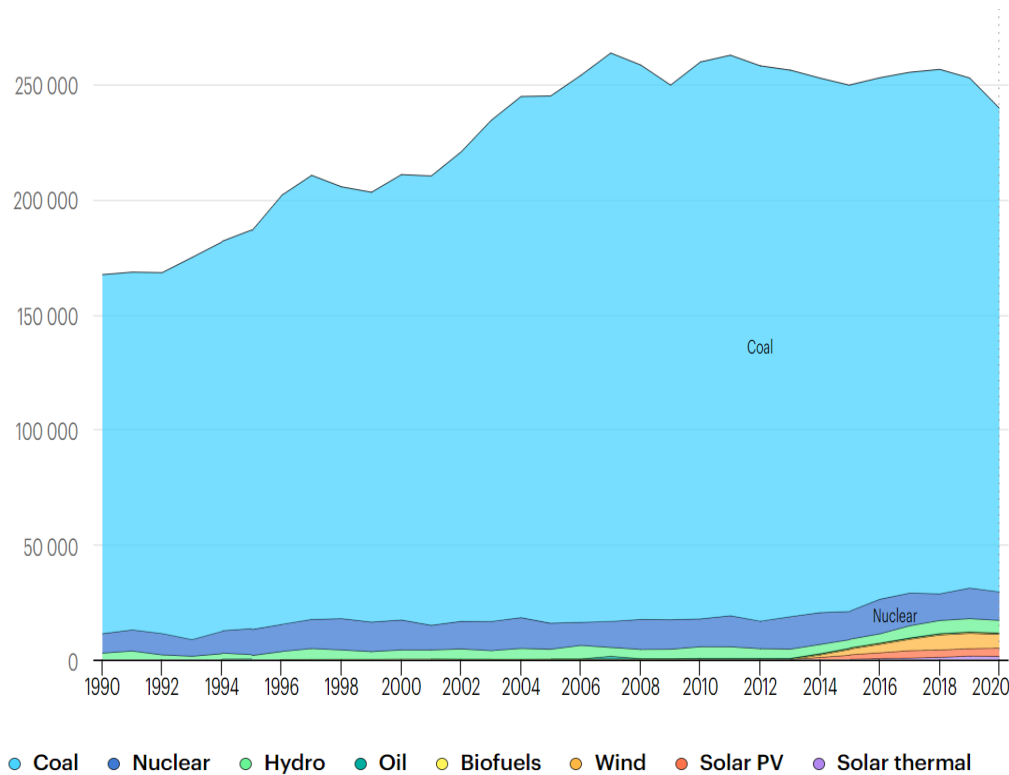
- Malaysia is attracting more industries due to the use of coal and NG to generate cheap power.
- Generation increased by more than 500% from 22.35TWh in 1990 to 147.2TWh in 2018.
- **Malaysia imports most of its coal resources, at least 2% from Africa**

Electricity generation by source, Malaysia 1990-2018





Electricity Generation in South Africa 1990-2018



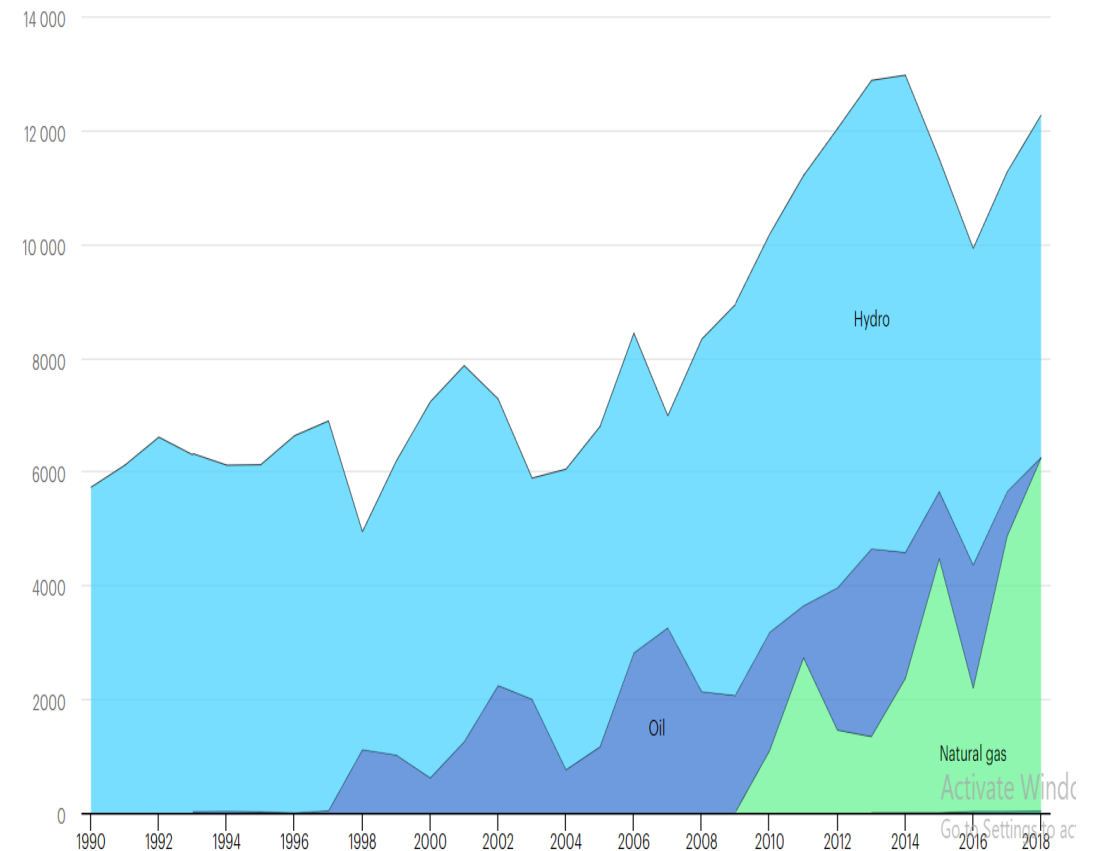
Source: www.iea.org

- South Africa is about the only industrialized country in Sub-Saharan Africa due to the availability of cheap coal and nuclear.
- Generation increased marginally by 43% from 167.2TWh in 1990 to 239.5TWh in 2018
- Unfortunately, since end of apartheid very little effort has been made to increase generation capacity.
- Sadly, there are no aggressive plans to increase generation from coal and nuclear which abounds locally.
- Rather, plan is to increase renewables such as solar and wind and export the coal to other countries to generate cheap power for their industrialization



Electricity Generation in Ghana 1990-2018

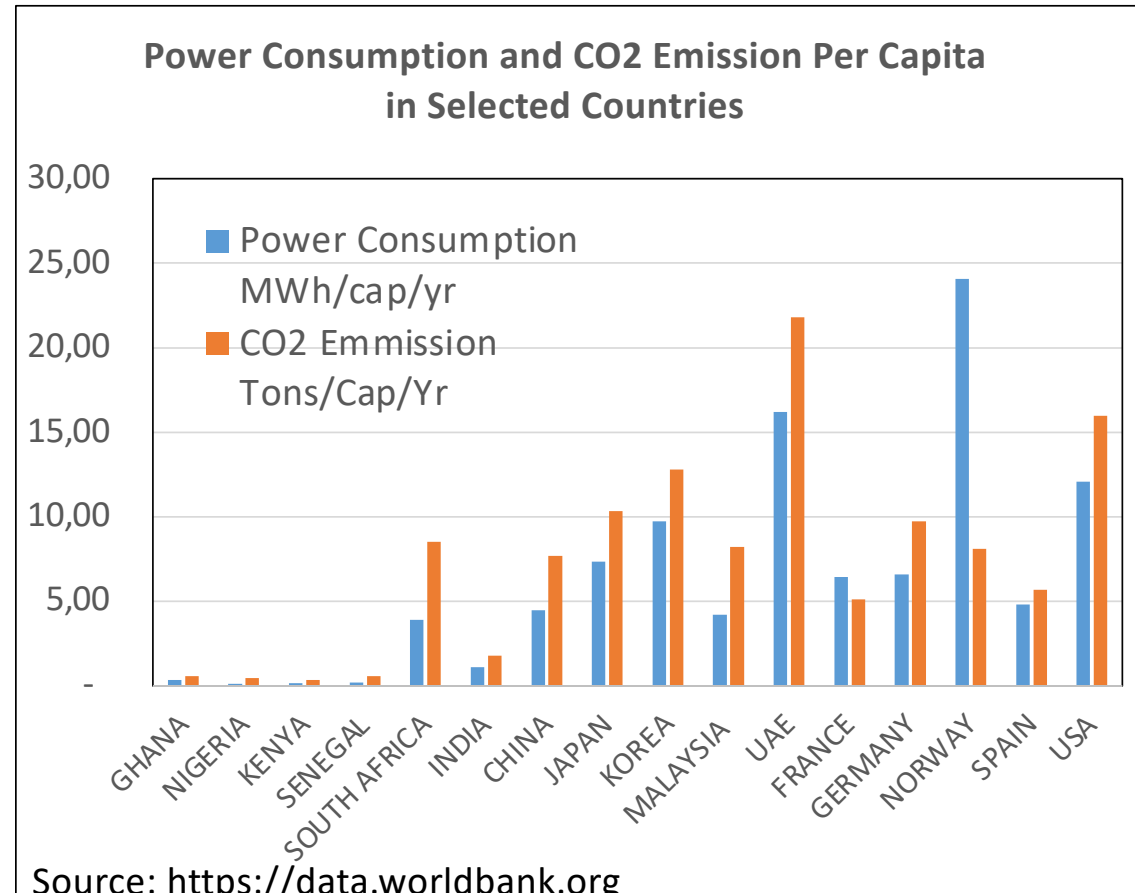
- Ghana's generation increased moderately from 5.7TWh in 1990 to 14.85TWh in 2018.
- Generation has been erratic and depended mainly on the rainfall pattern and cost of oil in the international market.
- The discovery of natural gas saved the situation in ensuring reliable power generation.
- Ghana will still need to diversify to include alternative reliable and affordable generation option to support the country's industrialization agenda



Source: www.iea.org



COUNTRY	Power Consumption MWh/cap/yr	CO2 Emission Tons/Cap/Yr
GHANA	0.34	0.6
NIGERIA	0.13	0.5
KENYA	0.16	0.4
SENEGAL	0.21	0.6
SOUTH AFRICA	3.91	8.5
INDIA	1.11	1.8
CHINA	4.48	7.7
JAPAN	7.37	10.3
KOREA	9.72	12.8
MALAYSIA	4.23	8.2
UAE	16.20	21.8
FRANCE	6.45	5.1
GERMANY	6.60	9.8
NORWAY	24.09	8.1
SPAIN	4.82	5.7
USA	12.07	16.0



Most countries in Africa have very low CO2 emission and very low per capita energy consumption. Meanwhile Africa has abundant natural and mineral resources.



What is the Way Forward for Africa's Industrial Transformation Agenda?

- Most industrialized countries have no resource of their own. They import both our the energy and natural resource to add value and send back to us at a higher price.
- Why will Africa export its crude oil to be refined outside the continent and return to us at a much higher price?
- Why will Africa export its cocoa and coffee beans at a ridiculously low price only to import chocolate and coffee at a much higher price?
- It is about time African countries unite to develop the continent's natural resource and add value to them within the continent.
- Its about time we come together and also follow the same path of the USA, EU, and Asia (India, China among others) by investing in cheaper reliable generation options and at the same time strengthening the regional power pools.
- APUA is therefore a very important vehicle for driving the industrialization agenda of Africa.
- We should not expect any industrialized country to support Africa to industrialize as this has the potential to weaken their economy.



Industry, Climate Change & Energy Transition

- World trade is also shifting towards green markets (commodities produced by industries will have to demonstrate decarbonization efforts).
- Africa's Industries therefore need to strategically position themselves to take advantage of the green energy resource potential in the continent to compete favorably in the green market.
- **This is why Ghana, Bui Power Authority and the VRA are focusing on the deployment of Renewable Energy to support Local Industries for them to compete in the green market.**



Fulfilling the Bui Power Authority's Mandate



404MW Hydropower Plant
Bui Generating Station
(BGS)

45KW Mini Hydropower
Plant at Tsatsadu-VR
(75kW to be added) - TGS



Operational 50MWp Solar Plant
with 200MWp currently under
installation at Bui & Yendi

5.0 MWp Floating Solar on
the Bui Dam







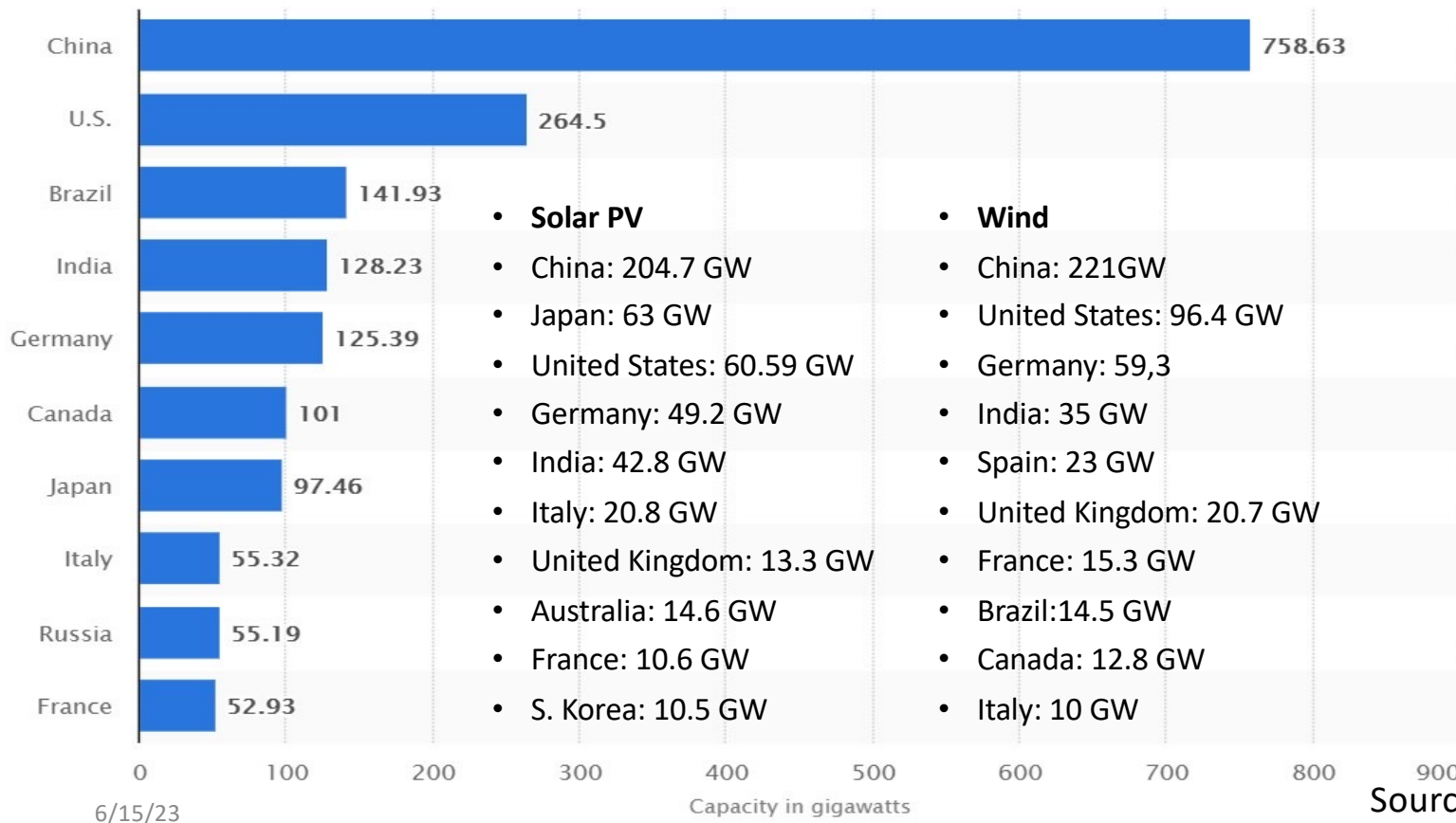
Key Takeaways/ Recommendations

- Africa needs reliable and affordable power to develop and add value to its abundant natural resources
- Natural Gas (NG), Large Scale Hydropower, Clean Coal and Nuclear still remain the most sustainable and relatively cost-competitive power generation option for the sustainable development of Africa, if Africa is to achieve the 17 UN Sustainable Development Goals.
- How to ensure effective utilization of Africa's abundant natural resources for the industrialization of the continent without adverse impact to the environment should therefore be of great concern to APUA.
- Africa needs to follow the examples of China, India and Malaysia to utilize its own energy resources for providing cheaper electricity to drive industries and add value to the abundant natural resources
- No evidence on the dependence of variable Renewable Energy sources such as solar, wind or tidal electricity to support industrialization without first having adequate baseload power from Coal, Natural Gas, Hydro or Nuclear.
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Leading Countries in Installed Renewable Energy Capacity

Worldwide relied on Coal, Nuclear and NG as baseload



Nuclear Power

1. United States – 98.2GW
2. France – 63.1GW
3. China – 47.5GW
4. Japan – 32GW
5. Russia – 28.5GW
6. South Korea – 23.2GW
7. Canada – 13.6GW
8. Ukraine – 13.1GW
9. United Kingdom – 8.9GW
10. Sweden – 7.7GW

Source: Statista 2021 / IRENA₁₈

Conclusions

Energy transition in Africa should be focused on Industrial transformation which is key to the attainment of the 17 UN Sustainable Development Goals





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Global Energy Interconnection
Development and Cooperation Organization
全球能源互联网发展合作组织



THANK YOU

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