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# The Pros and Cons of Ban on Coal Energy: Way Out for Africa

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## Abstract

Coal usage has contributed immensely to evolution of general manufacturing, iron and steel production, power generation, railways and other industries. Apart from its usage in the industries, coal mining is also an important source of income for many countries. The call for world transition from coal to renewable energy has been on for some times in the past. This is because coal is considered one of the most green-house-gas intensive sources of electricity. This paper, therefore, investigates the pros and cons of banning coal as a source of energy generation. The data used in this study were mostly sourced from the literature. The study reveals that China, the United States, India, Russia, Japan, Germany, South Africa, South Korea, Indonesia and Poland are the top ten top countries in the world using coal energy. The findings also show that the cons outweigh the pros. It is recommended that African countries whose main source of energy generation is from coal should endeavour to reduce its environmental impact through coal liquefaction and gradual phase-out of coal fired plants.

**Keywords:** Ban, coal, energy.

## I. INTRODUCTION

The human-caused (anthropogenic) changes to the climate have been attributed to Greenhouse gas (GHG) emissions. Global GHG emissions sources are usually attributed to five broad sectors, characterised by the Intergovernmental Panel on Climate Change (IPCC) Working Group III (WG3) as energy systems, industry, buildings, transport, and AFOLU (agriculture, forestry and other land uses). Most of the emissions are from carbon dioxide from burning fossil fuels: coal, oil, and natural gas. Electricity generation and transport are major emitters, the largest single source being coal-fired power stations with 20% of GHG. Deforestation and other changes in land use also emit carbon dioxide and methane [1],[2].

The United Nations Framework Convention on Climate Change (UNFCCC) established an international environmental treaty to combat “dangerous human interference” with the climate system, by 2022 the UNFCCC had 198 parties. Its supreme decision-making body, the Conference of the Parties (COP), meets annually to assess progress in dealing with climate change [3].

The treaty established different responsibilities for three categories of signatory states, which are developed countries, developed countries with special financial responsibilities, and developing countries. The developed countries, who are members of Organisation for Economic Co-operation and Development (OECD) also called Annex I countries, originally consisted of 38 states, 13 of which were Eastern European states in transition to democracy and market economies, and the European Union [1].

It was recognized that Annex I nations had produced most of the GHG emissions, and therefore were responsible for taking the first steps in reducing emissions. Annex I countries are called upon to adopt national policies and take corresponding measures on the mitigation of climate change by limiting their anthropogenic emissions of GHG as well as to report on steps adopted with the aim of returning individually or jointly to their 1990 emissions levels. The developed countries with special financial responsibilities are also called Annex II countries. They include all the Annex I countries with the exception of those in transition to democracy and market economies. Annex II countries are called upon to provide new and additional financial resources to meet the costs incurred by developing countries in complying with their obligation to produce national inventories of their emissions by sources and their removals by sinks for all greenhouse gases not controlled by the Montreal Protocol. The developing countries are then required to submit their inventories to the UNFCCC Secretariat [4].

Because key signatory states are not adhering to their individual commitments, the UNFCCC has been criticized as being unsuccessful in reducing the emission of carbon dioxide since its adoption [5]. For example, in 2009, the Chinese government maintained that coal would remain its major energy source despite the impact on global warming [4].

Coal is carbon-rich mineral that has been used to generate electricity in the US and other developed nations since the 1800s [6]. Coal being a major industrial and residential fuel in some countries, currently produces roughly 27% of the world’s energy, second only to crude oil, and is the largest single source of electricity (~41%). Globally, enough reserves are available to last more than a century, with nearly half the known reserves in the US, China and India. These countries have large projected increases in energy demand over coming decades. Coal-fired power plants are currently among the least expensive power source in cost to generators per kWh of electricity. Hence there are enormous economic and socio-political incentives to expanded construction of coal-fired power plants. However, emissions from coal-fired plants have substantial impacts on both air quality and climate change. The potential risks associated with Coal-fired power plants are emission of carbon dioxide (CO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), a precursor of fine particulate and acid rain, nitrogen oxides (NO<sub>x</sub>, which is NO+NO<sub>2</sub>), gases influencing tropospheric ozone and methane as well as particulate, in addition to producing other pollutants such as mercury and solid waste [4] [7] [8] [9].

Figure 1 shows the world population forecast between 2022 and 2100. It is projected that Africa will witness a tremendous population growth which implies that there will be increase in energy consumption. The continent, therefore, needs to strategise on ways of increasing electricity generation and distribution. This, however, must be achieved with serious consideration for environmental sustainability.

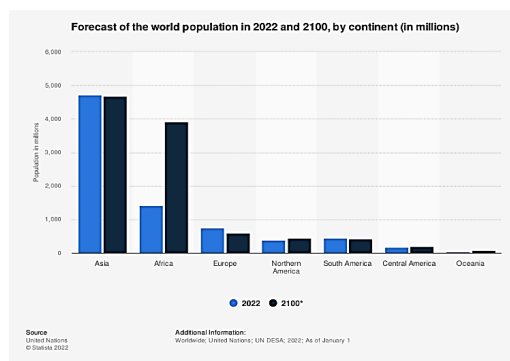


Figure 1: Forecast of the world population in 2022 and 2100 by continent (in millions)

Figure 2 shows electricity consumption by country for the year 2022. It is obvious that African continent is far behind in terms of electricity consumption. The reason can be attributed to inadequate power supply and low level of industrialization.

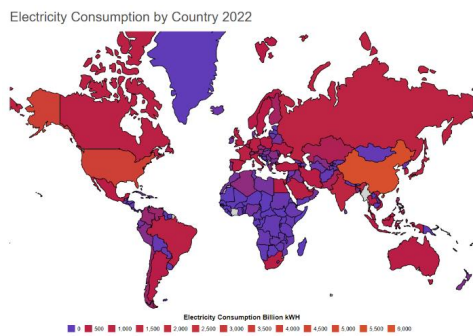


Figure 2: Electricity consumption by country for the year 2022

## II. METHODOLOGY

The data used in this research were sourced from online data repositories such as ourworldindata, Statista, worldometers, worldpopulationreview and published articles. The first set of data is on global CO<sub>2</sub> emission from industries and fossil fuel. The second set of data captures global CO<sub>2</sub> emission from coal. The dataset on coal consumption by country is from worldometers.

## III. RESULTS

### Global CO<sub>2</sub> emission from industries and fossil fuel

Figure 3 shows the global CO<sub>2</sub> emission from the seven continents: Africa, Antarctica, Asia, Australia, Europe, North America and South America between 1750 and 2020. The figure revealed that Asia, Europe and North America have the highest CO<sub>2</sub> emission with peak values of 20608,592 million tonnes, 8015,589 million tonnes, and 7376,088 million tonnes respectively. Africa, Antarctica, Australia, and South America have peak CO<sub>2</sub> emission of 1408,479 million tonnes, 1230,511 million tonnes, 416,001 and 0,015 million tonnes respectively. It is worth noting that the emission from Antarctica is negligible when compared with other continents. This is reason is that it is the only continent with no permanent human habitation.

Figure 4 shows countries with highest CO<sub>2</sub> Emission from fossil fuels and industry. It is evident from the figure that China, United States, European Union, India and Russia are on top, while Brazil, South Africa and United Kingdom follow.

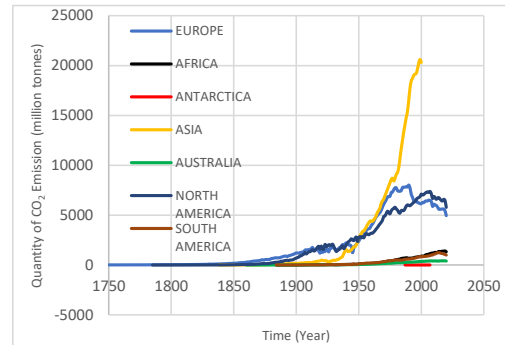


Figure 3: Global CO<sub>2</sub> emission by continents from industry and fossil fuel

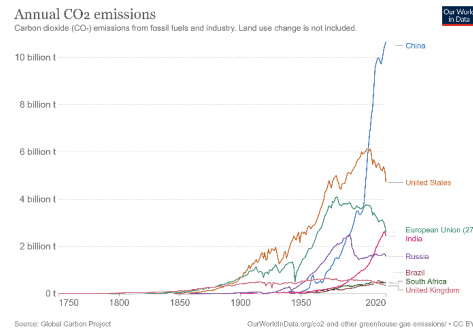


Figure 4: Global CO<sub>2</sub> emission by counties with highest emission

Figure 5 shows the comparison in level of CO<sub>2</sub> emission per person in the year 2005 and 2020. It is observed from the figure that there is reduction in the CO<sub>2</sub> emission across the continent except for Asia.

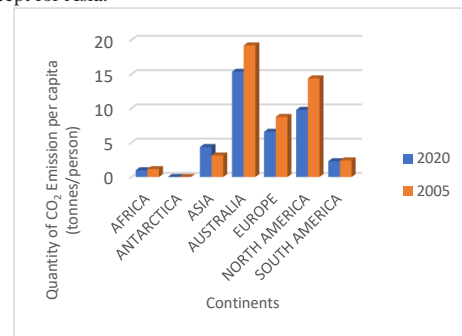


Figure 5: Global CO<sub>2</sub> Emission per capita compared between 2005 and 2020

Figure 6 presents the global CO<sub>2</sub> emission per capita for all the continents. As may be observed from Figure 6, it seems obvious

that the world's most populous countries and highest overall energy consumers would also use the largest amount of coal. However, when broken down into per capita usage (Figure 6), which divides the total usage by the number of people living in the country, the list of most coal-dependent countries changes significantly. Figure 6 revealed that Australia, Europe and North America have the highest CO<sub>2</sub> emission with peak values per capita.

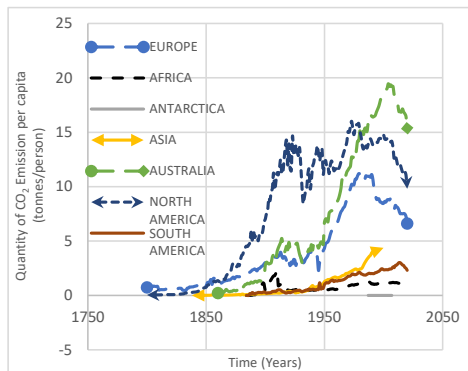


Figure 6: Global CO<sub>2</sub> Emission Per Capita

**Global CO<sub>2</sub> emission from coal**

Out of the fifty countries with the highest electricity consumption, only three African countries are on the list, with South Africa 21 (207.10 Billion kWh), Egypt 23 (159.70 Billion kWh) and Algeria (55.96 Billion kWh) having 21st, 23rd and 46th positions respectively. Table 1 shows the ten countries with the highest coal consumption. Numbers are expressed in Million cubic feet (MMcf). Not all these countries depend on coal for electricity generation.

Table 1: Ten countries with the highest coal consumption

S/N	Countries	Coal Consumption (MMcf)	Countries	Per Capita Coal Consumption (MMcf)
1	China	4,320	Australia	5,343
2	India	966	Bulgaria	4,927
3	United States	731	Serbia	4,878
4	Germany	257	Kazakhstan	4,858
5	Russia	230	Czech Republic	4,654
6	Japan	210	New Caledonia	4,213
7	South Africa	202	Poland	3,917
8	South Korea	157	South Africa	3,599
9	Poland	149	Greece	3,587
10	Australia	130	Germany	3,133

Figure 7 presents countries, indicating their coal utilization for electricity generation. It is obvious from the figure that China, United States and India are in the forefront. Following them are Japan, Germany, Russia, South Africa and so on.

Electricity generation from coal, 2021

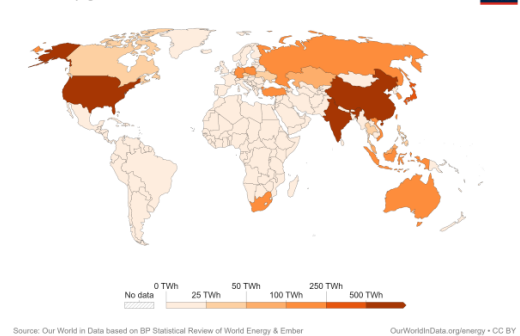


Figure 7: Electricity generation from coal

Aside using coal for generation of electricity, coal has been used for centuries to cook food, heat homes and businesses, fuel furnaces and forges, power the steam engines of locomotives and ships, and more. Figure 8 shows coal consumption by countries.

Coal Consumption by Country 2022

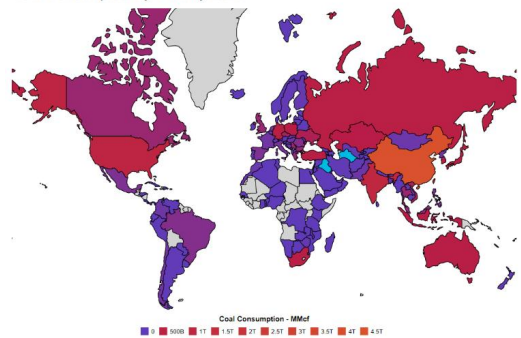


Figure 8: Coal consumption by countries.[10]

Coal has been termed "dirtiest" of the fossil fuels, known to release significant amounts of greenhouse gases and other air pollutants when burned. Figure 9 shows the global CO<sub>2</sub> emission from coal by continent while Figure 10 shows emission by country. This trend is not different from the one described for global CO<sub>2</sub> emission from industry and fossil fuel

Also, the trend of the global CO<sub>2</sub> emission from coal per capita (Figure11) is like the one observed for global CO<sub>2</sub> emission from industry and fossil fuel.

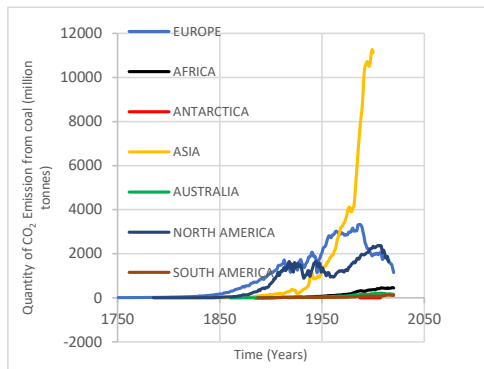


Figure 9: Global CO<sub>2</sub> Emission from coal by continent

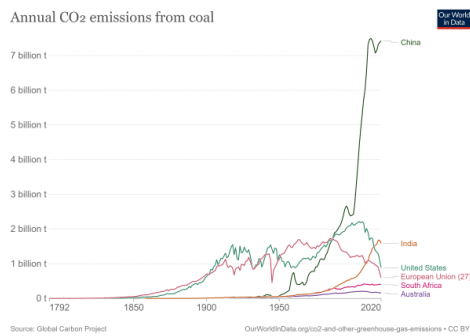


Figure 10: Global CO<sub>2</sub> Emission from coal by countries

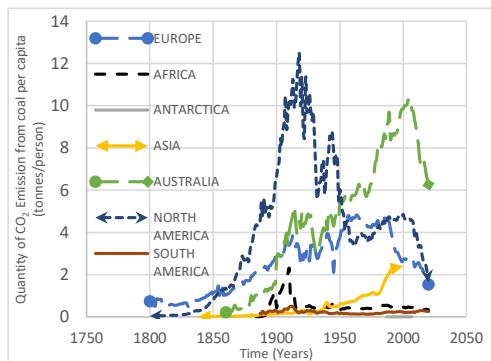


Figure 11: Global CO<sub>2</sub> Emission from coal per capita

When will countries phase out coal power?

Based on the significant contribution of coal power to greenhouse gases and other air pollutants, the question that comes to mind is “When will countries phase out coal power?”

Climate experts calculate that the use of coal, primarily in power plants generating electricity, is responsible for 30% of all global warming. Data such as this has prompted the majority of the world's countries to attend international meetings such as the 2021 COP26 climate summit in Glasgow, Scotland, and pledge to reduce their coal use as part of a global shift toward cleaner energy. Figure12 presents the map of countries that have pledged to phase out coal power at specified dates, while Figure 13 shows the distribution of existing, closing, planned and under construction power plant across the globe.

When will countries phase out coal power?  
 This measures pledges to phase out coal from the electricity mix.

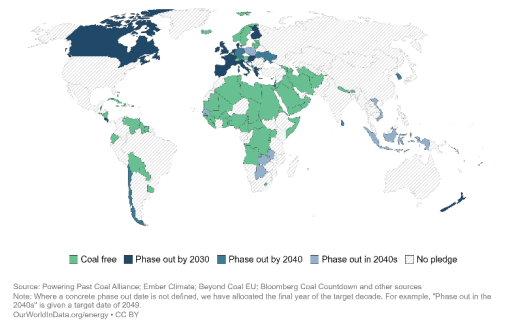


Figure 12 Plan to phase out power plant across the globe.

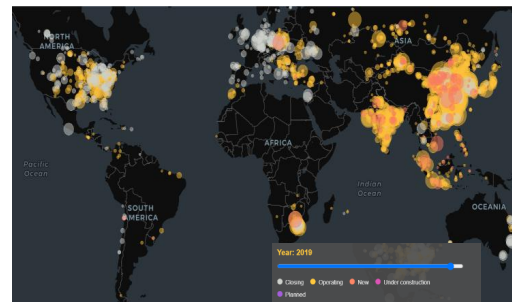


Figure 13 Distribution of power plant across the globe

Source: IndexMundi.com: Electricity - Consumption - Country Comparison

#### IV. CONCLUSION

The human-caused (anthropogenic) changes to the climate have been attributed to Greenhouse gas emissions. It is important to limit generation of Greenhouse gas emissions in order to counter its side effect such as extreme weather, food supply disruptions, and increased wildfires, global warming and so on. It is important for the African countries to have a strategic plan to achieve alternative renewable energy as replacement for the coal energy utilization.

#### REFERENCE

- [1] Heede, Richard. (2014). Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854–2010. *Climatic Change*. 122. 10.1007/s10584-013-0986-y.
- [2] Lamb, William & Wiedmann, Thomas & Pongratz, Julia & Andrew, Robbie & Crippa, Monica & Olivier, Jos & Wiedenhofer, Dominik & Mattioli, Giulio & Al Khourajie, Alaa & House, Jo & Pachauri, Shonali & Figueroa, Maria & Saheb, Yamina & Slade, Raphael & Klaus, Hubacek & Sun, Laixiang & Ribeiro, Suzana & Khennas, Smail & Can, Stephane & Minx, Jan. (2021). A review of trends and drivers of greenhouse gas emissions by sector from 1990 to 2018. *Environmental Research Letters*. 16. 10.1088/1748-9326/abee4e.
- [3] R. Stavins, J. Zou, et al., "International Cooperation: Agreements and Instruments." Archived 29 September 2014 at the Wayback Machine Chapter 13 in: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, 2014.
- [4] Shindell, D. & G, Faluvegi. (2009). The net climate impact of coal-fired power plant emissions. *Atmospheric Chemistry and Physics Discussions*. 10. 10.5194/acp-10-3247-2010.)
- [5] Schiermeier, Quirin (2012). "The Kyoto Protocol: Hot air". *Nature*. 491 (7426): 656–658. Bibcode:2012 Natur.491..656S. doi:10.1038/491656a. PMID 23192127. S2CID 4401151]
- [6] National Research Council of the National Academies 2010 *Hidden Cost of Energy Unpriced consequences of energy production and use* Washington DC USA the national academies press.
- [7] Mittal, M. L., Sharma, C., & Singh, R. (2012, August). Estimates of emissions from coal fired thermal power plants in India. In 2012 International emission inventory conference (pp.13-16).2.
- [8] Giuliano, S., Buck, R., & Eguiguren, S. (2011). Analysis of solar-thermal power plants with thermal energy storage and solar-hybrid operation strategy. *Journal of Solar Energy Engineering*, 133(3).3.
- [9] Nazari, S., Shahhoseini, O., Sohrabi-Kashani, A., Davari, S., Paydar, R., & Delavar-Moghadam, Z.(2010). Experimental determination and analysis of CO<sub>2</sub>, SO<sub>2</sub> and NO<sub>x</sub> emission factors in Iran's thermal power plants. *Energy*, 35(7), 2992-2998
- [10] Hannah Ritchie, Max Roser and Pablo Rosado (2020) - "CO<sub>2</sub> and Greenhouse Gas Emissions". Published online at OurWorldInData.org. Retrieved from: <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions> [Online Resource]