Nigeria's Energy Decision

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Objective

Explain the need for Nigeria to transform the country to a Renewable energy-based economy.

Our Interest

Sustainability is an important topic to us. Climate change is a major issue that directly affects all of us and will have a significant impact on how we live our lives and the health of the planet. We have the potential to mitigate the harm of carbon emissions, but only by acting now can we minimize the damages. We must redirect our energy economy away from non-renewable fossil fuels as soon as possible. For this reason, we chose to study and make recommendations to a developing country in the stage to tackle this issue and help shape the future of this planet.

Why Nigeria?

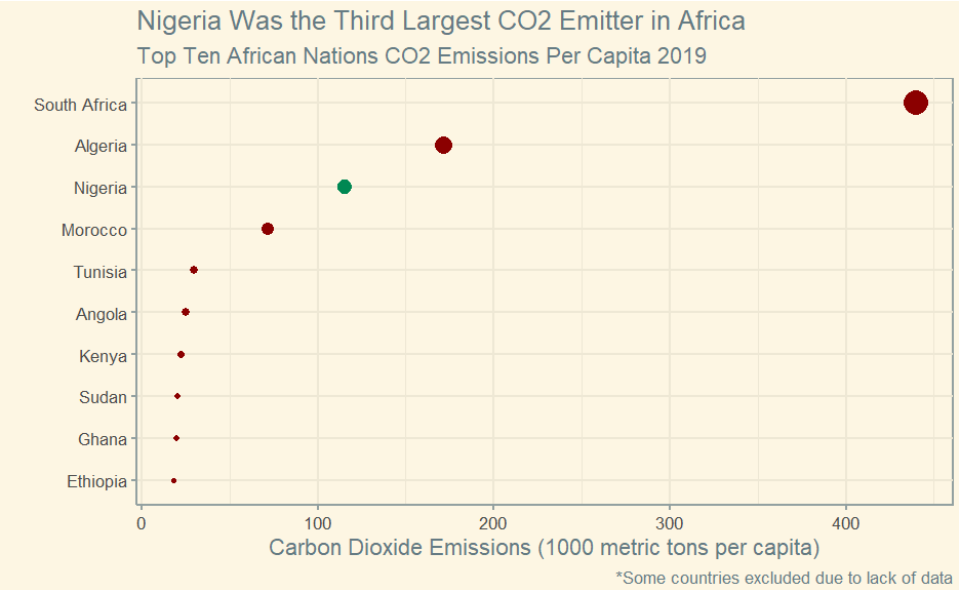
Nigeria currently is the largest country on the African continent. By 2050, it is projected to grow to 377 million people, the third largest population on the planet, surpassing even the United States. Currently, most energy is generated by individual homes or businesses, depending on diesel generators, which release significant emissions and pose health hazards to the local population. Nigeria is currently the largest economy in Africa, which is only expected to continue rapid growth over the next few decades. Besides an outlier year in 2020, the country's economy has maintained a steady ~3% growth rate per year and is projected to continue. It currently produces a significant share of energy, owing to its large oil, coal, and natural gas deposits, yet still suffers an energy crisis, failing to provide enough energy for a constant supply of electricity to all its 225 million residents. These rates are unacceptable, especially if Nigeria plans to lead the continent into the future. Now Nigeria must decide which sources to invest in, fossil fuels or renewable energy sources.

The African Continent is at a Crossroads

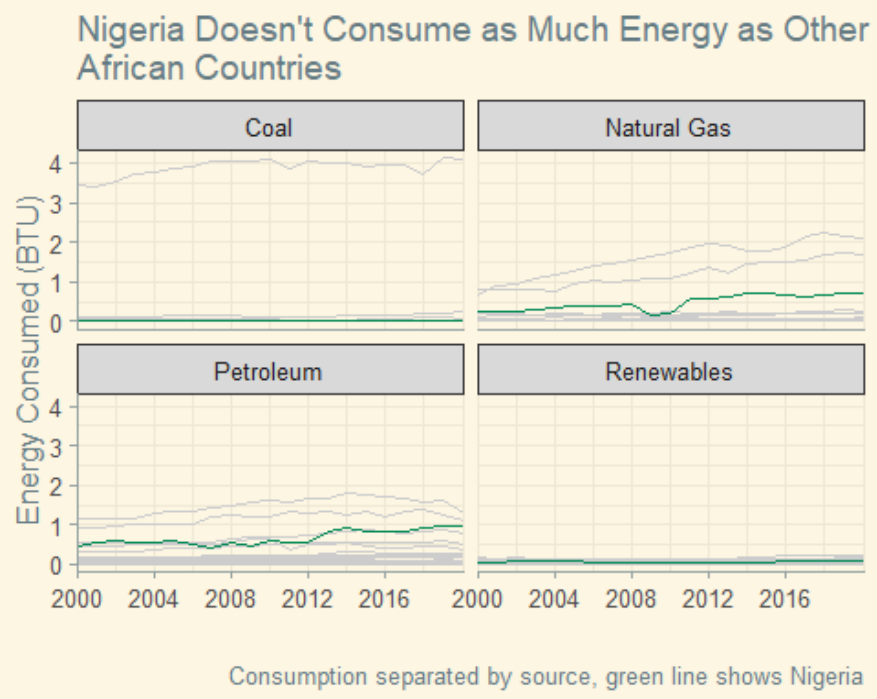
As the continent develops further, it could follow in the path of more developed continents (Asia, Europe, North America), using fossil fuels as the backbone of its energy economy, or it could strive a new path forward focusing solely on renewable sources.

#	Continent	Population (2023)	Area (Km²)	Density (P/Km²)	World Population Share
1	Asia	**4,753,079,726**	31,033,131	153	59.08%
2	Africa	**1,460,481,772**	29,648,481	49	18.15%
3	Europe	**740,433,713**	22,134,710	33	9.20%
4	North America	**604,182,517**	21,330,000	28	7.51%
5	South America	**439,719,009**	17,461,112	25	5.47%
6	Australia/Oceania	**46,004,866**	8,486,460	5	0.57%
7	Antarctica	**0**	13,720,000	0	0.00%

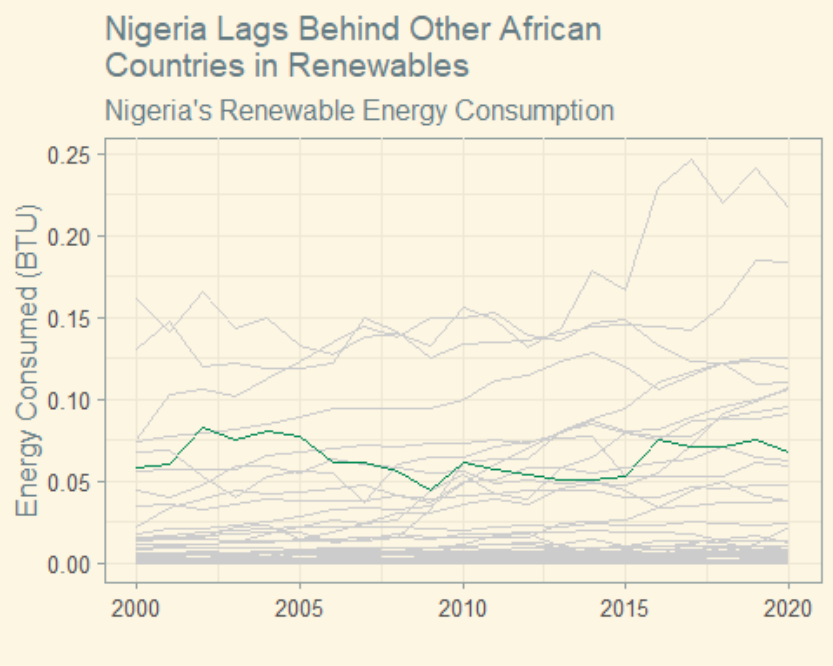
Currently, Africa's population is the seconds largest, about twice that of Europe, and more than twice North America's. Emissions per capita are low, due to the developing nature of the continent, but that is set to change as time continues. Because the infrastructure has not been fully established, now is the time to get ahead of the curve and commit to a sustainable future.



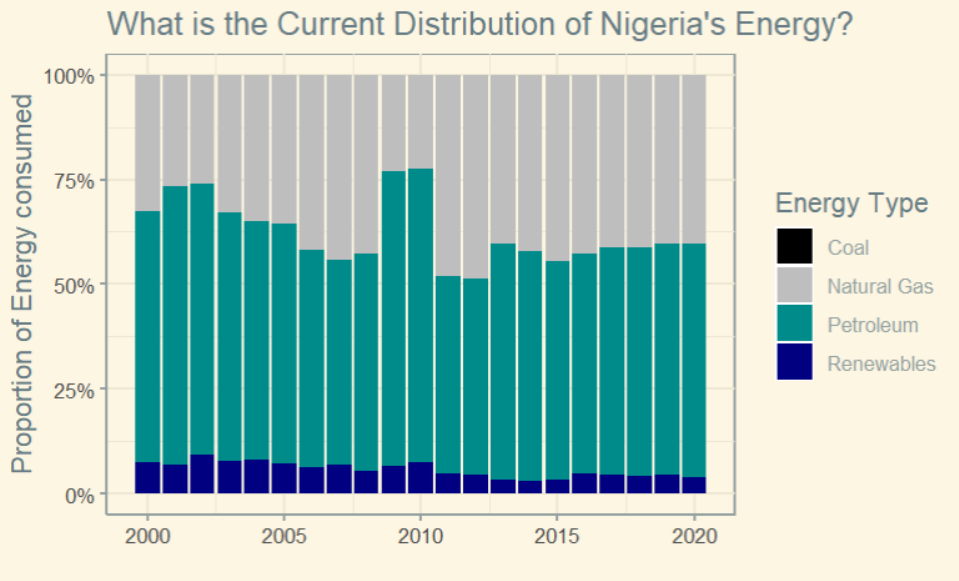
Nigeria currently is the third highest CO2 emitter per capita on the African continent, behind South Africa and Algeria. This puts it in a good position to curb emissions before they get out of hand.



Let's zoom in on Nigeria's Renewable energy consumption.



Now, Nigeria is behind on its Renewable energy consumption. It has not changed much over the past 20 years, helping contribute to the energy crisis. It is time to invest in new renewable sources to combat this deficiency.



Nigeria uses little renewables in its energy distribution. These trends have remained the same over the past 20 years.

Nigeria stands at a critical turning point

Now serves as a pivotal point in the trajectory of Nigeria's status and position in the future of the African continent. The country can continue its large-scale use of non-renewable energy sources, or it can anticipate the future landscape by aiming towards a renewable future. By acting now, Nigeria can place itself as the forefront leader in the charge against climate change for the betterment of its residents. If Nigeria is to become an African leader, it must demonstrate its commitment to changing its energy economy which starts with a change now.

In 2023, the International Renewable Energy Agency (IRENA) in collaboration with the Energy Commission of Nigeria released the Renewable Energy Roadmap Nigeria, a report about the current state and the future developmental blueprint of the future of the country. The report offers a long-term roadmap for the future of the country, though achieving this will be difficult and require immense focus and discipline. Our findings corroborate the conclusions of the report. By following this path, Nigeria will establish its leadership role and create a healthy living environment for its residents.

How should Nigeria implement this goal?

Nigeria is home to a large desert in its northern territory. This land is not widely inhabited, leaving a large area suitable for solar farms. Solar farms generate significant clean energy from a renewable source, with minimal environmental impact. Currently, Egypt has built one of the largest solar farms in the world in its desert region, the Benban Solar Park. This solar farm provides energy for over a million Egyptian households, reducing carbon emissions by 2 million tons each year. Nigeria can replicate this in its vast desert, building large solar farms to provide significant sustainable energy across the country. Solar panels generate a large amount of energy with a low physical footprint, unlike other forms of sustainable energy such as wind turbines, which require a large amount of space to work properly. While initially expensive to install, solar panels have low maintenance costs and quickly recover costs in energy savings. The large amount of sunlight in the desert makes it a great location for this type of energy generation. The materials used in solar panel manufacturing process can be difficult to obtain requiring mining which is damaging to the local environments. Despite this, the benefits of solar farms outweigh their negative impacts.

The Benban Solar Park in Benban, Egypt

Another lesser-known source of sustainable energy generation is Wave Energy Converters (WEC). WECs convert the surface motion of ocean waves directly into energy. WECs are relatively new, and not as widespread as other renewables, but there is a wide variety of WECs in different stages of development. Surface attenuators consist of multiple segments connected in a line, oriented parallel to incoming waves. They rise and fall with the motion of the surface waves, converting this motion into energy. These can be placed close to shore

or far out, depending on the need, and transfer the energy back to land through underwater pipelines.

Surface Attenuator off the Coast of Portugal

Another type of WEC, the Oscillating water column, uses pressurized air in a chamber, forced through an air turbine by the surface wave motion. As water recedes from the chamber, the vacuum left pulls air through, generating energy with a rotary generator. WECs use little space in a wide-open area, the middle of the ocean, leading to minimal environmental damage. Still marine life can be harmed from collision to these structures. Noise pollution is created by these devices which can disrupt the local ecology as well. Nevertheless, WECs are a safe new form of renewable energy generation with the potential to have large scale benefits to the energy economy. Nigeria has 850 KM of coastline extending about 200 nautical miles outward as their exclusive economic zone where they could install WECs.

Oscillating Water Column off the Coast of New South Wales, Australia

Other forms of renewable energy such as wind or geothermal could be used, but they all possess significant environmental downsides. As such, we recommend the use of Solar and Wave Energy for Nigeria's energy economy transformation.

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