ISS | AFRICAN FUTURES

Energy

Towards a viable Africa Energy Policy

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Last updated 03 May 2024 using IFs v8.18

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Briefly

Africa needs to transition rapidly to non-fossil fuels, become more energy efficient, and aggressively reduce carbon emissions. We discuss each below and present the results as an Africa Energy Policy scenario reflecting Africa's energy production and demand on the Current Path forecast. Then, we model a high-growth Sustainable Africa scenario. Forecasts on carbon emissions are discussed in the climate theme.

Reductions in fossil fuel production and use

To meet the challenges of the Paris Agreement to limit global average temperature rise to below 2°C above pre-industrial levels and to pursue ambitious efforts to limit it to 1.5°C, we turn to the UNEP 2023 Production Gap Report[1]: "Phasing down or phasing up?". The report highlights that under the current government plans and projections, a global 'Production Gap' is likely to grow wider out to 2050. This gap shows that governments plan to produce around 110% more fossil fuels in 2030 than would be consistent with limiting global warming to the ambitious 1.5^{O}C target, translating into 69% more fossil fuel emissions that would be considered compatible with limiting global warming to 2^{O}C. UNEP notes that the world only had a 14% chance of limiting warming to 1.5^{O}C. And that fully implementing efforts implied by unconditional national commitments would put the world on track to 2.9^{O}C. There is a large gap, the authors warn, between the fossil fuel production that is being planned and pursued and the Paris Agreement's global warming limits pointing to the need of drastic change.

To keep the 1.5^{O}C ambition alive, fossil fuel use must decline dramatically and other key mitigation and sequestration efforts must increase exponentially. The Production Gap report recommends that the world aim for a near-total phase-out of coal production and use by 2040 and reduce oil by three-quarters by 2050 compared to 2020 volumes. Africa will undoubtedly require significantly more energy in the future, but two caveats are important in considering the contributions from fossil fuels.

The first is that government revenues from fossil fuel production projects are often grossly overestimated in the pre-production process. The reasons vary and include the complex tax avoidance schemes that typically accompany such large-scale private investors (through, for example, the establishment of special purpose vehicles in tax havens such as Dubai) to avoid withholding taxes on dividends and interest. Thus a recent study of 12 African countries which exploited oil and gas resources between 2001 and 2020 found that revenue forecasts were exaggerated by an average of 63%.[2] Our work on the future of Mozambique which has some of the largest gas reserves in Africa, confirms the extent to which the subsequent government revenue streams will only realise several decades in the future and then at modest levels with little trickle-down effects - unless the government of Mozambique implements appropriate policies to avoid the Dutch disease effect and to ensure inclusive development benefits..

The second caveat is the damage associated with the Dutch disease (over-reliance on a single commodity for export revenues). The negative effect is well documented and briefly discussed in the Current Path theme. Instead of economic

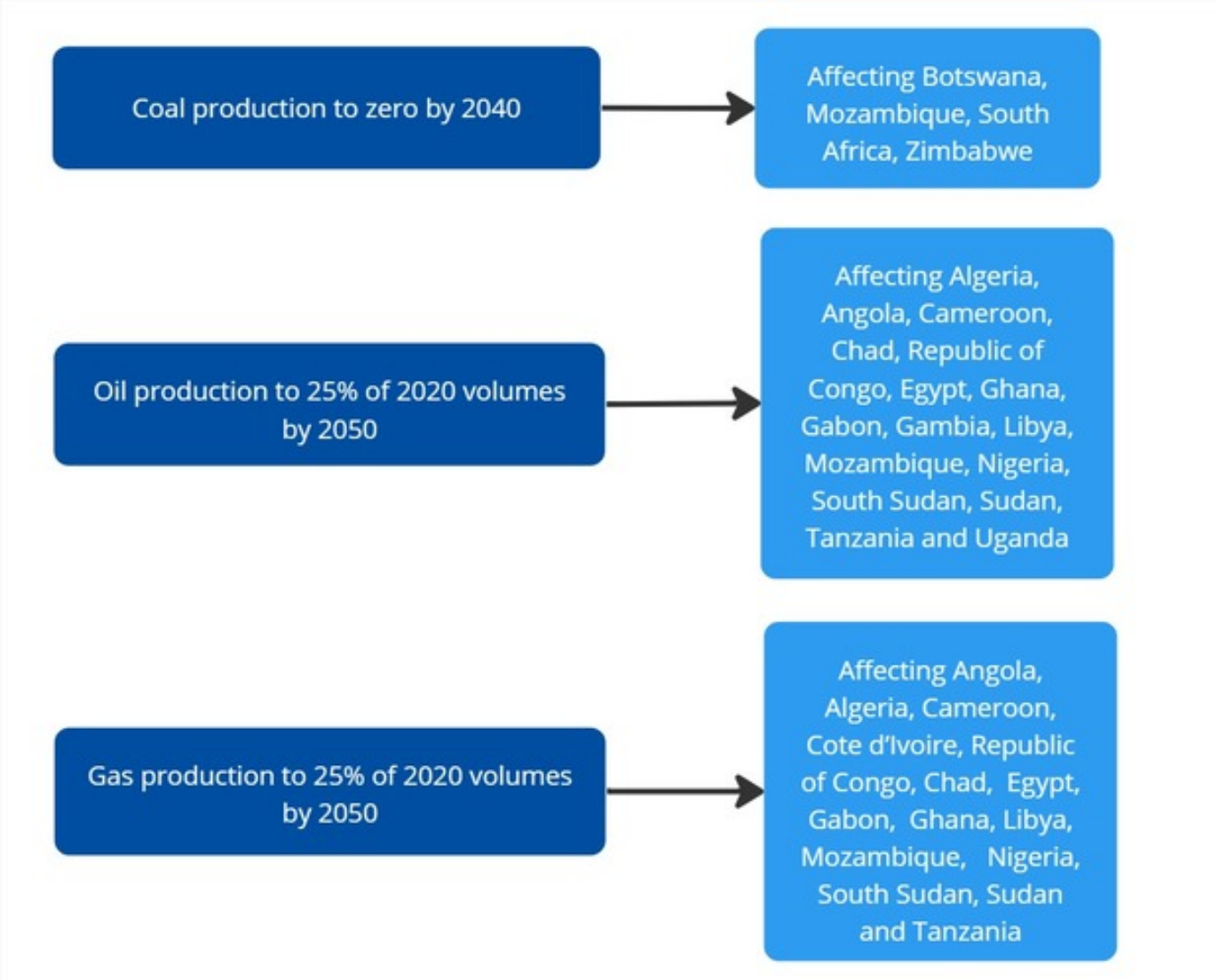
diversification, more African countries are becoming single-commodity dependent and hence trapped in a low-growth future, vulnerable to swings in commodity prices and global disruptions.

However, in considering these caveats, it is also important to recognize the opportunity that fossil fuel exploration projects offer to a continent that otherwise attracts limited foreign direct investment. Although trends are changing, the resource extraction sector (mining, oil and gas), attracts the bulk of Africa's FDI, implying that pressure to avoid these sectors amongst foreign investors could have a significant detrimental impact on a continent in dire need of capital.

The realisation of the Production Gap goals set out by UNEP is ambitious. According to the Current Path forecast, coal will still account for 18% of global energy production in 2040 (equivalent to 21.3 BBOE). By 2050, oil would account for 22% (equivalent to 30.2 BBOE) and gas for 29% (equivalent to 38.6 BBOE) of production. Therefore, the transition proposed by the Production Gap Report requires that 63% of global energy production in 2050 shift from coal, oil and gas to other energy sources, equivalent to 87 BBOE.

To explore the impact of the UNEP production gap targets on Africa, we undertook a separate sensitivity study to examine the impact of these reductions on the affected African fossil fuel producers.

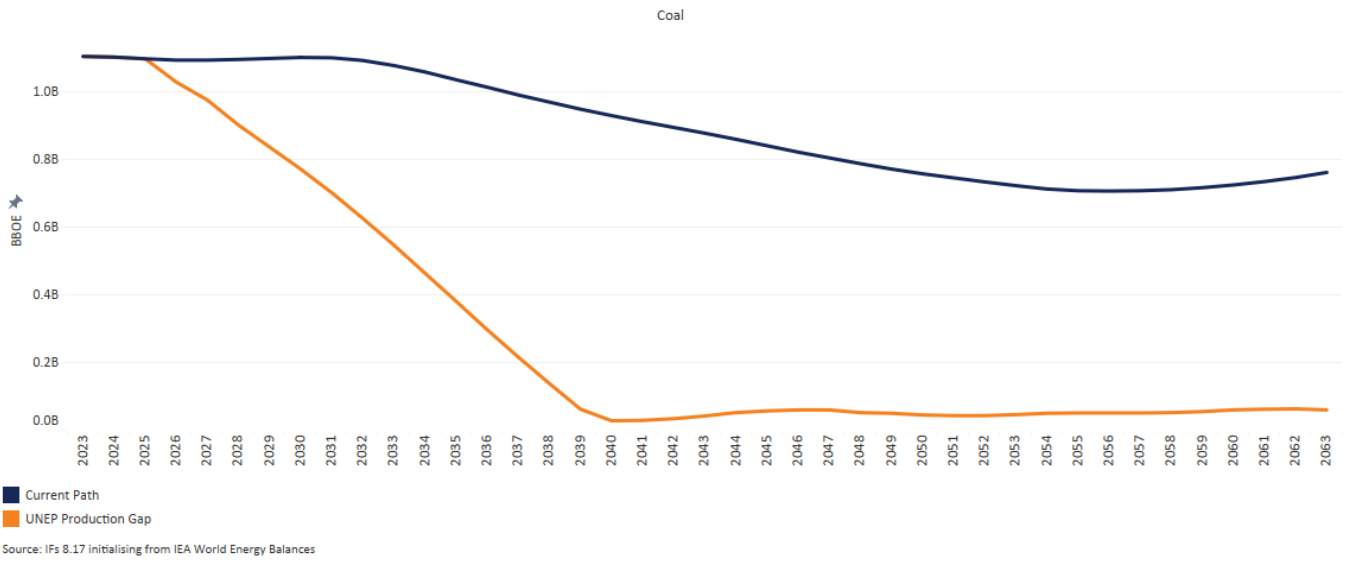
Chart 7: African countries affected by the UNEP Global Production Gap recommendations



The results are reflected in Chart 8, which compares energy production by type in the Current Path forecast with the UNEP

Production Gap recommendations.[3]

Chart 8: Energy production by type in Africa, Current Path vs implementation of UNEP Production Gap recommendations, 2023-2063



Source: IFs 8.17 initialising from IEA World Energy Balances

Africa's total energy production in 2023 was equivalent to 6.3 BBOE. Implementing the UNEP recommendations implies that Africa's total energy production, much of which is currently exported, will decline to 4.9 BBOE (instead of 10.9 BBOE) in 2050. The continent would produce 6 BBOE less energy than in the Current Path forecast.

Implementing the UNEP recommendations will require African countries to pay US$231.3 billion more for energy imports in 2050 while Africa's energy export earnings will decline by US$214.4 billion - a total difference of US$446 billion. The effects will be disproportionate on the twenty or so fossil fuel producers. Some of the effects include a deterioration in the current account balances and increased debt, but, in time, the result is a more productive and diversified economic structure that is not affected by the ills associated with single commodity dependence. After an initial painful adjustment period (lower energy exports, higher energy imports), total African export value in 2050 will be slightly higher and imports slightly lower (by about 2% in both instances).

Increased non-fossil energy production

To compensate for reduced fossil fuel production, Africa has to increase non-fossil energy production.

According to a 2023 report from the IEA, a tripling of energy production from renewables by 2030 is "technically and economically feasible", but requires significant policy and investment changes.[4] These ambitions were affirmed at COP28 later that year which agreed to target to triple renewable energy capacity to at least 11 000 GW by 2030, is now within reach with more rapid progress in China. African governments have already more than tripled public investment in renewable electricity, up to US$47.0 billion from US$13.4 billion the previous decade. Many African countries have also set ambitious targets for renewable energy development, typically 30% in 2030, although often from a shallow base. Some, such as Kenya and Cape Verde, aspire to 100%. Others, such as Mozambique, Rwanda and Eswatini, aspire to around 60%.

The reasoning for more rapid decreases in the costs of other renewables follows findings from the International Renewable Energy Agency (IRENA) that renewable energy costs have steadily fallen for years. Between 2021 and 2022, for example, the global weighted average cost of electricity from new onshore wind projects dropped by 5% and solar PV by 3%. These trends will likely continue, driven by technological advancements, economies of scale and competitive market

dynamics. IRENA projects that by 2050, the cost of electricity from utility-scale solar PV could fall by as much as 80% compared to 2020 levels, while onshore wind could see a cost decline of 50%.

The IEA Africa Energy Outlook 2022 report projects that under ambitious policy interventions and significant investments, Africa could see over 80% of new power generation capacity coming from renewables by 2030.

In their World Renewables Outlook 2023 report, IRENA estimates that Africa could achieve a renewable energy capacity of 750 GW by 2030, representing a four-fold increase from the current capacity of roughly 180 GW. However, the increase comes from a shallow base.

In 2023, the contribution from renewables only constituted 106 MBOE (or 1.7% of total energy production) and was set to increase to 266 MBOE in 2030, i.e. by a factor of 2.5.

Nuclear will likely also play an important role in Africa's energy future. For the first time since the annual climate summits commenced in 1995, the 198 signatory countries to the UN Framework Convention on Climate Change (UNFCCC) officially included nuclear energy to help achieve deep and rapid decarbonisation at the COP28 meeting in Dubai in December 2023. The inclusion of nuclear and a separate declaration by more than 22 countries to advance the aspirational goal of tripling nuclear power capacity by 2050, on top of statements by the IAEA and the nuclear industry, underscored a new momentum for this sector and its potential contribution to clean energy.

The enthusiasm for nuclear energy follows future technological developments nearing production-level maturity. Micor, small and medium-scale modular reactors (MMRs, and SMRs)[5] that are factory-built and standardised could eventually benefit from economies of scale, with simplified design, fuel efficiency, reduced nuclear waste management costs and hence faster deployments and lower construction costs with the potential to be ratcheted up or down to help balance the grid alongside surging renewable output in a decade or so. Larger units providing 1 GW or more would provide substantial additional base-load capacity.

Some studies suggest SMRs could achieve a levelized cost of electricity competitive with renewables by 2030-2040, while others estimate higher costs and slower cost reductions. It is unclear if these comparisons factor in the simultaneous expected reductions in renewable costs to allow for a like-to-like comparison. The IEA estimates current overnight capital costs for SMRs to be 4-7 times higher than large-scale reactors but expects significant reductions with further development and deployment.

In addition to nuclear, Africa also has to invest in more energy from hydropower - although the associated projects are often capital intensive and require significant lead-in times. A recent additional concern is the extent to which the increased variations in seasonal rainfall that are associated with climate change are making hydropower less reliable with each passing year. Thus, in February 2024, Zambia extended its national disaster to include a provision to import and ration electricity as a devastating drought affected hydropower generation from the Kariba Dam, its main source of energy. These considerations point to a degree of caution in the extent to which hydropower could be extended. The effect is being felt globally. According to the IEA, droughts were an important contributing factor to higher world energy demand in 2023, worsened by the El Nino weather pattern that warms the Pacific Ocean. To compensate, fossil fuel power plants were used instead, releasing about 170 million tons of additional CO_2.

At this point it is important to pause, for our analysis indicates that it will not be possible to close the 5.9 BBOE production gap[6] that will be left with the ending of coal production by 2040 and a drastic reduction in oil and gas by 2050 as recommended by UNEP. Even the most optimistic increases in hydro, other renewables and nuclear production will be

insufficient. Nor is it likely that Africa will be able to source sufficient energy through imports (even if it can fund the US$445.7 billion gap mentioned above) since the pursuit of the UNEP targets globally will constrain available fossil energy sources for import from other regions in the world.

After consideration of the impact, we, therefore, remove the constraints on gas production but maintain the UNEP targets for reductions in coal and oil in the subsequent scenarios.

Energy efficiency

In addition to the use of different sources of energy, fossil fuel dependence can also be reduced by improving the efficiency with which the fuel is used. Africa requires 70% more energy per unit of GDP than the global average, reflecting the potential for rapid improvement.

There are numerous commitments and plans to improve energy efficiencies, particularly championed by IRENA which argues for an aggressive energy efficiency strategy as a critical component towards emission reduction. At COP28, countries agreed to double the average annual rate of energy efficiency improvements to four per cent by 2030 and reduce methane emissions.

In the Africa Energy Outlook 2022, the IEA projects that with vital policy interventions and significant investments, Africa could achieve a 30% reduction in electricity demand through energy and material efficiency measures by 2030. However, in 2023, the electricity share of energy use in Africa averaged only 13% and is forecast to decline to 11% in 2050, meaning the reductions in electricity demand would have a negligible impact on total energy demand, particularly given energy poverty. Additional savings could come from implementing stricter building codes and energy standards, greater industrial efficiencies such as in cement, steel and chemicals (the ADB estimates this could save up to 10% of the continent's total energy consumption by 2030), and efficiencies in existing vehicles and promoting fuel-efficient modes of transport, which the IEA estimates could contribute a 5-10% reduction in total energy demand by 2030.

Africa has small, fragmented and inefficient electricity grids, as reflected in a recent innovative display developed by the World Bank. Among many other measures, improvements in connections within and between countries and Africa's five power pools (or regional networks) will significantly improve electricity access and reduce inefficiencies. An essential step in this regard occurred in June 2021 when the African Union launched the Africa Single Electricity Market (AfSEM) to be supported by the Continental Power System Masterplan currently being developed by the African Union Development Agency (AUDA-NEPAD).

Because it relies upon fossil fuels (mostly diesel) that are transported by road (and not by rail or pipeline), often for use in numerous small generators, the potential for greater energy efficiencies in Africa with fossil fuel use is significant.

Carbon sequestration

The theme on climate details Africa and global carbon emissions and the goals to limit global warming. It analyses associated trends on changes on the continent and their attendant effects. Carbon sequestration and storage are integral to efforts to combat climate change.

Africa was responsible for a mere 4.6% of global carbon emissions from fossil fuels in 2023, increasing to 11.3% in 2050 and 18% in 2063. However, it has significant carbon sequestration potential[7] due to its vast forests, savannah and grassland areas. According to the FAO, 21% or about 632 million hectares of Africa is forested, while land classified as grazing accounts for 29% (881 million hectares), significantly larger than cropland, constituting a mere 10% (296 million hectares). According to the 2019 IPCC Special Report on Climate Change and Land Summary for Policymakers: 'All assessed

modelled pathways that limit warming to 1.5ºC or well below 2°C require land-based mitigation and land-use change, with most including different combinations of reforestation, afforestation, reduced deforestation, and bioenergy.'

Endnotes

1. Published by the Stockholm Environment Institute (SEI), Climate Analytics, E3G, International Institute for Sustainable Development (IISD) and the UN Environment Programme (UNEP). It assessesgovernments' planned and projected production of coal, oil, and gas against global levels consistent with the Paris Agreement's temperaturegoal. The Report finds that the 20 major fossil fuel producers countries continue to provide significant policy and financial support for fossil fuel production and that governments plan to producearound 110% morefossil fuelsin 2030than would be consistent with limiting warming to 1.5°C,and 69% more than would be consistent with 2°C.
2. D Mihalyi & T Scurfield, 'How Did Africa's Prospective Petroleum Producers Fall Victim to the Presource Curse?', The Extractive Industries and Society, 7(4), November 2020, p. 1.
3. The Current Path forecast includes the completion of the nuclear plants in Egypt, and the completion of the hydroelectric schemes in Angola, Ethiopia, Nigeria, and Tanzania.
4. In 2022 (the base year from which the IEA forecast), renewables accounted 4.2% of Africa's energy production, equivalent to 232 million BOE. For Africa to triple its renewables could mean 11.2% or 696 million BOE from renewables. On the Current Path, the portion of Africa's energy from other renewables will more than double to 7.8% (579 million BOE) in 2030. In the Current Path forecast, renewable energy production would increase to 20.9% or 2.38 BBOE in 2050.
5. Progress with SMRs is uncertain. In December 2023, China announced that it had started commercial operations of the fourth generation Shidaowan plant in China's northern Shandong province, designed to use fuel more efficiently and improve its economics, safety and environmental footprint as the country turns to nuclear power to try to meet carbon emissions goals. The 200 MW high-temperature, gas-cooled reactor (HTGCR) plant, developed jointly by state-run utility Huaneng, Tsinghua University and China National Nuclear Corporation, uses a modular design. China aims to produce 10% of its electricity from nuclear by 2035 and 18% by 2060. On the other hand, NuScale Power, previously expected to be the first U.S. company licensed to build a small modular reactor, said in November 2023 that it was terminating a lanned 462 MW project in Utah due to low subscription after the company raised target power prices.
6. This is the gap between the Current Path forecast of total energy production and a production forecast where coal, gas and oil production are constrained in accordance with the UNEP Production Gap report.
7. Carbon sequestration is the process of capturing atmospheric carbon dioxide and storing it to prevent it from being released back into the atmosphere, thereby reducing greenhouse gas concentrations and mitigating global warming. It can occur naturally, as in the growth of plants through photosynthesis or through artificial means, such as the capture and storage of CO_2 from industrial sources before it reaches the atmosphere. Carbon storage refers to the long-term holding of carbon in stable reservoirs, including forests, soils, oceans, and underground formations such as depleted oil and gas fields or deep saline aquifers. It prevents its release and contributes to climate change mitigation efforts.

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Jakkie Cilliers and Alize le Roux (2024) Energy. Published online at futures.issafrica.org. Retrieved from https://futures.issafrica.org/thematic/15-energy/ [Online Resource] Updated 03 May 2024.

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Dr Jakkie Cilliers is the ISS's founder and former executive director. He currently serves as chair of the ISS Board of Trustees and head of the African Futures and Innovation (AFI) programme at the Pretoria oce of the Institute. His 2017 best-seller Fate of the Nation addresses South Africa's futures from political, economic and social perspectives. His three most recent books, Africa First! Igniting a Growth Revolution (March 2020), The Future of Africa: Challenges and Opportunities (April 2021), and Africa Tomorrow: Pathways to Prosperity (June 2022) take a rigorous look at the continent as a whole.

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