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# Energy
## Conclusion

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## Conclusion

Our findings in this theme highlight the complex nature of Africa's transition away from fossil fuels. Contrary to the rapid shifts proposed by UNEP and others, our analysis suggests a more gradual phasing out in Africa, starting with coal, then oil and only impacting on gas as from around 2040. That transition is moving fast in many advanced economies such as Europe, North America, Japan and China. It is much slower in developing countries, particularly in Africa, which requires substantial support from wealthier nations to establish a feasible transition to renewables and carbon emission pathways. For Africa, climate finance is the critical enabler of its energy transition and must be at the top of the COP agenda.

Although it will not be easy, Africa can embark upon a sustainable growth path to its own and global benefit—but only if it has the room to exploit its gas resources to avoid an energy and development crisis, reflecting a more modest scaling back on fossil fuel use compared to the UNEP recommendations. Instead, Africa should be recognised (and compensated) for its role in acting as a carbon sink and through the proceedings of a global carbon tax, investments should flow to renewables development on the continent.

In 2023, Africa only produced 4.8% of its energy from renewables, with North Africa doing particularly poorly. The other two comparable developing regions, South Asia and South America, produced 8.3% and 15.4%, respectively. On a Current Path, by 2050, Africa will produce around 34.8% of its energy from renewables, still significantly less than either comparable region and trailing even further behind. As a portion of total energy production, South Asia and South America also produce more nuclear and hydro power than Africa.

Our modelling underlines the importance of a global carbon tax as key to reduced emissions. With or without such a tax, we estimate that Africa would need a 2050 emissions budget of 10% of global emissions from fossil fuel use, increasing to 14% by 2053. Although the percentage is the same, Africa's required carbon budget from fossil fuel production in the Combined scenario would be 0.6 billion tons of $CO_2$ larger than in the Sustainable Africa scenario.

Considering these numbers, the reader is reminded that Africa's 2050 population will constitute 25% of the world's total and 28% by 2063. Currently, Africa constitutes 18% of the world's population. Therefore, Africa's required share of carbon emissions from fossil fuels is significantly below its share of the global population, even on a high-growth forecast. Africa’s 2050 population is, of course, 172 million smaller in the Combined scenario and 369 million less in 2063, given the reductions in fertility rates that accompany improvements in well-being.

The role that hydrogen could play in Africa's energy future is currently unclear. Energy from hydrogen has regularly attracted hype and disillusionment, and its journey towards becoming a ubiquitous fuel is bumpy at best, given the challenges of production, transportation and use. The most straightforward use of large-scale hydrogen is in hard-to-decarbonise areas of the economy, such as heavy industry, with limited application in Africa, given the low demand from these sectors. It is, instead, the potential for export as ammonia that is then converted back to hydrogen at the destination that attracts attention. Thus, with promises of US$10.8 billion investments from Germany, Namibia has the most ambitious plans to produce green hydrogen from its abundant solar and wind resources, turn it into ammonia, and then ship it to Europe.

With clear policies and determined leadership, many African countries can embark on an early transition to reduce fossil fuel use to global benefit. Large fossil fuel producers South Africa, Egypt, Algeria and Nigeria will be most affected. The future carbon emissions from a handful of African countries are globally significant, particularly Nigeria, Egypt, South Africa, Algeria, Ethiopia and Tanzania. These are countries with rapidly growing populations and a large fossil fuel emission footprint. Their success in rapidly transitioning to renewables and reducing their carbon footprint will be critical in determining Africa's contribution to global warming and a sustainable global future.

Amongst Africa's coal producers, South Africa faces the most significant challenge. In 2023, it depended on coal for 95% of total energy production and is one of the largest coal exporters in the world and Africa's largest carbon emitter. In the Current Path, South Africa depends on coal for 55% of its total energy production in 2050 while still exporting large amounts. It is only 36% in the Sustainable Africa scenario.

The transition from coal will also be painful for Zimbabwe, Mozambique and Botswana. The latter sourced 50% of its energy production from coal in 2023—Zimbabwe was 63% and Mozambique at 40%. On the Current Path, coal production in Botswana will remain at its current levels until 2050, while production in Zimbabwe is set to increase, implying that it could continue mining coal for domestic energy production given the size of its known coal reserves. All three will have to forego export earnings related to their coal assets in the Sustainable Africa scenario.

Africa's oil exporters, such as Angola and Libya, will also need help reducing production in line with the UNEP target. Nigeria, Africa's largest oil producer, will be challenged the most, as well as Algeria, the second-largest producer. Oil accounts for over 80% of Nigeria's exports and roughly 50% of the government budget, although production has steadily declined from its peak in 2005. Investments in exploration have also gone down. Many of the larger foreign oil companies such as Shell, TotalEnergies, Chevron, ExxonMobil, Eni and Equinor have either left, are in the process of doing so, or are shifting their investments into offshore waters given high levels of onshore insecurity, particularly in the Niger Delta that harbours most of that country's onshore and shallow-water oil rigs. With the largest gas reserves in Africa, Nigeria will inevitably pivot from oil to natural gas, which currently accounts for just 10% of Nigeria's exports. Increasing its gas exports would require significantly expanding the facilities to cool and liquefy gas.

In thinking about energy, African governments are primarily concerned about cost and speed and less about the choice of technology (such as nuclear or geothermal). In this context, SMRs could significantly contribute to meeting Africa's energy requirement in high-demand nodes, but so could geothermal as a source of dispatchable low-emissions electricity and heat. Baseload electricity supply can be produced close to high-demand areas using SMRs and geothermal technologies. Examples are the provision of energy for industrial or mining demand such as cement and fertiliser production, iron ore smelters, large data centres, and chemical and steel plants, with project-specific additions from other energy sources to meet peaking demand. Africa will, however, not invest in technology demonstrators (first of a kind) SMRs, implying that the most likely successful approach could either come later in the SMR development path (once demonstrator units are operating effectively elsewhere) or for SMR developers presenting a fleet option to several countries as a package option that resolves energy requirements across a host of higher demand nodes. The challenge with new geothermal is similar since the associated expertise is located in the fracking industrial ecosystem in the US.

Africa has set a path towards industrialisation and regional trade integration. These two ambitions inevitably release more carbon than the other six sectors modelled on this website and are included in the Sustainable Africa scenario. Therefore, it is important that industrial development, such as building fertiliser and cement plants, proceed with the appropriate technologies that keep carbon emissions to a minimum.

But perhaps the most important initiative to advance energy security in Africa is to fully operationalise the Africa Single Electricity Market (AfSEM) to harmonise regulatory frameworks for Africa's underdeveloped and fragmented electricity market and to connect electricity grids within and across regions. A much expanded and enhanced grid with greater interconnectivity is essential for the future. To this end, Renewable Energy Solutions for Africa (RES4Africa) launched Grids4Africa to raise awareness about the importance of grid infrastructure and the associated challenges that could bring additional private sector resources to transmission and distribution.

The Continental Power System Master Plan (CMP) needs to be updated and implemented to create a single, integrated grid for the continent from the five power pools that would allow for the optimisation of renewables. The advantages are manifold, allowing production in one country to supply demand in another and extending the period when solar produces energy given Africa's large East-West expanse.

Given the fear of stranded assets, the inevitable question is: How and who will finance Africa's exploration and production of gas and for which market—for domestic consumption or export? Africa would need lots of support from multilateral funding institutions, private sector partners, development agencies and bilateral support from high-income countries to realise a viable carbon emissions pathway, including for selected exploration and production of gas. The call is not new and was prominently made as part of the Bujumbura Declaration in August 2021 that urged the World Bank to scale up investments in energy cooperation in Africa, including the financing of gas-to-power projects beyond 2025. Yet, momentum is growing among wealthy countries to stop new investments in oil and gas ventures, and the risk of stranded investments looms large. The World Bank stopped financing upstream oil and gas projects in 2019 and the African Development Bank no longer puts money into fossil fuel projects—although some of this may change with Donald Trump as US president. In response, a coalition of oil-producing African countries intends to launch an "energy bank" to fund fossil fuel initiatives.

Africa's high levels of indebtedness and punitive risk premiums mean that the continent struggles to attract investment in the best circumstances. Even if Africa were to get a reprieve on gas projects, the negative perceptions associated with investments in fossil fuels imply a high level of risk to private or public sector investors. Mozambique is an example of a country that has entered into complex arrangements with private actors to develop its gas resources with only limited revenues flowing to the government towards the end of the project life cycle once the investors have recouped the return on their investment. At the same time, the large sums of money promised to help the green transition under the auspices of the so-called Just Energy Transition Partnerships have not materialised, and the result is that polluting coal plants stay open.

The obvious response to these challenges is to introduce a carbon tax on countries with high per capita emissions and those that have historically benefitted from a carbon-intensive growth path, using the associated funds to fund Africa's energy transition, as discussed in the theme on Africa's Climate Futures. In addition to debt relief and suspension, multilateral development banks need to implement the Climate Resilient Debt Clauses (CRDCs) developed in response to the Sustainable Debt Coalition created at COP27 in Egypt and the use of debt-for-nature or debt-for-climate swaps to strengthen recipient countries, allowing them to repay their debts by investing in nature regeneration and climate action as recently proposed by the African Center for Economic Transformation. The recommendations are one of five financial proposals to help African countries finance a just and equitable climate transition at scale.[1]

Various estimates have been tabled about the cost associated with tripling renewables by 2030 (the target set at COP28), ranging from US$1.3 to US$2 trillion annually. According to Climate Analytics, investment in Africa needs to grow five-fold to ramp up renewables twice as fast as the global average. These are significant amounts, probably only available within the private sector in the developed world and through a global carbon tax.

Africa needs vast amounts of energy. Linear, path-dependency thinking is that the base load requirements cannot come from renewables given the variability of solar and wind. Unlike fossil fuels, conventional approaches constrain options for nuclear or hydro as they currently offer the required potential without a technological breakthrough with energy storage. Yet, scaling up large-scale solar power in North Africa could power Europe, while the associated manufacturing requirements could significantly boost North Africa's economies. Instead, Germany chose gas from Russia and closed its nuclear energy plants until the war in Ukraine ignited demand for gas from America instead of solar energy from the Sahara. Africa can fund all of its power needs from solar radiation, as modelled as part of the solar power support study for the African Continental Power System Master Plan or from wind, as advocated by the African Union-EU energy partnership.

Without 'out of the box thinking', such as green hydrogen from Grand Inga and Namibia, and bulk solar from the Sahara, the costs associated with hydro, hydrogen and nuclear energy as well as the associated environmental challenges appear to limit options. In addition to wind, solar, geothermal, green hydrogen and other renewables, Africans must explore local

solutions, such as repurposing solid waste and redoubling their efforts towards a circular economy. Similar approaches have worked well in Brazil with ethanol-based biofuels. However, typical biofuels from food crops require agricultural land and water, thus reducing food production, which may enhance food shortages in an already crop-vulnerable region. Low-carbon liquid fuel security in sub-Saharan Africa can be improved substantially by small-scale decentralised production.

None of the potential of new technologies will succeed without much larger political and financial investment in African energy planning, which embeds the concept of regional power pools with policymakers of the present and future. Africa needs enabling regulatory regimes and regulators and bankable power purchase agreements to rapidly scale up solar and wind.

Technological development will fundamentally change the future of energy and emissions, particularly the investments being made in China that are spurring innovation in renewables, carbon capture, storage technology and nuclear energy. Previously, the fracking revolution in the US was an example of how technology, at scale, can disrupt the market to the extent that it is now the largest LNG gas exporter globally. Looking to the future, biomass, renewables such as wind, solar, hydrogen, small-scale nuclear plants, and new technologies such as solid-state battery storage, amongst others, could have similar disruptive effects. Much depends on the policy choices made, however, since the promise of technology as an enabler of the redistribution of political, economic and social power has yet to be realised. There is, instead, for many in the West, the fear that the concentration of the associated manufacturing capacity in China could provide that country with significant leverage in the renewables sector, given the extent to which it has also locked in the required rare earth and other metals in a vertically integrated production chain from mine to shop. Generous state subsidies, rapid domestic demand growth and intense local competition mean that China is responsible for the majority of global solar manufacturing, batteries and electric vehicle production. It is, however, not an issue that concerns Africans much.

Finally, an issue not discussed in this theme is that of critical minerals which are associated with renewables including copper demand for undersea power cables, and lithium and cobalt as key battery technology components. Thus, a typical electric car uses about six times the minerals of a conventional vehicle. Most of these minerals are in Africa, although Canada, Australia and others are emerging as well-endowed, providing significant development opportunities given the demand for critical minerals indispensable in renewable technologies. ‘A renewables-based energy transition’, writes IRENA’s Francesco la Carema, ‘provides a chance to rewrite the script for extractive commodities and ensure their value chains are more inclusive, ethical and sustainable.’ The problem, however, is that the extraction of cobalt, lithium and nickel only accounts for 0.1% of the total value chain, one example of Africans' need to redouble efforts at beneficiation, local production and manufacturing. Knowledge transfer and domestic investment in exchange for the export of beneficiated raw materials should, therefore, be front and centre in an African strategy to leverage the associated opportunities, with some countries, such as Namibia, already having instituted export restrictions.

Determined and early action is required to forestall the global damage that will follow a situation where Africa proceeds along its current fossil-fuel-dependent growth path. The theme of Climate Futures starkly presents the irony that the continent will suffer more than any other region, given its limited coping (or adaptive) capacity.

Chart 14: Recommendations

# Recommendations

- Africa needs energy for its development but trails behind other regions in renewables
- African leaders and partners must invest aggressively in wind, solar, geothermal, hydro and nuclear energy to power development
- South Africa, Zimbabwe, Mozambique and Botswana must accelerate efforts to end energy production from coal whilst Nigeria and Algeria need to transition from oil
- Planning should allow for 10% of global emissions from fossil fuels by Africa by 2050 and 14% in 2063
- A global carbon tax is required to reduce global emissions, provide room for Africa's growing emissions and support Africa's transition
- Africans need to prioritise grid connections along the lines of the Continental Power System Master Plan, and operationalise the African Single Electricity Market (AfSEM)
- Industrial development and regional integration must proceed with the appropriate technologies that minimise carbon emissions
- Land and forest management in Africa could make a large contribution to carbon mitigation, particularly in the Congo basin.
- Debt-for-nature or debt-for-climate swaps could facilitate debt repayment by investing in nature regeneration and climate action
- Africa must explore small-scale energy from biomass and knowledge transfers to go up the value chain of its critical mineral endowment

## Endnotes

1. The five recommendations are: 1. Debt relief and suspension for low- and middle-income countries, including innovative debt swaps and Climate Resilient Debt Clauses. 2. Extend below-market-rate, or concessional, capital to EMDEs. 3. Use credit enhancement and credit guarantee schemes to incentivize private sector participation. 4. Establish a foreign exchange guarantee mechanism. 5. Create a turbocharger facility for climate action projects and entrepreneurs in Africa.

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## Cite this research


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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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