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Energy

Comparing Energy Scenarios

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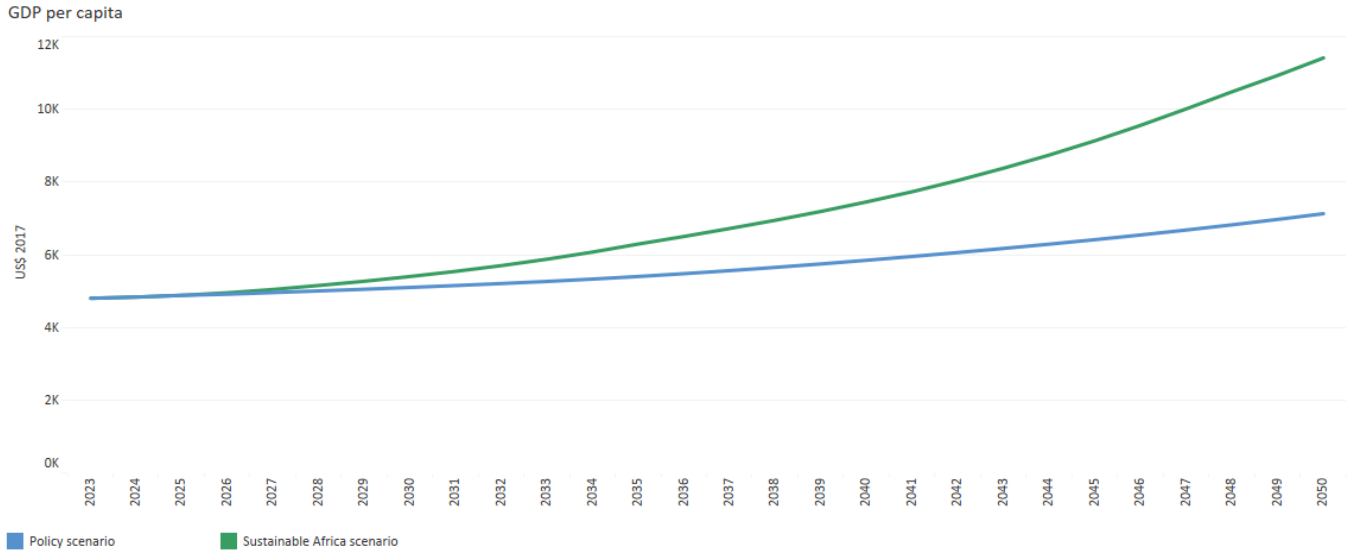
In this section, we compare Africa's Current Path or likely development trajectory with the impact of the two scenarios presented in the previous section:

- The first is the Africa Energy Policy scenario that dramatically reduces fossil fuel use, increases non-fossil fuel production and applies various mitigation policies; and
- The second is the Sustainable Africa scenario, which applies the Africa Energy Policy scenario to a high-growth future.

As a first step, Chart 11 presents GDP per capita (or extreme poverty - the user can choose) in the Current Path/Africa Energy Policy scenario compared to the Sustainable Africa scenario. It serves to illustrate the large difference in development outcomes between these two scenarios and serves to remind the reader that it is only the energy mix that changes in the Africa Energy Policy scenario. Africa's development outcomes are unchanged from the rather uninspiring Current Path forecast.

Chart 11: GDP per capita and extreme poverty in energy scenarios, 2023-2050



Source: IFs 8.17 initialising from WDI and PovcalNet data

Chart 12 allows the user to view energy production per type of energy for each African country and region. The user can choose between the Current Path, the African Energy Policy scenario (with its changed energy mix) and the Sustainable Africa scenario (that represents the energy mix in a high growth future consisting of the African Energy Policy scenario and the Combined Agenda 2063 scenario). In summary

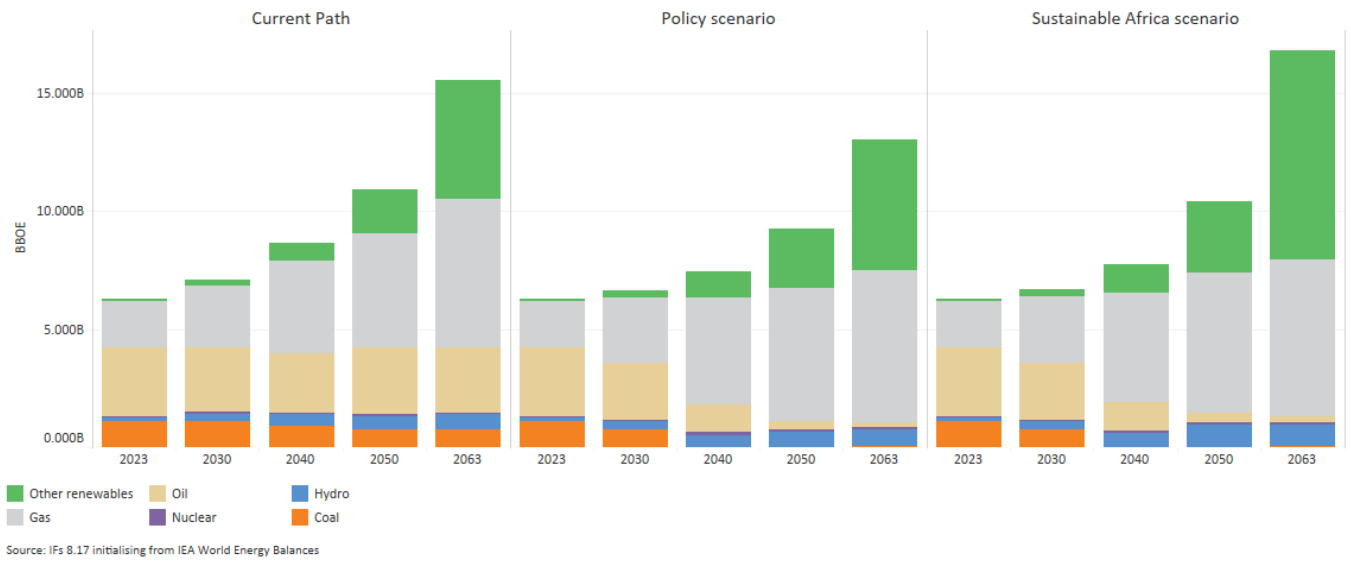
- The Africa Energy Policy and Sustainable Africa scenarios see an end to coal production by 2040 while oil production declines to below 400 MBOE by 2050. The 2050 Current Path forecast is 2.8 BBOE.
- The 2050 Current Path forecast for Africa's gas production is 4.8 BBOE. It increases to 5.6 BBOE and 5.9 in the Africa Energy Policy and the Sustainable Africa scenarios, respectively.
- An increase in energy production from other renewables (excluding hydro) by 33% above the Current Path forecast in 2050 and 150% in the Sustainable Africa scenario.

- An increase in energy production from hydro by 13% above the 2050 Current Path forecast.

- Greater energy efficiency that reduces Africa's energy demand (i.e. the amount of energy required to increase the size of the economy by a set amount) by 4.2% below the 2050 Current Path forecast.[1]

- An increase in nuclear energy production of 52% and 68% for the two scenarios above the 2050 Current Path forecast. Although large, the increase in Africa's nuclear energy production is small in absolute terms.

Chart 12: Energy production per scenario, 2023-2063
Toggle total production vs % of total



Source: IFs 8.17 initialising from IEA World Energy Balances

The Africa Energy Policy scenario reflects Africa's energy demand and production on its likely future development pathway. It would see average economic growth amongst African economies of 4.7% from 2024 to 2050. By 2050, we anticipate that Africa's energy production would be 1.7 BBOE below the Current Path forecast, and 2.5 BBOE by 2063. A reminder that in this scenario Africa ends coal production by 2040, reduces oil production significantly but increases gas production by 17% in 2050, tapering off thereafter. The gas production increase is at 23% (2050) in the Sustainable Africa scenario. The increase in gas production in the Africa Energy Policy and Sustainable Africa scenarios is, however, insufficient to compensate for the reductions in energy from coal and oil. As a result:

- In the Africa Energy Policy scenario energy imports increase by US$108 billion (2050) and US$326 billion (2063), reflecting a growing energy production gap.

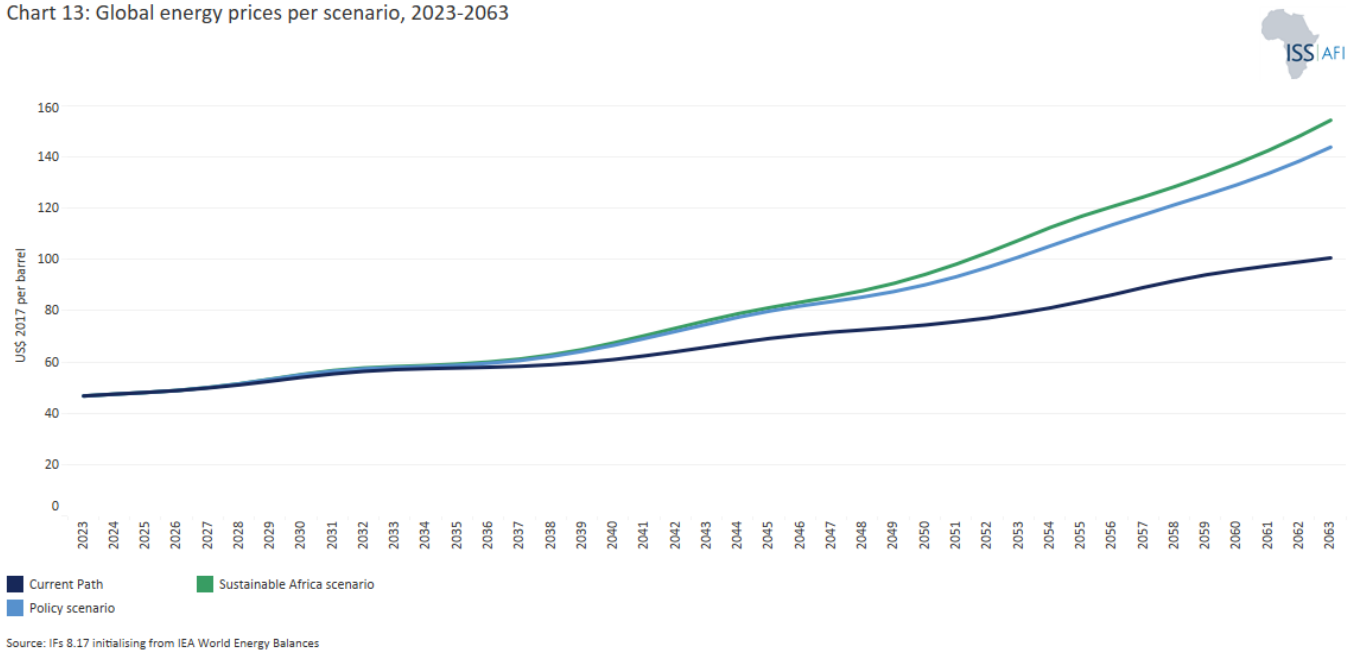
- The gap increases further with the Sustainable Africa scenario. In that scenario Africa imports US$397 billion more energy in 2050 and US$1.3 trillion in 2063.

In the Current Path forecast Africa becomes a net energy importer in 2041, paying more for energy imports than it gains from exports. In the African Energy Policy scenario, it happened five years earlier, and eight years earlier in the Sustainable Africa scenario, with obviously large national variations.

Chart 13 reflects the rapid change in Africa's energy production landscape over time comparing scenarios, particularly among Africa's 20 coal, oil and gas producers. Countries that do not produce coal, oil or gas, will be less affected and their transition to a sustainable growth path is much easier.

Although Africa is a small energy producer, the scenarios will affect world energy prices. Average global energy prices change with each scenario and the associated forecast is provided in Chart 13.

Chart 13: Global energy prices per scenario, 2023-2063



Source: IFs 8.17 initialising from IEA World Energy Balances

By 2050, much will have changed compared to 2023. The world population will have increased by 1.7 billion additional people to 9.7 billion, the world economy will be US$97 trillion[2] larger and GDP per capita will have increased by 49%[3].

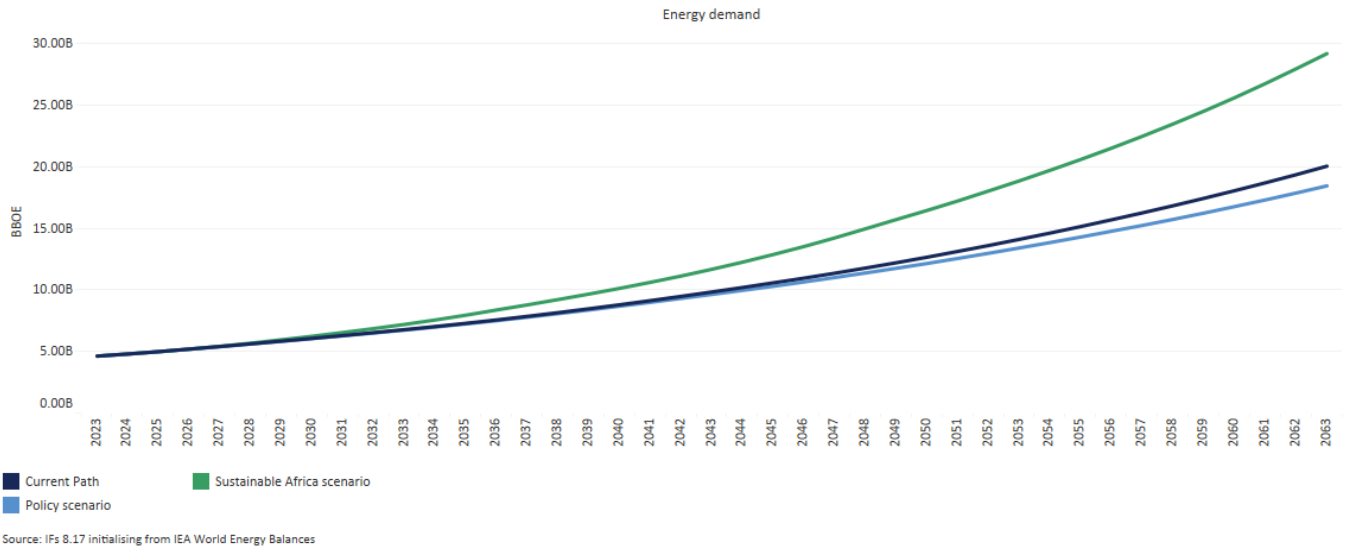
Africa and its relationship with the rest of the world will also change. Instead of constituting 18% of the world's population, by 2050, Africans would represent 26.5%. Africa's portion of GDP, 2.9% of the world in 2023, will be 4.8% in 2050 and, in the Sustainable Africa scenario, Africa would constitute 8.3% of the global economy.

The progress is reflected in the degree to which Africa will achieve almost total electricity access by 2050, although a handful of countries, Burundi, South Sudan, Central African Republic and Chad still have less than 60% access, but making rapid progress.

The fulfilment of the Sustainable Africa ambition would see a 2050 African economy that is 79% larger than the Current Path forecast. GDP per capita would be 61% higher and only 105 instead of 356 million Africans would be living in extreme poverty. African countries would, on average, grow roughly two percentage points more rapidly than in the Current Path forecast for 2050.

Chart 14 compares Africa's total energy demand with production and allows the user to select the data for any African group or country from the drop-down menu to compare the three scenarios. Energy demand in the Sustainable Africa scenario is significantly larger than in any other scenario, given the associated push on all aspects of growth including manufacturing and trade.

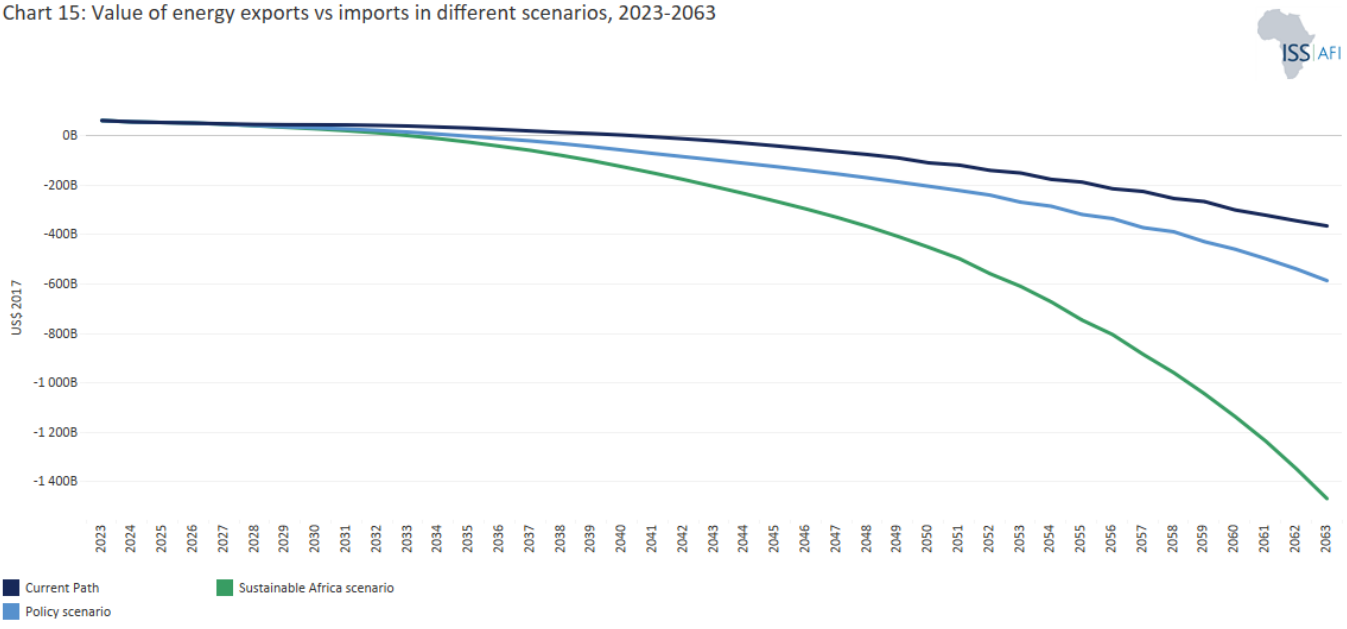
Chart 14: Africa's energy demand vs production in different scenarios, 2023-2063



Source: IFs 8.17 initialising from IEA World Energy Balances

The gap between the 2050 demand and production forecast on the Current Path would be 1.76 BBOE scenario, 2.9 BBOE in the Africa Energy Policy scenario and 6 BBOE in the Sustainable Africa scenario. A previous section presented the extent to which Africa is currently a net energy exporter despite its domestic energy poverty. Over time that surplus will decline implying that many more African countries would have to import more energy. Chart 14 compares the value of future exports with imports. It reflects that Africa will become a net energy importer in all scenarios and the extent to which its energy import dependence increases most markedly in the Sustainable Africa scenario. The effect will fall disproportionally on the continent's current oil and gas exporters.

Chart 15: Value of energy exports vs imports in different scenarios, 2023-2063



Source: IFs 8.17 initialising from IEA World Energy Balances

A previous section commented on Africa's low levels of energy demand per capita (at 3.2 barrels of oil equivalent per person in 2023 compared to an average for the rest of the world of 13.6 barrels) - see Chart 6. African energy demand is significantly below comparable regions such as South America and South Asia. The analysis referred to the importance of

sufficient energy for development, noting a consensus pointing to a minimum requirement of 8.6 barrels per person per annum and reflected on the fact that Africa, on average, does not achieve this minimum requirement, even by 2063 with an average demand on the continent at 6.4 barrels per person then. However, in the Sustainable Africa scenario the average continental demand crosses this threshold in 2056 and increases to 10.7 barrels by 2063.

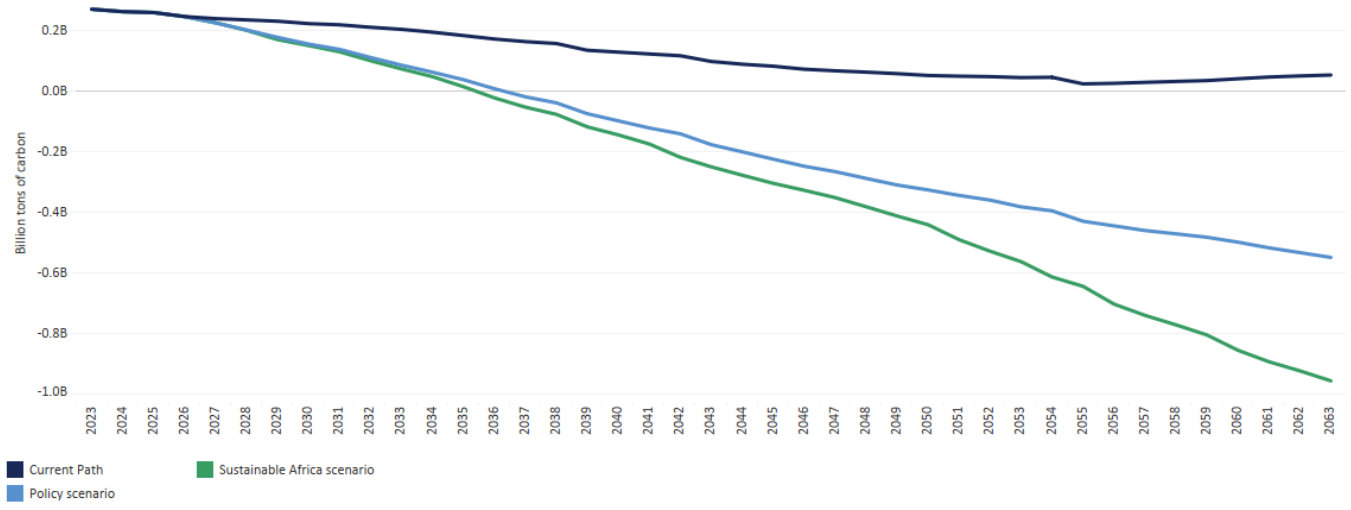
The impact of the suite of policies to improve energy efficiency and constrain carbon emissions is evident when considering that Africa will, in 2050, release 4.3% less carbon from fossil fuels in the Sustainable Africa scenario compared to the Current Path forecast. However, more rapid economic growth in the Sustainable Africa scenario eventually translates into more emissions. By 2063 Africa will release 6% more carbon from fossil fuels in the Sustainable Africa scenario than in the Current Path. So, with the implementation of an aggressive suite of mitigation measures, Africa could grow at an average of 7% per annum (instead of 4.7% on the Current Path forecast) while its carbon emissions only increase above the Current Path forecast three decades into the future.

The reason for the lower than expected carbon emissions in the Sustainable Africa scenario comes from the decline in deforestation and, eventually, from around 2040, reforestation that we use as a proxy for a range of policies, including restoring grasslands and better land management.[4] The result is that instead of 576 million hectares of forest in 2050, Africa will have 622 million hectares - an 8% difference. This large difference would require an ambitious departure from current slash-and-burn farming practices and a dedicated effort towards reforestation and improvements in general land management. In the Sustainable Africa scenario, forests absorb an additional 493 million tons of carbon (or 1.8 billion tons of CO_2 equivalent). See the theme on Climate for more details.

Rather than its ability to constrain all fossil fuel production, Africa's most significant contribution to a sustainable future is the extent to which it has the potential to act as a carbon sink through the application of policies on reforestation, improved land management and associated measures. This could serve as an essential incentive for investment and the purchase of carbon credits. In the Current Path forecast global carbon emissions from deforestation will decline from 200 million tons in 2023 to 36 million tons in 2050. In the Africa Energy Policy scenario, global reforestation increases carbon absorption to 347 million tons, and to 457 million in the Sustainable Africa scenario (see Chart 16).

Chart 16: Carbon emissions from fossil fuels (Africa) and deforestation (global) in different scenarios, 2023-2063

Emissions from deforestation is only at the global level



Source: IFs 8.17 initialising from Appalachian State University data

The impact of the mitigation and adaptation measures modelled as part of the Sustainable Africa scenario is powerful. 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 financial crisis, reflecting a more modestly scaling back on fossil fuel use compared to the UNEP recommendations.

There are many ways in which Africa can progress towards more sustainable energy use in addition to those modelled in this theme. In addition to determined efforts to increase renewable energy production, build hydroelectric schemes, and extend nuclear while simultaneously removing coal production and dramatically reducing oil production, on top of the various mitigation efforts, Africans and the international community would need to think creatively about the future including giving serious attention to the repurposing of solid waste as one obvious avenue to pursue. See the theme on climate for more details.

Endnotes

1. Applied to Angola, Benin, Botswana, Burkina Faso, Cameroon, Central African Republic, DR Congo, Republic of Congo, Eswatini, Gambia, Ghana, Guinea, Madagascar, Malawi, Mozambique, Nigeria, Sao Tome and Principe, Senegal, Sierra Leone, Tanzania, Togo, Zambia and Zimbabwe.
2. From US$93.2 trillion in 2023
3. From US$16 940 per person to US$25 120 in PPP.
4. Campaigns to plant trees (such as the 34-country African Forest Landscape Restoration Initiative or AFR100) as the major area of focus to absorb carbon is controversial given its potential to damage ancient grassland ecosystems that aborb carbon dioxide. The AFR100 project seeks to restore at least 100 million ha

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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.

Ms Alize le Roux joined the AFI in May 2021 as a senior researcher. Before joining the ISS, she worked as a principal geo-informatics researcher at the CSIR, supporting various local and national policy- and decision-makers with long-term planning support. Alize has 14 years of experience in spatial data analysis, disaster risk reduction and urban and regional modelling. She has a master's degree in geographical sciences from the University of Utrecht, specialising in multi-hazard risk assessments and spatial decision support systems.

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