Energy

Africa's Energy Landscape

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The 41st Ordinary Session of the Executive Council adopted the African Common Position on Energy Access and Just Transition, on the 15th of July 2022, a comprehensive approach that charts Africa’s short-, medium- and long-term energy development pathways to accelerate universal energy access and transition without compromising its development imperatives. The Common Position stipulates that Africa will continue to deploy all forms of its abundant energy resources including renewable and non-renewable energy to address energy demand. In terms of the Common Vision natural gas, green and low-carbon hydrogen and nuclear energy will play a crucial role in expanding modern energy access in the short to medium term while enhancing the uptake of renewables in the long term for low-carbon and climate-resilient trajectory.

Africa produces little energy compared to other regions. In 2023, Africa produced only 5.7% of world energy, which would increase to 6.8% in 2050—a portion vastly out of balance with its large and growing population and development needs. In its 2025 Outlook Report, the African Energy Chamber provides the following summary:

In general, electrification has been hindered by high grid connection costs, low disposable income levels, poor local distribution infrastructure and sluggish power demand. The economic strain on consumers leads to lower overall power consumption, as individuals and businesses may limit their usage to reduce costs. This disparity underscores the need for investment and infrastructure development to bridge the gap and improve living conditions across the continent. Increasing electricity access is crucial for boosting economic opportunities and overall quality of life in Africa.

Africa's energy demand is also low, at less than 5% of the world’s in 2023, and that year the continent exported energy to the value of US$87 billion generally consisting of coal, oil and gas..

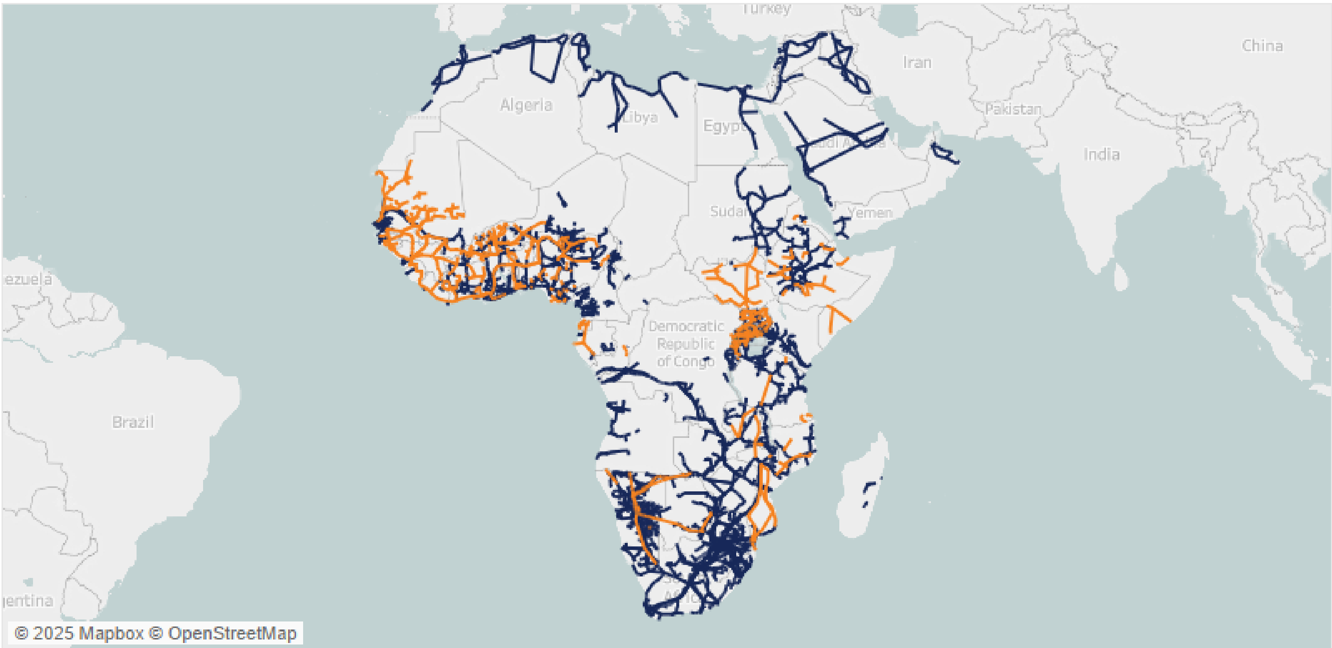
In discussions on energy, the focus is often on electricity since Africa’s residential sector is the largest consumer of energy. The electricity share of total energy use in Africa is, however, only 13%—ranging from 30% in Mauritius to 1.8% in Burundi. These are amongst the lowest shares globally. The rest is used for transport (primarily petroleum products), industry (which together with transport uses the bulk of energy), agriculture and services. Similar to the situation globally, the services sector dominates African economies, but much of it consists of low-end services, often as part of the informal economy, with limited energy demand. The informal economy in Africa is also large, on average contributing more than 26% to GDP and employing 58% of labour. While the informal sector also requires energy, cost recovery is low. Finally, because of low levels of mechanisation and the use of traditional farming methods, the agricultural sector in Africa consumes a relatively small amount of energy compared to other regions.

Energy in Africa is expensive and, because of poor infrastructure, much of it is wasted. For example, Africa requires 65% more energy per thousand dollars of gross domestic product (GDP) than the global average, reflecting the potential for rapid improvement in energy efficiency. Much of Africa’s energy, petrol and diesel, is transported by road. The World Bank has developed an impressive map of Africa’s electricity grid which is presented as Chart 2. It reflects the limited grid development in many Central African countries and in the Sahel. 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 Master Plan currently being developed by the African Union Development Agency (AUDA-NEPAD).

Grids are more than connections between energy producers and consumers. They allow a surplus or deficit in one area to complement or draw upon excess supply or feed demand elsewhere. Electricity grids enable a more efficient electricity market and the evolution of smart grids even allows households to sell excess electricity supply, such as from solar, into a grid for use by others.

Africa's poorly developed electricity grid means that the region loses a larger portion of electricity during transmission than any other region globally with Central, West and East Africa doing particularly badly. Regions with developed grids, such as Europe and North America, lose around 5% of electricity during transmission while electricity loss in Central, West and East Africa is between 15 and 20%.

Chart 2: Africa's electricity grid and power pools



Planned
Existing

Source: The World Bank, ENERGYDATA.INFO

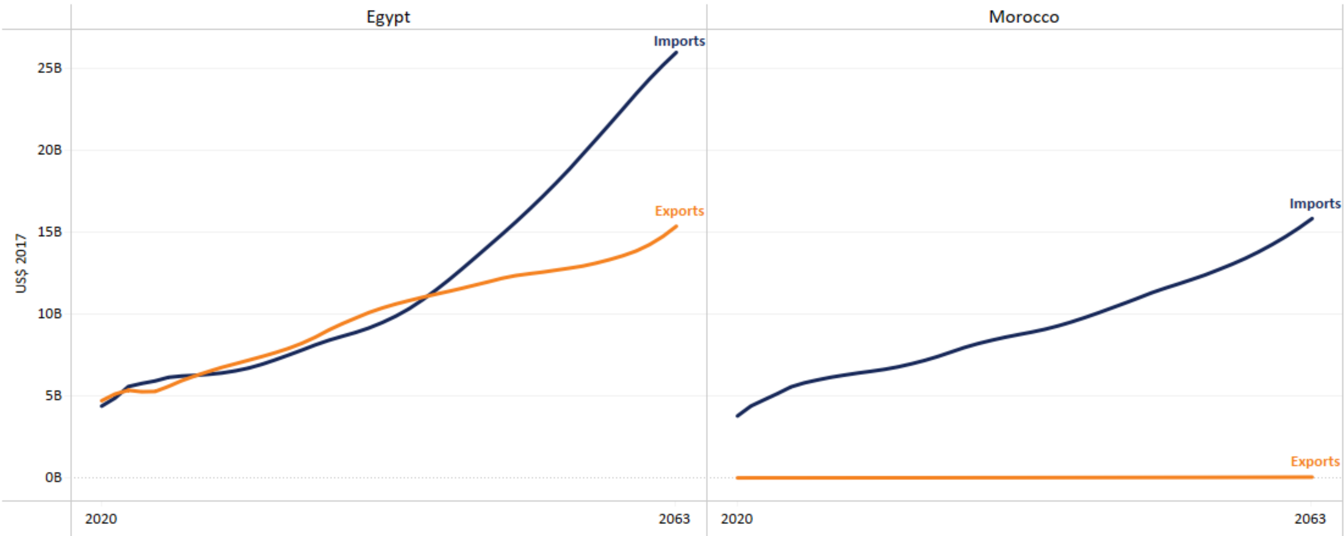
In addition to the aggressive development of electricity grid networks, there are numerous additional commitments and plans to improve energy efficiencies, particularly championed by the International Renewable Energy Agency (IRENA) which argues for an aggressive energy efficiency strategy as a critical component towards emission reduction. Additional savings could come from implementing stricter building codes and energy standards as well as greater industrial efficiencies such as in cement, steel and chemicals. The African Development Bank (ADB) estimates these measures could save up to 10% of the continent's total energy consumption by 2030. The IEA estimates that efficiencies in existing vehicles and promoting fuel-efficient modes of transport could contribute to a 5-10% reduction in total energy demand by 2030.

At COP28, countries agreed to double the average annual rate of energy efficiency improvements to four per cent by 2030 and reduce methane emissions.

Chart 3 presents the Current Path of total energy imports versus exports for each African country, with numbers expressed in BBOE or US$ values (the user can choose). Libya, Nigeria, Algeria, Angola, Egypt, South Sudan, the Republic of Congo, Uganda, Gabon Chad, Sudan and Equatorial Guinea have much of Africa's oil. Most gas reserves are found in Nigeria, Algeria, Mozambique, Egypt and Libya, while South Africa and Zimbabwe dominate in coal reserves. Much of these resources are exported (US$486.7 billion in 2023) making Africa a net energy exporter since energy imports, mostly refined petroleum, amounted to US$50 billion. With the recent commissioning of the Dangote refinery, Nigeria has the largest oil refining capacity in Africa, followed by Egypt, Algeria, Libya, South Africa, Angola, Gabon and the Republic of Congo.

Chart 3: Energy exports and imports, 2020-2063

Measured in billion barrels of oil equivalent (BBOE) and US$ 2017



Source: IFs 8.34 initialising IEA World Energy Balances

Rapid population growth, urbanisation and rising incomes will significantly increase energy consumption in Africa in the coming decades. While the continent has traditionally been a net energy exporter—largely due to oil and gas exports from countries like Nigeria, Algeria, Libya and Angola—this trend is set to reverse. As domestic demand surges, the availability of exportable energy will decline. By 2033, the total value of Africa's energy exports will fall below the value of its imports, signalling a fundamental shift in the continent's energy trade balance. This transition is driven by a combination of factors: rising consumption, limited refining capacity in many oil-producing nations, and the growing need to import refined petroleum products and electricity. As demand continues to grow faster than domestic supply and processing capacity, the trade deficit in energy will expand at a continental level, although with large country-to-country variations.

In fact, 28 African countries were already net energy importers prior to 2023, relying heavily on external sources to meet their domestic needs. Without substantial investment in local refining, natural gas processing and renewable energy infrastructure, this reliance is expected to deepen.

Several African countries are dependent upon energy imports for more than 50% of their domestic demand, including Morocco (for 90% of its demand), Benin, Mauritania, Senegal, Eritrea, Uganda, Mali, Mauritius, Togo and Tunisia (at 57%). By 2050, 31 African countries will import more than 50% of their demand reflecting the urgency of moving rapidly towards domestic renewable resources such as wind, solar, geothermal and biomass. Being dependent on fossil fuel energy imports makes these countries vulnerable to price fluctuations (such as the effect on gas prices that followed Russia's invasion of Ukraine) and supply disruptions in international markets (such as the attacks on commercial vehicles in the Red Sea early in 2024). It also points to the large potential with the development of Africa's five electricity trading entities or pools where electricity demand in one country can be offset by production in another. These are the Southern African Power Pool (SAPP), Eastern African Power Pool (EAPP), Central African Power Pool (CAPP), West African Power Pool (WAPP) and the North African Power Pool (NAPP). To this end, the African Union (AU) has articulated a vision for a continent-wide interconnected power system, the Africa Single Electricity Market (AfSEM), that is intended to be fully operational by 2040. Among the steps towards the realisation of AfSEM is the development of a Continental Power System Master Plan (CMP) to eventually allow countries to trade electricity across borders. The ambition is to achieve 100% access to electricity in the continent by 2030 in line with the AU Agenda 2063 and the UN Sustainable Development Goal (SDG) Number 7. However, in a business-as-usual forecast average electricity access would likely then extend to only 62% of Africa's population, reflecting the huge challenges that remain.

In the meanwhile, and in spite of its massive wind, solar, hydro, biomass and geothermal potential, Africa's people are energy-poor. In 2023 only 58% of Africa's population has electricity, meaning 626 million people lack access to the most basic household resource for heating, cooling, cooking, reading and home education—a number that will increase to 657 million in 2030 (62% of population) in the Current Path. Energy is much more than electricity but the data highlights the stark contrast between the continent's energy potential and widespread energy poverty.

In addition to limited access to electricity, a fundamental requirement for a decent quality of life, Africans generally lack energy for transportation, industry, agriculture, construction and services to enable economic growth. This energy paradox is particularly evident in countries such as the Central African Republic, Chad and South Sudan, where abundant energy resources such as oil and gas do not translate to electricity access.

In 2023, only 3.3% of Africa's total energy production came from renewables, compared to 12.8% in South America and 5.9% in South Asia. The Africa Energy Chamber in its 2025 Outlook report notes that, currently, nearly 80% of Africa's solar and wind-based capacity is installed in North Africa, South Africa, Kenya, Ethiopia, Angola and Senegal. South Africa accounts for a major chunk of Africa's solar PV and wind capacity, with a share of 41% and 34%, respectively. Solar PV and wind deployment are increasing rapidly. It grew by over 500% over the last decade, with solar PV growing from nearly 1.6 GW in 2014 to over 17 GW in 2023, while wind grew from 2.4 GW to over 10 GW. The result is that Africa is home to some of the largest solar PV installations globally such as Egypt's Benban complex and the 540 MW Kenhardt solar-storage hybrid power plant in South Africa. Egypt also hosts Africa's largest wind power facilities.

Africa boasts 60% of the world's best solar resources, utilising only 1% of its installed solar PV capacity. According to a support study undertaken for the CSP, solar radiation on only 200 000 km^2—approximately the size of Senegal—could satisfy all of Africa's projected power needs by 2040. Today solar power is the cheapest electricity amongst the various alternatives and its capacity factor improves as technologies advance. The modularity and versatility of solar technology enable it to be developed close to end users and within short timeframes. Solar offers both centralised and decentralised solutions—and is particularly well-suited to provide electricity access to remote areas. Several large-scale solar projects are already operational or under construction. Morocco's Noor Solar Complex, one of the largest Concentrated Solar Power (CSP) plants globally, has been operational for 8 years, with a capacity of over 500 MW. Egypt's Benban Solar Park, a massive photovoltaic (PV) solar farm with 1.65 GW capacity, has been running for 5 years. The newly constructed Kenhardt Solar Facility in South Africa, one of the world's largest hybrid solar and battery storage projects, sets a new standard in combining renewable energy with energy storage.

Africa is set to expand its solar energy. The Desert to Power initiative aims to provide electricity to 250 million people across the Sahel region, generating 10 GW of solar power. Tunisia's TuNur Solar Project, still under development, targets 4.5 GW, with the goal of exporting energy to Europe. Nigeria, in a recent deal, set a target of 5 GW of installed solar capacity by 2030, with a 1 GW solar plant already under development.

Grid interconnection from East to West across the vast African continent could also allow for extended hours every day with less need for energy storage capacity.

Large parts of Africa also have excellent wind resources, particularly in coastal areas and the Great Rift Valley. The potential is such that continental Africa possesses an onshore wind potential of almost 180 000 Terawatts-hours (TWh) per annum, enough to satisfy the entire continent's electricity demand 250 times over. An analysis by the IDC and Everoze states that 27 African countries on their own each have sufficient wind potential to theoretically supply all of Africa with electricity.

Africa also sits on top of numerous active geothermal hot spots, particularly along the Great Rift Valley in East Africa—but the potential for geothermal energy generation extends across the continent. Geothermal has been part of energy systems for more than a century, widely used in many North European countries to provide heating, and now emerging technologies such as horizontal drilling and hydraulic fracking honed through oil and gas developments in North America could enable access to previously untapped resources. On average, the temperature in the Earth's crust increases by 25-30 ^{o}C per kilometre of depth, although unevenly distributed and strongly linked to tectonic conditions. New drilling technologies exploring resources at depths beyond 3 km imply temperatures greater than 90^{o}C and open a potential for geothermal in nearly all countries in the world. Going deeper (such as to 8 km) potentially delivers exponential improvements. Geothermal can provide around-the-clock electricity generation, heat production and storage with an average utilisation rate of over 75% in 2023, compared with less than 30% for wind power and less than 15% for solar PV. In Africa, Kenya is most active in pursuit of geothermal energy as a technology that provides a secure base-load but its potential is ubiquitous. A study by the IEA finds that costs for next-generation geothermal could fall by 80% by 2035 at which point new projects could deliver electricity on par or below hydro, nuclear and bioenergy, and potentially compete with solar PV and wind paired with battery storage.

It is therefore ironic that, in 2023, less than 2% of Africa's energy production came from sources such as geothermal (0.7%), nuclear (0.34%), solar (0.43%) or wind (0.36%). Energy from hydro contributed less than 3%. Africa's energy production landscape is heavily fossil-fuel dependent (North and Southern Africa in particular) and is primarily composed of oil at 43.5%, gas at 32% and coal at 19%, much of which is exported. East and West Africa have a more balanced and cleaner power generation mix, particularly from hydropower and geothermal.

While the MENA region, including North Africa, holds around 60% of the world's proven oil reserves, most countries in sub-Saharan Africa (SSA) import much of their refined fuel requirements from elsewhere. SSA only has 2 to 3% of the world's refining capacity and is thus vulnerable to oil price shocks and regional fuel shortages. The region relies heavily on liquid fuels for primary energy consumption, particularly diesel, which accounts for most of transportation fuel consumption, baseload and backup electricity generation. For example, up to 90% of Senegal's electricity is generated via diesel and heavy fuel oil.

Improving local liquid fuel production is particularly challenging in the region due to underdeveloped infrastructure and unreliable transportation networks. Apart from Kenya and South Africa, which have pipelines to transport liquid fuels, petroleum products are generally transported by road and truck. Chart 4 from the Global Energy Monitor presents the location of energy projects and the few pipelines in Africa.

Chart 4: Africa's energy facilities and pipelines

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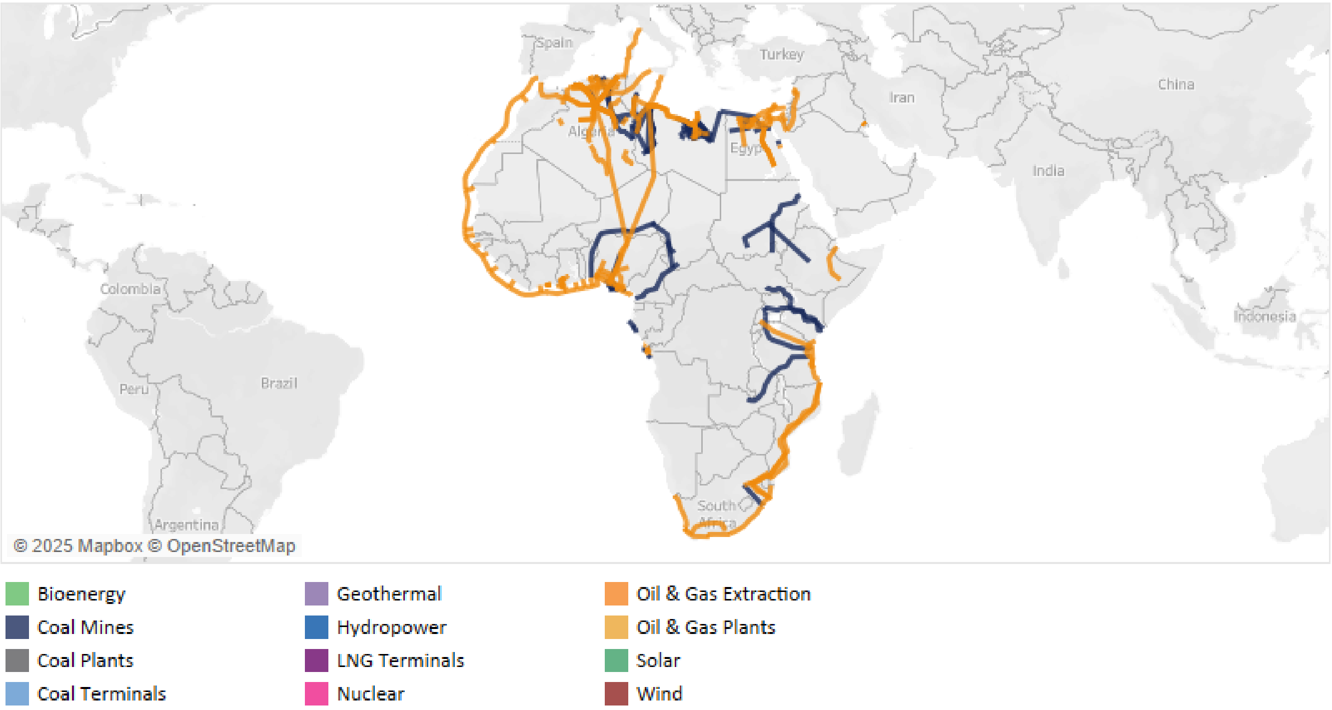

Source: Global Energy Monitor, Africa Energy Tracker, January 2025 release

Several African countries have expressed interest in developing nuclear power as a means to enhance energy security, diversify electricity generation and support industrial growth. Currently, only South Africa has a commercial nuclear power plant, the Koeberg station near Cape Town, that accounts for around 6% of the nation's electricity production, with a capacity of 1 940 MW. The first unit was synchronised to the grid in 1984 and was scheduled for decommissioning in 2024, but its lifespan has now been extended to 2044. Recognising the need for additional nuclear capacity, the National Energy Regulator of South Africa (NERSA) approved plans in 2021 for South Africa to procure an additional 2 500 MW of nuclear power.

Apart from South Africa, Egypt has taken the most significant steps toward nuclear power expansion. The country has embarked on a large-scale nuclear development program, awarding a US$25 billion contract to Russia's Rosatom for the construction of the El-Dabaa Nuclear Power Plant, located along the Mediterranean coast. The plant will have a total capacity of 4.8 GW, with the first reactor expected to come online in 2028, followed by full operational capacity across all four units by 2030.

Several other African nations, including Ghana, Morocco, Uganda, Burkina Faso, Kenya and Rwanda, have expressed interest in nuclear power and are in various stages of feasibility studies, regulatory planning and capacity building. However, none of these countries has begun construction of nuclear facilities. Challenges such as financing, regulatory frameworks, public acceptance and technical expertise remain significant barriers to nuclear development in the region.

In addition to its abundant renewable energy resources, Africa has the most significant untapped hydropower potential of any region globally, but hydro only constituted 2.8% of total energy production in 2023. The continent has many rivers and waterfalls, making it a prime candidate for hydropower generation. On the Current Path, hydro will contribute 6.1% of the continent's production in 2050, and several large hydroelectric schemes are currently under construction. For example, Ethiopia recently completed the US$5 billion Grand Ethiopian Renaissance Dam (GERD) on the upper reaches of the Blue Nile close to its border with Sudan. GERD is the third-largest hydroelectric facility in the world in terms of installed capacity, capable of generating almost 6.5 GW in peak operating conditions. With the completion of GERD, Ethiopia is now the largest source of hydroelectric power in Africa, having overtaken DR Congo.

Other hydroelectric projects include the Julius Nyerere Hydropower Plant and Dam in the Rufiji River basin in Tanzania, which would each deliver 2.1 GW. In DR Congo, the first two dams of the Grand Inga scheme, Inga I and II, are built, and Inga III is imminent. But the larger Grand Inga Dam (of which Inga III would only be a first phase) has been in planning since the 1950s, held back by poor planning, inefficiencies and corruption—and the need to lay transmission lines over several thousand kilometres to the large South African and Nigerian markets.

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About the authors

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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