ISCA
INTERNATIONAL SECURITY CONFERENCE ON AFRICA

GLOBAL ENERGY DYNAMICS AND IMPLICATIONS FOR AFRICA

ISCA/26 FEBRUARY 2026

Executive Summary

This report provides a comprehensive, data-driven analysis of the energy landscape in Sub-Saharan Africa. It situates energy as the fundamental enabler of economic growth, social progress, and human development while examining the contradiction between the continent's vast resource wealth and its status as the most energy-poor region in the world. The report explores the interconnections between energy systems, demographic shifts and development ambitions, emphasizing that energy security must be viewed as a strategic means for states to achieve broader development, security and sovereignty goals. Furthermore, it assesses the unique opportunities and strategic challenges presented by the global transition to clean energy, ultimately offering a framework for context-specific, locally driven policies to ensure a sustainable energy future.

The prevailing energy dynamics in Sub-Saharan Africa are shaped by significant structural hurdles, including the persistent urban-rural divide and the political complexities of reforming fossil fuel subsidies and inefficient state-owned utilities. While the continent contributes only a small fraction of global greenhouse gas emissions, it disproportionately bears the economic and social costs of climate change. The report highlights that successful adoption of low-carbon pathways can foster long-term environmental resilience and low-carbon industrialization. However, this requires navigating a severe funding gap for infrastructure and managing the risk of creating new forms of external dependency. Strategic opportunities for the region include leadership in renewable energy, integration into the critical mineral value chain and the adoption of smart grid and digital solutions to leapfrog traditional energy constraints.

To move beyond the paradox of resource abundance and energy poverty, the report proposes a strategic energy-security lens where energy is viewed not just as an end, but as the means by which a state achieves its strategic security goals. This approach is best achieved by aiming for energy sovereignty, a framework that strengthens the ability of a nation to exercise choice over its energy sources and uses to satisfy its specific needs. Governments must place energy sovereignty at the heart of future decision-making to ensure self-determined development and avoid new forms of external dependency.

Each section addresses distinct issues of huge contemporary importance to Africa in dealing with changing global energy dynamics. The first section examines the energy-development nexus, detailing energy's indispensable role in economic growth and its centrality to achieving the Sustainable Development Goals (SDGs). The second section addresses energy access and energy poverty, the sustainability challenge, and the evolving renewable energy eco-system. The following section of the report considers issues of governance and sovereignty as they relate to energy institutions. This section also tackles the politically charged and societally contentious issues of electricity politics and energy sector reform. The next section brings the issues considered in the previous three sections together by examining the strategic opportunities and challenges that African states now face individually and as regional and sub-regional actors. Specifically, this section is divided into two parts. The first addresses what the authors consider to be the four primary strategic opportunities: (1) renewable energy leadership; (2) critical mineral value chain integration; (3) energy storage, smart grids digitization; and (4) digital solutions, and entrepreneurship and sectoral innovation. The second then considers the five primary strategic challenges facing Africa in an era of rapidly changing energy dynamic. These are (1) regional trade integration and power trading; (2) stranded assets and revenue loss; (3) the economic and societal impact of the energy transition; (4) the lack of infrastructure funding; and (5) the need for sovereign control over the critical mineral value chain.

Take together, these sections offer a contemporary assessment of how global energy dynamics impact on Africa on a range of important but distinct issues. These four sections also serve another purpose. They complement each other and contribute in a cumulative manner to the key conclusions and recommendations set down in section five. These are based on a foundational premise that coherent leadership, the correct allocation of resources and proper operational processes are necessary to facilitate context-specific, locally driven strategies that are effective in maximizing the opportunities and minimizing challenges of today's global energy system. Specifically, this section argues that this requires African states working individually and collectively to adopt pragmatic long-term innovative strategies with a range of partners that consolidate, not concede, energy sovereignty. This will foster external interdependence and will allow for the best use of the continent's natural and human resources. This can be done in five main ways: (1) The development of local manufacturing and national green industrial policies; (2) The adoption of targeted incentives and de-risking mechanisms; The prioritization of investments in the resources, infrastructure, and technology that are most beneficial to long-term prosperity and sustainability; (3) A commitment to policy regime stability and regulatory certainty for renewable and energy transition strategies; and (4) The development of human capital in line with maintain national interests in the service of national objectives and strategic goals.

Table of Contents

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Rory Miller, PhD, is a Professor of International Politics, Director of the Small States Research Program, and Director of the Energy Studies Program at Georgetown University in Qatar where he teaches and researches on regional security, small states security, maritime and energy security, alliances and external intervention. He also serves as a Non-Resident Senior Fellow at the Middle East Council on Global Affairs. Between 2019 and 2024, he led a multi-year funded research project on “Managing National Security Risk during and after the Blockade: Strategic Challenges and Opportunities for Qatar’s Energy Sector”. In recent years, he has held a visiting professorship in the War Studies department of King’s College London (2014-17), and a Visiting Research Professorship at Trinity College Dublin (2020-21). He is the author or editor of 11 books. He is co-editor of the Cambridge University Press book series on “Intelligence and National Security in Africa and the Middle East”. His policy-focused work has appeared in Foreign Affairs, The Economist, Foreign Policy and The Wall Street Journal.

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Muez Ali, PhD

Acronyms

AfCFTA	African Continental Free Trade Area
AFSIA	Africa Solar Industry Association
AI	Artificial Intelligence
APG	ASEAN Power Grid
ASEAN	Association of Southeast Asian Nations
CBAM	Carbon Border Adjustment Mechanism
ECOWAS	Economic Community of West African States
EIIs	Energy-intensive Industries
EU	European Union
EV	Electric Vehicles
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GHG	Greenhouse Gases
IEA	International Energy Agency
IMF	International Monetary Fund
IRA	Inflation Reduction Act
IRENA	International Renewable Energy Agency
ISDS	Investor-State Dispute Settlement
LDCs	Least-developed Countries
MEAs	Multilateral Environmental Agreements
NDC	Nationaly Determined Contributions
NZE	Net Zero Energy
PAYG	Pay-As-You-Go
PLI	Production Linked Incentive
PPAs	Power Purchase Agreements
REC	Renewable Energy Certificate
SADC	Southern African Development Community
SDGs	Sustainable Development Goals
SHS	Solar Home Systems
STEPS	Stated Policies Scenario
TFC	Total Final Energy Consumption
UNFCCC	United Nations Framework Convention on Climate Change

The Energy-Development Nexus

Energy is not merely a commodity; it is the fundamental enabler of economic growth, social progress and human development. It is also a key factor in determining levels of human security. For these reasons, it transcends matters of simple economic growth to encompass the ‘realization of the human personality’, and the expansion of freedoms. In these contexts, energy systems, economic growth, demographic changes and development ambitions are all interconnected as one comprehensive societal process that improves the well-being of all individuals. Energy can no longer be treated as an isolated technical sector of economic endeavor. A sufficient and reliable supply of energy is a precondition for economic transformation and energy availability is a primary driver of economic growth.

The African continent holds vast reserves of fossil fuels, critical minerals and a large renewable energy potential. Yet Africa remains the most energy-poor region in the world. There are stark inequalities within the continent, where North African countries and South Africa have managed to achieve almost universal access to electricity, whereas in the rest of Sub-Saharan Africa more than 600 million citizens, nearly half of the continent’s population, still lack reliable access to modern, reliable and affordable energy. This contradiction between resource wealth and energy poverty defines the current state of Sub-Saharan African energy systems. Within these two poles, regional actors must simultaneously address widespread energy poverty and navigate the global transition away from fossil fuels, while ensuring energy security in the future. Addressing this challenge is a prerequisite to advance public health, enhance education to build human capital, create economic opportunities and build resilience for the future.

Domestic development needs and a rapidly transforming global energy system will shape and determine the future of energy in Sub-Saharan Africa. Two of the most significant and persistent policy challenges in Sub-Saharan Africa's energy sector are the prevalence of fossil fuel subsidies and the historical dominance of inefficient, state-owned power utilities. Reforming these areas is technically complex and politically fraught. Subsidy reform often sparks public opposition and threatens vested interests.

Sub-Saharan African states have enormous potential to fuel their future growth with clean energy. The successful adoption of low-carbon pathways offers opportunities to foster long-term environmental improvements through sustainable, decarbonized industrialization and renewable-based adaptation strategies. This can reduce the risk of water scarcity and agriculture stress and reduce the impacts of extreme weather events while cutting greenhouse gas emissions. As the renewable energy sector matures it may increase energy affordability and access for the poorest members of society.
Africa contributes a very small percentage to global greenhouse gas emissions, accounting for around 3 to 4% of the world’s total.

Seers, D. 1969. The Meaning of Development. IDS Communication 44, Institute of Development Studies.
Sen, A. 1999. Development as Freedom. New York: Alfred Knopf.
Mkandawire, T. 2001. Thinking about developmental states in Africa. Cambridge Journal of Economics 25(3): 289-313.
IEA, IRENA, UNSD, World Bank, WHO. 2025. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC. World Bank.
Ibid Kammen, D.M. 2024. and Akinsipe, O.D.African economic expansion need not threaten global carbon targets: study points out the path to green growth’, The Conversation (August 12)
https://theconversation.com/african-economic-expansion-need-not-threaten-global-carbon-targets-study-points-out-the-path-to-green-growth-235396

Yet it is one of the regions most effected by the negative impacts of climate change, which poses significant economic, social, and environmental challenges for the continent. Sub-Saharan African countries lose between 2 to 5% of their GDP each year due to the negative effects of climate change. Many states divert up to 9% of their budgets to respond to these crises.
At the same time, energy consumption is declining in developed economies as they diversify into service-oriented sectors and divert investment into energy efficient technologies. In developing countries, including those across Sub-Saharan Africa, the opposite is true. These emerging markets still rely on more traditional, less energy-efficient economic sectors.

Addressing these interrelated challenges is vital to ensure Sub-Saharan African energy security in the future. To do so effectively requires the introduction and expansion of mitigation and adaptation mechanisms across the continent that can tackle the use of inefficient and polluting 'zombie energy systems' and reduce the environmental impacts of fossil fuel use where renewable energy access is limited. The continent faces a severe lack of funding to undertake these necessary investments. It is estimated that $200 to $400 billion is required to respond to climate-related challenges across the continent. This presents a dilemma for decision-makers: allocate limited resources to the development of large-scale renewable energy systems or to other priorities including healthcare, poverty reduction, job creation and infrastructure projects. This is particularly challenging since the areas competing for resources compliment each other and are all necessary to ensure long-term development and resilience to climate change.

This report provides a data-driven overview of Sub-Saharan Africa's energy mix, consumption patterns, the difficulties of embarking on necessary reforms, and the potential pitfalls of any policy changes. This includes addressing the deep-seated inequalities that present significant barriers to sustainable development. It also explores future energy scenarios, the unique opportunities as well as challenges presented by the global shift to clean energy and the strategic choices facing the region's policymakers as they chart a path forward. The short-term recommendations made here are primarily intended to provide a pathway for gathering evidence and a framework for developing research and analysis on how best to address medium and long-term recommendations in a more formalized manner in the future by way of bespoke research and policy engagement.

The analysis in this report focuses on Sub-Saharan Africa for several reasons. First, Sub-Saharan African countries, are home to 600 million people without access to electricity, and they all face similar challenges in increasing access to modern energy. North African countries, in contrast, have virtually achieved universal access to modern energy. Second, Sub-Saharan African countries have similar political and social dynamics, that in many cases are transboundary in nature and cross sovereign borders. Third, the economies and labor markets of Sub-Saharan African countries are similar, with the agricultural sector employing a majority of the labor force in most countries. This means that there are real similarities in the constitution and dynamics of their energy infrastructures. Finally, the geographical proximity of Sub-Saharan African countries – and the physical separation from North Africa by the Saharan desert – allows for the development of energy alliances through regional pools. This further integrates Sub-Saharan African economies, though South Africa tends to be an outlier due to the size of its economy and level of development.

Jaynes, C.H. 2024. African Nations Are Losing up to 5% of Annual GDP due to Climate Change, WMO Finds. EcoWatch (September 4) https://www.ecowatch.com/africa-countries-climate-change-gdp-loss-wmo.html.
Clean Air Task Force. 2025. Unearthing the Reality of 'Zombie Energy Systems' in Africa's Energy Transition. (January 29) https://www.catf.us/resource/unearthing-reality-zombie-energy-systems-africas-energy-transition/.
Munyati, C. Signé, L. 2023. COP28: Bridging the Climate Finance Gap in Africa and Beyond. World Economic Forum (December 6) https://www.weforum.org/stories/2023/12/cop28-bridging-the-climate-finance-gap-in-africa-and-beyond/

It should also be noted that we refer to developments in North African countries in various sections across the report where there are examples of good (or bad) practice and where it is both necessary and beneficial to present data for the whole of Africa to make specific arguments around the continent's developmental path and global position (for example, commitments to the Paris Agreement and NDCs).

Energy's role in economic growth

Energy is an indispensable – though often overlooked – catalyst for economic transformation. In classical economic models, energy resources are implicitly embedded within the factor of "land." Similarly, in the neoclassical Solow-Swan model, energy is a crucial, though unstated, component that powers capital (machinery, infrastructure) and enables technological progress. The Industrial Revolution illustrates this link: the transition from wood to the energy-dense power of coal, coupled with the invention of the steam engine, was the main driver of economic expansion.

Research has also demonstrated that innovation and human capital development (as an outcome of earlier institutional development) are primary drivers of long-term growth. Energy fuels innovation and the systems that build human capital. In Kenya, electricity was essential in building and powering the telecommunications infrastructure that enabled the rise of mobile payment systems like M-Pesa, which revolutionized access to finance and spurred rural economic activity. New investments in energy infrastructure are also designed to power new industries and foster technological development, as in the case of Ethiopia's investment in hydropower embodied in the Grand Ethiopian Renaissance Dam.

Energy and the Sustainable Development Goals (SDGs)

Energy is central to the 2030 Agenda for Sustainable Development. Analysis shows that action related to the energy system is required to meet 113 of the SDG targets (65%). Sustainable Development Goal 7 (SDG 7) explicitly aims to 'ensure access to affordable, reliable, sustainable and modern energy for all.' Progress towards these targets, however, has been slow and uneven. The world is not on track to achieve universal access by 2030, and Sub-Saharan Africa faces the most significant challenges.

Ayres, R. et al. 2013. The underestimated contribution of energy to economic growth. Structural Change and Economy Dynamics 27: 79-88.
Wrigley, E.A. 2010. Energy and the English Industrial Revolution. Cambridge: Cambridge University Press.
Acemoglu, D. et al. 2014. Institutions, Human Capital and Development. The Annual Review of Economics 6: 875-912.
Diebolt, C. and Hippe, R. 2019. The long-run impact of human capital on innovation and economic development in the regions of Europe. Applied Economics 51(5): 542-563.

Target	Status/Key findings (as of 2023)
Target 7.1 (Electricity access and clean cooking): By 2030, ensure universal access to affordable, reliable and modern energy services.	The number of people without electricity access increased to 666 million. Sub-Saharan Africa accounted for 85% of this deficit. At current rates, 660 million will still lack electricity in 2030. 2.1 billion people still relied on polluting fuels and technologies. The access deficit in Sub-Saharan
Target 7.2 (Renewable energy share): By 2030, increase substantially the share of renewable energy in the global energy mix.	The share of modern renewable sources in total final energy consumption stood at just 17.9% in 2022.
Target 7.3 (Energy efficiency): By 2030, double the global rate of improvement in energy efficiency.	Energy intensity improved by only 0.8% in 2021, far below the required annual average of 4% to meet the 2030 target.
Target 7a (International finance): By 2030, enhance international cooperation to facilitate access to clean energy research and technology and promote investment in energy infrastructure and clean energy technology.	International public financial flows for clean energy in developing countries rose to $21.6 billion, but this is still half of the 2016 peak.

Achieving SDG 7 creates powerful synergies with other goals. For example, providing clean cooking fuels (Target 7.1) directly improves health outcomes by reducing indoor air pollution, contributing to SDG 3 (Good Health and Well-being). However, tradeoffs can also exist, such as the potential environmental and social impacts of large-scale hydropower projects aimed at increasing renewable energy capacity (Target 7.2). Addressing the foundational challenge of ensuring appropriate, sustainable and equitable access to energy is thus not just about achieving SDG 7, but about unlocking progress across the entire 2030 Agenda.

In these terms, energy is central to the debate over the positive and negative consequences of economic growth. The "green growth" perspective promotes development without exacerbating climate change. This decoupling of growth from environmental degradation relies on transitioning to renewable energy sources. Major global economies including the United States and United Kingdom have already decoupled growth from energy consumption (Figures 1 and 2). The African continent has yet to do so (Figure 3). The consequences of continued coupling are different for each country within the continent depending on the structure of their economies and levels of development. For more developed economies with large industrial sectors, continued coupling may mean continued reliance on energy imports for net importers of energy and vulnerability to potential global carbon taxes. For less developed economies with ambitions to industrialize, continued coupling would signal missed opportunities at increasing energy efficiency and enhancing energy security through renewable energy integration. For all countries, given developmental ambitions on the continent, continued coupling would exacerbate the impacts of climate change across the continent and globally.

Stern, D.I. 2004. The rise and fall of the environmental Kuznets curve. World Development 32(8): 1419-1439.

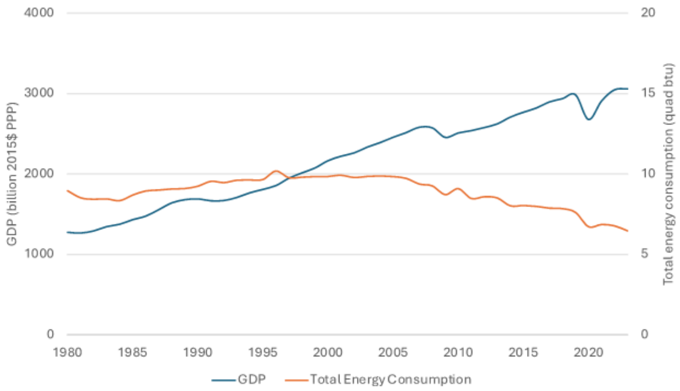


Figure 1 - Decoupling of energy use from economic growth in the UK (Source: US EIA).

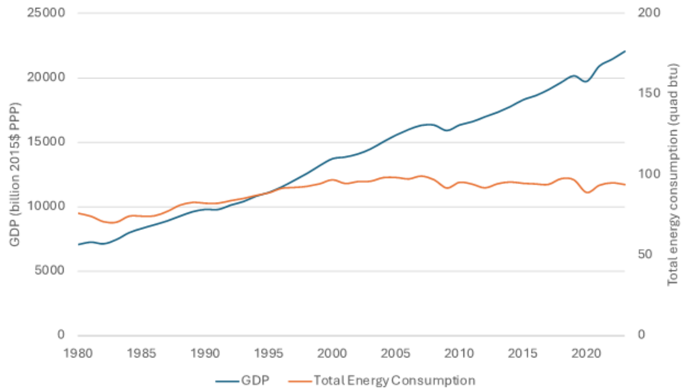


Figure 2 - Decoupling energy from economic growth in the US (Source: US EIA).

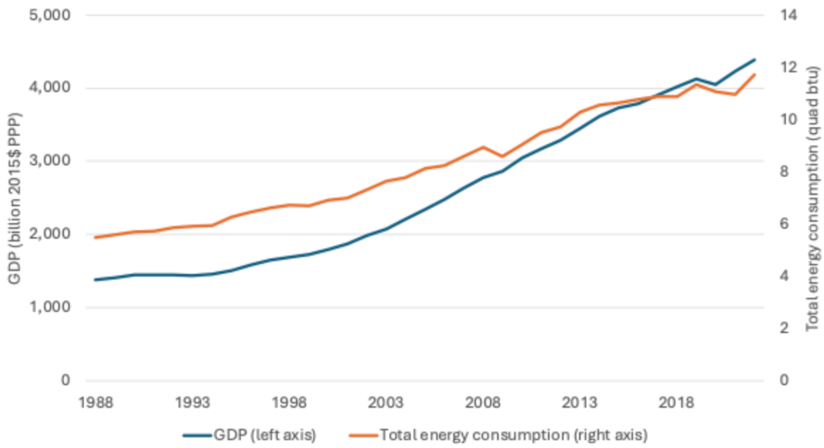


Figure 3 – GDP (in billion 2015$ PPP) and total energy consumption (in quad btu) in Africa over time (Source: US EIA).

One demonstration of Africa's strong commitment to environmental protection is the active participation of most countries in various Multilateral Environmental Agreements (MEAs), including conventions and declarations governing different aspects of environment protection, from energy transition to the protection of biodiversity and marine life. Since its introduction, 53 African countries have become members of the United Nations Framework Convention on Climate Change (UNFCCC). According to the UNFCCC, the environmental obligations of African countries are limited to a commitment to emission reductions and the responsibility of gathering and communicating information, mainly without a binding signatory obligation. All African countries are parties to the Paris Agreement, a legally binding international treaty on climate change. It was adopted at the UN Climate Change Conference (COP21) in Paris, France in December 2015, and entered into force in November 2016.

In addition, African countries also jointly develop their Nationally Determined Contributions (NDCs) every five years to address developments in the global energy transition. They also set their own agendas, which in principle comply with the African Union agendas and climate goals. The majority of African countries also set their climate targets in their NDCs. However, due to differences in resource distribution, each African region has a different climate focus in their NDC's. Angola's NDCs, for example, state that the country aims to reduce its GHG emissions by 50% by 2030; increase reliance on power generation from renewable sources; reduce demand for fossil fuels; and encourage the use of alternative energy. To achieve this, the country has committed to invest $14.7 billion in mitigation measures and $1 billion in adaptation. Mozambique has set the goal of increasing energy resilience at the provincial level between 2020 and 2025. Nigeria's NDCs include a commitment to increase the share of renewable energy in electricity generation and replace coal and other fossil fuels with cleaner alternatives in the manufacturing and construction sectors; and the adoption of sustainable practices in the oil and gas sectors.

All this situates energy at the nexus of strategic economic and development planning and national security for all African countries. Failure to understand energy in these terms, risks unmanageable urban strain on resources, an inability to meet even the most basic human development goals, vulnerability to global market dynamics and reliance on external actors for national security. But energy also provides an opportunity if policy actors can move beyond conventional thinking about energy security as primarily concerned with ends – what the actor seeks to achieve. For consumers, those ends are usually focused on ensuring access, stable supply, and affordability; for producers, they tend to be stable demand and safe transit of energy to consumer markets. Instead, it is possible to view energy security differently: as the way that a state actor seeks to achieve its strategic security goals (ends) and the means that it uses to do so.

Demographic changes and the energy landscape

The relationship between urbanization and energy consumption is deep-rooted and dynamic. While Africa remains one of the least urbanized continents, it is experiencing unprecedented urban growth. Projections indicate that by 2050, the urban population in Africa will exceed that of Europe and will potentially double to 1.4 billion people. As millions of people migrate to cities as a result of the negative impacts of climate change or in search of economic opportunities, demand for electricity, transportation fuels and modern energy services for homes and businesses will surge. This increased demand will place a great strain on already overburdened infrastructure. Mounting evidence also shows a positive correlation between urbanization and energy consumption. This makes the increase in urban populations the demographic factor with the most immediate implications for the energy sector in Sub-Saharan Africa and increasingly a key challenge to energy security.

African Development Bank. 2019. Africa NDC Hub," African Development Bank - Building today, a better Africa tomorrow (April 16) https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/africa-ndc-hub .
About Africa NDC Hub. 2015. Africandchub.org, https://africandchub.org/country/mozambique.
Nigeria's Third Nationally Determined Contribution 2025. UNFCC
https://unfccc.int/sites/default/files/2025-09/Nigeria%20NDC%203.0%20-%20Transimission%20Version%202.pdf
See, for example, Ipek, P. 2009. Azerbaijan's Foreign Policy and Challenges for Energy Security. Middle East Journal. 63 (2): (227-239.
OECD et al. 2025. Africa's Urbanization Dynamics 2025: Planning for Urban Expansion, West African Studies, OECD Publishing, Paris. https://doi.org/10.1787/2a47845c-en
While this relationship varies region, level of development and methods of analysis, on average, results for Sub-Saharan Africa and

The Current State of Energy in Sub-Saharan Africa

Energy consumption and generation profile

Total Final Energy Consumption (TFC) across Sub-Saharan Africa between 2000 and 2022 underscores the heavy reliance on traditional fuels and the dominance of the residential sector in energy consumption (Figures 4 and 5). The largest single source of energy consumed is biofuels and waste (such as wood and charcoal), primarily for household cooking and heating. This is followed by oil products, which are mostly consumed in the transport sector. The residential sector is by far the largest energy consumer. This is the result of widespread use of traditional biomass for cooking. The transport sector is the second-largest consumer, while consumption in the industrial sector largely plateaued since 2010.

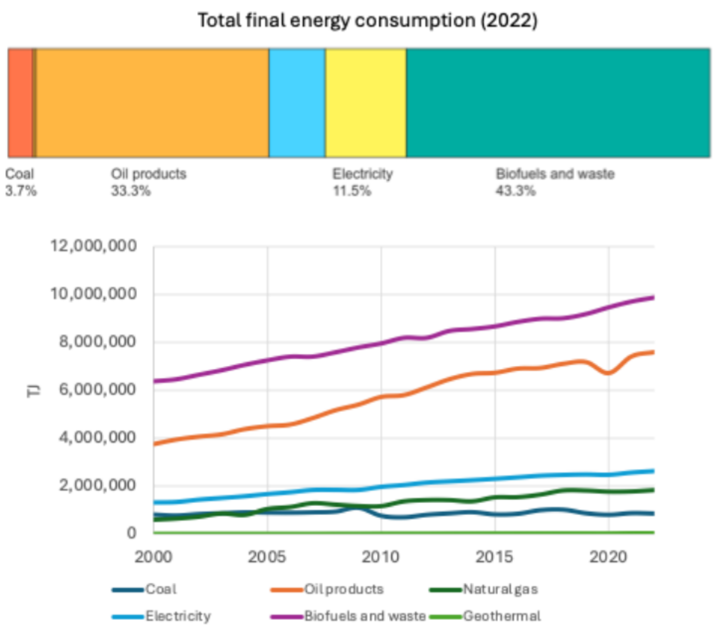


Figure 4 - Total Final Consumption (TFC) in Africa by energy type (in TJ) (Source: IEA).

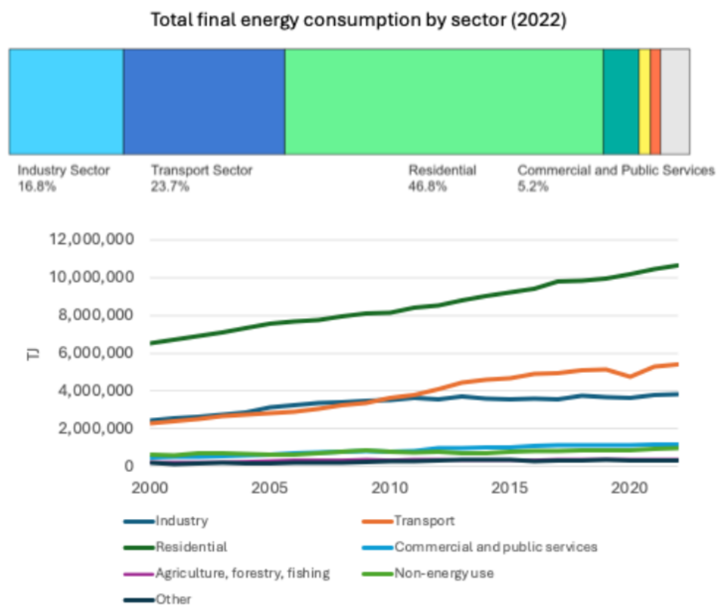


Figure 5 - Total Final Consumption (TFC) in Africa by sector (in TJ) (Source: IEA).

Africa's reliance on biofuels and waste and the dominance of the residential sector in TFC is emblematic of the underdevelopment of its energy sector and the structure of the wider economy in which industry's share of GDP decreased from 34% in 1980 to 26% in 2024. Africa's biofuels and waste share of TFC (43%) is double the share of Central and South America (21%) (Figure 6). Africa's residential share of TFC (47%) is almost double that of Europe's (24%), where most residential energy is used for heating (Figure 7).

IEA. 2023. Africa Energy Outlook 2022. Paris: IEA.
World Bank. 2025. World Development Indicators: Industry value added (% of GDP). Washington D.C.: World Bank.

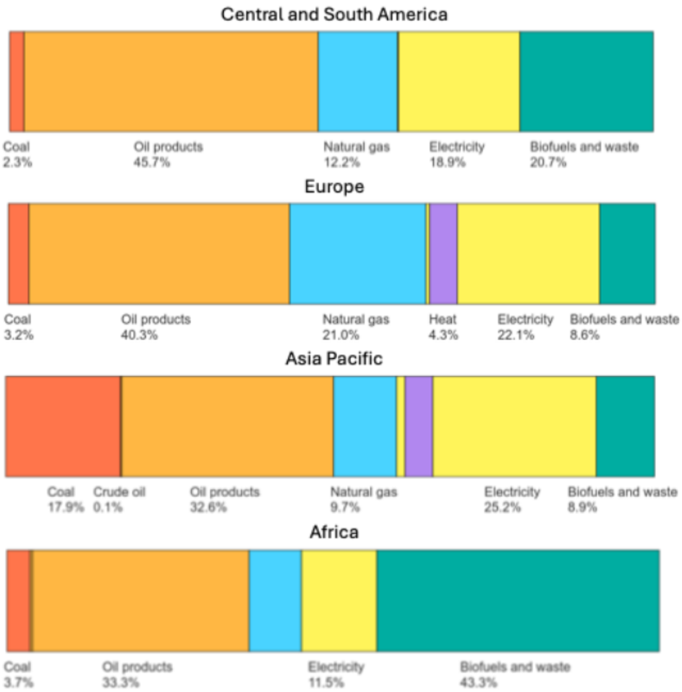


Figure 6 - TFC by fuel type for different regions (Source: IEA).

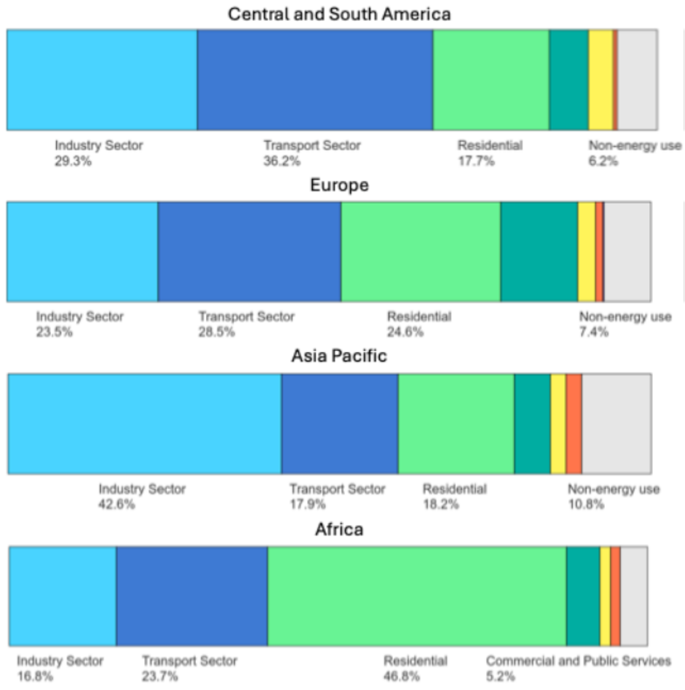


Figure 7 - TFC by sector for different regions (Source: IEA).

In the power sector, the generation mix is evolving gradually. Coal use is declining and there has been a steady increase in generation from natural gas and hydropower (Figure 8). There is also a noticeable increase in renewable sources (solar, wind, geothermal). As of 2021, renewables in Sub-Saharan Africa accounted for 3% of the global total, with over 80% installed in Southern Africa. Inequalities exist not only between urban and rural areas, but also in electricity generation and consumption across the continent. Just 5 of the 54 countries – South Africa, Egypt, Algeria, Morocco and Nigeria – account for 68% of the continent's total electricity generation (Table 1). This concentration of consumption may have negative impacts for regional trade as major consumers could dominate demand in a regional power pool. This means that smaller consumers – with smaller economies – who are more likely to need electricity to fuel future development may not benefit from regional energy trade and could get priced out.

IRENA. 2024. Sub-Saharan Africa: Policies and finance for renewable energy deployment, International Renewable Energy Agency, Abu Dhabi.

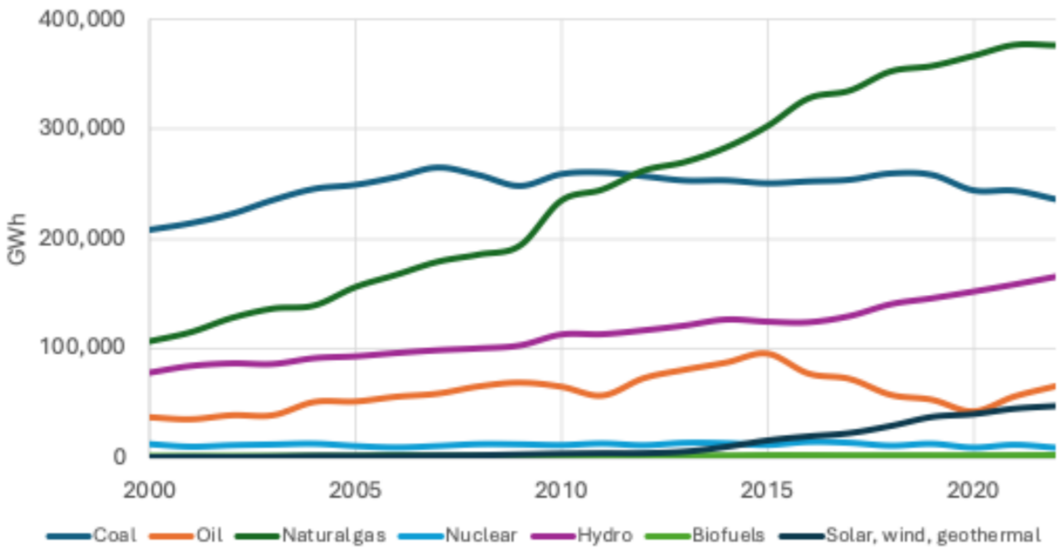


Figure 8 - Electricity generation by source in Africa (Source: IEA).

Table 1 - Top 10 producers of electricity by share of Total Generation in Africa in 2022 (Source: IEA) (Note: these figures do not include off-grid generation, which, despite recent growth, is negligible compared to grid generation).

Rank	Country	Total electricity generation (GWh)Total electricity generation (GWh)	Percentage (%)
1	South Africa	234,850	25.9
2	Egypt	208,739	23.1
3	Algeria	91,231	10.1
4	Morocco	42,722	4.7
5	Nigeria	37,915	4.2
6	Libya	35,106	3.9
7	Ghana	23,167	2.6
8	Tunisia	21,422	2.4
9	Mozambique	19,558	2.2
10	Zambia	19,475	2.2

Countries that are dependent on fossil fuel exports are economically vulnerable to the volatility of global energy prices. The fluctuations in oil and gas prices introduce significant instability into government budgets and national accounts (Figure 9). This volatility also has a direct impact on citizens' well-being, as there is a clear link between energy prices and food prices through the cost of agricultural inputs like fertilizers and fuel for machinery (Figure 10). This combination of internal inequality and external volatility creates a challenging environment for achieving appropriate, sustainable and equitable energy development.

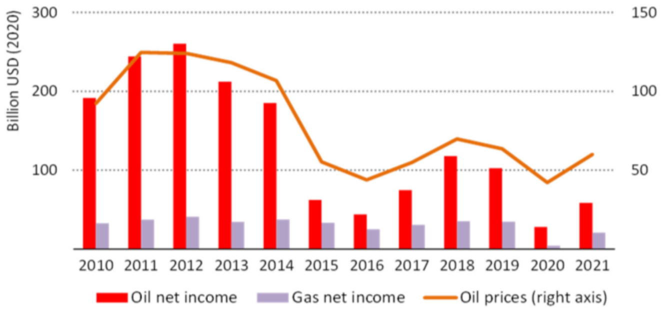


Figure 9 - Oil and gas income in Africa (Source: IEA).

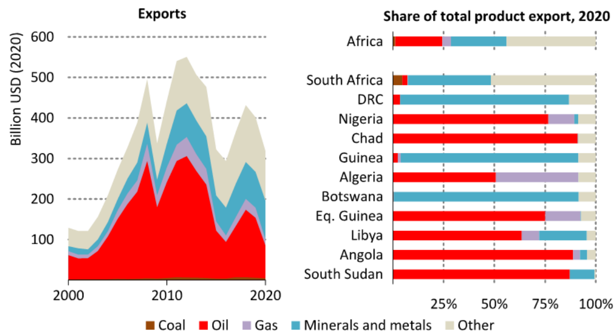


Figure 10 - Export value of fossil fuels, minerals and metals from Africa and share in total exports in selected African countries (Source: IEA).

The challenge of energy access and poverty

The scale of the energy access challenge in Sub-Saharan Africa is staggering. More than 660 million people lack access to electricity, and over 1 billion people rely on traditional biomass for cooking. During the colonial era a system of "urban bias" was implemented across Africa, whereby administrative centers were prioritized for infrastructure and services to manage resource extraction from rural areas. This disparity persists today, with modern energy and infrastructure services concentrated in urban areas and, since the beginning of this century, specifically in large million-plus cities. This compounds the stark urban-rural divide as over 80% of the rural population lacks electricity.

This lack of access translates into widespread energy poverty, defined as the inability to access modern and reliable energy services essential for a decent standard of living. This condition disproportionately affects women and children, who bear the primary burden of collecting firewood and suffer severe health consequences from indoor air pollution caused by burning solid fuels. This issue can be quantified using concepts like the "energy poverty line," which marks the threshold above which household energy consumption begins to rise with income, and various energy poverty indicators. However, it is crucial to recognize that simply providing energy access does not guarantee positive development outcomes.

IEA, IRENA, UNSD, World Bank, WHO. 2025. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC. World Bank.
Lipton, M. 1977. Why Poor People Stay Poor: a Study of Urban Bias in World Development. Canberra: Australia National University Press.
Njoh, A.J. 2003. Urbanization and development in Sub-Saharan Africa. Cities 20(3): 167-174.
IEA, IRENA, UNSD, World Bank, WHO. 2025. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC. World Bank.
Tsekane, P.N. 2024. Access to energy and women's human capital in Sub-Saharan Africa. Heliyon 10: e38473.
Khander, S. 2013. Why energy poverty may differ from income poverty. World Bank Blogs: Let's Talk About Development. Washington D.C.: World Bank. Available on: https://blogs.worldbank.org/en/developmenttalk/why-energy-poverty-may-differ-income-poverty
Al Kez, D. et al. 2024. Energy poverty assessment: Indicators and implications for developing and developed countries. Energy Conservation and Management 307: 118324.
MacGinley, T.J. et al. 2025. Electricity access advances human development… but not always. Energy for Sustainable Development 88: 101770.

A broader development agenda, like the one outlined below, and which includes infrastructure development and investments in industrial capacity, must be the focus of long-term plans to eradicate energy poverty and ensure energy security.
One approach is for government energy access expansion plans to explicitly differentiate between energy for basic household consumption and energy for productive uses. The commercial viability and sustainability of energy solutions – both grid and off-grid – especially in poorer regions cannot rely on consumption for lighting and phone charging. These only satisfy lower levels of access. Tackling energy poverty and ensuring resilience at the household level and scalability at the industrial level requires an approach centered around the productive uses of energy (PUE), which is energy that generates income and increases productivity. For example, in the agricultural sector, this may include energy for irrigation, milling and cold chains. In addition to income and productivity increases, a PUE approach enhances willingness- and capacity-to-pay for households and small and medium enterprises.

The paradox of resource abundance and energy poverty coupled with extreme production inequality, underscore that the primary barrier to development is not a lack of resources. Another significant factor is the failure of distribution and inappropriate governance frameworks to translate resource availability into widespread access. Energy infrastructure development and growth strategies must therefore prioritize long-term access to resources to ensure energy security, equitable infrastructure development and mechanisms to insulate economies from global commodity shocks.

Investments in renewable energy capacity

Despite vast potential and a significant energy access deficit, Sub-Saharan Africa has received a disproportionately small share of global renewable energy investment. This fell from under 1.5% of the world's total between 2000 and 2020 to less than 1% in the subsequent two years (2021 – 2022).

Total investment across the continent also declined from $5.3 billion in 2019 to less than $3.6 billion in 2022. Those investments that do take place in Sub-Saharan Africa are highly concentrated: South Africa, Nigeria and Kenya received over two-thirds of the regional total in 2021 and 2022. In addition, there are significant regional disparities in investment. Southern Africa (mostly South Africa) received disproportionately more investment in renewable energy between 2010 and 2020 than Central, West and East Africa. Conversely, the 33 least-developed countries (LDCs) have seen their small share decline further over the same period. In the decade between 2010 and 2020, driven largely by structured procurement programs, investment in Sub-Saharan Africa peaked in 2012 and 2018. Solar PV ($12.3 billion) and wind ($11 billion) were the dominant technologies, together making up most of the investment.

The World Bank's ESMAP's energy access framework, the Multi-Tier Framework (MTF), identifies six levels of access for households: Tier 0 (no access) to Tier 5 (access to affordable, reliable and safe energy). Each tier corresponds to a certain level of consumption and seven other factors, including reliability, safety and formality.
IRENA. 2024. Sub-Saharan Africa: Policies and finance for renewable energy deployment, International Renewable Energy Agency, Abu Dhabi. The investment data presented in the IRENA report is acquired from Wood Mackenzie's Off-Grid Renewable Investment database, which requires a subscription.

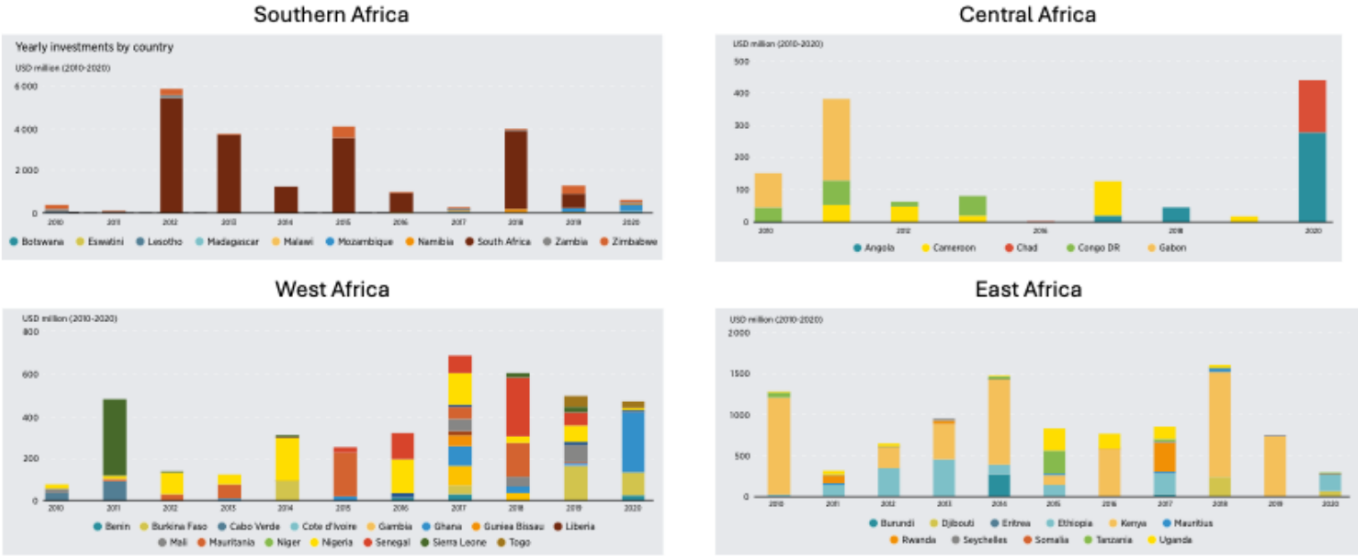


Figure 11 - Yearly investments in renewable energy by region by country (2010 - 2020) (Source: IRENA).

The increase in demand for solar PV across the continent is part of a global trend toward global decarbonization. Investment trends are also reflected in trade data. Growth in solar PV exports from between 2017 and 2024, has been mostly due to increased demand in Europe and Asia (Figure 12). Demand from Africa has increased significantly during this period but remains one of the lowest globally (Figure 12), only ahead of Oceania and North America (mainly due to tariffs on imports from China). Within Africa, the growth in solar PV imports from China has been uneven. Cumulative imports between 2017 and 2024 in Southern Africa (driven mainly by high demand in South Africa) are more than double imports into East Africa and more than 8 times greater than imports in Central Africa (Figure 13).

North Africa is the region with the second highest imports of solar PV from China, followed by West Africa. In these two regions, the increase in imports is driven by demand in Egypt and Nigeria, respectively. But recent trends in monthly imports show significant increases in demand in East Africa (Figure 13 and Figure 15). Since the beginning of 2025, monthly imports of solar PV in East Africa surpassed those in Southern Africa, North Africa and West Africa. While East African demand is dominated by Kenya, this trend is partially driven by a surge in imports in Sudan due to recent political instability. The conflict that started in April 2023 caused significant damage to energy infrastructure causing widespread power outages and demand for off-grid energy solutions.

On average, the trend in imports of solar PV in Africa for the period 2017 to 2024 shows a strong correlation between imports and economy size. African countries with the largest GDP show the highest demand for solar PV (Figure 14). But all countries have experienced significant and unprecedented demand during this period, with average year-on-year growth in demand for the continent at 191% (Table 2). It is important to note that, while there is a correlation between GDP and solar PV uptake for Sub-Saharan African countries, this does not imply causation.

Solar PV import data is compiled by Ember Energy source from the General Administration of Customs of the People's Republic of China. Given that China dominates global solar PV supply, it is a fair assumption to assume that this data is representative of total solar PV imports by country (see, for example, IEA. 2022. Special Report on Solar PV Global Supply Chains. Paris: IEA. Ember Energy's methodology is available here: https://ember-energy.org/data/china-solar-exports-data/#methodology

Other factors, including policies to incentivize renewable energy uptake – such as feed-in-tariffs, customs exemptions, power purchasing agreements (PPAs), independent power producer (IPP) regulations – have a significant impact on imports. The relationship between solar energy adoption and GDP is mediated by several factors, including quality of governance and, in some cases, the relationship is either non-linear or non-existent. Some smaller countries, such as Lesotho and Sao Tome and Principe, have shown demand growth of over 1000%, and even large energy producers such as Algeria, Angola, Egypt and Nigeria have shown average annual increases of 400%, 54%, 273% and 61%, respectively.

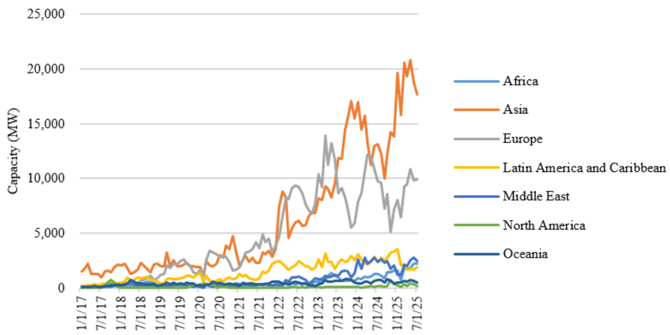


Figure 12 - Monthly imports of solar PV from China by region for the period 2017 to 2024 (Note: Capacity is in MW; Source: Ember Energy).

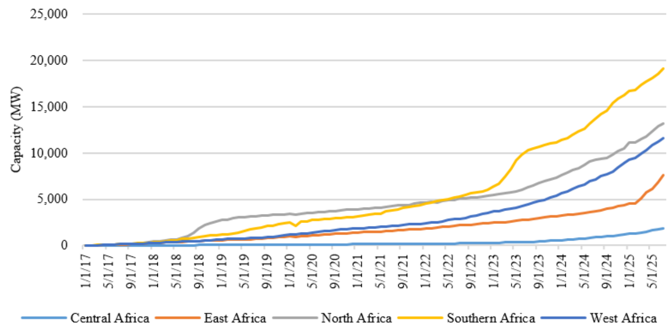


Figure 13 - Cumulative regional imports of solar PV from China into Africa for the period 2017 to 2024 (Note: Capacity is in MW; Source: Ember Energy).

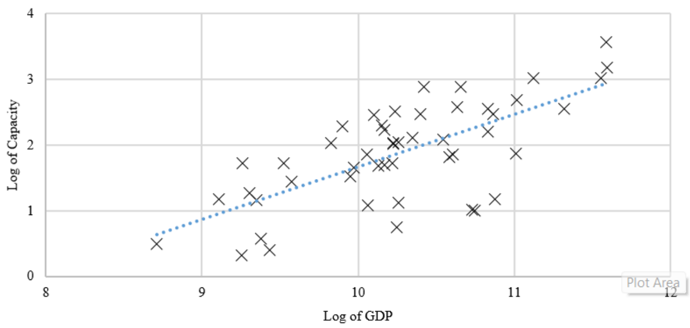


Figure 14 - Correlation between solar PV imports and GDP across African countries (Note: Capacity is in MW; GDP is in current US$; values are average for the period 2017 to 2024).

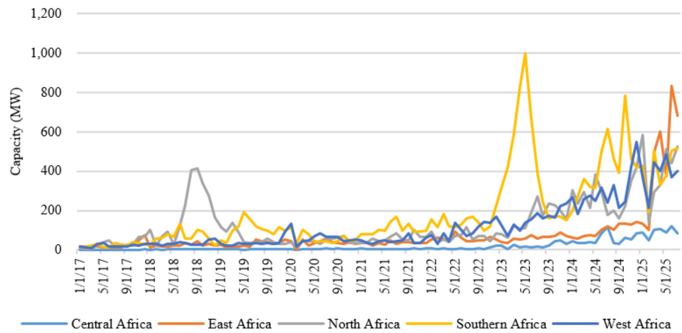


Figure 15 - Monthly regional imports of solar PV from China into Africa for the period 2017 to 2024 (Note: Capacity is in MW; Source: Ember Energy).

Diallo, S. and Ouoba, Y. 2024. Effect of renewable energy on economic growth in Sub-Saharan Africa: Role of institutional quality. Sustainable Development 32(4): 3455-3470.
Guliyev, H. and Tatoglu, F. Y. 2023. The relationship between renewable energy and economic growth in European countries: Evidence from panel data model with sharp and smooth changes. Renewable Energy Focus 46: 185-196.

Country	2017	2018	2019	2020	2021	2022	2023	2024	Avg. YoY increase (%) (2017-2024)
Algeria	3	20	13	20	33	3	38	361	400%
Angola	16	3	9	8	10	39	15	15	54%
Benin	7	17	17	26	47	81	82	105	53%
Botswana	1	2	2	1	2	5	7	6	48%
Burkina Faso	14	12	14	42	21	87	42	112	84%
Burundi	2	2	1	9	0	2	2	2	216%
Cabo Verde	1	0	0	0	1	0	6	14	368%
Cameroon	5	16	17	27	28	39	151	380	112%
Central African Republic	0	0	1	1	15	27	2	4	323%
Chad	2	3	2	7	4	9	30	53	99%
Comoros	0	0	3	5	0	1	0	15	718%
Congo	1	1	1	2	1	2	8	10	94%
Congo (DRC)	6	17	11	20	20	43	81	200	86%
Cote d'Ivoire	7	10	10	18	36	129	72	160	80%
Djibouti	4	8	8	6	11	18	28	53	56%
Egypt	103	1,83	519	228	368	225	968	1,042	273%
Equatorial Guinea	0	6	1	1	0	2	2	0	113%
Eritrea	13	4	0	1	0	1	1	2	189%
Eswatini	0	0	0	0	0	1	1	1	66%

Country	2017	2018	2019	2020	2021	2022	2023	2024	Avg. YoY increase (%) (2017-2024)
Ethiopia	3	6	5	9	8	16	19	75	78%
Gabon	0	1	3	1	1	0	2	13	264%
Gambia	3	3	4	9	7	7	30	19	66%
Ghana	66	55	33	128	52	61	117	303	62%
Guinea	5	13	12	13	17	18	61	100	76%
Guinea-Bissau	1	0	0	0	1	1	1	2	70%
Kenya	145	130	212	183	204	313	310	489	23%
Lesotho		0	0	0	0	2	0	1	1441%
Liberia	1	1	2	5	4	9	23	28	83%
Libya	1	0	3	3	5	13	10	11	95%
Madagascar	25	60	27	22	52	46	72	165	54%
Malawi	6	12	73	3	51	9	16	73	354%
Mali	8	13	9	18	19	22	50	126	61%
Mauritania	55	6	6	14	5	48	47	33	106%
Mauritius	4	84	9	2	3	20	41	47	422%
Morocco	165	381	123	222	230	368	600	1,05	49%
Mozambique	13	70	21	36	67	79	110	8	110%
Namibia	40	123	24	26	83	116	347	327	82%
Niger	2	6	1	2	10	7	18	282	125%

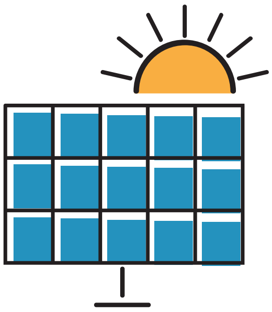
Country	2017	2018	2019	2020	2021	2022	2023	2024	Avg. YoY increase (%) (2017-2024)
Nigeria	64	115	155	194	220	509	928	1,487	61%
Rwanda	1	3	2	1	1	2	5	12	101%
Sao Tome and Principe					0	0	2	3	1817%
Senegal	62	129	132	189	85	172	279	754	62%
Seychelles		6	1	4	2	26	60	53	236%
Sierra Leone	2	8	2	6	8	44	34	108	183%
Somalia	13	6	9	34	16	41	29	46	56%
South Africa	172	390	1,071	566	967	1,330	4,246	5	82%
South Sudan	0	1	2	2	2	3	6	6	102%
Sudan	7	30	23	32	35	128	86	65	78%
Tanzania	68	73	78	112	105	110	161	365	33%
Togo	13	20	31	94	29	53	118	196	74%
Tunisia	26	20	81	45	64	146	279	752	95%
Uganda	28	35	31	40	38	48	88	73	18%
Zambia	13	63	10	11	5	40	90	305	193%
Zimbabwe	7	14	19	34	26	51	163	123	70%
Average for the continent									191%

Innovation, Technology and Transition

Leapfrogging towards a sustainable future?

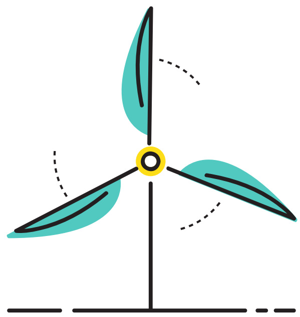
Innovation is integral to the future success of Sub-Saharan Africa's energy sector. Given the immense access deficits and infrastructure gaps, it has been argued that the continent has a unique opportunity to "leapfrog" traditional, centralized, fossil-fuel-based energy systems and move directly towards a more sustainable and decentralized future. This opportunity is especially critical in the context of Africa's rapid, and often unplanned, urbanization. In this context, the literature makes the case that decentralized renewable solutions can preempt the immense infrastructural strain and lock-in of carbon-intensive systems that would otherwise accompany this demographic shift. Innovation in this context should be understood not as a response to challenges but a proactive strategy to build resilient and modern energy systems from the ground up.

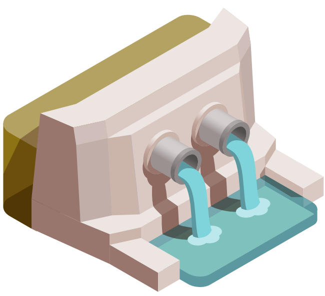
A diverse array of renewable energy technologies is being deployed across the region, tailored to local resources and needs, and often offering scalable solutions from the household to the national level.



- ***Solar power:***
Off-grid solar solutions have addressed some gaps in electricity access. Solar Home Systems (SHS), pioneered by companies like M-KOPA Solar, provide households with affordable electricity for lighting and small appliances. At a larger scale, community-based solar microgrids deliver power to villages without access to national grids. However, despite the growth in this sector, it is unlikely to contribute to long-term development and may in fact prove to be a temporary solution to infrastructure deficits.

- ***Wind energy:***
Regions with strong wind resources are harnessing it for utility-scale generation. The Lake Turkana Wind Power Project in Kenya, the largest in Africa, is a landmark project that contributes 310 MW to the national grid. However, while Africa's wind potential is high in coastal areas, wind energy infrastructure is much less developed than solar.





- ***Hydropower:***
The continent has massive hydropower potential. While small-scale hydro projects serve off-grid communities, large-scale developments like the proposed Grand Inga Dam in the DRC and Ethiopia's Grand Renaissance Dam have the potential to transform the energy landscape of entire regions. Despite the recent opening of the GERD in Ethiopia, it comes online on the back of regional tensions about Nile water rights that may spill over into other countries in the Red Sea

Yeboah, K.E. 2024. Could Africa leapfrog to a low-carbon future? Evidence on the nexus between environmental tax, foreign direct investment, resource dependence, and technological progress. Journal of Environmental Management 372: 123397.
Ouattara, B. 2025. Building net-zero African cities: Decarbonization and structural transformation. WIDER Working Paper No. 43/25. UNU-WIDER, Helsinki.

• ***Geothermal and biomass:***
Kenya is a global leader in geothermal energy, with its Olkaria plant contributing over 700 MW of clean energy. In rural areas, small-scale biogas plants that convert agricultural and animal waste into cooking fuel are proving useful as a sustainable alternative to firewood.

• ***Energy storage:***
To address the intermittency of solar and wind power, energy storage is critical. Battery technologies are becoming increasingly important for grid stability and for off-grid systems. Companies like Powerhive in Kenya are integrating solar power with battery storage to provide continuous electricity to off-grid communities. However, like off-grid solar home systems, these innovations must be part of broader, long-term infrastructure development plans.

The energy transition in context

In the African context, the "energy transition" comprises a shift from an energy system based on carbon-intensive, finite resources to one founded on low-carbon, renewable sources. For this transition to be sustainable and to avoid creating new forms of dependency, it must be accompanied by the development of local technological capabilities. This includes cultivating a skilled local labor force, building capacity for operations and maintenance and fostering local industrial supply chains. A key framework for achieving this is the "Triple Helix" model, which emphasizes the importance of purposeful interaction between academia, industry and government. By aligning research, commercial application, and public policy, African countries can accelerate technological change, build a resilient knowledge economy and ensure that the benefits of the energy transition are captured locally. But there are several long-standing structural distortions that threaten to undermine Sub-Saharan Africa's ability to take advantage of the energy transition. For example, Namibia's attempts to position itself as a major supplier of green hydrogen to Germany and the EU may have negative local impacts.

Some experts highlight this development as part of a pattern to transform economies of the Global South according to European interests (for decarbonization or otherwise). There's also the risk that countries like Namibia end up in the same position in the supply chain of global goods and services as their counterparts across the continent providing minerals and agricultural commodities. The idea that Namibia should take advantage of its green hydrogen capabilities to develop local industrial capacity – which is significantly better in the long-run – is currently not on the table and may be actively discouraged by those who benefit from less sustainable alternatives.
Innovations in technology and finance present an opportunity for the development of energy infrastructure that caters to the continent's priority ambitions. The strategic imperative for

Nkoa, B. and Fonguen-Kong-Ngoh, A. 2024. Industrialisation in Africa: The role of energy transition. Energy Policy 193: 114271.
Zadegan, M. et al. 2025. The Triple Helix Model of Innovation and Sustainable Development Goals: A Literature Review. Sustainable Development 1-16.
Tunn, J. et al. 2025. The German scramble for green hydrogen in Namibia: Colonial legacies revisited? Political Geography 118: 103293; see, also, Bassey, N. 2024. Green Colonialism in Colonial Structures: A Pan-African Perspective. In Lang, M., Manahan, M.A. and Bringel, B. (Eds.). The Geopolitics of Green Colonialism: Global Justice and Ecosocial Transitions. pp. 130-141. Pluto Press; Dorn, F.M. 2022. Green Colonialism in Latin America? Towards a new research agenda for the global energy transition. European Review of Latin American and Caribbean Studies (114): 137-146; Sanchez Contreras, J. et al. 2023. Energy Colonialism: A Category to Analyse the Corporate Energy Transition in the Global South and North. Land 12(6): 1241.

policymakers is to create an enabling environment that attracts investment and actively fosters the local capabilities required to own, operate and scale solutions that align with long-term development. Without a focus on building a domestic knowledge economy through frameworks like the Triple Helix model, the energy transition risks becoming another chapter of external dependency.

A Just Energy Transition framework has been advocated for by many experts, especially those concerned with the potential risk of the benefits of a global transition accruing to developed countries. While the benefits of such an approach at the global level are acknowledged, within the continent, an energy-security approach (driven by distributive, social justice tenets for the most vulnerable) is more sustainable in the long-term. This is in line with global developments towards more inward-looking policy priorities. For example, the US's Inflation Reduction Act (IRA) prioritizes onshoring of manufacturing jobs and high tariffs for imports to protect local industry. Europe's Carbon Border Adjustment Mechanism (CBAM) protects European industry – faced with stringent environmental regulations – from imports from regions with more lenient regulations. More recently, the decline of the UK's chemical industry and slowdown in developing North Sea oil and gas production has attracted criticism towards the UK's Net Zero policy, which has prompted the government to bail out industrial plants. These developments point to the urgent need for countries in Sub-Saharan Africa to prioritize security of supply and creating the conditions to enhance their ability to assert their sovereignty and make self-determined decisions about energy infrastructure.

See, for example, a recent study advocating for Sub-Saharan African countries to learn from the European experience, Kusi-Appiah, F. et al. 2026. Just sustainable energy transition: Lessons for Sub-Saharan Africa security of supply. Energy Policy 210: 114990.

IEA. 2025. Inflation Reduction Act 2022: Sec. 13502 Advanced Manufacturing Production Credit. IEA Policies Database. Paris: IEA.

PWC. 2024. The impact of EU CBAM on industrial manufacturing. PWC Blog. Available on: https://www.pwc.com/gx/en/industries/industrial-manufacturing/eu-cbam-on-industrial-manufacturing.html

Chemical Industries Association. 2025. Press Release: UK's industry of industries facing unprecedented challenges. Available on: https://www.cia.org.uk/press-releases/uks-industry-of-industries-facing-unprecedented-challenges/1423.article

Zapletnyuk, K. 2026. OPINION: UK Labour government stays wedded to net-zero while the country pays for the privilege. Independence Commodity Intelligence Service (ICIS). Available on: https://www.icis.com/explore/resources/news/2026/01/15/11171774/opinion-uk-labour-government-stays-wedded-to-net-zero-while-the-country-pays-for-the-privilege/

Department of Business and Trade. 2025. Press Release: 500 jobs protected at Grangemouth as UK Government partners with INEOS to save vital plant's future. UK Government. Available on: https://www.gov.uk/government/news/500-jobs-protected-at-grangemouth-as-uk-government-partners-with-ineos-to-save-vital-plants-future

Energy, Politics and Institutions

Energy systems are embedded in political and institutional contexts. Decisions about who receives energy, the kinds of energy they receive, and the price of that energy are all fundamentally political. The allocation of resources, the design of policies and the effectiveness of implementation are all shaped by governance structures, political incentives and the quality of institutions. All these factors will shape Africa's energy infrastructure in the future.

Institutions, governance and sovereignty

A consensus exists on the positive link between institutional quality and public service provision. In Kenya, the Slum Electrification Program demonstrated that political inclusion of marginalized communities is critical for the project's success. More generally, the results are mixed across Sub-Saharan Africa. Poor governance often leads to significant challenges in public service provision. In Senegal, for example, the well-funded Rural Electrification Action Plan has produced limited results due to inconsistent political support.

Weak governance and institutional contexts at the national level also risk the subordination of national policy to foreign corporate interests or through international legal frameworks. Notably, Investor-State Dispute Settlement (ISDS) clauses in trade agreements are among the mechanisms that enable multinational corporations to sue governments over policies that might impact their profits. The case of Pacific Rim v. El Salvador, where a mining firm sued over the denial of a permit due to water pollution concerns, illustrates this threat. This "chilling effect" extends beyond environmental policy. In the case of Foresti v. South Africa, investors used ISDS to challenge post-apartheid Black Economic Empowerment laws, demonstrating how these mechanisms can be weaponized against social justice reforms and undermine sovereign policymaking.

Electricity as a political tool

Political incentives fundamentally shape electrification strategies and the expansion of power infrastructure in counties in both the Global South and Global North.

See, for example, Harding, R. 2015. Attribution and Accountability: Voting for roads in Ghana. World Politics 67(4): 656-689; Harding, R. and Stasavage, D. 2014. What democracy does (and doesn't do) for basic services: School fees, school inputs and African elections. Journal of Politics 76(1): 229-245; Rothstein, B.O. and Teorell, J. 2008. What is Quality of Government? A Theory of Impartial Government Institutions. Governance 21(2): 165-190.

See, for example, conflicting evidence in Brown, D.S. and Mobarak, A.M. 2009. The Transforming Power of Democracy: Regime Type and the Distribution of Electricity. American Political Science Review 103(2): 193-213; Trotter, P.A. 2016. Rural electrification, electrification inequality and democratic institutions in Sub-Saharan Africa. Energy for Sustainable Development 34: 111-129; and Ahlborg, H. et al. 2015. Provision of electricity to African households: The importance of democracy and institutional quality. Energy Policy 87: 125-135.

Mawhood, R. and Gross, R. 2014. Institutional barriers to a "perfect" policy: A case study of the Senegalese Rural Electrification Plan. Energy Policy 73: 480-490.

Nolan, M. 2016. Challenges to the credibility of the investor-state arbitration system. American University Business Law Review 5: 429-444.

See Pac Rim Cayman LLC v. Republic of El Salvador, Available on: https://www.italaw.com/cases/783

Strike, M.A. 2019. Investor-State Dispute Settlement in Sub-Saharan Africa: Suggestions for Reform. African Journal of International and Comparative Law 27(1): 150-160.

See for evidence from Ghana, Briggs, R.C. 2012. Electrifying the base? Aid and incumbent advantage in Ghana. Journal of Modern African Studies 50(4): 603-624; and for evidence from Germany, Kauder, B. et al. 2016. Do

There are differences depending on political systems. In democracies, for example, elected politicians, facing the constant threat of losing office, often use electrification to secure votes. Evidence from Ghana shows that electrification projects initiated before elections increased votes for the ruling party. In India, there have been cases of electricity supply being manipulated to win support from key electoral constituencies. In those countries in which rural populations offer high numbers of prospective votes, ruling parties in democratic systems tend to prioritize rural electrification. In more centralized, authoritarian states, leaders whose primarily goal is regime survival tend to prioritize urban residential electricity access to neutralize any popular dissent.

This political logic partially explains the persistent disparity between urban and rural electricity access in Sub-Saharan Africa. There are also other contributing factors that reveal a complex and often counterintuitive relationship between the quality of governance and electricity access. In states with high levels of administrative capacity, including anti-corruption mechanisms, institutional effectiveness and the rule of law, there exists a positive correlation with rural electricity access and a negative correlation with urban electricity access. Other factors provide different results. The level of political rights, democracy and state fragility show no significant or, in some cases, negative effects on rural electricity access.

This suggests that the specific forms of governance – whether it be varying levels of administrative effectiveness or distinct political systems – impact differently on access to electricity. This underscores the extent to which politics will play a role in the future roll-out of electricity infrastructure. This demands that technical and economic solutions for energy access be aligned with the political realities of the state and the ambitions of incumbent governments regardless of the regime type.

politicians reward core supporters? Evidence from a discretionary grant program. European Journal of Political Economy 45: 39-56.
Briggs. 2012.
Min, B. and Golden, M. 2014. Electoral cycles in electricity losses in India. Energy Policy 65: 619-625.
See, for example, Brown and Mobarak (2009), Ahlborg et al. (2015) and Trotter (2016.

Key Energy Policies: Reforming Subsidies and Power Sectors

The political economy of fossil fuel subsidy reform

Fossil fuel subsidies are forms of financial support provided by governments to reduce the price consumers pay for fuels. Direct or explicit subsidies include price controls and tax exemptions; indirect or implicit subsidies include investment choices and carbon tax regimes. Sub-Saharan African countries spent an estimated $18.9 billion on fossil fuel subsidies in 2024. Poverty alleviation is often the stated rationale for subsidies. Yet these decisions tend to have unintended consequences: subsidies put pressure on state budgets, disproportionately benefit richer segments of society (groups with access to electricity, private vehicles, private generation) and encourage wasteful consumption. At the same time, the pressure for subsidy reforms applied by international organizations, including the IMF and World Bank, may make sense in technical terms and follow economic logic but they also overlook political realities.

Subsidy reforms are a politically sensitive issue and often contribute to societal instability. For example, an analysis of Sudan's most recent subsidy reforms in September 2020 suggests a causal link to the political instability that followed in October 2021. This requires that subsidy reform in developing countries are based on an informed assessment of the political environment and are then carefully designed. This entails several sequential steps: assessing existing subsidies and pricing mechanisms; building public and political support; designing and implementing compensation and social protection mechanisms; effectively communicating the redistribution and investment plans of revenue saving; and the effective communication of new pricing policies.

Power sector reform

Historically, state-owned utilities have dominated the power sector across the globe. The 1980s saw initial pressures for reform driven by ideological shifts, efficiency concerns and technological change. Power sector reforms have subsequently occurred along the following lines:

- Baseline model: Vertically integrated monopoly (the traditional state-owned model), where generation, transmission and distribution are owned and operated by the government.
- Stage 1 reform: Single buyer model – Generation is opened to competition, but a single state entity buys all power.
- Stage 2 reform: Wholesale competition model – Multiple buyers and sellers trade power in a wholesale market.
- Stage 3 reform: Retail competition – End-use customers can choose their electricity supplier from different retailers operating in an electricity marketplace.

Rentschler, J. and Bazilian, M. 2017. Reforming fossil fuel subsidies: drivers, barriers and the state of progress. Climate Policy 17(7): 891-914.

Black, Simon, Antung Liu, Ian Parry, and Nate Vernon, 2023. "IMF Fossil Fuel Subsidies Data: 2023 Update." Working paper, IMF, Washington, DC.

Rentschler and Bazilian. 2017.

Ali, M et al. 2024. The Role of MSMEs in Fostering Inclusive and Equitable Sustainable Economic Development within the Context of the Clean Energy Transition in the MENA Region: Sudan Case Study Report. ERF Policy Research Report No. 51. Cairo: Economic Research Forum.

Lockwood, M. 2015. Fossil Fuel Subsidy Reform, Rent Management and Political Fragmentation in Developing Countries. New Political Economy 20(4): 475-494.

In the 1990s, the World Bank promoted a standard reform model for developing countries based on principles of corporatization, commercialization, independent regulation and privatization. However, a 2020 World Bank review and assessment concluded that ‘one size does not fit all.’ It further acknowledged that starting conditions matter and that desired outcomes needed to expand to include climate and sustainability goals. Tanzania’s experience exemplifies these difficulties and demonstrates that the standard model is often ill-suited to the complex political and economic realities across different countries. For over two decades, Tanzania has attempted to reform its power sector. This decades-long process has been contentious and characterized by politically controversial attempts at privatization that were subsequently abandoned.

The widespread failure of standardized “one-size-fits-all” reforms for both fossil fuel subsidies and the power sector illuminate a crucial lesson: policy change is a political negotiation rather than a technical exercise. The strategic challenge for policymakers is to abandon imported blueprints and instead design context-specific reforms that build domestic political coalitions and navigate the vested interests and public perceptions that ultimately determine a policy’s success or failure.

Foster, V. and Rana, A. 2020. Rethinking Power Sector Reform in the Developing World. Washington, D.C.: World Bank.
Godinho, C. and Wangwe, S.M. 2023. Power Sector Reform and Regulation. In Bourguignon, F. (Ed.). State and Business in Tanzania’s Development: The Institutional Diagnostic Project. pp. 262-299. Cambridge: Cambridge University Press.

The Future of Energy in Sub-Saharan Africa

Global scenarios and regional realities

The International Energy Agency (IEA) provides several scenarios to map potential energy futures, each with different implications for the climate:

•Stated Policies Scenario (STEPS): This scenario is based on current policies and projects a global temperature rise of approximately 2.4°C above pre-industrial levels.
•Announced Pledges Scenario (APS): This scenario assumes all government pledges and targets are met in full and on time, leading to a temperature rise of about 1.7°C.
•Net Zero Energy (NZE) Scenario: This is a normative pathway designed to limit global warming to 1.5°C.

A key global trend across these scenarios is the explosive growth of renewables. They are projected to make up nearly 50% of global electricity generation by 2030, with solar PV projected to surpass hydropower as the world's largest renewable source by 2029. While these global models provide a valuable framework, they have limitations, particularly at the regional level. Historically they have been inaccurate in predicting the rapid cost decline of solar and wind and often rely heavily on technologies like carbon capture that are not yet proven at scale.

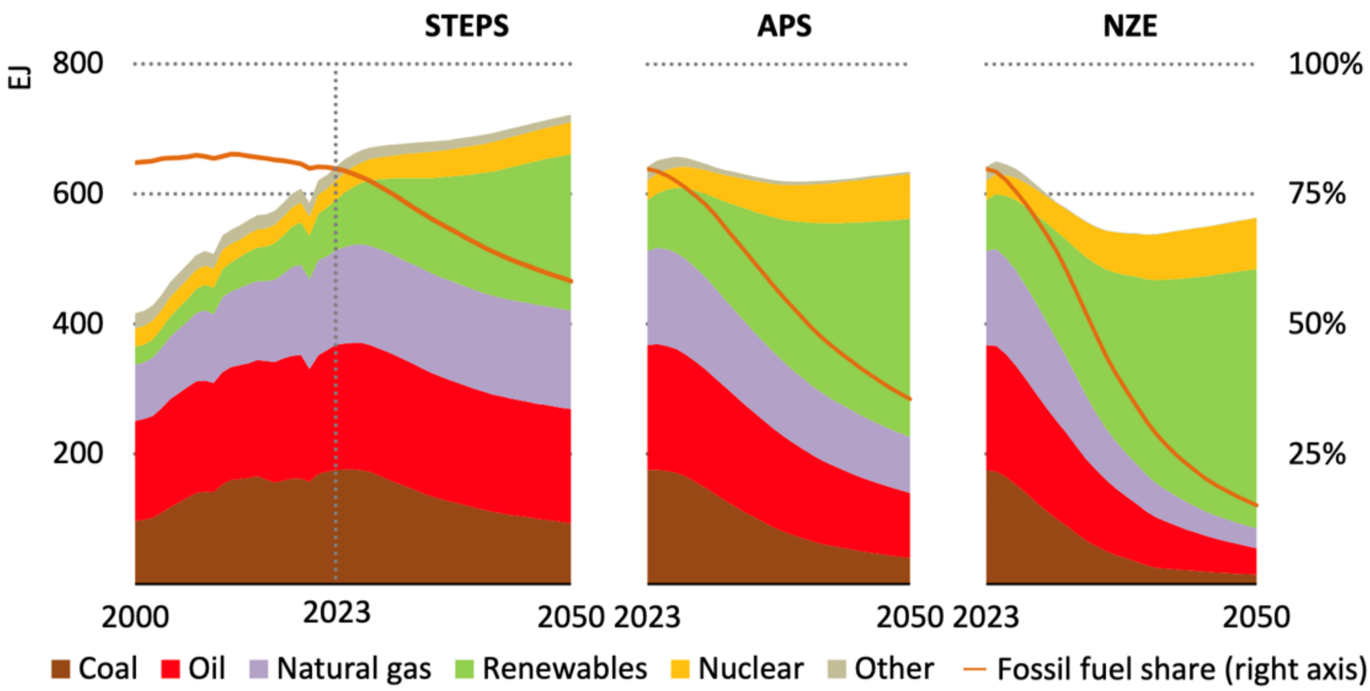


Figure 16 - Global total energy supply by source and fossil fuel share by scenario to 2050 (Source: IEA).

Energy sovereignty and self-determined development

Charting a self-determined path forward demands that Sub-Saharan Africa's leaders master a strategic trilemma: balancing the imperatives of energy security, affordability and sustainability. On energy

IEA. 2024. World Energy Outlook 2024. IEA, Paris.
IEA. 2024.

security, there needs to be a reliable and sufficient supply of energy to power industries, support economic growth and meet the development needs and aspirations of a growing population. This would also require guarantees that energy services will be financially accessible to all segments of society, particularly for low-income households, to promote and achieve equitable development. Finally, it is necessary to align the energy sector's development with national long-term development plans and there is an advantage in aligning with global climate goals by harnessing the continent's immense renewable potential and building a resilient, low-carbon energy system.

Given these challenges, and the need to address the resource wealth and energy poverty paradox, governments must shift their understanding of the role of energy toward thinking about energy sovereignty. Energy sovereignty, a concept which draws from the food sovereignty movement, is defined as a "framework that recognizes the individual, community or nation's rights, and strengthens their abilities to exercise choice within all components of energy systems, including sources, means of harnessing, and uses, in order to satisfy their needs for energy." From an ethics and social justice perspective, energy sovereignty encompasses accessibility, empowerment, sustainability, self-sufficiency, resilience, transparency, and self-determination.

Raimi, D. and Davicino, A. 2024. Securing energy sovereignty: A review of key barriers and opportunities for energy-producing Native nations in the United States. Energy Research and Social Science 107: 103324.
Laldjebaev et al. 2015. Energy security, poverty and sovereignty: complex interlinkages and compelling implications. In Guruswamy, L (Ed.). 2015. International Energy and Poverty: The Emerging Contours. London: Routledge (pp. 102-103).
Timmerman, C. and Noboa, E. 2022. Energy Sovereignty: A Values-Based Conceptual Analysis. Science and Engineering Ethics 28: 54.

The Global Energy Transition: Opportunities and Challenges for Africa

Strategic Opportunities

Opportunity 1: Renewable energy leadership

Regional cooperation is vital for African states if they want to maximise the opportunities available to them in the energy transition and facilitate intra-African energy production. This requires African states to move beyond individual and fragmented efforts and move toward a shared agenda to implement policies more conducive to free trade. This is currently hindered by non-tariff barriers and other protectionist policies at the national level. Major actors including South Africa, Egypt and Nigeria are well-placed to export solar, wind, and gas energy to neighboring countries. This transfer of power from energy-rich African countries to energy-deficient ones can, in turn, serve as a platform for power-sharing agreements. Formal institutions across Africa should also be mobilized to facilitate regional cooperation. In Asia, for example, Malaysia is using its chair of ASEAN in 2025, to shape policies that strengthen ASEAN's collective energy security and sustainability. One of its primary initiatives is advancing the ASEAN Power Grid (APG), promoting multilateral electricity trade to ensure a stable and integrated renewable energy network. This is intended to consolidate ASEANs' position as a key player in solar energy diplomacy.

Opportunity 2: Critical mineral value chain integration

The International Energy Agency (IEA) predicts that global demand for critical minerals will increase fourfold by 2040, with batteries accounting for half of that surge due to current climate pledges. Currently, the African continent possesses an estimated 30% of the world's known reserves of minerals like lithium, cobalt, and copper, which are essential components for renewable energy technologies, batteries and electric vehicles.

Taking advantage of these resources, in recent years Africa has developed into a major supplier to the global market of cobalt, manganese, bauxite and platinum group metals. As global demand for critical minerals continues to increase, these valuable minerals offer the potential to contribute to significant economic growth in countries with high resource endowments. The IEA has shown that if African countries succeed at leveraging their existing opportunities for clean industrialization, this could increase the market value for minerals in Africa by nearly three-quarters by 2040 compared with the current estimated level to $120 billion.

ASEAN. 2025. ADB and World Bank Group Launch the ASEAN Power Grid Financing Initiative with the ASEAN Secretariat and the ASEAN Centre for Energy (ACE).
https://asean.org/adb-and-world-bank-group-launch-the-asean-power-grid-financing-initiative-with-the-asean-secretariat-and-the-asean-centre-for-energy-ace/
Chen, W. et al. 2024. Harnessing Sub-Saharan Africa's Critical Mineral Wealth. IMF Country Focus. Washington, D.C.
IEA, "Stepping up the Value Chain in Africa – Analysis," IEA, October 6, 2025,
https://www.iea.org/reports/stepping-up-the-value-chain-in-africa.
IEA, "Stepping up the Value Chain in Africa – Analysis," IEA, October 6, 2025,
https://www.iea.org/reports/stepping-up-the-value-chain-in-africa.

Critical minerals also provide African countries with a potential strategic advantage in the global energy transition. However, the path forward lies in breaking the cycle of extraction without development. Realizing this opportunity and avoiding the resource curse requires more than just policy; it demands a concerted effort to build local technological capabilities to ensure the value from processing and manufacturing is captured domestically.

Building processing capacity can transform countries from commodity exporters to key players in value-added manufacturing. This is one way to transform mineral wealth into sustainable economic development. This requires the development of a comprehensive strategy designed to capture maximum value from a mineral wealth through a "downstreaming" policy centred on a transformation from the supply of raw material into an integrated hub for domestic industrial processing to position African countries at the center of global supply chains. This strategy requires critical minerals be processed within country before export and adoption of policies that demand international companies to establish domestic operations. This can catalyze unprecedented foreign direct investment in Africa's processing capabilities. This can fundamentally restructure global supply chains in Africa's favour and make the continent a significant player in the international value chain of the production and refining of critical minerals. In Indonesia, such policies have achieved remarkable success in attracting foreign investment.

However, developing this infrastructure will not be easy. African countries must consider trends in global trade, global demographics and the long-term plans of the largest economies. For example, China's 15th Five Year Plan, adopted in October 2025, puts emphasis on "emerging industries and industries of the future," and also on "high-quality, efficient development in the service sector." A focus on developing the service sector, emphasis on future industries – which are likely to be more high-tech and less labour intensive – and China's declining birth rate and plateauing population signal a potential offshoring of industrial capacity. There is an opportunity to fill the gaps that will be left by China's shift to more high-tech industrial production. The local production of raw materials makes this a particularly timely and relevant opportunity for African countries in the critical minerals sector. The effective development of this sector requires connected infrastructure especially from mines to ports. To take one example, it is estimated that the rail and port financing needs for the Simandou mine in Guinea are estimated to be at least $6 billion. At the same time, infrastructure projects built for mineral extraction are most beneficial if accompanied by investment in complementary secondary projects that contribute to the wider economy and improvements in the quality of life – roads, schools, medical facilities and housing. `

Critical minerals can also provide a vehicle for better cooperation between African countries across the entire mining value chain, from exploration and extraction to infrastructure, processing and high value exports. East African countries have the potential to jointly develop spherical graphite for battery

Beuter, P. et al. 2024. Mapping Africa's Green Mineral Partnerships. Report. Africa Policy Research Institute.
Clearkin, P. et al. 2025. Harnessing Africa's Critical Mineral Opportunity. BCG Global.
https://www.bcg.com/publications/2025/harnessing-africas-critical-mineral-opportunity.
Ministry of Foreign Affairs, People's Republic of China. 2025. Communique of the Fourth Plenary Session of the 20th Central Committee of the Communist Party of China. Available on:
https://www.fmprc.gov.cn/eng/xw/zyxw/202510/t20251023_11739505.html
World Bank. 2025. World Development Indicators Database. Washington, D.C.: World Bank.
Ijjasz-Vasquez, E. et al. 2025. Unlocking Africa's Critical Minerals for Broad-based Prosperity and Global Competitiveness. Brookings,
https://www.brookings.edu/articles/unlocking-africas-critical-minerals-for-broad-based-prosperity-and-global-competitiveness/
Clearkin. 2025.

anodes. South Africa and Gabon have the potential to expand production of high-purity manganese sulphate, a material with increasing global demand. Morocco could scale up its production of purified phosphoric acid, and the Democratic Republic of Congo (DRC) and Zambia have the capacity to produce substantial levels of cobalt and copper. Regional Organizations (ROs) can also play an important role here through the promotion of regional collaboration. This is already evident in the case of the Southern African Development Community (SADC), which is championing among members value chain integration, geographic coordination and cross-regional public-private partnerships in the critical mineral sector.

Opportunity 3: Energy storage, smart grids, digitization and digital solutions

The digitalization of Africa's energy systems presents one the most transformative opportunities in the continent's energy transition. The integration of smart grids, digital monitoring, and energy storage technologies could enhance efficiency and ensure stability across fragmented power networks as renewable energy adoption increases. Smart grids enable two-way communication between producers and consumers and enable the deployment of technologies like smart meters, grid automation and predictive analytics. These technologies help reduce power losses by 10-15%, and balance demand and supply through the application of real-time data to anticipate peak demand and reroute power. Artificial Intelligence (AI) is also playing an important role in redefining the way utilities plan, operate, and serve customers. The analysis of data streams from smart meters, the ability to forecast weather and demand trends allows AI to predict and identify the causes of energy demand prior to outages and can also optimize renewable generation.

Pay-As-You-Go (PAYG) business models are another important dimension of Africa's digital energy transformation. Solar products can be too expensive for some prospective customers, especially in rural, low-income and underserved areas. PAYG allows households in these categories to purchase solar energy. This lease-to-own or fee-for-service model leverages the widespread adoption of mobile money to allow customers to pay for energy services, such as a Solar Home System, in small, regular and affordable installments and avoids the need to pay high upfront costs.

However, the PAYG model is not without its concerns. The poorest households may not represent a profitable market segment and might be excluded from participation. The use of algorithms to remotely deactivate systems for non-payment also raises ethical questions, including those relating to the right to privacy.

IEA. 2025. Stepping up the Value Chain in Africa – Analysis. https://www.iea.org/reports/stepping-up-the-value-chain-in-africa.
Coetzee, R. and Naidoo, U. 2025. How Coordinated Strategies for Critical Mineral Mining can Drive Southern Africa's Industrial Growth', World Economic Forum, https://www.weforum.org/stories/2025/12/strategies-for-critical-mineral-mining-southern-africa/
Akoth. S et al. 2025. Africa's Energy Revolution: The Rise of Smart Grids and Digital Utilities. Indepth Research Institute, https://indepthresearch.org/blog/digital-utility-africa-smart-grids-ai-energy-future/.
Ibid.
Endeavor. 2022. Innovation and Entrepreneurship in Clean Energy.
https://endeavor.org/wp-content/uploads/2022/01/Innovation-and-Entrepreneurship-in-Clean-Energy.pdf.
Ibid.
Barry, M.S. and Creti, A. 2020. Pay-as-you-go contracts for electricity access: Bridging the "last mile" gap? A case study in Benin. Energy Economics 90: 104843.

Furthermore, the commoditization of user data by providers and the fact that most large PAYG companies are headquartered in high-income countries raise issues of energy and data sovereignty, which could dampen local economic benefits. Finally, while extending basic access to electricity for low-income, underserved communities is a step towards achieving universal access, it does not contribute to industrial development and structural change. For that, more deliberate infrastructure investment is needed.

Energy storage is also going through an exponential evolution, driven by falling battery costs and increased demand for renewable energy sources, especially wind and solar. This is important for a continent that has 60% of the world's best solar resources. Since 2017, the African energy storage market has risen from 31 MWh to 1,600 MWh in 2024, according to AFSIA Solar's recent reporting. This includes projects that co-locate battery energy storage systems with renewable energy power plants. In 2024, South Africa brought online one of the world's largest solar and battery projects. The Kenhardt hybrid complex in the Northern Cape combines 540 megawatts of solar with a 225-megawatt, 1140 megawatt-hour battery system, delivering reliable clean energy to the grid and strengthening power supply for the mining sector. This contributes to shifting the energy mix away from fossil fuels and toward clean renewable sources, by reducing the reliance on oil and gas and stabilizing the grids by having energy ready to dispatch when needed.

Opportunity 4: Entrepreneurship and sectoral innovation

Renewable energy expansion is not only an environmental imperative but also an industrial and trade opportunity for Africa. As global demand for clean energy technologies grows, Africa has opportunities to become an increasingly significant manufacturing and export hub of key technologies and components, including wind turbine parts, solar PV cells and modules.

These bring with them the possibility of more consistent private and public investments in new technologies and renewable energy projects. This allows countries to leapfrog legacy infrastructure. The localization of technology and infrastructure through policy tools, including weighted Renewable Energy Certificates (RECs), financial incentives for private-sector involvement and targeted subsidies for residential PV systems are all important.

As demand for wind energy continues to rise in Africa as well as across the globe, there are also real incentives for Africa to become a home for turbine manufacturing, particularly in countries like South Africa, which also has some of the continent's best wind resources. Lessons can be learned from Brazil's experience in developing a wind turbine manufacturing industry. A low-rainfall year in 2001 caused severe power shortages due to heavy reliance on hydropower. In 2002, the Brazilian government

Perros, T. et al. 2024. Towards responsible and fair pay-as-you-go energy access in Sub-Saharan Africa. Nature Energy 9: 520-525.
Baker, L. 2023. New frontiers of electricity capital: energy access in Sub-Saharan Africa. New Political Economy 28(2): 206-222.
Heynes, G. 2024. Energy Storage Boom' in Africa from 31MWh in 2017 to 1,600MWh in 2024 Trade Group AFSIA Finds/ Energy-Storage.News (January 20) https://www.energy-storage.news/energy-storage-boom-in-africa-from-31mwh-in-2017-to-1600mwh-in-2024-trade-group-afsia-finds/.
Gupta, H. 2025. Energy Storage and Flow Batteries in Africa - the Borgen Project," The Borgen Project, (September 2) https://borgenproject.org/flow-batteries-in-africa/.
Heynes. 2024.
Gupta. 2025.

introduced several policy measures to incentivize the development of alternative energy sources, including long-term power purchasing agreements, low-cost financing from the national development bank and regulations requiring recipients of low-cost finance to meet local content requirements in their manufactured products. International companies were also required to open local subsidiaries and develop local supply chains.

Several other African countries already have the ports infrastructure critical for the transportation of large and heavy wind turbine components and for enabling wind turbine manufacturing. In addition, several ports in North and Southern Africa are located near zones with strong wind resources and could serve both domestic deployment and exports to Europe.

Regarding solar PV manufacturing, Africa's potential is anchored in its abundant solar resources and growing interest in domestic module assembly. Private sector power producers such as Scatec Solar and Mainstream Renewable Power have invested in large-scale solar and wind projects across the continent, demonstrating the private sector's vital role in renewable energy development. Additionally, banks and investment firms are increasingly financing renewable energy projects. For example, the African Development Bank has played a lead role through programs like the $379.6 million Desert to Power initiative, which aims to develop 10 GW of solar capacity and provide electricity to 250 million people across the Sahel region.

Foreign investors have traditionally adopted a cautious approach toward investing in Africa but financial resources are increasingly being targeted in countries with advanced green economies. As the case of India has shown, a large domestic market and a clear policy direction serve as significant pull factors for investors. Renewable energy capacity and a supportive policy environment for green investments are becoming increasingly important factors in FDI decisions. For example, RE100, a global corporate renewable energy initiative, brings hundreds of large businesses committed to sourcing 100% of their electricity from renewable sources. These companies are actively selecting investment locations where sustainable commitments can be met reliably and cost-effectively. For example, Amazon, Google, Microsoft, and Cargill have deployed substantial investments into Chile, the US, the European Union (EU), and Brazil; while Apple, DuPont, and Schneider Electric have brought significant capital to India.

The manufacturing of clean energy technologies also provide competitive advantages across Africa. Africa's EV production has the potential to rise from a low base to nearly 4 million units in 2035 and then 5 million in 2050. At this stage, mid-century, the continent could become a net exporter of EVs, supplying both the domestic and global market, especially into the EU. North African countries, such as Morocco, have the potential to establish a foothold in the EV and battery manufacturing industries, building on their existing automotive industrial base. Morocco has already made investments in this direction by establishing new technical training institutes, such as Mohammed IV Polytechnic Univeristy, to foster local innovation and train a future-ready workforce.

Ifeanyi-Nwaoha, N. 2025. Energising Africa: Enabling Private Sector Development in Renewable Energy. African Policy Research Institute. (June 30) https://afripoli.org/energising-africa-enabling-private-sector-development-in-renewable-energy.
Ibid.
Javalov. M and Bae J.H. 2025. Exploring the motivations behind corporate participation in the RE100 initiative and its impact on financial performance. Energy Policy. 198 (114503).
IEA. 2025. Stepping up the Value Chain in Africa – Analysis. https://www.iea.org/reports/stepping-up-the-value-chain-in-africa.

International partnerships are also important. Major global economic actors, including China and the EU are currently looking to invest in clean energy projects in Africa. In 2024, the European Commission announced a € 545-million boost for the campaign of Scaling up Renewables in Africa, launched jointly by the EU, the Republic of South Africa and Global citizen. Bilateral collaborations with international partners are also valuable. Kenya has a joint venture with Indonesia in geothermal energy, a clean and renewable energy that, unlike solar and wind, provides a baseload of electricity with high degree of reliability, low land requirement, and minimal environmental impact.

The transition to renewable energy has the potential to create over 2 million jobs in Sub-Saharan Africa alone by 2030. Specifically, the transition is projected to boost employment significantly, raising economy wide jobs by 3.8% by 2030 and 3.6% by 2050 compared to a fossil-fuel-based pathways. Regional job creation is expected to be particularly strong in Central Africa with 6.7%, Southern Africa with 4.1%, and East Africa with 4.1%. Most new roles will emerge in renewables, energy efficiency, and electricity systems, potentially adding over nine million jobs by 2030 and an additional three million by 2050.

Strategic Challenges
Challenge 1: Regional trade integration and power trading

The energy transition has made effective regional electricity trade of great strategic importance and has redefined how countries, including those in Africa, generate, exchange, and integrate power across borders. The Continental Power Systems Masterplan provides a roadmap for a continent-wide power network that promotes energy security through integration. African regional energy integration takes place primarily through formal frameworks such as AfCFTA, ECOWAS and SADC. These regional frameworks are intended to contribute to stronger cooperation in power generation and transmission through the harmonization of regulatory policies. Notably, AfCFTA aims to reduce trade barriers, align regulations and improve infrastructure to create large and efficient markets, which would enable the free flow of renewable energy across the continent.

European Commission. 2024. Energy for Africa.
https://commission.europa.eu/topics/international-partnerships/global-gateway/energy-africa_en.
Ernest, B. 2024. Africa's Energy Transition: Economic Impact of the Shift to Renewable Resources. African Leadership Magazine (September 20)
https://www.africanleadershipmagazine.co.uk/africas-energy-transition-economic-impacts-of-the-shift-to-renewable-resources/?q=global-africa-business-initiative-gabi-announces-fourth-unstoppable-africa-flagship-event-in-new-york&pr=353633&lang=ar.
IRENA, 2022. Renewable Energy Market Analysis: Africa and Its Regions.
https://www.irena.org/publications/2022/Jan/Renewable-Energy-Market-Analysis-Africa.
Ibid.
Ajagun, A.S et al. 2024. The Status and Potential of Regional Integrated Energy Systems in Sub-Saharan Africa: An Investigation of the Feasibility and Implications for Sustainable Energy Development. Energy Strategy Reviews 53(101402).
IRENA, 2024. The Energy Transition in Africa: Opportunities for International Collaboration with a Focus on the G7.
https://www.irena.org/Publications/2024/Apr/The-energy-transition-in-Africa-Opportunities-for-international-collaboration-with-a-focus-on-the-G7
IRENA. Renewable Energy Market Analysis: Africa and Its Regions.
Onyekwena, C and Adeniran, A. 2020. Accelerating Green Energy Transition in Africa through Regional Integration. Policy Briefing 216. South African Institute of International Affairs. https://www.jstor.org/stable/pdf/resrep28365.pdf

The absence of adequate grid infrastructures that can accommodate conventional energy resources result in high electricity losses and low supply quality. This is the prevalent reality in many parts of Africa and requires improvements. This is being addressed through five main regional electricity pools in Southern Africa, West Africa, East Africa, Central Africa, and North Africa. By interconnecting national grids and coordinating developments, these Pools are intended to lower the cost of electricity, improve grid reliability and expand access to power.

However, the effectiveness of these Pools is hampered by an absence of adequate cross-border transmission infrastructure, diverse and misaligned regulatory frameworks, a lack of investment and governance, and political instability. Different regions also have different energy priorities. North Africa is more focused on achieving high renewable targets through major investment in green hydrogen. Due to reliance on oil revenues, West African countries are more focused on gas transition and adaptation mechanisms. In East Africa, countries are focused on strong renewables and hydropower while looking to overcome significant levels of energy poverty and a major lack of required infrastructure. For Southern African countries, pledges on the phasing out of coal have been prevalent and there has been much focus on promoting a Just Energy Transition Partnership.

Moreover, a major point of concern across the continent is the role of debt in dictating government decisions. Due to high and increasing debt burdens, many African countries, particularly those with certain resource endowments, see energy trade more as a source of revenue (in foreign currency) than as a tool to establish national, regional or continental energy security. For example, Ethiopia's plans for the long-term financial sustainability of the GERD includes significant cross-border trade. While this might satsify the energy demands of neighbouring countries and serve as a new source of revenue to pay off debts, it neglects the fact that only 55% of the population has access to electricity, the majority living in urban areas.

Challenge 2: Stranded assets and revenue losses

In an era of decarbonization, as the global energy transition moves gradually toward clean energy, global extractive companies and investors are increasingly adjusting their portfolios to meet new low-carbon regulations. This has a real potential to make petroleum assets vulnerable and can even result in high levels of stranded assets. An estimated 8 percent of African oil and gas assets and 3 percent of coal assets could be stranded in certain scenarios. This, in turn, can reduce revenues, slow-down development and even lead to economic destabilization due to energy price shocks. All fossil fuel-dependent states face these vulnerabilities but the risks are particularly acute in Africa, because most fossil-fuel rich countries on the continent rely on oil and gas revenues and are increasing their oil and gas production. Linked to this, developing countries in Africa, as elsewhere, are resource dependent and face greater difficulty diversifying their economies away from fossil fuels than more industrialized states.

World Bank. 2025. World Development Indicators Database. Washington, D.C. https://www.google.com/search?client=safari&rls=en&q=World+Development+Indicators+Database&ie=UTF-8&oe=UTF-8
Hansen, T.A. Stranded Assets and Reduced Profits: Analyzing the Economic Underpinnings of the Fossil Fuel Industry's Resistance to Climate Stabilization. Renewable and Sustainable Energy Reviews 158(112144):1–14, https://doi.org/10.1016/j.rser.2022.112144.
United Nations University Institute for Natural Resources in Africa. 2019. Africa's Development in the Age of Stranded Assets.https://inra.unu.edu/publications/articles/discussion-paper-africas-development-in-the-age-of-stranded-assets_2019.html

A recent study suggests that over $100 billion in oil-related investments across Nigeria, Angola, and Algeria will be stranded due to the shifting global energy policies linked to the clean energy transition and volatile market dynamics.

Challenge 3: Economic and societal impact of energy transition

The energy transition is likely to result in significant job losses in the oil and gas sectors, which traditionally offered some of the continent's highest salaries and compensation. Yet by one estimate only 13% of the African workforce possess the skills required to make a meaningful professional contribution to the green transition. The continent needs to be more focused on improving work-force skills through skill development programs and adapting existing university mining engineering programs to keep pace with commercial developments and new technologies.

The negative impacts of the energy transition can also lead to rising income poverty amongst workers in sectors that rely significantly on fossil fuels. Income inequality, especially household poverty, can grow due to energy price shocks in response to the green transition. There is also the danger that, in the absence of fiscal reforms, and financial inclusion agendas that include progressive redistribution measures, the anticipated economic benefits of renewable energy will not trickle down to the poorest segment of the population, thus further amplifying poverty levels.

Challenge 4: Funding energy infrastructure

According to the International Renewable Energy Agency (IRENA), by 2030 Africa has the potential to install 310 gigawatts of clean renewable power, thus meeting nearly a quarter of its energy needs. However, this will cost an average annual investment of $70bn over the next five years. The development of energy-intensive industries (EIIs) – such as data centers, green hydrogen production, and advanced green manufacturing – also requires plentiful and competitively priced renewable enegy.

The investment choices made in the coming decade will determine whether the continent locks into legacy infrastructure or builds the foundation of modern, resilient and inclusive energy infrastructure. Currently, there is a lack of early-stage funding in Africa as well as a significant gap in equity financing for these and other smaller energy projects, particularly for those off-grid or linked to mini-grid systems. Domestic sources of finance provided only half of the investments between 2013 and 2020. Local banks

Abolarin, S.K. et al. 2025. Navigating the Energy Transition: International Oil Company Divestments and the Stranded Asset Dilemma in Africa. The Extractive Industries and Society. 24:101737.
Sustainable Energy for All. 2025. Powering Africa's Future: How Youth Can Drive the Green Energy Revolution. https://www.seforall.org/news/powering-africas-future-how-youth-can-drive-the-green-energy-revolution .
Oshokoya, P.O. and Tetteh, M.N.M. 2018. Mine-of-The-Future: How Is Africa Prepared from a Mineral and Mining Engineering Education Perspective? Resources Policy 56: 125–33.
Oleg Mariev, O. et al. 2025. Clean Energy Transition and Income Poverty in Sub-Saharan Africa: Fiction or Factual? Renewable Energy 250: 123259.
Ibid.
Onyekwena, C and Adeniran, A. 2020.
Ibid.
Miller, R. et al. 2025. Data Centers in Ireland and Singapore: Balancing Resilience-building and Environmental Management in Small States. Global Policy 16 (5):1103–1110.

also lack the capacity to finance large-scale, long-term energy infrastructure projects, and when they do provide funds, the interest rates are high to compensate for the risks involved.
The capital cost of African clean energy projects is two to three times higher than that in developed nations, in part due to investor perceptions of heightened risks due to political instability, currency fluctuations, and regulatory and governance concerns. Yet many African countries with limited financial resources and high debt burdens are heavily dependent on global capital. Even still, they often need to provide sovereign guarantees to attract foreign direct investment from prospective outside investors. As a result of the absence of public and private sources for the required levels of investment, the energy transition continues to suffer from a lack the infrastructure finance for renewable energy projects.

Challenge 5: Sovereignty and critical mineral value chain integration
As noted above (Opportunity 2), mineral resource production is already an important source of income for Africa, but there is huge potential to increase the value of this sector by moving up the value chain towards processing, smelting and refining. However, to achieve these outcomes it is necessary to address existing institutional weaknesses and the absence of long-term planning. Chile, for example, is widely seen as a global example of responsible resource governance. State-owned Codelco controls the country's copper sector, and it functions under a robust legal and fiscal framework that balances state regulation with market-friendly policies, allowing both state and private sectors to thrive in the mining industry. This approach has ensured policy continuity and stability. In 2023, mining accounted for 39% of Chile's exports. Chile's model stands out for its depoliticized and technocratic governance of copper revenues, with decisions on investments and revenue management largely insulated from short-term political and elite pressures

Much of the literature on the interrelationship between energy security and foreign policy activity is focused on how the foreign policies of exporters and consumers have been influenced by conventional thinking about energy security that is primarily concerned with ends – what the actor seeks to achieve. In the case of consumers those ends are usually focused on ensuring access, stable supply, and affordability; in the case of producers, they tend to be stable demand and safe transit of energy to consumer markets. It is also possible, however, to view energy security differently – as the way that a state actor in the international system seeks to achieve its strategic security goals (ends) and the means that it uses to do so. In these terms, critical minerals are not only reshaping the nature of the global economic competition. They are also influencing geopolitics. Becoming a key player in value added manufacturing in critical minerals can create new avenues for foreign policy influence. Rising energy wealth amplifies the scale and scope of foreign policy activity and can have significant diplomatic implications. It can also promote assertiveness, unilateralism, isolationism, aggression and reckless over-ambition in foreign-policy decision-making. On the other hand, many major energy players – including Australia, Norway, Mexico, the United Kingdom – have no track-record of causing instability in the system.

IEA. 2023. Financing Clean Energy in Africa World Energy Outlook Special Report. https://www.iea.org/reports/financing-clean-energy-in-africa
OECD. 2023. Mining Regions and Cities in the Region of Antofagasta, Chile: Towards a Regional Mining Strategy, OECD Rural Studies. OECD Publising, Paris.
O'Sullivan. M.L. 2013. The Entanglement of Energy, Grand Strategy, and International Security in Goldthau, A. (ed.), Handbooks of Global Policy Series, Oxford: Wiley Blackwell.

The move into down streaming critical minerals can also result in strategic vulnerabilities as powerful outside actors looking to take control over these valuable resources. In the Indonesian case, Chinese companies now control almost 90% of nickel refining capacity. Many of these firms try to maintain ties with the Chinese government and defense contractors. The replication of a similar reality in the African context represents significant geopolitical challenges as countries seek to maintain strategic autonomy. These challenges are two-fold: 1) avoiding China achieving dominance across Sub-Saharan African critical mineral processing and supply chains as it has done in recent years in several other regions, 2) avoiding entanglement in the growing critical mineral tensions and competition over access to and control over resources between the US and its international allies and China. This competition between global competitors has real potential to fuel instability and conflict and slow down development across the continent.

One way to counter these risks is to develop a comprehensive diplomatic strategy to diversify critical mineral partnerships. This requires navigating the competing demands of different international partners, but it also provides the opportunity to leverage resource wealth to secure favorable terms with major global powers. Research has demonstrated that the success of a country's energy strategies requires a very strong pragmatic streak in decision-makers because it creates a set of 'geopolitical imperatives' that demanded good relations with other actors. This can lead to new alliances based on critical mineral cooperation that provides national security. This can also allow countries to leverage complementary strengths along the critical mineral supply chain, including the provision of technology and maintenance capabilities, operational knowledge and other forms of expertise, and integration with downstream manufacturing processes.

Ipek's 'The role of oil and gas in Kazakhstan's foreign policy: Looking east or west?' Europe-Asia Studies, Vol 59, Issue 7, 2007

Conclusion and Recommendations

There is no single blueprint for success. The path forward must be built on context-specific, locally driven strategies. By prioritizing human development and designing policies that capture the full value of the continent's natural and human resources, Sub-Saharan Africa can chart a self-determined course towards a prosperous and sustainable energy future. To do so, requires efficiency, coherent leadership, the correct allocation of resources and proper operational processes. In particular, African countries both on their own and working together should develop policies that are defined by four main principles:

1. A tolerance for strategies with medium-to-long term benefits.
2. A willingness to enter into innovative and long-term partnerships with external actors;
3. An understanding of the value of cooperation that fosters interdependence, whereby one's fortunes are inextricably tied together with those of other actors;
4. A commitment to pragmatism at the policymaking level, in support of their long-term strategic positioning.

The volatility of continental and global political and market realities requires agile and adaptive policy making. Governments must be equipped with the necessary tools to make decisions that ensure sovereignty and energy security in the longer-term. Today, given the challenges of energy access and low levels of industrial development in the continent, many African countries are preoccupied with short-term poverty reduction and development. There is little consideration for what measures need to be taken to ensure that existing programs promoting economic growth and development are sustained and sustainable. Given that energy is a necessary input for growth, long-term energy security is essential to see through development plans into the future. Any decision about industrial development must take into consideration how and at what cost energy will be sourced. Recent shifts in the narratives around the energy transition point to a more fragmented approach to global decarbonization. This may mean the persistence of fossil-fuel energy systems. But in terms of the need to maximize energy security, as most African countries are net importers of energy, they may still prioritize renewable energy sources regardless of whether they are prioritized elsewhere.
Regardless of the development path chosen, to address the multitude of future challenges, African countries must prepare for the future by adopting an energy-security nexus approach to development. This will better facilitate the implementation of policies in a programmatic fashion in the service of short, medium and long-term national objectives and strategic goals.

This requires strong coordination across government agencies and between public and private sector stakeholders. This may be hampered by different accountability requirements and varying mandates and obligations, but if done properly will maximize the likelihood that the recommendations set out below will be executed in a successful manner. Similarly, coordination between national governments and regional and sub-regional organizations in knowledge transfer about good practice, technological innovations and other forms of substantive support will also provide for a more conducive environment for success.

Short-term
In the short-term, governments should prioritise understanding what mechanisms work best in the medium- and long-term.

Targeted incentives and de-risking mechanisms: These can encourage domestic manufacturing of renewable energy components and other green products, such as green hydrogen, electric vehicles, and batteries. Understanding which incentives, including taxation and de-risking instruments, such as government-backed Power Purchase Agreements (PPAs) for strategic green projects and public procurement (governments buying goods and services) as a strategic tool to foster innovation and support specific sectors by creating early markets, would work best is an essential step towards fostering a domestic manufacturing base. Robust monitoring and evaluation systems must be in place to assess effectiveness of pilots and the extent to which these programs will depend on available government resources.

Prioritization of investments: Whether governments should invest in grid modernization or green industrial zones, or both, will depend on resource availability and the extent of the impact of these investments on industrial development in the short-, medium and long-term. Investments will include both public and private finance for upgrades to national electricity grids. This is a capital-intensive endeavour and is complicated by the significant upfront capital costs associated with grid modernization and large-scale infrastructure projects, and the complexities of long-term planning. One way to overcome these challenges is to leverage blended finance mechanisms, combining public funds with private capital and low-cost financing programs from global philanthropies. However, over reliance on private capital – especially global private capital – can dilute a governments' autonomy in making strategic decisions about energy security. A more balanced, sequential approach to investment must be developed, one where public funding incentivizes private capital but does not do so at the expense of other priorities. To develop such an approach, more evidence is needed to understand the implications of different investment and financing approaches.

Medium-term

Building on the findings of the short-term recommendations listed above, governments could plan for medium-term developments.

Development of local manufacturing and a national green industrial policy: This should focus on policy areas that ensure sovereignty in decisions about energy infrastructure and development and meeting transition goals by fostering domestic manufacturing capabilities in the clean energy sector. This can include piloting production linked incentive (PLI) schemes for solar PV and electrolyzer manufacturing, and the possibility of creating local value chains to reduce import dependency while attracting FDI into manufacturing. Moreover, modelling of the different types of fiscal incentives to boost domestic manufacturing by linking benefits to production output with attracting FDI in green technologies. Modelling efforts should cast a wide net to test the outcomes of different targeted industrial policy strategies, such as the protection of nascent domestic industries through trade tariffs and import restrictions. The successful implementation of such a plan requires effective inter-ministerial coordination. The development of a national green industrial policy will require a holistic, cross-sectoral approach with a broad evidence base.

Ensuring policy regime stability and regulatory certainty for Renewable Energy investments: Provide expedited approvals and remove bureaucratic hurdles regarding simplifying land acquisition procedures and ensuring transparent, predictable, and economically viable tariff structures for renewable energy producers. It also requires the avoidance of ad-hoc policy changes that can erode investor confidence and overcoming inherent bureaucratic inertia that slows down reforms and resistance from existing conventional energy players.

Long-term

To realize the benefits of adopting an energy-security approach, it is important that a long-term view is taken when making decisions today through developing the necessary local conditions for transformation.

The development of human capital to maintain national interests: This requires the incentivization of joint ventures between foreign investors and local companies. This must include explicit provisions for mandated technology transfer and collaborative local research and development (R&D) targets linked to investment incentives. At the same time, it requires investment in vocational training and higher education programs specifically designed to develop a skilled workforce for the burgeoning renewable energy and green industries. While often overlooked, human capital is an attractive force for FDI, especially in manufacturing.

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