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Energy Security Based on Renewable Sources in Africa: The Role of India-Africa Partnership

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Introduction

Africa remains one of the world's least-developed regions, recording poor performance on several human development indicators. One major contributing factor is its extremely low per capita energy consumption, which remains among the lowest globally. In 2024, Africa's per capita energy consumption was only about 19 per cent of the global average and less than 9 per cent of that of OECD countries (EI, 2025). Over the past decade, Africa's per capita energy consumption has stagnated or declined, even as the global average has risen, reflecting the continent's rapid population growth and inadequate expansion of modern energy infrastructure. Nearly 80% of Africa's population continues to rely on traditional biomass for cooking and heating. Furthermore, a large number of African countries are classified as least developed countries by the United Nations. This underscores that achieving the level of economic transformation necessary to meet the United Nations Sustainable Development Goals will require substantial expansion of access to modern, reliable, and affordable energy sources.

The African region is endowed with abundant renewable energy resources. However, these resources remain largely underutilized due to several factors, including lack of finance, absence of proper policy and regulatory frameworks, inflexible grid infrastructure, high cost of technologies, etc. Modern renewable sources (solar, wind, hydro, etc.) account for only about 6 per cent of total energy consumption in Africa. Economic development, energy consumption, and greenhouse gas emissions are closely linked, with higher economic activity generally leading to increased energy use and emissions. At the same time, countries around the world are committed to the pledges of the Paris Agreement to mitigate climate change, based on the principle of common but differentiated responsibilities and respective capabilities.

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African countries are also expected to meet their commitments under their submitted Nationally Determined Contributions (NDCs). In such a situation, they must strike a balance between advancing economic development to secure the benefits of a modern economy and fulfilling their climate commitments under the Paris Agreement.

There is another aspect as well to consider for meeting their energy needs in the changing world marked by geopolitical fragmentation. It is the geopolitical risk. The Russian-Ukraine conflict, and America-Israel combined attack on Iran and Iran's strategic retaliation on the US-Israel defence bases in the Gulf region and energy infrastructure of the allies have amply demonstrated how significant this aspect is, from the energy security's perspective. They have disrupted the energy supply, triggering the increase in oil and gas prices, import bills and fiscal stress. It has impacted the oil importing countries of the world, including African countries, as the majority of them are already reeling under debt stresses of varying degrees.

There is one additional factor relevant to African countries. Since the majority of them have underdeveloped and inadequate energy infrastructure, which they need to expand and modernize to make available a better form of energy to their citizens, it is a better strategy to develop energy infrastructure based on clean / green energy, instead of fossil fuel-based polluting infrastructure. It will entail many benefits for the countries of the region. Firstly, it will facilitate the fulfillment of their commitments under the Paris agreement. Secondly, it will save precious foreign exchange for the countries of the region and shield them from the fluctuation of world energy prices, which is found to be the main reason of BOP and fiscal stresses for many countries. Thirdly, it will also save the countries from the risk of stranded fossil fuel- based assets in the medium term, in the face of likely tightening environmental regulations. Lastly, embedding green development in broader economic development strategies would offer them many additional benefits, including more concessional funding from donor agencies, countries and international financial institutions, as they are more likely to finance green projects as a principle, under a changed mandate. Private investment will also be more attracted if a proper regulatory system, green taxonomy and de-risk mechanisms are put in place with the help of international organizations. The gas-based infrastructure can also be thought of as a transitional option to increase the grid stability , as gas is a lower-emission fuel and sufficiently available in many countries of the region. (Mehrotra and Gupta, 2019)

This strategy will also fit well into the framework developed by the author on the basis of emerging trends and literature in today's scenario marked by geopolitical fragmentation, trade wars, an almost dysfunctional WTO and climate change. This framework is based on the Modern Portfolio Theory, propounded by Harry Markowitz. The theory emphasizes diversification of investments as the key to optimizing expected returns while minimizing risk. Stirling (2010) argued that if knowledge is lacking on the likelihood of an event occurring and on the possible outcome, then ignorance prevails and the best hedge option is to diversify in order to spread the risk as much as possible . Applied to energy security, a country's energy mix- comprising coal, oil, gas, renewables, nuclear, and other sources-can be viewed as a portfolio. The objective is not merely cost efficiency, but the minimization of risks such as geopolitical shocks, supply disruptions and price volatility, while ensuring adequate and affordable energy supply. In an increasingly uncertain world, over-reliance on a single energy source or geography- even if it

appears to be the cheapest option- can be inherently risky. Instead, countries should diversify both their energy sources and supply origins. Such diversification enables a better balance between efficiency and resilience, making the overall energy system more robust and adaptable to external shocks.

The countries should try to maximize their self-sufficiency as per the availability of domestic energy resources. The increasing share of renewable and clean sources should be a continuous effort. It will not only help fulfil country's commitments under the Paris Agreement but also increase the resilience by saving it from the systematic risk, as they are no or less correlated with the fossil fuels' prices. Since African countries have abundant renewable energy potential, they should make their strategies to meet the increasing energy demand in the future by harnessing these varied sources of renewable energy (including solar, wind , hydro, etc.).

However , at the same time, careful attention must be paid to emerging vulnerabilities associated with renewable energy supply chains, particularly in green technologies and critical minerals. While reducing traditional energy risks, new dependencies may arise, especially given the dominant position of China in these sectors. Therefore, building new partnerships and strengthening existing alliances with friendly countries for resilient and diversified critical mineral supply chains should be an integral part of the strategy. Africa is rich in many critical minerals. Countries such as the Democratic Republic of the Congo (cobalt), Zambia (copper), Zimbabwe (lithium), and South Africa (platinum group minerals) hold major reserves. However, they should be used strategically to derive the maximum developmental benefits by climbing up the value chain through value addition within the continent itself, rather than again falling into the trap of remaining confined to low-value-extractive roles in global value chains. Existing regional trade agreements can be leveraged for the same purpose.

India can be a trusted partner in this drive, as it is also striving to make resilient and reliable supply chains in green sectors. It has already initiated many global-level programs, including the International Solar Alliance (ISA) and the Global Bio-fuels Alliance, and forged many bilateral partnerships. Many African countries are already members of these initiatives. Many projects are already being developed under the ISA and through bilateral partnerships in Africa. The government of India has many memorandums of understanding (MOUs) for renewable energy cooperation with African countries and also organizes many specialized training programs in renewable energy for their professionals. These platforms can be further leveraged in Africa to strengthen collaborations in various areas of renewable energy for the mutual benefit of both sides. The forthcoming Fourth India-Africa Forum Summit presents a significant opportunity to further expand collaborations in renewable energy and allied sectors.

Renewable Energy in Africa : Potential, Status and Challenges

As is evident from Table 1, Africa has huge potential of renewable energy resources. However, these resources remain unharnessed because of many factors discussed below.

Hydropower

Hydropower is a major source of electricity in many African countries. It provides about 85% of electricity in Ethiopia, 86% in Zambia, 76 % in Mozambique, and more than 95% in the Democratic Republic of the Congo. While this supports clean electricity generation, it also makes these countries vulnerable to droughts and rainfall changes,

making diversification through solar and wind necessary.

Africa's hydropower capacity exceeded 47 GW by 2023, generating enough electricity to meet about one-fifth of the continent's power demand. In 2024, over 4.5 GW of new capacity was added through projects such as the Julius Nyerere Hydropower Project, the Grand Ethiopian Renaissance Dam, and the Karuma Hydroelectric Power Station. Countries like Kenya also rely heavily on hydropower, though seasonal water shortages can affect supply.

Despite this progress, only small share of Africa's hydropower potential has been developed. Major rivers such as the Zambezi River, Nile River, Congo River, and Niger River still offer vast opportunities. However, challenges such as limited financing, regulatory barriers, water-sharing disputes, and climate risks slow development. To fully utilize hydropower, African countries need stronger investment, regional cooperation, and integration with solar, wind, and storage systems to build resilient and sustainable energy systems (Takal, S. Uwumborge et al., 2026).

Solar

Solar energy, generated from sunlight through technologies such as photovoltaic (PV) panels and concentrated solar power (CSP), is one of Africa's most promising renewable energy sources because the continent receives some of the highest solar radiation in the world. Many parts of Sub-Saharan Africa (SSA) receive 4–7 kWh/m² of sunlight per day, making solar suitable for household lighting, water pumping, community electrification, and other off-grid uses. Despite this strong resource base, Africa has not fully utilized its solar

Table 1 : Spread of Renewable Energy In Africa

Source	Regional distribution	Technical Potential	Current Stalled Capacity
Solar	North , East, west and Souhern Africa	Aprox 7900 GW	23 GW (2024)
Wind	Strong in North, East and Southern African Coastal and highland zones	Aprox 461 GW	7.4 GW (2024)
Hydro	Major river basin in Central, Eastern, Southern and West Africa	Aprox 1100 GW	50 GW (2024)
Geothermal	East African Rift (Mainly Kenya, Ethiopia, Tanzania.	Aprox 15-20 GW	0.85 GW, mostly Kenya (2024)
Biomass	Sub-Saharan Africa rural and agriculture areas	Large but variable, large feedstock potential	1.9 GW (2024)

Source : International Renewable Energy Agency, African Development Bank and International Energy Agency, and (Takal, S. Uwumborge et al., 2026)

potential. By the end of 2024, the continent's installed solar capacity reached about 23 GW, which is a small fraction of potential, highlighting the gap between potential and actual deployment.

Solar PV is the dominant technology because it is modular, relatively affordable, and well-suited for off-grid and mini-grid applications, especially in rural areas. CSP, though useful because of its storage capability, remains limited to a few countries like South Africa due to high costs and technical complexity. Countries such as South Africa, Egypt, Zambia, Nigeria, and Angola are expanding solar capacity, while Kenya and Togo increasingly use solar for households, refrigeration, and small businesses. Since 2020, solar growth has accelerated, particularly in South Africa and Egypt, supported by private investment and policy reforms. However, limited financing, weak infrastructure, high initial costs, and regulatory barriers continue to slow wider adoption. Greater investment and stronger policy support are essential for Africa to fully unlock its solar energy potential (Takal, S. Uwumborge et al., 2026).

Wind

Wind energy is produced by converting the movement of air into electricity using wind turbines. It is an important renewable energy source because it helps meet rising electricity demand while reducing dependence on fossil fuels. Africa's wind energy capacity is still relatively small but is growing steadily. By 2025, the continent is expected to have around 8 GW of installed wind capacity, with further additions planned. However, this is only a small fraction of Africa's wind energy potential, showing that the sector remains largely underdeveloped.

Countries such as Kenya, Morocco, Egypt, Ethiopia and South Africa are leading wind power development in Africa. Major projects, like Kenya's Lake Turkana Wind Farm, have contributed significantly to national the electricity supply and reduced fossil fuel use. In some rural areas, small wind systems are also being used for water pumping and basic electricity needs.

Despite these advances, wind energy expansion faces several challenges, including weak policy support, limited financing, and inadequate grid infrastructure. High initial investment costs make large-scale wind projects difficult for many countries. Hybrid systems that combine wind, solar, and battery storage offer a promising solution for remote areas. To fully utilize Africa's wind potential, stronger policies, better financing mechanisms, and improved electricity infrastructure are essential.

Geothermal

Geothermal power is generated by converting heat from the Earth into electricity. It works much like conventional thermal power plants, where steam is used to run turbines. Heat is extracted from underground reservoirs through wells that bring hot water or steam to the surface for electricity generation and other heating applications. Because it uses the Earth's natural heat, geothermal energy is a clean and sustainable renewable energy source.

In Africa, only Kenya and Ethiopia currently exploit geothermal energy. Kenya is the leading producer, generating about 949 MW of electricity. Its location in the Great Rift Valley gives it large untapped geothermal potential, estimated at 4,000-7,000 MW. Africa's total geothermal potential is estimated at around 15 GW, mostly concentrated in the Rift Valley region, with Kenya and Ethiopia holding major shares.

Despite this potential, geothermal development in Africa remains limited compared to solar and wind energy. High initial investment costs, expensive drilling, weak transmission infrastructure, limited research funding, lack of advanced

technology, and shortage of skilled workers continue to slow progress. Although several African countries have geothermal resources, most have not yet developed them. Greater financial support, especially for exploration and drilling, along with improved infrastructure and technology, is essential for expanding geothermal power across Africa.

Off-shore Wind Energy

Offshore wind energy is a largely untapped renewable energy resource in Africa, especially along the coastlines of North, West, East, and Southern Africa. Studies show that many coastal areas have strong wind speeds and suitable shallow sea conditions for installing offshore wind turbines. However, offshore wind development in Africa is still very limited because of high investment costs, weak port and electricity grid infrastructure, and the lack of clear regulatory policies.

Research also shows that Africa's offshore wind potential is very large and could meet or even exceed the electricity demand of several coastal countries. Regions along the Mediterranean coast and the southern Atlantic have particularly strong potential. As offshore wind technology becomes cheaper and lessons are learned from other advanced countries , it could help diversify Africa's energy mix, supply electricity to major coastal cities, and complement onshore wind and solar power.

Green Hydrogen

Green hydrogen is becoming an important part of Africa's future clean energy transition. It is produced by using renewable electricity, such as solar and wind power, to split water into hydrogen and oxygen through a process called electrolysis. Green hydrogen can help reduce emissions in sectors that are difficult to decarbonize, such as steel, cement, chemicals, and long-distance transport.

Africa has strong potential for green hydrogen production because it has abundant solar and wind resources, large areas of available land, and is close to major export markets in Europe and Asia. Countries such as Egypt, Namibia, Morocco, and South Africa have already announced hydrogen strategies and pilot projects, showing growing interest from governments and investors.

Although large-scale development is still at an early stage, green hydrogen could improve Africa's energy security, support industrial growth, and make the continent a future exporter of clean fuels. However, achieving this will require major investment in renewable energy, water infrastructure, clear regulations, and strong international cooperation (Takal, S. Uwumborge et al., 2026).

Challenges

The growth of renewable energy in Africa remains slow because of several technical, financial, and institutional challenges. Many countries face weak infrastructure, limited technical expertise, inconsistent policies, lack of affordable finance, and low private investment. These problems have reduced the pace of renewable energy adoption .

Although countries such as China and India have rapidly expanded renewable energy through strong industrial policies and local manufacturing, Africa still lags behind. As of 2024, over 600 million people in Sub-Saharan Africa still lack access to electricity. Regional power pools and economic blocs such as the Economic Community of West African States (ECOWAS), the Southern African Development Community (SADC), and the East African community (EAC) have been created to improve cooperation, but their impact has been limited due to regulatory differences, weak infrastructure, and funding shortages (Takal, S. Uwumborge et al., 2026).

To address these challenges, African governments need stronger and more coordinated renewable energy policies. Financial incentives, such as subsidies, feed-in tariffs, and concessional loans, can make electricity more affordable and attract investment. Energy efficiency should also be promoted through wider adoption of LED lighting and efficient appliances. Encouraging local manufacturing of such technologies can further reduce costs. Solar thermal systems, especially solar water heaters, remain underutilized despite their potential to reduce electricity demand in homes, schools, hospitals, and hotels. Their adoption can be increased through awareness campaigns and financial support.

Transport electrification is another important opportunity. Expanding electric vehicles, motorcycles, and renewable-powered charging infrastructure can reduce fossil fuel dependence and improve air quality. Similarly, solar-powered irrigation systems can support agriculture, but high upfront costs remain a barrier for small farmers. Innovative financing models such as pay-as-you-go and micro-credit can help overcome this challenge.

Clean cooking is also critical. A large share of households in Sub-Saharan Africa still depend on traditional biomass fuels, causing health and environmental problems. Promoting LPG, biogas, electric cooking, and improved cook stoves requires policy support and targeted subsidies.

At the system level, Africa must modernize transmission and distribution networks, reduce energy losses, improve regulations for decentralized renewable systems, and invest more in renewable energy instead of fossil fuels. Many African countries have introduced policies to support decentralized renewable energy, especially for rural electrification. These include private-sector incentives, mini-grid regulatory reforms, and measures aimed at reducing dependence on fossil fuels.

However, implementation remains weak. Many policies lack consistency, enforcement, and transparency, which discourages long-term investment. Political instability and poor coordination between national and local governments further slow progress. To accelerate deployment, African countries need stable and well-enforced policies, clear tariff structures, risk-reduction mechanisms, and stronger governance systems.

African countries are using several policy tools to promote renewable energy. They include feed-in tariffs providing fixed prices for renewable electricity and supporting smaller projects in countries like Kenya and South Africa; competitive auctions helping countries such as Morocco and Egypt achieve lower renewable energy costs and attract private investors; and subsidies and de-risking measures, including tax exemptions and concessional loans, in countries like Nigeria and Rwanda to improve the project viability. A balanced use of these instruments can encourage investment and reduce costs.

Weak electricity grids remain a major barrier to renewable energy integration. For example, in South Africa, aging transmission networks limit renewable integration; in Nigeria, unreliable grids and high technical losses discourage grid-connected renewable projects; and in Ethiopia, limited transmission lines restrict power delivery to demand centers. Strengthening grid infrastructure is therefore essential for expanding renewable energy across Africa (Takal, S. Uwumborge et al., 2026).

India -Africa Partnership in Renewable Energy

Africa, a region of vast renewable energy potential, is still facing energy poverty, especially in the form of modern energy

services. The continent presents many contradictions. Despite the abundance of renewable resources in the region, only a small fraction of them has been harnessed in the form of modern energy. 80 per cent of the population still uses traditional biomass (like wood and charcoal) for cooking and heating, exposing the population, especially women, in the region to pollution-related health hazards. Despite being rich in many critical minerals , indispensable for energy transition and other strategic sectors, the region still struggles to add some value locally to derive some additional developmental benefits, as a result of a shortage of technology and skilled human capital. 600 million people still do not have access to electricity. These all present ample opportunities for India to offer responsible partnership a in many forms to promote inclusive growth, mutual economic benefits and development of human capital, along with accelerating the transition to a green economy on both sides. India has already developed significant conventional energy partnerships across Africa, including upstream and downstream investments in the hydrocarbon sector in countries such as Sudan, Nigeria, Egypt, Equatorial Guinea, and Côte d'Ivoire, largely driven by India's pursuit of long-term energy security. At the same time, cooperation in renewable energy is also expanding and requires further strengthening.

India has expertise and experience in solar and wind energy , as these two sources make about 75 per cent of total installed capacity in renewables in India (including solar, wind, bio-energy, and hydro). Africa needs to harness these two sources of energy to meet the burgeoning demand for energy. Besides sharing technologies, India can help African countries in streamlining the policy and regulatory frameworks to implement grid-based large projects, and off-grid and mini grid-based projects to serve the rural community, which is sparsely populated. Rural electrification and grid modernization offer important areas for cooperation between India and Africa. India's success in achieving full village electrification through decentralized renewable energy systems provides a useful model for many African countries that still face major electricity access challenges. India's public and private sectors can work with African governments to expand mini-grids and off-grid renewable energy systems, especially in remote and under-served areas. Many projects are already being developed in Africa by India.

India and France initiated the International Solar Alliance (ISA) in 2015. It has driven the alliance's agenda on cost reduction, demand aggregation, technology adoption, and capacity building, while promoting solar financing, technology transfer, and skill development across member countries. The ISA now comprises over 120 member countries, including many from Africa, and aims to mobilise more than US$1 trillion by 2030 to deploy 1,000 GW of solar capacity globally, enhancing energy access, security, and clean energy transitions. Complementing this, India has advanced the One Sun One World One Grid (OSOWOG), which envisions a globally interconnected grid for round-the-clock solar power. This vision was aligned with the UK-led Green Grids Initiative, leading to the launch of the Green Grids Initiative-OSOWOG (GGI-OSOWOG) at the COP26 Glasgow Summit (Dua, 2026).

To bolster collaboration in Africa, India has pledged a US$ 2 billion concessional credit line for solar projects in Africa out of the Government of India's total US$ 10 billion concessional Line of Credit (LOC) for Africa. Exim Bank of India is implementing this line of credit in close coordination with ISA countries in Africa (MNRE, 2019-20). A major joint initiative between ISA and

the African Development Bank aims to install 10,000 MW of solar capacity across the Sahel, providing electricity access to nearly half of 600 million Africans, still without electricity. Africa has also launched Africa Renewable Energy Initiative (AREI) targeting 300 GW of renewable energy by 2030 (CII, 2025). The Government of India has Memorandums of Understanding (MOUs) for renewable energy cooperation with many African countries (MNRE, 18-25). In order to understand the challenges and issues on the ground and to strengthen support for ISA programmes, the ISA sent country missions to eight countries during 2019, including Benin, the Democratic Republic of the Congo, Guinea, Malawi, Mali, Niger, Togo, and Uganda. (MNRE, 2019-20).

The MNRE supports specialized training programs in solar, wind, small hydro, and biomass energy for participants from African and other developing countries through the Government of India's ITEC programme. These trainings are conducted at leading Indian institutions, including National Institute of Solar Energy, National Institute of Wind Energy, Alternative Hydro Energy Centre, and Indian Institute of Science. Under the India–Egypt bilateral cooperation program, the MNRE helped electrify the remote village of Aggawen using solar PV systems. The project was implemented by Rajasthan Electronics & Instruments Limited with support from the Ministry of External Affairs, after the village was identified by Egypt's Ministry of Electricity and Energy. In 2016–17, the Ministry of New and Renewable Energy provided financial and technical support for pilot solar projects, including home systems, pumps, mini-grids, street lighting, and solar installations in schools and clinics across nine African and Latin American countries (MNRE, 2016-17). Besides these examples, as per India-Africa Forum Summit's briefings, India has many other bilateral engagements in renewable energy and allied sectors with many African countries.

The complementary strengths of India and Africa in green hydrogen also present ample opportunities for cooperation. Africa's substantial renewable resources can be combined with India's cost-effective technologies, developed human resources and policy expertise in this area. North African countries can serve as an exporting hub of green hydrogen and its derivatives to Europe. Six African nations, including Egypt, Kenya, Mauritania, Morocco, Namibia, and South Africa, have formed the Africa Green Hydrogen Alliance (AGHA) to accelerate green hydrogen projects, positioning Africa as a future clean energy powerhouse.

Africa has a vast reserve of critical minerals. India and African countries can work together to develop the resilient supply chains in these areas. African countries are also interested to use these critical minerals as a pathway to economic development by doing value-addition within Africa, instead of exporting raw minerals. India is working to build its lithium supply chain, while African countries are increasingly focusing on processing lithium locally. Zimbabwe's Sandawana lithium concentrator is one such example. If India and African countries work together in this area, they can build a stronger lithium supply chain that can support clean energy development and benefit both parties (CII, 2025).

India and African countries can work together to improve mining through better technology. By carrying out joint research and sharing knowledge on digital tools such as Geographic Information System (GIS), automation, and robotics, they can make mineral exploration more accurate, and mining operations safer and more efficient. India and African countries can organize joint innovation programs to develop new solutions for mining challenges. They

can also create common guidelines to promote sustainable and responsible mining practices. Such cooperation would improve productivity, reduce environmental damage, and help build stronger and technology-driven mining sectors that benefit both sides.

India launched the National Critical Mineral Mission in January 2025 to increase investment in important minerals, such as lithium, cobalt and rare earth elements, across the full value chain. Under this mission, Indian public sector companies and other stakeholders are expected to invest ₹18,000 crore in activities such as mineral exploration, mining, processing, and recycling. This creates new opportunities for cooperation with African countries, which have large reserves of many minerals. It can help India secure the minerals needed for clean energy technologies, while also supporting Africa's industrial growth and job creation. To support this effort, India's February 2025 Union Budget removed import duty on several critical minerals, including cobalt powder, lithium-ion battery waste, lead, zinc, and other key minerals. This step is meant to ensure a steady supply of these minerals for Indian manufacturing and create more employment opportunities. It also builds on the July 2024 Budget, which had already removed import duty on 25 critical minerals.

Africa's transition toward electric mobility presents significant opportunities for deeper India–Africa cooperation. EV adoption across much of Africa remains at an early stage, but rising urbanisation, high fuel import dependence, and demand for affordable transport are accelerating interest in electric two-wheelers, three-wheelers, buses, and light commercial vehicles. India is well positioned to support this transition because its EV ecosystem has developed around low-cost manufacturing, battery swapping, and small-vehicle electrification suited to developing-country conditions.

Indian firms such as Tata Motors, Mahindra & Mahindra, and TVS Motor Company, which already have a presence in Africa in various forms, possess expertise in affordable EV platforms relevant to African markets. Battery-swapping models pioneered by Indian companies may also help overcome Africa's limited charging infrastructure and unreliable electricity access. In addition, Africa's large reserves of lithium, cobalt, manganese, and graphite create scope for collaboration in battery value chains and mineral processing. An India–Africa EV partnership could therefore combine African mineral resources with Indian manufacturing, software integration, and vehicle assembly capabilities. Such cooperation would support industrial development, reduce dependence on imported fossil fuels, and strengthen South–South economic integration while providing an alternative to excessive reliance on Chinese EV supply chains.

India initiated the Global Bio-fuels Alliance. Several African countries are members of it. India has achieved its 20 per cent ethanol blending target, creating new opportunities for cooperation with Africa. India can work with African countries by sharing technology, skills, and experience in biofuel production. This partnership can help develop Africa's ethanol infrastructure, support sustainable agriculture, and promote cleaner energy solutions across the continent.

Egypt is discussing with the Indian company ReNew Energy to build an $8 billion green hydrogen project in the Suez Canal Economic Zone. The project aims to produce 220,000 tons of green hydrogen every year and help Egypt become a clean energy hub (ReNew Energy Global, 15 Nov. 2022). A report states that Inox Clean Energy and RJ Corp formed a joint venture to invest ₹1,700 crore in Africa's renewable energy sector. The first phase targets 570 MW of renewable energy capacity, with

plans to scale up to 2.5 GW by FY29, including projects in countries such as Zambia, Zimbabwe, and the Democratic Republic of Congo (The Economic Times, 12 February 2026).

At the same time, the International Solar Alliance received $25 million support from India for its Global Solar Facility, which aims to provide clean energy access to 200 million Africans by 2030. The ISA is also helping expand solar energy across Africa, with 30 solar projects under development, following India's successful solar energy model.

The forthcoming Fourth India-Africa Summit presents an opportunity to further strengthen mutually beneficial collaborations in green energy.

Conclusion

Energy security has always been a significant issue for a country, as energy is an important input for economic development. Its importance increases manifold in the contemporary world context, marked by geopolitical fragmentation, deglobalization, dysfunctional WTO and inadequate response from other global institutions, and climate change. For African countries, which are in perpetual struggle to overcome poverty and provide their citizens a decent life, the issue of energy security assumes all the more importance. They have to meet all Sustainable Development Goals from lower baselines. 80 per cent of the continent's population relies on traditional biomass, like wood and charcoal, for their household fuels for meeting their cooking and heating needs. 600 million people lack access to electricity. It is in marked contrast to the reality that the African continent has huge renewable energy potential, which remains unharnessed on account of shortage of finance, affordable technologies, skilled human resources and modern energy infrastructure, along with weak policy and regulatory frameworks. Almost half of the countries of the continent are net importers of fossil fuels.

In this evolving new world, the concept of energy security has undergone a paradigm shift from being primarily driven by cost-minimization to resilience-focussed, even at the expense of a little higher cost, to ensure the uninterrupted supply of energy. The root of the new paradigm lies in Modern Portfolio Theory generally used in financial investment to manage the heightened risk. It minimizes the risk and ensures the optimal returns. The key is diversification in the uncorrelated financial assets. In the same way, in case of energy security, diversification of energy sources and geographies reduces the risk of geopolitical conflict and disruption of energy supply, while ensuring the adequate supply of energy at the optimal price.

Three dimensions are required for consideration for the policy makers to ensure the perpetual flow of energy at a reasonable cost. They include geopolitical risk, climate change and degree the self-sufficiency. The ongoing conflict in the Middle East and the Russia-Ukraine war have already demonstrated the danger of geopolitical risk to energy security. Climate change, whose impact is being felt gradually, adversely affect fossil full based energy security in the medium term, in the face of tightening environmental regulations to mitigate climate change. The self-sufficiency, particularly in renewable sources, ensures a viable path to addressing both geopolitical and climate risks. Here, the vast renewable resources in Africa can prove to be a boon, provided they are used in electricity generation.

Africa holds approximately 60 per cent of the world's best solar energy resources with almost 7900 GW technical potential. However, it utilizes a very small portion of it (almost 19 GW). Similarly, wind energy offers significant potential, estimated at nearly 461 GW, particularly across the coastal and highland regions of North, East, and Southern Africa. But a small part of it has been used so far (almost 8 GW). Hydro-power has an estimated potential of almost

1100 GW, out of which, only a small portion is used for electricity generation. In the same way, geothermal energy also has potential in the countries located in Great Rift Valley (almost 20 GW), out of which, only 1 GW is used, especially in Kenya. Biomass energy has huge potential, but it is mainly used for heating and cooking purposes as traditional biomass fuels. If these renewable energy resources are harnessed for electricity generation, they will not only be sufficient to meet the future energy demand of the African continent but could also enable Africa to export electricity to other regions, including the Middle East and Europe.

However, due attention should be paid to avoid creating future vulnerabilities while addressing the existing ones emanating from over-dependence of imported fossil fuels. They may emerge from new dependency on green technologies and critical minerals, where China is the main player. Africa holds huge reserves of many critical minerals. It should make new alliances and collaborations with trusted countries to develop them. India can be one such partner, as it is also striving to develop resilient supply chains in critical minerals. India can also help in developing renewable sources , as it has cost-efficient technologies and expertise in solar and wind energy. It can also help African countries in streamlining their policy and regulatory frameworks. The International Solar Alliance was launched by India and France in 2015. Many African countries are members of it. Many projects are being developed under this alliance in Africa. The Government of India has signed many MOUs with African countries for renewable energy cooperation. It provides specialized training programs to African professionals in solar, wind, small hydro and biomass energy. India can also help African countries in developing green hydrogen, which also aligns with the Indian vision. The private companies have also shown interest in green energy development in Africa. Further, the forthcoming Fourth India -Africa Summit can be leveraged to build more mutually beneficial collaborations in green energy.

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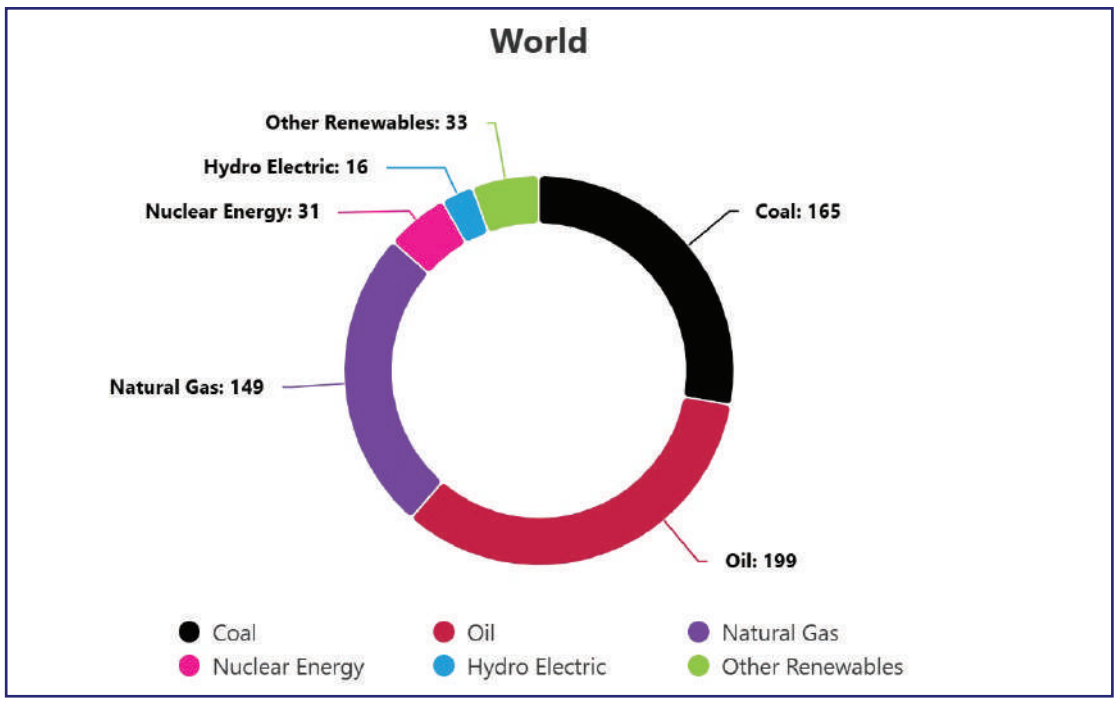
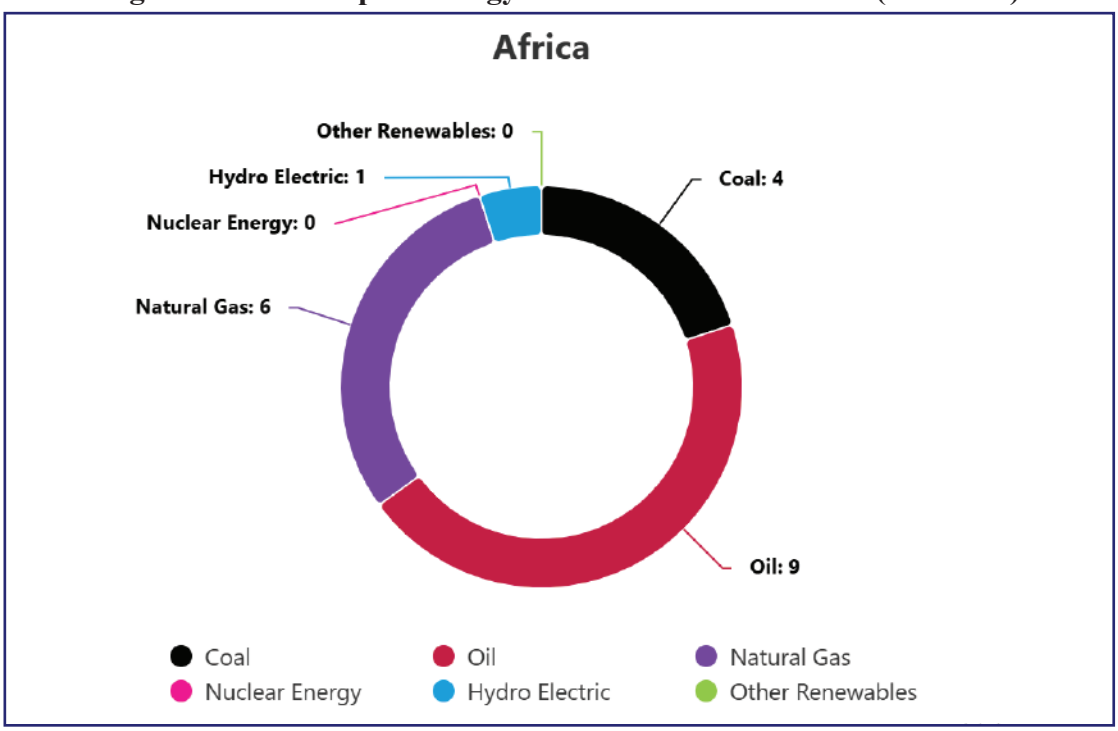
Figure 1 : Break -up of Total Energy Sources in World in 2024 (Units:EJ)



Source : Statistical Review of World Energy 2025.

Figure 2: Break-Up of Energy Sources in Africa in 2024 (Unit: EJ)



Source : Statistical Review of World Energy 2025

RIS
Research and Information System for Developing Countries
विकासशील देशों की अनुसंधान एवं सूचना प्रणाली

RIS specialises in issues related to international economic development, trade, investment and technology. It is envisioned as a forum for fostering effective policy dialogue and capacity-building among developing countries on global and regional economic issues. The focus of the work programme of RIS is to promote South-South Cooperation and collaborate with developing countries in multilateral negotiations in various forums. Through its following centres/forums, RIS promotes policy dialogue and coherence on regional and international economic issues.

The word "DAKSHIN" (**दक्षिण**) is of Sanskrit origin, meaning "South." The Hon'ble Prime Minister of India, Shri Narendra Modi, inaugurated DAKSHIN – Global South Centre of Excellence in November 2023. The initiative was inspired by the deliberations of Global South leaders during the Voice of the Global South Summits. DAKSHIN stands for Development and Knowledge Sharing Initiative. Hosted at the RIS, DAKSHIN has established linkages with leading think tanks and universities across the Global South and is building a dynamic network of scholars working on Global South issues.

AIC at RIS has been working to strengthen India's strategic partnership with ASEAN in its realisation of the ASEAN Community. AIC at RIS undertakes research, policy advocacy and regular networking activities with relevant organisations and think-tanks in India and ASEAN countries, with the aim of providing policy inputs, up-to-date information, data resources and sustained interaction, for strengthening ASEAN-India partnership.

CMEC has been established at RIS under the aegis of the Ministry of Ports, Shipping and Waterways (MoPS&W), Government of India. CMEC is a collaboration between RIS and Indian Ports Association (IPA). It has been mandated to act as an advisory/technological arm of MoPSW to provide the analytical support on policies and their implementation.

FITM is a joint initiative by the Ministry of Ayush and RIS. It has been established with the objective of undertaking policy research on economy, intellectual property rights (IPRs) trade, sustainability and international cooperation in traditional medicines. FITM provides analytical support to the Ministry of Ayush on policy and strategy responses on emerging national and global developments.

BEF aims to serve as a dedicated platform for fostering dialogue on promoting the concept in the Indian Ocean and other regions. The forum focuses on conducting studies on the potential, prospects and challenges of blue economy; providing regular inputs to practitioners in the government and the private sectors; and promoting advocacy for its smooth adoption in national economic policies.

FIDC, has been engaged in exploring nuances of India's development cooperation programme, keeping in view the wider perspective of South-South Cooperation in the backdrop of international development cooperation scenario. It is a tripartite initiative of the Development Partnership Administration (DPA) of the Ministry of External Affairs, Government of India, academia and civil society organisations.

FISD aims to harness the full potential and synergy between science and technology, diplomacy, foreign policy and development cooperation in order to meet India's development and security needs. It is also engaged in strengthening India's engagement with the international system and on key global issues involving science and technology.

As part of its work programme, RIS has been deeply involved in strengthening economic integration in the South Asia region. In this context, the role of the South Asia Centre for Policy Studies (SACEPS) is very important. SACEPS is a network organisation engaged in addressing regional issues of common concerns in South Asia.

Knowledge generated endogenously among the Southern partners can help in consolidation of stronger common issues at different global policy fora. The purpose of NeST is to provide a global platform for Southern Think-Tanks for collaboratively generating, systematising, consolidating and sharing knowledge on South South Cooperation approaches for international development.

DST-Satellite Centre for Policy Research on STI Diplomacy at RIS aims to advance policy research at the intersection of science, technology, innovation (STI) and diplomacy, in alignment with India's developmental priorities and foreign policy objectives.

— Policy research to shape the international development agenda —

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