

# **Renewable Energy and Sustainability in Africa: A Review with Insights from the South African Energy Transition**

**Nyasha Grace Gatawa and Charles Mbohwa**

Sustainability Engineering and Future Technologies Centre

University of South Africa

Johannesburg, South Africa

[gatawng@unisa.ac.za](mailto:gatawng@unisa.ac.za), [mbohwc@unisa.ac.za](mailto:mbohwc@unisa.ac.za)

## **Abstract**

Energy drives development and underpins sustainable economies. Africa stands at the crossroad and is at a critical time in its energy transition as it grapples with the need to expand access to reliable power while aiming to achieve environmental sustainability. In Africa over 600 million people do not have access to reliable energy and energy poverty is prevalent. This paper discusses current developments, strategies, policies, and technologies driving sustainability in Africa's energy sector. Drawing on recent studies, regional reports, and case analysis, it explores the progress and challenges in integrating renewable energy sources such as solar, wind, hydro and geothermal into national energy mixes. The paper examines barriers to sustainability in the energy sector and proposes viable pathways for a just and inclusive energy transition in Africa. The critical role that energy plays in development makes urgent the need for a just energy transition. Finally, the paper underscores the potential for Africa to advance to a more sustainable and low-carbon future by drawing upon its abundant renewable resources and emerging green technologies. Sustainable development in Africa will be driven by an energy sector that takes into consideration the specific and unique nuances of the continent in an increasingly globalised world.

## **Keywords**

Energy, Sustainability, Africa, Sustainable Energy, Sustainable Development

## **1. Introduction**

Energy is a pivotal component of sustainable economies. Sustainable energy is crucial for sustainable development. Africa faces significant energy challenges (Agoundedemba et al. 2023, IRENA, 2025). Energy demand has outweighed availability. The reality of energy poverty is evident on the continent. As the urgency to attain the sustainable development goals by 2030 becomes key the focus on a more sustainable future intensifies. Sustainable Development Goal 7 underlines the critical importance of transitioning to sustainable, reliable, and clean energy. The climate crisis has also made urgent the need to transition away from fossil fuels. The negative impact of fossil fuels on the environment has become clear. Additionally, renewable energy resources have played a key role and contributed significantly to the sustainability of many countries (Aliyu et al. 2018). The global energy crisis underscores the urgency of moving to cleaner sources of energy as the benefits of moving to cleaner sources of energy are clear (IEA, 2025)

Energy drives development. Africa's energy sector presents unique challenges, notably the need to strive to balance growing energy demands with sustainability goals. This paper aims to assess the current state of the sector in Africa and to identify pathways toward a cleaner and more resilient future. The paper contributes a timely and concise overview of sustainability trends in Africa's energy sector, drawing attention to the significance and importance of the energy sector in Africa and how this sector underpins development on the continent. It is crucial that the energy

sector in Africa moves away from the current reliance on fossil fuels towards more sustainable energy sources and this paper underscores the urgency of this transition.

Specific objectives of this paper include the following:

### **1.1 Objectives**

1. To provide an overview of the energy sector in Africa
2. To outline the progress towards sustainability in the African energy sector.
3. To provide recommendations on how to move Africa's energy sector forward to a more sustainable future

## **2. Methodology**

The study adopted a narrative review research approach comprising a mini -review approach as well as case analysis. The narrative review approach was selected and is appropriate to provide a broad, interpretive overview of a topic. The narrative review focused on recent research articles on the energy sector in Africa. The aim is to synthesise recent academic and policy literature on sustainability in the energy sector and to present practical examples that illustrate the trajectory towards sustainability of the energy sector in Africa.

The review focused largely on a selection of publications largely from 2021 to 2025, ensuring that these articles provided a holistic overview of recent developments in the energy sector in Africa. Key electronic databases including Scopus ,Web of Science, Google Scholar and Science Direct were searched. Relevant reports from international organisations such as the International Energy Agency (IEA) and the International Renewable Energy Agency (IRENA) were used to add to the academic literature. Targeted keywords such as sustainability, renewable energy, energy in Africa were used to search for recent literature.

### Inclusion Criteria

Publications focused on energy systems, sustainability, and renewable energy in Africa  
Peer-reviewed journal articles, policy reports, and policy-oriented articles  
Mainly publications released between 2021 and 2025  
Studies published in English

### Exclusion Criteria

Publications not directly related to the energy sector and particularly the African energy sector.  
Publications not published in recent years  
Publications not published in English

A total of 33 peer reviewed journal articles, policy documents and policy articles were analysed. These documents were selected based on recency, alignment and relevance to the review topic, i.e. sustainability in the energy sector in Africa

Although a growing body of literature has examined sustainability in Africa's energy sector, existing studies are largely fragmented. There remains a dearth of comprehensive synthesis that integrates key trends in a concise way. This paper addresses this gap by synthesizing 33 studies and policy documents into a concise overview of the state of sustainability in the African energy sector complementing the review with a detailed case study of South Africa's energy sector illustrating practical sustainability dynamics and implications.

## **3. Overview of Reviewed Studies**

Table 1 provides a summary of the studies included in the review highlighting key findings, context/setting and methodology.

Table 1. Overview of Reviewed Studies

Author(s), Year	Context/Setting	Methodology	Key Findings
Abdelrazik et al 2022	Africa	Literature Review	Renewable energy has a key role to play in Africa's development. Solar energy has significant potential in Africa.

Author(s), Year	Context/Setting	Methodology	Key Findings
			There is need to address the challenges facing the adoption of solar energy technologies in Africa.
Adedoyin et al 2021	32 countries in sub-Saharan Africa	Quantitative Analysis	Economic policy uncertainty plays a role in renewable and non-renewable trajectories.
Agoundedemba et al. 2023	Africa	Literature Review	Africa faces significant challenges in the adoption of renewable energy.  There is need to fully exploit renewable energy potentialities in Africa.
African Union, 2025	Africa	Focuses on Agenda 2063 which is Africa's development blueprint and master plan.	Electricity is key to Africa's development.  Transforming Africa's energy sector to a more sustainable pathway is crucial.
Akinbami et al 2021	South Africa	Literature Review	South Africa has abundant resources for renewable energy.  South Africa is still heavily reliant on coal. There are challenges to renewable energy development in Africa.
Akrofi 2021	Africa	Quantitative data analysis	Africa should develop its vast renewable resources.
Alemzero et al 2021	Africa	Quantitative Analysis: Technical and Economic Analysis	There is need for greater scaling up and promotion of wind energy in Africa
Aliyu et al. 2018	Africa (South Africa, Egypt, Nigeria)	Literature Survey of Energy Efficiency	Africa is facing challenges in sustainable development in the energy sector.
Amir & Khan 2022	Africa	Literature Review	Africa has immense potential for power generation.
Bothongo & Kinyar 2025	South Africa	Quantitative analysis and modelling	South Africa is highly reliant on coal and coal contributes significantly to South Africa's energy sector.  There is need for a cautious phase out of coal in South Africa.
Bugaje 2006	Africa (South Africa, Egypt, Nigeria, Mali)	Literature Review	Africa is facing an energy crisis.

Author(s), Year	Context/Setting	Methodology	Key Findings
			The is need to address Africa's energy needs urgently.
Department of Mineral Resources and Energy, 2023	South Africa	Integrated Resource Plan 2023	South Africa needs to adopt a diversified energy mix and one that incorporates renewable energy.
Department of Mineral Resources and Energy, 2025	South Africa	Solar Energy Technology Roadmap, SETRM	Solar energy is crucial to South Africa's energy mix.
Ellen McArthur Foundation 2025	Global	Circular economy article on Ellen McArthur Foundation website	There is a global movement away from the linear economy to the circular economy which is highly beneficial to sustainability.
Falcone, 2023	Albania, Brazil, India, Kenya	Literature Review	While there is progress towards the adoption of renewable energy in developing countries challenges exist and there is need to harness opportunities.
Hanto et al. 2022	South Africa	Case Study	South Africa is highly dependent on coal. Increasingly, the dependency on coal is unsustainable. A just energy transition in South Africa is crucial.
Ibrahim et al 2021	Nigeria, Cameroon, Ghana, South Africa	Case Study	All four countries ( <i>Nigeria, Cameroon, Ghana and South Africa</i> ) have immense potential in renewable energy but there is need to fully harness this potential.  South Africa is the leading country in terms of harnessing renewable energy potential.
IEA, 2025	Africa	Article on IEA website on the energy systems in Africa	Energy is crucial to Africa's development.
IRENA, 2025	Africa	Article on IRENA website on energy in Africa	Africa has huge demand for energy and faces significant energy challenges.
IRENA, 2025	Southern Africa	Article on IRENA website on investment forums in Southern Africa	South Africa has vast renewable energy resources.
Karekezi, 2002	Africa	Narrative Review	Energy is critical to Africa's development.

Author(s), Year	Context/Setting	Methodology	Key Findings
Maqbooi & Akubo 2022	Africa	Qualitative & Quantitative Methodologies	Solar energy has a strong positive direct effect on sustainability.  Socio economic factors significantly moderate this positive relationship.  A detailed model of solar energy development is required in the developing parts of the world.
Molepo et al. 2025	South Africa	Application of the AKTESP theoretical framework	South Africa remains heavily dependent on fossil fuels for economic growth. Renewable energy can transform South Africa's energy sector.  There are a number of barriers that have impacted South Africa's energy transition.
Mossisa & Han, 2025.	Sub-Saharan Africa	Literature Review	There is need to embed renewable energy strategies within urbanisation processes and development agendas.  There are marked regional disparities in the green transition.
Muller et al. 2021	Africa	Comparative Policy Analysis	Renewable energy policies in Africa are uneven in supporting energy justice.  The energy justice concept is crucial in the energy transition.
Mutezo and Mulopo, 2021	Africa	Systematic Literature Review	Africa's energy demand is rising sharply.  There is uneven energy mix across the continent.  Circular economy principles can support the transition.  Policy and financial support are crucial.
National Planning Commission 2012	South Africa	National Development Plan 2030	There is need for South Africa to transition to more sustainable sources of energy
Nsafon et al. 2023	Africa	Literature/Policy Review and Conceptual Analysis	A just and inclusive transition is key in Africa.  To ensure that clean energy policies are effective they have to be based on evidence and the experiences of individuals and communities.

Author(s), Year	Context/Setting	Methodology	Key Findings
Panja et al. 2025	Africa	Literature based review with multi scenario analysis.	Africa's renewable energy transition is essential for meeting SDG 7  Strategic interventions are crucial to accelerate progress.  Renewable energy offers not just environmental benefits but socioeconomic transformation.
PWC 2024	Africa	A review of Africa's energy sector	Africa is emerging as a leader in renewable energy development.  South Africa is leading the way in the adoption of renewable energy.
Todd & McCauley 2021	South Africa	Qualitative Literature Review with empirical analysis based on expert interviews.	Policy barriers are the key constraint to South Africa's energy transition. It is crucial to address these policy barriers.
Tomala et al. 2021	Sub-Saharan Africa	Mixed Quantitative Methodology	There are wide disparities in energy sector development in Sub-Saharan Africa highlighting the need for targeted policies and investments.
UNCTAD, 2021	Africa	UNCTAD report highlighting the extent of poverty in Africa	Poverty remains a very real challenge in Africa.

#### **4. Overview of Africa's Energy Sector**

Energy is a key pillar of sustainability and greatly influences the growth and development of countries, regions, and communities. The energy sector in Africa faces key challenges, notably the lack of energy security and rampant energy poverty. A key challenge that Africa faces is to find a sustainable way to meet its growing energy demands (Panja et al. 2025). Most African countries are unable to meet the energy demand of much of the population and a staggering 61% of people without access to electricity are from Sub-Saharan Africa (Ibrahim et al, 2021). In Africa over 600 million people do not have access to electricity (Tomala et al. 2021). With a population of 1.51 billion the continent has significant energy requirements and faces a daunting energy challenge (IRENA, 2025).

Access to modern energy in Africa is vital and critical for socioeconomic development and Africa faces significant challenges in the energy sector. Most countries in Sub-Saharan Africa rely on non-renewable energy in a region where energy demand is increasing and there is urgent need for the region to transition away from fossil fuels (Adedoyin et al. 2021). By 2030 it is projected that Africa will be home to one fifth of the world's population increasing energy demand significantly (IEA, 2025). In order to reach development objectives, it is critical that energy spending on the continent more than doubles by 2030 (IEA, 2025). By diversifying its energy mix Africa can increase its energy access (Akrofi, 2021).

Energy decisions in developing countries impact their own economic and social development as well as global efforts to combat climate change so it is imperative that Africa moves swiftly towards sustainability (Falcone, 2023)

Addressing the energy challenges in Africa is crucial. The African Union's Agenda 2063 which outlines the goals of mitigating climate change, achieving sustainable development, addressing poverty and building prosperity highlights that electricity is crucial to achieve these goals (African Union. 2025). Agenda 2063 notes that Africa has vast resources of energy, both renewable and non-renewable. Agenda 2063 also calls for the transformation of the energy sector in Africa moving away from traditional biomass to renewable and cleaner sources of energy.

As shown in Figure 1, biofuels and waste comprise the highest percentage of Africa's energy supply (IEA, 2025). In 2023 total energy supply in Africa comprised coal and coal products 12.7%, oil and oil products 26.5%, natural gas 17.6%, hydropower 1.7%, solar, wind and other renewables 1.6% and biofuels and waste 39.9% (IEA, 2025). In terms of regional ranking of total energy supply South Africa was ranked first followed by Egypt. Nigeria was ranked third.

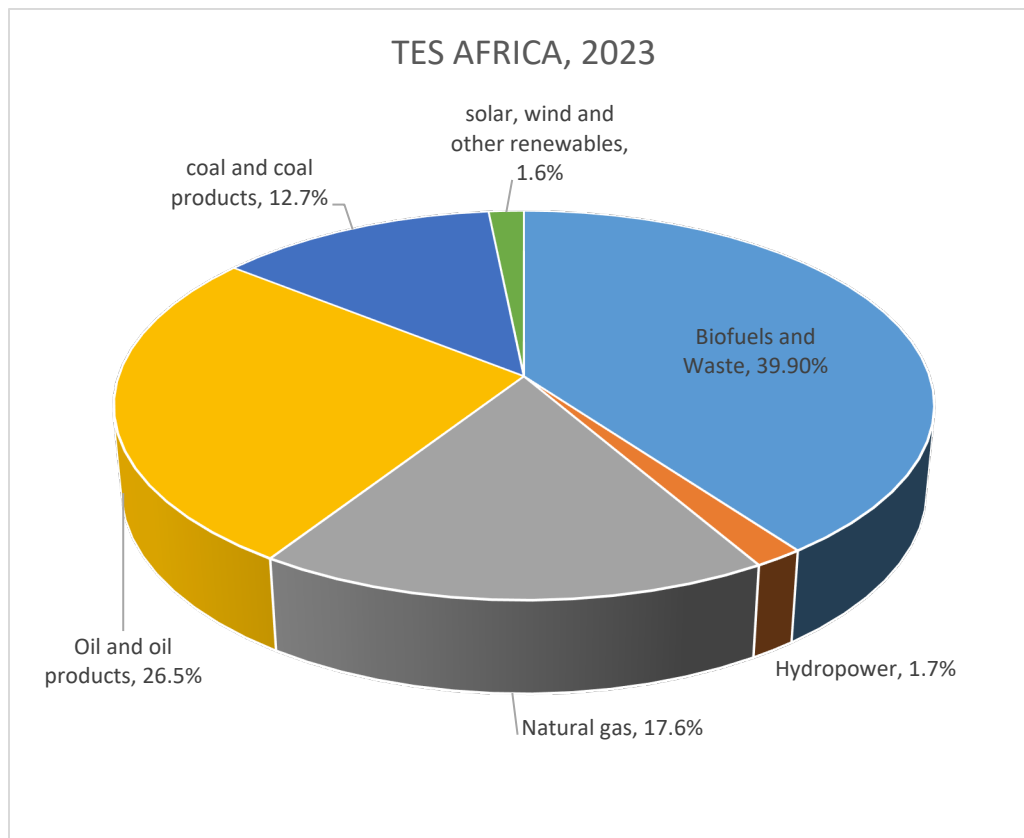


Figure 1. Total Energy Supply in Africa in 2023. (TES, Africa, 2023)

Biomass remains the dominant energy source in Africa and this has several disadvantages including environmental degradation. There is need to move more cogently to other sources of energy that are more sustainable such as hydropower and solar energy. The use of coal is also unsustainable and needs to be addressed. Driving sustainability in the energy sector in Africa will require a focus on renewable energy and a transition away from fossil fuels especially in light of the deepening concerns around climate change and environmental degradation.

## **5. The potential of renewable energy in Africa**

Despite an abundance of renewable energy resources Africa has not been able to fully realise this potential (Amir & Khan. 2022). While there has been significant progress to adopting renewable energy on the African continent progress towards SDG 7 remains limited (Muller et al. 2021). In Sub-Saharan Africa some regions and countries have made good progress in renewable energy adoption but many others depend on fossil fuels to a larger extent (Mossisa & Han, 2025).

Alternative energy resources are plentiful on the African continent and these include solar energy, wind energy, wood and biomass and biogas production (Bugaje, 2006). Notably solar energy and wind energy are increasingly playing a key role in Africa's energy mix. Africa is well endowed with resources for solar energy (Panja et al. 2025). Southern Africa is emerging as a leader in renewable energy development especially solar and wind (PWC, 2024). In Southern Africa renewables comprise a growing share of power capacity up from 23% in 2015 to 39% in 2018 and many countries in Southern Africa have set renewable energy targets (IRENA, 2025) One of the most abundant renewable energy resources in Africa is solar energy. Solar energy impacts all aspects of sustainability in all the three dimensions of sustainability; economic, social and environmental sustainability (Maqbool & Akubo, 2022).

Solar energy in Africa has the potential to address climate change and solar energy can address the critical energy challenges facing the continent (Abdelrazik et al. 2022). Wind energy also has the potential to contribute to sustainability in Africa. Africa has the potential for wind energy and wind energy in Africa has grown from 0.74GW in 2009 to 5.5GW in 2018 but while wind energy is rapidly gaining traction in Africa it remains far short of its capacity (Alemzero et al. 2021).

## **6. Poverty and Sustainable Energy in Africa**

Poverty in Africa is a stark reality and the levels of energy poverty are remarkably high. In 2019, 478 million people in Africa lived in extreme poverty (UNCTAD, 2021). Nsafon et al (2023) emphasise that it is crucial that the clean energy transition in Africa is guided by fairness and equity considerations. The authors note that increasing the use of clean energy incrementally is the most effective way to transform Africa's energy sector.

Sustainable energy is vital to stem the poverty cycle in Africa. Sustainable energy can drive economic growth and move the continent to a low-carbon future. Energy poverty in Africa needs urgent attention. Energy policies play a crucial role in driving sustainability in the energy sector. As early as 2002 Karekezi noted the inadequate nature of energy availability in Africa calling for policy reform to drive energy sustainability on the continent.

## **7. Circularity and Sustainable Energy in Africa**

Africa faces a dual challenge: the need to meet rising energy demands and the need to reduce environmental degradation and carbon emissions. Circular economy principles can play a key role in sustainability in the energy sector (Mutezo & Mulopo, 2021). Unlike the linear economy, the circular economy which is a foundational concept in sustainability focuses on the most efficient use of resources and aims to keep resources in a closed loop. The traditional linear system follows the take – make -waste approach but the circular economy aims to reduce waste and reuse and redesign resources. According to the Ellen McArthur Foundation the circular economy is driven by the following principles shown below. Waste remains a key challenge to the achievement of sustainability and a more restorative, circular and regenerative approach can aid sustainability and the move towards a circular economy. Adopting the circular economy is integral to sustainability in the energy sector (Ellen McArthur Foundation, 2025). By using resources more efficiently and reducing waste and carbon emissions the energy sector can embrace circular economy principles.

## **8. Swot Analysis – Sustainability in the African Energy Sector**

To assess the potential for sustainability within the African energy sector a SWOT analysis is beneficial. This analytical framework enables a structured evaluation of external and external factors influencing the progress towards sustainability in the sector. The swot analysis as shown in Table 2 highlights the potential for sustainability in the African energy sector but also emphasises the challenges and obstacles that can impede the move to sustainability.

Table 2. A swot analysis of sustainability in the African energy sector

<p><b>Strengths</b></p> <ul style="list-style-type: none"><li>• High potential in the renewable energy sector.</li><li>• Strong resolve to transform the energy sector.</li><li>• Evolving policies aimed at fostering sustainability in the energy sector.</li><li>• Encouraging progress towards a more sustainable energy sector</li></ul>
---

<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>• Strong reliance on fossil fuels.</li> <li>• Fragmented approach to transforming the energy sector.</li> <li>• Key policy shortcomings with uneven progress across different regions.</li> <li>• Slow progress to adopt renewable energy in many regions.</li> </ul>
<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Africa has abundant renewable energy resources.</li> <li>• Collaboration across countries to aid the energy transition.</li> <li>• Abundant solar energy potential</li> <li>• Energy transformation across the continent</li> </ul>
<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Regional instability, global economic volatility, and geopolitical events.</li> <li>• Mindsets that prioritise fossil fuels such as coal.</li> <li>• Continued reliance on fossil fuels.</li> </ul>

### 9. Case Study: South Africa

South Africa located on the southernmost tip of the African continent has in recent years faced significant energy challenges. The sustainability of the energy sector in South Africa has come under considerable strain with widespread power outages and loadshedding. Achieving sustainability in the energy sector in South Africa is crucial as it impacts socioeconomic development (Figure 2).

The energy mix of a country plays a vital role in determining its energy security (Akrofi, 2021). South Africa’s main fuel source is coal and South Africa’s overreliance on coal is unsustainable (Akinbami et al. 2021, Todd & McCauley, 2021). Coal has contributed to substantial environmental degradation in South Africa (Bothongo & Kinyar, 2025). Moving away from coal in South Africa has been a challenge although there is growing consensus that coal cannot continue to dominate South Africa’s energy landscape (Hanto et al. 2022).

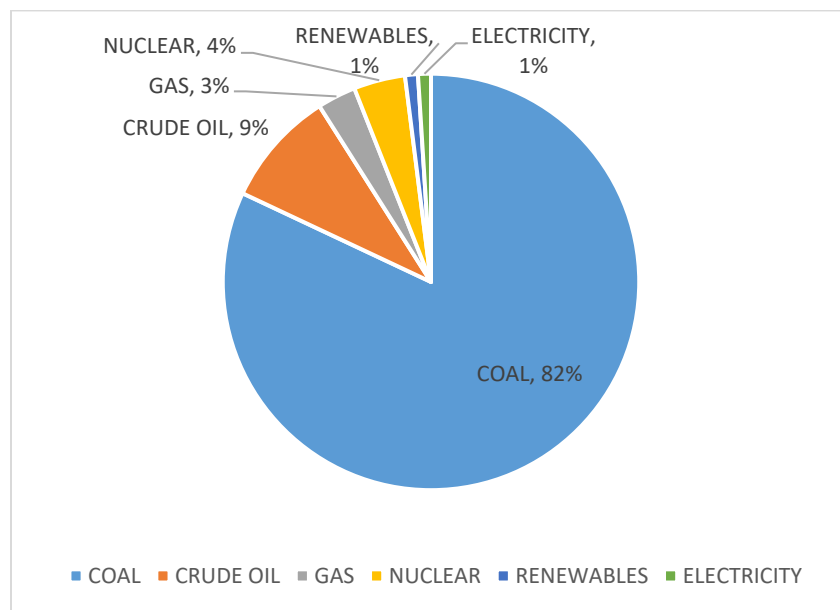


Figure 2. Total Primary Energy Supply ,2021

Transitioning to renewable energy presents a way to make the energy sector in South Africa more sustainable. South Africa is leading the way in the adoption of renewable energy (Pwc, 2024). The country has an abundance of renewable energy resources including biomass, wind and solar energy (Akinbami et al. 2021, Molepo et al. 2025). Renewable energy development can transform South Africa's power generation landscape (Molepo et al. 2025). South Africa is particularly well-suited for solar energy. South Africa has one of the highest levels of solar radiation as shown in Figure 3. The Northern Cape is a key region for solar energy development. Solar energy development can move South Africa's energy sector in a more sustainable pathway.

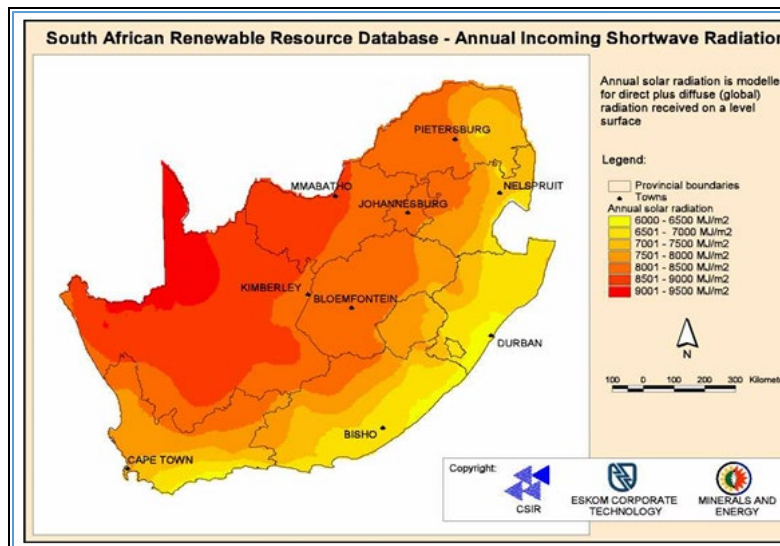


Figure 3. Annual solar radiation in South Africa

South Africa has introduced several policies that have been beneficial to the adoption of renewable energy and a more sustainable energy future. These policies have been instrumental in the push towards a more sustainable future in South Africa although policy failures and infrastructure bottlenecks have also impeded progress towards sustainability. The next section outlines some key policies that have impacted the energy sector in South Africa.

### 9.1 Integrated Resource Plan (IDP)

The Integrated Resource Plan was published by the Department of Mineral Resources and Energy of South Africa (DMRE 2023). The main purpose of the IRP is to 'ensure security of electricity supply necessary by balancing supply with demand, while considering the environment and total cost of supply'. The IRP aligns with the objective of pursuing a diversified energy mix that will lead to energy security and comply with emission reduction plans. The IRP has focused on several key outcomes relating to energy mix diversification, capacity growth, economic impact and energy security. This policy was recently updated with more ambitious targets and has been a key bedrock of energy policy and energy goals in South Africa.

### 9.2 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

The REIPPPP is an initiative of the South African government designed to promote private sector investment into renewable energy generation and aims to diversify the country's energy mix away from its dependence on coal (DMRE,2025). The program was launched in 2011 by the Department of Mineral Resources and Energy. This initiative has been quite successful in mobilizing private capital to invest in the energy sector and driving the push towards renewable energy. The programme has resulted in renewable energy capacity additions, private investment, job creation and has local economic benefits. The programme continues to have a tangible impact in the South African energy sector although it has also faced challenges such as the need for transmission upgrades.

### 9.3 National Development Plan (NDP)

The National Development Plan is a foundational pillar for development and economic growth in South Africa focused on eliminating poverty and reducing inequality by 2030 (National Planning Commission, 2012). The plan provides a

long-term vision for the country's development. The need for South Africa to exploit opportunities to transition to low carbon energy and other clean energy sources is outlined. The need for an energy sector that provides reliable, efficient and affordable energy is stressed in the plan. This plan provides direction regarding the priority placed on the diversification of the energy sector, and particularly the growth of the renewable energy sector. Some of the key outcomes targeted relating to energy in the NDP include universal and affordable electricity access, energy supply diversification and energy security as well as energy reliability.

#### **9.4 Solar Energy Technology Roadmap**

The South African Solar Energy Technology Road Map is an initiative of the South African government that aims to provide a comprehensive plan for the growth and diffusion of solar technologies in South Africa (DMRE, 2025) The objective of the plan is to develop a detailed plan for the development of concentrated solar power; solar photovoltaic technology and related R&D in South Africa with the aim of reducing energy usage, reducing carbon emissions and to achieve carbon emissions reduction, and distributed electricity generation. The plan also aims to expand independent power production and electricity supply to the national grid and also to reduce the reliance on carbon fuels. While the roadmap is a commendable policy to drive growth in the solar energy sector much more needs to be done to drive growth in this sector.

South Africa has immense potential for a more sustainable energy sector and has made progress to transition to low carbon energy sources. Creating an enabling policy environment has been key to the successes achieved in the renewable energy sector. There has been some progress towards adopting renewable energy in South Africa and notably solar energy presents a key opportunity

### **10. Discussion**

This exploratory paper presented the state of the energy sector in Africa. Energy is the bedrock of sustainable economies. Thriving economies have energy sectors that are sustainable, resilient and reliable. The challenge in Africa is that the energy sector's reliance on fossil fuels like traditional biomass is increasingly unsustainable. The need to transition to cleaner sources of energy is clear. Balancing the energy demands of a growing population presents a unique African challenge. This challenge must be addressed. The potential of renewable energy in Africa presents an avenue to diversify Africa's energy mix. With an abundant supply of renewable energy, the continent can more emphatically adopt renewable energy sources like solar and wind. While Africa has made strides in the transition to cleaner energy there is still much more that needs to be done to adopt renewable sources of energy.

Different countries in Africa have made varied progress in achieving a more sustainable energy sector. South Africa for instance is one of the leading countries in Africa in transitioning to sustainable energy. Other countries in Africa can learn from countries that are ahead of them in the green transition. A collaborative approach across Africa can help propel the continent to a more sustainable pathway. It is also crucial that policies that are favourable to a more sustainable energy sector are adopted across the continent and that implementation of these policies is prioritised in a timely and effective manner.

### **11. Conclusion**

Sustainability in the energy sector in Africa has become imperative. There is need to address the bottlenecks that have impeded the adoption of more sustainable practices in the energy sector in Africa. Policies and regulations can help drive sustainability in the energy sector. South Africa, for instance, has adopted policies that are favourable to the adoption of renewable energy and to drive growth in the sector. Achieving sustainability in Africa's energy sector is vital to unlock the development potential of the continent and to address energy poverty. Africa has abundant renewable energy resources and can transition to clean and sustainable energy. To realise a pathway to sustainability in Africa's energy sector priority has to be placed on the sector and will require considerable investment in the sector.

This paper underscores the critical importance of the energy sector in Africa and highlights the central role that energy sustainability plays in the continent's socio-economic progress. While the analysis shows that encouraging progress has been made to adopt more sustainable practices in Africa's energy sector much more needs to be done. Progress remains uneven and insufficient across the continent. Policy reforms can be catalytic to sustainability in the energy sector in Africa. A more coherent approach to sustainability in the energy sector in Africa is required, Countries like South Africa are leading the way in the energy transition but many other countries remain locked in the throes of fossil

fuel reliance with little progress to sustainability. As revealed by the SWOT analysis there are significant strengths and opportunities in the African energy sector but there also key weaknesses and threats which need to be addressed,

There is need for more research on the energy sector in Africa and in particular how countries can adopt renewable energy and align with sustainable development goals and best practices. Research targeting the following areas could provide key trends and directions in the African energy sector.

- Best practices for sustainable energy adoption in Africa can be uncovered by a comparative analysis of the state of the energy sector in different countries. South Africa has been the focus of significant research on the energy sector while many other countries in Africa remain underrepresented in research on energy sustainability.
- In depth case analysis could provide more specific, nuanced and unique insights on the progress of sustainability in Africa. Countries that have made progress to a more sustainable future can provide key lessons to other African countries.
- Research focused on energy access and energy poverty should also be carried out focusing on how sustainable energy can help address challenges relating to energy poverty.
- This paper has outlined the state of the African energy sector in a brief way. There is significant room for more comprehensive research as well as more empirical research and research that could also include communities in Africa that are living daily in a continent where energy challenges persist.

Driving sustainability in the energy sector in Africa will require concerted efforts that go beyond policy frameworks to concrete implementation of actions and initiatives that can enable sustainable energy.

## References

- Abdelrazik, M. K., Abdelaziz, S.E., Hassan, M.F., Hatem, T.M., Climate action: Prospects of solar energy in Africa, *Energy Reports*, Vol 8, pp 11363 – 11377. 2022
- Adedoyin, F.F, Ozturk, I., Agboola, M.O., Agboola, P.O, Bekun, F.V., The implications of renewable and non renewable energy generating in Sub-Saharan Africa: The role of economic policy uncertainties, *Energy Policy*, Vol 150, 2021
- Africa, Available at <https://www.irena.org>, Accessed 11 November, 2025
- Africa Energy Review 2024, Available: <https://www.strategyand.pwc.com/>, 14 November, 2025
- Agenda 2063: The Africa We Want, Available: <https://au.int/en/agenda2063/overview>, 11 November, 2025
- Agoundedemba, M., Kim, C., Kim, H., Energy Status in Africa: Challenges, Progress and Sustainable Pathways, *Energies*, Vol 16, 2023
- Akinbami, O.M., Oke, S. R., Bodunrin, M.O., The state of renewable energy development in South Africa: An overview', *Alexandria Engineering Journal*, Vol 60, No 6, pp 5077 – 5093. 2021
- Akrofi, M.M., An analysis of energy diversification and transition trends in Africa. *International Journal of Energy and Water Resources*, Vol 5, pp 1 -12. 2021
- Alemzero, D., Acheampong, T., Huaping, S., Prospects of wind energy deployment in Africa: Technical and economic analysis. *Renewable Energy*, Vol 179, pp 652 – 666. 2021
- Aliyu, A.K., Modu, B., Tan, CW., A review of renewable energy development in Africa: A focus in South Africa, Egypt and Nigeria, *Renewable and Sustainable Energy Reviews*, Vol 81, pp 2502 – 2518. 2018
- Amir, M., Khan, S.K., Assessment of renewable energy: Status, challenges, COVID-19 impacts, opportunities and sustainable energy solutions in Africa', *Energy and Built Environment*. Vol 3, pp 348 -362. 2022
- Bothongo, K and Kinyar, A., Rethinking the coal phase – out in South Africa: Can renewable energy and eco-innovation promote a just transition and sustainable economic growth. *Sustainable Futures*, Vol 10, 2025
- Bugaje, I.M. Renewable Energy for Sustainable Development in Africa: A Review. *Renewable and Sustainable Energy Reviews*, Vol 10, No 6, pp 603 – 612. 2006
- Energy System of Africa. Available at <https://www.iea.org>, Accessed 13 November, 2025
- Facts and Figures, Available at <https://unctad.org/press-material/facts-and-figures-7>, Accessed 1 November, 2025
- Falcone, P.M. Sustainable Energy Policies in Developing Countries: A Review of Challenges and Opportunities, *Energies*, Vol 16, No 18, 2023

- Hanto, J., Schroth, A., Krawielicki, L., Oei, P., Burton, J., South Africa's energy transition – Unraveling its political economy, *Energy for Sustainable Development*, Vol 69, pp 164 -178. 2022
- Ibrahim, I.D., Hamam, Y., Alayli, Y., Jamiru, T., Sadiku, E.R., Kupolati, W.K., Ndambuki, M., Eze, A.A., A review on African energy supply through renewable energy production: Nigeria, Cameroon, Ghana and South Africa as a case study, *Energy Strategy Reviews*, Vol 38, 2021
- Integrated Resource Plan (2023), Available: <https://www.dmre.gov.za/>, 11 November 2025
- Investment Forums in Southern Africa, Available: <https://www.irena.org/>, 13 November 2025,
- Karekezi, S. Poverty and Energy in Africa: A brief review. *Energy Policy*, Vol 30, No 11 and 12, pp 915 -919. 2002
- Maqbool, R., Akubo, S.A, Solar energy for sustainability in Africa : The challenges of socio-economic factors and technical complexities, *Energy Research*, Vol 46, pp 16336 – 16354. 2022
- Molepo, P.M., Aboalez, K., Mathaba, T.N.D., Analysis of Barriers to South Africa's Energy Transition: Perspectives from industry experts, *Energy for Sustainable Development*, Vol 88, 2025.
- Mossisa, A.T, Han, A.T., Transitioning to renewable electric energy in rapidly urbanizing Sub-Saharan Africa: Challenges and Opportunities, *Energy Strategy Reviews*, Vol 61. 2025
- Muller, F., Neumann, M., Elsner, C., Claar, S., Assessing African Energy Transitions: Renewable Energy Policies, Energy Justice and SDG 7, *Politics and Governance*, Vol 9, pp 119 -130. 2021
- Mutezo, G., Mulopo, J. , A review of Africa's transition from fossil fuels to renewable energy using circular economy principles, *Renewable and Sustainable Energy Reviews*, Vol 137, 2021.
- National Development Plan (2030). Available at <https://www.gov.za>, Accessed 16 November 2025
- Nsafon, B.E.K, Same, N.N, Yakub, A.O., Chaulagain, D., Kumar, N.M Huh, J. The justice and policy implications of clean energy transition in Africa, *Frontiers in Environmental Science*, Vol 11, 2023.
- Panja, A., Paul, S., Jha, P., Aligning Africa's renewable energy sector with sustainable development goals: Opportunities and Challenges, *Sustainable Futures*, Vol 9, 2025
- REPPPP Programme', Available at <https://www.dmre.gov.za>, 1 May 2025.
- Solar Energy Technology Road Map (SETRM), Available at <https://www.dmre.gov.za>, 17 March 2025
- Department of Mineral Resources and Energy (2025). 'Solar Energy Technology Road Map (SETRM), Available at <https://www.dmre.gov.za>, Accessed 17 March 2025
- Todd, I., & McCauley, D., Assessing policy barriers to the energy transition in South Africa, *Energy Policy*, Vol 158. 2021
- Tomala, J., Mierzejewski, M., Urbaniec, M., Martinez, S., Towards sustainable energy development in Sub-Saharan Africa: Challenges and Opportunities, *Energies*, Vol 14, No 19, 2021
- What is the meaning of a circular economy and what are the main principles?, Available at <https://www.ellenmcarthurfoundation.org>, 11 November, 2025

## **Biographies**

**Professor Charles Mbohwa** is a Distinguished Professor of sustainability engineering and future technologies at the College of Science, Engineering and Technology, at the University of South Africa, Florida Campus. He was, previously the University of Zimbabwe Pro-Vice Chancellor responsible for Strategic Partnerships and Industrialisation. Before that he was a professor and a visiting professor of sustainability engineering in the Faculty of Engineering and the Built Environment at the University of Johannesburg and a Professor Extraordinaire at the Tshwane University of Technology in South Africa. He was a mechanical engineer in the National Railways of Zimbabwe from 1986 to 1991, and lecturer and senior lecturer at the University of Zimbabwe from 1991 to 2007. He was Senior Lecturer, Associate Professor and Full Professor at the University of Johannesburg from 2007 to 2019. He was Chairman and Head of Department of Mechanical Engineering at the University of Zimbabwe from 1994 to 1997. He was Vice-Dean of Postgraduate Studies Research and Innovation in the Faculty of Engineering and the Built Environment at the University of Johannesburg from July 2014 to June 2017 and Acting Executive Dean in the Faculty of Engineering and the Built Environment from November 2017 to July 2018. He was a Special Advisor to the Dean after that until the end of 2018. He has published very widely and holds a BSc Honours in Mechanical Engineering from the University of Zimbabwe in 1986; Master of Science in Operations Management and Manufacturing Systems from University of Nottingham 1992; and a Doctor of Engineering from the Tokyo Metropolitan Institute of Technology 2004.

**Nyasha Grace Gatawa** is a postdoctoral fellow at the College of Science, Engineering and Technology at the University of South Africa, Florida Campus. She was previously a research fellow at UN-Aligned. She has a PhD in Geography from the University of the Witwatersrand, Johannesburg, a Masters degree in Tourism Studies from the University of the Witwatersrand, a Postgraduate Diploma from the University of Cape Town and a Bachelor of Science Degree from the University of Zimbabwe. She has worked in a range of different roles focusing on research and strategy.