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CLEAN ENERGY GUIDE:

Commercial Minigrids in Nigeria

March 2024

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Foreword

Welcome to our comprehensive guide on clean energy—a roadmap towards a sustainable and resilient future. As the lead advisor on this initiative, I am honored to introduce you to a wealth of insights and recommendations aimed at accelerating the global transition to clean energy.

This Guide through a comparative analysis of environmentally friendly energy systems, statistics, tables, charts, and global clean energy trends in the energy sector, addresses key regulatory frameworks, financing options, technological innovations, and potential benefits of commercial mini-grids for industries, households, and businesses in Nigeria, other Sub-Saharan Countries and World Economies. At its core, this publication embodies our unwavering commitment to driving positive change and fostering innovation in the pursuit of a low-carbon economy. By synthesizing diverse perspectives, best practices, and actionable recommendations, we aim to inspire investment, spur economic growth, and catalyze transformative impact across industries and geographies.

Our objective is clear: to empower stakeholders with the knowledge, tools, and strategies needed to navigate the journey to a clean future. For investors, this guide offers invaluable insights into emerging clean energy trends, investment opportunities, and risk mitigation strategies. Whether you are a venture capitalist seeking high-growth opportunities in renewable energy startups or a private equity firm exploring innovative financing models for large-scale infrastructure projects, this guide provides a roadmap for maximizing returns while advancing sustainable development goals.

For businesses, this publication serves as a strategic resource for navigating the evolving regulatory landscape, harnessing technological innovations, and capitalizing on market opportunities in the clean energy sector. From energy-intensive industries seeking to enhance operational efficiency and reduce carbon footprints to startups pioneering disruptive clean energy solutions, our guide offers practical guidance and actionable recommendations for achieving sustainability goals while driving business growth.

As we embark on this journey towards a cleaner, more sustainable future, I invite you to leverage the insights and recommendations presented in this guide to inform your investment decisions, shape your business strategies, and drive meaningful impact. Together, we have the power to transform the global energy landscape, unlock new opportunities for growth and innovation, and build a brighter, more prosperous future for generations to come.

We sincerely appreciate all dedicated professionals whose contributions produced this Guide and excitedly look forward to the limitless possibilities of creating a sustainable future.

Thank you for joining us on this important mission.

Tosin Ajose
Lead Advisor

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1. Introduction

The global energy transition is a critical but ambitious shift in the global energy landscape, seeking cleaner and more sustainable alternatives to traditional fossil fuel sources, which have successfully powered technological advancement and large-scale industrialization across the world. At its core, clean energy refers to energy derived from renewable resources that have minimal impact on the environment such as solar, wind, hydroelectric, and biomass energy, which harness the power of nature to generate electricity and power our modern world.

The need to transition to clean energy sources cannot be overstated, particularly in the face of mounting environmental challenges such as flood, extreme weather conditions, deforestation, desertification, eutrophication and severe air pollution, to mention a few. Unlike fossil fuels, which emit harmful greenhouse gases and contribute to climate destabilization, clean energy sources offer a path towards decarbonization and a more sustainable future. Transitioning to clean energy creates a clear path to mitigating the impacts of climate change, whilst reducing our continued reliance on finite resources.

From a global perspective, the need for clean energy transition has morphed gradually but imperatively into the consciousness of Nations, Political Leaders, Corporate Leaders, and even individuals. Over the years, scientific research and environmental advocacy groups have underscored the urgency of transitioning to cleaner, renewable energy sources. Governments, businesses, and communities worldwide have begun to embrace this shift, recognizing the interconnectedness of environmental, social, and economic sustainability.

Energy transition refers to the shift by World Economies from the use of fossil fuels such as oil and coal, to renewable and clean energy sources such as wind and solar for energy production and consumption. This paradigm shift is galvanized by a number of factors such as:

1. the need to mitigate the adverse effects of climate change on the environment and businesses globally;
2. rapidly evolving global business trends and consumer patterns;
3. prioritisation of environmental, social and governance (ESG) factors by investors and providers of capital; and
4. recent technological innovations which have transformed renewable energy into cheaper and more affordable energy sources.

The clean energy transition agenda aims to reduce carbon emissions, combat climate change, and promote the use of renewable energy sources such as solar, wind, hydro, and geothermal power. Shaping Global Energy transition therefore entails implementing policies and strategies that would promote the utilization of cleaner and renewable energy sources in the energy mix[1] and as well encourage decarbonization in order to achieve sustainability and eradicate energy poverty.

[1] Energy mix as used throughout this guide is defined to mean: the combination of the various primary energy sources used to meet energy needs in a given geographic region. It includes fossil fuels (oil, natural gas and coal), nuclear energy, and the many sources of renewable energy, (wood and other bio-energies, hydro, wind, solar and geothermal). See: https://www.planete-energies.com/en/media/article/what-energy-mix



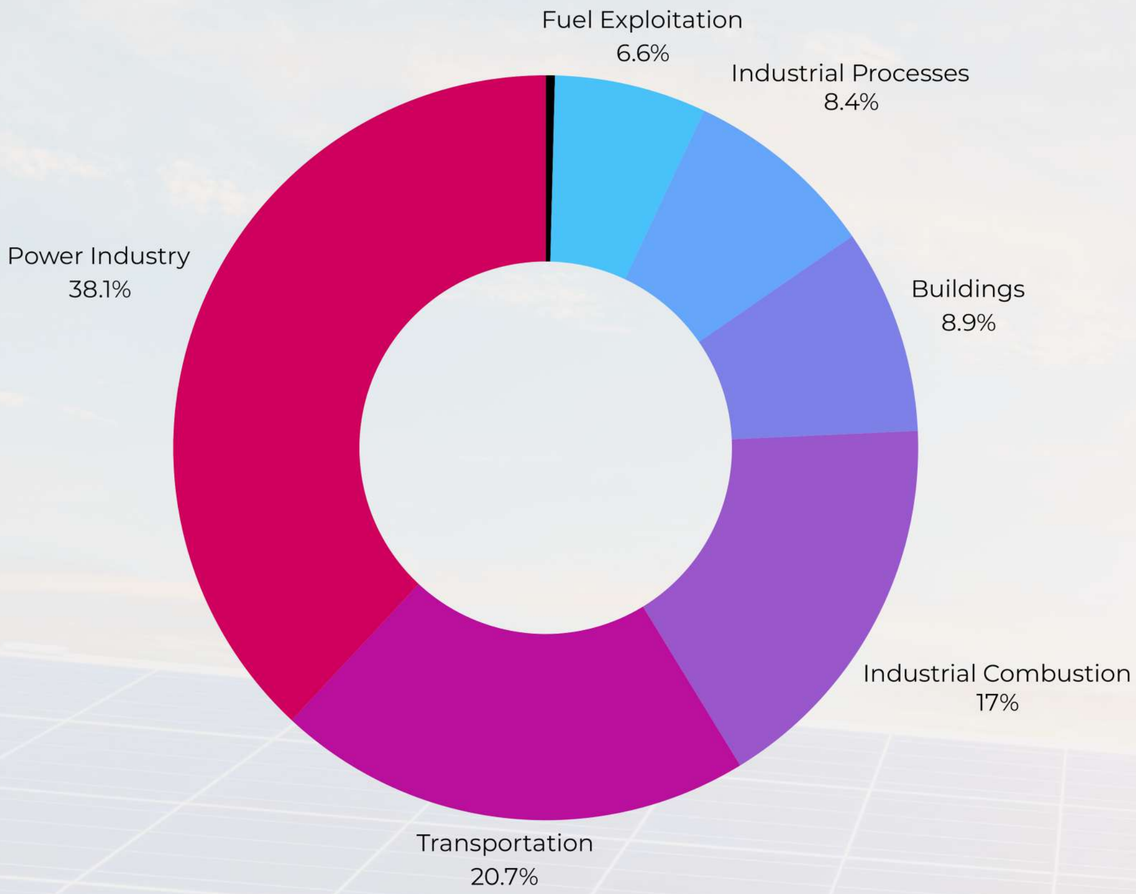
1.1. Historical Context of Clean Energy Transition

The Earth's atmosphere is facing a monumental challenge – the accumulation of greenhouse gases (GHGs) resulting from human activities. These gases, primarily carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O), trap heat in the atmosphere, leading to global warming and climate change. The primary source of these emissions is the burning of fossil fuels for energy, transportation, industry, and agriculture.

There is now a firm consensus amongst environmental thought leaders that the concentration of GHGs in the atmosphere has reached unprecedented levels due to human activities [2]. The consequence of this accumulation is severe, threatening the continued existence of humanity, and includes rising temperatures, melting glaciers, frequent extreme weather events, and disruptions to ecosystems and biodiversity.

The combustion of fossil fuels, for electricity generation, heating, and transportation is the largest source of GHG emissions globally. The transportation and power sectors remain the biggest contributors to global emissions, accounting for a substantial portion of CO2 emissions from the burning of fossil fuel to generate electricity, and diesel fuel in cars, trucks, ships, and airplanes. Rapid urbanization and increasing demand for mobility have led to a rise in emissions from transportation activities.

[2] IPCC (Intergovernmental Panel on Climate Change). 2021. Climate change 2021: The physical science basis. Working Group I contribution to the IPCC Sixth Assessment Report. Cambridge, United Kingdom: Cambridge University Press. www.ipcc.ch/assessment-report/ar6.



Worldwide contributions to Emission by sectors (2022) ***Source: Statista***

In addition, industrial processes, including manufacturing, cement production, and chemical manufacturing, emit CO2 and other GHGs through energy-intensive operations and chemical reactions. Emissions from industrial processes contribute to both direct and indirect sources of greenhouse gas emissions. The widespread adoption of fossil fuels during the Industrial Revolution marked the beginning of significant increases in GHG emissions. The combustion of coal, oil, and gas for industrial production, transportation, and electricity generation led to a rapid rise in atmospheric CO2 concentrations.

In recent decades, global emissions have continued to rise, driven by growing energy demand, population growth, and economic development in emerging economies. Whilst efforts to improve energy efficiency and promote renewable energy have helped to slow the rate of emissions growth in some regions, overall emissions remain at historically high levels.

The conversation surrounding clean energy transition has its roots in the mid-20th century, as concerns about environmental degradation and the finite nature of fossil fuel resources began to emerge. However, it was not until the latter part of the century that the concept gained significant traction on the global stage.

The 1970s marked a turning point in environmental awareness spurred by events such as the oil crises and growing evidence of pollution's impact on public health and ecosystems. Heightened awareness of the environmental and social costs associated with conventional energy sources prompted calls for cleaner, more sustainable alternatives. This led to several conferences and international agreements on the need to prevent climate change and protect the environment. Some of these agreements shall now be considered below.

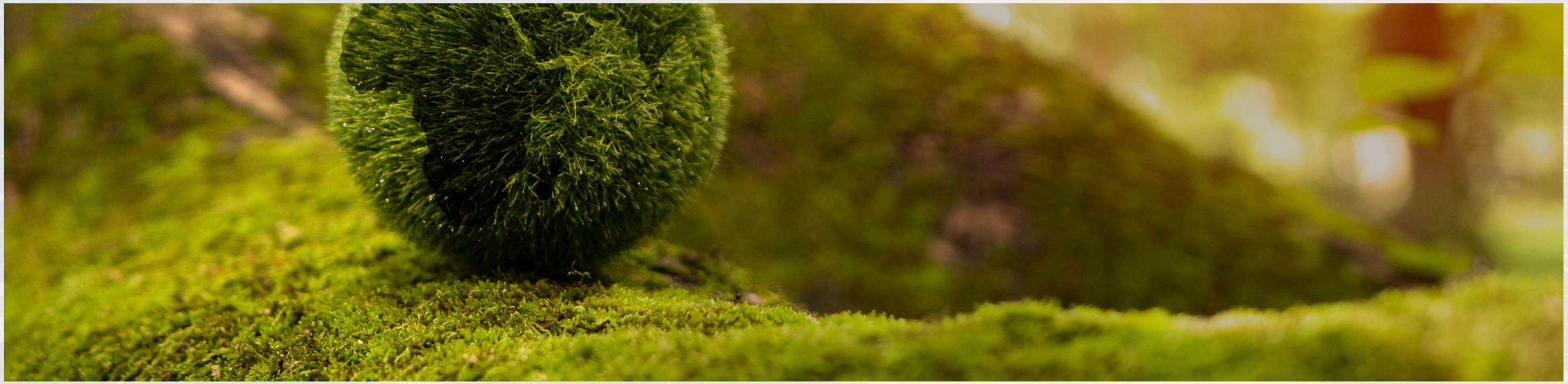
1.2. Recognition of the Need for Clean Energy

Several landmark conferences and international agreements have played a pivotal role in shaping the clean energy conversation:

1. **United Nations Conference on the Human Environment (Stockholm, 1972):** This conference marked the first major international gathering focused on environmental issues. Whilst not specifically centered on clean energy, it laid the groundwork for future discussions and heightened awareness of the need for global environmental cooperation. One of the key achievements of the Stockholm conference was the creation of the United Nations Environment Programme (UNEP).
2. **Montreal Protocol on Substances Depleting the Ozone Layer (1987):** The Montreal Protocol on Ozone Depleting Substances (ODS) is one of the most successful international environmental agreements to date, achieving universal adoption. The Montreal Protocol focuses on reducing the use and consumption of harmful chemicals called hydrochlorofluorocarbons and hydrofluorocarbons which are also potent greenhouse gases that contribute to climate change. This Protocol is credited as being one of the most successful agreements by UNEP, contributing to a 98% reduction in the emission of greenhouse gases compared to 1990 levels.
3. **United Nations Framework Convention on Climate Change (UNFCCC, 1992):** The UNFCCC, adopted at the Earth Summit in Rio de Janeiro, established a framework for addressing climate change on a global scale. The UNFCCC, with a view to protecting the global climate for present and future generations of mankind, initially focused on greenhouse gas emissions reduction and adaptation. However, subsequent agreements within the UNFCCC framework, such as the Kyoto Protocol and the Paris Agreement, have emphasized the importance of clean energy as a means of mitigating climate change.
4. **Kyoto Protocol (1997):** The Kyoto Protocol was the first international agreement to set binding targets for reducing greenhouse gas emissions, with a particular focus on industrialized countries. Whilst not specifically centered on clean energy, it spurred investments in renewable energy and laid the groundwork for subsequent clean energy initiatives. The Kyoto Protocol urged both developed and developing countries in transition to reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets.

5. **Paris Agreement (2015):** The Paris Agreement represents a landmark global accord aimed at limiting global temperature rise to well below 2 degrees celsius above pre-industrial levels. Central to the agreement are commitments by participating countries to transition to clean energy and reduce reliance on fossil fuels. So far, the Paris Agreement has been signed by 195 countries, including 54 African nations. The Paris Agreement bears lots of potential, particularly for Africa, and provides a framework for the funding of adaptive and climate change needs of developing countries whilst recognizing the Common But Differentiated Responsibilities principle.

6. **United Nations Sustainable Development Goals (SDG) 7 & 13:** Goal 7 of the United Nations Sustainable Development Goals (SDGs) advocates for universal access to affordable, reliable, sustainable, and modern energy by 2030 whilst Goal 13 of the United Nations Sustainable development goals (SDGs) advocates for positive actions to curb climate change. The looming threat of climate change affects every person on the planet with devastating consequences such as extreme weather patterns, rising sea levels, and potential mass migrations. At the current rate, the UN alarms that the world will exceed 1.50C by 2035 and could rise to 2.50C warming levels by 2100 and therefore calls for a “deep rapid and sustained Greenhouse gases emissions reductions by 43% by 2030 and a Net-Zero Target by 2050.” To combat Climate change and reduce the biggest contribution to carbon emissions, World Economies must commit to ambitious measures, including transitioning to renewable energy and transforming various systems to limit temperature rise.



1.3. The Case for Clean Energy

1. Mitigating Climate Change: According to UNEP, the world's energy consumption rate accounts for 60% of total global emissions of greenhouse gases, making it a key driver of climate change. Consequently, the possibility of generating and meeting the world's energy demands without emitting these harmful gases makes clean energy a viable option. By reducing reliance on fossil fuels which are the primary drivers of climate change, clean energy helps mitigate global warming and its associated impacts, including rising sea levels, extreme weather events, and disruptions to ecosystems.
2. Energy Security: In addition to the emission of greenhouse gases, fossil fuels are finite and susceptible to volatile energy markets. On the contrary, renewable energy sources are abundant and naturally replenished, offering opportunities for decentralized energy production and enhancing energy resilience in the face of geopolitical tensions and supply disruptions due to war and international trade restrictions. Clean energy technologies such as solar photovoltaics and decentralized mini-grids offer scalable solutions for expanding energy access to underserved communities, particularly in rural and remote areas thereby combating energy poverty.
3. Air Quality: Traditional energy sources such as coal and oil are responsible for the release of vast amounts of methane, black carbon (soot) and other greenhouse gases, which not only contribute to climate change but reduce air quality. According to the World Bank, gas flaring (associated with oil production), is responsible for the emission of an equivalent 350 million tons of CO2 annually[3]. This reduction in air quality in turn causes health problems ranging from cancer to neurological and reproductive challenges. Clean energy technologies produce electricity with minimal air pollutants, leading to improved air quality, public health benefits, and reduced healthcare costs.
4. Preservation of Natural Resources: Clean energy sources are renewable and abundant, harnessing natural processes such as sunlight, wind, and water flow. Unlike fossil fuels, which are finite and require extraction, clean energy technologies minimize environmental degradation and habitat destruction, preserving ecosystems and biodiversity for future generations.
5. Economic Growth and Job Creation: The transition to clean energy drives innovation, investment, and job creation across diverse sectors of the economy. Clean energy industries, including renewable energy generation, energy efficiency, and clean technology manufacturing, offer opportunities for sustainable economic growth, entrepreneurship, and skills development.

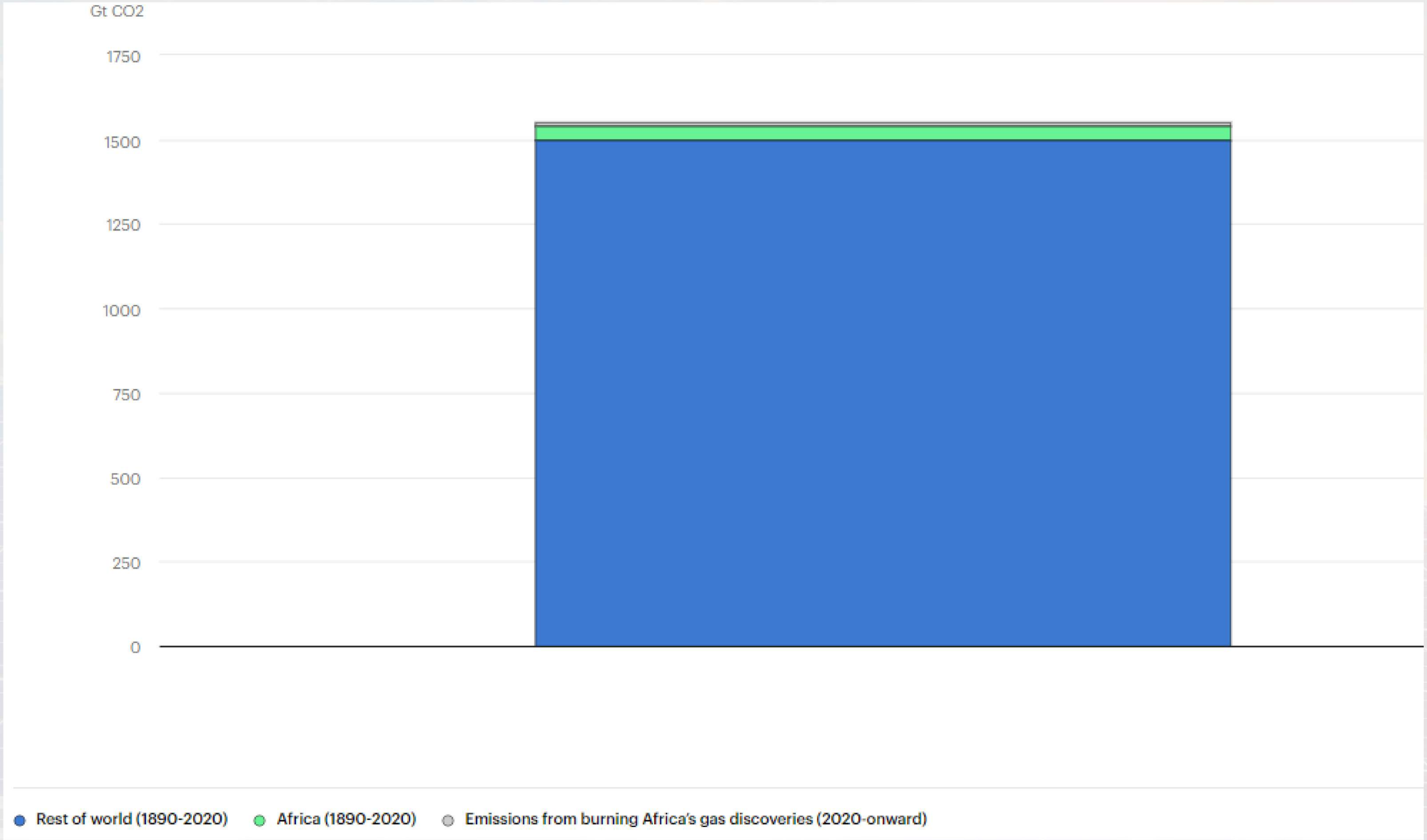
[3] World Bank Global Flaring and Methane Reduction Partnership (GFMR). See - - [2] IPCC (Intergovernmental Panel on Climate Change). 2021. Climate change 2021: The physical science basis. Working Group I contribution to the IPCC Sixth Assessment Report. Cambridge, United Kingdom: Cambridge University Press. www.ipcc.ch/assessment-report/ar6.

1.4. Africa and the Journey Towards Clean Energy Adoption

Africa has always had local home-grown traditional practices focused on sustainability and preservation of natural resources, most notably the use of clay construction which helps in thermal insulation and heat regulation. Food preservation was achieved through sun drying, smoking, and fermentation rather than refrigeration which relies on hydrochlorofluorocarbons a chemical substance that is harmful to the environment. In addition to this, the continent is blessed with vast amounts of renewable energy sources including solar, wind, and biomass. However, the continent has primarily focused on the exploration and exploitation of its fossil fuels and mineral resources. As a result, coal-fired plants, generators, and gas facilities remain the primary sources of energy in Africa, whilst its exportation remains a major source of revenue. Regardless of the huge deposits, there remains a widening energy deficit in Africa, evidenced by data from the African Development Bank that over 640 million Africans lack access to energy, with a continental electrification rate of 40%.

As the world continues to shape conversations and commit to determined contributions toward CO2 emission reduction; Equity is a key precursor of that conversation for Africa. Africa as a continent is the least contributor to historical carbon emissions [4] and should not bear the cost of transitioning alone particularly given its economic status as a developing continent. This consideration is internationally recognized as the principle of common but differentiated responsibilities. Common But Differentiated Responsibilities (CBDR) acknowledges that developed countries such as China and the USA, which have historically emitted the most greenhouse gases, have a moral obligation to support developing countries in their transition to clean energy. The CBDR is an international environmental governance principle that all nations share a collective responsibility to address climate change, but that this responsibility should be differentiated based on historical contributions to the problem, as well as capabilities and levels of development.

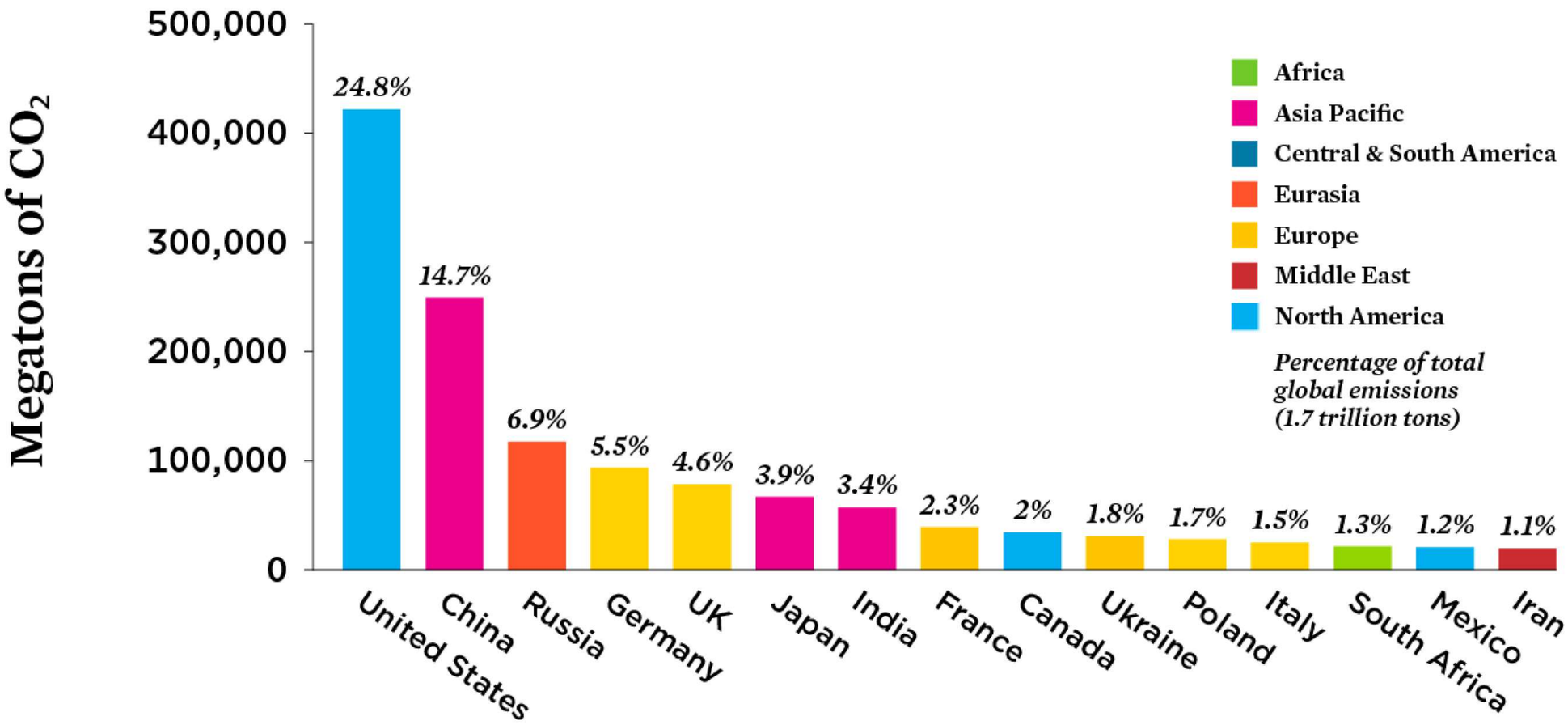
[4] The International Energy Agency (IEA) World Energy Outlook Special Report notes that Africa is responsible for only 3% of the total global emissions. Available at ([3] World Bank Global Flaring and Methane Reduction Partnership (GFMR). See - - [2] IPCC (Intergovernmental Panel on Climate Change). 2021. Climate change 2021: The physical science basis. Working Group I contribution to the IPCC Sixth Assessment Report. Cambridge, United Kingdom: Cambridge University Press. www.ipcc.ch/assessment-report/ar6.)



Cumulated Energy related CO2 Emissions across the World. ***Source: International Energy Agency.***

Top CO_2 Emitting Countries, 1750-2021

(from fossil fuels and cement)



Data: Global Carbon Project via Our World in Data

The CBDR is recognised in Article 3 of the United Nations Convention on Climate Change

Article 3: *"The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof."*

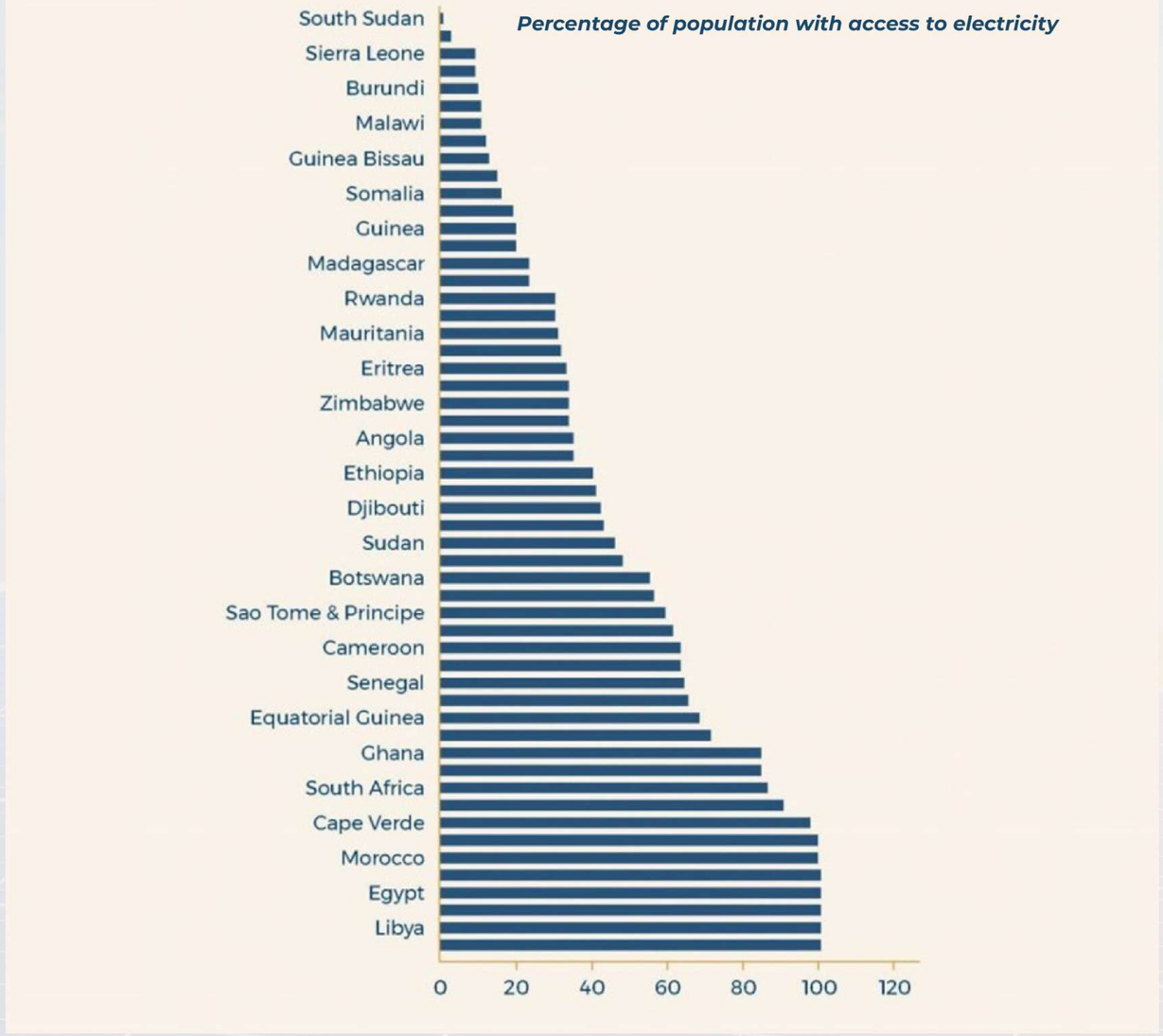
In addition, Article 5 of the Montreal Protocol on ODS creates obligations for developed countries to provide developing countries with subsidies, grants, credits, and insurance programs to enable developing countries use alternative technology and substitute products. African countries face significant adaptation needs to build resilience to the impacts of climate change. These include investments in climate-resilient infrastructure, agricultural practices, and disaster preparedness measures. However, limited financial resources and technical capacity constrain Africa's ability to adapt effectively.

Relatedly, despite having the lowest emissions per capita ratio of any region, the African continent faces more severe impact of climate change compared to the rest of the world due to a low adaptive capacity to climate change resistant practices, technological constraints and implementation in energy generation, and unsustainable agricultural practices such as overgrazing and mono-cropping. The negative effects of climate change prevalent on the African continent include food insecurity, flood, and extreme weather events. These events have exacerbated several existing challenges including poverty, access to energy, infrastructure and the widening gap between developed and developing nations. The disproportionate realities of climate change on the African continent have resulted in adaptation struggles, with constraints on technical and financial resources, making the clean energy transition a lofty goal that remains out of reach for most of Africa. As it stands, the sustainable goal of ensuring universal access to modern energy services by 2030 seems less achievable on the African continent unless a clear and strategic commitment to exploring clean energy sources is implemented by African countries with support from the international community.

Situating Africa in the Global Transition Agenda

1.5. Situating Africa in the Global Transition Agenda

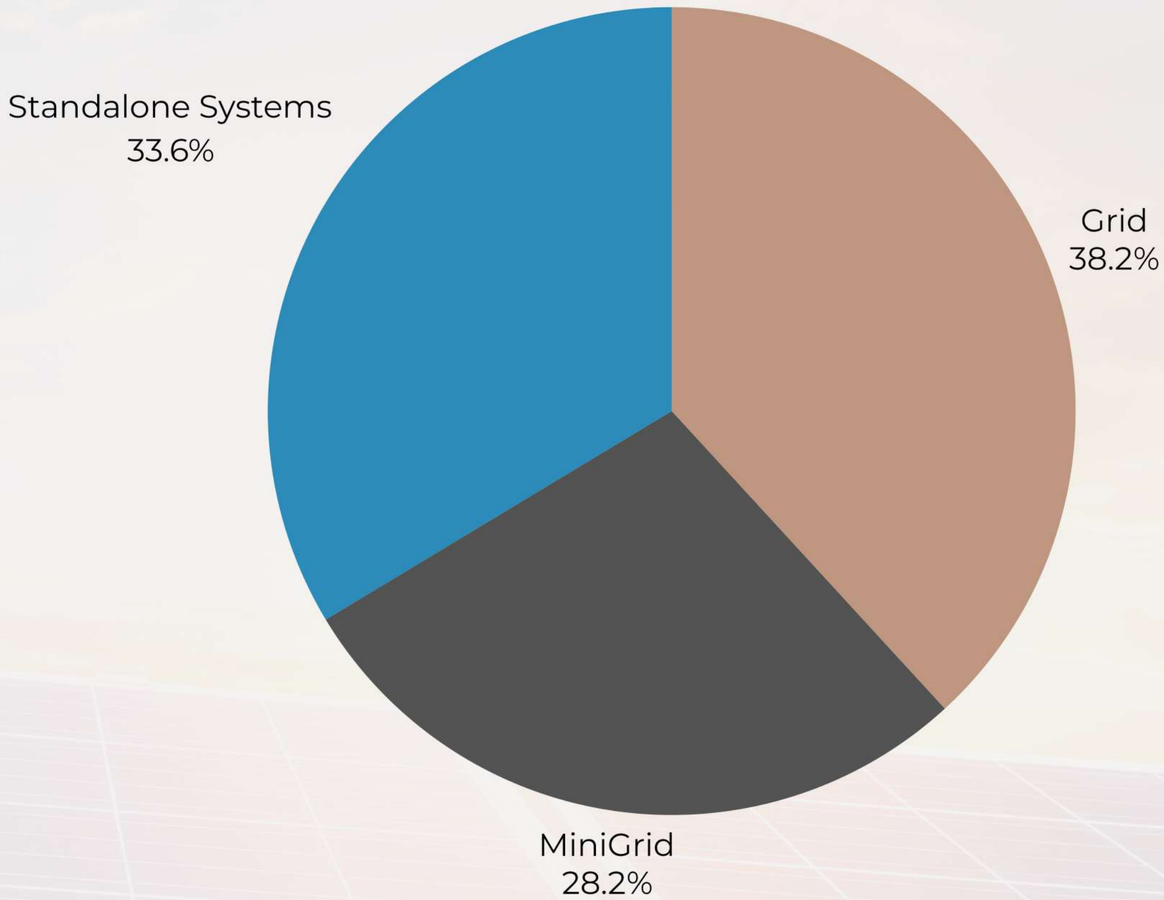
Africa as a continent is expected to play a pivotal role in energy transition. Its abundant solar energy source positions it to be a major hub for solar energy where sufficient funding can be aggregated and where Africa's leaders demonstrate firm political will to scale up foreign investment in the energy sector. Unfortunately, although the continent is home to the world's biggest deposit of sustainable energy resources including solar power, wind, hydro-power and bio-mass the International Energy Agency ("IEA") records that Africa currently receives less than 2% of global clean energy spending, therefore inducing the continent to continue its dependence on fossil fuel. This dependence makes the transition to clean energy difficult, with lack of needed capital for clean energy infrastructure and reduced investment in renewable sources of energy which could serve as a viable alternative to the continent's epileptic power supply. As a result, the continent continues to suffer from a staggering energy poverty rate. Currently, the reliance on fossil fuel and its capital-intensive nature discourages investors from ensuring the transmission and distribution of power to low income and rural areas. Whereas, implementing clean energy can provide the much-needed access to energy in these areas.



As identified by the IEA in its report - "Africa Energy Outlook 2022", achieving universal access to affordable energy for all Africans by 2030 will require connecting at least 90 million people to steady electricity supply annually. Presently, less than 600 million of Africa's 1.4 billion people or 43% of the total population, lack access to electricity, most of them in sub-Saharan Africa. To solve the electrification problem, the IEA recommends commercial mini-grids and stand-alone systems, particularly solar based, as the most viable solutions for sustainable electrification of rural areas where over 80% of the electricity-deprived live. Relatedly, the IEA in its classification of the share of people gaining access to electricity by technology in Africa in the Sustainable Africa Scenario between 2022-2030 projects that stand-alone systems will account for 27%, Mini-grid for 31% , and Grid for 42% respectively of the total power generation sources.

Despite its less than 5% contribution to global emissions, the African Energy Transition Programme report of the African Energy Commission (AFREC Energy) has declared the Continent to be highly susceptible to far-reaching disastrous consequences of global warming due to a lack of adaptive technology, funding challenges and a dearth of technology access. Such discovery therefore requires that the Continent as a whole, doubles its effort to attaining the Net Zero target by 2060 through a multidimensional approach that is driven by strategic policies and regulation.

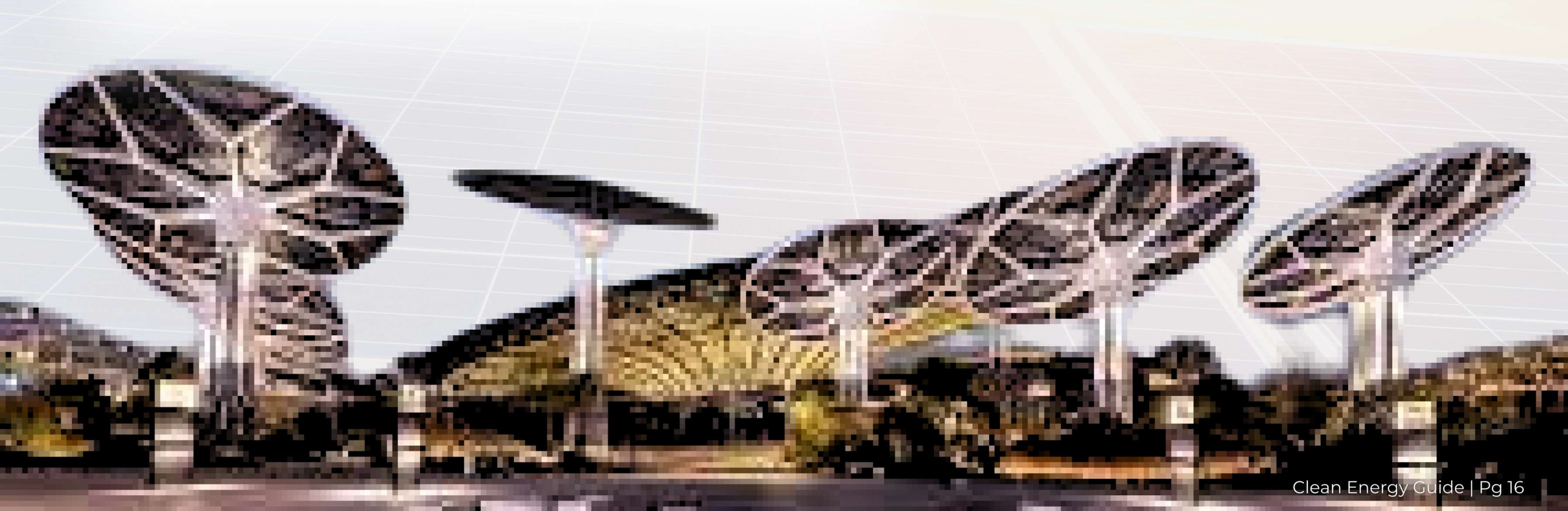
Situating Africa in the global transition agenda for cleaner energy therefore entails understanding and addressing the key challenges and opportunities that African countries encounter in the clean energy transition. It encompasses an alignment with the vision of the United Nations Sustainable Development Goal 7, which canvasses a cleaner and affordable energy for all. As such, the government and key players in the energy sector must develop tailored strategies that take into consideration, the continent's energy needs, economic priorities and peculiar environmental considerations, to ensure an inclusive and sustainable transition leading to poverty reduction, improvement of quality of life and economic transformation. It is expected that African Nations will implement the commitments under the Paris Agreement by enacting and implementing clear policies for cleaner energy whilst the international community scales up support to achieve universal access to affordable, reliable, and modern energy services by 2030 where Africa is expected to be a critical beneficiary.



Share of people gaining access to electricity by technology in Africa in the Sustainable Africa Scenario, 2022- 2030.

Notwithstanding the challenges being faced in transitioning to clean energy, commendation must go to African countries making efforts to achieve the Net Zero Target such as Nigeria which has enacted a Climate Change Act and has launched an Energy Transition Plan. The Kenyan government has equally invested immensely in the development of renewable energy sources, such as geothermal, wind, and solar power. The country has indicated its interest to increase the portion of renewable energy in its energy mix and to reduce its dependence on fossil fuels for the attainment of the Net-Zero plan of the United Nations on climate change.

Recently, at the first-ever African Climate Summit in Nairobi, Kenya, the International Renewable Energy Agency (IRENA) in collaboration with Kenya, Denmark, Germany, and the United Arab Emirates founded a new partnership on Monday, 4 September 2023, pledging to boost renewable energy in Africa. During the summit, H. E President of Kenya Dr. William Ruto, launched the Accelerated Partnership for Renewables in Africa (APRA). to drive rapid energy transitions, secure access and sustainable livelihoods, and foster green industrialization across the African continent in alignment with Sustainable Development Goals of the United Nations and the Paris Agreement entered at the 21st Conference of the Parties (COP21) in France.



2. COP 28 AND AFRICA'S RACE TO CLEAN ENERGY TRANSITION

COP28, the 28th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), convened in 2023 with the objective of accelerating international action to combat climate change and foster sustainable development through the widespread adoption of clean energy solutions. This landmark assembly brought together national delegates for a comprehensive evaluation of current climate change mitigation efforts, conducting a thorough global stock take to gauge the effectiveness of existing strategies and initiatives. Additionally, COP28 served as a critical platform for negotiations and decision-making on pivotal issues encompassing climate action, renewable energy deployment, and climate finance, aiming to drive consensus and commitment towards ambitious climate targets and policies on a global scale.

The highpoint of the convention was the adoption of the Five Pillar Strategy for Sustainable Energy by Participating Nations, emphasizing the promotion of renewable energy sources, energy efficiency improvements, decarbonization of the economy, universal access to clean energy, and climate resilience and adaptation measures. These pillars formed the foundation for collective action towards achieving the goals of the Paris Agreement and accelerating the transition to a low-carbon future.

Central to the discussions at COP28 was the mobilization of climate finance to support clean energy initiatives and climate resilience efforts, particularly in developing countries. Through pledges of public finance, private investments, and international aid and grants, countries committed to providing financial resources to address the urgent challenges of climate change and promote sustainable development worldwide.

One of the most significant outcomes of COP28 was the delivery of clean energy deals for Africa, marking a transformative moment in the continent's energy landscape. These deals represented significant investments in renewable energy projects, off-grid solutions, and climate resilience measures, driving economic growth, energy access, and climate adaptation across Africa. The announced deals are worth over USD 4 billion, demonstrating an increase in the intention to usher Africa into modern and sustainable energy generation.

Overall, COP28 had a profound impact on the global climate change discourse, highlighting the importance of collective action, international cooperation, and ambitious commitments to combatting climate change and promoting clean energy solutions. By advancing the agenda of sustainable development and climate resilience, COP28 set the stage for continued progress towards a more sustainable, resilient, and equitable future for all.

Renewable Energy Promotion: COP28 emphasizes the promotion of renewable energy sources such as solar, wind, hydroelectric, and geothermal power as key pillars of sustainable energy development. Through policy incentives, financial mechanisms, and capacity-building initiatives, countries aim to scale up renewable energy deployment and reduce reliance on fossil fuels.

Energy Efficiency Improvements: Improving energy efficiency across sectors is critical for achieving emissions reductions and enhancing energy security. COP28 focuses on implementing energy efficiency measures in buildings, industry, transportation, and appliances to reduce energy consumption and carbon emissions while enhancing economic productivity and competitiveness.

Decarbonization of the Economy: Decarbonizing the economy involves transitioning away from carbon-intensive fuels and industrial processes towards low-carbon alternatives. COP28 seeks to accelerate the phase-out of coal-fired power plants, promote e-mobility, and support industries in adopting cleaner production methods and technologies.

Access to Clean Energy: Ensuring universal access to clean and affordable energy is a fundamental aspect of sustainable development. COP28 prioritizes efforts to expand energy access in underserved communities, particularly in developing countries, through investments in off-grid and decentralized clean energy solutions, rural electrification projects, and innovative financing mechanisms.

Climate Resilience and Adaptation: Building climate resilience and adaptive capacity is essential for addressing the impacts of climate change on vulnerable communities and ecosystems. COP28 highlights the importance of integrating climate resilience considerations into clean energy projects and infrastructure development, enhancing adaptive capacity and reducing vulnerability to climate risks.

2.2. Global Contribution to Climate Funding for Developing Countries

One of the success stories of COP28 is the mobilization of climate finance to support clean energy initiatives and climate resilience efforts, particularly in developing countries. Global contributions to climate funding play a crucial role in accelerating the transition to clean energy and achieving the goals of the Paris Agreement. At COP 28, participating nations established a new fund dedicated to addressing the resultant loss and damage effects of climate change. The establishment of this fund saw immediate commitment from participating nations, garnering over USD 600 million to date. The immediate establishment of the fund and commitment to it by Parties symbolizes global solidarity and the urgency of addressing the effects of climate change in developing nations.

Other relevant funds committed towards the energy transition of developing countries include:

The Green Climate Fund (GCF): The GCF is the world's largest climate fund focused on helping developing nations to raise and realize their climate ambitions towards achieving a low emission and climate resilient economy. As at 2023, the GCF's board reported a disbursement of over USD 12 billion in funding to 243 green climate projects across 129 developing countries. The GCF in a bid to scale up mitigation and adaption strategies, is mandated to allocate 50% of its resources to mitigation and 50% to adaptation in grant equivalent. At least half of its adaptation resources must be invested in the most climate vulnerable countries (Small Island Developing States (SIDS), Least Developing Countries (LDCs), and African States).

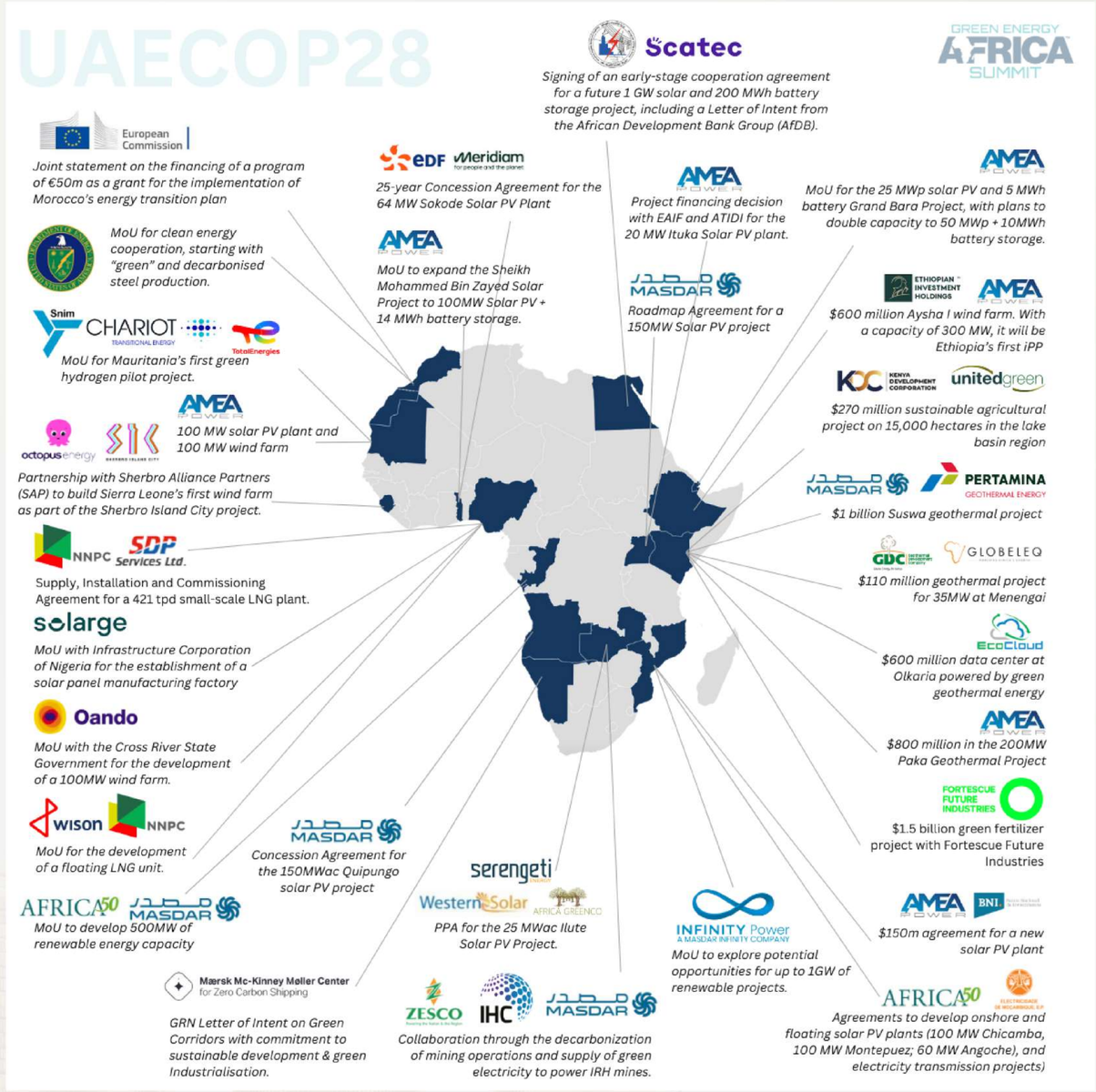
Least Developed Countries Fund (LDCF): The LDCF is a facility dedicated to assisting the least developing nations attain their nationally determined commitments to climate change ambitions and recover from its disastrous effects. This facility was created in 2001 under the aegis of the UNFCCC and has financed over 400 projects amounting to USD 2 Billion in grants as of February 2024. Some of the beneficiaries of the LDCF include Nepal, Senegal, The Gambia, Togo and Sao Tome and Principe. The LDCF together with the Special Climate Change Fund received over USD 170 million in commitments from Parties at COP 28.

Loss and Damage Fund: The Loss and Damage Fund was established at COP 28 to address the economic, social, cultural and environmental loss and damage suffered by developing countries as a result of climate change. The idea for the fund emanates from the realization of the effects of climate change on developing nations due to their existing social and economic challenges.

2.3. Clean Energy Deals For Africa

Following COP28, a wave of clean energy deals is poised to transform Africa's energy landscape, drive sustainable development, economic growth, and climate resilience across the continent. These clean energy deals represent significant investments in renewable energy projects, infrastructure development, and capacity-building initiatives, supporting Africa's transition to a low-carbon and climate-resilient future. The clean energy deals total over USD 4 billion geared towards the construction of wind farms, solar generation plants, LNG facilities and geothermal projects. Nigeria, one of Africa's biggest economies sealed four energy deals including the development of a floating LNG unit by NNPC and WISON; the development of a 100MW wind farm in Cross River State and a MoU for the establishment of a solar panel manufacturing factory.

Renewable Energy Investments: COP28 catalyzes investments in large-scale renewable energy projects such as solar photovoltaic (PV) parks, wind farms, and hydroelectric plants across Africa. These investments expand access to clean and reliable electricity, reduce carbon emissions, and stimulate economic development in rural and urban areas.



COP 28: Resulting Clean Energy Deals for Africa. Source: Green Energy Africa Summit.

Off-Grid and Decentralized Solutions: COP28 promotes off-grid and decentralized clean energy solutions to address energy access challenges in remote and underserved communities. Through initiatives such as the Africa Renewable Energy Initiative (AREI) and the Scaling Solar program, countries are deploying off-grid solar systems, mini-grids, and energy-efficient appliances to improve energy access and livelihoods. Plans are in motion to establish a 150MW Solar plant in Southern Angola. The plant is set to be Sub-Saharan Africa’s largest solar project and will power over 250,000 homes.

Partnerships and Collaboration: COP28 fosters partnerships and collaboration between governments, development organizations, and the private sector to accelerate the deployment of clean energy technologies in Africa. For instance, Africa GreenCo Group, a London-based intermediary renewable power buyer and seller, signed a power purchase agreement with Serengeti Energy and Western Solar Power for the Ilute Solar PV Project in Zambia. Public-private partnerships, bilateral agreements, and multilateral initiatives facilitate technology transfer, knowledge sharing, and capacity-building, unlocking investment opportunities and driving innovation in the clean energy sector.

Climate Resilience and Adaptation: Clean energy deals delivered for Africa on the heels of COP28 prioritize climate resilience and adaptation measures integrating climate considerations into energy planning and infrastructure development. Investments in climate-smart agriculture, sustainable water management, and disaster risk reduction enhance Africa's capacity to withstand climate impacts and build a more resilient future for its people.

3. EQUITABLE ENERGY TRANSITION AND THE GLOBAL CARBON MARKET

The transition to clean energy is not just about reducing carbon emissions; it's also about ensuring that the benefits of this transition are distributed fairly across society. Achieving an equitable energy transition requires addressing social, economic, and environmental justice concerns whilst promoting clean energy access, affordability, and sustainability for all. Equitable energy transition emphasizes the fair distribution of costs and benefits associated with shifting towards clean energy sources. This includes ensuring that vulnerable communities, marginalized groups, and low-income households have access to affordable and clean energy options, as well as opportunities for participation in decision-making processes and economic benefits from clean energy investments. One of the ways of achieving equitable energy transition is the Carbon Market.

3.1. Understanding Carbon Credit, Carbon Offset, and Carbon Trade

Traditionally dominated by regulatory frameworks such as cap-and-trade systems and carbon taxes, the global carbon market has evolved to include innovative mechanisms such as carbon credits, offset projects, and emissions trading platforms. These mechanisms enable entities to buy, sell, and trade carbon credits, effectively placing a financial value on emissions reductions and creating economic incentives for emission reduction activities. With the Paris Agreement setting ambitious targets for greenhouse gas mitigation, the global carbon market is expected to play an increasingly pivotal role in facilitating international cooperation, driving emission reductions, and mobilizing climate finance.

The global carbon market is valued at USD 100 billion and projected to grow at a Compound Annual Growth Rate of 14% between 2024 and 2032. Notable carbon markets on the international scene include the European Union Emissions Trading System (EU ETS), the Korean Emissions Trading System (KETS) and several other cap-and-trade systems in China, Canada, New Zealand and the USA. The EU ETS is the biggest carbon market in the world, encompassing all the European Union Member States. The EU ETS has helped reduce EU emissions in power and industry plants by 37% since 2005. The EU ETS has also generated more than 152 million Euros in revenue in the past decade. The revenue generated from the EU ETS is invested in renewable energy projects, and energy efficiency innovations that further drive down emission rates across the continent.

The African Carbon Market was launched in 2022 at COP 27, with the objective of increasing Africa's participation in the global carbon market. Now in its second year, the African Carbon Market has secured over USD 200 Million in advanced commitments from corporate organisations. In addition, 7 African countries including Nigeria, Kenya and Malawi have signed up to the development of carbon activation plans with a view to unlocking Africa's carbon market potential which is expected to generate over USD 120 billion in revenue by 2050 and create about 100 million jobs.

AFRICA'S CARBON POTENTIAL

WHERE WE ARE

Over the last decade...

- **13%** of credits originated in Africa
- Kenya, Zambia and Malawi account for **50%** of African issuances[1]
- **18** African countries did not produce a single carbon project[2]

WHERE WE COULD BE

Nature-based solutions alone could unlock massive GDP growth and job creation[3]

$22 BILLION

estimated annual revenue generated

66 MILLION

new jobs created across carbon project supply chain

assuming a price point of $30 (currently the top end of the VCM)

AFRICA HAS THE INGREDIENTS TO LEAD GLOBAL CARBON MARKETS

- Young, entrepreneurial workforce
- Untapped renewable energy resources
- Vast natural endowments*

*accounting for a quarter of the world's biodiversity

- Tech innovation hubs*

*in Kenya, Egypt, Nigeria, and South Africa

- Co-benefits for ecosystem and livelihoods

SOURCES

1. https://gspp.berkeley.edu/research-and-impact/centers/cepp/projects/berkeley-carbon-trading-project/offsets-database
2. https://gspp.berkeley.edu/research-and-impact/centers/cepp/projects/berkeley-carbon-trading-project/offsets-database
3. https://capa.earthrise.media/

Carbon credits represent a unit of measurement for greenhouse gas emissions reductions. They are awarded to entities or projects that reduce emissions below a predetermined baseline, with each credit equivalent to one ton of CO2 equivalent avoided. Carbon credits can be bought, sold, or traded on carbon markets, providing financial incentives for emission reduction activities.

On the other hand, carbon offsets involve compensating for emissions by investing in projects that reduce or remove greenhouse gas emissions elsewhere. Common offset projects include reforestation, renewable energy development, and energy efficiency initiatives. By purchasing offsets, individuals or organizations can mitigate their carbon footprint and contribute to global emission reduction efforts. Carbon offsets are purchased by companies or organizations to compensate for their own emissions or achieve carbon neutrality. Carbon offsets may be project based whereby an organization invests in a specific emission reduction project, or market based which involves buying of verified emission reductions already achieved by a project.

Carbon trading, also known as Cap-and-trade, refers to the buying and selling of carbon credits or allowances on carbon markets. It involves buying and selling carbon credits or offsets on carbon markets to meet emissions reduction targets or compliance obligations. Carbon markets can be either voluntary or mandatory, depending on regulatory frameworks and international agreements such as the Kyoto Protocol or the Paris Agreement.

Trading carbon credits creates a financial incentive for emissions reductions and facilitates the flow of capital towards clean energy projects and climate mitigation initiatives. Tradable permits are allocated to industries or countries, allowing them to emit a certain amount of greenhouse gases within a defined timeframe. Entities with excess allowances can sell them to those facing emission constraints, creating a market-based mechanism for emission reduction.

3.2. The Kyoto Protocol and Emissions Trading

The Kyoto Protocol, adopted in 1997 as an international treaty under the United Nations Framework Convention on Climate Change (UNFCCC), represents a landmark agreement aimed at addressing global climate change through legally binding emission reduction targets. At the heart of the Kyoto Protocol is the establishment of emissions reduction mechanisms. To achieve these targets, the protocol introduced three flexible mechanisms: emissions trading, clean development mechanism (CDM), and joint implementation (JI). Emissions Trading allows participating countries to trade emissions allowances and credits as a means of achieving their emission reduction commitments in a cost-effective manner.

Emissions trading, also known as cap-and-trade, is a market-based mechanism established by the Kyoto Protocol to facilitate the trading of emissions allowances between countries. Article 17 of the Kyoto Protocol empowers the Conference of the Parties (COP) to define the principles, modalities, rules, and guidelines for emissions trading, including verification, reporting, and accountability.

3.3. How Emissions Trading Works

Participating countries (Annex B parties) under the Kyoto Protocol are assigned emission reduction targets or caps, which specify the maximum amount of greenhouse gas emissions they are allowed to emit over a certain compliance period. Each country is allocated a certain number of emissions allowances or credits, representing the right to emit a specific quantity of greenhouse gases, usually measured in metric tons of carbon dioxide equivalent (CO_2e). These allowances are distributed among participating countries based on historical emissions, economic factors, and other relevant considerations. Countries that emit less than their allocated allowances can sell their surplus allowances to countries that exceed their emission caps. This creates a market for emissions allowances, where countries can buy and sell allowances to meet their emission reduction targets in a cost-effective manner.

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Emissions trading under the Kyoto Protocol represents a pioneering approach to addressing global climate change through market-based mechanisms and international cooperation. By enabling countries to trade emissions allowances and credits, emissions trading promotes cost-effective emission reductions, encourages innovation in clean technologies, and fosters international collaboration towards achieving climate goals in a sustainable manner.

3.4. Global Carbon Trade Country by Country Case Study

Eurozone: The European Union Emissions Trading System (EU ETS) is the world's largest carbon market, covering over 11,000 installations across various sectors. The EU ETS is born of the EU's objective to become carbon neutral by 2050 and operates on a cap-and-trade system, with emissions allowances allocated to member states and industries. It covers emissions from various sectors, including power generation, industry, and aviation. These allowances are allocated or auctioned to participants. The system has evolved over time, with reforms aimed at tightening emission targets, enhancing market stability, and promoting low-carbon investments.

China: As one of the world's largest emitters of greenhouse gases, China has launched several regional carbon trading schemes as pilot projects to test emissions trading mechanisms. These pilot schemes are part of China's broader efforts to transition to a low-carbon economy and address air pollution and climate change. China aims to establish a national carbon trading system to regulate emissions from key industries and promote sustainable development. China's carbon market aims to support the country's climate goals, encourage emission reductions, and drive investment in clean technologies.

According to the Science Direct publication, which examines the environmental impact of globalization on trade, particularly focusing on China's CO2 emissions, it estimates that 10.03–26.54% of China's annual CO2 emissions are due to the manufacture of goods for export, while CO2 emissions from imports account for only 4.40% (1997) and 9.05% (2007) of that. The Publication further documents that in 1997 and 2007, the rest of the world avoided emitting 150.18 Mt CO2 and 593 Mt in 2007 respectively, by importing goods from China instead of manufacturing them domestically. This publication then spotlights that the net "additional" global CO2 emissions resulting from China's exports were 4894 Mt during 1997–2007. Given the significant number of emissions emitted from the Country's industrial activities, the launch of a national carbon market is a welcome development that will facilitate carbon trade.

Singapore: Singapore has implemented a carbon tax since 2019 to incentivize emissions reduction and promote clean energy adoption. The carbon tax applies to large emitters in the industrial and power sectors, covering over 80% of the country's total GHG emissions, with the revenue generated used to fund climate mitigation and adaptation measures. Singapore's carbon tax serves as a market-based mechanism to internalize the costs of carbon emissions and encourage businesses to transition to cleaner technologies.

The Managing Director of the Monetary Authority of Singapore, Ravi Menon recently cited the carbon tax to be set at 5 Singaporean dollars per tonne of emissions and an increase to 25 Singaporean dollars per tonne (S$25/tCo2e) from 2024 and to 45 Singaporean dollars per tonne (S$45/tCO2e) between 2026 and 2027. It is further expected to reach between 50 -80 Singaporean dollars per tonne (S$50-80/tCO2e) by 2030. In essence, the tax is designed to incentivize emission reductions and promote energy efficiency. Singapore is also exploring opportunities for carbon trading and collaborating with international partners to address climate change.

Australia: Australia's carbon pricing mechanism, known as the Carbon Pricing Mechanism, was introduced in 2012 but subsequently repealed in 2014. The mechanism imposed a carbon price on large emitters, with a transition to an emissions trading scheme planned for the future. Despite the repeal of the carbon tax, Australia continues to explore policy options for reducing emissions and meeting its international climate commitments.

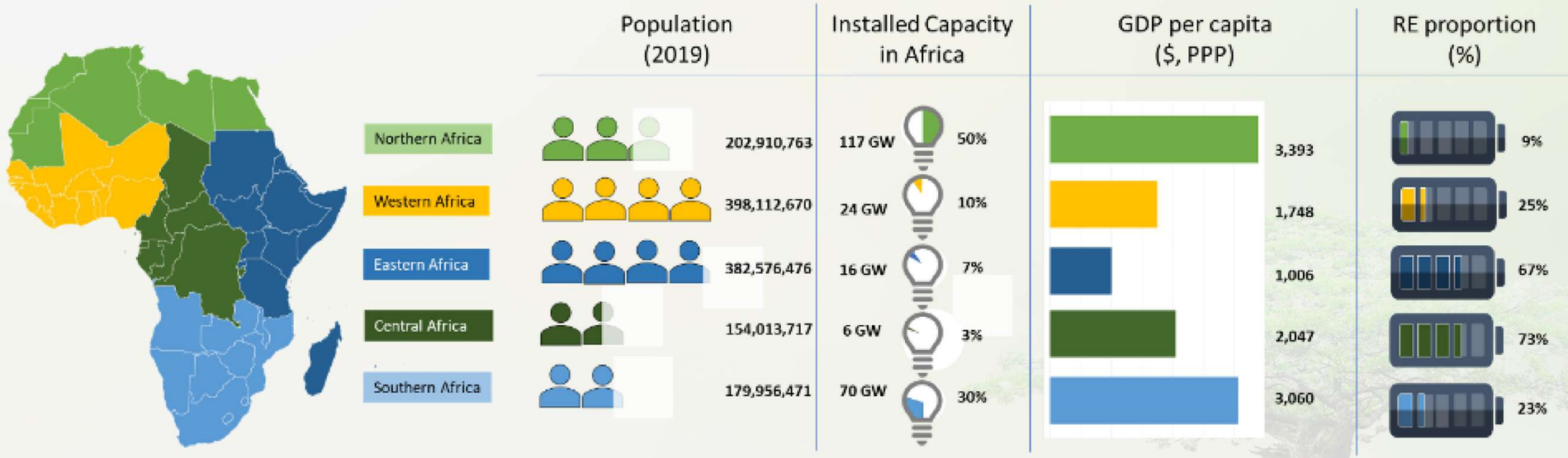
Indonesia: Indonesia is exploring the potential for implementing a carbon pricing mechanism to address deforestation and land-use emissions, which account for a significant portion of the country's total greenhouse gas emissions. Initiatives such as the REDD+ (Reducing Emissions from Deforestation and Forest Degradation) program aim to incentivize forest conservation and sustainable land management practices through carbon finance mechanisms.

South Africa: In 2019, South Africa introduced the Carbon Tax Act with the objective of reducing greenhouse gas (GHG) emissions in a cost-effective manner. The Carbon Tax has at its roots the polluter-pays-principle, ensuring that organisations take the impact of production and investment activities into consideration when making decisions.

3.5. Carbon Trade: AFCFTA and the Economic Opportunity For Africa/Nigeria

The African Continental Free Trade Area (AfCFTA) represents a significant opportunity for Africa, including Nigeria, to leverage carbon trade as a means of driving sustainable development, economic growth, and climate action on the continent. As the largest free trade area in the world by number of participating countries, AfCFTA aims to create a single market for goods and services, facilitate intra-African trade, and enhance regional integration.

The AfCFTA presents a unique opportunity for Africa to leverage carbon trade as a catalyst for sustainable development and economic growth. By integrating carbon pricing mechanisms and emission trading systems into regional climate policies, African countries can unlock economic opportunities, attract investment in clean energy projects, and promote green industries. Nigeria, as the largest economy in Africa, stands to benefit from participating in carbon markets and embracing low-carbon development pathways. By leveraging its abundant renewable energy resources and implementing carbon pricing initiatives, Nigeria can attract green investments, create jobs, and transition towards a more sustainable and resilient economy.



AfCFTA can serve as a platform for mobilizing climate finance and investment in Africa's clean energy transition. By integrating climate considerations into trade policies, financial instruments, and investment frameworks, AfCFTA can attract funding from international climate funds, multilateral development banks, and private sector investors to support climate-resilient infrastructure and green projects on the continent. AfCFTA also has the potential to facilitate emission reduction through the establishment of a regional carbon market for harmonizing carbon pricing mechanisms. AfCFTA can incentivize emissions reductions, promote sustainable development, and drive investments in climate-friendly technologies and practices.

African nations and Nigeria in particular, through the AfCFTA have the potential to unlock economic opportunities and stimulate growth in sectors such as renewable energy, energy efficiency, and sustainable agriculture. This would help achieve critical infrastructure needed to solve energy deficit, attain universal access to energy, and diversify its economy away from traditional fossil fuel industries towards cleaner and more sustainable sectors such as renewable energy, agriculture, and manufacturing.

In conclusion, carbon trade within AfCFTA presents a unique opportunity for Africa, including Nigeria, to harness the synergies between trade, climate action, and sustainable development. By embracing carbon trade as a driver of economic growth and climate resilience, Africa can unlock the full potential of AfCFTA to build a prosperous, inclusive, and sustainable future for all.

4. REGIONAL TRENDS IN CLEAN ENERGY TRANSITION

The demand for affordable and efficient energy solutions in Africa has been a driving force in shaping regional energy trends. With a focus on expanding energy access and enhancing energy efficiency, African countries are prioritizing sustainable and cost-effective energy solutions to meet the needs of their growing populations and emerging economies. Initiatives aimed at promoting affordable energy demand and efficiency include the adoption of energy-efficient technologies, the implementation of demand-side management strategies, and the promotion of clean cooking solutions to reduce reliance on traditional biomass, such as wood and charcoal.

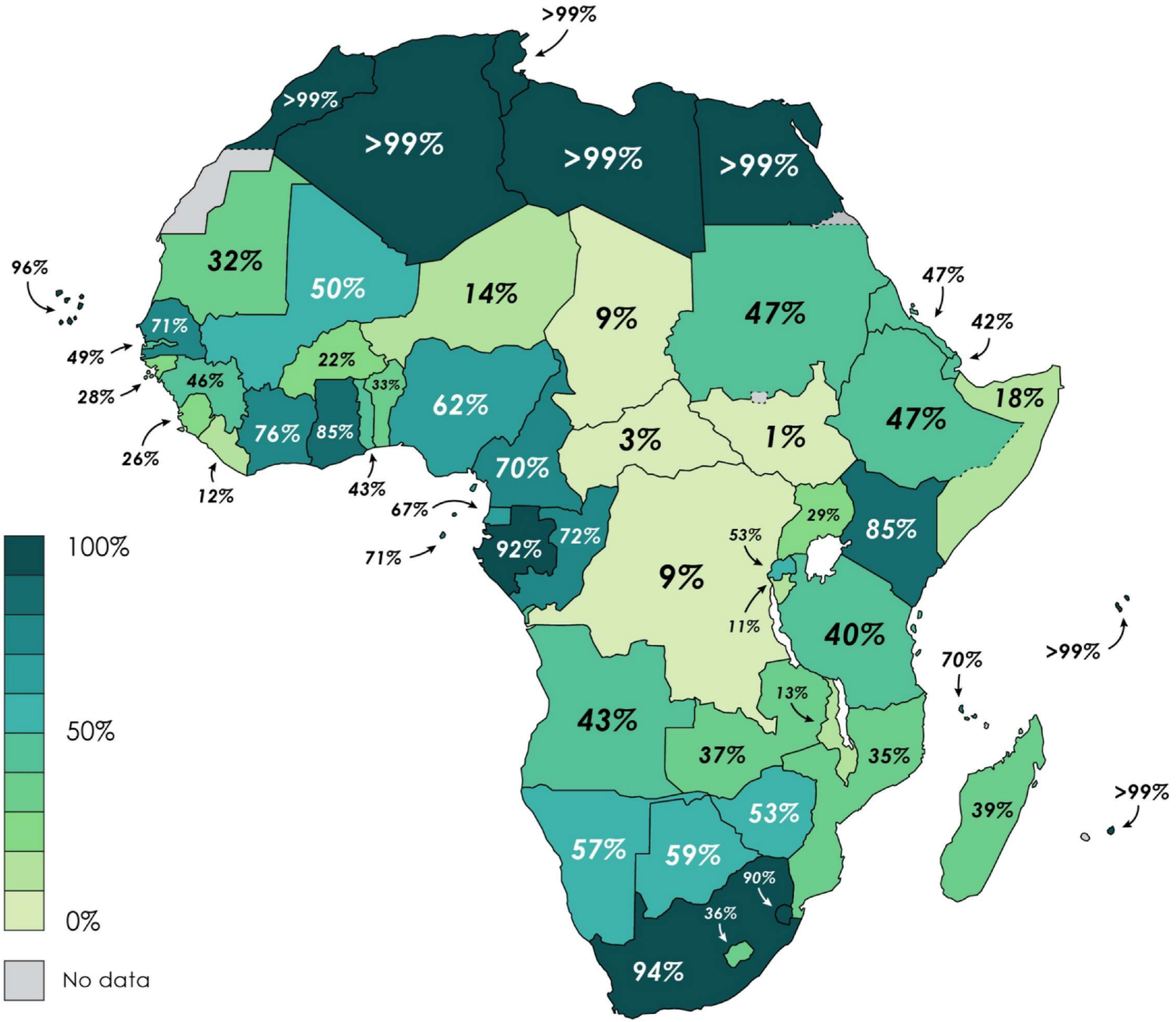
4.1. Affordable Energy Demand

In Africa, addressing affordable energy demand and improving energy efficiency are critical priorities for sustainable development and economic growth. With a rapidly growing population and increasing urbanization, the demand for energy in Africa is expected to rise significantly in the coming decades. However, access to affordable and reliable energy remains a challenge for many African countries, particularly in rural and underserved areas. According to a United Nations Conference on Trade and Development report titled Commodities At A Glance: Special Issue On Access To Energy In Sub-Saharan Africa (March, 2023), about 50% of the population of Sub-Saharan Africa lack access to electricity and affordable energy. Access to electricity in Africa is the lowest of any region in the world, with about 600 million out of the world's 733 million people who lack access to electricity resident in Africa[6].

[6]Report: COVID-19 Slows Progress Toward Universal Energy Access (World Bank, 2022) Available at [3] World Bank Global Flaring and Methane Reduction Partnership (GFMR). See - - [2] IPCC (Intergovernmental Panel on Climate Change). 2021. Climate change 2021: The physical science basis. Working Group I contribution to the IPCC Sixth Assessment Report. Cambridge, United Kingdom: Cambridge University Press. www.ipcc.ch/assessment-report/ar6. .

Access to electricity in Africa

By the proportion of the population, 2019 data



Source: The International Energy Agency

efisha.com

Rural electrification remains a formidable challenge in Africa, with many remote communities relying on expensive and inefficient energy sources such as kerosene lamps, diesel generators, and traditional biomass for lighting and cooking. Expanding access to affordable and reliable electricity is essential for improving living standards, promoting economic productivity, and unlocking opportunities for rural development. Africa's rapid urbanization is driving increased energy demand in urban centers, where population growth, industrialization, and commercial activities are concentrated. However, inadequate infrastructure, aging power grids, and unreliable electricity supply pose challenges to meeting urban energy needs, leading to energy poverty, service disruptions, and economic losses in urban areas.

A significant portion of the African population still lacks access to electricity, relying on traditional biomass sources for cooking and heating. Improving energy access requires investments in off-grid solutions, decentralized energy systems, and rural electrification initiatives to reach remote communities and underserved populations.

Enhancing energy efficiency across sectors such as industry, transportation, and buildings is essential for meeting growing energy demand sustainably. Implementing energy efficiency measures, such as energy-efficient appliances, building codes, and industrial processes, can reduce energy consumption, lower energy costs, and mitigate adverse environmental impacts.

4.2. The Renewable Energy Market in Africa

Africa holds immense renewable energy potential, including solar, wind, hydroelectric, and geothermal resources, which can play a transformative role in driving Africa's energy transition. The continent stands at the cusp of a renewable energy revolution, with immense potential to harness its vast and diverse renewable energy resources to drive sustainable development, energy security, and climate resilience across the continent.

The renewable energy market in Africa is experiencing rapid growth, with an annual growth rate of 21% over the past decade and a generative capacity of more than 50 Gigawatts. The growth in this sector is driven by declining technology costs, policy support, and increasing investor interest in clean energy projects.

Africa boasts abundant renewable energy resources, which offer immense potential for electricity generation, energy access, and economic development. The continent receives abundant sunlight throughout the year, making solar energy a particularly attractive option for powering off-grid and grid-connected systems across Africa's diverse landscapes.

1. **Solar Power:** Solar energy is emerging as a game-changer in Africa's energy transition, with the continent's vast solar resources offering unprecedented opportunities for solar photovoltaic (PV) deployment, concentrated solar power (CSP) projects, and solar mini-grids. Large-scale solar farms, distributed solar systems, and rooftop solar installations are being developed to expand access to clean and affordable electricity, particularly in remote and off-grid areas.

2. **Wind Energy:** Africa's coastal regions and high-wind areas present significant opportunities for wind energy development, with wind farms and wind power projects being deployed to harness the wind's kinetic energy and generate electricity for both grid-connected and off-grid applications. Onshore and offshore wind projects are being developed to exploit Africa's wind potential and contribute to renewable energy integration in national energy systems.

3. **Hydroelectric Power:** Africa's numerous rivers, water resources, and hydroelectric potential offer vast opportunities for hydroelectric power generation, with large-scale hydroelectric projects, small-scale hydro installations, and run-of-river schemes being implemented to harness hydropower for electricity production and water management. Hydropower remains a cornerstone of Africa's renewable energy portfolio, providing reliable and dispatchable electricity to support economic growth and industrial development.

4. **Geothermal Energy:** Africa is home to significant geothermal resources, particularly along the East African Rift System, where geothermal fields and volcanic activity offer ideal conditions for geothermal energy development. Geothermal power plants, geothermal wells, and geothermal heating projects can be developed to tap into Africa's geothermal potential and provide clean, baseload electricity for grid stability and energy security.

5. **Biomass and Bioenergy:** Biomass and bioenergy resources, including agricultural residues, forestry residues, and organic waste, play a vital role in Africa's energy mix, providing cooking fuel, heating fuel, and renewable energy feedstocks for power generation and thermal applications. The construction and implementation of biomass power plants, biogas digesters, and biofuel production facilities can help utilize biomass resources sustainably and reduce reliance on traditional biomass fuels.

According to Mordor Intelligence's Africa Renewable Energy Market Size & Share Analysis Report - (2024 - 2029),, the renewable energy market in Africa is expected to grow at a Compound Annual Growth Rate (CAGR) of over 8% from 2022 to 2027 due to supportive government policies, increasing power demand, and efforts to electrify most of the population. Solar energy is also expected to be a significant market driver. South Africa, for instance, stands out as a major player in the African renewable energy market, with plans to add 17.8 GW of renewable energy capacity by 2030. Though moderately fragmented,, Africa's renewable market, with major companies including Vestas Wind Systems A/S, Juwi Holding AG, ACWA Power, Enel Green Power S.p.A., and EDF Renewables, has the potential to reach and surpass this projected growth rate. Notable recent developments in the continent's renewables market include the recent acquisition of Lekela Power by Infinity Group and the Africa Finance Corporation which is the continent's biggest renewable energy deal to date[7], and the recent announcement by Eskom of plans to invest over US$7.3 billion in renewable energy over the next nine years.

Governments across Africa are increasingly recognizing the importance of policy support and market incentives in driving the deployment of renewable energy technologies, attracting investments, and accelerating the transition to a sustainable and low-carbon energy future. Policy frameworks, regulatory mechanisms, and financial incentives play a crucial role in creating an enabling environment for renewable energy development and market growth in the region.

[7] The deal builds on Infinity Power's promise at COP 27 to become the biggest provider of renewable energy on the African continent. The company currently has a combined energy portfolio of 1.3 gigawatts across three African countries. [6]Report: COVID-19 Slows Progress Toward Universal Energy Access (World Bank, 2022) Available at [3] World Bank Global Flaring and Methane Reduction Partnership (GFMR). See - - [2] IPCC (Intergovernmental Panel on Climate Change). 2021. Climate change 2021: The physical science basis. Working Group I contribution to the IPCC Sixth Assessment Report. Cambridge, United Kingdom: Cambridge University Press. www.ipcc.ch/assessment-report/ar6. .

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4.3. Nairobi Declaration on Climate Change

The Nairobi Declaration on Climate Change, adopted in 2023, by the African Heads of State and Government at the inaugural African Climate Summit underscores Africa's commitment to addressing climate change, promoting sustainable development, and enhancing resilience to climate impacts across the continent. The declaration affirms Africa's role in global climate action and calls for increased support and cooperation to accelerate Africa's transition to a low-carbon and climate-resilient future. The objective of this declaration was to aggregate global funding and support responsible call for exploitation of the continent’s natural assets in the transition journey to a low carbon future.

African Leaders at the Summit recognizing the disproportionate emission contributions and effects of climate change called for global and multilateral funding channels as the cost of transitioning is beyond the borrowing capacity of any nation’s balance sheet. The declaration also lent support to the importance of implementing a global carbon taxation regime to discourage continued reliance on fossil fuel, [particularly in the aviation, maritime and construction sectors] to fund green climate projects.

Carbon taxation is already being implemented on the African continent, with the South African government implementing a Carbon Tax Act in 2019. Nigeria has also passed a Climate Change Act in 2021 which empowers the Federal Inland Revenue Service (FIRS) to develop a mechanism for imposing carbon tax. In addition, the Act also establishes a Climate Change Fund geared towards funding innovative climate change mitigation and adaptation projects; conducting assessments of climate change impact on vulnerable communities and population; and incentivizing entities for their efforts toward transiting to clean energy and sustaining a reduction in GHG emissions, among others.

4.4. Africa Carbon Markets Initiative and the Africa Mini-grids Programme

The Africa Carbon Markets Initiative (ACMI) and the Africa Mini-grids Programme are flagship initiatives of African Leaders aimed at promoting carbon markets, renewable energy deployment, and energy access in Africa. These initiatives seek to leverage carbon finance, market mechanisms, and innovative technologies to drive Africa's energy transition and address climate change challenges.

1. **Africa Carbon Markets Initiative (ACMI):** ACMI aims to develop and implement carbon pricing mechanisms, emissions trading schemes, and carbon offset projects to incentivize emissions reductions and promote sustainable development in Africa. By establishing regional carbon markets and carbon pricing frameworks, ACMI seeks to mobilize climate finance, attract investments, and catalyze clean energy investments across the continent. The ACMI'S 2022 Roadmap Report highlights that Africa has the potential to scale its carbon credit market 19-fold by 2030, providing up to 30 million jobs and about $6 billion in revenue. However, the ACMI recognizes that for these potentials to be realized, governments must establish a clear regulatory framework conducive for scaling carbon markets. In addition, the resulting carbon market must be a high-integrity market where no greenwashing occurs. So far, ACMI has secured signed commitments of over $250 million from investors seeking to trust a high integrity market.

2. **Africa Mini-grids Programme (AMP):** The AMP Programme focuses on expanding energy access and promoting renewable energy mini-grids in rural and underserved areas of Africa. According to its website, the AMP's objective is to support access to clean energy by increasing the financial viability, and promoting scaled up commercial investment, in low-carbon mini-grids in Africa, with a focus on cost-reduction levers and innovative business models. By deploying off-grid and decentralized energy solutions, such as solar mini-grids, biomass mini-grids, and hydro mini-grids, the programme aims to electrify remote communities, improve livelihoods, and foster economic development in Africa. The AMP is sponsored by the Global Environment Facility (GEF) and the United Nations Development Programme (UNDP) with a view to enable access to clean energy in Africa through low carbon mini-grids. The AMP has identified three key areas for investment with a view to reducing the cost of developing and implementing mini-grids, namely data and digitization, the productive use of electricity and driving national dialogues on mini-grid delivery models.

4.5. Enabling Africa’s Energy Transition Plan

Africa's energy transition represents a pivotal moment in the continent's development trajectory, offering opportunities to address energy poverty, promote sustainable development, and mitigate climate change impacts. An effective energy transition plan for Africa must encompass a holistic approach that integrates policy reforms, regulatory frameworks, capacity-building initiatives, and investment mobilization efforts to accelerate the deployment of clean energy technologies and foster a resilient and sustainable energy system. Africa’s energy transition approach should include the following to ensure an effective and reliable energy source.

1. **Policy Reforms and Regulatory Frameworks:**

   - Renewable Energy Targets: Establish ambitious renewable energy targets to increase the share of renewables in the energy mix, promote energy access, and reduce greenhouse gas emissions. Set clear and measurable goals for renewable energy deployment, capacity expansion, and energy efficiency improvements.

   - Policy Incentives: Implement policy incentives such as feed-in tariffs, tax breaks, subsidies, and concessional financing to incentivize renewable energy investments, attract private sector participation, and stimulate market growth. Provide regulatory certainty, stability, and transparency to investors to mitigate investment risks and encourage long-term commitments.

   - Energy Market Reforms: Reform energy markets, liberalize electricity markets, and promote competition to create a level playing field for renewable energy developers and investors. Facilitate grid access for renewable energy projects, streamline permitting processes, and enhance regulatory frameworks to accelerate project development and deployment.

2. **Capacity Building and Skills Development:**

   - Technical Expertise: Build technical capacity among policymakers, regulators, energy practitioners, and stakeholders to facilitate the planning, implementation, and management of renewable energy projects. Provide training, workshops, and knowledge-sharing platforms to enhance skills in project development, financing, and operation.

   - Institutional Strengthening: Strengthen institutional capacity within government agencies, regulatory bodies, and energy ministries to effectively oversee and regulate the renewable energy sector. Enhance coordination, collaboration, and communication among relevant stakeholders to ensure alignment with national energy priorities and objectives.

   - Entrepreneurship and Innovation: Foster entrepreneurship, innovation, and local participation in the renewable energy value chain, including manufacturing, installation, maintenance, and service provision. Support incubators, accelerators, and ecosystems to nurture renewable energy startups, scale-up initiatives, and technology innovations.

3. **Investment Mobilization and Financing Mechanisms:**

   - Public-Private Partnerships: Foster partnerships between public and private sectors to mobilize investment capital, share risks, and leverage resources for renewable energy projects. Develop public-private partnership (PPP) models, project finance structures, and blended finance mechanisms to attract institutional investors, development finance institutions (DFIs), and commercial banks.

   - Climate Finance: Mobilize climate finance, green bonds, and climate funds to support renewable energy investments, climate mitigation initiatives, and adaptation projects in Africa. Engage with international donors, multilateral development banks (MDBs), and climate finance institutions to access concessional funding, grants, and concessional loans for renewable energy projects.

   - Innovative Financing Instruments: Explore innovative financing instruments such as green bonds, carbon finance, and impact investing to diversify funding sources, reduce financing costs, and scale up renewable energy deployment. Develop financial instruments tailored to the needs of renewable energy projects, including project finance, revenue-based financing, and risk-sharing mechanisms.

4. **Community Engagement and Social Inclusion:**

- Community Participation: Promote community engagement, consultation, and participation in renewable energy projects to ensure local ownership, support, and benefit-sharing. Foster partnerships with local communities, indigenous groups, and marginalized populations to address social, cultural, and environmental concerns and enhance project acceptance and sustainability.

- Energy Access for All: Prioritize energy access for underserved communities, off-grid areas, and vulnerable populations to improve livelihoods, enhance resilience, and reduce poverty. Deploy decentralized energy solutions, off-grid technologies, and community-based energy systems to extend energy services to remote and marginalized areas.

Enabling Africa's energy transition requires a comprehensive and coordinated approach that integrates policy reforms, regulatory frameworks, capacity-building initiatives, and investment mobilization efforts. By adopting a holistic energy transition plan, Africa can accelerate the deployment of clean energy technologies, promote sustainable development, and achieve universal energy access whilst contributing to global climate goals, and building a resilient and inclusive energy future for all.

5. **RENEWABLE ENERGY AND THE NIGERIAN ENERGY SECTOR**

5.1. Nigeria’s Electricity Act 2023; A Catalyst for Renewable Electricity

The Nigerian Electricity Act of 2023 represents a significant milestone in the country's energy sector, aiming to modernize and diversify Nigeria's electricity generation mix by promoting renewable energy sources. The Electricity Act consolidates the laws regulating the Nigerian Electricity Supply Industry (NESI) and provide a holistic policy for the generation, transmission, and distribution of electricity including the integration of renewable energy into Nigeria’s energy mix. Among the Act’s objectives include:

A. the provision of a framework to stimulate the development and utilization of renewable energy resources and create an enabling environment for investment in renewable energy sources in order to increase the contribution of renewable energy in Nigeria’s energy mix;
B. provision of a framework to improve the access to electricity in rural, underserved and urban areas through the use of renewable energy;
C. promotion of indigenous technological capacity in the renewable energy sector.

The Act also makes provision for the publication and implementation of a National Integrated Electricity Policy and Strategic Implementation Plan (NIEPSIP) within one year of the Act coming into force. The NEPSIP shall include, among others, plans to develop the electric power sector based on optimal utilization of coal, natural gas, nuclear substances as well as renewable energy sources such as solar, wind, hydro and other forms of renewable energy. The NIEPSIP also provides for the implementation of power sector specific policies including waivers and subsidies that will stimulate the development of renewable energy[8].

The Nigeria Electricity Act of 2023 is expected to catalyze investment in renewable electricity projects, stimulate economic growth, and contribute to Nigeria's energy transition objectives. By providing a supportive policy framework, regulatory certainty, and financial incentives for renewable energy development, the Act creates opportunities for private sector participation, technology innovation, and job creation in the renewable energy sector. The Electricity Act grants States, the freedom to make regulation for the construction and operation of mini-grids to augment the existing power generation framework[9].

[8]Section 3 of the Nigerian Electricity Act, 2023.
[9] Section 63

The development and efficient utilization of renewable energy is a key focus of the Act with several nascent provisions included to guarantee support for investment in this sub-sector. These provisions include:

1. **Feed-in Tariffs (FiTs):** The Act introduces feed-in tariffs (FiTs) and other market mechanisms to incentivize renewable energy investments and promote the development of solar, wind, hydro, and other renewable energy projects across Nigeria. This is ensured in Section 168 of the Act, which precludes electricity distribution companies from entering into power purchase agreements with generators of electricity from renewable energy sources on rates not approved by the Nigerian Electricity Regulatory Commission (NERC). This empowers the NERC to set the feed-in-rates for these transactions taking into consideration the cost of setting up and maintaining the facility, the technology being used in generating electricity, the reasonable rate of return and the balance of the interests of the consumer and the investor.

2. **Tax Incentives:** Section 166 of the Act provides that the Federal Ministry of Finance shall provide tax incentives to promote and facilitate the generation and consumption of energy from renewable sources. Any such incentives to be granted shall be in accordance with the Industrial Development (Income Tax Relief) Act.

3. **Regulatory Support:** Other supportive measures geared towards the development of the renewable energy sector are contained in Section 164 of the Act which stipulates measures to be implemented by the NERC to increase the contribution of renewable energy to the energy mix. Some of these measures include the simplification of licensing and fees regime, provision of mini-grid regulations on renewable energy to cater for installation, metering, and other requirements for renewable energy mini-grid systems, supporting the Rural Electrification Agency to ensure increased access to electricity through renewable energy sources, and ensuring a favourable and long-term pricing mechanism for renewable energy.

5.2. Nigeria Energy Transition Plan; Achieving Carbon Neutrality By 2060

Nigeria, like many countries around the world, is recognizing the need to transition towards a more sustainable and low-carbon energy future. The energy transition plan outlines a comprehensive strategy to address key challenges such as energy access, energy security, and climate change mitigation whilst promoting economic growth and social development.

The Nigerian Energy Transition Plan was announced at COP26 by former President Muhammadu Buhari. This Energy Transition Plan (ETP) is a strategy developed by the country to achieve carbon neutrality by 2060 through the reduction of emissions in five critical sectors: Power, Cooking, Oil, Transport and Industry. According to the ETP, these five sectors are responsible for over 65% of the total emissions of greenhouse gases (GHG) in the country. The ETP's core objectives include the deployment of natural gas as a transitional fuel in the journey towards carbon neutrality. The ETP aims to bring modern energy services (by which is meant renewable energy) to the population and create job opportunities to manage the expected job cuts in the oil sector due to the reduction in global demand for fossil fuel.

The ETP aligns with Nigeria's national development priorities, climate commitments, and international obligations under the Paris Agreement. It integrates climate considerations into energy planning, policymaking, and investment decisions to ensure coherence and synergy between climate action and energy sector development. The ETP also prioritizes the deployment of renewable energy technologies, such as solar, wind, hydro, and geothermal, to diversify Nigeria's energy mix and reduce greenhouse gas emissions from the power sector. Investments in renewable energy infrastructure, grid integration, and energy storage are essential for achieving renewable energy targets and promoting energy security. The ETP is expected to create significant economic and investment opportunities including the expansion and establishment of industries pertaining to solar energy, hydrogen, and e-mobility.

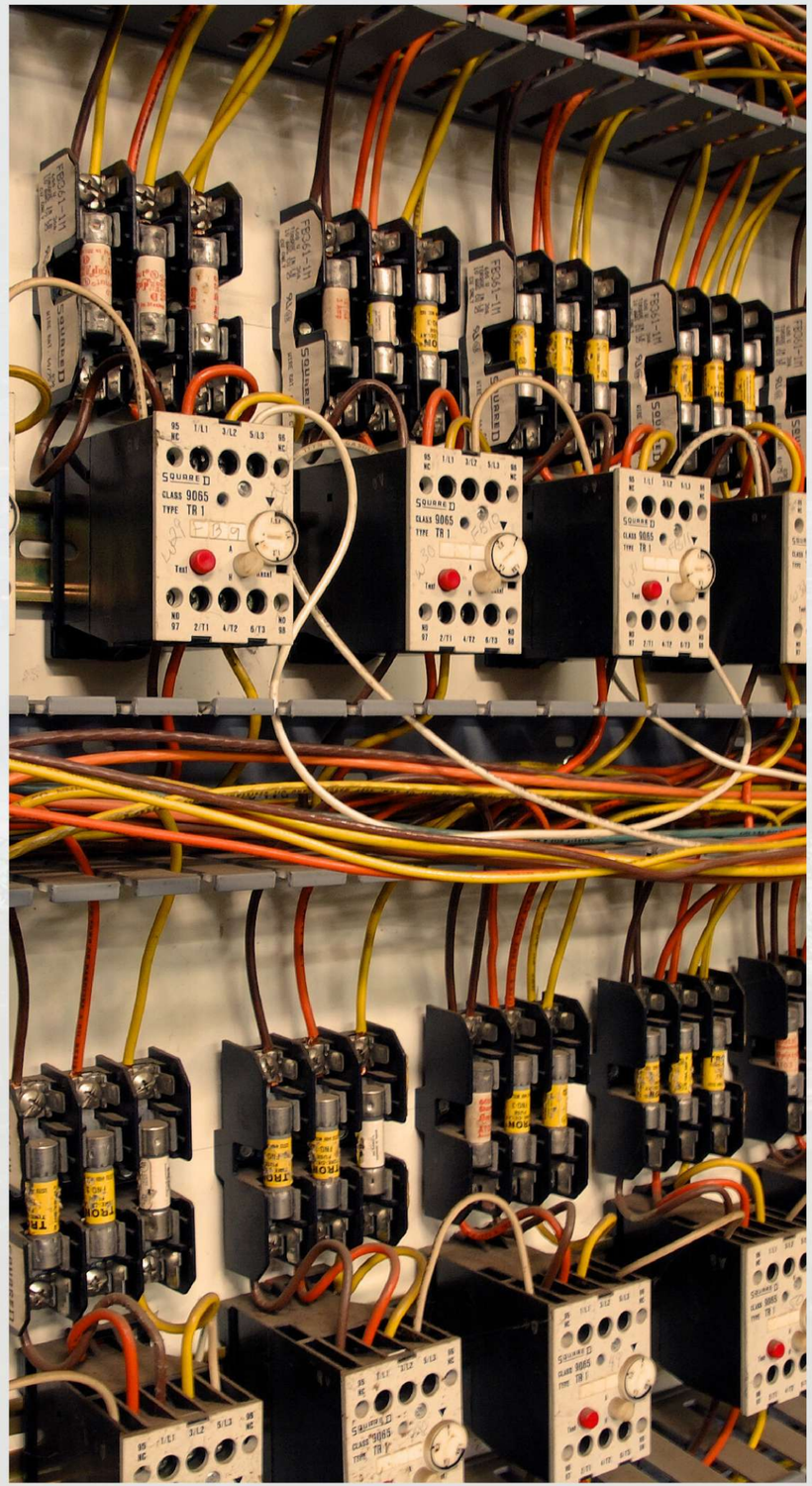
While ETP proposes lofty goals, it faces a significant challenge in funding and capital expenses. The ETP initially conceived a 2050 target for carbon neutrality but had to be amended due to the huge financial demands of the transition project. The Energy Transition Office (ETO) reports that $1.9 Trillion is required to get to Net Zero by 2060, including $410 Billion above projected usual spending. This additional cost translates to about $10 billion annually. The ETP aims to meet its funding obligations in the following ways:

1. **Public-Private Partnerships (PPPs):** The plan encourages collaboration between the public and private sectors to mobilize investments, leverage expertise, and share risks in renewable energy development. Public-private partnerships (PPPs) can unlock financing, facilitate technology transfer, and accelerate project implementation in key priority areas.

2. **Climate Finance:** The plan seeks to access climate finance sources, including international climate funds, multilateral development banks, and green investment mechanisms, to support renewable energy projects and climate adaptation initiatives in Nigeria. The ETP also incorporates the creation of the Climate Change Fund as provided for in the Climate Change Act. Climate finance instruments such as grants, concessional loans, and risk mitigation instruments can provide critical support for renewable energy deployment and climate resilience building.

3. **International Cooperation:** The plan emphasizes the importance of international cooperation and collaboration in mobilizing finance, technology, and capacity-building support for Nigeria's energy transition efforts. Bilateral and multilateral partnerships, technical assistance programs, and knowledge-sharing initiatives can facilitate technology transfer, skills development, and policy exchange to accelerate renewable energy deployment and climate action in Nigeria.

4. **Domestic Investment Incentives:** The plan promotes domestic investment in renewable energy projects through fiscal incentives, tax reliefs, and investment promotion schemes as applicable under the Climate Change Act. Creating an enabling environment for renewable energy investments, reducing investment risks, and enhancing investor confidence are essential for attracting domestic capital to the renewable energy sector.



The Nigeria Energy Transition Plan represents a visionary roadmap for advancing renewable energy development, promoting sustainable development, and addressing climate change challenges in Nigeria. By implementing the plan's strategies, leveraging funding and investment opportunities, and fostering collaboration between stakeholders, Nigeria can achieve its ambitious energy transition objectives and contribute to global efforts to combat climate change whilst ensuring energy access, economic prosperity, and environmental sustainability for all.

5.3. Regulatory Bodies in the Nigerian Energy Sector

a. **Nigerian Electricity Regulatory Commission (NERC)**: The NERC is the principal regulator of the Nigerian Electricity Supply Industry (NESI) per the Electricity Act, 2023[10]. NERC's key functions include licensing and regulating persons involved in the generation, transmission, supply, and trading of electricity within the country. The Electricity Act also empowers the NERC to promote competition and private sector participation in the NESI. In line with its responsibilities under the Act, the NERC has developed several regulations including the National Electricity Regulatory Commission Mini-grid Regulations 2023.

b. **Rural Electrification Agency (REA):** The REA is saddled with the responsibility of ensuring electricity access to rural, underserved and unserved communities under the Act. This responsibility is to be carried out in an economical manner that guarantees investors reasonable returns upon investing in these underserved and unserved areas. In addition to assisting in setting profitable tariffs for investors, the REA has the responsibility of supporting and promoting the use of renewable energy sources in the generation and distribution of electricity to meet the needs of rural communities.

The REA is divided into the Rural Electricity Fund (REF) Directorate; the Engineering and Technical Services (ETS) Directorate and the Corporate Services Directorate. The REF Directorate is responsible for providing monetary subsidies to qualified electrification projects at all levels of the federation and has the mandate to support public and private sector participation in renewable and sustainable electricity generation. The sources of funds for the REF include grants, loans, fines and penalties and intervention funds provided by any of the levels of government. The ETS Directorate is tasked with providing technical support and ensuring compliance with existing engineering standards in project implementation whilst the Corporate Services Directorate deals with administrative functions.

c. **National Electricity Management Services Agency (NEMSA):** NEMSA is created by Section 172 of the Act to replace the defunct Electricity Management Services PLC. The Agency is charged with the enforcement of statutory technical electrical standards and the issuance of competency certificates to qualified personnel in the NESI. NEMSA also has an oversight function of inspecting and assessing power plants and transmission lines for suitability and fitness for purpose. The sources of funding for NEMSA include government grants and such funds as may be approved by the National Assembly.

d. **National Power Training Institute of Nigeria (NPTIN):** The NPTIN serves the dual functions of a training and research centre. NPTIN is responsible for ensuring human resources capability by training willing professionals to ensure proficiency in the power sector. This includes the development of engineering and technical certification programmes to build skills, knowledge and behavioral standards in the NESI. NPTIN shall also be responsible for researching all matters arising or in relation to electricity in Nigeria and Africa.

e. **National Power Policy Coordinating Council:** The Power Council has the function of ensuring conformity in regulations and policy in the NESI. The objective of this body is to ensure regulatory certainty for investors and review the National Integrated Electricity Policy and Implementation Plan (NIEPSIP) for approval by the government. The Council shall also deliberate on the challenges being faced by stakeholders in the NESI and come up with strategic solutions and government policies to encourage investment in the electricity sector.

f. **National Hydroelectric Power Producing Area Development Commission (N-HYPPADEC):** The N-HYPPADEC is created by Section 82 of the Act and charged with formulating policies for the development of hydroelectric power producing communities. The Commission shall identify, examine and proffer solutions to challenges inhibiting the development of hydroelectric power producing areas with a view to formulating and implementing federal government approved policies in these areas. All states where hydroelectric power is being produced shall be members of the N-HYPPADEC. The N-HYPPADEC shall also tackle ecological problems being faced by communities in these areas due to the overloading of dams.

6. COMMERCIAL MINIGRIDS AS A VIABLE ENERGY ALTERNATIVE FOR AFRICA

From day-to-day activities including cooking and storage of foods to the more complex demands of business operations, the average individual needs a reliable and constant access to electricity. However, this reliable access is absent in several countries around the world, where the national transmission is absent or only supplies epileptic power. This is particularly true in Africa, where over 600 million people lack access to reliable energy sources. This realization underscores the United Nation's Sustainable Development Goal 7 which aims to ensure universal access to energy by 2030. Currently, the world is running behind schedule and needs to look outside the traditional methods of generating and distributing power to reach underserved areas. This realization and need to scale up efforts towards the provision of efficient and reliable energy makes the concept of commercial mini-grids appealing.

Mini-grids are decentralized electricity networks that generate and distribute power to localized communities who are underserved by the national grid or out of reach. These decentralized networks ensure that remote and rural communities are not left behind in energy access by providing a viable alternative to the national grid.

This also facilitates load shedding as there is less demand on the national grid. Efforts towards addressing the energy gap and achieving SDG 7 have made mini-grids a popular option particularly in regions where there is an abundance of renewable energy sources. By harnessing abundant renewable resources such as solar, wind, hydro, and biomass, mini-grids offer a sustainable alternative to traditional fossil fuel-based electricity generation. This transition to renewable energy sources facilitated by mini-grids contributes significantly to emission reduction efforts by mitigating the environmental impacts associated with conventional energy generation.

Mini-grids offer substantial emission reduction benefits by displacing polluting sources of energy such as diesel generators, kerosene lamps, and traditional biomass stoves. By providing clean and reliable electricity from renewable sources, mini-grids help reduce the combustion of fossil fuels and the release of harmful greenhouse gases into the atmosphere.

The electrification of off-grid and underserved communities through mini-grids not only improves energy access but also contributes to climate change mitigation by lowering carbon emissions and promoting sustainable energy consumption practices. Mini-grids play a crucial role in bridging the energy access gap by providing off-grid and remote communities with access to clean and sustainable electricity. The deployment of mini-grids aligns with SDG7 targets and reinforces the commitment to leaving no one behind in the quest for sustainable development.

6.1. Mini-grids and existing ownership models for power assets

Mini-grids represent a dynamic and flexible solution for delivering electricity to communities beyond the reach of centralized grid infrastructure. Understanding the various ownership models for power assets within the context of mini-grids is crucial for effective implementation and sustainable operation.

1. **Public Sector Ownership:** In some cases, mini-grid projects are initiated and owned by the public sector, typically through government agencies. Public sector ownership may involve direct investment in mini-grid infrastructure, with the government assuming responsibility for project development, financing, and operation. This model is often employed in areas where public utilities are the primary providers of electricity services, and mini-grids serve as complementary solutions to extend electricity access to remote or underserved communities.

2. **Private Sector Ownership:** Private sector ownership of mini-grids is increasingly common, driven by the participation of independent power producers (IPPs), energy service companies (ESCOs), and other private entities. Under this model, private investors develop, finance, and operate mini-grid projects, either independently or through public-private partnerships (PPPs). Private sector ownership offers advantages such as efficiency, innovation, and market responsiveness, as well as opportunities for revenue generation through electricity sales and service provision.

3. **Community Ownership and Cooperative Models:** Community ownership and cooperative models involve local communities, cooperatives, or community-based organizations taking ownership and control of mini-grid assets and operations. These models empower communities to manage their energy resources, make decisions collectively, and benefit directly from electricity services. Community-owned mini-grids promote social inclusion, local empowerment, and sustainable development by fostering community engagement, capacity-building, and economic opportunities.

6.2. Consideration For Choosing Ownership Structures

When selecting ownership models for mini-grid projects, several factors should be considered:

- Financial Viability: Ownership models should align with the financial viability of mini-grid projects, considering factors such as capital investment requirements, revenue potential, and operational costs.
- Regulatory Environment: The regulatory framework governing electricity markets, tariffs, and licensing procedures may influence ownership decisions and project feasibility.
- Community Engagement: Involving local communities in decision-making processes and ownership structures can enhance project acceptance, sustainability, and social impact.
- Technical Expertise: Ownership models should reflect the technical expertise and capacity available within project stakeholders to ensure effective project implementation and operation.

Mini-grids offer a range of ownership models for power assets, each with its own advantages and considerations. By understanding and selecting appropriate ownership models, stakeholders can maximize the effectiveness, sustainability, and impact of mini-grid projects in expanding energy access, promoting renewable energy deployment, and advancing sustainable development goals.

6.3. Mini-grids and the Global and Regional (African) Electrification Process: Ending Energy Poverty

Mini-grids align with global development agendas such as the United Nations Sustainable Development Goals (SDGs), particularly SDG7 of ensuring access to affordable, reliable, sustainable, and modern energy for all by 2030. Mini-grids have been identified as a potential gamechanger in the electrification process due to their potential ability to close the energy access gap while also reducing carbon emissions through the use of renewable energy sources. In Africa, regional electrification initiatives such as the African Union's Programme for Infrastructure Development in Africa (PIDA) and the African Renewable Energy Initiative (AREI) prioritize expanding energy access and accelerating electrification to end energy poverty and promote socio-economic development. Mini-grids are recognized as a strategic tool for achieving these electrification objectives and advancing regional energy security and resilience.

According to a 2019 report by the Energy Sector Management Assistance Program (ESMAP)[10], over 19,000 mini-grids are already in operation worldwide, providing energy access to about 47 million people. The report states that 2,500 of these 19,ooo mini-grids are clean energy based, contributing to the war against energy poverty through sustainable practices. However, the world needs more mini-grids with a further 180,000 mini-grid constructions needed to bring energy to 440 million people. The World Bank estimates that Africa alone would require as much as 140,000 mini-grid installations due to its high energy deficit numbers.

Mini-grids serve as a critical enabler of energy access in remote and off-grid areas where extending centralized grid infrastructure is economically challenging or technically unfeasible. By deploying mini-grid systems powered by renewable energy sources such as solar, wind, hydro, and biomass, communities can access clean and reliable electricity for lighting, cooking, heating, productive uses, and other essential services. Mini-grids bridge the energy access gap, empowering communities and improving quality of life. Mini-grids can operate independently or in parallel with centralized grid systems, offering flexibility and resilience in the energy supply chain. This hybrid approach to electrification enhances energy reliability, resilience, and affordability, particularly in rural and peri-urban areas.

[10]Energy Sector Management Assistance Program (ESMAP) Annual Report 2019

Rural electrification is a key priority for achieving universal access to electricity and ending energy poverty, as a significant portion of the global population residing in rural areas lacks access to modern energy services. Mini-grids expedite rural electrification by offering scalable, cost-effective, and sustainable energy solutions tailored to the needs and characteristics of rural communities. By prioritizing rural electrification projects and deploying mini-grid systems, countries can address energy poverty, stimulate economic development, and improve livelihoods in rural areas.

In furtherance of SDG 7 and to facilitate the realisation of the inherent potential of mini-grids, the United Nation's Industrial Development Organization (UNIDO); Alliance for Rural Electrification (ARE), the African Development Bank (AfDB); the Green Mini Grid Help Desk; and the Africa Mini grid Developers Association (AMDA) launched a Clean Energy Mini-Grid Policy Development Guide to help policy makers understand and regulate the renewable mini-grid market. The aim of the policy development guide is to fast-track rural electrification through accelerated and precise mini-grid policy formulation.

The guide notes that the governments of countries such as Nigeria, Kenya, Uganda, Zambia, Sierra Leone and Senegal – among others – have recognized mini-grids as a cost-effective and implementable solution for promoting the development and industrialization of rural areas, supplying reliable electricity to hospitals, schools,

police stations, government offices and religious institutions, and connecting the surrounding households and businesses to decentralized distribution systems. The Nigerian Electricity Act of 2023 for instance grants the Electricity Boards of States the power to issue mini-grid licenses[11], recognizing the potential of mini-grids to solve electricity deficits. Similarly, the Act empowers the NERC to make regulations on the installations of renewable mini grid systems in the country. All of these point to a global and regional/African support and framework for the utilization of mini-grids in solving the energy deficit and achieving SDG 7.

6.4.The State of The Global Mini-Grid Market

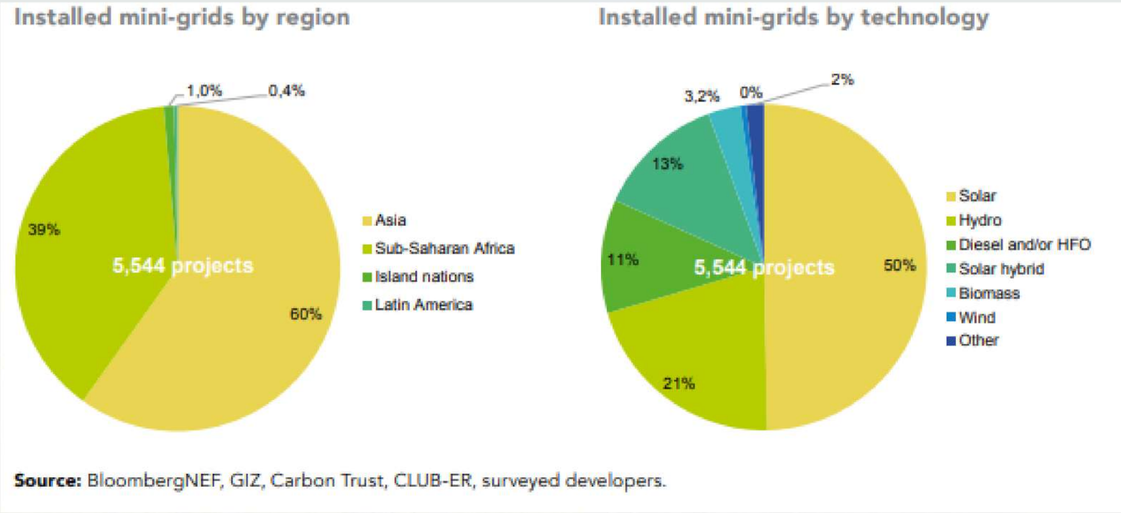
The global mini-grid market is experiencing rapid growth and transformation, driven by increasing energy access needs, technological advancements, supportive policy frameworks, and growing investment interest in decentralized energy solutions. Mini-grids are gaining traction as a cost-effective and scalable solution for providing electricity to remote and underserved communities, particularly in areas where grid extension is impractical or economically unviable. Market growth is fueled by rising energy demand, population growth, urbanization trends, and the need to address energy poverty and achieve universal access to electricity.

[11] Section 63 of the Nigerian Electricity Act.

Many countries have implemented policies, incentives, and regulations to promote mini-grid development, including feed-in tariffs, tax incentives, licensing exemptions, and streamlined permitting processes. Governments are recognizing the role of mini-grids in achieving energy access goals, reducing emissions, and advancing sustainable development objectives, leading to increased policy support and investment in the sector.

The global mini-grid market has witnessed substantial growth and evolution, driven by technological advancements, supportive policies, and increasing investments in decentralized energy solutions. The market encompasses a diverse range of players, including technology providers, project developers, investors, and policymakers, contributing to the expansion of mini-grid deployments worldwide. The state of the global mini-grid market reflects a growing momentum towards decentralized energy solutions and their role in addressing energy access challenges.

As at March 2020, the State of the Global Mini-grids Market Report 2020 identified the presence of 7, 181 mini-grid projects in Sub-Saharan Africa, Asia, small island nations, and Latin America combined together. 5,544 wee found to be operational, with 63 percent comprising solar or solar hybrid systems, 21 percent hydro, and 11 percennt diesel/heavy fuel. However, as pointed out by the Report, the number of mini-grids installed do not satisfy the volume required for full rural electrification.



Source: BloombergNEF, GIZ, Carbon Trust, CLUB-ER, surveyed developers.

Remarkably, in spite of challenges such as non-cost reflective tariffs, bureaucratic licensing processes faced by investors and ambiguous policies, mini-grids particularly solar hybrid mini-grids have continued to grow at an impressive pace such that this Report forecasts that with a capital investment of USD 128 billion and regulations protecting and enhancing mini-grid development and sustenance, mini-grids have the potential to provide electricity to half of the 238 million households required to gain electricity access across Sub-Saharan Africa, Asia and island nations by 2030 to achieve universal electrification.

Despite its growth potential, the global mini-grid market faces several challenges, including regulatory barriers, funding constraints, technological barriers, and market fragmentation. Addressing these challenges requires coordinated efforts from governments, regulators, industry stakeholders, and financiers to create a supportive ecosystem for mini-grid deployment.

However, the market also presents significant opportunities for innovation, collaboration, and investment in sustainable energy solutions that can address energy access challenges, promote economic development, and combat climate change.

6.5. The Nigerian Mini-grid Market

The Nigerian mini-grid market is characterized by a significant energy access gap, with a large portion of the population lacking access to reliable electricity services, particularly in rural and underserved areas. According to a report by the Rocky Mountain Institute (RMI) and the Nigerian Economic Summit Group (NESG)[12], the Nigerian mini-grid although in its nascent stage is beginning to realise its commercial potentials with about nine members of the African Mini-grid Developers Association (AMDA) entering the Nigerian min-grid market since 2010.

The report audited ten operational mini-grids across the country in 2018, with a view to assessing the viability, operational support and willingness of consumers to transition to Mini-grid systems as an alternative to unreliable electricity supply and high costs of self-power generation through carbon emitting generators.

The Report notes that mini-grids have evolved from a publicly owned government initiative to projects funded by private equity and debt capital.

[12] RMI Nigeria Mini-grid Investment Report 2018.

Data collected during the report estimates rural electrification to be one of the country's major challenges with over 36% of the population resident in rural areas lacking access to electricity. When considered with the fact that over 55% of Nigeria's population lacks access to electricity, the utilization of commercial mini-grids becomes an appealing option.

Nigeria's Power Sector Recovery Programme (PSRP) estimates that the erratic supply of power results in an annual economic loss in excess of US$25 billion as more than 80% of business owners face electricity challenges. This erratic power supply and non-existence of grid connections also creates socioeconomic challenges such as food insecurity, lack of access to potable water, education, information, and healthcare. Yet, the RMI/NESG report estimates the investment opportunity in the Nigerian Mini-grid Market as worth a potential annual revenue of about USD 8 billion annually.

6.6. Policies, Regulations and Incentives for Renewable Mini-grids

Nigeria has implemented policies, regulations, and incentives to support the development of renewable mini-grids as part of its efforts to enhance energy access and promote sustainable development. These measures include:

1. the Rural Electrification Fund (REF) managed by the Rural Electrification Agency to promote cost-effective expansion to un-electrified areas via renewable off-grid and on-grid solutions;

2. the National Electricity Regulatory Commission Mini-grid Regulations 2023 which assures an isolated mini-grid compensation in the event that a Distribution Licensee extends its network to areas previously uncovered by the isolated mini-grid;

3. incentives under the National Renewable Energy and Energy Efficiency Policy (NREEEP) such as:
   - Free Custom Duties for two (2) years on the importation of equipment and materials used in renewables and energy efficiency projects;
   - Granting access to project developers to obtain soft loans and special low-interest loans from the Renewable Electricity Fund for renewable energy supply and energy efficiency projects;
   - Advocacy to the Government to ensure that an appropriate economic instrument is put in place to allow generators of renewables to obtain preferred pricing rates.

4. Tax incentives to manufacturers of renewable energy, and energy efficient equipment and their accessories include:
   - five-year tax holiday for manufacturers from date of commencement of manufacturing; and
   - five-year tax holiday on dividend incomes from investments on domestic renewable energy source.

In essence, the conducive policy environment aims to attract investments and foster the growth of the mini-grid market in Nigeria.

6.7. Nigeria Electrification Project (NEP) Solar Hybrid Mini Grids for Rural Economic Development

The Rural Electrification Agency's Nigeria Electrification Project (NEP) funded by the World Bank was set up to facilitate the development of private sector mini grids in unserved areas across Nigeria. The NEP which aims to electrify 300,000 households and 30,000 local enterprises has been instrumental in deploying solar hybrid mini-grids to electrify rural and underserved communities. In 2023, the NEP hit the milestone of successfully deploying 103 mini-grids across Nigeria under its Performance Based Grant (PBG) subcomponent. This therefore signified a major advancement in expanding access to clean, reliable and affordable energy by households, micro, small, and medium enterprises (MSMEs), as well as public facilities in rural and underserved regions of Nigeria.

6.8. Critical Success Factors for deployment of Mini-grid Success Factors

a. **Community Engagement/Participation:** Involving local communities in the planning, design, and management of mini-grid projects is essential. Community engagement fosters ownership, trust, and support, ensuring that the project meets the specific needs and priorities of the community. It also enhances the long-term sustainability of the mini-grid by promoting local buy-in and participation.

b. **Regulatory and Policy Support:** A supportive regulatory and policy environment is crucial for the successful deployment of mini-grids. Clear and consistent regulations, licensing procedures, and tariff structures enable developers to navigate the regulatory landscape efficiently and make informed investment decisions. Governments play a pivotal role in creating an enabling environment for mini-grid deployment through incentives, subsidies, and streamlined permitting processes.

c. **Technological Suitability and Reliability:** Selecting appropriate technology solutions that are suited to local conditions and energy needs is essential for the success of mini-grid projects. Reliable and efficient equipment, such as solar panels, wind turbines, batteries, and smart meters, ensures the uninterrupted supply of electricity to end-users. Investing in high-quality, proven technologies and implementing robust maintenance and monitoring systems is crucial for the reliability and performance of mini-grids.

d. **Viability and Operational Efficiency:** Designing mini-grid projects with scalability and replicability in mind is essential for achieving widespread impact and sustainability. Scalable projects can be expanded or replicated to serve additional communities or regions, maximizing the benefits of investment and resources. Standardized design, modular technology solutions, and knowledge sharing facilitate the scalability and replicability of mini-grid projects.

e. **Security (Vandalization/Bypass of Metering Connections and Power Theft):** Implementing physical security measures is essential to protect mini-grid infrastructure from vandalism and theft. This may include fencing off the mini-grid site, installing security cameras and lighting, and employing security personnel to deter unauthorized access. Adequate signage and community awareness campaigns can also help discourage vandalism and promote a sense of ownership and responsibility among community members. Deploying smart metering technology with remote monitoring capabilities can help detect and deter meter tampering and bypass. Smart meters equipped with tamper detection features can alert operators to any unauthorized access or manipulation of metering connections. Remote monitoring systems allow operators to track energy consumption, detect anomalies, and respond promptly to security breaches, enhancing the overall security and integrity of the mini-grid system. Obtaining insurance coverage for mini-grid infrastructure can also help mitigate financial risks associated with vandalism, theft, and equipment damage

f. **Efficient Pricing and Economically Viable Sites Selection:** Choosing economically viable sites for mini-grid deployment is essential to ensure the long-term financial viability of the project. Site selection criteria typically include factors such as population density, energy demand, proximity to existing infrastructure, and availability of renewable energy resources. By targeting sites with sufficient energy demand and revenue potential, mini-grid developers can optimize their investment and maximize the return on investment (ROI) whilst providing reliable electricity services to communities in need. Furthermore, setting tariffs at affordable levels for end-users is crucial to ensure widespread adoption and acceptance of mini-grid services. Affordability considerations take into account the income levels and purchasing power of the target population, as well as the perceived value of electricity access. Implementing tiered pricing structures or pay-as-you-go (PAYG) models can help tailor tariffs to different income groups while ensuring that the service remains accessible and affordable for all users.

g. **Government Subsidies and Support:** Government subsidies and support mechanisms can play a crucial role in making mini-grid electricity affordable and financially viable, particularly in underserved and remote areas. Subsidies can be provided in various forms, including capital grants, feed-in tariffs, tax incentives, and revenue guarantees, to reduce the upfront costs of mini-grid development and operation. Government support also extends to policy and regulatory frameworks that facilitate mini-grid deployment, streamline permitting processes, and provide regulatory certainty for investors.

6.9. Access to finance for Commercial Mini-grids

Regional and international organizations including corporate and multilateral bodies have been actively involved in providing financing initiatives to support the development and deployment of mini-grids. These funding initiatives include grants, equity investment, concessional loans, technical assistance, and capacity building support aimed at catalyzing investments in mini-grid projects. By leveraging these financing mechanisms, stakeholders can overcome financial barriers and accelerate the implementation of mini-grid initiatives.

The table below sheds light on the financing mechanism provided by some of the donor- organizations.

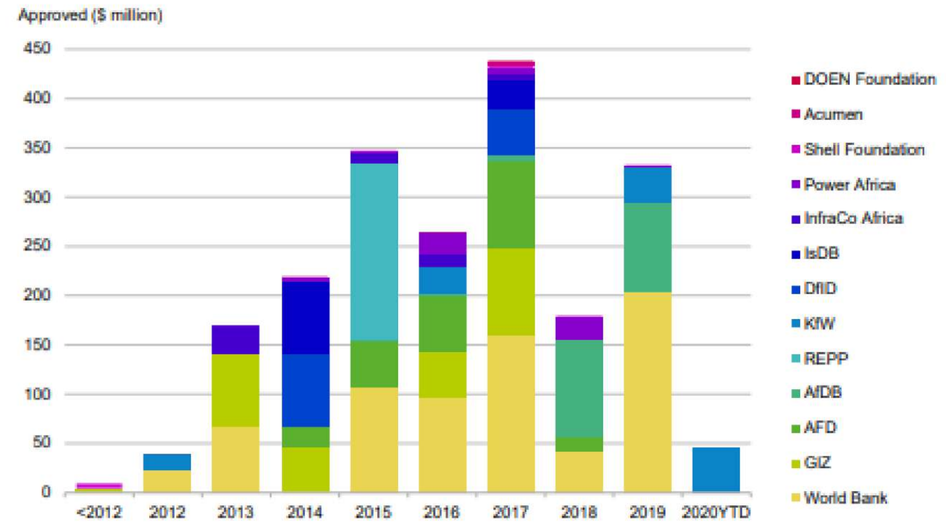
Select mini-grid financiers

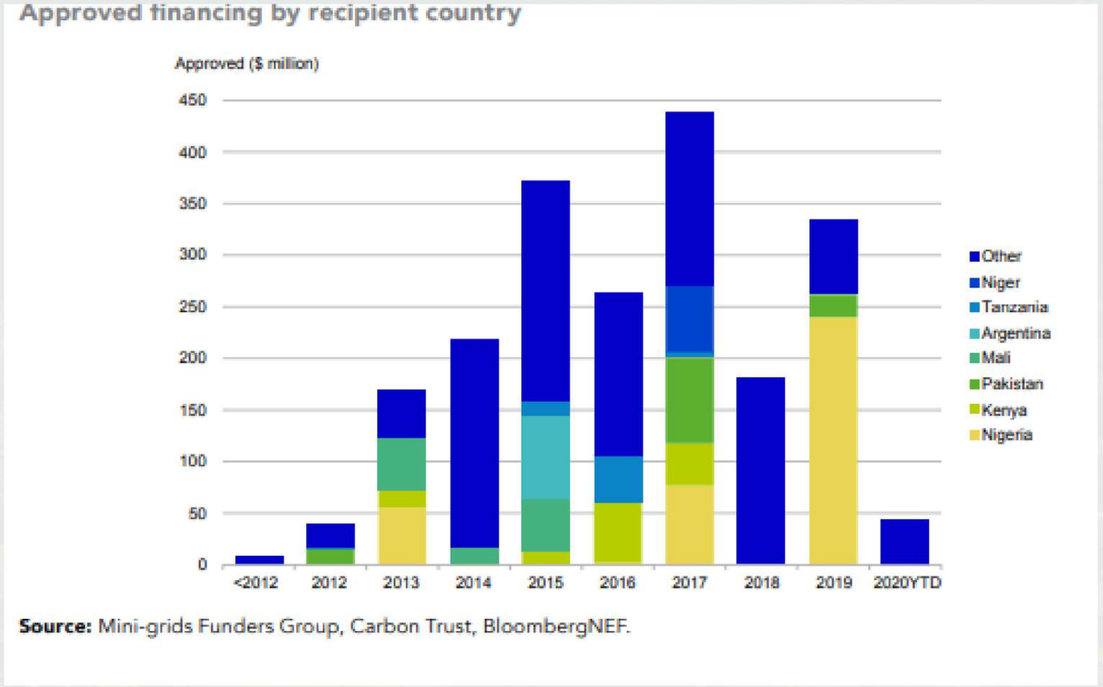
	DFI/donor/ public fund	Foundation/ Impact investor	Commercial financier	Strategic investor
Grants	endev, AFD, UKaid, CIF, ADB, USAID, REPP, Sweden Sverige	The Rockefeller Foundation, Shell Foundation, IKEA Foundation		
Equity		The Rockefeller Foundation, FACTOR[e] VENTURES, KAWI SAFI, dob equity	CROSSBOUNDARY ENERGY ACCESS	TEPCO Power Grid, YOMA, NEoT CAPITAL, Sumitomo Corporation, MITSUI&CO., ITOCHU, TOYOTA TSUSHO
Debt	WORLD BANK, ADB, REPP, GREEN CLIMATE FUND	The Rockefeller Foundation, ceniarth	SUNFUNDER	

Source: BloombergNEF, company websites. **Note:** The organizations here are limited to those that have financed the mini-grid sector. Often governments provide grants with loans directly from DFIs.

Furthermore the State of the Global Mini-grids Market Report 2020 revealed that over the past 10 years, the World Bank has approved a total of USD 705 million for mini-grids, followed by USD 253 million from the German Agency for International Cooperation (GIZ) and USD 227 million from the French Development Agency (AFD). The UK government has equally approved a total of USD 383 million. 79 percent of the approved funding has been for the benefit of Sub-Saharan Africa while 14 and 4 percent have been for Asia and Latin America respectively. In these regions, the total funding approved has further been narrowed down to only 10 countries, with Nigeria receiving the largest amount totaling USD 374 million and Kenya receiving the second largest at USD 132 million.

Approved financing by funder





Source: Mini-grids Funders Group, Carbon Trust, BloombergNEF.

6.10. Investment Opportunities in the Nigerian Mini-grid Market

The Nigerian mini-grid market presents attractive investment opportunities for domestic and international investors. With a conducive policy environment, a growing demand for energy access, and supportive financing mechanisms, the market offers avenues for investments in project development, technology deployment, and operational management of mini-grid systems. These investment opportunities align with the country's commitment to expanding energy access and driving sustainable development through decentralized energy solutions.

In the Nigerian energy sector, there are notable market trends in commercial mini grids. These trends include:

1. **Increasing Investment:** There is a growing interest from private investors and development finance institutions in funding commercial mini grid projects in Nigeria. This investment is driven by the need to provide reliable electricity to underserved communities and businesses.

2. **Regulatory Support:** The Nigerian government has shown support for the development of mini grids through policies and regulations that create an enabling environment for private sector participation. This has led to increased confidence among investors and developers.

3. **Technology Advancements:** Advancements in solar, battery storage, and smart grid technologies have made commercial mini grids more efficient and cost-effective, further driving their adoption in Nigeria.

4. **Rural Electrification:** Commercial mini grids are playing a crucial role in rural electrification efforts, providing clean and reliable power to off-grid communities and businesses, thus contributing to economic development in these areas.

5. **Public-Private Partnerships:** There is a growing trend of public-private partnerships in the development of commercial mini grids, leveraging the strengths of both sectors to expand electricity access in Nigeria.

These market trends indicate a positive trajectory for commercial mini grids in the Nigerian energy sector, with increasing investment, regulatory support, technological advancements, and a focus on rural electrification driving their growth.

7. ASSSESSING THE LEGAL AND REGULATORY FRAMEWORK FOR AFRICA'S CLEAN ENERGY SECTOR

Africa has witnessed a growing recognition of the importance of clean energy and sustainable development, leading to the adoption of various laws, policies, and regulations aimed at promoting renewable energy deployment and mitigating climate change impacts. Many countries have enacted renewable energy targets, feed-in tariffs, and incentive schemes to attract investment and facilitate market development. Additionally, regional initiatives such as the African Union's Agenda 2063 and the African Renewable Energy Initiative (AREI) have provided a strategic framework for advancing clean energy transitions across the continent.

Despite these efforts, challenges persist in the legal and regulatory landscape for clean energy in Africa. Inconsistent and fragmented regulatory frameworks across countries pose barriers to investment and project development, hindering the scalability and replicability of clean energy solutions. Limited access to financing, inadequate grid infrastructure, and political instability further complicates the implementation of clean energy projects. Moreover, gaps in enforcement mechanisms and capacity constraints within regulatory bodies undermine the effectiveness of existing regulations, leading to delays and uncertainties for investors and developers.

7.1. Challenges in Existing Framework

a **Regulatory Fragmentation:** The lack of harmonization and consistency in regulatory frameworks across African countries creates uncertainty for investors and developers, hampering the scalability and integration of clean energy projects.

b. **Access to Financing:** Limited access to financing remains a significant challenge for clean energy projects in Africa, particularly for small and medium-sized enterprises (SMEs) and decentralized energy solutions. High upfront costs, perceived investment risks, and inadequate financial mechanisms hinder project development and deployment. The lack of access to finance for clean energy adoption formed the basis of the NAIROBI Declaration on Climate Change and Africa's unified stance at COP 28. Africa currently receives only 2% of global climate funding with a deficit of over USD 2.8 Trillion needed to achieve universal access to energy by 2030[13]. Nigeria has also had to delay its energy transition plan by a full decade due to funding challenges.

c. **Grid Integration:** Inadequate grid infrastructure and technical challenges in grid integration pose obstacles to the deployment of clean energy projects, particularly in remote and rural areas. Grid modernization efforts are needed to accommodate variable renewable energy sources and enhance system flexibility.

[13] Africa To Be $2.8 Trillion Short Of Climate Finance By 2030 - [12] RMI Nigeria Mini-grid Investment Report 2018..

d. **Capacity Building:** Capacity constraints within regulatory bodies and government agencies impede effective implementation and enforcement of clean energy regulations. Strengthening institutional capacity and fostering collaboration between stakeholders are essential for enhancing regulatory oversight and promoting transparency and accountability.

7.2. Strengths of the Existing Framework

The legal and regulatory framework governing the clean energy sector plays a pivotal role in shaping the development, deployment, and adoption of renewable energy technologies. In Africa, the strength of the existing framework varies across countries, reflecting diverse political, economic, and social contexts. Our assessment of the legal and regulatory landscape reveals both opportunities and challenges for advancing clean energy transition in the region.

a. **Policy Commitments and Targets:** Many African countries have demonstrated strong political will and commitment to clean energy transition through the adoption of national energy policies, strategies, and targets. These policy frameworks set ambitious goals for renewable energy deployment, energy access expansion, and emissions reduction, providing a clear roadmap for sustainable development. Countries like Nigeria and South Africa have implemented Energy Transition Plans and Carbon Taxation with a view to achieving carbon neutrality over the next couple of decades.

b. **Regulatory Incentives and Support:** Governments across Africa have implemented regulatory incentives and support mechanisms to promote investment in clean energy projects. These include feed-in tariffs, tax incentives, renewable energy auctions, and favorable permitting processes, which encourage private sector participation and facilitate project development.

c. **Capacity Building and Technical Assistance:** Efforts to strengthen institutional capacity and provide technical assistance for clean energy deployment have been observed in many African countries including Kenya, Nigeria, South Africa and Egypt. The establishment of training programs, workshops, and knowledge-sharing initiatives enhance the capabilities of government agencies, regulatory bodies, and stakeholders, facilitating the implementation of effective policies and regulations.

d. **Regional Integration and Cooperation:** Regional initiatives and partnerships promote collaboration and knowledge exchange among African countries, fostering regional integration and cooperation in the clean energy sector. Platforms such as the African Union's Agenda 2063, the African Renewable Energy Initiative (AREI), the Nairobi Declaration on Climate Change, the African Carbon Markets Initiative and the African Mini-grids Programme and regional economic communities facilitate coordination on energy policy, regulation, and infrastructure development.

7.3. Recommendations for Strengthening the Framework

a. **Harmonization and Standardization of Regulatory Framework:** Enhancing harmonization and standardization of policies, regulations, and technical standards across African countries can promote consistency, clarity, and investor confidence in the clean energy sector. Harmonized frameworks facilitate cross-border trade, investment, and project development, unlocking economies of scale and driving cost reductions. However, the different challenges and levels of development should be considered in such harmonization objectives.

b. **Capacity Development and Institutional Strengthening:** Continued investment in capacity development and institutional strengthening is essential to build the expertise and capabilities needed to effectively implement and enforce clean energy regulations. Training programs, technical assistance, and knowledge-sharing platforms should target policymakers, regulators, industry professionals, and civil society stakeholders. Galvanized effort at increasing the knowledge base of stakeholders in the clean energy sector will go a long way in fast tracking Africa's journey to clean energy adoption and carbon neutrality.

c. **Inclusive Stakeholder Engagement:** Meaningful engagement of diverse stakeholders, including government agencies, regulatory bodies, industry players, civil society organizations, and local communities, is critical for developing inclusive and effective clean energy policies and regulations. Consultative processes can ensure that the interests, perspectives, and priorities of all stakeholders are taken into account, fostering ownership, transparency, and accountability.

d. **Innovative Financing Mechanisms:** Exploring innovative financing mechanisms, such as green bonds, climate funds, and public-private partnerships, can mobilize additional resources and investment for clean energy projects in Africa. Governments should leverage international climate finance, development assistance, and private sector investment to scale up clean energy deployment and address financing gaps.

e. **Adoption of Emerging Technologies:** Anticipating and adapting to emerging clean energy technologies and market trends is essential for ensuring the relevance and effectiveness of regulatory frameworks over time. Regulatory agility and flexibility enable governments to accommodate innovations such as energy storage, smart grids, and digital energy solutions, facilitating the integration of new technologies into the clean energy ecosystem.

8. CONCLUSION

Clean energy transition presents the opportunity for the World Economies to limit rising global temperatures through emission reduction, mitigate the adverse impacts of climate change, promote the well-being of individuals (particularly women and children), increase access to clean cooking, realise the UN Net-Zero target, and achieve affordable and reliable universal access to energy.

As spotlighted across the Guide, the transition to clean energy requires the collective efforts of all sectors of the global community in accelerating the adoption and expansion of renewable energy technologies. This collective effort is particularly needed in funding and regulatory support to ensure a proper balance of the interests of energy generators, consumers' energy needs and the environment.

The energy gap, particularly pronounced in regions like Africa, underscores the urgent need for innovative approaches to bridge disparities in energy access. Renewable energy stands as the cornerstone of our transition towards sustainability. Harnessing the power of solar, wind, hydro, and other renewable sources not only provides clean and reliable electricity but also mitigates the adverse effects of climate change. The importance of renewable energy cannot be overstated—it is not only an essential tool for achieving carbon neutrality but also a catalyst for economic growth, job creation, and social development.

Commercial Mini-grids in particular hold the potential to electrifying a significant number of people by 2030 and driving economic growth. Commercial mini-grids, with their ability to deliver affordable and sustainable electricity services, represent a game-changer in our quest for universal energy access. By leveraging private sector expertise and investment, we can accelerate the deployment of mini-grids, reaching communities that have long been left in the dark. These mini-grids not only provide power for lighting and household needs but also unlock opportunities for education, healthcare, and entrepreneurship, driving progress and prosperity at the grassroots level.

The advancement of Mini-grids therefore requires enabling regulatory policies and financial commitments. It is therefore imperative that governments, businesses, investors, and communities come together to overcome barriers, foster innovation, and create an enabling environment for the widespread deployment of commercial mini-grids. By harnessing the power of collaboration and innovation, we can pave the way for a sustainable energy future that benefits humanity.

Looking ahead, the potential to achieve carbon neutrality and universal access to energy has never been greater. With bold policy interventions, technological innovation, and collaborative partnerships, we can pave the way towards a future where clean energy is accessible to all, and where our planet thrives in harmony with nature.

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DealHQ is an Africa-focused deal advisory/boutique commercial law firm focused on supporting businesses and positioning them to operate efficiently within their market sphere. We are known for our quality service delivery which is focused on attention to detail, creativity, timely execution, and client satisfaction.

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