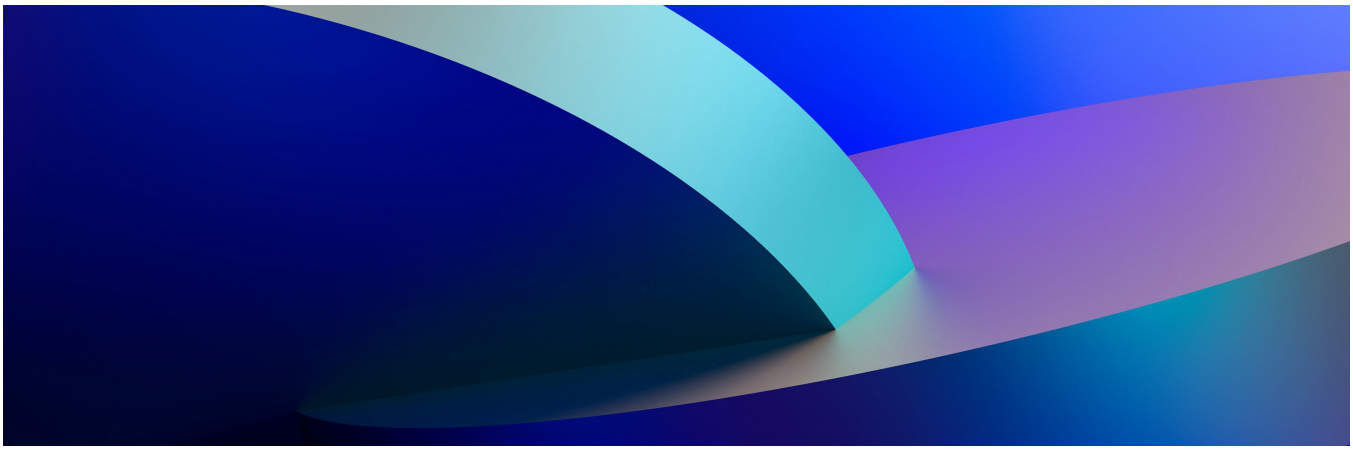

Renewable energy in Angola

1. Introduction

Like many nations worldwide, Angola is focused on achieving the United Nations' Sustainable Development Goals (“SDGs”). Among these goals, Angola has a particular focus on SDG No. 7, which emphasises the need to ensure access to reliable, sustainable, and modern energy sources for all citizens. In pursuit of this objective, Angola has undertaken significant efforts to both increase its electrification rate and diversify its energy sources.

One of the recent milestones in this endeavour is the approval of the General Guidelines for the Rural Electrification Plan in 2023. This ambitious plan aims to bring electricity to remote areas of the country that currently lack access to the national power grid. By adopting this strategy, Angola seeks to bridge the energy divide and provide its citizens with access to cleaner and more dependable energy sources.

To further address SDG 7, Angola has been actively implementing solar energy solutions. They have been building hydro power plants, and solar power plants, as well as off-grid and micro-grid systems, through strategic partnerships and external financing agreements. By harnessing the abundant solar potential, Angola aims to reduce its reliance on traditional fossil fuels, such as oil and natural gas, and unlock its potential to become a prominent solar energy hub.

As a result of these efforts, Angola is presenting itself as an attractive country to foreign investors seeking sustainable and renewable energy ventures. The country's commitment to transitioning away from fossil fuels demonstrates its readiness to embrace solar energy as a key driver for future energy security and environmental preservation.

In this renewable energy guide, we will explore Angola’s current initiatives, highlight successful projects, and shed light on the numerous opportunities for investors looking to participate in the transformation of Angola's energy landscape.

2. Brief overview of renewables sector

Angola is a country with abundant indigenous energy resources. Its geographical features grant it one of the highest potentials for hydroelectric production in Africa. Moreover, the country's vast territory and geographical location offers an exceptional capacity for solar energy generation.

In recent years Angola has experienced continuous growth in energy production as a result of

intensified exploration of all energy sources, reaching 14.92 million tonnes of oil equivalent in 2019, and registering 1,424 TWh of electricity production in 2021. While oil showed substantial growth from 2005 to 2014, biomass surpassed oil in 2020 as the leading energy source in the overall mix. Hydro, however, remains a significant player in the energy landscape being responsible for the production of 3,676 MW of electricity in 2021.

More recently, the Angolan Government has been taking steps towards increasing the country's solar energy capacity. The country kicked-off the construction of its first solar power plants in 2022 with other solar projects are underway and expected to be concluded in 2023, in an effort to accelerate the country's energy transition and reduce reliance on diesel and coal fired power generation.

Regarding energy consumption, the residential sector accounts for 63.9% of the total energy consumption, followed by 18.9% in the transportation sector, 10.6% in the industrial sector, and 4.7% in the services and commerce sector. In 2019, approximately 54.6% of the final energy consumed in Angola came from renewable sources, with biomass contributing 46.9% and hydropower 7.7%.

The electrification rate in Angola remains relatively low compared to many other countries, but the government's efforts have shown progress. According to studies carried out in 2022 (ENDE, 2022), only 42.8% of the population had access to electricity (67% in urban areas and 23% in rural areas). The government aims to achieve a 60% electrification rate by 2025.

Electricity consumption has remained relatively stable over the last five years, averaging 297 kWh per capita in 2021. Nevertheless, it is expected to reach 1,230 kWh per capita by 2025, which is due to factors such as population growth, rising disposable income, increased consumption rate among electrified customers, and Angola's industrialisation.

Angola's current energy legislation is quite diverse but the sector still awaits specific legislation on renewable energies, which should include mechanisms to protect private sector investments, and the definitions of tariffs and contracts. Nevertheless, there have been recent investments in large solar power plants and hydro projects which are currently being developed. The Angolan government has also been investing, alongside with the private sector, on mini and micro grids and other off-grid projects to fulfil its established electrification goals and the development of rural areas.

3. Recent developments in the renewables sector

Angola continues to implement the 2025 National Strategy for the New Renewable Energies, which provides an in-depth look at the goals that Angolan wishes to meet by 2025.

The strategy seeks to contribute to the National Energy Security Policy and Strategy, promoting the diversification of national energy, and to the Program of Integrated Rural Development and Poverty Combat, to promote growth and employment.

Internationally, Angola considers that this strategy contributes to its climate change commitments and is in line with its participation in SADC (Southern African Development Community) and IRENA (International Renewable Energy Agency).

The Angolan government's target is that in 2025 at least 7.5% of the electricity generated in the country (equivalent to an installation of 800MW) will come from new renewable energies (major hydro projects are not included). In order to reach this goal, the Angolan authorities identified three priorities:

- Improve access to energy services in rural areas based on renewable energy (e.g. the "Solar Villages" programme, creation of distribution networks and service providers throughout the territory).

- Develop the use of new grid-connected renewable technologies – with targets and guidelines for each type of renewable energy and the promotion of investment.
- Promote and accelerate public and private investment – e.g. the creation of specific legislation for renewables, a system of tariffs such as “feed- in” for projects up to 10MW, and credit lines to stimulate private sector initiatives in rural areas.

In order to promote investment in the renewables sector by 2025, the Angolan government is considering implementing the following actions:

- Approve specific laws for new renewable energies.
- Approve pre-defined subsidised tariffs for renewable projects to be grid-connected of up to 10MW and review the tax system.
- Allocate an amount of at least 1bnKz per year to the National Electricity Fund by 2025 to support rural electrification programmes based on renewable energies, and establish subsidised credit lines for the purchase of individual systems or the launch of productive activities.
- Ensure the establishment of at least one training centre for renewable energies.
- Launch a media campaign about renewable energy and its advantages, particularly as a means of bringing basic energy services to rural areas and boosting solar thermal energy.

More recently, the Government approved the General Guidelines for the Development of the Rural Electrification Plan through Executive Decree No. 78/23, of 30 May 2023. The main objective of this plan is to bring electricity to remote areas of the country that currently lack access to the national power grid and are not expected to be connected within the next 10 years. The guidelines encompass short, medium, and long-term goals.

Short-term objectives include:

- Adopting a political and regulatory framework that encourages private sector participation in electrification through installation, operation, maintenance, and energy commercialization.
- Implementing fiscal incentives to boost private sector investment in electrification.
- Implementing risk mitigation measures for investments.
- Developing a public tender pilot project for the installation of mini-grids by private operators to validate the model for replication.
- Establishing a planning unit (National Electrification Agency) to execute programs for mini-grids and solar kits in identified areas, ensuring future public tenders are well-planned and providing guidance to potential private operators and financial partners.

As for medium and long-term objectives, the focus lies in developing large-scale public tender (consolidating lots of mini-grids for bidding) to achieve universal access to electricity between 2025 and 2030.

4. Forthcoming developments / opportunities in the renewables sector

The Angolan government has conducted a thorough assessment of the potential of Angola in the renewable energy sector. Highlights include:

Solar energy: solar radiation is high and constant throughout the territory, with 55GW of generation potential. According to government studies, Angola has a high potential solar resource, with a global annual horizontal solar radiation between 1,370 and 2,100kWh / m2 / year.

The first two Angolan solar power plants are under construction in the municipality of Biópio and Baía Farta, Benguela province. The project totals more than 500,000 solar panels and the solar energy

production has a capacity of 285MW. In 2023, the construction of one more solar power plant was launched in Namibe province. The Caraculo Solar Plant has 25 MW installed, corresponding to 46,000 panels, and it is the first public-private partnership in the area of renewable energies.

Currently, there are several solar energy projects in various stages of execution:

1. The construction of seven solar plants in six different provinces (Benguela, Moxico, Luanda Sul, Bié, Huambo, and Luanda Norte) with a combined capacity of 370MW.
2. The development of a solar plant in Lubango with a capacity reaching up to 80MWac/100 MWp, along with two other solar power plants.
3. The electrification of 61 communities in the provinces of Malanje, Bié, Moxico, Lunda Norte, and Lunda Sul, achieved through the installation of hybrid photovoltaic generation systems with lithium-ion battery storage.
4. The electrification of 26 municipal headquarters and 56 communities in the provinces of Cunene, Huíla, Cuando-Cubango, and Namibe. This project includes the construction of 65 solar mini-grids, generating approximately 220MW of energy, with energy storage capacity of 287MWh.
5. The construction of two solar power plants in Catete (104MW) and Laúca (400MW).
6. The construction of a 90MWp grid-connected photovoltaic power plant in Cabinda, along with a 25MWp battery storage system.

The combined capacity of all these projects is expected to reach approximately 1,200MW upon completion.

Hydropower: hydro potential is currently estimated at 18GW, with numerous rivers with adequate flows and falls identified to support smaller projects (up to 10MW) throughout the territory. The river basins of Kwanza, Cunene, Catumbela and Queve (representing 86% of the estimated potential) were identified as the best targets for this technology. Several other rivers throughout the territory have conditions for smaller size projects.

Angola currently has around 3.7GW of active hydro power installed and producing. Additionally, there are five more hydro power projects under construction for energy production. The largest of these projects will be Caculo Cabaça, located in Malanje, with an installed capacity of 2.07GW, followed by Baynes in Cunene with 300MW, and Ecológica Laúca in Malanje with 65.50MW.

Biomass energy: Angola’s forests, the existing forest polygons, the favourable agricultural areas for the planting of sugar cane or other crops with energy potential, the farming of livestock and municipal solid waste, all have the potential to generate energy in excess of 3GW. The Central Region (the provinces of Huambo, Bie and Benguela) and the Eastern Region (the provinces of Moxico, Lunda Sul and Lunda Norte) are the most favourable zones in terms of forestry and agro-industry resources.

However, there is only one operational biomass project in Angola, which generates an average of 30MW of electricity from sugarcane industry waste in the province of Malanje. In 2022, the management of the Mulenvos Landfill was privatized under a public-private partnership to transform the landfill into a waste valorization center. The Mulenvos Landfill remains the only landfill project in the country at present, however another project of this kind, the Catenguenha Landfill in the Huambo Province, is in the works.

Wind energy: recent studies concluded that the wind in the southwest and on the Atlantic slope, along to the north-south axis, present favourable conditions for the installation of more than 3GW of wind farms.

Currently, Angola does not have any wind energy projects in operation, although there has been interest in developing a wind project in Malanje. The proposed project involves implementing wind

turbines for electricity generation at two different locations: Kiwaba Nzoji I and II, with a total capacity of 104 MW. However, there have been no further developments on this project yet.

Other renewables: geothermal signs of average enthalpy in the centre of the country and an extensive ocean coastline also constitute potential resources to be explored and developed.

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