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Editorial Feature

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An Energy Efficient Future for Africa

The Advent of Renewables-Based Micro-Grid Solutions in Cape Verde and Angola

Regulatory frameworks can play a critical role in attracting investment and ultimately electrifying a nation

African Innovation

Africa has often shown the world how necessity leads to innovation, overcoming lack of resources and infrastructures with the integration of modern technologies in unexpected ways.

In early 2000 Africa made a major breakthrough in telephone communications. At that time, sub-Saharan Africa as a whole had less fixed telephone lines than Manhattan alone. Most rural settlements had no access to fixed line networks, some countries showing penetration rates of less than 3% in remote areas. One would have expected a gradual growth of fixed lines, slowly covering areas without coverage, with significant investment in fixed infrastructure. Instead, Africa leapfrogged stages of technological development by installing mobile infrastructure and directly connecting to mobile devices. In 2006, although fixed lines were still scarce, 45% of rural settlements in Africa had mobile phone coverage. More recently, coverage has reached 90% of the territory in several countries, including Comoros, Kenya, Malawi, and Uganda. In simple terms, in the flash of an eye, Africa jumped over 30 years of technological evolution and proved that less developed regions can quickly meet modern standards under the right conditions and with the correct vision.

This leapfrogging may be applied to other types of technology as well, including for electrification.

Angola and Cape Verde

Angola and Cape Verde face similar difficulties in terms of power supply to those faced in the past by the continent in the telecommunications sector. As a matter of fact, in Angola the current electrification rates are estimated at 51% in cities and less than 3% in rural areas. Although Cape Verde shows better figures, with 96% of urban population and 79% of rural population having access to electricity, both countries still have some catching up to do to reach the rates found in more developed countries. However, the infrastructure challenge is significant, as both countries suffer from insufficient generation and transmission facilities that are incapable of transporting power to most of the remote areas. In order to overcome these difficulties, the Governments of both countries are now considering investing in the creation of isolated micro-grids based on renewables instead of expanding the national high voltage grids through vast distances and/or challenging geography in order to reach remote areas.

Micro-grid Solutions and their Potential in Cape Verde and Angola

Cape Verde

In the case of Cape Verde, power transportation difficulties are easy to identify just by looking at the country's map. The national electricity system is comprised of separate and inefficient power grids on each of its nine inhabited islands. Since inter-island power transportation is not technically viable and the country does not have non-renewable resources, the power supply of each island is mainly based on thermal power stations burning heavy fuel or diesel, which has to be imported, giving rise to one of the highest electricity tariffs in the world. Overcoming this dependency on imported energy resources has been one of the main goals of the country's government over the last six years.

In order to achieve this goal, the government approved a fairly comprehensive legal framework with its main focus on renewables. It is worth mentioning that Cape Verde has an estimated potential of approximately 3,000 MW of renewable energy. To tap into this potential, in 2012, the Strategic Sector Plan for Renewable Energy was enacted by means of Resolution No. 7/2012, of February 3, 2012. This statute foresees the installation of more than 100 MW of renewable-based energy supply by 2020, which would lead to a reduction of at least €30 million in the current fuel importation costs, at the same time saving more than 200.000 tons of CO_2 (with significant additional advantages in terms of carbon trading). The plan envisages that, with the legislative framework put in place, by 2020 at least 50% (100% according to more recent estimates) of the national power supply will be based on renewable resources and transported to remote areas by more modern and efficient infrastructures.

Also with renewable generation in sight, Decree-Law No.1/2011, of January 3, 2011 (since amended by Decree-Law No.18/2014, of February 20, 2014) had already enacted new rules for the promotion, incentive and access, licensing and exploitation of activities related to independent production and self-production of energy based on renewable sources. The intention of this new regime was to decentralize national power production, defining a total of 46 special Renewable Energy Development Areas – REDA – each of which shall have least one power production center.

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Another goal was to ease licensing procedures for producers, making investments in this sector more attractive. According to the above-mentioned Decree-Law No.18/2014, within the REDAs, power production may be conducted either under the general regime (subject to licensing by the General Directorate for Energy), the micro-production regime (subject to mere registration of the operator) or the simplified regime for rural decentralized electrification (subject to licensing by the member of the government responsible for energy). The statute also foresees several incentives that may be granted to companies that engage in any of the above power production activities in the country. Projects developed in the rural and decentralized areas may, in addition, benefit from a special Financing Fund, aimed at financing acquisition of equipment used for electrification programs, as well as for the maintenance of micro-grids.

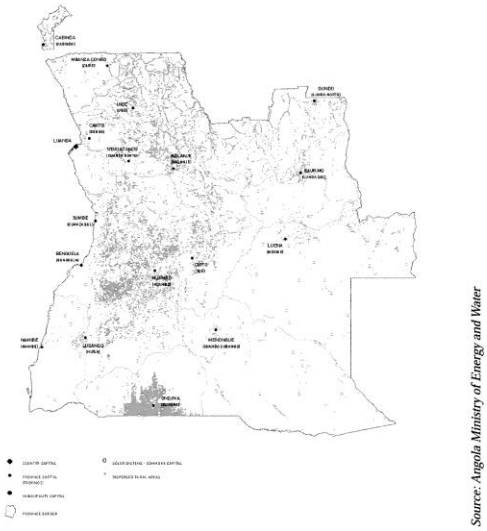
In addition to the above, the Council of Ministers more recently enacted, by means of Resolution No. 100/2015, of October 15, 2015, the National Action Plan for Renewable Energies for the period 2015-2020/2030. This statute completes the new legal framework by providing an ambitious national agenda for the sector.

Experiences have already been made with micro-grid based power transportation. In 2015 the Cape Verdean State, together with several NGO's and UN funding mechanisms, installed a total of 88 solar panels with a global production of 22Kw in the small village of Carriçal, in São Nicolau. The solar plant was connected to a micro-grid infrastructure that transports power to a number of local homes, as well as to the local school, social center and health center, making a huge impact on the community, and laying bare the advantages for other areas of the country.

Angola

Angola faces similar challenges, although for different reasons. One distinctive aspect of Angola is its vast territory. Angola is the seventh largest country in Africa, with an area of approximately 1,246,700 km². Although the majority of its 25 million citizens live in large cities (Luanda has a total of 6.5 million inhabitants) connected to the national grid, most of the populated areas, mainly in the south-east, are not yet served by the national grid. In fact, Angola's power transportation infrastructure is made up of three separate grid systems (northern, central, and southern) in addition to some isolated grids. The northern grid covers the Provinces of Luanda, Bengo, Malange, Kwanza Norte and Kwanza Sul, while the central network includes Benguela and Huambo and the southern grid serves Huila and Namibe.

Since the current electrification rate in rural areas is of only 3%, one of the main goals that the Government defined in the "Angola Energy 2025 – Power Sector Long Term Vision" released by the Ministry of Energy and Water in 2016, is implementing a rural electrification strategy. For this purpose, the Ministry opted for an electrification model known as "Balanced or Economy-based" Model, which foresees an expansion of the national grid as well as the creation of micro-grids for isolated systems, serving energy to around 31 municipalities that have been identified as being too distant from the national grid to justify its extension.



Source: Angola Ministry of Energy and Water

Map of Localities Proposed for the Installation of "Solar Villages"

In line with this strategy, Executive Decrees 304/14 and 303/14, both dated October 3, 2014 enacted the internal regulations of the National Directorate for Rural and Local Electrification, responsible for coordinating and promoting the country's electrification process – and the National Directorate for Renewable Energy – responsible for the creation, promotion, evaluation, execution and monitoring of renewable energy sector policies.

The National Development Strategy for 2013-2017 approved by the Ministry of Energy and Water also included a National Program for Rural Electrification, allocating 1,228.8 million Kwanzas to mini-hydro projects and expansion of the local grids in order to provide power for street lighting.

Regarding the requirements for these types of projects, Decree No. 47/01, of July 20, 2001 which enacted the Regulations on Power Production, sets forth that power production activities aimed at providing electricity to isolated areas of up to 1 MW capacity are merely subject to licensing by the local authorities.

In order to support the implementation of these projects, the latest amendments made to the General Electricity Law (Law no.14-A/96, of May 31, 1996 as amended by Law No. 27/15, of December 14, 2015) foresees the creation of a National Rural Electrification Fund aimed at ensuring the progressive electrification of rural areas.

In the meantime, the new framework has seen some interesting micro-grid electrification projects being launched, and in 2015 the Ministry of Energy and Waters released the National Strategy for New Renewable Energies. Under said strategy the electrification of locations not covered by the national grid should be made through micro-grids or individual systems. One of the most innovative

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projects included in the strategy was the launching of public tenders for the installation of at least 500 local grids (known as solar or renewable villages) based on small photovoltaic power plants, a number of which have already been implemented.

Conclusion

In the coming years, Africa may lead another technological revolution, similar to the one that happened in the mobile telecommunications sector in the early 2000s. This time, micro-grid power generation and transportation infrastructure could be the solution to some of the biggest challenges the region is facing in terms of electrification. Although there are still several regulatory, technological and financial issues that need to be addressed, micro-grids will most certainly be a reality in future electrification projects.

Bankability difficulties are currently being overcome with sovereign guarantees and subsidies, although more autonomous financing solutions are expected to be found when technology prices drop.

In terms of regulation, the micro-grid sector demands clear legal frameworks for integration with the main grid, or as an alternative to ensure solutions that cater to off-grid systems and their specificities. Fair tariffs systems, as well as lighter regulation for the registration and permitting of micro-grid systems are also a pressing need. As described above, these efforts are already being made and, as of today, both Angola and Cape Verde have fairly comprehensive and modern regulatory systems regarding micro-grid projects.

African countries such as Cape Verde and Angola have the advantage of already counting on the prior experience of more developed nations. As a matter of fact, technologies for generation, storage, and smart metering – all critical elements of the future smart grids – have already been developed, tested and improved in other countries and can now be copied with some degree of certainty, and at a lower cost.

All these factors appear to indicate a bright future for micro-grid solutions in Africa, and interesting opportunities for foreign investors, notably as they may hold the key to unleash significant growth, mitigate carbon emissions and reduce energy poverty in these countries. AEA

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