RENEWABLE ENERGY IN AFRICA:

An opportunity in a time of crisis

Kenya

State of electricity

Kenya has one of the most developed power sectors in sub-Saharan Africa, having opened its market to Independent Power Producers (IPPs) in the mid-1990s. Factors contributing to this development include: an active private sector, Kenya Power's long track record as a creditworthy offtaker, and abundant renewable energy resources, especially geothermal, wind and solar. Problems include: limited and aging transmission and distribution infrastructure, access to finance, opaque procurement processes, right of way disputes (where property owners do not willingly give access to power infrastructure), and other challenges affecting sector growth.[1]

Kenya has a well-developed electricity grid compared to other East African countries and significant renewable energy generation. Electricity is mainly generated from Kenyan hydro and geothermal power where Kenya is the ninth largest geothermal electricity producer worldwide.[2]

Of the population 73.4% have access to electricity. In rural areas, 67.6% of the population have access, while in urban areas electricity is available to 89.5% of the population. There are 13.2 million people without access to electricity.

Relevant energy policy for renewable energy

Kenya is in the process of transitioning its renewable energy policy from a feed-in tariff scheme launched in 2012 to an auction-based one. Under the feed-in tariff, the fixed tariff of USD 0.12/kWh for solar projects of 10-40 MW has led to an oversupply in proposed sites. This surplus reduced the incentive to rush large projects to commissioning, and as of August 2018, the rate is no longer available. A draft bill to introduce the auction scheme was passed in parliament in August of the same year, but the government has not clarified further details at the time of publishing. The government plans to price tariffs for solar projects below 10 MW in local currency although it is uncertain when it will take effect or if it will impact operational power plants.

The Rural Electrification Authority (REA) was also established as an entity within the Ministry of Energy and Petroleum (MOEP) under the Energy Act of 2006, which mandates the institution to accelerate rural electrification. REA is mainly financed by a 5% levy paid by all electricity consumers through the Rural Electrification Fund. REA promotes grid extension and intensification activities, as well as the development of micro-grids and electrification of public institutions in rural areas.[2] Retail electricity prices are fully regulated for all customer segments.[3]

[1] https://www.usaid.gov/sites/default/files/documents/1860/Kenya-_November_2018_Country_Fact_Sheet.pdf
[2] Murdock, H.E., Gibb, D., André, T., Appavou, F., Brown, A., Epp, B., Kondev, B., McCrone, A., Musolino, E., Ranalder, L. and Sawin, J.L., 2019. Renewables 2019 Global Status Report.
[3] http://global-climatescope.org/results/ke#power-prices-and-lcoes

Under the latest draft of the National Energy and Petroleum Policy published in June 2015, Kenya would aim to install 5 GW more power-generating capacity by end-2016, of which 1.6 GW will be geothermal, 630 MW will be onshore wind, and 18 MW will be cogeneration. The revised bill has not been enacted.[4]

While one of the cornerstones of the government's 'Kenya Vision 2030' is to increase electricity access, at present nearly half of all Kenyans have no access to electricity at all. In rural areas, approximately 90% of citizens are not connected to any form of grid electricity.

Renewable energy projects

Geothermal accounts for 50% of Kenya's clean energy investments and wind is in second place with 39% of investments. The feed-in tariff and significant past experience in geothermal development means that uncertainty about exploration and the development of new projects or capacity additions is relatively low, and loans are readily available from development finance institutions.

CASE STUDY: Geothermal Power in Kenya - Olkaria V in Olo Nongot

The Olkaria V project is the fifth geothermal project to be implemented in the Olkaria region of Kenya. The plant is located in Olo Nongot village, outside Hell's Gate National Park. It is comprised of two power units rated at 83 MW each, giving a total power output of 166 MW. The plant has been constructed for the Kenya Electricity Generating Company (KenGen) which is 70% owned by the Kenyan government. It will supply power to the national grid via Kenya Power, which is majority government owned. The USD 450 million plant is financed by the Japan International Cooperation Agency (JICA) and construction began in February 2017. The plant became fully operational in October 2019.

At a glance:
Construction company: Steam & Gesto Consortium, which consists of Steam from Italy and Gesto Energy from Portugal.
Operator/owner: Kenya Electricity Generation Company
Technology: Geothermal
Size of plant: 166MW
Cost of plant: USD 450 million
Finance: Concessionary loan from Japan International Cooperation Agency
Community Ownership Share: 0%
Operational Date: 2019

The four previous phases of the Olikaria geothermal development have been plagued with controversy because of the failure of funders, developers and operators to properly engage with, and fairly compensate, local communities. The Maasai people, who live semi-nomadic lives on the land in the Olkaria region, have complained that land and livelihoods have been taken from them without proper compensation. They contend that they have not been consulted meaningfully. Even after mediation between communities and KenGen


Olkaria V Geothermal Power Station

[4] http://global-climatescope.org/policies/4005

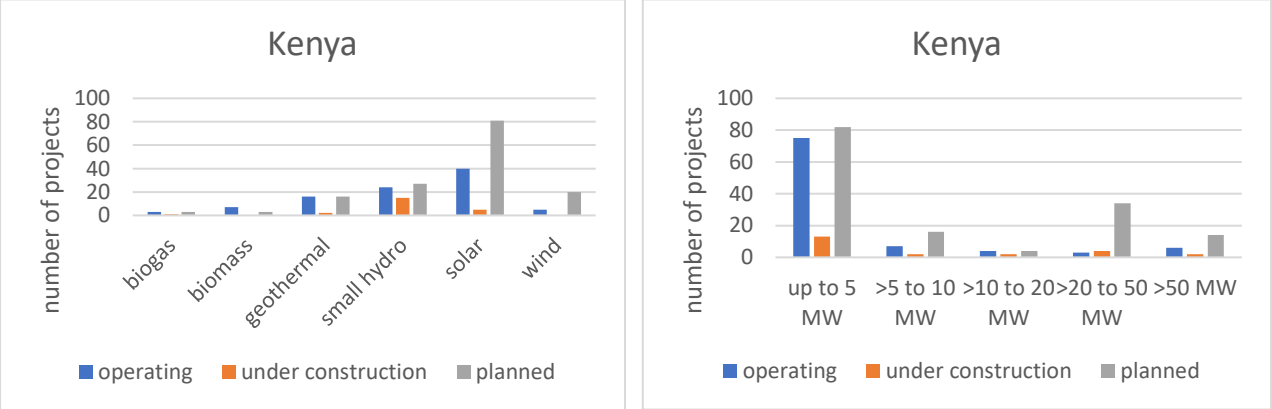
at the insistence of the major funders of previous phases (the European Investment Bank and the World Bank), community members complain that resettlement plan promises have been broken by KenGen.

Important lessons appear to have been learnt from the four prior geothermal projects and inform a new approach in regard to Olkaria V. From the outset of the Olkaria V project, a partnership was formed between community members and KenGen. This partnership was facilitated with USAID funding and technical support from New Zealand energy companies experienced in engaging with communities impacted by geothermal energy, and with community representatives from New Zealand (the Ngati Tahu community).

Through this partnership process, the local community, represented by a group called the Olkaria Maasai community, engaged with KenGen and drew up a document, called Vision 2050. This document sets out the community's expectations of KenGen in eight focus areas, including educational provision, access to land, housing and health. It remains to be seen whether this agreement will be respected.

The majority of the investment in the wind sector was asset financing for the 310 MW Lake Turkana wind project, which came online in November 2018. The Ngong Hills Wind Farm (25 MW – see case study) is owned and operated by KenGen, the largest power producing company in Kenya producing about 69% of the electricity consumed in the country.

In October 2017, Kenya recorded the largest financing deal for solar in sub-Saharan Africa, with the USD 80 million debt financing for M-KOPA, a pay-as-you-go solar firm. It was led by Kenya-based Stanbic Bank's USD 55 million debt, denominated in local currency.[3] The graphs below show the scale of renewable energy at different planning stages, with new large-scale solar being a dominant feature.



Distribution of renewable energy projects in Kenya by technology and scale, by stage of development ('operating', 'under construction', or 'planned'). Source: Authors' estimates from African Energy Live database, September 2019.

Biogas is gaining momentum in Kenya. Over 200,000 biogas systems were installed by 2018, however, the potential for biogas is reportedly not being adequately exploited and contractors were not able to advise farmers of how to use the energy to greatest effect, with the exception of using it for household cooking. A handful of large-scale biogas plants are also under development. Waste-to-energy projects are emerging but are still in their early stages. UNIDO is supporting projects to convert agricultural waste-to-electricity. Co-generation systems are also being applied on a small scale.

Off-grid

The Kenyan market for off-grid, pay-as-you-go solar home systems is the best established in Africa. Kenya had an installed PV capacity in the range of 4 MW in 2018. An estimated 300,000 rural households in Kenya have solar home systems and annual PV sales are between 10,000-20,000 systems. According to the Kenyan Renewable Energy Association (KEREA) the average solar PV system size for households in Kenya is

25-30 Wp and costs, on average, slightly more than a grid connection with Kenya Power and Lighting Company (KPLC). Pay-as-you-go business models make it possible for many to pay for their PV solution from the savings on reduced usage of kerosene and candles. A recent study in 44 of Kenya's 47 counties highlights that solar home systems are also popular among grid-connected urban consumers to compensate for grid unreliability or to save fuel costs.

CASE STUDY: Micro-hydro power – the Tungu-Kabri project in Kenya

The non-governmental organisation (NGO) Practical Action decided, in collaboration with the Kenyan Ministry of Energy, to pilot a micro-hydro system in Kenya to overcome the disproportionate use of kerosene, wood and dung. In the late 1990s, Practical Action picked Mbuiru village in Tungu Kabiri district in central Kenya as their pilot location. The site was chosen after representatives from the NGO studied data which confirmed that the River Tubgu, near Mbuiru, was an ideal location for micro-hydro.

At a glance:

Construction company: The community of Mbuiru with assistance from Practical Action
Operator/owner: The community of Mbuiru
Technology: Micro-hydro
Size of plant: 18 KW
Cost of plant: USD 49 000
Finance: United Nations Development Programme
Community Ownership Share: 100%
Operational Date: 1999

Before they could proceed with the project, Practical Action needed to gain the approval and support of villagers. To do so, the NGO explained what they wanted to do, before detailing how villagers would be expected to build and maintain the system (skills transfer), and how they would own it once it was completed. After 'many questions' from villagers were answered, construction commenced. Over 200 villagers spent every Thursday working on the project after they were each issued with a project ownership share.

After two years the system was switched on, much to the delight of the residents. Mbuiru villager, Mrs Kaburu, states, "This power is wonderful … all of us will feel the benefit for many years to come." The electricity generated by the project supports up to 200 households (approximately 1,000 people) via the charging and distribution of batteries. Batteries are used to support a host of businesses, such as hair salons and welders, while providing much-needed electricity to villagers' homes. A local business centre is also run by the project, which has enabled local farmers to use the Internet to check produce prices and grow crops accordingly. There is also evidence that the presence of electric lights and computers has improved educational outcomes in the village.

Additional positive outcomes from the project include residents having more money to spend on essentials such as clothing, food, and schooling because the cost of electricity is less than kerosene or diesel, as well as the preservation of local woodland which is no longer needed for fuel. Research shows that the involvement of the community in the project has resulted in the community being more effective in dealing with government, has boosted community confidence, and has promoted solidarity among villagers.

Since the project was completed, two more villages in the area have installed similar micro-hydro systems.

The powerhouse in which the turbine and generator are located. Credit: Practical Action.[5]

[5] http://microhydropower.net/ke/Tungu-Kabiri/

Local market

Kenya's robust value chain and international lending presence, relative to its East African Community (EAC) neighbours, makes it the least susceptible to currency risk for developers.[3]

The power prices in Kenya are higher compared to the neighbouring large economies such as Ethiopia and Tanzania, where cheap, large, hydropower is available relatively widely and the government regulates the tariffs lower than the costs. Power prices could decline in Kenya after new renewable energy capacity is added and cheaper hydropower electricity is imported from Ethiopia.[3]Land access has been a challenge for both site selection and transmission connection. The recent Lake Turkana wind farm project faced severe delays in the construction and transmission phases. Generally, administrative processes take a long time and developers often face reluctance by Kenya Power and the Electricity Regulatory Commission in the development of a new project. PowerAfrica describes the main challenges for the sector as being: (1) Inadequate access to project financing, especially early stage risk capital; (2) Land risks in terms of complex forms of ownership, right of way, and community engagement; (3) Long procedures and inconsistency in approval of Power Purchase Agreements (PPAs); and (4) Lack of a clear off-grid regulatory framework.

These policy conditions are not sufficient for the off-grid sector, especially concerning the mini-grid sector in Kenya. Supporting innovative policy solutions, such as creating PPAs that allow for cross-subsidies across market segments is necessary to stimulate this market. Biomass and cook stoves do not attract private capital investors, as much as grid-integrated electricity generation. The scale-up of existing solutions is urgently needed.

CASE STUDY: Wind power in Kenya – The 26 MW Ngong Hills wind farm

Over the last few years, twenty new proposals to develop 1 GW of wind power have been accepted. These proposals are in addition to Africa's largest wind farm, the 310 MW Lake Turkana Wind Power Project, and Kenya's oldest wind farm at Ngong Hills.

The Ngong Hills wind farm, located 20 kilometres from Nairobi on 80 hectares leased from the Kenya Forest Service within the Ngong Forest, was built in 1993. Since 1993, the farm has experienced two phases of development which has increased capacity from 5.1 MW to 26 MW. Phase 3 plans have been approved to increase this capacity to 36 MW, while provisional phase 4 plans have been submitted to add a further 40 MW.

At a glance:

Constructed company: Phase 1 - Iberdrolla/Gamesa (Spain), Phase 2 - TPF-Econoler (Belgium)
Operator/owner: Kenya Electricity Generation Company
Technology: Wind
Size of plant: 26 MW
Cost of plant: USD 47 million (to date)[1]
Finance: Mixture of concessionary loans from governments and private bank funds.
Community Ownership Share: 0%
Operational Date: 1993

The farm is owned by the Kenya Electricity Generation Company (KenGen), which is 70% owned by the Kenyan government. All power generated by the farm is sold to Kenya Power (in which the government has a controlling interest) and fed into the national grid.

Through its community development programme, KenGen has built a primary school in the area and has provided three water points and three public toilets to the local community, which is largely made up of semi-nomadic Maasai people. Local people note that only a handful of entry level jobs, such as cleaners and guards, have been created for locals, while more skilled and better paid jobs are said to go to outsiders. Some community members have benefitted through the sale of Maasai products to tourists who come to visit the farm.

Ngong Hills Site

Most people living in the vicinity of the wind farm say that little, if any, benefit has accrued to them. Residents complain about noise that comes from the turbines, and report that birds regularly fly into the blades at night. The disillusionment that local people feel comes from the fact that they were not consulted about the farm, and they feel they have had no say in its location or operation. In addition, they do not directly benefit as partial owners, while the power that is generated by the farm bypasses them.

Local people feel especially disempowered because they are living on government land over which they have no title. They fear they will be evicted if they complain about the project.

Visit the report webpage at https://350africa.org/renewable-energy-report.