

TOPIC: Solar Power and its development challenges in Kenya.

“The fact that there are approximately 1.3 billion people who lack access to even the most basic levels of electricity, and another billion or so (who is counting?) who lack reliable electric service. They still cannot access solar power despite the fact that solar energy is demonstrably cheaper than conventional diesel power or energy sources such as kerosene or candles. Not to mention less smoky. So, with all of the financing agencies focused on large-scale grid connected auctions such as the one recently completed in Zambia, who is going to deal with the problem of the billions of people who are too poor to attract financing?”(Danley, 2016)

Energy experts reckon that micro and mini grids, especially those that rely on solar-powered sources, offer Africa the shortest route to lighting off-grid towns where stretching national power grids is not cost-effective.

With World Bank support, Kenya has recently launched the Multi-tier Framework (MTF) Survey to accurately estimate the quality of energy access based on the attributes of energy service such as: Affordability, Reliability, and Legality to supply alternatives, energy-related expenditure and user preferences & satisfaction so as to develop a nuanced understanding of the socioeconomic profile of communities in these 14 counties in the north and northeastern parts of Kenya which collectively represent 72 percent of the country’s total land area and 20 percent of the country’s population.

There are 14 underserved counties in the north and northeastern parts of Kenya which collectively represent 72 percent of the country’s total land area and 20 percent of the country’s population. They are Garissa, Isiolo, Kilifi, Kwale, Lamu, Mandera, Marsabit, Narok, Samburu, Taita Taveta, Tana River, Turkana, Wajir, and West Pokot. Their population is highly dispersed, at a density four times lower than the national average. They present profound infrastructure deficits, including lack of access to roads, electricity, water, and social services. There is also significant insecurity in certain areas, giving rise to substantial numbers of displaced persons and livelihood adaptations that further undermine economic prosperity.

National Electrification Strategy¹ (NES)

The people inhabiting the underserved areas (with the footprint in off-grid areas negligible) are largely cash poor, nomadic, and pastoralist—in contrast with those living in grid-connected areas—also known as the core market. *Therefore, the challenge is to create mechanisms to incentivize the private sector to deliver services in these areas in a sustainable manner; dovetail with anchor loads such as community facilities to reach remote households; and ensure affordability for consumers and adequacy of revenue for service providers.*

Mini-grid potential should ideally be mapped through a least-cost electrification plan and its viability confirmed through detailed feasibility studies.

Off-grid Electrification

Developed innovative business models to reach more customers such as pay-as-you-go (PAYG) systems (SHS); pioneering the rollout of technological approaches such as pay-as-you-go (PAYG) systems that enable customers to pay for their solar products in affordable, monthly installments, often through mobile money; and attracting private equity and debt capital to fund their fast-growing businesses. Kenya's thriving off-grid solar industry translates into robust competition, with companies seeking to differentiate themselves to customers through their product offerings.

Challenges to be addressed for effective scale-up of off-grid solutions:

1. **Defining a service level:** - offered through systems of varying capacities and configurations
2. **Planning for electrification:** -difficulty articulating the extent of potential grid densification and expansion and mix of solutions for the off-grid areas calls for a Geospatial mapping to lay out a prioritized least-cost and sequential investment plan and define the investments for proposed projects via a detailed baseline information.
3. **Sustainability:** - business models that think carefully about sustainability upfront and to set up strategy beyond the project life such as the choice of appropriate system sizes based on robust up-front analysis, suitable delivery approaches, and post installation O&M arrangements had a significant bearing on the efficiency, cost-effectiveness, and sustainability of those programs. Challenges of sustainability often resulted in tariffs that are insufficient to cover the costs of O&M and eventual mini-grid expansion, resulting in high user tariff, which

¹ Supported by KEMP (P120014).

limits the household electricity usage and impact and often led to community and political discontent, due to the high difference between the main grid and mini-grid tariffs. The **time profile of cash flows, high initial risks and illiquidity** – make purely private investment difficult and costly.

Microsoft co-founder Paul Allen’s multi-billion dollar private firm, Vulcan, has been operating electricity mini grids in the last two years in Samburu and Kajiado, connecting homes and businesses to solar power to demonstrate business viability of rural mini-grids to investors, empower communities and trigger interest among businesses to invest in off-grid power solutions.

The company has been selling electricity to Kenyan rural folk at a tariff of between Sh180 (\$1.80) per kilowatt hour (kWh) and Sh400 (\$4) per unit, depending on their consumption levels.

This is higher charges for solar power than connection to the national grid at Sh12 per unit, partly because customers do not pay upfront charges for connection to mini grids.

The higher tariffs are also due to the fact that mini-grids lack economies of scale associated with the central power transmission in the national grid which is subject to regulatory interventions, ensuring lower tariffs.

The average revenue from electricity sales to consumers on the mini grids stands at Sh535 (\$5.34) per month with the largest consumer using power worth Sh1, 550 (\$15.38) monthly while the lowest is Sh38.

- 4. Understanding the off-grid market:** There is limited understanding of the households and economic activities, including income, and consumption patterns, in the counties outside the core market. This lack of recent data increases the uncertainty over the true purchasing power of consumers. Cost sharing with consumers is the key to an enduring service delivery model, through a minimal subsidy per SHS and the leveraging of microfinance institution services) showed that even low-income rural households would be willing and able to pay for SHS to have access to improved lighting services if the consumers were well informed and after-sale services were accessible to a dispersed population and as long as the up-front payment can be spread over time.

“Most of the customers who are beneficiaries of the World Bank’s GPOBA (Global Partnership of Output Based Aid) and the Last Mile Connectivity programmes are largely from

informal settlements whose monthly consumption is 2 units on average. As a result, most of them take long to exhaust the initial pre-loaded units,” said Mr Tarus. (Ngugi, 2017)

5. **Articulating the rules of the game:** The policy and regulatory oversight for off-grid service provision has lacked clarity. The Kenya Bureau of Standards has, however, recently adopted International Electro-technical Commission (IEC) standards (modelled on Lighting Global standards) for solar lanterns and SHS, although their enforcement is still lagging behind.² For mini-grids, as in many other countries, the regulatory framework is catching up with the increased private investments in this sector. The rules related to tariffs, licensing, service quality, and interconnection with the grid are still evolving. GoK’s announcement of application of national uniform tariff for electricity services implying any other distributor or provider cannot charge a price aligned with cost recovery—they have to be compensated for the gap (between cost and uniform national tariff) through a subsidy mechanism. A mini-grid regulations study³ has recently been completed by the GoK that lays out recommendations on business models, tariffs, coordination among stakeholders, and quality of service.

The **cost structures are front loaded** in the sense that there are additional high costs to build transmission lines and other basic infrastructure that get rolled into the project cost.

“Those arrangements that are not cost-effective to the Kenyan people must be terminated, in a legal way, in the shortest time possible,” said the President Mr Kenyatta.

6. **Rationalizing institutional arrangements:** There is a lack of institutional clarity in rural electrification compounded by the devolution process. At the national level, REA is tasked with building distribution lines in the rural areas and then hands them over to KPLC, which retains its monopoly status as electricity distributor in Kenya. The National Government has the mandate for “energy policy including electricity and gas reticulation and energy regulation.” The county governments’ mandate is provided as “county planning and development, including—electricity and gas reticulation and energy regulation.” As such, some rural electrification activities are viewed as a component of county planning; however, counties have limited engagement capacity in electrification programs.

² Kenya Bureau of Standards adopted Lighting Global standards up to 10 Wp, but enforcement may still be an issue.

³ Supported by IDA-financed Kenya Electricity Expansion Project (P103037).

Treasury removed valued added tax and import duty on solar kits, making them cheaper to ship in and install, in efforts to woo investors. The incentive has pulled in companies like Indian Orb Energy, UK-based Azuri Technologies and German firm Mobisol whose pay-as-you-go concept allows homes to pay for the solar systems on mobile phone staggered over a period of up to three years. (Otuki, 2017)

Success Strategy Focus

1. achieve greatest impact with limited resources,
2. deliver services where the need is the largest
3. consider additional costs due to low population density
4. consider principles of equality
5. Maximize the likelihood of success through tailored approaches to sustainable market development.
6. well informed consumers and accessible after-sale services
7. spread over time up-front payment
8. using smart prepaid meters, allowing remote monitoring, and balancing of supply and demand, resulting in increased reliability at reduced operating costs
9. have clarity about the tariffs if it's allowed to charge (and if applicable, subsidies it is entitled to), licensing regime and the time frame during which it is entitled to operate the mini-grid and/or the rules of what happens when the main grid arrives.
10. Creating conditions for a large-scale mini-grid deployment to leverage economies of scale in both construction and operation.
11. exploring PPPs that rely on public resources to reduce the mini-grid costs, thereby reducing user tariff
12. Support for productive uses (gender-sensitive designs that provide increased opportunities for women to engage in productive uses) as an inherent part of mini-grid development.

Benefits of attending the Big 5 Construct EA workshop on Solar PV in EA particularly, Kenya.

Come learn how to optimize your Solar PV Grid Connected and/or Off-Grid Investments

1. Competitive advantage with uncertainty over the true purchasing power
2. Service delivery Innovative technological Business models such as pay-as-you-go (PAYG) systems
3. Market incentives (zero VAT and Import Duty) on solar kits
4. Front loaded cost structures leading to price aligned with cost recovery to compensate for the gap between cost and uniform national tariff.
5. Robust up-front analysis on sustainability to be able to set sustainable tariffs.
6. Geospatial mapping laying out a prioritized least-cost and sequential investment plan and that which defines the investments for proposed projects (Affordability, Reliability, and Legality)
7. Why off-grid systems where stretching national power grids is not cost-effective
8. Geospatial mapping of underserved Mini-grid potential areas also known as the core market (World Bank support Multi-tier Framework (MTF) Survey)