

MAPPING OFF-GRID RENEWABLE ENERGY POLICY ENVIRONMENT FOR COMMERCIAL INDUSTRIAL SECTOR IN KENYA

REF: GREEN GROWTH 2021



Source: Unsplash

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Executive summary

Innovation Norway East Africa is the Norwegian Government's most important instrument for innovation and development of Norwegian enterprises and industry established to promote business, trade and investment cooperation in Kenya, Tanzania and Uganda.

Vital to the most basic human needs is energy services. Renewable energy has the potential to transform Africa's industrial sector, supporting sustainable growth through the provision of reliable and affordable energy, as well as transforming the economic competitiveness of small and medium-sized enterprises which are crucial in the socioeconomic development of a nation as key enabler and contributor to employment, innovation and economic dynamism (International Energy Agency).

Kenya among other nations, in their quest for sustainability have developed policies and strategies (Kenya's Vision 2030 and The Big Four agenda) that aligns to the Sustainable Development Goals (SDGs).

SDG 7 is to guarantee access to affordable, reliable, sustainable and modern energy for all while addressing the climate change impacts of energy consumption, which can be reduced by switching to renewable energy sources and reducing energy demand through greater efficiency.

Government's strategic agenda over five years (2018-2022)- The Big Four agenda serves to accelerate attainment of Vision 2030 (long term economic blueprint) in terms of government priorities that will accelerate economic growth (enhance the country's economic performance) and transform lives by creating jobs improve the livelihoods of Kenyans.

To support of the above, Innovation Norway East Africa is marshalling Norwegian Energy Partners (NORWEPS) and Export Credit Norway companies to bring into these markets; new ideas, technologies and processes, which is highly dependent on access to sufficient resources. However, to attain that, they have sought to first establish the prevailing policy environment, networks and partnerships at all levels which are very important conditions for innovation.

Off-grid renewable energy sector policy data and information is crucial in providing the much needed insights appropriate for investor decision making especially for the commercial industrial consumer market in Kenya. Commercial and industrial customers seek energy-efficient solutions to help access a stable supply of power to reduce its overall cost while sustainably integrating renewable solar energy. Customers energy demand profile is monitored over some time to inform the design of the energy solution, for example if to install energy hybrid (solar/Genset) and off-grid (storage) solar PV solutions to complement the grid supply or fossil fuel generator supply. In multi-tenant commercial institutions such as office buildings and retail parks, load monitoring systems are designed to incentivize customers to shift demand to times when there is high solar energy capacity.

Objectives

The overall objective of the report is to assess the current policy environment for the off-grid renewable energy for commercial industrial customers in Kenya.

The specific objectives were:

- a) Consideration of the off grid system for commercial industrial consumers in the Least Cost Power Development Plan
- b) Implementation of the National Electrification Strategy
- c) Requirements for setting up an off-grid system for the commercial and industrial sector
- d) Energy Act 2019 Regulatory and policy updates and the Finance Act Amendments affecting off grid system for commercial industrial consumers
- e) Brief comparison of these issues with other countries in the region.
- f) Key players and relevant contacts in the sector

Conclusions

Commercial and industrial customers seek energy-efficient solutions to help access a stable supply of power to reduce its overall cost while sustainably integrating renewable solar energy. Hybrid solar power supply systems achieve between 20 – 30% energy savings for commercial and industrial customers, there can also be an overhaul of grid electricity with off-grid solar power supply. C&I customers are responsible for approximately 72 percent of energy consumption in Kenya and 68 percent of Kenya Power electricity sales. As such, it represents a huge opportunity for energy providers. Please see details of some projects in the appendices.

Number of customers per tariff

TARIFF CATEGORY	2013/14	2014/15	2015/16	2016/17	2017/18
DC	2,481,856	3,305,934	4,565,907	5,839,865	6,404,632
SC	278,929	296,735	313,764	328,576	341,306
C11	2,728	2,940	3,087	3,150	3,227
C12	333	348	378	405	527
C13	36	43	43	57	64
C14	24	31	35	41	53
C15	27	32	32	33	41
IT	789	802	809	799	1120
SL	3,261	5,039	6,318	9,356	10,120
TOTAL	2,7679,83	3,611,904	4,8903,73	6,182,282	6,761,090

Source: KPLC Data, 2019

- DC – Domestic Customers*
- SC – Small Commercial*
- CI 1-5 – Commercial & Industrial customers 1 to 5*
- IT - Interruptible Tariff*
- SL – Street Lights*

1. Introduction

The off-grid solar industry is instrumental for achieving universal electricity access. Kenya's mini-grid industry is currently regulated through the Internal Procedures and Guidelines for Regulating Mini-Grids, 2018. The guidelines were developed under provisions of the Energy Act, 2006 (now repealed). The Authority undertook to review the current guidelines to align them with the Energy Act, 2019.



Modern energy services are crucial to human well-being and to a country's economic development; and yet globally over 1.3 billion people are without access to electricity and 2.6 billion people are without clean cooking facilities. More than 95 per cent of these people are either in Sub-Saharan African or developing Asia and 84 per cent are in rural areas (International Energy Agency, 2015). Sub-Saharan Africa is rich in energy

Source: qimono/Pixabay

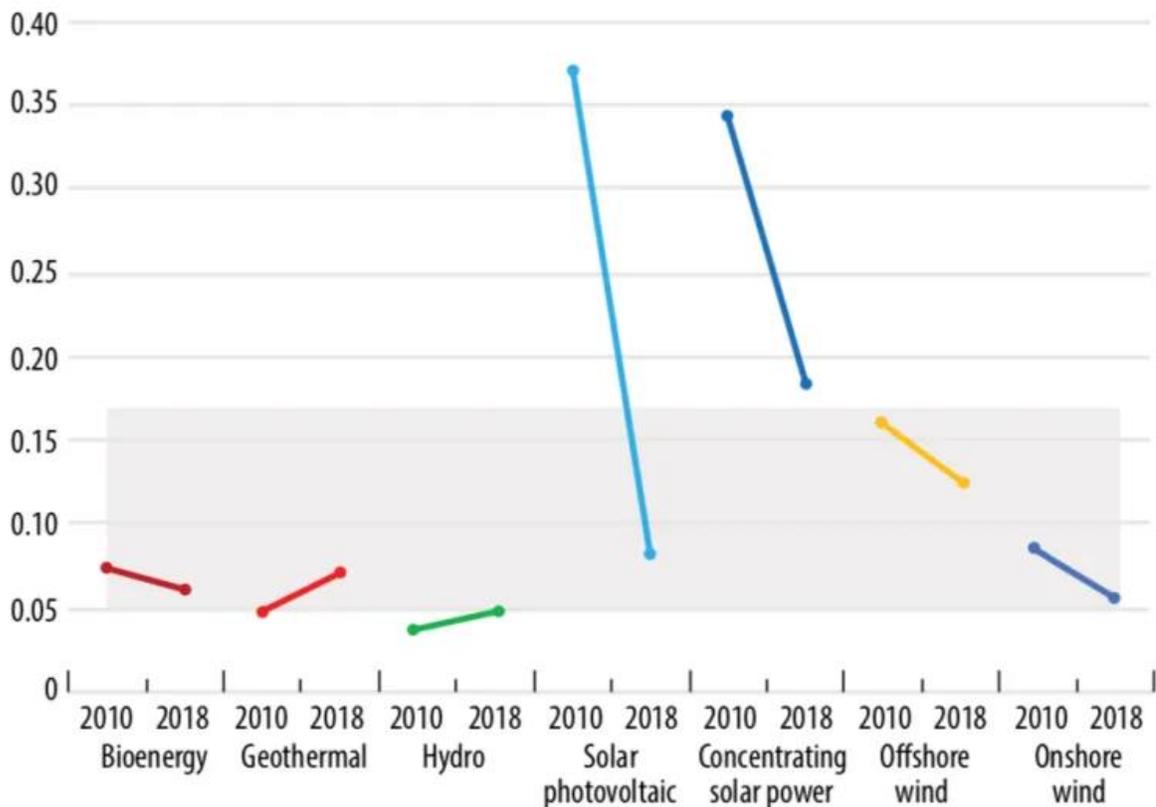
resources but very poor in energy supply, making the region have highest access deficit in electrification rate, only just managing to stay abreast of population growth. Making reliable and affordable energy widely available is therefore critical to the development of the region that accounts for 13 per cent of the world's population but only 4 per cent of its energy demand (OECD/IEA 2014). Although investment in modern energy supply (predominantly electricity) is on the rise, these gains are outpaced by the population growth. The country's electricity generation is currently based on large-scale hydro power, fossil fuels, and recent focus on geothermal, while other renewable energy sources play only a minor role (GoK 2015). At the same time, the resource potential for various renewable energy technologies (such as wind and solar energy) is deemed substantial. However, despite the advantages that increased use of such 'new' renewable resources, such as wind and solar (as opposed to Kenyan well-established hydro power and geothermal), could potentially bring to the country in terms of energy access to spur rural development, the uptake of renewable energy continues to be low.

Today we have the technologies and the solutions that can dramatically accelerate the growth trajectory of electricity access. Tremendous progress has been made in recent years as technology costs have plummeted, innovation in delivery models and financing has picked up, and a more diverse set of stakeholders, including communities, local entrepreneurs and the private sector, have become engaged in the sector. The number of people benefiting from off-grid renewable energy solutions grew six-fold between 2011 and 2016, reaching more than 133 million. This includes about 100 million using solar lights (<11 watts), 24 million using solar home

systems (>11 watts) and at least 9 million connected to a mini-grid¹. Besides providing electricity services for households, off-grid solutions are also increasingly supporting public services (e.g., education, water and primary health care) and livelihoods (e.g., in agriculture).

Among all the renewables for providing energy access, solar energy holds a big promise. From 2000–10, solar photovoltaic (PV) was the fastest growing renewable power technology worldwide (OECD/IEA 2011). Rural electrification using solar PV has been emerging as a viable option for the developing countries. PV systems not only provide reliable, clean, and environment-friendly energy but also create employment opportunities in the vicinity of its operation (UNEP 2014). Solar market development in EAC region has also been aided by the global fall in the solar PV prices over the last decade. Similar to solar PV, distributed electricity storage is also getting cheaper largely due to mass production of batteries for electric vehicles and introduction of new technologies. Kenya having high grid electricity connection cost, solar PV and batteries joining forces (both for solar micro-grid or standalone systems) has the potential to make the electric grid optional for many customers—without compromising reliability and possibly at prices cheaper than utility retail electricity.

(2018 US dollars a kilowatt hour)



Source: Gregor Schwerhoff and Mouhamadou Sy, “Where the Sun Shines,” *Finance and Development*, IMF, 2020.

¹ https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jul/IRENA_Off-grid_RE_Solutions_2018.pdf

In East Africa, there is an estimated 74MW of installed capacity of grid solar for commercial and industrial use, with an estimated 15 MW recorded in Kenya, meaning the market is still small but has great growth potential. Commercial and industrial customers seek energy-efficient solutions to help access a stable supply of power to reduce its overall cost while sustainably integrating renewable solar energy. Customers energy demand profile is monitored over some time to inform the design of the energy solution, for example if to install energy hybrid (solar/Genset) and off-grid (storage) solar PV solutions to complement the grid supply or fossil fuel generator supply. In multi-tenant commercial institutions such as office buildings and retail parks, load monitoring systems are designed to incentivize customers to shift demand to times when there is high solar energy capacity.

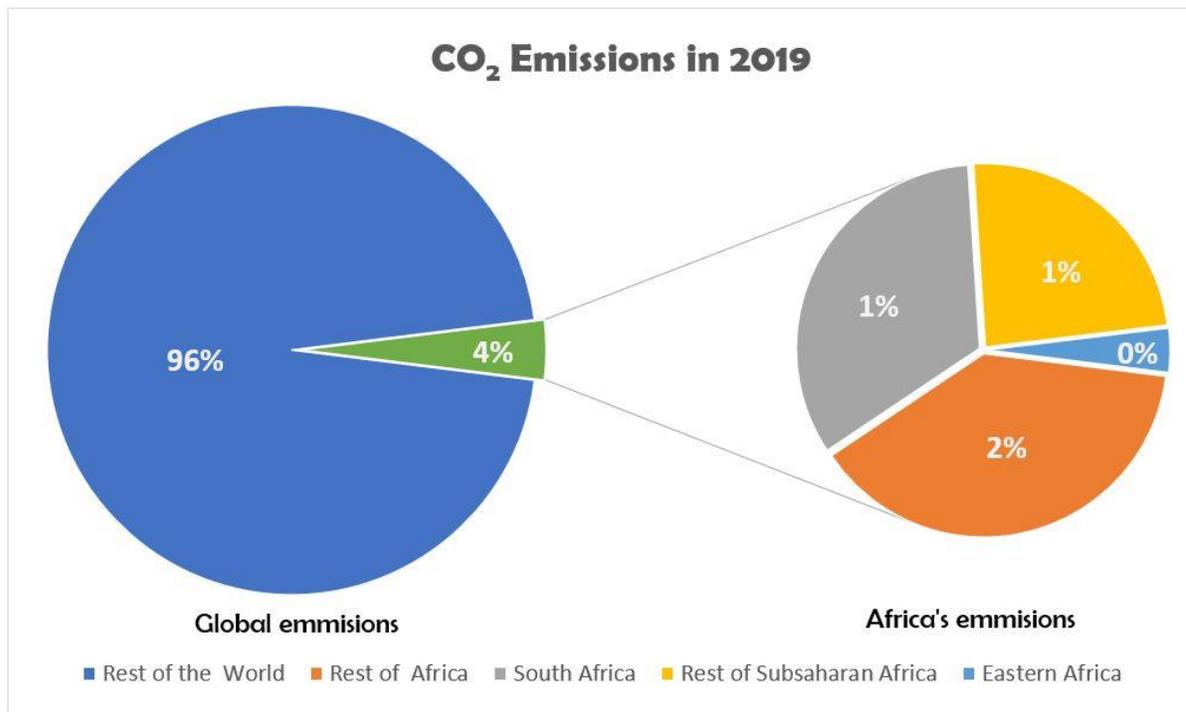
The off-grid solar market is growing due to superior abilities to the grid-tied sources of electricity. Most importantly, off-grid systems can store renewably – generated electricity for use later, instead of requiring continuous consumption or selling-back in the “use it or lose it” scenario presented by simple grid-tied PV/solar schemes. Storage is the fulcrum over how renewable energy’s leverage will play out as it moves from a single to double-digit contribution to the total electricity mix. Recent versions of off-grid solar systems possess operating modes that can “zero out” the grid, effectively keeping the customer/user off-grid whenever possible and drawing on the grid only to meet peak needs or charge batteries when renewable sources are insufficient. If the C&I market was to develop rapidly, there is need to explore a more collective, effective and sustainable approach to customer awareness – this can be innovatively modelled into the financing instrument with clear milestones – may be repayment reliefs. Inadequate financing is the biggest obstacle to faster growth. Reasons for limited financing include unfavourable terms (lack of proven business model leads banks to charge high interest – within a 2 – 3 years’ tenure) and limited suitable financing structures (limited project financing allowing borrowing against cash flows or equipment). There is a need for patient, affordable and with longer investment tenure coupled with technical assistance and business development services. Overall, solarisation of commercial and industrial facilities is the correct path to achieve the United Nations’ sustainable development goal number seven which focuses on the provision of sustainable, affordable, reliable and modern energy for all.

Investments in the mini-grid sector are supported by different development agencies including the World Bank, African Development Bank, KfW Development Bank, Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) and Agence Française de Développement (AFD). The 2018 Kenya National Electrification Strategy (KNES) aims to achieve universal electrification by 2022 and mini-grids are seen as an important step towards achieving that target. New mini-grids are expected to supply an additional 34,700 households by 2022. Therefore, the number of mini-grids operating in Kenya is expected grow significantly over the next years to achieve the targets set by the KNES. This will involve a combination of public and private mini-grids. The government has planned 158 mini-grids under the Kenya Off-Grid Solar Access Project (KOSAP) to be build and operated by REREC or KPLC. In addition, the private sector is planning over 130 mini-grids, currently at various stages of development. Therefore, over 280 mini-grids will be constructed and commissioned before 2022 to

achieve the targets set in the KNES. This will make the total number of operating mini-grids to increase from 106 in 2018 to 391 in 2022.

Distributed renewable energy (DRE) systems are rapidly becoming the preferred option to provide basic energy services to the millions of people in rural and peri-urban regions that lack energy access.

Some 26 million households worldwide are served by DRE systems, primarily with solar systems, renewables-based mini-grids (mainly micro-hydro) and small-scale wind turbines. The EAC region has emerged in recent years as a thriving place for the deployment of DRE systems, particularly off-grid pico solar. The region accounts for nearly half of all sales of pico solar systems in Africa, and Kenya and Tanzania are among the continent's top markets for solar lighting products. DRE systems play a key role in providing basic energy services for much of the population of the EAC region. Some 15–20% of households in Kenya use solar lighting systems, and more than half of households in Tanzania's Lake region are served by pico solar lighting products. Increasingly, EAC partner states are considering off-grid and mini-grid options to offer remote districts, businesses and communities the possibility of managing their own electricity generation and access. Kenya and Tanzania are Africa's largest micro-grid markets, and similar momentum is building in these countries for renewables-based hybrid mini-grid systems.



Source: Electricity Sector Association of Kenya

Some remote businesses, such as mines or nature lodges, may be off-grid businesses since they rely wholly on expensive diesel power for any electricity consumed. For the time being, off-grid C&I solar is a part-time diesel

displacement business. Energy storage may be paired with some C&I PV projects but only in niche situations. Diesel generators are relatively inexpensive to acquire, but quite expensive to run. Battery systems, by contrast, are currently expensive to acquire (though prices are falling and systems are lasting longer) but cheap to operate. Similar dynamics exist for off-grid PV businesses expecting uninterrupted power. Batteries could indeed “smooth” PV production during cloudy days or shift some production to night-time use. Innovations around system integration may bring storage into the C&I solar picture.

. The IEA estimates that to achieve universal electricity access globally, mini-grids will have to provide more than 40% of the new capacity needed by 2030, with a market potential estimated at USD 4 billion per year.

2. Consideration of the off grid system for commercial industrial consumers in the Least Cost Power Development Plan

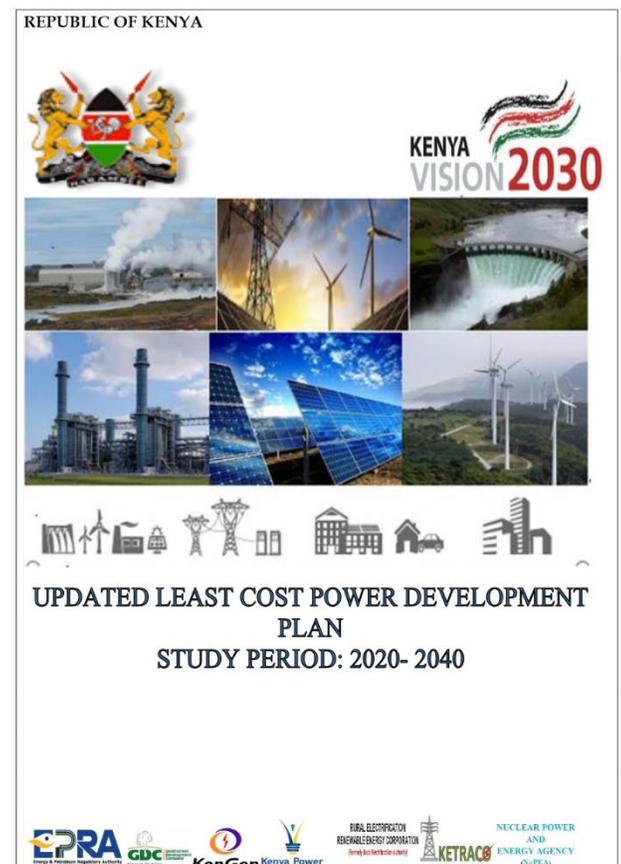
Kenya's power industry generation and transmission system planning is undertaken on the basis of a 20 year rolling Least Cost Power Development Plan (LCPDP) updated every 2 years. Solar projects developed for commercial and industrial (C&I) businesses in Kenya seem to have found a sweet spot. System sizes range from 50 kilowatts to several megawatts, and high commercial energy tariffs make the economics of solar broadly attractive. Moreover, direct business-to-business negotiations and the absence of a heavy regulatory burden results in solar projects being installed more rapidly. And because the market lacks the incentives prevalent in European and U.S. markets, such as net metering and renewable energy credits, solar projects are being completed in an environment that is unsubsidized, ensuring competitive prices for commercial and industrial clients - plus proven scalability of supplier and investor business models.

This target market represents a large share of Kenyan energy consumers. C&I customers are responsible for approximately 72 percent of energy consumption in Kenya (5,237 gigawatt-hours per year out of a total 7,330 gigawatt-hours) and 68 percent of Kenya Power electricity sales. As such, it represents a huge opportunity for energy providers. With relatively high tariffs of \$0.15 per kilowatt-hour combined with demand charges ranging from \$2 to \$7 per kilovolt-amp, electricity costs are high. In addition to that, many companies rely on expensive diesel generators to provide backup power during the region's frequent power outages. An estimated 7 megawatts of captive C&I solar have been installed and awarded since 2013, and the growth rate is likely to increase as confidence in the market grows.

Off-grid renewable energy solutions, including stand-alone systems and mini-grids, have emerged as a mainstream, cost-competitive option to expand access to electricity.

With the project development and financing in place, a successful, well-managed solar project -- C&I or utility-scale -- also needs impeccable installation, accompanied by long-term O&M over its lifetime, typically up to 20 years or more.

For C&I customers, access to capital and debt has historically been difficult and expensive. PPAs made through Energy Service Companies (ESCO) provide access to cost-competitive alternative energy sources that can help companies improve their bottom line.



These investor-backed PPA contracts are also setting the precedent for better market standards. For example, CrossBoundary Energy applies international standards to all its contracts, where provisions such as performance-ratio and uptime guarantees are common. These demands drive improvements in the quality of installed systems and increase performance expectations, contributing to the stability and viability of the market.

A prevalent issue for installers and financiers alike is the high cost of, and length of time required for, project sales and pipeline development. But these obstacles should be viewed as opportunities for companies to compete with each other to deliver the best solution to C&I customers. Kenya has made a move towards ensuring that entrepreneurs willing to invest in solar PV are catered for. As early as 2008, Kenya developed a feed-in tariff policy meant to ensure market stability for investors in PV. The feed-in tariff made it possible for independent power producers to deliver power from wind and hydro sources to the national grid. In 2012, the feed-in tariff policy was revised to also include solar power.

3. Implementation of the Kenya National Electrification Strategy (KNES)

KNES launched in December 2018. It provides a roadmap to achieving universal access to electricity for all Kenyans by 2022. It identifies least-cost and most-effective solutions for electrification coverage. The supply options considered in the KNES include grid densification, intensification, and expansion as well as off-grid solutions. The strategy has a strong off-grid component and expects to provide approximately two million new connections by 2022 (SHS and mini-grid). Energy Act 2019, places a lot of focus on renewable energy resource development in the country. The Energy Act, 2019, aligns with the 2010 Constitution and specifies the roles and functions of both national and county governments in the energy sector. According to the Kenya National Electrification Strategy (KNES), about 1.1 million households that will need to be electrified are 15 kilometres or further from the main grid and are best served by off-grid energy. Therefore, off-grid solutions provide a viable avenue to achieving the targeted access rate.

The World Bank is supporting the Kenyan government through the Kenya Off-grid Solar Access Project (KOSAP), with an equivalent of USD 42 million (KES 4.41 billion) to increase energy access through SHS. This funding has two components; USD 30 million (KES 3.15 billion) and USD 12 million (KES 1.26 billion) as Solar Debt Facility and Result Based Financing respectively. The target is to deploy 250,000 SHS to reach 1.1 million people living in the underserved areas of Northern Kenya

The GoK's ongoing projects and strategies highlight a clear role for mini-grids in granting a significant proportion of the population access to electricity:

- › KNES plans for 138,661 additional mini-grid connections by 2022, with 100,000 coming from intensification of existing mini-grids and 38,661 coming from new mini-grids.
- › KOSAP will deploy 121 new mini-grids.
- › REREC is currently deploying 26 mini-grids.
- › The Kenya Electricity Modernization Project (KEMP) plans to construct eight wind or solar mini-grids.
- › The hybridization of 20 existing diesel mini-grids to incorporate solar and/or wind generation.

The expected new mini-grid regulations and GoK's ongoing commitment to mini-grid electrification are likely to ease investor concerns. One area that may require further clarification is compensation of asset owners and operators upon grid arrival.

The plan recognizes the role of stakeholders, including the private sector, in the achievement of targets.

There has been renewed focus on renewable energy in Kenya's energy mix through the enactment of the Energy Act, 2019. The created the new Energy and Petroleum Regulatory Agency (EPRA) and Rural Electrification and Renewable Energy Corporation (REREC).

Rural Electrification and Renewable Energy Corporation (REREC) (Rural Electrification Agency [REA]) Strategic Plan 2017–2021

RERECs current strategic plan (2016/2017–2020/2021 financial year) was developed before the assent of the Energy Act 2019. The plan provides a roadmap for electrification of public facilities and nearby households. By

2020, the plan projects to electrify 28,323 public facilities, 3,787 of which will be off-grid areas electrified through solar PV. The remaining 24,536 will be connected to the national grid. Standalone solar systems and mini-grids are recognized as a cost-effective electrification solution for households and community facilities in the dispersed areas. The plan expects to establish 450 mini-grids and interconnect existing diesel mini-grids. The plan recognizes the role of stakeholders, including the private sector, in the achievement of targets.



Sustainable Energy for All (Se4all) Action Agenda

Kenya opted in to the SE4All Initiative and has developed an action agenda, which is a sector-wide, long-term vision covering 2015–2030. The agenda outlines how the country will achieve its SE4All goals of universal access to modern energy services, increase the rate of energy efficiency, and increase to 80 percent the share of renewable energy in the energy mix by 2030.

Kenya Electricity Distribution Master Plan, 2013

The Kenya Electricity Distribution Master Plan was developed by KPLC in 2013, to guide distribution grid investment, expansion, and intensification. It provides a forecast of electricity demand for each of the counties up to 2030. In addition, it identifies the distribution infrastructure required to meet that demand while achieving acceptable levels of power quality and reliability. The plan is currently due for review.

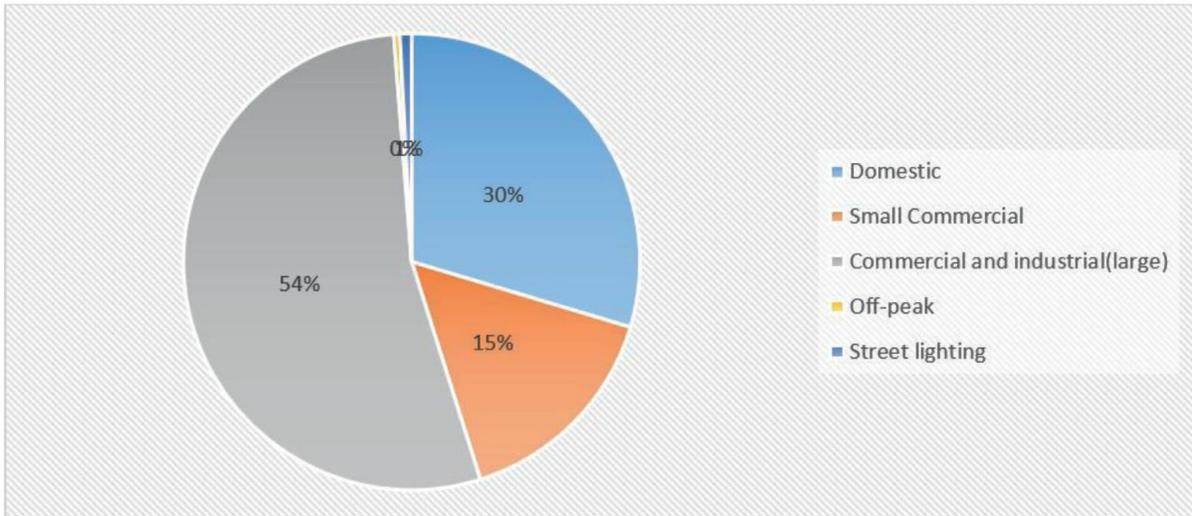
Kenya Electricity Sector Investment Prospectus 2018–2022

The current Kenya Electricity Sector Investment Prospectus was developed by energy sector institutions. It presents investment and financing opportunities in geothermal development, power generation, electricity transmission and distribution, off-grid electrification and energy efficiency. This investment prospectus outlines areas for mobilization of resources and multi-stakeholder engagement to facilitate implementation of priority projects in the electricity sector. It also presents the opportunity for increased private-sector participation across all sub-sectors through the private-public partnerships framework, feed-in tariffs, and renewable energy auctions frameworks, among other things.

Energy Act, 2019

The Energy Act, 2019, passed in March 2019, aims to align the energy policy and regulation with the changes brought about by the 2010 Constitution of Kenya. The Act outlines obligations between national and county governments for the provision of affordable energy services. It provides for the establishment, powers, and functions of energy sector entities, including the EPRA, Energy and Petroleum Tribunal, REREC, and Nuclear Power and Energy Agency.

In addition, the act has provided direction in the promotion of renewable energy, exploration, recovery, and commercial utilization of geothermal energy; the regulation of midstream and downstream petroleum and coal activities; and the regulation, production, supply, and use of electricity and other energy forms for connected purposes.



Source: EPRA – Grid electricity sales by customer category 2017/18 (% GWh)

The Draft Energy (Mini-Grid) Regulations, 2021

The Energy and Petroleum Regulatory Authority (Authority) together with industry stakeholders has developed the Draft Energy (Mini-Grid) Regulations, 2021 . The Regulations have been developed within provisions of the Energy Act, 2019. The Regulations provide guidance to mini-grid developers and other stakeholders on the tariff approval and licensing requirements.

Data Protection Bill, 2018

The Data Protection Bill, 2018, seeks to regulate the processing of personal data, to ensure that the handling of personal data is guided by the overarching principles of data protection. The bill lays out the rights of data subjects to protect personal data from unlawful processing. One provision likely to affect off-grid energy companies is the condition for transfer out of Kenya, which prevents employee and customer data from being transmitted or stored in another country unless that country also has similar data protection regulations. Currently, Rwanda and Uganda have similar laws, so they would be exempt from this, but transmitting data to any other country in the region may be prohibited.

Repatriation of profits

Kenya has no restrictions on converting or transferring investment funds. Capital repatriation and remittance of dividends and interest to foreign investors are guaranteed in the Foreign Investment Protection Act (FIPA). Investors are free to convert and repatriate profits including un-capitalized retained profits after payment of the relevant taxes, the principal and interest associated with any loan.

Dispute resolution facility

Kenya has a facility for dispute resolution in its Nairobi Centre for International Arbitration (NCIA). The NCIA has won the confidence of foreign investors who for years have been hesitant to do business in the country due to drawn out and costly court litigation on commercial matters.

4. Regulatory requirements for setting up an off-grid system for the commercial and industrial sector

Pursuant to Section 27 of the Act, licenses and permits are required for the importation or exportation, transmission or distribution of electrical energy, or for supply of electrical energy to consumers. In order to obtain such a license or a permit, an application containing a letter of interest and a detailed feasibility study for the project must be submitted to the EPRA. Upon confirmation, the applicant is required to conduct an Environmental Impact Assessment (EIA) and submit the report to the National Environment Management Authority (“NEMA”).

Policy	focus
National government	As per the Energy Act 2019, functions include national policy formulation, energy regulation and licensing and operation and development of energy infrastructure,
County governments	<ul style="list-style-type: none"> • Developing renewable energy policies and master plans, including resource mapping. • Responsible for county energy regulation, thus will play a role in SAS deployment. • Technical committee on energy and infrastructure formed at the Council of Governors.
Ministry of Energy	Finalised and gazetted the new Energy Act, 2019 that repealed the Energy Act, 2006. <ul style="list-style-type: none"> • Responsible for creation of a conducive environment to spur investments in the energy sector. • Launched the National Energy Efficiency and Conservation Strategy in Sept 2020 that covers 5 sectors, one of them being households.
Energy and Petroleum Regulatory Authority (EPRA)	<ul style="list-style-type: none"> • Responsible for regulating energy activities in Kenya as per the new Act. • Organised stakeholder consultations on the new Solar Regulations in 2020. • The board is considering new organization structure to comply with the Act.
Rural Electrification and Renewable Energy Corporation (RREC)	<ul style="list-style-type: none"> • Replaced the Rural Electrification Authority (REA) under the new Act. • New mandate includes research, promotion and deployment of renewable energy. It is thus responsible for enhancing uptake of renewable energy, especially SAS systems in off-grid locations. • Has been engaging the county governments for partnership in energy provision
Kenya Power	<ul style="list-style-type: none"> • The national utility has been advocating an increase in grid electricity charges by up to 20% which is under consideration by EPRA. • The company’s financial performance has been declining over the last two years, further slowing grid expansion and maintenance.
Kenya Bureau of Standards	In consultation with stakeholders, spearheaded development and adoption of the new standard KS IEC 62257 to replace the old KS 2542 standard. The new standard covers the plug-and-play systems and appliances with a peak power rating of 350Wp. It was gazetted in February 2021.
Kenya Revenue Authority (KRA)	Implemented new taxation regime that has an impact on the SAS sector.
East African Community (EAC)	<ul style="list-style-type: none"> • On June 30, 2020 the EAC Customs Management Act was amended to include import duty tariffs on solar accessories and spare parts.⁸¹ • PV modules, Direct Current Charge Controllers and inverter qualify for exemption
Ministry of Environment and Forestry	<ul style="list-style-type: none"> • In May 2020, the ministry invited public submissions on draft regulations on Extended Producer Responsibility (EPR) within the country. • The regulations are likely to be finalised and gazetted in 2021.
National Environmental Management Authority (NEMA)	<ul style="list-style-type: none"> • Organised stakeholders’ consultations on proposed E-Waste Management Strategy and Regulations. • There is no indication when the regulations will be finalised and gazetted

Table 1: Existing policy focus on the sector

Feed-in-Tariff's (FiTs) policy of 2012: The current 500 kW minimum cap for FiTs is high and excludes small scale producers, such as rooftop installations, which are representative of the poor and neediest segment of the Kenyan solar PV market.

All imported or manufactured solar PV systems, components and consumer devices shall be required to meet the relevant Kenya standards thus any manufacturer, vendor or importer of solar PV systems shall not offer for sale solar PV products, components, and consumer devices without the appropriate safety and health warning labels being affixed.

Consumer devices which are off-the-shelf, readymade kits which do not require installation work, and lighting kits will be registered with the EPRA who will maintain and publish a register of the approved kits through the mandatory provision of information by all licensees as applicable on the solar PV systems installed in watts, the value of solar PV systems and components manufactured, sold and installed, the installed project capacity and locations of the installations.

Local Content Requirements

The Energy Act, 2019 imposes local content requirements on energy projects and states that "every person carrying out any undertaking of works under the Act shall comply with local content requirements in all of its operations". EPRA is required to issue guidelines and format for the preparation of local content plans.

Preparation of Renewable Energy Resources Inventory and Resource Map

The Act has also adopted the provisions relating to the creation of an inventory and resource map for renewable energy resources by the government through the Ministry of Energy & Petroleum. This inventory and map once created will reduce the burden on prospective investors of conducting exploratory and feasibility studies.

Net-Metering

The Act now provides the legislative backing needed to allow consumers to supply any excess capacity they have back to the grid. It is worthwhile to note that the wording in the new Act is to the effect that a licensed distributor or retailer must make available a net metering service to a consumer upon their request. The new Act states at section 162 (2) that:

Each distribution licensee or retailer shall, upon application, make available net metering service to any electricity consumer that the licensee serves as prescribed in regulations.

Renewable Energy Feed-in Tariff System

The Energy Act, 2019 provides for a Feed-in Tariff ("FiT") System aimed at catalyzing the generation of electricity through renewable energy sources; encouraging local distributed generation thereby reducing demand on the network and technical losses associated with transmission and distribution of electricity over long distances; encouraging uptake of, and stimulating innovation in, renewable energy technology; and reducing greenhouse gas emissions.

Power Supply

The new Act has introduced under section 166 a system to penalise electricity suppliers and compensate consumers for unwarranted power outages or for their provision of irregular or poor quality electricity which leads to damage to consumers' property, financial losses and even loss of life

The following table summarises recent policy and regulatory activities that have an impact on the stand-alone solar (SAS) sector.

Policy	focus	comments
Energy Act, 2019	<ul style="list-style-type: none"> • Gazetted on March 14, 2019. • Focus given to renewable energy resources mapping. • Provides clear functions for national and county governments. • Created REREC with mandate to spearhead renewable energy drive. • Created the Renewable Energy Resources Advisory Committee (RERAC), which is in charge of overseeing the management, allocation, licensing and development of renewable energy sources. • Allows net-metering concept capping at 1MW. This will encourage households and businesses to invest in own generation. 	<ul style="list-style-type: none"> • Clear roles and responsibilities are useful for renewable energy investors and those wishing to invest in Kenya. • When renewable energy resource mapping is availed to potential investors, it will reduce assessment and feasibility costs. • Likely to increase promotion and adoption of SAS to increase energy access. • County governments are expected to roll out renewable energy plans • KOSAP will increase energy access through SAS.
The Draft Energy (Solar Photovoltaic Systems) Regulations 2020.	<ul style="list-style-type: none"> • They are a revision of the existing Energy (Solar Photovoltaic Systems) Regulations, 2012 within the provisions of the Energy Act, 2019. • They provide a framework for enforcing standards in the importation, design and installation of solar PV systems; regulation of solar plug-and-play devices; certification and licensing fees for solar PV installers and contractors; and collection of energy data. 	<ul style="list-style-type: none"> • Registration of imported SHS products may impose additional costs. • Licensing of personnel and longer warranties will ensure higher quality of SAS supplied and installed hence more reliability and adoption.
East African Community legislation	Amendments reintroduced up to 25% import duty on solar lanterns.	10%-25% import duty plus 16% VAT calculated on top imply a major new cost impact on solar lanterns
Standards Act, 2020	<ul style="list-style-type: none"> • New quality standard covering SAS developed by stakeholders through KEBS. • The Act requires a certificate of conformity to Kenyan standards for imported products, approved specifications and other applicable regulations. 	Will ensure importation of quality SAS appliances.
Data Protection Bill, 2018	Intended to regulate the processing, transfer and protection of privacy in personal data.	Likely to affect SAS companies dealing with PAYG systems where customers' data is transferred to another country for processing or storage.
Extended Producer Responsibility (EPR) Regulations, 2020	Regulations are targeted at product manufacturers to make them responsible for the entire product chain with focus on recycling and final disposal of the product.	The country will immensely benefit from better management and disposal of e-waste, but the cost is likely to be passed on to consumers.
E-waste Regulations	<ul style="list-style-type: none"> • Developed by NEMA and discussed by stakeholders. • Official approval wait before public dissemination. 	Disposal of electronic equipment e.g. batteries is now regulated.

Table 2: Existing Policies and areas of focus

A. The Draft Energy (Solar Photovoltaic Systems) Regulations 2020

The new classes will enable solar PV technicians to design, install, commission, maintain, and repair solar PV systems and solar water pumping systems of sizes and capacities as follows:

class	Solar PV handling capacity	Solar water Pumping
ST1	System not more than 400watts	Not provided
ST2	not more than 2kW and controller of up to 70 amperes	not more than 2kW
ST3	Grid tied PV system not more than 50kW, single phase hybrid system not more than 10kW	not more than 50kW
ST4	Grid tied PV & hybrid system of any capacity	system of any capacity

Table 3: Solar PV Technician licensing classes & Project capacities

New classes have also been created for contractors, which mirror the changes made to the technician classes.

class	Solar PV engagement capacity	Solar water Pumping
SC1	Imports and sells Solar PV System Components not exceeding 400watts. Shall design, install, commission, maintain and repair Solar PV System not exceeding 400watts	Not provided
SC2	Imports and sells Solar PV system Components not exceeding 2kW. Shall design, install, commission, maintain and repair Solar PV System not exceeding 2kW	Imports and sells, design, install, commission, maintain and repair systems not exceeding 2kW
SC3	Imports and sells single phase Grid tied PV & hybrid system Components not exceeding 50kW. Shall design, install, commission, maintain and repair Solar PV System not exceeding 50kW	Imports and sells, design, install, commission, maintain and repair systems not exceeding 50kW
SC4	Imports and sells Solar PV system of any capacity. Shall design, install, commission, maintain and repair Solar PV System of any capacity.	Imports and sells, design, install, commission, maintain and repair system of any capacity
SM	Imports parts necessary for the manufacture of solar PV components and to sell solar PV components and systems.	Imports parts necessary for the manufacture of solar PV components and to sell solar PV components and systems.

Table 4: Solar PV Contractor licensing classes & Project capacities

Licence Duration

All licences will have a validity period of 3 years unless the applicant makes a request for a licence valid for 1 year. The adjustment of the licence duration period is a direct response to changes requested by licensees who find the current 1-year licence duration too short.

Licence Renewal

In order to renew a licence, technicians will be required to show that they have accumulated sufficient Continuous Professional Development points, much like other professional organisations.

Licence Upgrades

Licence upgrades of any kind will only be made upon the expiry of at least one year under the current licence.

Upgrading from		Project Credit Points Required	Project Credit Points earned for each project under supervision	Project size
ST1	ST2	18	2	401w- 2kW
ST2	ST3	27	3	2Kw- 50kW
ST3	ST4	36	4	Above 50Kw

Table 5: license upgrade requirements

For contractors to upgrade their licences, they will be required to show that they have in their employment technicians with the relevant licence for the class they are seeking to upgrade to.

Importation and Manufacture of Solar PV Systems, Components and Consumer Devices

All imported or manufactured solar PV systems, components and consumer devices shall be required to meet the relevant Kenya standards. They may not be sold without appropriate health and safety warning labels attached.

Consumer devices which are off-the-shelf, readymade kits which do not require installation work, and lighting kits will be registered with the EPRA who will maintain and publish a register of the approved kits.

Components in the solar PV system and the PV Installation, and consumer devices must all carry warranties for the following minimum periods:

Component	Proposed Warranty Period (years)	Current Warranty Period(years)
Controller/regulator	5	10
Inverter	5	10
Battery- Lead Acid	2	1
Battery- Lithium ion	5	1
Panels	10	20
Consumer devices	2	2
workmanship	1	Not Provided

Table 6: Solar PV components and consumer device warranty periods

Design, Installation and Maintenance of Solar PV Systems

The draft regulations specify the relevant solar PV system design standard to which the technicians and contractors are required to conform to as the International Electro Technical Commission Technical Standard IEC/TS 62548 2013 or its replacement. This is intended to ensure that design work is done to an appropriate international standard in the interest of customers.

Data Collection

Part of the functions of the EPRA under the Energy Act, 2019 is the collection of energy data. The draft regulations propose the mandatory provision of information by all licensees as applicable on the solar PV systems installed in watts, the value of solar PV systems and components manufactured, sold and installed, the installed project capacity and locations of the installations

To enhance the reliability, quality of supply and quality of service in the electric power sub-sector, the Authority has developed two (2) draft regulations namely:

B. The Draft (Electricity Reliability, Quality of Supply & Quality of Service) Regulations, 2021

These Regulations shall be applicable to importation, exportation, generation, transmission, distribution and retail supply of electrical energy.

C. The Draft (Electricity Supply) Regulations, 2021

These Regulations shall apply to any person carrying out or intending to carry out the generation, exportation, importation, transmission, distribution, retail supply and use of electricity or any work relating thereto, including—

- a) System operations.
- b) Planning, design, construction, operation and maintenance of electric power generators, electric supply lines and equipment.
- c) Connection of any premises to an electricity supply system.
- d) Electrical installation work at the premises of any consumer.
- e) Quality of supply and service.

5. Comparison of these issues with other countries in the region.

There is a growing recognition of the importance of mini-grids to achieve rural electrification. Although the majority of minigrids in the region are donor-based, some private sector success stories exist, especially in Tanzania and Uganda.

So far KPLC has owned and operated Kenya’s mini-grids, but two companies – Powerhive and Talek Power Company Ltd. – have been licensed for generation and distribution, opening the market for additional private sector involvement. More widespread use of distributed urban rooftop PV power production for own-use and for sale to the grid is likely to occur only if net metering regulations come online or if more aggressive distributed generation and auction policies are implemented. All EAC partner states, except Burundi, have established FIT policies.

GAPS	TANZANIA	UGANDA	RWANDA	KENYA
Policy and regulations	<p>Lack of dedicated renewable energy policies in the country (i.e., policy and regulations that directly target the Pico & SHS segment)</p> <p>Licenses for private mini-grids are required only for projects that exceed 1 MW. Standardized small power purchase agreements/tariffs for private producers providing less than 10 MW. Below 1 MW, mini-grid projects are further categorized into very small power projects (below 100 kW) and small power projects. For site allocation, both top-down and bottom-up approaches (unsolicited proposals from developers) are possible. Very small power projects need a letter of support of Small Power Projects Rules, 2019 The Electricity (Standardized Small Power Projects Tariff) Order, 2019 from the Ministry of Energy, while SPPs need to register with EWURA using a two-step process. For situations when the main grid encroaches on an isolated mini-grid, there is a provision which specifies who pays to take over the mini-grid and how it should be done. SPPs and small power distributors as well as very small power</p>	<p>The Rural Electrification Strategy and Plan II (RESP II) does, however, aim to add 140,000 connections through off-grid sources (including mini-grid systems) by 2022. Government entities are concerned about micro-grid affordability and scalability.</p> <p>Most of the off-grid energy in Uganda is generated by small-scale hydropower and thermal plants.</p> <p>0.5>&lt;2 MW License: -Exemption Cert & No exclusivity Licensing Process: Application or Bidding Tariffs: ERA Guidelines Reporting to: REA also ERA</p> <p><0.5 MW License: Reg. Cert. No exclusivity Licensing Process: Application or Bidding Tariffs: -Not Regulated Customer Service: Guidelines of REA Reporting to: REA also ERA</p> <p>mini-grids under two megawatts are exempt from licensing, but</p>	<p>A Rural Electrification Strategy has been developed and support is being provided through a number of initiatives, including the Renewable Energy Fund (REF) and results-based financing programs run by the electric utility EDCL and Energising Development (EnDev).</p> <p>According to the National Electrification Plan (NEP), 52% of households will be electrified through on-grid whereas 48% will be electrified through off-grid technologies by 2024.</p> <p>To date, the off-grid sector in Rwanda has been dominated by SHSs and solar lanterns, with most SHSs being small with Tier 1 capabilities. The ministerial guidelines for mini-grids defines the process by which the private sector obtains approval for their planned projects. The process involves review by EDCL, MININFRA, RURA, and other agencies of proposals submitted by developers. The technical and financial feasibility of the project, including the tariff, is assessed and if</p>	<p>The Kenyan government acknowledges the crucial role of mini-grids in achieving universal electrification by 2020 and has invited the private sector to participate in additional hybrid projects under the country’s FIT, which applies to renewable-based mini-grids of above 500 kW.</p> <p>Kenya’s FIT policy was revised in 2010 to include off-grid solar technologies and to review existing tariffs, which were revised again in 2012 to provide for grid-connected solar and to address market changes.</p> <p>no permit or licence is required to generate electricity where the electricity generated does not exceed 1,000kW and is generated for own consumption.</p> <p>A permit shall be required in respect of all undertakings</p>

	<p>projects must apply to EWURA for tariff approval.</p> <p>In 2007, Electricity Regulatory Authority (ERA) enforced the Electricity (license exemption) Isolated Grid Systems Order, regulations that were used to govern off-grid systems. The draft Electricity Isolated Grid Systems regulations 2019 underscores the future of off-grid systems in the wake of extension of the national grid to rural areas. It is proposed that an off-grid operator be given six months' written notice before the extension of the primary grid to the area where he operates. An off-grid operator will also be given a choice of either terminating the business in exchange of sufficient compensation or relocate the assets to a different location. The regulation is expected to be rolled out before the end of 2021.</p> <p>Tanzania has 109 mini-grids that serve more than 180,000 customers. The country's mini-grids provide 157.7 MW of installed capacity from hydropower, biomass, hybrid, fossil fuel, and solar PV systems. In 2008, Tanzania adopted a regulatory framework to encourage low-cost investment mini-grids.</p>	<p>developers undergo a long process to receive a license exemption. Off-grid energy is not budgeted for or addressed directly in key ministries. In another instance, the Ugandan Government piloted a subsidy program that was to provide a 50 percent subsidy for each unit sold. As some providers did not pass on the cost savings to the consumer and others did not receive the subsidy at all; the program was discontinued. Different regulatory bodies have different targets for electrification, and sometimes overlapping mandates for or interests in off-grid energy. There is some duplication of roles in the coordination of off-grid energy with USAID, DFID, USEA, and the SOGE Advisory Committee</p>	<p>approved, a Memorandum of Agreement is signed with the government. The RURA simplified licensing framework is the regulation that governs the mini-grid sector. It defines the processes for registering mini-grids under 50kW and licensing mini-grids larger than 50kW. Tariffs and compensation upon grid arrival are also regulated by the framework as are the technical specifications for the mini-grid. GOR developed a map based on potential electricity demand and the cost of various electrification options to provide guidance on grid densification and extension to reach 52 percent of households by 2024. The areas that are not designated for the grid— representing 48 percent of the population—are marked for off-grid solutions. SHS subsidies and new mini-grid sites will be restricted to these areas, with approximately 38 percent and 10 percent of the country allocated to each, respectively. However, these off-grid allocation percentages may change if the rollout of either solution is slower than anticipated.</p>	<p>transmitting electrical energy that does not exceed 3,000Kw, and a licence for the transmission of any electrical energy exceeding 3,000Kw.</p> <p>Persons who wish to distribute electrical energy require a distribution licence issued by the ERC under the Energy Act. It is important to note, however, that KPLC is the sole distributor for electrical energy in Kenya.</p>
Duties and taxes	<p>In the past the government has provided support through the exemption of import taxes (import duty and VAT) on main solar components to make SHS more affordable. The 2015 VAT Act and 2016 Customs Law amendments removed exemptions for some items that make up a</p>	<p>Recent improvements in tax policy provide for exemption of items such as solar batteries. The lack of clarity in import regulations, customs and tax policy has led to continual delays in importation for companies.</p>	<p>Introduced a VAT exemption on solar products that has considerably reduced the price of solar products, however, that was amended to restrict this measure to solar PV modules of at least 25 W. Clean energy projects do</p>	<p>The Finance Act, 2018, removed the current VAT exemption for “specialized equipment for the development and generation of solar and wind energy, including deep cycle</p>

	solar system like wire/cables, switches, light emitting diode (LED) lights.		have to pay a 5 percent cost, insurance, and freight tax.	batteries which use or store solar power. Finance Act 2020 brought back the exempt status
Access to finance	<p>In Tanzania, the Rural Energy Agency (REA) has lined up the implementation of 90 off-grid power projects, many of which involve mini-grids. Examples include Malolo in the country's southern highlands, where four mini-grid projects are planned with a combined capacity of 300 kW.</p> <p>A successful privately run mini-grid in Tanzania is the Tanganyika Wattle Company (TANWAT), a private owner-operator that runs a biomass co-generation plant as well as the Njombe off-grid biomass mini-grid. With an installed capacity of 2.5 MW, the mini-grid is connected to a regional mini-grid and ultimately to the national grid, and it sells any excess power generated to TANESCO.</p> <p>Other mini-grid examples in Tanzania include Mwenga Hydro (which connects 17 villages), three mini-hydro systems run by the Italian NGO CEFA, the Stanley's biomass plant on Mafia Island and the TPC bagasse generation plant in Moshi (which connects a number of villages, with excess capacity sold to TANESCO).</p>	<p>In Uganda, the SREP programme will use mini-grids to electrify island communities on Lake Victoria and will install ten 25 kW solar PV rooftop systems in national buildings around Kampala, Jinja, Mbale and Entebbe.</p> <p>Also, under the World Bank-funded ERT Additional II, the Kagondo Hospital mini-grid will be upgraded to 64 kW, and the country's REA is constructing two 13.5 kW solar PV micro-grids at Kanyegamire in western Uganda.</p> <p>In addition, Uganda has a hydropower mini-grid, owned and operated by Kisiizi Hospital Power Ltd. As an independent company, that supplies 24-hour electricity to the hospital and to more than 300 nearby households, serving some 2,500 people.</p>	<p>In 2015, the Sustainable Energy Fund for Africa (SEFA) awarded Rwanda a grant of USD 840,000 to finance feasibility studies for green mini-grids as well as a roll-out plan to enable the systems to contribute to the country's rural electrification target of 145,000 households by 2018.</p> <p>Rwanda is benefitting from USD 840,000 in SEFA support for the development of 20 hydro-based mini-grids.</p>	<p>Off-grid solar PV investments, the mini/micro-grid sector is attracting significant investments. Powerhive (United States) and Enel Green Power (Italy) plan to invest USD 12 million in the construction of 100 solar-powered micro-grids throughout rural Kenya</p>
Consumer protection and quality assurance	Large quantities of low-quality Pico/SHS products in the market	UBOS working to adopt IEC standards for pico PV & smaller home systems but there exists no clear global standard for component based systems at the moment	In 2013, GOR adopted the IEC standard "requirements for special installations or locations – Solar photovoltaic (PV) power supply systems" for imported solar products. This standard, which was generally well received, aims to prevent quality assurance issues that might undermine confidence in the industry.	EPRA shall maintain and publish a register of the approved kits. Components in the solar PV system and the PV Installation, and consumer devices must all carry warranties.

Table 7: East Africa Regional Solar PV off-grid Sector policies comparisons

6. Key players and relevant contacts in the sector

The model for mini-grid development is not without drawbacks, but it was seen by GoK as the most effective way to include the private sector in a time-efficient manner and is discussed below:



Relevant Government and Donor Mini-Grid Programs

- **Kenya off-Grid Solar Access Project (KOSAP)**

The KOSAP program will deploy 121 mini-grids expected to cover 27,000 households by 2022 at a cost of \$40 million. These will be deployed in a public-private partnership model and coordinated by KPLC and RREC. KOSAP will employ a unique method of procurement and ownership for mini-grids financed under the project. KPLC will own the customers, RREC will own the assets, and companies will provide to mini-grids the following services: engineering, procurement, construction (EPC), power purchase agreement (PPA) and operations and maintenance (O&M). This method is significant because in the past the government has been skeptical of trusting companies to provide operations and maintenance services. The hope is that this arrangement increases trust between the government and the private sector. Companies will not own the infrastructure assets and so they will not be able to leverage them to obtain further financing, and this is a major complaint of companies.

- **Kenya Electrification Modernization Program (2015–2020)**

KEMP is a \$562-million World Bank electrification program that is mostly focused on on-grid activities; however, \$10 million was used to build six mini-grids on islands, including sites at Margeta Island, Siaya County; Ngodhe and Takawiri Islands, Homa Bay County; Shimoni Island, Kwale County; Chardende, Tana River County; and Kadaina Island, Kilifi County. 108

- **Green Mini-Grid Facility**

The facility was initially funded by DFID, but is now funded by the EU, and is implemented by AFD via Innovation Energie Développement (IED), I-Dev, and Practical Action Consulting. The facility provides technical assistance, investment grants, and output-based grants to catalyze investment in the mini-grid sector while providing support to KNES. It has also published many knowledge products, particularly on the topic of productive use.

- **German Society for International Cooperation (Deutsche Gesellschaft Für Internationale Zusammenarbeit [Giz]) Program for The Promotion Of Solar-Hybrid Mini-Grids (2013–2018)**

GIZ's Program for the Promotion of Solar-Hybrid Mini-grids (PROSOLAR) aimed to improve the overall framework, the technical expertise of government actors, and the implementing capacity of private businesses for the sustainable installation and operation of climate-friendly, solar-hybrid village power systems. The focus has been in remote rural areas. The project developed many mini-grid guidebooks, namely, Where Shall We Put It?, How Do We License It?, and What Size Shall It Be? It also supported the development of energy sector plans in Turkana and Marsabit Counties, which informed the design of the county energy planning template that has been adopted by the Ministry of Energy.

- **Facility for Energy Inclusion—African Development Bank (2018-)**

The Facility for Energy Inclusion (FEI) was designed by the African Development Bank (AfDB) to provide senior and mezzanine debt to off-grid, mini-grid, and small-scale independent power producers with a target ticket size of \$1 million to \$15 million, with a maximum of \$30 million. The overall size of this fund is \$500 million with on-grid (including mini-grids) and off-grid windows. FEI provides loans in hard and local currency. This fund is managed by Lion's Head.

Current/Next Opportunities for Mini-Grid Financing

As there has been limited interest in market-based financing to this point, the opportunities for financing mini-grids in the short term will likely come from donors, development finance institutions, or impact investors. There have been important tools developed that will play a key role in moving the financing of mini-grids forward.

- ✓ **Results-Based-Financing**

Results-based financing has been popularized in the past few years through programs such as the Energizing Development Program (EnDev). This mechanism provides a company with a subsidy payment once it has completed a given action (like selling an SHS system or building a mini-grid). This ensures that expected results are achieved before grant funds are disbursed and therefore increases accountability for results. AMDA among others has championed this form of financing for mini-grids. AMDA is expected to play a more significant role in the coming years.

- ✓ **Crowdfunding for Bridge Funding**

Crowdfunding platforms, such as Trine, have raised significant funding for solar companies while providing investors with an interest rate that averages 6 percent. This has been helpful for earlier-stage companies that need lower levels of financing than the larger entities. In addition, it has been identified as a possible way to provide bridge funding for mini-grid projects that expect to receive results-based financing funds, since the process for obtaining these funds can sometimes take a while.

- ✓ **FEI from AfDB for Longer Term Financing**

While results-based and bridge financing are part of the picture, they still fail to provide patient capital that is needed to finance the infrastructure of mini-grids. FEI could be an attractive option for mini-grid developers looking for patient capital (10–14-year tenors), but FEI is expected to be more interested in a pipeline of projects than in a project-by-project approach.

- ✓ **Power Africa Transactions and Reforms Program (PATRP)**

- ✓ **Beyond the Grid (BTG) Transaction Support.**

PATRP will provide targeted small-scale renewable energy technical assistance focused on the off-grid market (United States Agency for International Development, 2021). PATRP will assist new companies entering the market and existing market players with respect to transaction support, registration and tax regime, market

growth strategy (e.g. reverse logistics and partnership development, among others), and connections to sources of funding. This task is expected to deliver:

- Increased system sales for at least two new small-scale renewable and off-grid companies.
- Increased approval rates of at least one financial institution including national banks, MFIs, and international intermediaries for small-scale renewable and off-grid companies.

Industry Associations

- **Kenya Renewable Energy Association (KERA)**

The association operates through working groups established along the lines of sub-sectors, such as solar PV, solar water heating, and mini-grids. The bioenergy sub-sector issues are handled by the Biogas Network and the Clean Cooking Association of Kenya (CCAK). The associations' main roles include promoting the interests of its members: government, donor organizations, nongovernmental organizations, the general public, and any other organizations that may have an impact on the development and general wellbeing of the industry.

KERA is a member of the Kenya Private Sector Association (KEPSA), which serves as a voice for the private sector to the GoK.

- **Kenya Private Sector Association**

Set up in 2003, KEPSA is the private-sector umbrella organization that brings together business membership organizations and corporate members. KEPSA is a key player in championing the interests of the Kenyan business community in trade, investment, and industrial relations. It engages and influences public policy to enable a better business environment.

- **Global Off-grid Lighting Association (GOGLA)**

GOGLA is the global association for the off-grid solar energy industry, established in 2012. It currently represents over 140 members as a neutral, independent, nonprofit industry association. GOGLA helps build sustainable markets.

- **African Mini-Grid Developers Association (AMDA)**

The African Mini-Grid Developers Association (AMDA) is a Pan-African organization mini-grid trade association established in 2018. It has chapters in Kenya, Tanzania, and Nigeria with plans to expand to 12 countries by 2020. Current membership comprises 16 mini-grid developers. The association's goal is to promote best practices in policy and regulation and attract finance to the mini-grid sector.

SolarAfrica is partnering with approved EPC contractors and developers to install, operate and manage solar PV systems for C&I offtakers.

Cross Boundary Energy Access, which has developed the first dedicated investment fund to finance C&I systems in East Africa. CrossBoundary Energy has developed SolarAfrica, a platform that allows local solar developers to offer a fully financed power-purchase agreement

Harmonic Systems is a local installer that already has an impressive portfolio of on-grid and off-grid projects across the region.

SunFunder-Provides debt financing to solar companies (including off-grid, C&I, and others). It has financed 45 companies with over 60 total debt facilities. Investors include the Overseas Private Investment Corporation and the Rockefeller Foundation.

Energy and Environment Partnership Africa- Multi-donor fund that provides early-stage grant and catalytic financing for clean energy. Fund is managed by the Nordic Development Fund.

Africa Enterprise Challenge Fund Renewable Energy and Adaptation to Climate Technologies Sub-Saharan Africa- Supports SHS and mini-grid companies with a focus on access and climate change mitigation, supported by Swedish International Development Cooperation Agency and United Kingdom Department for International Development.

7. Challenges/Opportunities

Kenya has a large potential for PV since it is located near the equator, which provides it with a high insolation. It has the potential of receiving approximately 5 kWh/m² /day throughout the year with an annual mean radiation of 6.98 kWh/m². In spite of the demonstrated large potential of PV utilisation in Kenya, current exploitation is still limited, and projections show a modest growth that may not even match the increase in electricity and general energy consumption. The Ministry of Energy has been supportive of the off-grid sector and often goes to East African Community (EAC) meetings to support positions that are beneficial to the off-grid sector. To exploit the potential more thoroughly, there is need for proper analysis of the opportunities and barriers for integration of PV in Kenya's electricity generation mix. The development of commercial and industrial (C&I) off-grid projects in Kenya has been constrained by:

- The lengthy negotiation periods and a modest feed-in tariff (FIT) raises risk and suppresses the potential return grid developers could realize.
- A number of barriers have been mentioned as responsible, which include awareness about the technology, capacity (both technical and end users), and value chain financing. All these issues are directly or indirectly related to policy framework.
- Regulatory burden on businesses seeking to engage in renewable energy in Kenya may be overwhelming.
- Issues that affect all off-grid companies, such as the National E-waste Management Strategy, which places responsibility for waste on the producer, poses a risk to SHS entities that may not be able to manage the waste on their own
- Minimum financing options that is affordable (construction costs) have previously made financial institutions more likely to perceive renewables as risky, lending money at higher rates and making it harder for utilities or developers to justify the investment
- The Data Protection Bill, 2018, seeks to regulate the processing of personal data, to ensure that the handling of personal data is guided by the overarching principles of data protection.

- There are two main issues facing equity investment in the Kenyan market:
 1. Current investors (mainly impact investors but some private equity funds and development finance institutions) have already invested and have not exited. This makes it difficult to invest in new off-grid companies and recycle capital in the market, because many investors have either reached saturation limits or are concerned about investing in new off-grid companies that compete with early investments.
 2. There is an erroneous assumption that the equity market is saturated, which is discouraging to new investors. Further, potential new investors have been dissuaded by initially high company valuations, which can make it difficult to participate in a later equity round. Foreign exchange risk has been a key issue that companies face in the acceptance of customer payments in local currency.
- Although PV technology has advanced significantly in the last decades, there are still several technical barriers to its adoption. The quality of PV systems is of vital importance for its integration. A large technological challenge for PV in Kenya has been the lack of energy storage systems. Battery storage solutions also exist but the accompanying initial cost is high. Commercial lending is not yet common, as local banks struggle to understand and mitigate the specific risks associated with this type of project.
- Capacity to pay and very low power needs by remote populations must be understood as part of early-stage feasibility work, and tariffs must be developed accordingly.
- Tensions exist between the norms of “unified” consumer tariffs (e.g., in Kenya, where rural consumers expect to pay the same for power as their urban counterparts) and the greater cost of producing power in remote areas that requires either subsidies or cost-reflective tariffs to recover.
- Regulatory uncertainty in most EAC partner states around allowable consumer tariffs, national grid extension plans, asset taxation and depreciation, and other issues, which leaves private mini-grid developers to shoulder additional risk.
- Unanswered questions concerning what happens after the grid arrival

Despite slow uptake, governments and the private sector alike are paying increasing attention to the potential for green mini-grids in rural electrification. International initiatives such as the “High Impact Opportunity” under the SEforALL global initiative provide further motivation. Rapidly advancing technologies (for remote monitoring, metering and payments), innovative business models (payment for appliances not watt-hours, or capped daily allowances to manage loads) and significant new foreign investments in EAC-based mini-grid developers all point to continued growth in this sector.

8. Recommendations and conclusions

Today we have the technologies and the solutions that can dramatically accelerate the growth trajectory of electricity access. The number of people benefiting from off-grid renewable energy solutions grew six-fold between 2011 and 2016, reaching more than 133 million (IRENA, 2018a). The supply options considered in the KNES include grid densification, intensification, and expansion as well as off-grid solutions. The strategy has a strong off-grid component and expects to provide approximately two million new connections by 2022 (SHS and mini-grid). According to the Kenya National Electrification Strategy (KNES), about 1.1 million households that will need to be electrified are 15 kilometres or further from the main grid and are best served by off-grid energy. Therefore, off-grid solutions provide a viable avenue to achieving the targeted access rate. The expected new mini-grid regulations and GoK's ongoing commitment to mini-grid electrification are likely to ease investor concerns. One area that may require further clarification is compensation of asset owners and operators upon grid arrival. The plan recognizes the role of stakeholders, including the private sector, in the achievement of targets.

Among all the renewables for providing energy access, solar energy holds a big promise. From 2000–10, solar photovoltaic (PV) was the fastest growing renewable power technology worldwide (OECD). Kenya having high grid electricity connection cost, solar PV and batteries joining forces (both for solar micro-grid or standalone systems) has the potential to make the electric grid optional for many customers—without compromising reliability and possibly at prices cheaper than utility retail electricity.

Commercial and industrial customers seek energy-efficient solutions to help access a stable supply of power to reduce its overall cost while sustainably integrating renewable solar energy. hybrid solar power supply system's achieve between 20 – 30% energy savings for commercial and industrial customers, there can also be an overhaul of grid electricity with off-grid solar power supply. C&I customers are responsible for approximately 72 percent of energy consumption in Kenya and 68 percent of Kenya Power electricity sales. As such, it represents a huge opportunity for energy providers.

If the C&I market was to develop rapidly, there is need to explore a more collective, effective and sustainable approach to customer awareness – this can be innovatively modelled into the financing instrument with clear milestones – may be repayment reliefs. Inadequate financing is the biggest obstacle to faster growth. Overall, solarisation of commercial and industrial facilities is the correct path to achieve the United Nations' sustainable development goal number seven which focuses on the provision of sustainable, affordable, reliable and modern energy for all.

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Appendices

Acronyms and Abbreviations

AfBD	African Development Bank
A2F	Access to finance
CAGR	Compound annual growth rate
CBK	Central Bank of Kenya
CO2	carbon dioxide
CRM	Customer relationship management
DFI	Development finance institution
EA-RISP	East Africa Regional Integration Strategy Paper.
EAC	East African Community
EPRA	Energy and Petroleum Regulatory Authority
GEF	Global Environmental Facility
GESIP	Green Economy Strategy and Implementation Plan
GDP	Gross domestic product
GIZ	Gesellschaft für Internationale Zusammenarbeit GmbH (German Corporation for International Cooperation GmbH)
GONGLA	Global Off-grid Lighting Association
GoK	Government of Kenya
GW	Gigawatt
IEA	International Energy Agency
IFC	International Finance Corporation
IPP	independent power producer
IRENA	International Renewable Energy Agency
IRR	Internal Rate of Return
KEREA	Kenya Renewable Energy Association
KITP	Kenya Industrial Transformation Program
KNBS	Kenya National Bureau of Statistics
KRA	Kenya Revenue Authority
KOSAP	Kenya Off-Grid Solar Access Project
KP	Kenya Power

KES	Kenya Shillings
KNES	Kenya National Electrification Strategy
KWh	kilowatt-hour
LMCP	Last Mile Connectivity Programme
ME&F	Ministry of Environment and Forestry
MEP	Ministry of Energy and Petroleum
MOF	Ministry of Finance
MFI	Microfinance institution
MIV	Microfinance investment vehicle
MTF	Multi-Tier Framework
MW	megawatt
NCCRS	National Climate Change Response Strategy
OEM	Original equipment manufacturer
OGS	Off grid solar
O&M	Operation and Maintenance
PV	photovoltaic
PUE	Productive Use of Energy
REREC	Rural Electrification and Renewable Energy Corporation
RES	Renewable Energy Sources
ROGEP	Regional Off-Grid Electrification Project
SAS	Stand-Alone Solar
SEFA	Sustainable Energy Fund for Africa
SDG	Sustainable Development Goal
SE4All	Sustainable Energy for All
SHS	Solar home system
SME	Small and medium enterprises
SPV	Special purpose vehicle
USAID	United States Agency for International Development
VAT	Value added tax
WB	World Bank

C&I Projects

	Company	Solar PV capacity KwP	Location	Cost	On-grid or off-grid
1	Fresha Dairies	1000	Kenya	N/A	On-grid, roof mounted
2	Red Plum Industries	584	Kenya	N/A	On-grid, roof mounted
3	Royal Group	450	Kenya	€ 328,000	On-grid, roof mounted
4	Label converters	300	Kenya	€ 315,000	On-grid, roof mounted
5	Vision Plaza	150	Kenya	€ 170,000	On-grid, roof mounted
6	Simbi Roses	150	Kenya	€ 152,000	On-grid, ground mounted
7	Zena Roses	120	Kenya	€140,000	On-grid, ground mounted
8	United Selections	110	Kenya	€ 99,000	On-grid, ground mounted
9	Credible blooms	100	Kenya	€ 119,000	On-grid, roof mounted
10	Tarakwo Dairies Kenys ltd	100	Kenya	N/A	On-grid, roof mounted
11	Live Wire	100	Kenya	€ 168,000	On-grid, roof + ground mounted
12	Jaganath growers	85	Kenya	N/A	On-grid, roof mounted
13	Rift Valley Roses	75	Kenya	€ 94,000	On-grid, roof mounted
14	The Point Mall	43	Kenya	€ 27,000	On-grid, roof mounted
15	CPF House for Laptrust	52	Kenya		On-grid,
16	MetroPark Solar for LPS	40	Kenya		On-grid,
17	Pension Towers for CPF	36	Kenya		On-grid,
18	Freedom Height for Laptrust	100	Kenya		On-grid,
19	International Centre of Insect Physiology and Ecology (ICIPE), Mbita	200	Kenya		roof mounted
20	EA Data Centre	135.6	Kenya		roof mounted
21	Aga Khan Kuze Medical Centre, mombasa	20	Kenya		roof mounted
22	Kenya Nut Factory, Naivasha	162	Kenya		roof mounted
23	Leleshwa Winery, Naivasha	66	Kenya		roof mounted
24	Adventis University, Rongai	50	Kenya		roof mounted
25	Highlands Drinks Ltd, Nyeri	386	Kenya		roof mounted
26	Mbogo tea factory, Kericho	650	Kenya		roof mounted
27	Williamson tea factory, Changoi Tea Factory in Bomet	1000	Kenya		roof mounted
28	Westside Mall, Nakuru	362	Kenya		roof mounted
29	Garden City Mall	858	Kenya	Sh209 M	carport system
30	Two-Rivers Mall	2000			roof + carport system
31	ALP in Tatu City	506			roof mounted
32	London Distillers Ltd	1000			roof mounted
33	Strathmore University (SU)	600			roof mounted
34	Kenyatta University (KU)	100		US\$165,400	ground mounted
35	Bidco Africa	1200			roof mounted
36	Kapa Oil Refineries	2500			
37	Total Kenya (107 service stations)	3,390 solar panels			roof mounted
38	Mombasa International Airport	500			ground mounted
39	International Centre of Insect Physiology and Ecology (ICIPE), Kasarani	1154		US\$2.5 M	roof + carport system
40	Nairobi's Galleria shopping mall	562			roof mounted
41	East African Breweries, Ruaraka plant	9300			Licensing stage
42	East African Breweries, Kisumu	2400			Licensing stage
43	Blue Nile Rolling Mills	1500			Licensing stage

