STRENGTHENING THE OFF-GRID SOLAR ELECTRIFICATION MARKET THROUGH IMPROVED POLICY AND ADVOCACY IN EAST AFRICA

EPD Energy Private Developers
Your partners for energy in Rwanda

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Burundi Renewable Energy Association
BUREA

KEREA
Kenya Renewable Energy Association

UNREEEA

This study was conducted by National Renewable Energy Associations in East Africa with support from GOGLA and Goldstone Enterprise Consulting & Training. The study was funded by the PowerUp! project under the Transforming Energy Access (TEA) programme of the Foreign, Commonwealth and Development Office (FCDO)

BURUNDI FOREWORD

The lack of sufficient supply of energy is a great hindrance to investments, which coupled with unfavourable policy measures in place greatly affect the off-grid energy sector which results in poor economic development and growth of our countries.

Besides the insufficiency, there is a problem of unaffordability due to heavy taxation on solar products including the importation costs that do not spare the businesspersons. These are regional policy concerns among others that need to be dealt with in order to make the scaling up of the off-grid electrification market achievable.

It is a call to each individual country to synergize in finding advocacy approaches and policy review mechanisms so as to find a long-lasting solution to this burden. It is my great expectation that the audience that will read this report will find it highly informative and resourceful more especially the solar energy companies.
I am grateful to Goldstone Enterprise Consulting and Training Limited for having carried out this great work, which will complement the individual countries' determinations in bridging the knowledge gaps by addressing regional policy concerns to support the scale up of the off-grid solar electrification.

I believe this report will pave the way for more constructive engagements by the stakeholders in the sector to come up with suitable policies that will provide room for a more enabling business environment

DONATIEN NZOKIRA
Burundi Renewable Energy Association

KENYA FOREWORD

Kenya has made great strides in the adoption of renewable energy. About 89% of the installed electricity capacity, and up to 95% of the electricity generated and consumed is from Renewable Sources.

While Kenya has demonstrated leadership and created opportunities in the renewable energy sector, specifically for solar, there are still several challenges faced which could hinder the further development and uptake of renewable energy.
The Kenya Renewable Energy Association is committed to promoting the use of renewable energy and to supporting a roadmap to 100% use of renewable energy for all the country's energy demand.

The key challenges that remain persistent include the political, regulatory framework with intermittent policy shocks such as the rolling back of VAT exemption for renewable energy technologies. To be able to boost investor confidence, it is important that the policy and regulatory landscape be predictable. It will be important to have a defined time frame for application of tax regimes so that they are known well in advance.

Other key challenges include access to finance, both for companies that want to develop renewable energy projects and for consumer financing to be able to afford the cost of using renewable energy. Access to technology and to markets also remain challenges that the industry is systematically addressing to enable achieving the desired outcome of 100% access to electricity and clean energy for cooking.

The inclusion of solar technology, solar home systems and mini grids has made the goal of providing access to electricity more achievable and connectivity has gone up from below 30% in 2013 to over 70% in 2021 with about 20% of that coming from Solar based technologies.

Regional integration and cooperation will help to increase the markets and uptake of renewable energy technologies by creating economies of scale and matching the huge potential to the funds that are available for developing renewable energy in Africa.

This report gives good insight into the Off Grid sector and provides sound recommendations which, if implemented will result in a vibrant, sustainable, and prosperous future for Kenya and indeed the region.

ANDREW AMADI
CEO, KEREA

RWANDA FOREWORD

All of today's energy sources that are used globally will continue to be needed in the foreseeable future. Energy, especially electricity, is the basis for the modern society development and contributes to the improvement of quality of life. Global energy consumption continues to increase, while at the same time there is greater emphasis on finding renewable, carbon neutral solutions for power generation with an emphasis for sustainable development through safeguarding the environment.

Today there is great focus on the next transition, on the expectation or the possibility of a substantial change in the energy mix. What would be the nature of the changing mix? What would drive it? How fast could it come? Or how long might it take? The answer to these questions will have a profound impact on the global energy system, on producers and consumers. Private business community is part of the answers and has to be involved at a high level in order to join efforts with governments to implement that energy mix as quickly as possible.

Achieving universal access to energy by 2030 requires the off-grid solar sector to grow much faster, with significantly more external investment and public funding to bridge the affordability gap, the off-grid solar sector will certainly grow faster, if public funds can be used to catalyse markets and crowd in private sector finance with innovative financing products.

Rwanda's energy policy regime is anchored onto their vision 2050, the vision recognizes the availability of efficient and reliable energy supply for social prosperity, human development and economic growth, the vision underscores the importance of clean and renewable energy in meeting the energy needs of at least 60% of the population. The Government of Rwanda has set an ambitious target of reaching 100% by 2024, through a combination of energy sources. Off-grid solar solutions are considered a priority because of its wide range of solutions.

The Government of Rwanda targets 556 Megawatts (MW) of generation capacity by 2024. So far, Rwanda total production capacity is on 238.368 MW.

As an Energy Association under Private Sector Federation (PSF), Rwanda Energy Private Developers (EPD) is a platform coordinating and advocating for the business community investing in energy, the platform creates partnerships with partners and especially the government for successful public private partnerships in energy sector. EPD wishes to position its members as the best local partners for international investors interested in developing energy projects in Rwanda.

SANDAY KABAREBE
CEO, EPD

UGANDA FOREWORD

Uganda's electrification rate has grown from 14% in 2013 to 28% in 2019 (NDPIII). This has been as a result of grid extension and stand-alone solar PV systems. Even with 60 % urban areas and 18% rural areas electrified, the bulk of Uganda's 44 million people reside in the rural areas without energy access. The Government of Uganda realizes that grid extension is not only expensive but can only go so far and a combination of off-grid solutions must be considered. The third National Development Plan (NDPIII) set key targets to increase electricity access from 24% of the population to 60%; increase per capita electricity consumption from 100 kWh to 578 kWh and reduction in the share of biomass energy used for cooking from 85% to 50%.

Considering the above, Uganda's revised Energy Policy vision has been aligned with the nation's development goals. The policy provides multiple strategic interventions that include reinforcing and expanding the electricity grid based on service territory electrification, master plans for increased grid densification and intensification, promoting and developing innovative off-grid renewable energy supply systems, and promoting productive use of energy to increase energy uptake and overall affordability.

In the last decade, there has been increased focus on energy access for rural areas and vulnerable communities, moreover, solar kits have proven that off-grid systems have a major role to play in Uganda's race towards universal energy access. It's important to note, that most of these efforts have been championed by the private sector and development partners. Additionally, increasing access to electricity will continue to require a sharp increase in energy access investments. Since the desired investments cannot be made by the government alone as public funds are limited; So, mobilization of private investment and robust financing mechanisms finance, is still crucial.

Today, there is therefore need for increased government participation to improve the policy and regulatory environment for the off-grid sector in Uganda. While the government has addressed the creation of a favourable business environment, some areas have received less than adequate attention and support. For example, mini-grid developers have to wait several months for license exemption approval. Even when the approval is received, the tariff regime is not cost reflective, hindering further investments. Besides, standalone systems providers still face many bottlenecks such as poor distribution networks, unpredictable demand patterns, fiscal barriers, quality standards and low affordability.

A multi-dimensional approach to electrification is needed to leverage comparative strengths and achieve this milestone. The Ministry of Energy and Mineral Development needs to make deliberate efforts to provide a platform for government to engage the private sector and other key stakeholders on how best to reach universal access by 2030 as per the UN's SDG7. Finally, viable business options need to be developed alongside financing mechanisms as this will attract investment.

This report is the effort of industry associations of East Africa to help put the spotlight on off-grid electrification. It outlines the policy efforts that need to be made in the off-grid sector to spur investment, increase consumer demand, and thus improve productivity. UNREEEA's hope is that as you read this report, if there is one thing that should be remembered, it is that off-grid electrification holds the key to Uganda's electrification development.

ESTHER NYANZI
CEO, UNREEEA

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ACRONYMS

ABER	Agency for Rural Electrification
BUREA	Burundi Renewable Energy Association
CIREPS	Community Initiated Rural Electrification Projects
EAC	East African Community
EACREEE	East African Centre of Excellence for Renewable Energy Efficiency
EARP	Energy Access Roll out Program
EDCL	Energy Development Corporation Limited
EPD	Energy Private Developers
GDP	Gross Domestic Product
GiZ	German Technical Cooperation
GOGLA	The Global Off-Grid Lighting Association
GoB	Government of Burundi
GoT	Government of Tanzania
GoR	Government of Rwanda
GOU	Government of Uganda
GoK	Government of Kenya
MEMD	Ministry of Energy and Mineral Development (Uganda)
MFPED	Ministry of Finance, Planning and Economic Development
MINIFRA	Ministry of Infrastructure
NDP	National Development Plan
NPA	National Planning Authority
NREA	National Renewable Energy Association
OGS	Off-grid Solar
PAYGO	Pay as You Go
PPA	Power Purchase Agreement
PV	Photovoltaic
REA	Rural Electrification Agency
REF	Rural Electrification Fund
REFIT	Renewable Energy Feed-in Tariff
REG	Rwanda Energy Group
REGIDESO	Region of Production and Distribution of Water and Electricity (Burundi)
RURA	Rwanda Utilities Regulatory Authority
SEforALL	Sustainable Energy for All Initiative
SHS	Solar Home Systems
SWH	Solar Water Heating
TAREA	Tanzania Renewable Energy Association
UEDCL	Uganda Electricity Distribution Company Limited
UEGCL	Uganda Electricity Generation Company Limited
UETCL	Uganda Electricity Transmission Company Limited
UNREEEA	Uganda National Renewable Energy and Energy Efficiency Alliance
USEA	Uganda Solar Energy Association
VAT	Value Added Tax

MEASUREMENTS

GWh	Gigawatt Hour
KM^2	Square kilometre
kWh	Kilowatt Hour
kWp	Kilowatt Peak
MW	Megawatt
Wp	Watt-Peak

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EXECUTIVE SUMMARY

The East African region has been recognised as a prime location for solar energy growth as it experiences very high levels of solar irradiation (1500 - 3000 kWh/m2/year) throughout the whole year. However, in terms of energy access, the region has the highest share of un-electrified populations in the continent. With the population of East Africa standing at 177 million people, it is estimated that about 82 million people living in Uganda, Kenya and Tanzania do not have electricity access . Less than a quarter of the regional population (about 44 million People) have access. Kenya stands at 56%, Uganda at 42.6%, Rwanda at 59.7%, and with Tanzania at 36%. Burundi is one of the least electrified countries globally, with only 7% access. It is noteworthy that access is mostly skewed to more economically empowered persons in the region. Even those that are privileged enough to have access, most often experience a service that is unreliable and expensive. The unreliable and expensive grid electricity are the main drivers for the scale up and development of solar energy systems in the region.

Both grid and off-grid renewable energy (RE) sources are vital in the development of the East African economy. Demand for electricity has shown an upward trend since 2007 due to accelerated regional growth. While preference has been given to high-cost hydropower dams, penetration to the end user is slow. The East African governments have continued to skew grid access to industrial, urban and peri-urban areas, while rural areas are left with limited access despite efforts of rural electrification. This is also reflected in the electricity tariffs charged across the various consumer categories; industrial, commercial, retail & House Holds, in descending order.

Over the last decade, grid-tied solar plants such as Rwamagana 8.5MW in Rwanda, Gitega plant in Burundi (7.5 MW), Garissa plant in Kenya (50MW) and the Soroti plant in Uganda (10MW) are the trailblazers in solar electrification. The high potential for solar power in East Africa has been confirmed in various studies, due to the region's geographical location (astride the equator). Since the year 2000, off-grid electrification has grown significantly with the adoption of solar systems for productive and consumptive use, prior to Covid -19, 2.43 million solar products had been sold in East Africa.

East African countries have set national electrification targets and developed strategies for universal energy access through RE policies which focus on off-grid electrification. Despite their existence, these policies and strategies remain largely on paper. Implementation has been hampered by limited budgets, competing priorities, weak follow-up, and uncoordinated execution of activities by stakeholders in the RE industry.

A policy gap analysis was conducted during the first quarter of 2021, by examining the energy sector of the East African countries and a range of themes concerning off-grid electrification which were used to guide the study. These included affordability, institutional capacity, skills development, innovation and technology, finance and investment and standards and quality, as well as assessments of the current status of the RE sector.

These themes were investigated and the key issues facing the OGS sector regionally were found to include: the uneven application of provisions of the tax regime, low levels of access to affordable

1. IRENA, 2014. Estimating the Renewable Energy Potential in Africa: A GIS-based approach
2. https://www.wri.org/insights/millions-east-africans-who-need-electricity-most-data-shows-renewable-energy-viable-and
3. ERA,2021. Tariff Guide https://www.era.go.ug/index.php/tariffs/tariff-schedules
4. Kenya Power Electricity Cost Tariffs & Schedule of Tariffs, 2018. https://kplc.co.ke/category/view/77/electricity-tariffs

and appropriate solar systems, low access to appropriate financing for OGS, constrained economic development (causing inadequate solar energy sector investments), inadequate technical capacity for assembly, maintenance, and manufacturing of solar products, and uneven enforcement of standards. Subdued regional coordination and non-integrated planning for the sector compounds the aforementioned challenges.

The key recommendations deduced from the study and in full consideration by the NREAs and various stakeholders and industry experts include:

1. Clarifying the application of the tax regime on solar products and accessories,

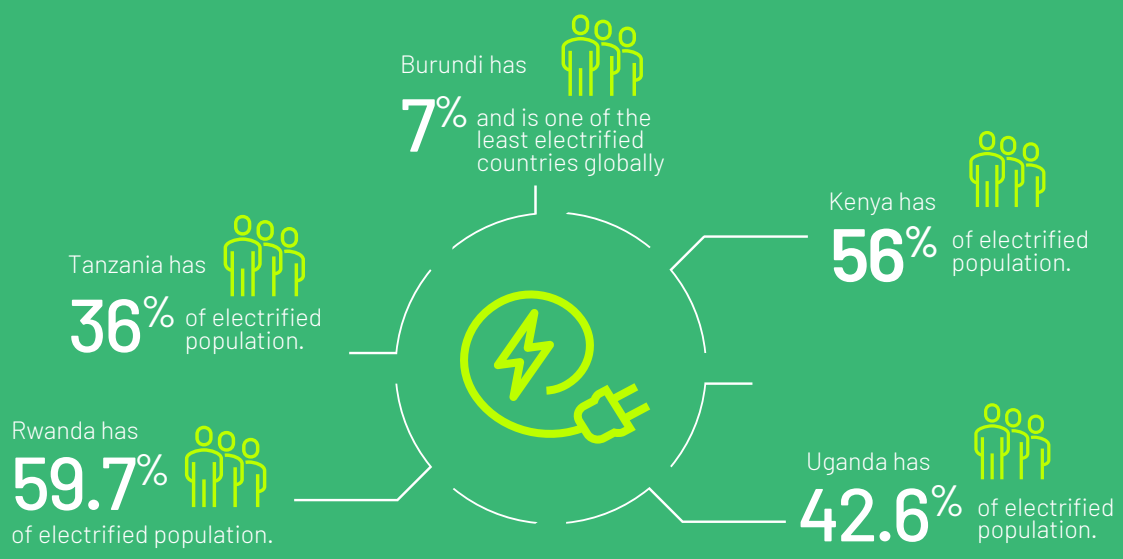
2. Focus being put on improving mechanisms for enforcement of technical standards and compliance which should be multi-sectoral in conformity with IEC standards. It is Important to note that in 2020, Kenya Bureau of Standards (KEBS), Tanzania Bureau of Standards (TBS) & UNBS reviewed the IEC Technical Standards - IEC 62257-9-8 (Quality Requirements) and IEC 62257-9-5 (Test Methods) and adopted them as National Standards. The standards were gazetted in January for Uganda, March 2021 for Kenya and Tanzania is expected by July 2021

3. Developing feasible financier options for the OGS sector through innovative mechanisms and

4. Strengthen coordination of the stakeholders in the RE sector (Government, Development, Business and Civil Society),

5. Strengthen skills development and mainstreaming solar installation and maintenance skills at all levels of learning.

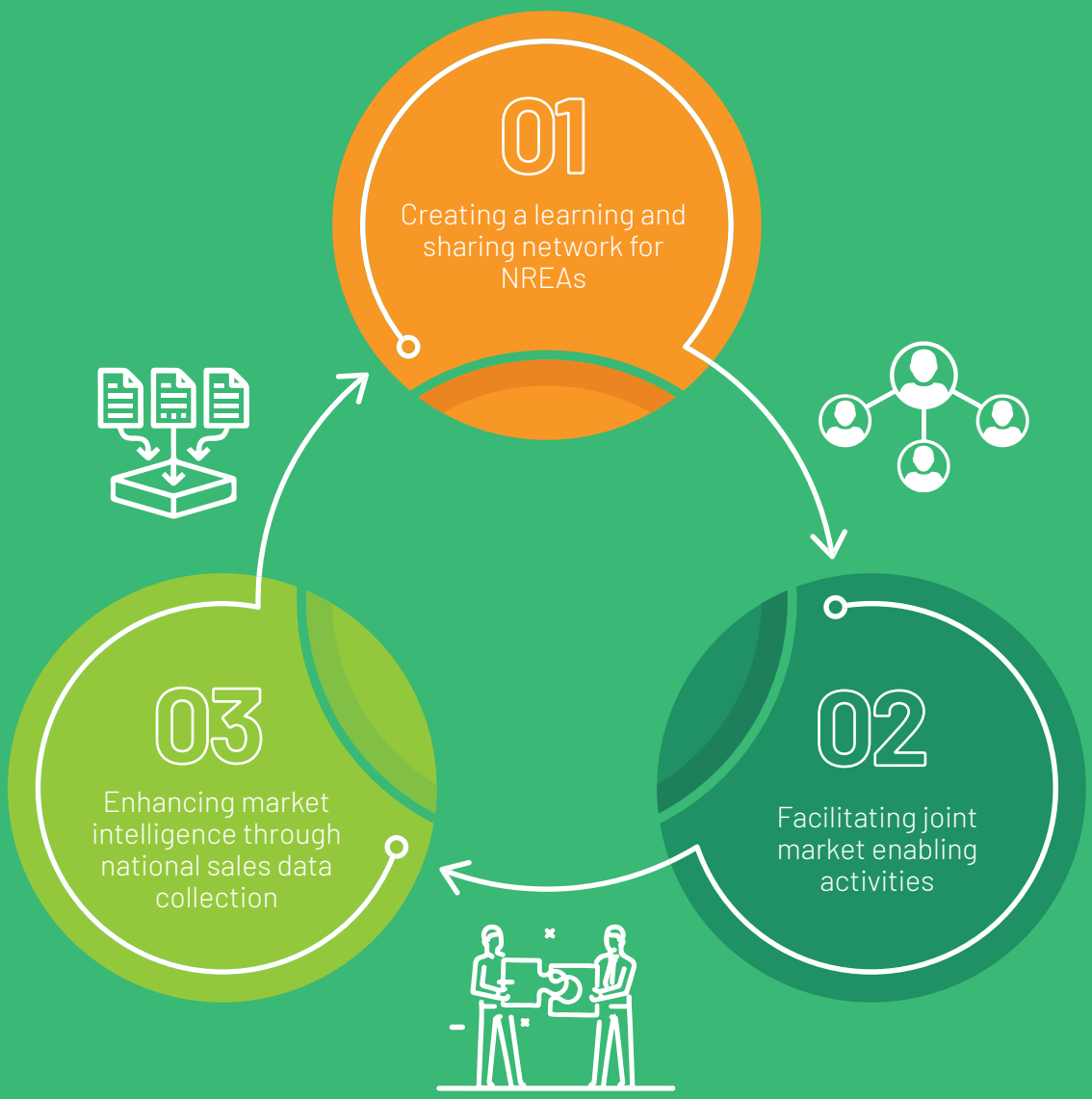
The policy gaps and asymmetry identified across the East African Community (EAC) states are a great step forward in driving advocacy efforts on known and verified issues for the betterment of the renewable energy sector in East Africa. The results of this study are key in bringing meaningful change in the governance of the renewable energy sector in the individual countries and the EAC region. It is expected to be beneficial to the East African Community governments, Development Partners, International and local NGOs, impact investors, and philanthropists with interest in improved renewable energy access. Overall, the countries discussed in this report show great potential, but still have a long way to go in terms of scaling up the OGS market. This report will further guide the NREAs in their mandate to advocate for the Off-grid solar electrification market in the EA region.



BACKGROUND

This study was born out of the Powerup! Project facilitated by GOGLA. One of the key objectives of the project is to strengthen National Renewable Energy Associations (NREA's) in carrying out their mandate of promoting off-grid solar markets both nationally and regionally.

The project consists of three pillars:



This study is aligned to the project's second pillar with a goal of strengthening ties amongst NREAs to address regional policy challenges affecting off-grid energy. Over the last three decades, the governments in the EAC region have grown to appreciate the value of renewable energy in fighting climate change, improving health, literacy & numeracy levels among children, and generally meeting national energy mix and access targets. As such, all governments have put in place policies meant to support the growth and development of the RE sector. For example, Kenya through Vision 2030 set a 65% access target by 2022 and 100% by 2030. In Uganda, a 10-year Renewable Energy Policy was slated to grow renewable energy (RE) use from 4% in 2007 to 61% in 2017. Rwanda targets 100% electricity access by 2024 with at least 60% of the electricity coming from renewable energy sources. The governments have noted the potential of off-grid solar and have emphasized the need to increase uptake of SHS through subsidy programs among other initiatives.

Despite the existence of these well-intentioned policies and strategies, energy access across the region is still low with less than 45 million people having access to sustainable electricity in all its forms. With varying degrees across the countries included in this report, Implementation of RE policies has been weak and disjointed. National Renewable Energy Associations (NREAs) were formed over the last decade with a primary role of advocating for a better policy environment for the RE industry and to assist governments to achieve universal energy access by focussing on off-grid electrification. However, the NREAs are generally in their infancy and lack the financial resources to engage and cause meaningful change in policy formulation and implementation.

The study was therefore purposed to review existing energy policies and strategies in EA, and specifically;

01

Review the off-grid energy policies within each country and identify the existing gaps.

02

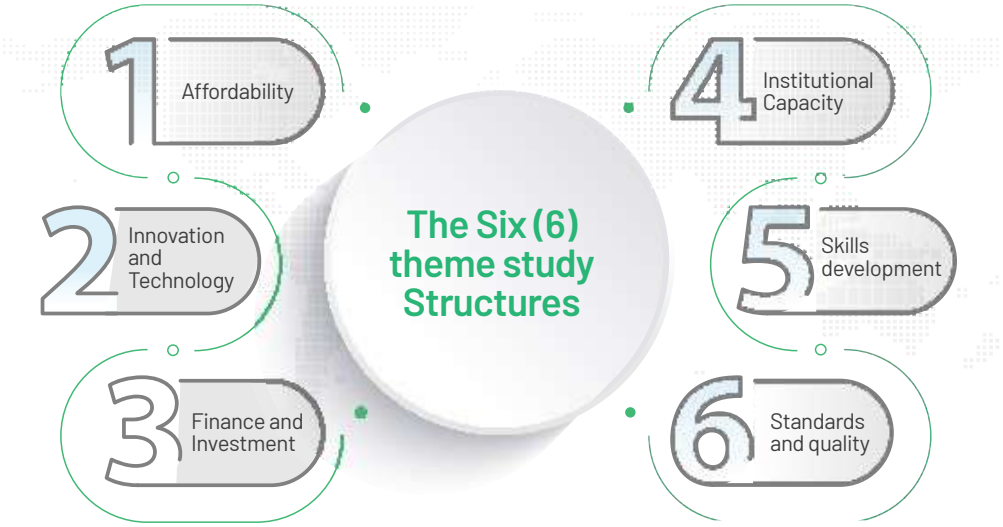
Provide pragmatic and progressive recommendations on policy gaps to various stakeholders within the Off-grid solar sector.

03

Provide an advocacy plan to be used by NREAs to engage governments (nationally and regionally) and other stakeholders in the off-grid solar sector, based on the gaps identified and recommendations provided in the report.

5. Sustainable Energy for all, circa 2016 https://www.se4all-africa.org/seforall-in-africa/country-data/uganda/ accessed on 14th Oct 2020

This study was therefore carried out by the National Renewable Energy Associations (NREAs) in partnership with GOGLA and Goldstone Enterprise Consulting and Training Ltd. The study is structured along six (6) themes which have a bearing on RE and off-grid electrification.



The design of the study was derived from the PowerUp! objectives and was guided by a mixed method approach. It covered five East African countries, focusing on members of the NREAs, and key stakeholders concerned with renewable energy with particular interest in off-grid solar. These were drawn from the public, private and the development sector. The respondents from the NREAs were randomly identified from their membership.

PowerUp Project

The design of the study was derived from the PowerUp! objectives and was guided by a mixed method approach. It covered five East African countries, focusing on members of the NREAs, and key stakeholders concerned with renewable energy with particular interest in off-grid solar. These were drawn from the public, private and the development sector. The respondents from the NREAs were randomly identified from their membership the offgrid solar sector

Purposive sampling was used in consultation with GOGLA and the NREA to target relevant stakeholders. This ensured reception of more incisive information regarding the off-grid solar sector in East Africa. Most of the primary data was collected virtually using online platforms such as Zoom, Microsoft Teams, and Skype, and an online survey hosted by Kobo. This helped to ensure flexibility in the context of COVID-19. Desk research was conducted with information collected from relevant literature related to off-grid solar. Information was drawn from RE policies, reports from NREAs and GOGLA, as well as reports from Power Africa and Lighting Africa. General industry reports and publications were also used to strengthen the findings. A full list of references is available at the end of this report.

The online survey was used to collect qualitative data from the members of the NREAs. This was analysed using SPSS and MS EXCEL. Qualitative data was collected using the aforementioned online platforms and physical meetings with stakeholders in Uganda, Kenya and Burundi. Transcripts drawn from those interviews were analysed using NVivo 12. Regarding data security and confidentiality, consent was sought from the respondents, with information being coded to protect respondents' identity. Collectively 87 stakeholders including, 38 solar companies, 11 civil society actors and 38 other stakeholders including government and NREAs as key informants participated in the study across the East African region. This afforded the study depth and breadth of information pertaining to RE policies and the status of OGS in each of the participating countries.

2.0 BURUNDI

2.1 COUNTRY OVERVIEW

Burundi is a land-locked country located on the western fringes of East Africa. It is bordered by Rwanda, Tanzania, and the Democratic Republic of Congo. It has a land mass of 27,830 km2. The country has a population of over 11 million people and is the second most densely populated in Africa with approximately 500 inhabitants per square km. The landscape is hilly and mountainous and as such infrastructure development is very costly for roads and grid electricity connectivity. Only 13% of this population lives in the urban areas and the majority are settled in rural and remote areas providing an opportunity for the growth of OGS electrification.

Since 2010, the country's GDP has grown at an average of 4% per annum, despite the consecutive years of recession in 2015 and 2016 following political instability. Majority of the population is poor, with an estimated 65% of Burundians living below the food consumption poverty line. The average per capita income in Burundi is US$ 210 per annum, nearly 90% lower than the average across sub-Saharan African countries. The education and health outcomes are poor, with the country ranking 185 out of 189 countries. The high levels of poverty have made access to basic services and infrastructure such as health, education, transport and logistics and electricity remain a major challenge to many people.

The economy continues to be vulnerable to external shocks and is highly dependent on donors and development partners that have come up with several programs to support the development of the economy especially with electrification. Such partners include the World Bank's International Development Association (IDA), African Development Bank (AfDB), German Technical Cooperation Agency (GIZ), United Nations Children's Emergency Fund (UNICEF), Energising Development (ENDEV) among others.

2.2 ENERGY SECTOR

Burundi is one of the least electrified countries globally, with currently only 200,000 households considered to be electrified, and the remaining 2.3 million households without electricity access, which gives Burundi a national electrification rate of just 7%. While 49% of the urban population have access to electricity, approximately 1.8% of the rural population have access. Even among these households who are connected to the main grid, nearly two-thirds do not receive electricity due to intermittent supply. The total energy consumption is comprised of; electricity at 1.3%, petroleum products at 2.5%, and biomass at slightly over 95%. The hydropower capacity potential is 1700 MW, with roughly 300 MW being economically viable. Twenty four percent (24%) of hydroelectricity is imported from Ruzizi I and II Hydro-power plants, with more than 147 MW to be tapped from Ruzizi III. Hydropower accounts for over 75% of all on-grid electricity.

Aside from low generation capability and infrastructure limitations, the major issue in Burundi's energy sector is a lack of technological and management capabilities, which has hampered the country's ability to increase access to electricity. In view of the above challenges, off-grid solar electrification presents a viable alternative for penetration to the rural and remote areas.

6. World Bank Data, 2018 https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=UG-KE
7. East African community, 2016, Renewable energy and energy efficiency regional status report
8. https://www.statista.com/statistics/455787/urbanization-in-burundi/
9. https://www.worldbank.org/en/country/burundi
10. https://www.wfp.org/countries/burundi
11. UNDP, 2020. Human Development Report

2.2.1 Off-Grid Electrification

Burundi has densely populated rural areas due to its low urbanization level at 12 percent. This generates pressure on land and natural resources making off-grid energy an appropriate alternative given that electricity penetration in rural areas is as low as 1.8 percent .

The country's natural environment is conducive to the long-term utilization of water, solar energy, and wind power. The average sunshine in Burundi (estimated at 2000kWh/m2 per annum) points to very high solar energy potential. Off-grid electricity production in Burundi includes four energy sources; small hydro plants (less than 1MW each), diesel generators, Société Sucrière du Moso's (SOSUMO) bagasse operations (4MW) and Solar PV power .

Since 2013, Burundi has received development support from various partners aimed at enhancing the capacity of the government to engage with the private sector to accelerate access to electricity. However, the political crisis that occurred in 2015 affected progress and caused shortage in funding for energy projects from public and private sources. This has resulted in low penetration of quality-verified off-grid solar products estimated to be 5% of the potential market of 2.1 million households. The most common off-grid solar (OGS) items sold are Pico lanterns, which are normally single-light systems with cell phone charging in some cases. A few companies offer solar home systems, mostly sold to customers in Bujumbura and often as a secondary source of electricity alongside a weak grid connection.

Some of the challenges facing the OGS sector include; average household expenditure in rural areas which is extremely low and places a hard limit on the ability of households to pay for OGS. Rural livelihoods are largely agriculture based, and ownership of assets such as mobile phones and radios is low compared to other countries in the region. Also, most of the population has limited awareness of the value of OGS products, due to low penetration by the private sector and lack of awareness programmes by the GoB.

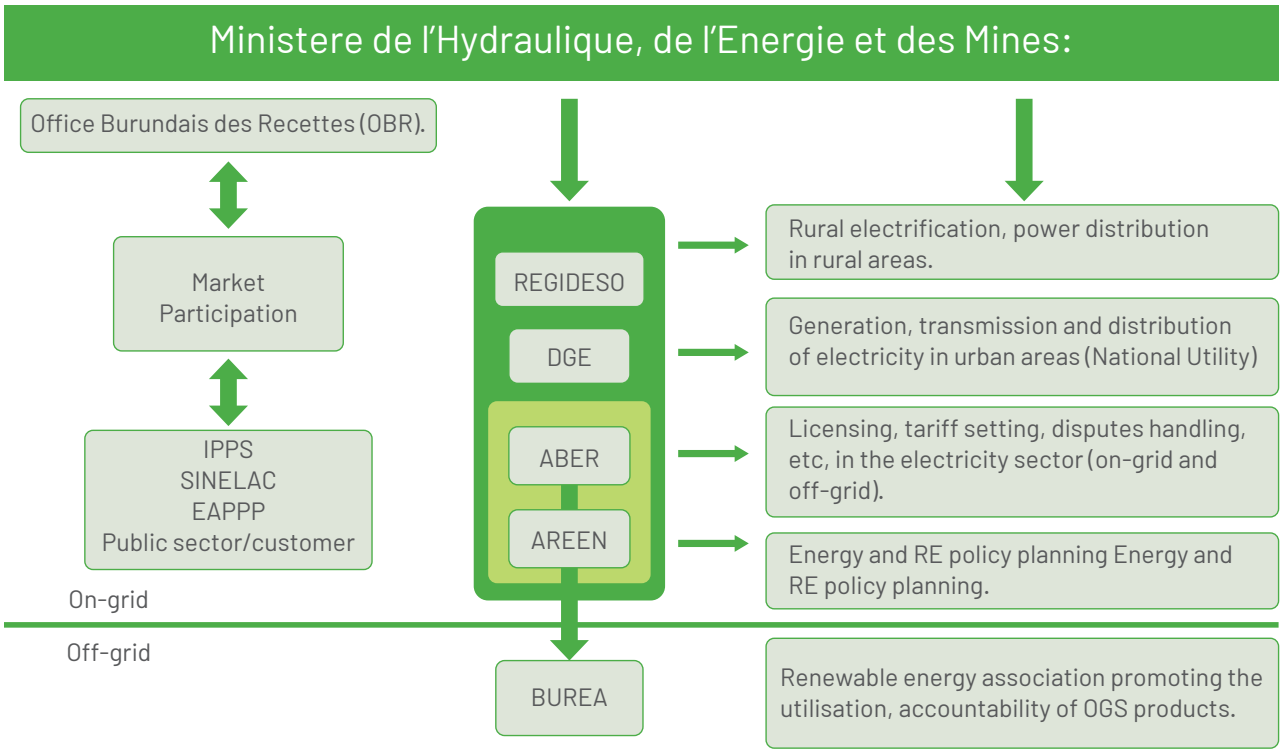
While the government is committed to expanding access to modern energy resources, the policy and regulatory mechanisms for off-grid energy are still in their infancy. Burundi's Vision 2025, five-year National Development Plan, and 2011 Energy Policy Letter all stress the importance of energy access as a national priority, with a focus on off-grid solar, however these policy documents are not implemented and affordability of solar products still remains a major challenge due to the country's poverty levels especially in the rural areas. Approximately 50% of households in Burundi can bear the cost of a small solar lantern of US$ 10 per unit this is largely due to irregular income and inability to pay

2.2.2 Institutional Framework

The energy sector in Burundi is governed by Ministère de l'Hydraulique, de l'Energie et des Mines (MinHEM), Agency of Regulation of Water, Electricity and Mines, National Utility (REGIDESO), Agency for Rural Electrification (ABER) and the Directorate General of Energy (DGE).

12. https://www.se4all-africa.org/seforall-in-africa/country-data/burundi/
13. https://eepafrica.org/wp-content
14. World Bank, 2019. Project Information Document. Burundi Off-grid Access Project
15. Bamber, A. Abdulsamad & G. Muhimpindu, (2013). Burundi in the Energy Global Value Chain. Skills for Private Sector Development
16. World Bank, 2019. Sustainable Energy for All Technical Assistance Program (S-TAP) for Burundi
17. Lighting Africa, 2020. Burundi Market Assessment for Off Grid Solar and Improved Cooking Technologies for Households
18. Ibid

Figure 1: Institutional Framework for Burundi



Source: Lighting Africa, 2020

The table below outlines the key responsibilities of the aforementioned organisations.

Table 1 The key institutions in the sector and their roles

Ministry of Energy and Mines	Strategy to support sustainable development through the provision of electricity.
Agency of Regulation of Water, Electricity and Mines (AREEN)	Licensing, tariff setting, disputes handling, etc. in the electricity sector (on-grid and off-grid).
National Utility (REGIDESO)	Generation, transmission and distribution of electricity; responsible for power distribution in urban areas.
Agency of Rural Electrification (ABER)	Government institution in charge of rural electrification. Owns and manages some mini-grids around the country.
Directorate General of Energy (DGE)	General energy policy, definition and planning. It has a department of renewable energy and energy efficiency.
Burundi Investment Promotion Agency	Facilitates the market entry by investors.
SINELAC (Société Internationale des Pays des Grands Lacs)	Regional body responsible for developing international electricity projects.

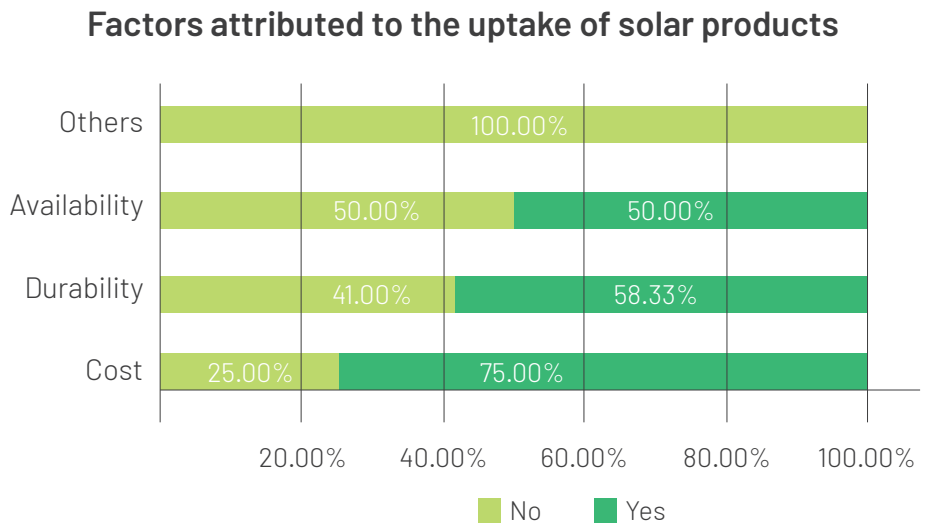
2.3 FINDINGS

2.3.1 Affordability

With the majority of the population in Burundi living below the food consumption poverty line, its estimated that 60% of households cannot afford a multi-light system with an upfront cost of US$ 130 even under a monthly instalment repayment plan. This was confirmed by 75% of solar businesses who ranked cost highest among factors inhibiting the uptake of solar products (see fig 2). One of the solar entrepreneurs remarked that;

> *"The purchasing power of potential consumers is low especially in rural areas. This is attributed to the high prices characterized with unrealistic payments."*

Figure 2 Factors Attributed to uptake of Solar products



Source: Survey findings

Due to cost challenges OGS product penetration has remained low, with very few operators. Some businesses are experimenting with PAYGO powered technologies to further penetrate the peri-urban and rural markets. The affordability of OGS products has improved by spreading costs over 12 to 18 months through PAYGO and microfinance lending. Consumer financing is being used to minimize the upfront costs so that more households are reached to receive solar lanterns with phone charging and/or radios. While spreading the cost helps make each monthly repayment more affordable, the final cost is prohibitive for the intended clients.

The study found that an irregular tax regime (inconsistently applied) on solar products is one of the stumbling blocks affecting affordability of OGS products. One of the policy makers said; "The tax burden is transferred to the final consumer in the form of high prices. This has discouraged last-mile communities from consuming solar products as they are looked at as luxurious gadgets because of the exorbitant prices." The industry is still in its infancy stage and currently there is no clarity on the tax regime for the OGS products.

GoB has not put in place any specific regulations or strategies to support direct subsidy programs for the OGS sector. However, development partners

19. Lighting Africa, (2020). Burundi Market Assessment for Off-Grid Solar and Improved Cooking Technologies for Households

such as EnDev and UNICEF have supported the distribution of solar lanterns and solar kiosks for small enterprises with the recipient paying 30% of the purchase price. Under the Results Based Financing Programme, GIZ in partnership with EnDev also supported the distribution of stand-alone solar electrification systems to health centres and schools from 2014 to 2019. This was under an arrangement where public institutions paid 20% of the purchase price and EnDev provided a subsidy for the remainder. In the short to medium term, banks and impact investors will need sensitisation on debt financing to solar businesses. Innovative and blended financing which is taking root globally has a place in the OGS sector, and it is expected to de-risk financing to the sector. The overarching result of this will be narrowing and eventual closure of the affordability gap.

2.3.2 Quality and standards

Despite a few measures to expand the use of off-grid solar products, only about 1% of Burundi's population uses quality-verified off-grid solar solutions. In 2020, approximately 50,000 to 100,000 quality-verified OGS products were consumed which represents less than 5% of the potential market. This suggests that the government agency in charge of quality standards has to do more to protect consumers and OGS companies including the urgent need to develop standards for OGS products in Burundi. There being no standards, the collaborative labelling and appliance standards program (CLASP) and the World Bank have initiated the process to support Burundi in developing appropriate OGS standards.

Burundi should align its OGS regulations and standards with its EAC counterparts by following the IEC Quality Standards including:

01 IEC Technical Standard 62257-9-8 (Quality Requirements for Renewable Energy Products for Rural Electrification) or simply **'Quality Requirements'**

02 IEC Technical Standard 62257-9-5 (Laboratory Evaluation of Renewable Energy Products for Rural Electrification) or simply **'Test Methods'**

2.3.3 Finance and Investment

Whereas the OGS sector in Burundi is still in its infancy stage, there has been government efforts to liberalise the investment sector. The sector has had several setbacks but critical among them is the political instabilities of 2016 that saw major donors and the private sector pull out of the country. There was zero foreign direct investment between 2016 and 2017 .

Development partners have since re-engaged the government of Burundi in increasing electrification access. The International

Development Association (IDA) has approved two grants totalling $160 million from the World Bank to help Burundi improve basic services through solar power and local development in rural and remote areas. Solar Energy in Local Communities

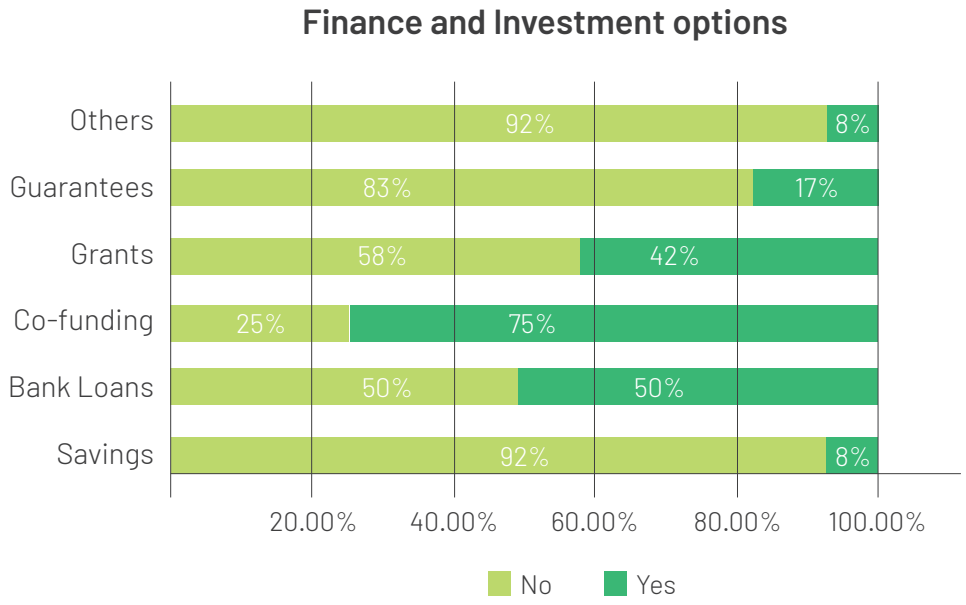
20. Ibid
21. Lighting Africa, 2020. Burundi Market Assessment for Off-Grid Solar Ibid
22. EACREE (2018), Situation Analysis of Gender and Sustainable Energy in the East African Community, EACREE

(SOLEIL), which seeks to expand access to energy in the country by nearly 100% by electrifying local communities, will receive $100 million in subsidies .
Gigawatt Global a private firm is in the final stages of constructing a 7.5-MW solar plant supported by the Renewable Energy Performance Platform (REPP), demonstrating the government's willingness and commitment to open up the energy space to the private sector .

The survey findings show that there are several available investment options in Burundi within the RE sector. Co-funding arrangements account for 75% of these investment options. See figure below. One of the significant responses from a prominent RE policy maker was

> *The overarching problem that the RE sector is facing is that there are few companies and banks specialized to support the investment options for RE and that the solar sector was destabilized by the political clashes that befell Burundi in 2015.*

Figure 3 Finance and Investment options



Source: Survey finding

2.3.4 Innovation & Technology.

Solar PV technology for households, small and medium enterprises and institutions have been incorporated in Burundi due to its favourable irradiation. The PAYGO technology has been embraced in Burundi as a business model helping solar companies to penetrate rural off-grid areas previously perceived as risky and underserved. It is worth noting that mobile payments platform is a key component of this technology. Adoption of mobile Money payments is still nascent in Burundi compared to the other East African countries. Its rate of penetration and growth provides hope for the PAYGO business model. Econet, Lumitel, Onamob and Smart Mobile provide the GSM platforms for PAYGO. With this, OGS consumers don't have to make the full upfront payment for Solar systems, making them accessible and in some cases affordable to end-users. The Solar companies driving the

23. Lighting Global. 2020. Burundi Market Assessment for Off-Grid Solar and Improved Cooking Technologies for Households. Washington, DC: World Bank.
24. World Bank, 2019. Sustainable Energy for All Technical Assistance Program (S-TAP) for Burundi
25. World Bank, 2019. Sustainable Energy for All Technical Assistance Program (S-TAP) for Burundi

PAYGO agenda in Burundi include; Greenlight, Omni Voltaic, Maxlight Ltd, and BOS balance for storage systems. These are working in partnership with Climate Co-Lab.

Innovation is more in product development especially in areas of productive and consumptive use. No specific data was collected on the various products developed thus far.

2.3.5 Skills Development

It was found that there are limited trained professionals with experience in the installation and maintenance of OGS products in Burundi. The available -training programs are donor funded and attached to specific projects. The GoB needs to develop capacity-building programs for the OGS sector and have them included in the various vocational training institutions. Revision of the existing curricula in vocational training institutions to include solar PV as a stand-alone course and not a unit embedded within the regular electrical engineering vocational courses should be seriously considered. Along with the foregoing, partnerships with international OGS companies would also bring access to technical expertise and advisory services, in which case these skills will develop organically. It was found that 33% of members who joined the Burundi Renewable Energy Association (BUREA) sought training programs, however, the available training is not specific to solar electricity, but skewed to general electrical engineering .

2.3.6 Institutional capacity

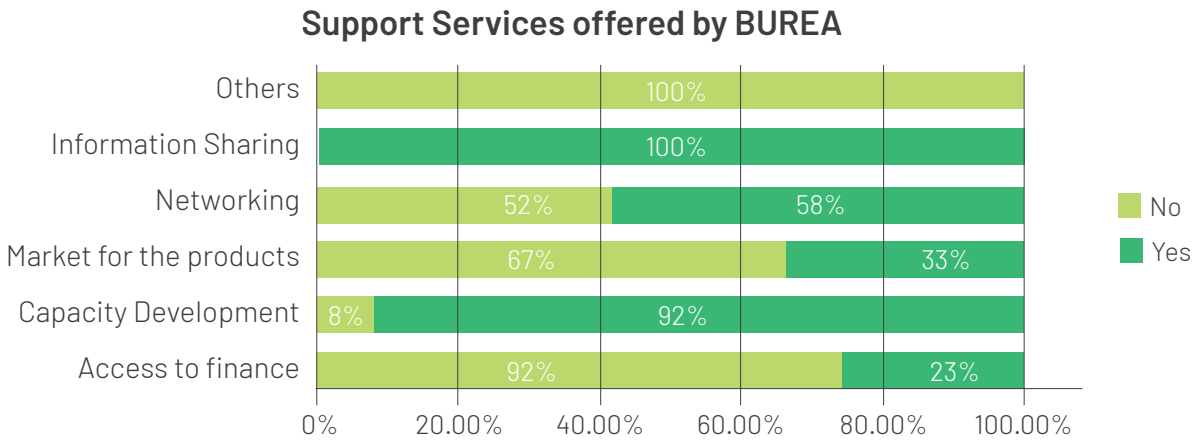
There are several players in the energy sector including the Ministry of Energy and Mines, private sector, development partners and the RE associations. GoB decentralised the energy sector by incorporating REGIDESO in 1993 to improve performance in generation, transmission and distribution of electricity, and ABER in 2011 to lead and develop rural electrification in Burundi.

The sector however, has continued to face various challenges such as lack of coordination among the players and limited technical skill in the various required aspects like contract negotiation, sourcing and structuring finance, understanding RETs among others. Solar companies (92%) that participated in the survey identified BUREA as a key partner in the RE sector in-terms of advocacy, coordination and interfacing with the GoB. One of the survey respondents said,

> *There are organizations such as BUREA whose mandate is to promote Renewable energy, and support the Ministry in carrying out activities related to renewable energy.*

BUREA renders support to their members in various ways such as access to finance, capacity development, information sharing, networking, access to markets and others. See figure below.

Figure 4 Support services offered by BUREA



Source: Survey findings

26. https://www.esi-africa.com/industry-sectors/finance-and-policy/grants-valued-at-160m-to-uplift-burundi-communities-through-solar/

Despite the services that BUREA offers to its members, the Association needs support in areas of funding to run their various activities, staffing, and advocacy to be effective in policy formulation and to have a conducive RE environment. It is worth noting, that member subscriptions do not provide a source of sustenance for the BUREA, and by extension, all the other regional NREAs. As such, there is need for a sustainability plan for them that looks beyond membership feed and donor funding. With inadequate donor funding and low member subscription, BUREA may collapse.

2.4 POLICY REVIEW AND GAP ANALYSIS

GoB has set three policy goals, the first of which is to ensure that the country's infrastructure is in good working order. The second goal encourages the use of renewable energy sources. It focuses on adequate facilities to promote energy efficiency.

The third policy goal focuses on restoration of existing (hydropower) plants and distribution grids as well as the development of new hydro-electric sites. Much as rural electrification is planned to be spearheaded by hydropower dams, provision of information on alternative energy sources of electricity that is affordable for low-income households is given consideration.

The study identified the following policy frameworks that govern or relate to the renewable energy sector in Burundi.

Table 2 List of policies reviewed in Burundi.

	Policy	Responsible Institution	Period	Status
1	Burundi's Vision 2025	Office of the President	2025 - 2023	Current
2	National Development Plan	Office of the President	2018 - 2027	Current
3	Burundi Electricity law	REGIDESO	2016-2020	Expired
4&5	Decree Rfi00/132 du June 2016 Procedure of development of a production plant for the production of energy for exclusive and commercial use	Office of the President	2016-2020	Expired
6	Decree N0 100 On the reorganisation of the company's operation. Transportation, Distribution and Marketing	Office of the President	2016-2020	Expired
7	Investment code 2008	Ministry of Finance	2008	Expired

Source: Survey Findings

2.4.1 Description of Relevant Policies

2.4.1.1 Burundi's Vision 2025

The vision focuses on eight pillars centred on good governance and capacity-building of the state, the Government of Burundi is largely focused on rebuilding structures and promoting good governance, to fight poverty and drive economic recovery and development through key transformative sectors like RE energy.

2.4.1.2 The National Development Plan (2018 - 2027)

The Government of Burundi (GoB) identified three strategic objectives, the first of which being to ensure "sustainable and inclusive growth for economic resilience and sustainable development, the second strategic pillar focuses on appropriate infrastructure to support energy production and promotes alternative sources of energy.

The long-term objective of this Plan aims to restore the structural balances of the Burundian economy through:

01 strengthening food self-sufficiency and the diversification of exports through the promotion of agro-industrial, commercial and extractive;

02 Development of the energy sector and the craft sector,

03 Construction and maintenance of growth support infrastructure

04 Improvement of access to basic social services, in particular education, health and social protection

05 Continuation of environmental protection and land use planning programs

06 Improvement of financial governance and decentralization

07 Development of regional and international partnership

2.4.1.3 Electricity Law 2015

The electricity sector in Burundi is largely governed by the electricity law of 2015. The government manages and owns the electricity supply chain from generation, transmission and distribution through the REGIDESO. The sector currently operates under a single-buyer model, with independent power producers that inject supply to the main utility. Rural electricity service is managed by the rural electrification agency which owns and operates the infrastructure.

The Electricity Law is not comprehensive, there is no specific legal framework for the development of renewable energy. However, the Law allows for

27. https://www.renewableenergyworld.com/solar/7-5-mw-mubuga-solar-plant-in-burundi-begins-construction/
28. EEP S&EA Energy Market Landscape Study August 2017

public-private partnership in electricity production and distribution which is good entry point for off-grid solar electrification.

The study established that the energy policy environment in Burundi is weak, the ministry responsible for energy has no authority in making policies or strategies rather it is the president's office that currently makes decrees that govern the energy sector. This corroborates the World Bank index that "assesses countries' policy and regulatory support for sustainable energy which places Burundi in a red zone in terms of electrification—indicating that the country is in the bottom third in their policy and regulatory environment.

2.4.2 Gap Analysis

Table 3 Policy Gap Analysis

Policy Status on Affordability:
There is no clarity on policies regarding taxation and or subsidies to make solar products affordable to the population. No evidence of an OGS tax exemptions.

Existing Situation: It's mainly the development partners that are active in the off-grid sector through projects and programs.

Policy Gap: The tax regime is un known with no specific policy, strategy on either tax exemptions, application of import duty or subsidies etc.

Policy Status: Standards and Quality
Whereas there is existence of the Bureau Burundais de la Normalisation (BBN) responsible for setting national quality standards and norms, which includes off-grid solar products, there is no known national policy on regulations, standards and quality for off-grid solar products.

Existing Situation: There are no specific national standards for off-grid national products in Burundi. The BBN has limited experience in developing, holding and enforcing such standards. There is a need for capacity development in terms of training, equipment and facilitation of the BBN.

Policy Gaps: There is a lack of regulations to address the challenge of standardisation in Burundi's OGS sector.

Policy status: Innovation and Technology
There is no known policy and strategy on innovation and technology in the OGS sector

Existing situation: PAYGO is the only known solar innovation

Policy gaps: There is no policy position on innovation and technology in the OGS sector.

29. Office of the president, (2018). Burundi Vision 2025 World Bank, (2019).

Policy status: Skills Development
By and large there is no stipulated policy or initiative within the GoB providing skills initiatives specifically for solar products.

Existing Situation: The training in solar is carried out by development partners such as GIZ, EnDEV, UNICEF among others. These training target youth in last-mile community who are trained on solar installation, maintenance and health and safety measures. The training last for 3-6months and are fully financed by the private implementers.

Policy gaps: There is no skilling policy or strategy to build the off-grid solar sector workforce.

Policy status: Institutional Capacity.
There is no clear government policy or strategy on institutional Capacity in the sector.

Existing situation: The electricity sector in Burundi is placed under the supervision of the Ministry of Energy and Mines who designs and implements the national energy policy, supervises the rural electrification, and plans to build and manage energy infrastructures. The execution of the national energy policy is under the responsibility of the Direction Générale de l'Energie. Two personalized state administrations have been established, the Water and Energy Regulatory Authority (AREEN) and the Rural Electrification Agency (ABER). BUREA acts as an umbrella body that brings together stakeholders in the RE sector for advocacy and representation before government.

Policy gaps: There is no known policy position or strategy on institutional development in the RE sector. This has resulted in poor coordination among stakeholders.

Policy status: Finance and Investment.
Investment in the electricity sector is liberalised and the Electricity Act of 2015 is favourable to foreign investment. Article 1 of the law emphasises favourable investment in the electricity energy sector thus there are no restrictions on foreign investment in the electricity sector. The Burundi Electricity Act stipulates a PPP regime which allows collaboration with the state. The electricity law also stipulates that the operations must comply with the legal regulatory provisions.

Existing situation: The International Development Association (IDA) has approved two grants totalling $160 million from the World Bank to help Burundi improve basic services through solar power and local development in rural and remote areas. Solar Energy in Local Communities (SOLEIL), which seeks to expand access to energy in the country by nearly 100% by electrifying local communities, will receive $100 million in subsidies. This confirms the government's willingness to partner with the private sector.

Policy gaps: There are no policies providing for a separate investment strategy and incentives to increase private sector participation in the Off-grid solar sector.

2.5 RECOMMENDATIONS

Affordability

Clarity on the OGS tax regime and promotion of subsidies to make solar products affordable.

The government should put in place a clear OGS tax regime and institute subsidy programs that will not only attract development of the sector but also increase advocacy through the relations and interconnection of the energy institutions, tax authorities, and investment agencies in development of the sector and the electrification of rural and urban customers, leading to positive socio-economic impacts.

Finance and investment

Access to Finance by off-grid solar companies

There is need to create appropriately structured financing by the government for the solar companies for them to access funds and be able to invest into the various off-grid technologies. Government can use the several available financial partners to engage the Solar companies.

Skills Development

The Ministry of Energy and Mines in corroboration with the Ministry of Education, should develop a skills strategy for the OGS sector. The strategy should enhance workforce capacity by conducting content specific training in OGS. The training programs should involve tertiary level training (Degrees, diplomas and vocational trainings), short-term based learning which may include on-the-job training, and certification programs.

Exchange training programs with neighbouring countries

Local trainers could be received from neighbouring countries such as; Rwanda, Kenya, Uganda, and Tanzania on short exchange visits to provide skills training and good practices in the OGS sector. Government should lobby development partners such as GIZ, BMZ, KFW for funding to engage in OGS skilling.

Standards and Quality

Develop OGS standards, regulations and policies

There is need to develop a comprehensive policies, regulations, standards and quality for OGS products. These regulations should be aligned to IEC standards and augmented with strong enforcement mechanisms to curb counterfeit solar products. The ministry of energy and mines should lead this effort in collaboration with BUREA and the Bureau Burundais de la Normalisation (BBN).

Institutional capacity

Coordination among energy stakeholders

There is need to establish a mechanism under the Ministry of Energy and Mines to improve coordination among energy stakeholders.

Strengthening RE institutions

While this is a growing sector still in its infancy, there is need to strengthen the capacity of government RE institution with financial and technical support. Key resources need to be empowered with skills like contract negotiations and finance, infrastructure planning, energy financing

Innovation and technology

Development of government policies and Strategies on innovation and technology

There is need for government to put in place deliberate efforts towards harnessing innovation and technology in the OGS sector. This can be achieved through partnerships with OGS innovators and inventors. This can be sought through exchange programmes and exhibitions.

30. Burundi off-grid access project.
31. https://www.worldbank.org/en/topic/energy/publication/rise—-regulatory-indicators-for-sustainable-energy

3.0 KENYA

3.1 COUNTRY OVERVIEW

Kenya is located in East Africa and is bordered by South Sudan and Ethiopia to the north, Somalia and the Indian Ocean to the east, the United Republic of Tanzania to the south, and Uganda to the west with a total area of 580,370 km^2.

The population-census of 2019 placed Kenya's population at 47.5 million people. With a population growth rate of 2.3 percent, the population is estimated to have increased by approximately nine million people between 2009 and 2019. The youthful population of Kenya is reflective of the national population structure, bloated at the bottom with over 75% being under 35 years, and 68.9% living in rural areas. The northern part of the country is arid and is sparsely populated and can go for months or years without a drop of rain. The census affirms that the rural population is youthful, and with 39% of them being unemployed. This steep population growth is expected along with demand for energy in the mid-term. See Figure below.

population growth rate of

2.3%

the population is estimated to have increased by approximately

9M

people between 2009 and 2019

youthful population of Kenya is

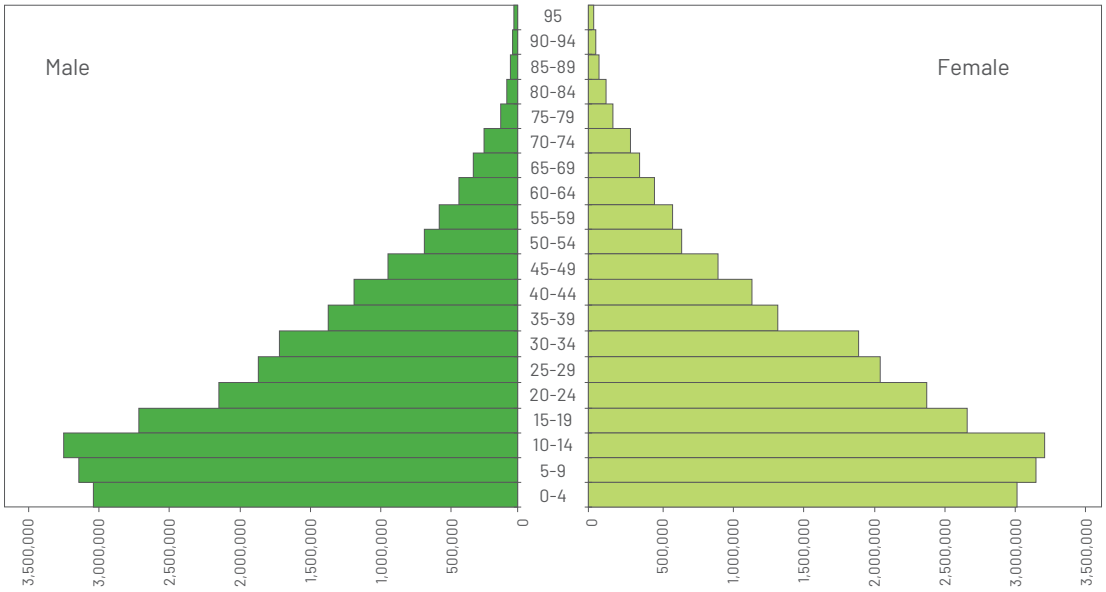
75%

being under 35 yrs and

68.9%

living in rural areas

Figure 5 Structure of Kenya's Population at a Glance, 2019



Source: 2019 Population and housing Census reports

Kenya has the biggest economy in East Africa with an average growth rate of 5.7% in 2019. Forestry and Agriculture are the lead contributors to the country's annual GDP. The GDP was expected to drop to 1.5% in 2020 due to the challenges occasioned on the economy by Covid-19. The Covid-19 pandemic has created a challenge in revenue collection for the tax authority. The effects of Covid-19 left 61% of businesses in Kenya with a long runway to recovery. The off-grid solar sector has not been an exception among the business sectors affected by Covid 19. businesses in Kenya with a long runway to recovery. The off-grid solar sector has not been an exception among the business sectors affected by Covid 19.

32. Proceedings, (2020). Electricity Sector Organization and Performance in Burundi
33. Alternative energy and power, Juris chamber 2019
34. Kenya National Bureau of Statistics (KNBS), The 2019 Kenya Population and Housing Census Volume I: Population by County and Sub-County
35. KNBS (2019). Census Report 2019. Kenya National Bureau of Statistics. Nairobi

3.2 ENERGY SECTOR

Kenya's hydropower capacity increased from 769 MW in 2010 to 837 MW in 2019. However, the electrification rate is only at 9% despite this increment. The energy demand is projected to grow at a rate of more than 18% annually, making it the largest energy consumer in East Africa. To bridge this gap, Kenya has ventured into the Off-grid solar sector by taking advantage of the fact that Kenya's solar insolation is estimated at 4-6 kWh/m^2/day all year round. Kenya's non-large hydro renewables generation increased from 52.3% in 2018 to 60% in 2019. Hydropower and Geothermal are now the two main sources of Kenya's electricity generation mix. For the last couple of decades, solar has been the fastest growing renewable energy source.

Kenya has a variety of sources of energy including hydropower, Wind Power, Solar Energy, Geothermal Energy, Biomass and Biogas energy, altogether accounting for 93% of the country's energy needs. In December 2019, Kenya was ranked 5th globally in the annual Bloomberg index of investments and opportunities in clean energy. By the close of 2018, Kenya, had Ksh140 billion ($1.4 billion) investments, doing much better than many developed countries, some of which manufacture a variety of clean energy appliances and accessories. The Government of Kenya aims at achieving 100% electrification by 2022, both in the rural and urban areas with KenGen producing about 70% of the country's electricity via the main national grid, and the other 30% produced by other feed-in sources to the national grid. These include Wind, Solar, Geothermal, and Thermal energy.

The under exploited hydro-electric power production in Kenya's stands at 1,630MW and on average, the energy production from the potential projects is capable of yielding at least 5,605 GWh per annum. This hydropower potential is mainly is located in the five geographical regions, representing Kenya 's major drainage basins namely; Rift Valley (305MW); Tana River (790MW), Athi River (60MW), Ewaso Ng'iro North River (146MW) and Lake Victoria (329MW). In 2017, the hydropower generation capacity of the country was 823.8MW which is 35.3% of the total installed capacity. With geothermal at 652 MW representing 28%, Solar standing at 0.66 MW representing 0.02%, Wind-generated energy at 26.05 MW, biomass at 28 MW and a total capacity of 2,33.07 MW. Kenya aims at achieving a generation capacity of 23,000 MW by 2030.

In 2019, the hydropower installed capacity of the country was 826.2MW which is 35.3% of the total installed capacity. With geothermal at 828.4 MW representing approximately 28%, Solar standing at 51.0 MW representing approximately 1.8%, Kenya aims at achieving a generation capacity of 23,000 MW by 2030. See table below on installed and effective capacity of electricity in Kenya as at 2019.

36. World Bank.2020 https://www.worldbank.org/en/country/kenya/overview accessed on 19th Jan 2021
37. Ministry of Energy and Petroleum, sustainable Energy for All, Kenya Investment Prospectus
38. UNDP, 2020, Policy Brief; A vehicle to articulate development issues and foster dialogue, Articulating the Pathways of the Socio-Economic Impact of the Coronavirus (COVID-19) Pandemic on the Kenyan Economy
39. Deloitte, 2020, Economic impact of the COVID-19 pandemic on East African economies, Summary of government intervention measures and Deloitte insights
40. REN21, 2016. EAC Renewable Energy and Energy Efficiency Regional Status Report (Paris: REN21 Secretariat)
41. Dr. Eveline Jansen et al (2016) Facts & Figures solar Energy
42. Climate scope 2020. https://global-climatescope.org/results/KE
43. Benard O. Muok, 2015 Solar PV for Enhancing Electricity Access in Kenya: What Policies are Required, Kenya
44. Africa energy series Kenya Special Report / 2020, Invest in The Energy Sector of Kenya
45. Africa energy series Kenya Special Report / 2020, Invest in The Energy Sector of Kenya
46. https://www.kengen.co.ke/index.php/who-we-are.html

Table 4 Installed and Effective Capacity of Electricity by 2019

Sources of Electricity	Installed Capacity 2019 (MW)	Effective Capacity 2019 (MW)
Hydro	826.2	805.2
Thermal Oil	749.3	716.0
Geo Thermal	828.4	816.0
Wind	336.1	325.5
Cogeneration	28.0	23.5
Solar	51.0	50.4
TOTAL	**2,818.9**	**2,736.4**

Source: Kenya Power & Lighting Company and Kenya Electricity Generation Ltd

3.2.1 Off-grid Solar Sector

The history of solar in Kenya started five decades ago when the Government of Kenya used solar PV to power broadcasting installations in remote areas. The steady involvement of Development Partners and Government in supporting the private sector has yielded a thriving solar industry. As of 2019, the total installed PV capacity in Kenya stood at 50.25 MWp. This capacity has been doubled by the new online Garissa Solar Plant which produces 55 MW of electricity and sells it to the Rural Electrification and Renewable Energy Corporation (REREC) through the Power Purchase Agreement. This was a landmark project financed by Exim Bank of China, construction started in 2017 and commissioned in 2018. It is now the largest off-grid solar plant in East and Central Africa contributing 2% of the overall energy mix of Kenya. The Garissa solar Power plant, owned by the Kenya Rural Electrification Authority, sells its output to Kenya Power and Lighting Company (KPLC) through a Power Purchase Agreement (PPA) and is expected to serve over 350,000 people. This attest to Kenya having one of the most competitive commercial PV system markets in Sub-Saharan Africa, with an estimated 300,000 rural households using solar home systems.

Solar energy is at approximately 2% of total installed capacity and generates approximately 1% of annual power production. As mentioned above, this sector is growing at a fast rate with the encouragement of Government policy. The foregoing is strengthened by renewed interest in the solar mini-grid and its growing capacity though it is still marginal compared to the overall installed power production capacity of approximately 5000 MW.

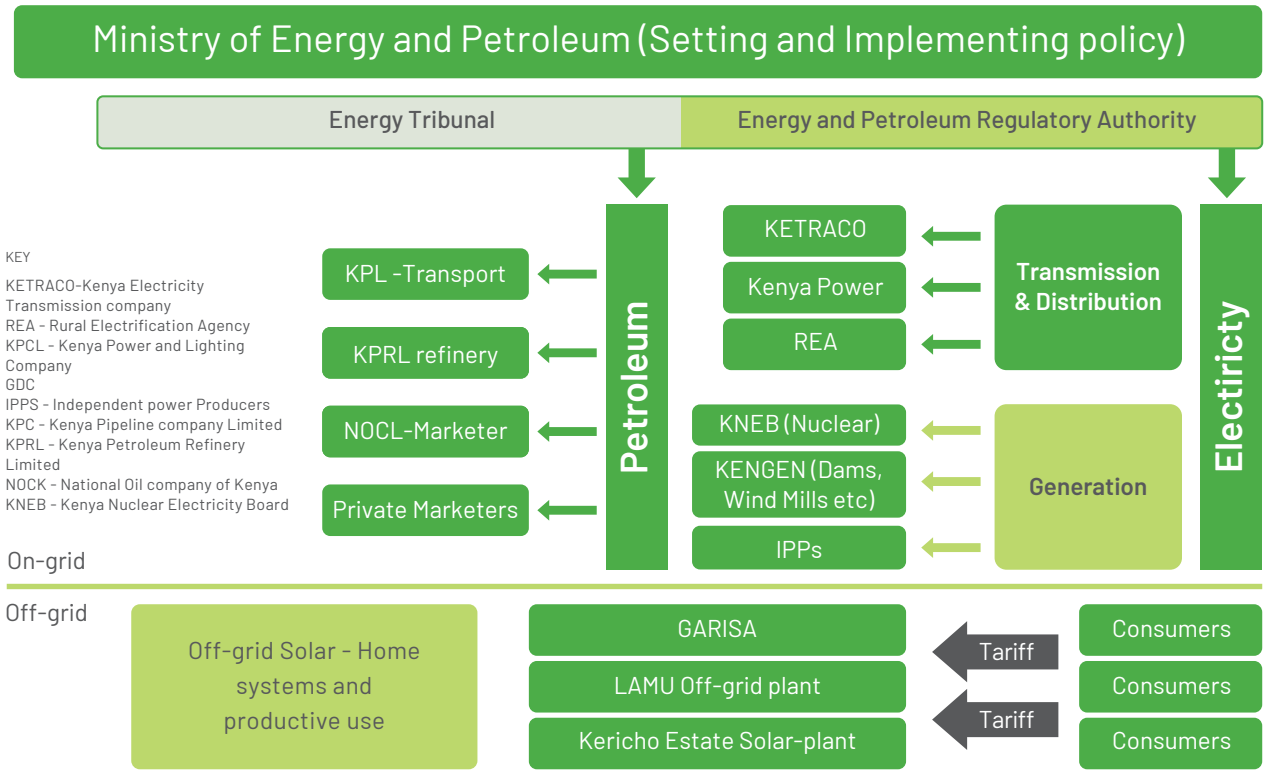
47. Ministry of Energy, National Energy Policy, 2018
48. Ministry of Energy and Petroleum, 2015, sustainable Energy for All, Kenya Investment Prospectus
49. S Dominic, N Charles et al, (2020). Barriers and solutions of increasing the integration of Solar PV in Kenya's Electricity mix.

According to Power Africa (2019), Kenya's overall sales of SHS in off-grid goods from 2016 to 2019 were approximately $5 million. Kenya currently leads and has retained its dominance on the sub-Saharan African continent, attracting investors, especially in the pay-as-you-go business model. Kenya has been the hub of EA business for over three decades, easily attracts FDI and makes raising capital easier than in the other areas. Kenya's total Off-grid solar sales amounted to 995,000 units with PAYGO sales totalling approximately 5,000,000 USD. This indicates an increase in the uptake of off-grid solar products in Kenya.

3.2.2 Institutional Framework

African continent, attracting investors, especially in the pay-as-you-go business model. Kenya has been the hub of EA business for over three decades, easily attracts FDI and makes raising capital easier than in the other areas. Kenya's total Off-grid solar sales amounted to 995,000 units with PAYGO sales totalling approximately 5,000,000 USD. 54 This indicates an increase in the uptake of off-grid solar products in Kenya.

Figure 6 Kenya's Institutional framework



Source: Survey findings

50. www.afrik21.Africa/en/Kenya-Jiangxi-international-commissions-50-MW-Garissa-solar-power-plant/
51. https://kerea.org/renewables/solar-pv-systems/ USAID, Power Africa 2019, Off-Grid Solar Market Assessment Kenya Power Africa Off-grid Project
52. USAID, Power Africa 2019, Off-Grid Solar Market Assessment Kenya Power Africa Off-grid Project

Table 5 Roles of institutions in Kenya

Institution	Role
Ministry of Energy and Petroleum (MEP)	Policy and strategy formulation in addition to administering the Rural Electrification Scheme in the energy sector.
Rural Electrification and Renewable Energy Corporation (REREC)	Implement rural electrification projects and promote off-grid electrification in the hard-to-reach areas
Energy and Petroleum Regulatory Authority (EPRA)	Draft technical and economic regulations, issue licenses, permits, certifications, development and enforcement of regulations codes and standards as well as investigation and resolution of disputes
Kenya Power and Lighting Company (KPLC)	To plan for sufficient electricity generation and transmission capacity to meet demand, build and maintain the power distribution and transmission network and retail electricity to its customers
Kenya Electricity Transmission Company. (KETRACO)	To plan, design, construct, own, operate and maintain the nation's high voltage electricity transmission grid and regional power interconnectors
Independent Power Producers (IPPs)	Build, own and operate power stations and sell the power in bulk to KPLC.
Kenya Electricity Generating Company (KenGen)	Manages and develops all public power electricity generating facilities. It sells electricity in bulk to KPLC.
Kenya Nuclear Electricity Board (KNEB)	Driving the nuclear energy generation programme for Kenya

Source: survey findings

3.3 FINDINGS

3.3.1 Affordability

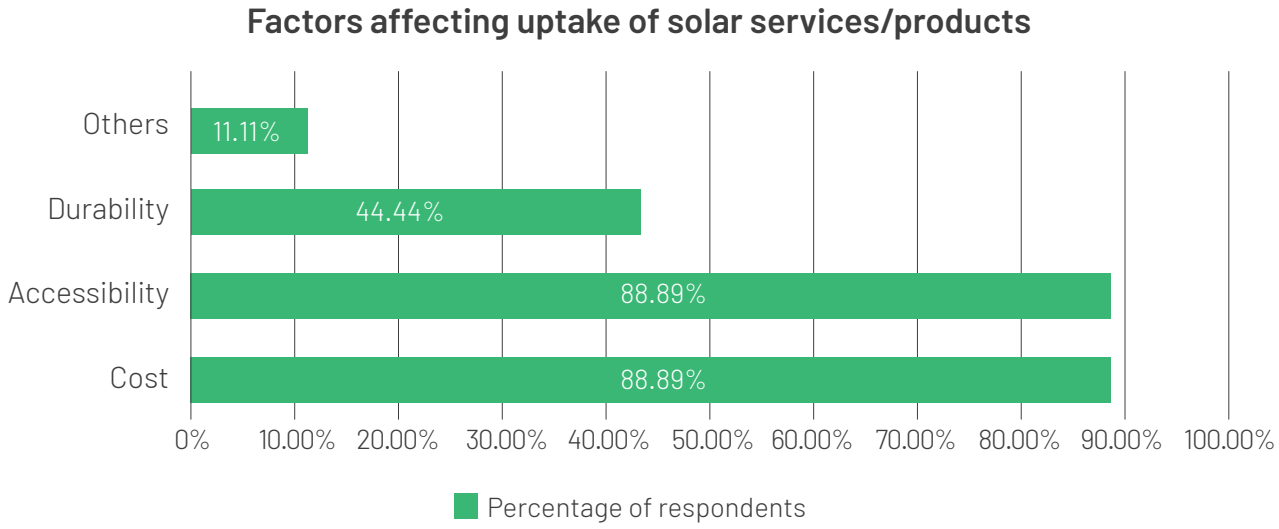
Kenya is the leading country in SHS sales in Africa, with approximate total sales of over $5 million in Off-grid SHS products. Kenya was one of the first countries in East Africa to introduce the PAYGO business model, aimed at ensuring solar is more affordable, by allowing customers to pay in smaller instalments, for example, the smallest basic Solar Home System goes for as low as Ksh. 2,999 with an instalment payment as low as Ksh50 payment per day for a period of 12 months.

53. Gogla 2020, Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data, Amsterdam.
54. REN21, 2016. EAC Renewable Energy and Energy Efficiency Status Report (Paris: REN21 Secretariat)
55. Kenya Revenue Authority, 2020 Highlights of Amendments under the Finance Act, 2020
56. Kenya Revenue Authority, 2020 Highlights of Amendments under the Finance Act, 2020
57. https://www.the-star.co.ke/business/kenya/2020-12-11-state-drafts-tough-rules-for-solar-energy/

Affordability is the main obstacle to electricity access particularly for households living in rural northern parts of Kenya. This was confirmed by 88.9% of respondents who indicated that cost was a major factor affecting uptake of solar products. See figure below.

However, this situation is likely to improve with the Finance Act of 2021 that has reinstated VAT exemption on solar PV panels, this is a milestone since taxes trickle down to the consumers, hence affecting the cost of solar products.

Figure 7 Drivers of uptake of off-grid Solar products



Source: Survey findings

3.3.2 Standards and Quality

GoK has set tough licensing and operational conditions for solar investment in the country including the solar photovoltaic and solar water heating regulations. However, the problem of counterfeits is persistent in the Kenyan Market due to weak enforcement mechanisms, as stated by an industry player.

"We need to support and empower the regulatory bodies in Kenya with the resources and manpower so that they can be able to rein in on these fake products through testing and law enforcing".

Sceptics in the RE industry argue that the regulations are rather meant to protect Kenya Power (KPLC) from competition, as revenues continue to fall despite the company enjoying monopoly. Others have argued that the regulations may stifle growth of the industry due to its strong punitive nature, the senate Committee on Energy questioned the regulations, cautioning that the rules could slow down the uptake of solar energy in the country .

It is suggested by some studies that solar (Solar Water Heating) Regulations 2012, should be repealed and replaced with a dedicated SWH policy that seeks to provide incentives that will grow the market rather than enforce compliance. The new policy should at a minimum provide or result in financial incentives for end-users, support capacity development efforts across practitioners, strengthen the licensing procedures for practitioners, raise awareness among end-users through industry led standards and certification processes.

58. The study on solar water heating Industry in Kenya, (2017) see link here
59. Africa Energy Series Kenya Special Report 2020, Invest in The Energy Sector of Kenya
60. https://www.epra.go.ke/download/power-generation-and-transmission-master-plan-kenya-long-term-plan-2015-2035-vol-i-main-report
61. Kenya National Electrification Strategy: Key Highlights 2018
62. Ministry of energy and Petroleum, Kenya National Electrification Strategy, 2018, Key Highlights
63. Kenya National Electrification Strategy: Key Highlights 2018

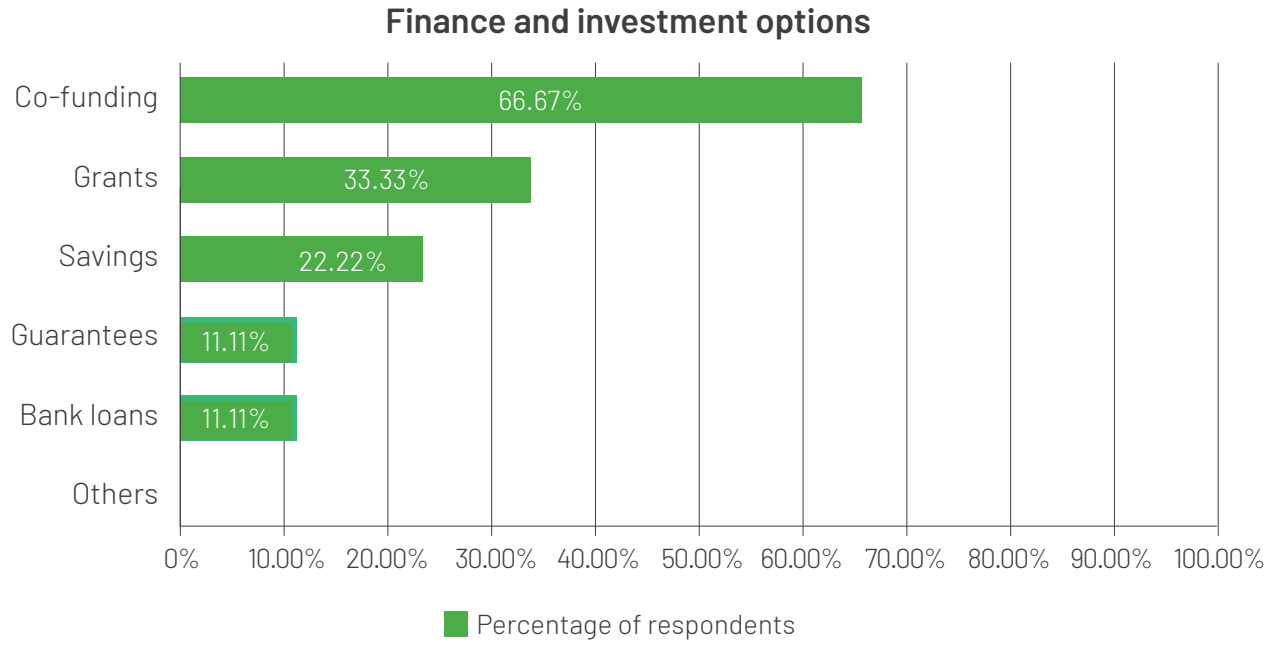
3.3.3 Finance and Investment

The renewable energy sector in Kenya has attracted several development and investment partners including both local and international financiers and investors. By the early 2000s, independent Power Producers (IPPs) had started taking dominance of Kenya's Off-grid electricity supply building mini-grid and off-grid plants. The Africa Energy Series Kenya Special Report, 2020 revealed that the IPP electricity supply in Kenya represents approximately 30% of the overall electricity generation capacity, contributing to the national energy mix. Kenya also has a Power Generation and Transmission Master Plan (2015 - 2035). It shows opportunities for off-grid electrification by presenting where on-grid power will focus, leaving an open area of focus for OGS actors to have longer term focus.

The Kenya National Electrification Strategy (KNES) recognizes the role of the private sector in RE and plans to invest up to 121 mini-grids, connecting 35,000 households by 2022. This is in pursuit of the expected 5.7 million to achieve universal access to electricity by 2030. These government programs target rural low-income households, urban and peri-urban areas. The KNES, therefore, estimates a total investment requirement of $2.8 billion for the national electrification program through public investment in grid and mini-grid expansion implemented with donor-financing and $458 million of private investment in solar home systems.

KNES envisions one hundred and ninety-six million connections through standalone solar home systems and 35,000 connections through the 121 new mini-grids to serve housing clusters too distant from the network or too small to be connected to the national grid by 2022. The KNES also capitalizes on the key contribution that the private sector plays in providing off-grid technologies, to boost the drive towards universal access to electricity. This is confirmed by several partnerships with development partners like SNV, GIZ, African Clean Energy. However, this investment strategy can only be realized through enabling financing options, it was established that the RE financing landscape is dominated by co-funding financing arrangements and guarantees from banks and financial institutions. See figure below.

Figure 8 Investment options for OGS



Source: Survey findings

64. especially the Pay-as-you-go solar system
65. USAID Global Development Lab Centre for Digital Development Strategy & Research AUGUST 2017 Pay-As-You-Go Solar as A Driver of Financial Inclusion
66. https://www.reuters.com/article/us-kenya-energy-solar-tech-idUSKCN1B50IH visited on 14/02/2021

2020 revealed that the IPP electricity supply in Kenya represents approximately **30%** of the overall electricity generation capacity

121 private sector in RE and plans to invest up to **35,000** mini-grids, connecting households by 2022

KNES, estimates a total investment requirement of **$2.8 B** for the national electrification program.

$458 M private investment in solar home systems.

3.3.4 Innovation and Technology

The PAYGO business model is the dominant solar innovation in the Kenyan market, 100% of industry players were conversant with the PAYGO model that has evolved to include payment made through mobile transfers using the Global System for Mobile Communications (GSM) infrastructure or Machine-to-Machine (M2M) technologies. Some of the prominent PAYGO service providers in Kenya are M-KOPA, D. Light, Azuri Technologies, Barefoot Power, Mibawa, BBOXX, Greenlight Planet, Mobisol, Off-Grid Electric, Solar Now, and Pawame.

It was found that other technologies are beginning to penetrate the market such as the building-Integrated Photovoltaic technology, a new solar roofing tile technology that is fitted with energy-producing cells. These tiles are manufactured by Strauss Energy, a Kenyan company with support from the United States African Development Foundation.

3.3.5 Skills development

There are several institutions offering training and skills development in the renewable energy sector. The Strathmore University Energy Research Centre (SERC) is leading this sector, by providing hands-on training courses on solar PV. The National Industrial Training Authority (NITA) accredited Strathmore University to train renewable energy professionals and examine them before being licensed as qualified technicians by the Energy and Petroleum Regulatory Authority (EPRA). More than one thousand technicians have currently been trained in various technical programs at Strathmore university and other associated institutions in East Africa.

This programme has not only strengthened the existing training centres, but it has also inspired the establishment of more solar training centres that are recognised by NITA. However, the fact that the number of training centres across the country is unevenly distributed poses a challenge in the implementation of the solar training curriculum. This denies manufacturers and practitioners the opportunity to get necessary training in solar PV.

Kenya Renewable Energy Association (KEREA) has made efforts to bridge this gap by providing refresher, and industry-specific training programs, 88% of members confirmed attending training programs convened by KEREA. One of KEREA's officials mentioned that "Our mandate requires sharing knowledge and expertise across the membership base of practitioner experience in different regions, so we advocate for training and information sharing" It was found that, despite these skilling initiatives, the solar industry suffers a deficiency of skilled personnel qualified to design, install and effectively maintain modern solar energy systems.

3.3.6 Institutional capacity

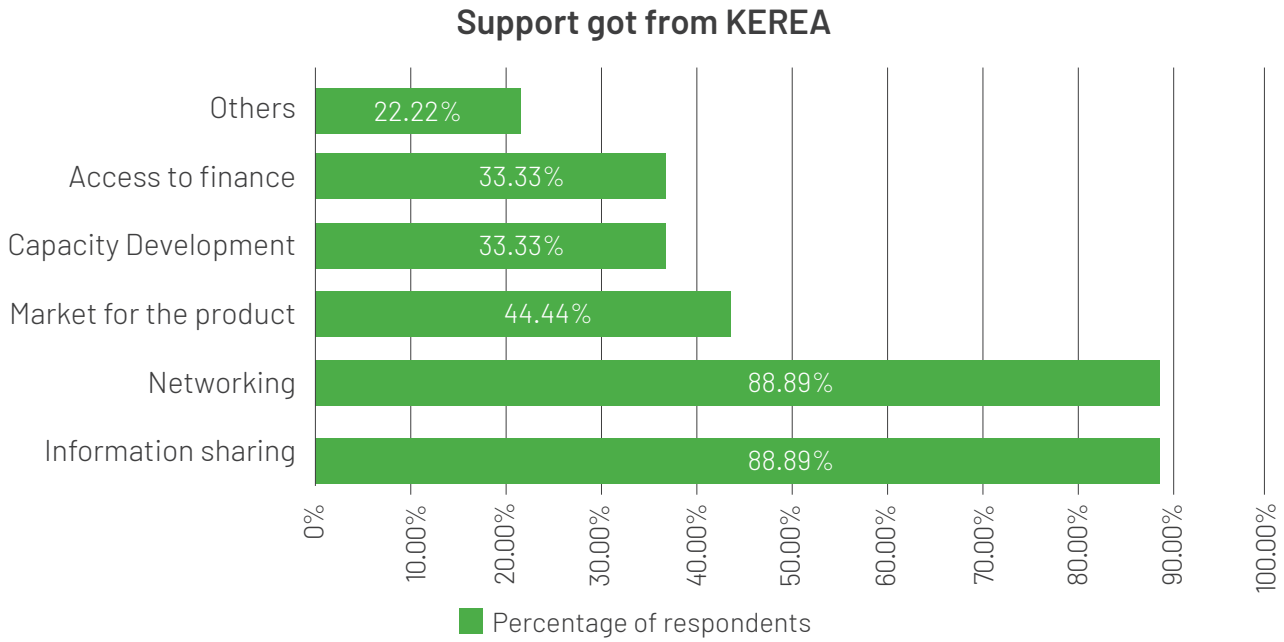
It was found that the RE institutional set up consists of several stakeholders like the government institutions, private sector, civil society and associations. GoK has taken steps to strengthen these institutions such as restructuring REA to REREC. This was done to create more competitive market structures with clear delineation of roles for public and private sector players in generation, transmission, distribution and retail functions.

KEREA was found to have a strong presence in the RE landscape including supporting county governments to develop their county energy plans, despite being a private sector led membership organisation. It was confirmed to be beneficial to its members, 89% of members reported to have benefited a lot through information sharing and Networking, while 44% have benefited from product marketing and capacity building. (See figure below) By its location in the RE Ecosystem of Kenya, KEREA plays a pivotal role of driving awareness, development, and investment in the Renewable Energy space. However, findings from the

67. https://www.strathmore.edu/serc/programmes/ accessed on 06/01/2021
68. https://www.strathmore.edu/serc/programmes/ Accessed on 06/01/2021
69. USAID, Power Africa 2019, Off-Grid Solar Market Assessment Kenya Power Africa Off-grid Project
70. SE4ALL, Kenya Action Agenda, Ministry of Energy and Petroleum, 2015
71. Kenya's Vision, 2030, Ministry of Planning and National Development, 2007

study revealed that the association has a weak institutional set up, both technically and financially. It was also found that overall collaboration among RE institutions is weak. The 2019 energy policy identified inadequate institutional capacity to negotiate energy contracts and inadequate local content in energy projects as key challenges to be addressed in institutional reform.

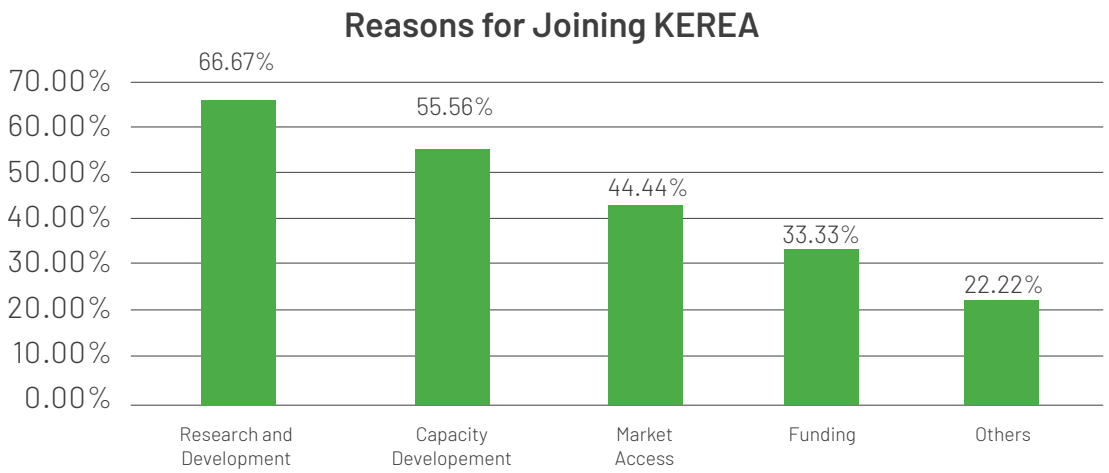
Figure 9 Support from KEREA to Members



Source: Survey findings

There is a need to have more collaboration among the institutional players (NREAs, Government, Development partners and civil society) to increase funding, offer technical support, capacity building, and development of policy frameworks for solar products in order to strengthen the institutional capacity.

Figure 10 Motives for joining KEREA



Source: Survey findings

72. Energy Act, Ministry of Energy, 2019
73. Strategic Plan, Rural Electrification Authority, 2016
74. Kenya National Electrification Strategy, Ministry of Energy, 2018
75. Ibid

3.4 POLICY REVIEW AND GAP ANALYSIS

The study identified the following renewable energy policies and regulations in Kenya. See table 4 below.

Table 6 Energy Polices in Kenya

No.	Policy	Period	Status
1.	Kenya Vision 2030	2007 - 2030	Current
2.	Energy Act	2019	Current
3.	National Energy Policy	2014	Current
4.	Energy (Solar Photovoltaic) Regulations	2020	Current
5.	Rural Electrification Authority, Strategic Plan	2016 - 2021	Current
6.	Updated least-cost power Development Plan 2011-2031	2011	Updated
7.	Kenya National Energy Efficiency and Conservation Strategy	2020	Current
8	Feed-in-Tariff Policy	2012	Current
9.	Kenya National Electrification Strategy	2018	Current
10.	Scaling-Up Renewable Energy Program (Investment Plan for Kenya)	2011	Current
11.	Sustainable Energy for All, Kenya Action Agenda	2015	Current
12	Energy (Solar Water Heating) Regulations	2012	Current

Source: survey findings

3.4.1 Sustainable Energy for All, Kenya Action Agenda, 2015

Kenya is a signatory to the SE4ALL Action Agenda. In line with this, Kenya envisions 100% access to affordable quality energy for all Kenyans by 2030. As such, under this international framework, Kenya launched its energy action agenda in 2015, setting out three (3) broad targets :

Table 7 Kenya SE4ALL Targets

Universal access to modern energy	Doubling global rate of improvement of energy efficiency	Doubling share of renewable energy in the global energy mix
• 100% of the population with electricity access • 100% of the population with access to modern cooking solutions	• 2.7% rate of energy improvement intensity per year	• 80% share in total final energy consumption

Source: SE4ALL, Kenya Action Agenda, 2015

3.4.2 Kenya's Vision, 2030

Kenya's Vision 2030 recognizes that energy is critical to achieving an industrial middle-income status. The vision underscores the need for increased energy supply to meet the demands for both consumptive and productive energy. It reiterates the need to exploit new energy sources in the renewable energy sector, including encouraging more private sector participation and building a strong institutional framework to guide the growth and development in the renewable energy space .

3.4.3 Energy Act, 2019

The Energy Act, 2019 is the overarching policy that governs the energy sector in Kenya, it articulates the Government's obligation to facilitate the provision of affordable energy services to all persons. The policy emphasizes the promotion and development of renewable energy technologies, including but not limited to solar. The policy also provides for the establishment of the Rural Electrification and Renewable Energy Corporation, to develop, promote and manage the renewable energy sector . All other subsequent strategies including the Kenya National Electrification Strategy (KNES), and specific renewable energy regulations i.e., solar photovoltaic regulations, and the establishment of the rural electrification authority have been developed in line with the Energy Act. The rural electrification authority is mandated to develop and promote renewable energy sources, specifically to install solar home systems for households in areas far away from the grid.

3.4.4 Kenya National Electrification Strategy, 2018

In 2014, the government of Kenya realized that universal access to electricity would not be possible by 2022. As such, the Kenya National Electrification Strategy was developed, which aims to achieve electricity access for all households and businesses over the shortest time-frame and at an acceptable quality of service. The strategy is designed to deliver on two fronts:

- To expand grid electric power to areas where expansion costs are below a reasonable ceiling ("grid compatible") at an accelerated pace.

- To identify Off-grid solutions that can meet the energy needs of lower-income remote population centres and housing clusters at reasonable costs and within the government's timeframe.

The strategy recognizes the role of solar PV technology in helping Kenya achieve universal access to electricity by 2022. As such, it emphasizes the need to devise a systematic strategy to deliver Off-grid power. The strategy provides for a geospatial planning framework to create a mechanism that provides for objective planning for universal access to energy across Kenya, in the sense that where grid extension and mini-grid services are not viable, off-grid standalone energy systems such as solar photovoltaic systems will be employed, including subsidy programs akin to the last mile connectivity program, that has been a success in Kenya . The last mile connectivity program is an initiative of the scaling-up renewable energy program for Kenya, the program aims at promoting hybrid mini-grids, solar water heating, small hydropower, and geothermal power across Kenya.

3.4.5 Energy (Solar Photovoltaic Systems) Regulations, 2020

In 2020, the Kenya Energy and Petroleum Regulatory Authority (EPRA) undertook a participatory process to revise the 2012 Energy (Solar Photovoltaic Systems) regulations, in line with the provisions of the Energy Act, 2019. The updated regulations emphasize the promotion of solar PV technology as a form of renewable energy technology. The specific objectives of the regulations are :

- To protect end-users of solar PV systems from sub-standard products by enforcing adherence to the relevant Kenyan Standards during manufacture, design, installation, repair, and maintenance of Solar PV systems.

76. Scaling-up Renewable Energy Program, Ministry of Energy, 2011
77. Energy (solar photovoltaic systems) regulations, EPRA, 2020
78. Scaling-up Renewable Energy Program, Ministry of Energy, 2011

- To enhance the quality of solar PV installations by licensing all persons involved in the manufacture, importation, distribution, promotion, sale, design, or installation of any Solar Photovoltaic systems.

- To facilitate collection of energy data as provided for in Section 10 of the Energy Act, 2019.

- To promote fair business practices in the Solar PV industry.

The regulations were revised bearing in mind that it will ultimately lead to a better regulated and more competent and accountable solar PV Industry resulting in social, economic, and environmental impacts. The regulations are explicit in their provisions relating to requirements for licensing of technicians, contractors, and manufacturers, component standards, installation requirements, including component warranty, and powers conferred upon the EPRA to inspect and monitor the solar PV sector, including penalties for contravention.

3.4.6 Energy (Solar Water Heating) Regulations, 2012

The solar water heating regulations were put in place in 2012 as part of a government effort to promote the uptake and regulation of low-temperature solar water heating systems in industrial, commercial, and residential buildings . As part of the scaling-up renewable energy program, the Government published a notice to all property owners, home and hotel owners in Kenya to install solar water heating systems or risk a fine of $ 9,970- or one-year imprisonment or both . This was particularly for all premises with hot water demand above 100 litres per day, the regulations provide for mechanisms in the installation and use of water heating systems, licensing of SWH installation works, including compliance and general penalty.

3.4.7 The Feed-in Tariff (FiT) Policy

The Kenya Feed-in-Tariff (FiT) policy of 2012 was crafted to attract investment into the solar PV sector through Independent Power Producers (IPPs) and to promote the generation of electricity from renewable energy sources. The policy allows for the sale of renewable energy generated electricity to the Kenya Power and Lighting Company (KPLC) at a fixed tariff determined by the Power Purchase Agreement (PPA) for a minimum of 20 years.

The FiT policy encourages investment into the off-grid sector, however, some of these policies are not in harmony with the Energy Act 2019. One of the core objectives of the FIT policy is to reduce transaction and administrative costs and delays associated with conventional procurement processes. The Energy Act, 2019 PART VI section 117 on the other hand requires a person or an entity intending to apply for a license as an IPP to make a public advertisement with fifteen days' notice, in at least two newspapers of nationwide circulation. Subsection 3 prescribes the same period for an individual or entity intending to object to an IPP license application. The objection can be made on the 30th day or before 30 days elapse after the application has been made. This is contrary to the FiT policy that aims at reducing transaction and administrative costs and delays associated with the conventional procurement processes makes the full implementation of the FIT policy hard and application for an IPP license cumbersome.

3.4.8 Solar Tax Regime in Kenya

The Finance Act as amended in 2021, reinstated VAT exemptions on specialized equipment for the development and generation of solar and wind energy, including photovoltaic modules, direct current charge controllers, direct current inverters and deep cycle batteries that use or store solar power. However, import duty and income tax are still the main levies that constitute the tax regime in Kenya as shown in the table below.

79. https://www.esi-africa.com/industry-sectors/renewable-energy/kenya-final-deadline-for-solar-water-heating-systems-installations/
80. Energy (solar water heating) regulations, EPRA, 2012
81. The Republic of Kenya, Ministry of Energy and petroleum, 2012, Feed-In-Tariffs Policy on Wind, Biomass, Small-Hydro, Geothermal, Biogas and Solar Resource Generated Electricity

Table 8 Tax requirements on selected solar accessories in Kenya

Description	VAT	Import Duty
SHS, modest unit of 3-4 lights, phone charge, powering radio, etc. plus TV	Non-exempt (as per Finance Act 2020)	Non-exempt (as per Finance Act 2020)
PV Solar module	Exempt	Exempt
Solar charging control units	Exempt	Exempt
DC to AC Inverters	Exempt	Exempt
Secondary cables	Non-exempt	Non-exempt
Primary cables	Non-exempt	Non-exempt
Solar Lanterns (non-integrated solar panels)	Exempt	Exempt
Solar torches	Non-exempt	Non-exempt
Solar TVs	Non-exempt	Non-exempt
Solar Radios	Non-exempt	Non-exempt
Battery Control Unit		
Solar home system kit (Assorted Components)	Exempt	Exempt
Charge controllers		
Specialized solar mounting structures (for large systems)	Non-exempt	Non-exempt
Battery control unit	Exempt	Exempt
Deep cycle batteries	Exempt	Exempt
Solar Lanterns integrated solar panels)	Exempt	Exempt
Solar metering units	Exempt	Exempt
Hair Cutter	Non-exempt	Non-exempt
Batteries (all categories)	Exempt	Exempt
Charge controllers	Exempt	Exempt
Solar power display meter	Non-exempt	Non-exempt
LED lights (all categories)		
Solar water pump	Non-exempt	Non-exempt
Solar irrigation	Non-exempt	Non-exempt
Solar water heater	Exempt	Exempt
Solar cookers	Non-exempt	Non-exempt
Solar refrigerators	Non-exempt	Non-exempt
Solar street lights	Exempt	Exempt

Source: The East African Regional Handbook on Solar Taxation, 2020

82. Dominic Samoita, Charles Nzila, et al,2020 Barriers and Solutions for Increasing the Integration of Solar Photovoltaic in Kenya's Electricity Mix,
83. Ministry of energy and petroleum, The Energy Act, 2019
84. Ministry of Energy and petroleum, 2012, Feed-In-Tariffs Policy on Wind, Biomass, Small-Hydro, Geothermal, Biogas and Solar Resource Generated Electricity
85. GoK, 2021. The Finance Act
86. https://www.afdb.org/en/countries/east-africa/rwanda/rwanda-economic-outlook

3.4.9 POLICY GAP ANALYSIS

Policy Status: Standards and Quality
National Energy Policy 2018 section 3.7.3 on Solar Energy
The policy has an objective for a Regular review of standards for solar energy technologies and equipment.
National Energy Policy 2018 section 7.2.1 (I) Energy Regulation
The Policy has an objective of Certification of solar system installation technicians and contractors,
The Energy (Solar Water Heating) Regulations, 2012 provides for mechanisms in the installation and use of water heating systems, licensing of SWH installation works, including compliance and general penalty.

Existing Situation: The government of Kenya has put in place the Energy (Solar Photovoltaic Systems) Regulations, 2020 that are key in streamlining enforcement and compliance including Severe penalties to protect consumers and enhance quality of solar PV. These include a fine of Ksh. 10,000 for a person who is delaying the renewal of his or her license and Ksh. 20,000 for delaying the issuance of a project completion certificate or installation warranty to implement it.
In addition, KEBS reviewed and adopted the IEC Quality Standards in July 2020, and they were gazetted by September 2020. Kenya was the first EA country to review and adopt the IEC Quality Standards.

Solar water heating regulations were placed in place in 2012 as part of the Government's efforts to encourage the uptake and regulation of low-temperature solar water heating systems in manufacturing, commercial and residential buildings. As part of the scaling-up of renewable energy, the Government issued a directive to all property owners, home owners and hotel owners in Kenya to install solar water heaters.

Policy Gap: The regulations are more punitive rather than providing incentives for the growth of the off-grid sector.

Policy Status: Innovation and Technology
National Energy Policy 2018 section 3.7.3 (11) on Solar Energy
Government has a policy and strategy to undertake RD&D on solar technologies.
National Energy Policy 2018 section 9.3.3 Research and Development
The Policy has an objective and strategy to establish an Energy Institute to undertake training, research, development, dissemination, nurture talent, innovation and enhance capacity building in the sector.

Existing situation: There are two major technologies deployed in Kenya, the PAYGO technology and the Building Integrated Photovoltaics (BIPV) that have been tried and tested in Kenya.
The Strathmore University Energy Research Centre (SERC) is carrying out high-quality research and consultancy services and provides laboratory testing and project development for the RE sector in Kenya. SERC offers services to the Government, Private Sector and the general public.

Policy gaps: There is no direct government financing towards RD&D for solar innovation and technology

Policy status: Finance and Investment
National Energy Policy 2018 section 8.3 (2) Energy Financing
The government has set a policy and a strategy to create a competitive and predictable investment climate to attract investments in the energy sector, and strategy to ensure a reasonable return on investments through a cost reflective pricing.
National Energy Policy 2018 section 8.3 (10) Energy Financing
The policy has an objective and a strategy to review relevant legislations and provide fiscal incentives to the energy sector.

Existing situation: The conducive investment climate has attracted several IPPs in the Kenya renewable energy sector and realized several projects funded and implemented by development partners such as KOSAP financed by World Bank to the tune of US$150m, SREP (The Scale-up Renewable Energy Programme) funded by the Strategic Climate Fund and KEMP which was also facilitated by the World Bank a program worth $562-million.
GoK has introduced special RE tariffs and Power Purchase Agreements (PPAs) to ensure returns on investment and to facilitate borrowing by private sector investors.
Additionally, the Kenya RE investment prospectus the various opportunities that exist within the sector.

Policy Gap: The finance act, 2021 has just been amended to reinstate VAT exemptions on solar products, whereas, this is commendable there is need for consistency in the solar tax regime and clarify in detail the extent (kind of products) to which this exemption applies.

Policy status: Institutional Capacity
National Energy Policy 2018 section 9.1.3 (3) Legal and Regulatory Framework
The policy has an objective and strategy to review the institutional mandates of the various public institutions in the energy sector to streamline their respective mandates, businesses and operations.

Existing situation: There are many players in the sector (KPLC, KETRACO, EPRA, IPPs, REREC, KENGEN, among others), the OGS in Kenya is overseen by the Renewable Energy Directorate of the Ministry of Energy.
The Solar companies are represented by KEREA and KEPSA in addition to the many civil society organizations and international development partners that are active in the sector. There has been a successful advocacy by KEREA and sector players which is expected to result into a decision to reverse the reintroduction of VAT on RE products .

Policy gaps: Inclusion of key stakeholders, The solar companies and their consumers to policy framing and implementation. This will bear better compliance to policy and least resistance from the persons trading in, and consuming off-grid solar products. For example, the requirement to have water heaters in every home has impacted real estate owners and yielded resistance.

Policy status: Skills Development
National Energy Policy 2018 section 9.8.3 Local Content
The Policy has an objective and strategy to establish capacity building programs in conjunction with local industry associations, local training institutions and international institutions and also develop and implement legislation for energy industry linkages for capacity building.

Existing situation: The National Industrial Training Authority (NITA) accredited Strathmore University to train renewable energy professionals and examine them before being licensed as qualified technicians by the Energy and Petroleum Regulatory Authority (EPRA). Strathmore University Energy Research Centre (SERC) is providing hands-on training courses and carrying out research on solar PVs.

Policy gaps: There is no direct government funding towards these technical skills programs

87. https://africa.com/heres-what-you-need-to-know-about-rwanda/

3.5 RECOMMENDATIONS

Affordability

Popularise Off-grid solar in the rural areas

There is a need for the government through the EPRA and REREC to popularise solar use in rural areas where it is needed. This is because Off-grid solar has been widely viewed as an urban energy. This can be done by distributing pico-solar and SHS products at subsidized prices, by scaling the KOSAP project. To avoid market distortion, market development alongside deployment of fintech options like PAYGO and related technology that increase the affordability of pico-solar and SHS need to be strengthened. While sensitizing the masses about the benefit of solar technology, this should be done cautiously to avoid market distortions.

Clarify the solar tax regime

Given the current amendments to the Finance Act, 2021, there is need to clarify the solar tax regime and create awareness among stakeholders, especially businesses and customs officials on the application of these tax exemptions. There is need to provide more clarity on the kind of specialized equipment exempted from VAT and yet critical in the development and generation of solar energy and how SHS will be classified for exemption.

Finance and investment

Access to Finance by off-grid solar companies

There is a need to create appropriately structured financing by the government for the solar companies for them to access funds and be able to invest into the various off-grid technologies. Government can use the several available financial partners to engage the Solar companies. That said, an enabling environment is present and it allows for private sector financing like Equity / Venture Capital, Impact investment. In comparison to other EA nations, Kenya is far ahead but with more to achieve.

Skills Development

Direct government funding to RE Skills programs and subsidise tuition fees for solar technical courses

There is a need for government to allocate funds towards creating awareness for the existing programs. The tuition fees for the solar technical courses offered by SERC and other technical institutes ought to be revised to make the courses attractive especially in the rural areas where solar is needed most.

GoK should carefully consider a tuition subsidy program in the short run for students pursuing solar technical courses. However, subsidies create a precedent that is not sustainable in the long run. The GoK should make provisions of linkages to solar companies offering internships midway and subsequently employment to graduates adds more long-term value than a tuition subsidy. This should be augmented with career guidance to encourage as many students as possible to take up solar technical courses to bridge the deficit of solar technicians across the country.

Update solar training curricular

The government through the National Industrial Training Authority (NITA) and Strathmore Energy Research Centre (SERC) ought to continuously update the solar technical training curricular to match the current needs and demands of the Off-grid solar market.

Standards and Quality

Streamline compliance

There is a need for coordination among energy stakeholders to ensure improved enforcement and better compliance to curb counterfeit products in the OGS sector. Sensitization seminars on quality and standards can also be conducted across the country through the existing energy centres, including information sharing with Kenya Revenue Authority (KRA) and solar companies.

Institutional capacity

Coordination among energy stakeholders

Strides have been made with the establishment of an Off-grid Taskforce (created in March / April 2020). It should be further supported and empowered in its duties under the Ministry of Energy to improve coordination among energy stakeholders. This should bring all key energy players on the same table and harmonize decision making in the OGS and avoid duplication of roles and or unnecessary overlaps in planning and executing energy projects. This will also strengthen advocacy and coordination in the solar sector. Carefully consider because subsidies create a precedent that is not sustainable in the long run. The provision of linkages to solar companies offering internships midway and subsequently employment to graduates adds more long-term value than a tuition subsidy.

Refine the mandate of REREC

The mandate of REREC through EPRA ought to be expanded to actively get involved in determining the PAYGO rates for SHS. REREC may design incentive programmes for PAYGO companies to enable them to subsidise their rates to increase uptake of off-grid solar in rural areas.

Innovation and technology

Awareness campaigns

More awareness campaigns should be conducted targeting existing and new solar PV technologies through trade exhibitions, road shows, and radio talk shows in rural areas.

Research & Development

There is a need for direct government funding to support research institutions like the Strathmore Energy Research Centre (SERC) to create discoveries that are tailored to provide technological solutions in the Kenya solar energy space.

4.0 RWANDA

Rwanda measuring approximately 26,338 km2, with a population of **12.6** million people

since the year 2000, Rwanda has experienced sustained economic growth, thus reducing the percentage of the country's population living in poverty from **57%** to **45%**

An average growth rate **5%** per year has driven the Rwandan economy.

Rwanda's real GDP per capita increased to **6.1%** in 2019

growth is projected to reach **8.0%** in 2020 and **8.2%** in 2021

Energy is estimated to cost **22.2%** more than the regional average

4.1 COUNTRY CONTEXT

The Republic of Rwanda is among the smallest countries in Sub-Saharan Africa, measuring approximately 26,338 km2, with a population of 12.6 million people. Rwanda is a landlocked country, located between the great lakes and central Africa region, it is bordering Burundi, Democratic Republic of Congo, Tanzania and Uganda .

Rwanda has experienced sustained economic growth since the year 2000, reducing the percentage of the country's population living in poverty from 57% to 45%. Over the same period, the country's infrastructure has grown rapidly, as a result, agriculture, roads, mining, and tourism have developed. An average growth rate of 5 % per year has driven the Rwandan economy over the last decade .

Rwanda's real GDP per capita increased to 6.1% in 2019, and growth is projected to reach 8.0% in 2020 and 8.2% in 2021. Energy is estimated to cost 22.2% more than the regional average, putting the country in greater need of policy options to bolster the energy sector.

4.2 ENERGY SECTOR

Rwanda has electricity generation capacity of 210.9 MW, the majority of this power comes from hydroelectric power plants (48%), thermal (32%), solar PV (5.7%) and methane to power (14.3%) . The hydropower potential in Rwanda stands at 300MW, however current capacity stands at 59MW, exploration studies have estimated the potential for geothermal energy to range from 170 to 340 MW, along the lake-kivu belt.

4.2.1 Off-Grid Electrification

The current electricity access rate in Rwanda stands at 59.7% (2020); with approximately 43.8% of the population connected to the national grid while 15.9% are accessing electricity through off-grid solar systems. The location of Rwanda just a few degrees south of the equator makes it a good fit for the development of solar PV plants , this geographical location endows it with sufficient solar radiation intensity of approximately equal to 5kWh/m2/day and peak sun hours of approximately 5 hours per day.

In 2007, the Government of Rwanda (GoR) through the Ministry of Infrastructure (MININFRA) and with the support of Stadtwerke Mainz was able to establish the Kigali Solaire Plant located on Mount Jali at the outskirts of the city and is currently feeding 250 kWp into the grid. It is so far the largest solar power plant known in Rwanda. Stadtwerke Mainz in cooperation with MININFRA is planning to expand the plant to a capacity of 1 MWp. By 2010, with mixed financing from BTC, GEF, EU, USAID and German Technical Cooperation Agency (GTZ), 268 health centres, 500 schools and 200 administrative offices were electrified with solar systems .

The solar-powered mini-grids segment has grown over the years, GoR has supported the establishment of several mini-grids through private sector partnerships (see table below), the government plans to boost the deployment of mini-grids to increase Off-grid connections from the current 14% tally to 48% .

88. https://africa.com/heres-what-you-need-to-know-about-rwanda/
89. https://www.afdb.org/en/countries/east-africa/rwanda/rwanda-economic-outlook
90. Ibidem
91. https://africa.com/heres-what-you-need-to-know-about-rwanda/
92. https://www.get-invest.eu/market-information/rwanda/renewable-energy-potential/
93. https://www.reg.rw/what-we-do/access/
94. Jean Baptiste Rutibabara et al. Ijsrm.Human, 2018; Vol. 10 (1): 150-163: A review of the solar energy situation in Rwanda and Uganda
95. https://www.epdrwanda.com/solar-energy/
96. GIZ, 2009. Renewable Energies in East Africa, Regional Report on Potentials and Markets, 5 Country Analyses
97. Dublin, 2020. Rwanda Mini-grids Market Study

Table 9 Status of Solar Powered Mini-grids

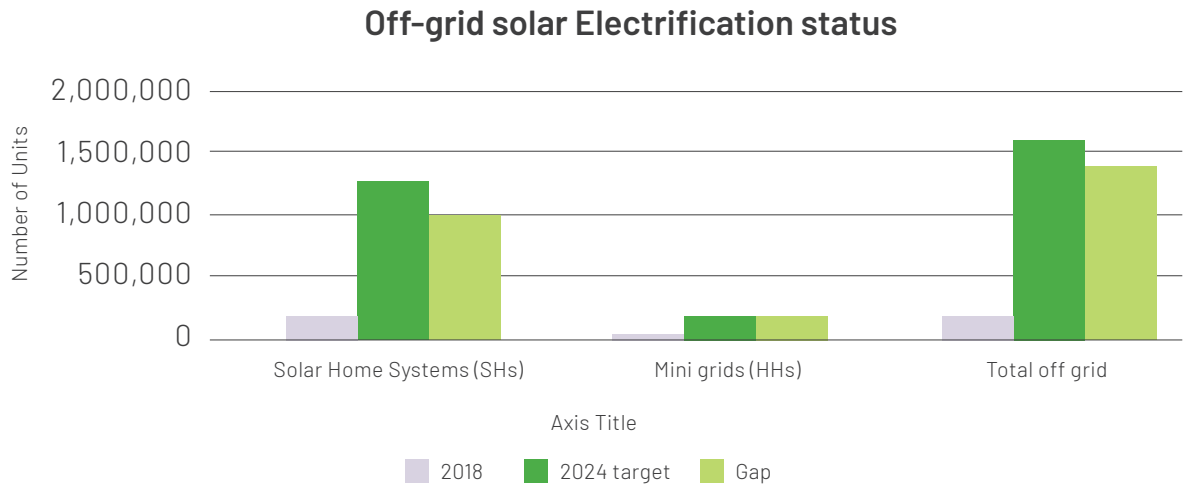
Solar powered mini-grids	Capacity
Solaire	250 KWP
Rwamagana	8.5 MW
Nyamata	0.03 MW
Ndera	0.15 MW
Kirehe	30 KW
Nyamesheke	30 KW

Source: Rwanda Mini-grids Market Study

The energy sector strategic plan of Rwanda underscores the need for universal access to electricity by 2024, with a projection that 48% of households shall be connected through Off-grid power systems. The rural electrification strategy outlines ways through which households could have access to electricity through the most cost-effective means by developing programs that will facilitate energy access through increased private sector participation in the provision of Off-grid solutions .

Over the last 5 years, Rwanda's Off-grid solar sector has grown tremendously , approximately 15.9% of Rwandan households accessing electricity through off grid solutions, manly solar PV. Currently, a total of over $ 11.58 million has been invested in the sector since 2017. The Off-grid solar sector in Rwanda is dominated by large multinational companies with over 30 private solar companies operating in Rwanda. The companies are deploying business models such as PAYGO services to customers who acquire solar home systems through instalment payment with, the average price for SHS varying from $4 to $45 per month depending on capacity and use. GoR has made efforts to reduce taxes on solar PV, so as to make solar home systems affordable to the ordinary citizen; out of a total number of 2,709,000 households, 15.9% are connected to Off-grid. According to the Rwanda Energy Group (REG), the Off-grid solar electrification status is as follows:

Figure 11 Off-grid Electrification Status



Source: Off-grid electricity access expansion program in Rwanda, REG, 2019

98. https://www.epdrwanda.com/solar-energy/
99. Ministry of Infrastructure, 2016. Rural Electrification Strategy
100. Power Africa Fact Sheet, 2018
101. Selen Kesrelioglu & Sarah Leitner, 2018. Rwanda Off-grid status report
102. Selen Kesrelioglu & Sarah Leitner, 2018. Rwanda Off-grid status report

The government of Rwanda (GoR) set up the Energy, Water and Sanitation Authority (EWSA) to manage all national matters in those dockets. In 2016, it split into Rwanda Energy Group (REG) and Water & Sanitation Authority. REG is a parastatal agency functioning as a leading provider of innovative and sustainable energy solutions for national development. REG has established two mini-grids through independent service providers in Kirehe District with a capacity of 30KW, and in Nyamaheke District with a capacity of 30KW as well. The REG through its subsidiary, the Energy Development Corporation Limited (EDCL) signed a memorandum with 21 private companies to increase the supply of solar systems to rural households, schools, health facilities and administrative units. One of the key mandates of REG is to use a blend of grid, mini-grid and Off-grid solutions to provide access to 70% of all households by end of 2021 and 100% by 2024, the REG aims at achieving 100% (48% off-grid and 52% on-grid) electricity access by 2024 .

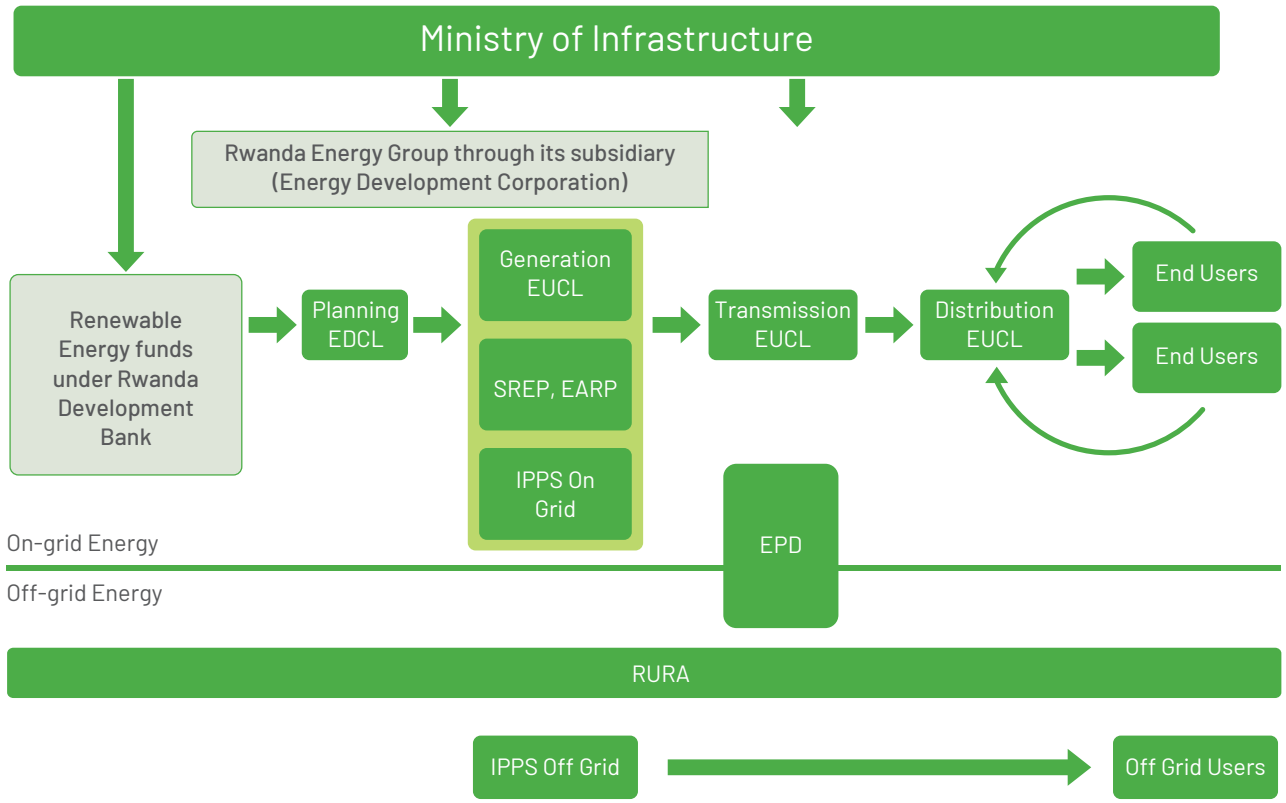
4.2.2 Institutional Framework

Table 10 Energy Institutions

Institution	Mandate
Ministry of Infrastructure (MININFRA)	MININFRA has the primary responsibility for setting the overall policy and strategy of the Energy Sector, and for coordinating the developments of the electricity sub-sector. MININFRA is the lead Ministry responsible for development of Renewable Energy (methane, peat, geothermal, solar and wind energy).
Rwanda Utilities Regulatory Authority (RURA)	The Rwanda Utilities Regulatory Authority plays the role of regulation of public utilities and implementation of policies formed by MININFERA, it has the mandate to regulate four Energy sub-sectors namely, electricity, Renewable Energy, gas and petroleum, with objectives to ensure sufficient, reliable, affordable and sustainable energy supply fairly to all consumers. RURA plays a regulatory role in Renewable Energy sub-sector through monitoring off-grid Renewable Energy projects to ensure safe and efficient performance, as well as their compliance with rules and regulations in place .
Rwanda Energy Group (REG)	This is a government parastatal with the mandate to lead in innovative approaches in the energy sector. REG and its two subsidiaries; the Energy Utility Corporation Limited (EUCL) and the Energy Development Corporation Limited (EDCL) are entrusted with energy development and utility service delivery. EUCL is in charge of power generation, transmission, distribution, and sales to the final consumer. EDCL is in charge of developing both generation and transmission and exploiting new energy sources.

Renewable Energy Fund (REF)	The REF was established in 2017 to facilitate access to electricity through Off-grid technologies and promote private sector participation in renewable Off-grid electrification. The World Bank, recently provided an additional $ 150 million to REF, the additional funding will subsidize the deployment of Off-grid solar systems, through five (5) funding windows; lending to SACCOs, lending through banks, lending to mini-grids and lending to Off-grid companies, and subsidies provided through the fifth window to qualifying OGS companies. The Renewable Energy fund is therefore financing the following programs through the Rwanda Development Bank.
Energy Private Developers (EPD)	EPD is a registered professional association in Rwanda, bringing together private companies operating in the energy sector. It is one of the five associations comprising the Chamber of Industry under the Private Sector Federation (PSF). EPD focuses on advocacy of its members, encouraging collaboration and partnership for development of the energy sector in Rwanda. EPDs' purpose is to assist organizations interested in investing in the future of Rwanda energy sector.

Figure 12 Institutional Framework



Source: EAC Energy Security Policy Framework

103. REG, 2021. Off-grid electricity access expansion programs in Rwanda
104. (2018), Selen Kesrelioglu & Sarah Leitner, Rwanda Off-grid status report
105. REG, 2019. Rwanda Energy Group Strategic Plan 2019-2020
106. https://www.reg.rw/what-we-do/off-grid-solutions/solar-home-systems/
107. (2019), REG, Rwanda Energy Group Strategic Plan 2019-2020
108. (2020), Gihana .D & Kooijman A: Gender & Energy Briefs Rwanda

4.3 FINDINGS

4.3.1 Affordability

The market share for SHS in Rwanda has grown over the years. It is estimated that more than 465,000 households (15.9%) access electricity through OGS solutions with solar home systems costing between USD 58 to over USD 1,000. Solar lamps on the other hand cost between USD 5.50 and USD 45. Among other issues however, affordability is the biggest issue for the sector and is causing SHS sales to drop. A study on SHS's found that as many as 52% of consumers reported struggling to pay for a solar home system.
A study on SHS's found that as many as 52% of consumers reported struggling to pay for a solar home system.

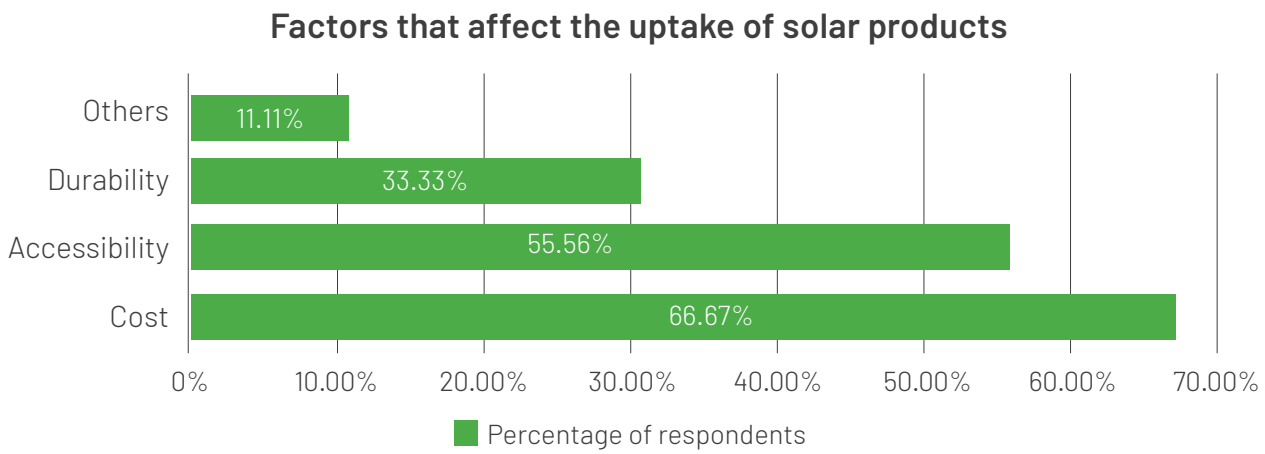
The PAY-GO business model was embraced in the Rwandan market to make OGS products more affordable and accessible, and this increased SHS sales by 130% with almost 100,000 systems sold in 2018. However, it is observed that the PAY-GO business model has not necessarily addressed affordability, due to unclear repayment rates.

Some select solar energy equipment, components and appliances have been exempted from VAT since 2015 to ensure solar products are more affordable. However, import (non-tax) tariffs on solar products cause as high as 40% of the Cost of Goods, raising prices and putting OGS products and services out of reach of the poor and rural customers who need them most.

GoR is implementing the Scale-up Renewable Energy Program (SREP)which aims to allow low-income households to access modern energy services through a stratification system called ubudehe that classifies households according to tiers which makes them eligible to subsidies; tier 1 at 90%, tier 2 at 70% and tier 3 at 45% depending on the vulnerability of the household. However, solar companies have argued against this program since some households are almost given free OGS products, thus causing price distortions. One of the respondents mentioned; "GoR provides subsidies for those who cannot afford, the subsidies are up to in excess of 70%, tax holidays are also part of the initiatives to promote affordable solar products."

Despite these efforts, the study established that affordability is still a challenge, 67% of companies, indicated that cost of OGS products was affecting uptake, see figure 13 below.

Figure 13 Factors affecting uptake of solar products



Source: Survey findings

109. https://www.epdrwanda.com/
110. ibid
111. Power Africa Off-grid project, Fact Sheet, USAID
112. Power Africa Off-grid project, Fact Sheet, USAID
113. Power Africa Off-grid project, Fact Sheet, USAID
114. https://www.epdrwanda.com/

4.3.2 Standards and Quality

The ministerial guidelines on minimum standards for solar home systems was established in 2018 (and reviewed in 2019) to promote quality and curb counterfeit in the Rwanda OGS market. The standards provide guidelines to end users and the private sector in importation, design and installation of photovoltaic power systems. The guidelines are definite on minimum standards for accessories such as lamps, cables, batteries, solar photovoltaic panels, charge controller, and installation procedures. The guidelines provide for approval of SHS, to be done by RURA, and electrical installation processes to conform to the national electrification regulations. They stipulate penalties for non-compliant SHS, being disposal or re-exportation of the product. These guidelines are aligned to the IEC Standards.

The GoR is known to be very strict in effecting guidelines. The level of counterfeits and low quality SHS is believed to be low in the Rwanda OGS market. However, there is a need to further improve enforcement among government agencies in verifying and clearing imported OGS products.

4.3.3 Finance and Investment

Rwanda has attracted a lot of investment in the Renewable Energy sector given its conducive business environment, several donor agencies are providing finance to companies operating in Rwanda, it is estimated that USD 34 million was invested in the Rwanda SHS sector by December, 2017. In 2018 alone, USD 11.58 million was invested in the OGS sector.

In November, 2017, the Rwanda Development Bank unlocked USD 50 million of capital targeted to the Off-grid solar sector, to expand energy access in rural areas, through the SREP. The SREP is implementing two components under the Renewable Energy Fund (REF):

01 Component

The private sector is being supported through a risk-mitigation facility, targeting solar companies to make available products on affordable financial terms for citizens to acquire through loans provided to SACCO/ Banks.

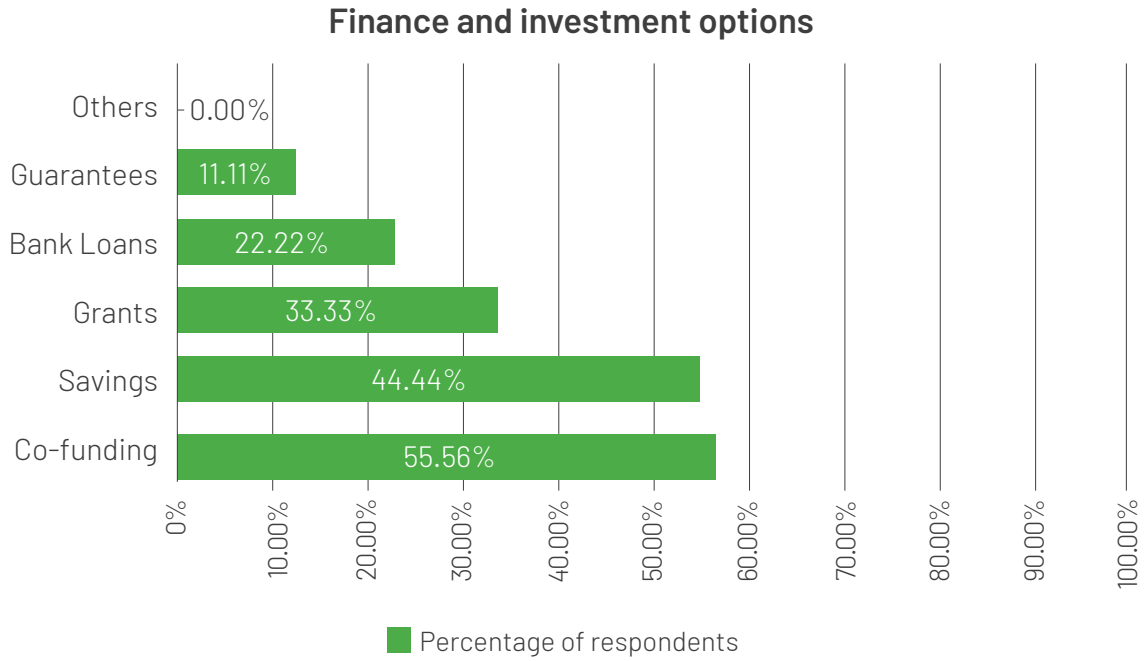
02 Component

Providing loans to private companies to set up mini-grids as financially viable investments . In addition, GoR is developing a results-based financing mechanism, to bolster investments in the RE sector.

The GoR engaged in a Public-Private Partnership (PPPs) dubbed the 'Rent to Own Solar Home Systems' initiative; a collaboration with the Rwanda Energy Group (REG), European Union (EU), and Mobisol. The initiative grew to be the market leader and installed a capacity of 2.7MW of solar energy, electrifying 162,500 rural beneficiaries.
While the RE investment climate has grown over the years, the available financing streams are more favourable to international firms than small and local companies, access to local credit conspicuously remains a challenge. However, 56% of companies believed that existing co-funding investment agreements are still a key strength in the Rwandan market as shown in figure 14.

115. ibid
116. Power Africa Off-grid project, Fact Sheet, USAID
117. Power Africa Off-grid project, Fact Sheet, USAID

Figure 14 Existing Investment Options



Source: Survey findings

4.3.4 Innovation and Technology

The dominant technologies in the RE sector are; Solar PV, whose uptake is majorly driven by PAY-GO technology. Whereas, the energy sector strategic plan recognizes Solar PV technologies as critical in providing access to electricity .It was found that there is low perception of solar technology within the population. One of the respondents said, "There seems to be reluctance to fully embrace solar technologies, since it is just about lighting and charging phones in comparison to hydro power which can do refrigeration, irrigation, etc".

4.3.5 Skills development

Skills development in the OGS sector is spearheaded by the Skills Development Fund that was initiated in 2017 and further extended in 2020 through a financing agreement with the World Bank. The skills development fund established the Priority Skills for Growth (PSG) Program, the PSG aims at strengthening skills related to three priority sectors of the Rwandan economy namely: manufacturing, transport and energy (renewable energy). The PSG supports short-term and long-term training, principally through technical and vocational training (TVET) schools, integrated polytechnic regional colleges (IPRCs) and University level . The PSG is coordinated by the Ministry of Education and implemented by University of Rwanda (UR), Rwanda Polytechnic (RP), Workforce Development Authority (WDA), Higher Education Council (HEC), Rwanda Development Board (RDB) and Development Bank of Rwanda (BRD). The table below shows. GoR is working directly with the private sector to improve skills in the RE sector, for instance, Mobisol with support from Government has set up the Mobisol Academy to train local solar technicians and entrepreneurs. The training has produced more than 400 local technicians and sales staff, resulting in a sizeable number of skilled solar technicians. The Stadtwerke in collaboration with GIZ is also training solar technicians on the maintenance of the Kigali Solaire solar plant

118. Power Africa Off-grid project, Fact Sheet, USAID
119. Power Africa Off-grid project, Fact Sheet, USAID
120. (2019), Selen Kasrelioglu & Sarah Leitner, Off-grid sector report on Rwanda
121. GOGLA, Providing energy access through Off-grid solar: Guidance to governments
122. (2019), REG, Off-grid electricity access expansion program in Rwanda

Table 11 Skills development programs/initiatives in the RE sector

Institution	RE skills development programs
Ministry of Education	Has prioritized renewable energy in TVET programs and schools working closely with the Ministry of infrastructure to effect this
University of Rwanda	Masters' studies in Renewable Energy Masters and PhD in Energy for sustainable development
Rwanda Polytechnic and associated IPRC colleges	Certificate and diploma courses in renewable energy under the department of electrical and electronics engineering.
Workforce Development Authority	Managing the Skills Development Fund that provides training opportunities (on-job training) to providers in the energy sector
Higher Education Council	Has approved the Bachelor of science in renewable energy to be offered by the Institute Polytechnique de Byumba.
Rwanda Development Board	Is working with the Rwanda Energy Group to align skills development with labour market demand in the renewable energy sector.
Development Bank of Rwanda	Is providing technical assistance in start-up support, operations, structuring energy deals and in-house expertise in packaging energy arrangements.

Despite these skilling programs, there is no known mechanism to regulate the practice and licensing of solar professionals and the industry is vulnerable to unauthorized personnel.

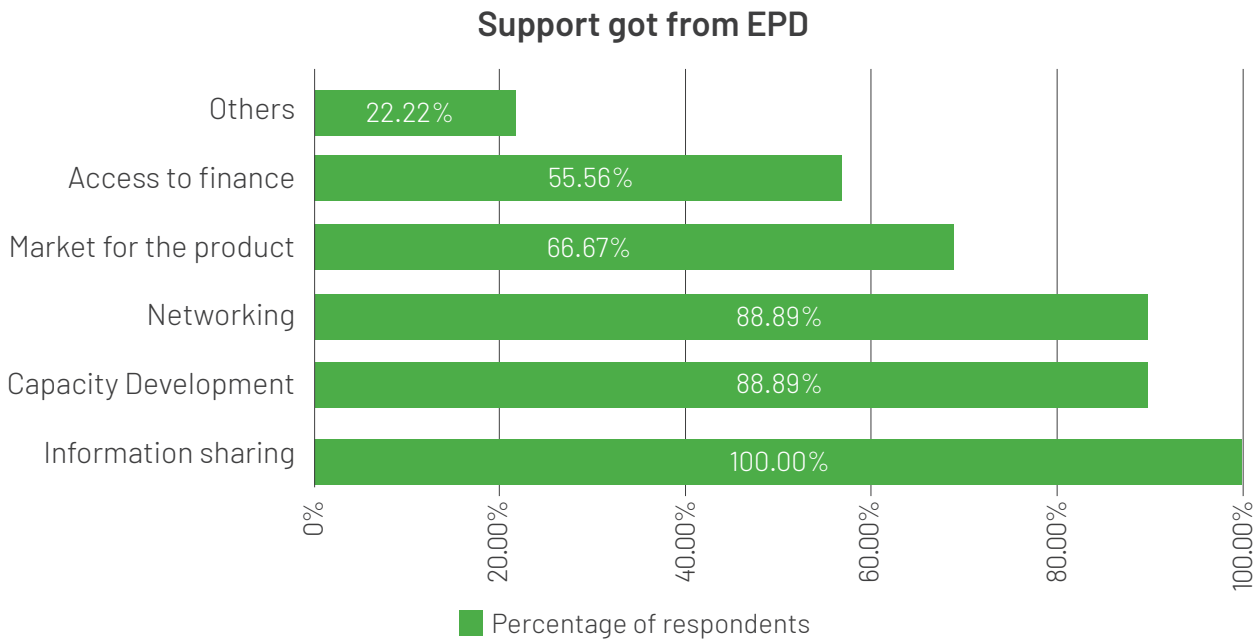
4.3.6 Institutional Capacity

The institutional set up of the Renewable Energy sector is centralized and consists of several players. Unlike other countries in the region, Rwanda has no standalone Rural Electrification Agency to manage the Off-grid energy sector - the Ministry of Infrastructure plays this role in collaboration with other government agencies. The Rwanda Energy Group, a government parastatal, also plays a key role in coordinating private sector solutions in the RE sector.

There is very strong linkage between the various government agencies, however the sector is faced with limited technical skill in crucial aspects like contract negotiation, sourcing and structuring finance, understanding RETs among others. All solar companies that participated in the survey identified EPD as a key partner in the RE sector in-terms of advocacy, coordination and interfacing with the GoR. EPD renders support to their members in various ways such as access to finance, capacity development, information sharing, networking, access to markets and others. See figure 15 below.

123. MININFRA, 2019. Ministerial guidelines on minimum standards for solar home systems.
124. Ibid
125. GOGLA (2019) Country Brief on Rwanda
126. (2019), REG, Off-grid electricity access expansion program in Rwanda
127. ibid
128. REG, 2019. Off-grid electricity access expansion program in Rwanda

Figure 15 Support to EPD members



Source: Survey findings

4.4 POLICY REVIEW AND GAP ANALYSIS

The study identified the following policy frameworks that govern or relate to the Renewable Energy sector in Rwanda:

Table 12 Renewable Energy Policies

	Policy	Responsible Institution	Period	Status
1.	Rwanda's Vision 2050	Ministry of Finance and Economic Development	2015 - 2050	Current
2.	Regulations on Governing Electricity Quality of service in Rwanda	Rwanda Utilities Regulatory Authority	2016	Current
3.	Energy Sector Strategic Plan	Ministry of Infrastructure	2018/19-2023/24	Current
4.	Guidelines Promoting Energy Efficiency Measure	Rwanda Utilities Regulatory Authority	2013	Current
5.	National Electrification Plan	Renewable Energy Group	2016	Current
6.	Ministerial Standards on Minimum Standards for Solar Home Systems	Ministry of Infrastructure	2018	Current
7.	National Energy Policy and National Energy Strategy	Ministry of Infrastructure	2008-2012	Updated
8.	National Energy Policy and Strategy, 2011	Ministry of Infrastructure	2011	Updated
9.	Rwanda Electricity Law	Rwanda Utilities Regulatory Authority	.....	.....
10.	Rwanda Energy Policy	Ministry of Infrastructure	2015	Updated
11.	Sustainable Energy for All (SE4ALL), Rapid Assessment and Gap Analysis	Ministry of Infrastructure	2014	Current
12.	Rural Electrification Strategy	Ministry of Infrastructure	2019	Current
13.	Solar Water Heater Regulations	Rwanda Utilities Regulatory Authority	2019	Current

Source: Survey findings

4.4.1 Vision 2050

Rwanda's energy policy regime is anchored onto Vision 2050, and recognizes the availability of efficient and reliable energy supply for social prosperity, human development and economic growth. The vision underscores the importance of clean and Renewable Energy in meeting the energy needs of at least 60% of the population. The Government of Rwanda has set an ambitious target of reaching 100% access to electricity by 2024, through a combination of energy sources. Off-grid solar solutions are considered a priority because of its wide range of solutions. Rwanda

129. Ministry of Education & Rwanda TVET Board,2020. SDF operational manual,
130. Ministry of Education ,2019. Description of Priority Skills for Growth,
131. https://plugintheworld.com/news/mobisol-celebrates-5-bright-years-electrifying-rwanda/2019
132. GOGLA, 2019. Rwanda Country Brief

subscribes to international energy frameworks such as the Sustainable Energy for All (SE4ALL), Rwanda is also signatory to the regional strategy on scaling up access to modern Energy Services adopted by the EAC Council of Ministers. Both the international and regional frameworks are aligned to the SDG 1 (Zero Poverty) and SDG 7 (Universal Energy Access), as it pursues its development objectives by 2030; these include: -

Development Objectives By 2030

- Ensuring universal access to modern energy services
- Doubling the global rate of improvement in energy efficiency
- Double the share of Renewable Energy in the global energy mix

The study identified the following relevant policy documents for review and analysis in respect to the Off-grid solar sector in Rwanda:

4.4.2 Energy Sector Strategy, 2018-2024

The Energy Sector Strategy is the overarching National Policy document for the energy sector in Rwanda implemented by MINIFRA, the strategy aims at creating conditions for the provision of sufficient, safe, reliable, efficient, cost-effective and environmentally appropriate energy services to all economic sectors. The overall goal of the strategy, is to ensure that all residents and industries can access energy products and services that are sufficient, reliable, affordable, and sustainable. The specific objectives of the strategy are

01	02	03	04	05	06
Ensuring the availability of sufficient, reliable and affordable energy supplies for all Rwandans.	Creating an enabling environment for increased private sector participation in energy supply and service provision.	Encouraging and incentivizing more rational, efficient use of energy in public institutions, and amongst industrial and household end-users.	Ensuring the sustainability of energy exploration, extraction, supply, and consumption to prevent damage to the environment and habitats.	Promoting safe, efficient, and competitive production, procurement, transportation, and distribution of energy.	Developing the requisite institutional, organizational, and human capacity to increase accountability, transparency, national ownership and decentralized implementation capacity for sustainable energy service delivery.

133. Ministry of Infrastructure, 2019. Energy Sector Strategy Plan
134. Ministry of Education & Rwanda TVET Board,2020. SDF operational manual,
135. Ministry of Education ,2019. Description of Priority Skills for Growth,
136. https://www.brd.rw/brd/energy/
137. Paul Kirai, Anjali Saini and Mark Hankins: 2009. The solar energy market in Rwanda: Integrated Energy Solutions (IES)
138. Rwanda Polytechnic ,2019. Student Handbook
139. HEC, (2020. list of accredited academic programs

4.4.3 Rural Electrification Strategy, 2016

The Rural Electrification Strategy (also Implemented by MINIFRA) is the central policy document that guides the Off-grid solar sector In Rwanda. This strategy recognizes the vital role that electricity access plays in accelerating economic development through improving health and standards of living. It identifies a combination of solutions that focus on the location, income and consumption level instead of the traditional connection to the grid that may not be suitable for all households. The strategy categorizes Off-grid solutions as the most cost-effective means for increasing access to electricity to all households, productive use, and in-service delivery.
See table 8.

4.4.4 Ministerial Guidelines for Solar Home Systems, 2019

The ministerial guidelines are intended to ensure quality in the Off-grid solar sector by describing the minimum requirements for standalone solar home systems. They are meant to guide government agencies, practitioners, solar businesses, and consumers, to ensure that all solar product specifications in Rwanda comply with the standard requirements from accredited global bodies under IEC conformity assessment and lighting global. They also provide for the approval of SHS, to be done by any competent rural electrification program, and electrical installation processes to conform to the national electrification regulations. They stipulate penalties for non-compliant SHS, being disposal or re-exportation of the product.

4.4.5 Solar Water Heating (SWH) Regulations, 2015

The solar water heating regulations are intended to provide a licensing and regulatory framework for the design, installation, operation, repair, maintenance and upgrade of solar water heaters. The regulations provide for mechanisms regarding issuance of installation certificates, license and permits, compliance by consumers, qualifications of SWH technicians and standards for SWH equipment, including the mandate of Rwanda Utilities Regulatory Authority (RURA) in enforcing the SWH regulations.

4.4.6 Tax regime for Off-grid Solar Systems

The Off-grid energy policies cannot be reviewed in isolation of the tax regime, since taxation is critical in fast-tracking access to energy, ensuring affordability, and promoting increased private sector investment; available data indicates that VAT exemptions for RE products in Rwanda was extended in 2015 to include solar water heating systems, solar-powered pumping stations, solar appliances (including TV, radios and fridges) as well as renewable power generation equipment(including solar panels, batteries, inverters, trackers and wind generation equipment.) Value-added tax (VAT), withholding tax (WHT) and Import duty are the three main levies that constitute the tax regime in Rwanda as shown in the table below.

140. Paul Kirai, Anjali Saini and Mark Hankins: The solar energy market in Rwanda: Integrated Energy Solutions (IES): December 2009
141. (2015), Ministry of Finance and Economic Development, Vision 2050
142. Paul Kirai, Anjali Saini and Mark Hankins: 2009. The solar energy market in Rwanda: Integrated Energy Solutions (IES)
143. RURA, 2015. Solar water heating regulations
144. David Mazzoni, 2019. Digitalization for energy access in sub-Saharan Africa. Challenges, opportunities and potential business models.
145. (2018), Ministry of Infrastructure, Ministerial guidelines for solar home systems
146. (2015), RURA, Solar water heating regulations

Table 13 Tax requirements on selected solar accessories

Description	VAT	WHT	Import Duty
SHS, modest unit of 3-4 lights, phone charge, powering radio etc. plus TV	exempt	5%	exempt
PV Solar module	exempt	exempt	exempt
Solar charging control units	exempt	5%	10%
DC to AC Inverters	exempt	5%	exempt
Solar PV cables	exempt	exempt	25%
Solar metering units	18%	exempt	exempt
Batteries (all categories)	exempt	5%	35%
Solar power display meter	18%	5%	25%
LED lights (all categories)	exempt	5%	25%
Solar water pump	18%	5%	exempt
Solar irrigation	18%	5%	exempt
Solar water heater	exempt	exempt	exempt
Solar cookers	18%	5%	10%
Solar refrigerators	18%	5%	25%
Solar street lights	18%	5%	25%

Source: The East African Regional Handbook on Solar Taxation, 2020

4.4.8 POLICY GAP ANALYSIS

Policy Status: Affordability

The rural electrification strategy (2019-2024) sets out a clear agenda for the Off-grid solar sector in Rwanda: The policy provides for the establishment of a risk-mitigation facility targeting the private sector such that solar products will be made available on financial terms that the population can afford. The East African Tax Handbook, highlights the solar tax regime in Rwanda, this involves Tax exemptions (VAT & Import duty) on some energy supply equipment such as energy bulbs, solar water heaters, and solar PV modules .

Existing Situation; GoR is implementing several programs in line with the rural electrification strategy; supporting vulnerable households to access SHS through private companies, providing loans to households to purchase SHS, and lending to Off-grid companies to expand their operations. The government is implementing subsidy programs through different platforms and is working with private companies to expand SHS across the country, and especially in rural areas where the systems are not commercially affordable.

GoR has endorsed business models aimed at providing Off-grid Solar services i.e., pay as you go,

147. (2019), David Mazzoni, Digitalization for energy access in sub-Saharan Africa. Challenges, opportunities and potential business models.
148. RURA, 2015. Solar water heating regulations
149. David Mazzoni, 2019. Digitalization for energy access in sub-Saharan Africa. Challenges, opportunities and potential business models.
150. Power Africa, (2018). off-grid project, Fact Sheet
151. Ministry of Infrastructure, (2018). Ministerial guidelines for solar home systems

through which solar equipment can be made affordable. The PAYGO enables customers to purchase solar equipment in a specified period, including customer support and maintenance. The average cost for SHS is between USD 58 to USD 1,000 and for a solar lamp from USD 5.50 to USD 45.

Policy gaps: The varied tax regime, in which VAT and import duty is being levied on some critical solar accessories such as batteries and cables, is raising the cost of solar products.
Africa Clean Energy and TAF have written position papers on this subject. These need to be adopted and aggressively utilised with the infusion of new ideas for better engagement of stake holders in the streamlining of OGS the business models (PAYGO) since end users meet the surcharge costs of using these systems, significantly rising the cost of solar products over a period of time.
The government is fully in control of the subsidy program, and it is well defined. However, some private sector players are affected by the distortions in prices this causes to the market.

Policy Status: Standards and Quality

The ministerial guidelines (2019) for solar home systems provides for standards, quality and minimum service level requirements in the Off-grid solar sector. The guidelines specify the minimum requirements for solar accessories such as; lamps, cables, batteries, solar PV panels and charge control units. Solar equipment of less than 350 W shall conform to lighting global Pico PV quality standards, while SHS shall conform to the stand-alone system design verification, among other standards specified in the guidelines, all of which are aligned to the lighting global accreditation to ensure that only accredited products can be sold .

Solar Water Heater Regulations provides for the licensing and regulatory framework for the design, installation, operation, repair, maintenance and authorization of solar water heating systems in Rwanda. The SWH regulations provide for the installation of a SWH system for any premises that exceeds a water requirement of 100 litres per day.

Existing Situation: The GoR has ensured that all suppliers of OGS must comply with the minimum ministerial standards. This implies that all the 21 companies working with GoR must show compliance with the existing guidelines. The regulations on SHS and SWH have reduced on counterfeits, as a result the market has not been saturated with counterfeit products

Policy gaps: Lack of clarity on testing and certification of solar products by the responsible government agency. There is no implementation mechanism or communication strategy to effect the guidelines and regulations, resulting in limited awareness of existing standards among stakeholders, especially customs agents and consumers .
No policy position on coordination by relevant stakeholders in enforcing these regulations.

152. RURA, (2015). Solar water heating regulations
153. World Bank, (2020). Rwanda energy access and quality improvement project appraisal document World Bank.

Policy status: Innovation and Technology
The rural electrification strategy indicates that Government finance will be targeted at ensuring consumers have the most appropriate, cost-effective technology for their needs, this is meant to align electricity access interventions with customer needs .

Existing Situation; There is no known initiative or program that aims at promoting local innovation in the Off-grid solar sector and yet Rwanda aspires to become the leading ICT Hub in Africa by establishing conducive innovation ecosystem to adopt emerging technologies.

Policy gap: There is no policy position on Innovation and Technology for the RE sector.

Policy status: Skills Development
The Ministry of Education has the mandate to expand technical and vocational training (TVET), through which the RE workforce in Rwanda is being trained.

Existing Situation: The Ministry is coordinating the Skills Development Fund that has prioritized RE as one of the key priority areas for skilling. The Ministry is working with several other agencies such as the University of Rwanda, Rwanda Polytechnic, Workforce Development Authority, and Higher Education Council etc. The Government is also working directly with the private sector to promote skills in the RE sector i.e., the Mobisol academy and partnership with Stadtwerke Mainz and GTZ to train solar technicians .

Policy gap: There is no mechanism that regulates and or licences renewable energy professionals

Policy status: Institutional Capacity.
The rural electrification strategy identifies key institutions responsible for advancing Renewable Energy, including public and private sector institutions. The policy articulates their respective roles and responsibilities .

Existing Situation: The Ministry of infrastructure is responsible for strategy and policy, Rwanda Inspectorate, Competition and Consumer Protection (RICA) is responsible for Consumer protection, REG is responsible for implementation, while its subsidiaries Energy Utility Corporation Limited (EUCL) and Energy Development Corporation Limited (EDCL) are responsible for transmission and distribution respectively. The EPD is responsible for rallying the solar energy businesses and advocating to government on their behalf. There are also several active development partners in the RE sector.

Policy gaps: Whereas EPD is a key stakeholder in the energy sector, there are no provisions that recognize their mandate

154. Lighting Global, GOGLA, ESMAP, (2020). Off-grid solar market trends
155. Ministry of Infrastructure, (2016). Rural Electrification Strategy
156. https://www.minict.gov.rw/programs/innovation-emerging-technologies-directorate-general
157. GIZ, Renewable Energies in East Africa, (2009). Regional Report on Potentials and Markets, 5 Country Analyses
158. Ministry of Infrastructure, (2016). Rural Electrification Strategy

Policy status; Finance and Investment.
The rural electrification strategy recognizes the role of the private sector in financing and delivering solar energy. It provides mechanisms of working with the private sector through which low-income households can have access to electricity. The strategy provides for a results-based financing mechanism, and a risk mitigation facility to support private off-grid solar companies, in expanding their business and in establishing mini-grids.

Existing Situation: GoR is leading efforts through REG in working with 21 companies to deliver off-grid through government programs, such as EARP and SREP. In partnership with the World Bank and other development partners, GoR established the Rwanda Energy Fund in 2017 with $48.98 million to provide access to off-grid electrification to 1 million people by 2024. The NEP currently further divides the off-grid areas into SHS and mini-grids. The designations are not accurate in many cases. The NEP seems to prefer building and owning the distribution network, but the private sector fears contracting/construction delays and would prefer to build it themselves and have control.

Policy gaps: There is no separate investment strategy that identifies investment areas and incentives to attract RE investment.

4.5 RECOMMENDATIONS

Affordability:

Revise the current tax regime

The current tax regime on solar products and components needs to be revised to ensure that tax cuts and exemptions are appropriately applied on solar home systems (SHS) as a package rather than on accessories. This will need engaging with and sensitising the tax agency (customs). It is proposed that SHS packages are categorized into three(3)types, a package for the last mile, rural and peri-urban households. Tax cuts and exemptions on solar products and components should also be applied to solar-powered equipment like solar refrigerators to enable continued health service delivery especially in the rural areas and last-mile communities.

Deployment of appropriate business models

There is a need to streamline existing business models and pivot new business models, such as B2B sales in partnership with NGOs or community associations to ensure that payment terms are not only convenient but products remain affordable to end-users. The Ministry of Infrastructure and RURA should provide a more enabling environment for private sector driven innovation of business models which will drive uptake of OGS.

Strengthen existing subsidy program (REF Window 5)

The National Electrification Plan currently divides the off-grid areas into SHS and mini-grids. The designations are not properly made and not accurate in many cases. Consequently, REF Window 5 subsidies should be allowed in all off-grid areas, and mini-grid developers should also be allowed to propose projects in all off-grid areas.

Institutional Capacity

Government should consider a dedicated Ministry staff person or a Ministry team that only focuses on off-grid issues within the rural electrification Department. This will aid the development of programmes which build capacity of the Ministry in the short to medium term, and amplify the mandate of the Off-grid sector within the overall RE sector.

Sustainability and growth of EPD

There is a need to align the functions of EPD with those of the Ministry of infrastructure, to ensure coordination, including clarifying their mandate on Off-grid matters. Whereas EPD is largely constituted by the private sector, it should also provide support to Government in executing its duty of availing energy to its citizens, given its unique role in representation and advocacy on behalf of its members. As such, the Ministry of Infrastructure should commit a portion from its operational budget, including further collaboration with EPD to oversee and implement solar projects on behalf of Government. This is the ideal situation. How implementable it is remains with the two parties to agree.

Budget allocation

Government should consider increasing the budget allocation for the renewable energy sector, and particularly establish a budget line for Off-grid rather than only focusing resources towards Hydro power production. This will ensure sufficient resources are made available for the smooth functioning of the sector and realizing the energy targets by 2024.

Finance and Investment

Explore innovative financing mechanisms

The Ministry of Infrastructure should lead efforts in collaboration with the private sector in

exploring (through feasibility and scoping studies) likely innovative finance approaches for mini-grid solar plants that may be applicable within the Rwandan context.

Develop a national investment guide for Off-grid solar

The Ministry of Infrastructure should develop an investment guide for the RE sector, with emphasis on Off-grid solar. The guide should articulate the investment needs of the sector, and provide pathways to attract, retain and promote private sector investments in Off-grid solar electrification, including incentives to solar energy investors.

Restructure existing financing schemes

There is a need to restructure the risk management facility to include a component like guarantees to finance innovations and local industrialization efforts in the Off-grid solar space. This should support solar businesses that do not have the required collaterals to access finance from financial institutions. The overall target of this is to reduce risk of doing business in the solar sector.

Standards and Quality:

Develop comprehensive standards

Harmonization of existing National standards to international standards i.e., solar home systems standards and water heating regulations into consolidated National Standards that address all quality aspects of OGS. GOGLA can guide / work with EPD to develop a strong Code of Conduct for its members which it can then enforce and align the National standards with global frameworks. The standards should provide for strong punitive measures against dealing in counterfeit products. There is a distinction between national standards which can be aligned.eg. IEC and are mandatory, and global association ideals which are voluntary. GOGLA can guide / work with EPD to develop a strong Code of Conduct for its members which it can then enforce.

Skills Development

Strengthen collaboration with the private sector in co-creating and delivering tailor-made solar skilling programs across the countryside i.e., solar academies or solar garages etc. similar to the Mobisol Solar Academy.

Establish a mechanism within the Ministry of Infrastructure or through RURA to license solar professionals, including monitoring and regulating their practice.

Innovation and Technology

Government should facilitate collaboration with innovators through exhibitions, exchange programmes, and apprenticeship programmes in-country and across the world, to manufacture and assemble off-grid solar products.

5.0 TANZANIA

Tanzania's population was expected to reach **59.73** Million People by the end of 2020, with an additional **282.67** million by the end of the century

Country's population rate is **2.98%** with a fertility rate of 4.8 births per woman and a high birth rate of **36.2** births per 1,000 people

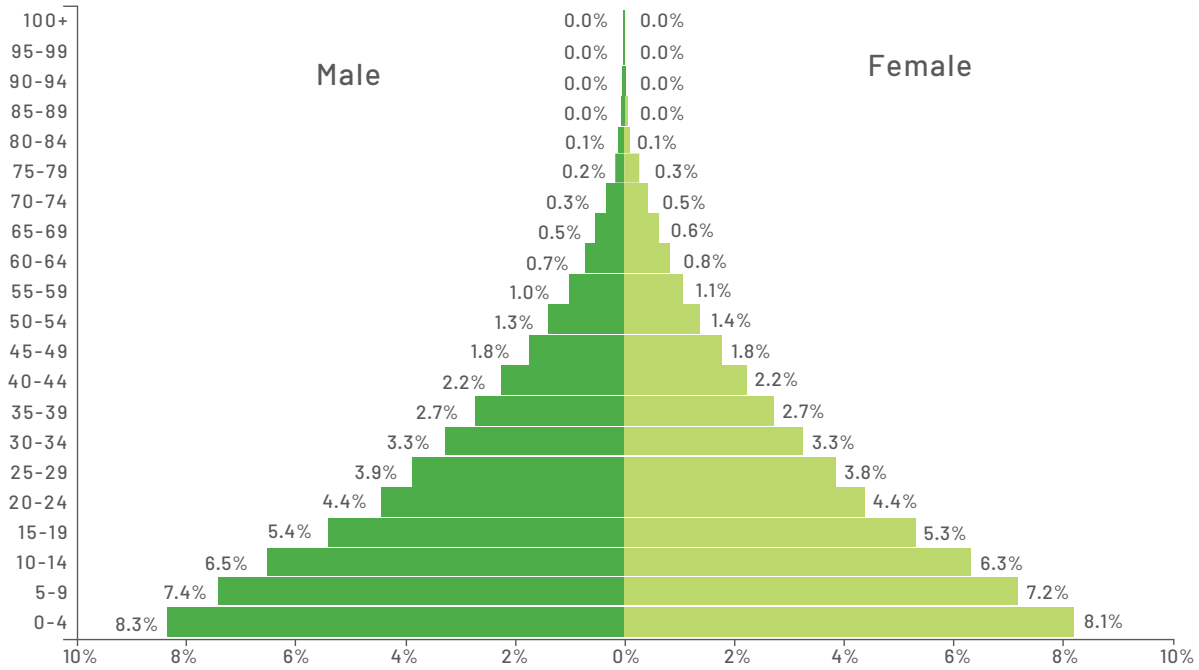
population is scattered, with **70%** of the population living in rural areas

5.1 Country Overview

The United Republic of Tanzania borders Uganda to the north; Kenya to the northeast; Comoro Islands and the Indian Ocean to the east; Mozambique and Malawi to the south; Zambia to the southwest; and Rwanda, Burundi, and the Democratic Republic of the Congo to the west.

Tanzania's population was expected to reach 59.73 million by the end of 2020, with an additional 282.67 million by the end of the century. The country's population is currently increasing at a rate of 2.98 percent. The population is scattered, with 70% of the population living in rural areas and a population density of 60 per km2. In rural areas the distribution of population varies significantly. The high population in rural areas, combined with high levels of poverty, creates barriers to energy access and affordability, raising the opportunity and need for OGS energy usage. The bottom-heavy population suggests that the majority of the country's population is young. In the short to medium term, such a system has a high risk of exploding. Over the next 15-25 years, the demand for education, health, jobs, energy, and water will grow exponentially across the nation. It is pertinent that OGS has a role in Tanzanian energy mix, drawing from the population structure and its distribution across the country.

Figure 16 Structure of Tanzania's population



Source: World Bank (2016) "Tanzania: Population density

Tanzania's good macroeconomic performance over the last six years has resulted in strong income growth, with the World Bank reporting that the country's GNI per capita increased from $1,020 in 2018 to $1,080 in 2019, surpassing the lower-middle income threshold. Although the country's poverty rate has decreased, the actual number of poor people has not because of the country's high population growth rate. The Nation's economic outlook is highly ambitious, with risks leaning to the downside. A global health crisis that lasts beyond 2021 may stifle global demand and hurt the Tanzanian Economy. According to the World Bank Doing Business Report 2020, Tanzania ranks 141 out of 190 economies in ease to doing business, trailing Rwanda, Kenya, and Uganda.

5.2 ENERGY SECTOR

Natural gas, coal, uranium, hydro, biomass, solar, wind, geothermal, tidal, and waves are among Tanzania's ample energy options. Tanzania's energy supply is primarily based on biomass. A total of 78.4 percent of the population has access to grid electricity, with 37.7% of households connected. Solar photovoltaic technology electrifies 30.4 percent of households. Other energy sources are petroleum, which makes up 7.8% of total primary energy consumption, natural gas (2.4%), hydropower (1.2%) and coal/peat (0.3%). Approximately 6.6 per cent of primary energy needs to be imported annually, primarily from Uganda (17 MW), Zambia (8 MW), and Kenya (1 MW).

Energy Sector in Tanzania faces several challenges like low private sector participation in large scale power generation; over-reliance on few generation sources; unreliable and expensive energy supply; overdependence on Government subsidies; low access to modern energy services; inadequate human resource with requisite skills and knowledge.

The Government of Tanzania is currently implementing a national energy policy, the National Rural Electrification Program (2013-2022), whose goal is to increase the country's overall electricity access of the population from 36% in 2014 to 50% by 2025 and at least 75% by 2033. The Program includes both on-grid and off-grid solutions with four major objectives; the connection of new customers to the grid in already electrified settlements, new connections to the grid, electrification through off-grid investments, and development of distributed technologies, in particular off-grid solar and other renewable technologies. However, the electrification program and the available renewable energy policies do not specify how RE technologies can be used to meet the set target and likewise does not have set targets for OGS.

Tanzania has a high and mostly undeveloped potential for renewable energy (RE) sources. The only RE significantly exploited is largely hydro and it has proven to be highly vulnerable to droughts in recent years. Nevertheless, large hydro is projected to increase substantially in the next two decades and remain at about one-third of the total share . Small hydro also has great potential and it is particularly suited for remote rural areas. Several geothermal sites have been found, and commercial production will be established if feasible with the help of SREP (AfDB). Solar energy is plentiful, and it is being produced for both off-grid and grid-connected applications. Wind resources are being evaluated, and development plans are in the works. Biomass resources are mostly exploited in traditional and unsustainable ways, but the potential for using agro-residues for electricity generation is high and only partially exploited.

Tanzania's energy supply is 78.4% of the population has access to grid electricity with 37.7% of households connected

Solar photovoltaic technology electrifies 30.4% of household

Other energy sources are petroleum, which makes up 7.8% of total primary energy consumption

natural gas 2.4%

1.2% hydropower

coal/peat 0.3%

6.6% of primary energy needs to be imported annually, primarily from Uganda

5.2.1 Off-Grid Electrification

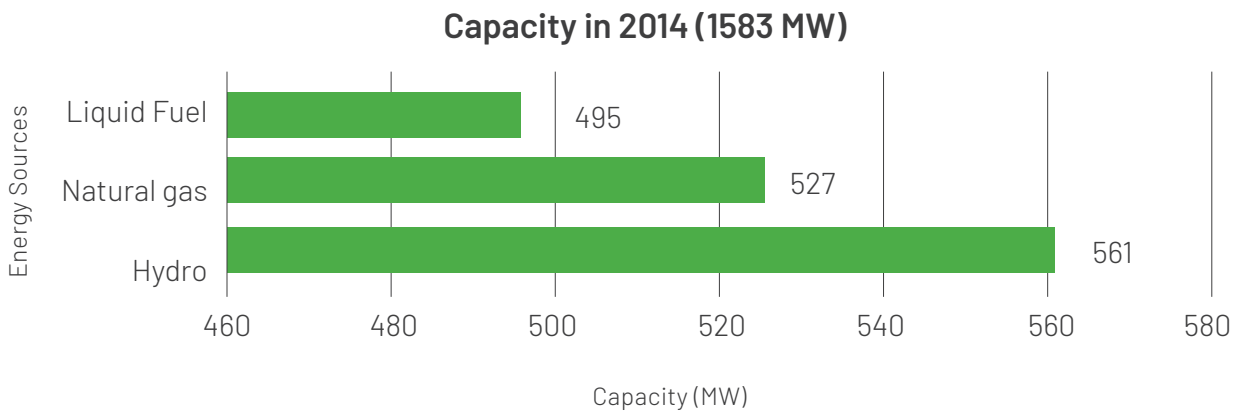
Tanzania is naturally suitable for application of solar energy as a viable alternative source for modern energy services supply for rural electrification. The country has promising levels of solar energy, ranging between 2,800 and 3,500 hours of sunshine per year and a global horizontal radiation of 4–7 kWh per m2 per day. Solar mini-grids are expected to play a key role in achieving universal access to modern energy in rural areas, especially where grid extension is technically and/or financially unfeasible. Via government bodies such as Tanzania's Rural Energy Department, there has been a political drive for mini-grid growth in recent years. Approximately 6 MW of solar off-grid power has been installed to date. PV installations are generally used at villages, schools, hospitals, health centres, police stations, small telecommunications enterprises and households, as well as for lighting, street lighting and basic electricity needs.

Renewable energy powered stand-alone systems include solar PV, wind or hybrids of several technologies, the most prevalent being pico-solar (e.g., lanterns) and solar home systems . Access to Solar PV products into rural markets has significantly increased since the year 2010 with lighting and basic power at over 4% of Tanzanian households. The decision by the Government of Tanzania to drop VAT and to abide by the East Africa Community decision to drop taxes on solar products has made the solar market very interesting to entrepreneurs and commercial institutions dealing in solar products.

The affordability and ease of use of solar products perfectly replaces the use of Kerosene lamps that are currently being used for lighting in most Tanzanian rural households. The solar lights can also give school children the chance to study in the evening. According to the latest statistics from the International Renewable Energy Agency, the country had only 26 MW of installed solar power at the end of 2019.

Most of the private solar energy companies are organised under the Tanzania Renewable Energy Association (TEREA) but work independently in solar PV installation, importing and selling solar PV products. These companies include Zola, Mobisol, GLP, ENSOL, Sustainable Energy Services Company (SESCOM), Ashton Energy, Alternative Energy, Step Solar, Solar Sisters, Resco, Davis and Shirtliff, Rex Energy, Baraka Solar, Anchor Power, Photons Energy, among others.

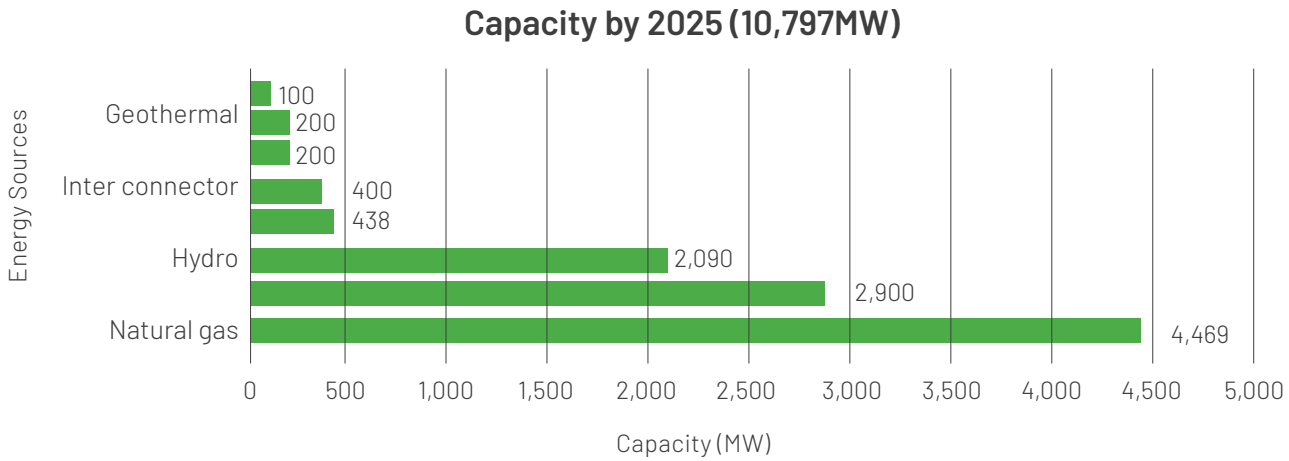
Figure 17 Installed energy capacity of Tanzania in the base year of 2014.



Source: Survey findings

159. Ministry of Infrastructure, (2016). Rural Electrification Strategy
160. ibid
161. Power Africa, (2019). Off-grid Solar Market Assessment
162. World Population Review. Tanzania Population. Retrieved from https://worldpopulationreview.com/countries/tanzania-population
163. World Bank (2016) "Tanzania: Population density (people per sq. km of land area)" http://data.worldbank.org/indicator/EN.POP.DNST
164. World Bank Overview HTTPs://www.worldbank.org/en/country/tanzania/overview
165. REA, (April 2020). Energy Access and Use Situation Survey II in Tanzania mainland. Summary of Findings

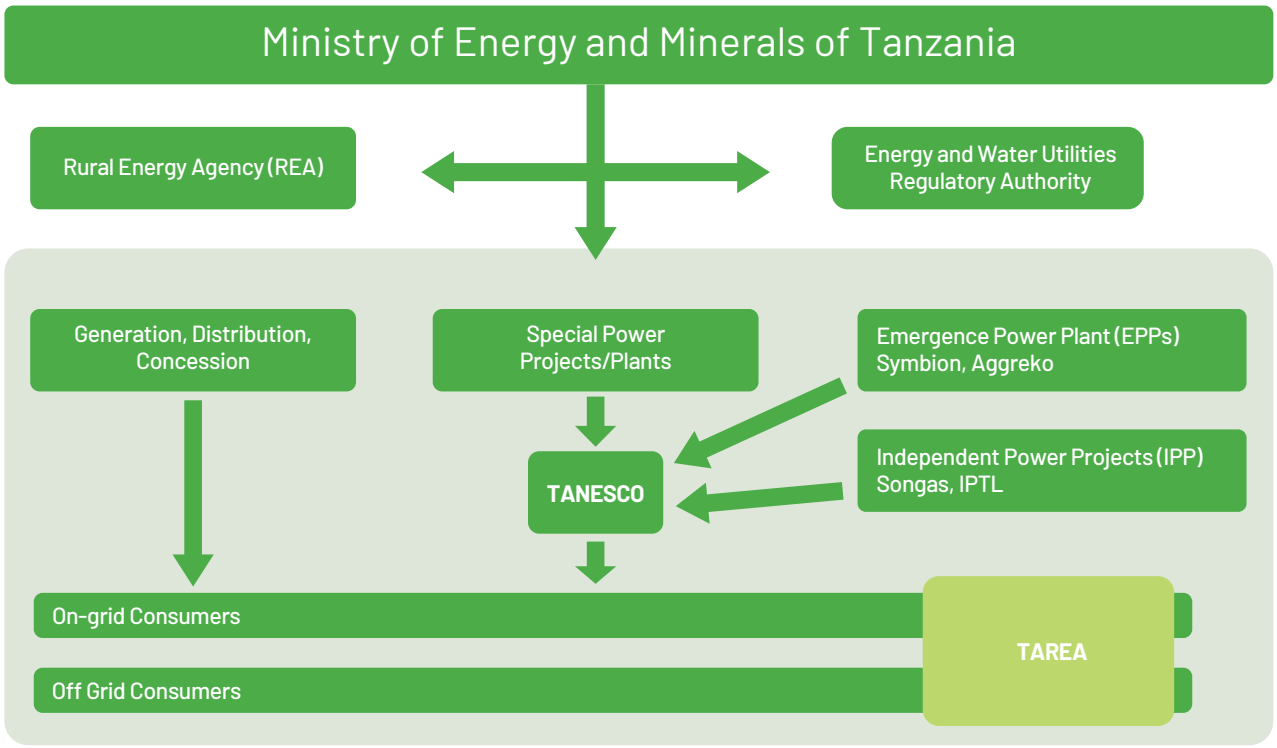
Figure 18 Projected National energy mix by 2025



Source

5.2.3 Institutional Framework

The Ministry of Energy and Minerals has the overarching role of overseeing policies, strategies and laws within the areas of energy and mineral resource management. The ministry's stated vision is to be "an effective institution contributing significantly to the acceleration of socioeconomic development through sustainable development and utilisation of energy and mineral resources in Tanzania by 2025"



166. Ibid
167. MEM, (2015). National Energy Policy
168. World Future Council Report (2007). Policy Roadmap to 100% Renewable Energy and Poverty Eradication in Tanzania
169. Enerdata (2016) "World Bank lends US$200m for electrification project in Tanzania"
170. Sosis, K & Hankins, M, (2015). Power to the people. Policy options to attract investment in off-grid renewable energy in Tanzania
171. https://www.get-invest.eu/market-information/tanzania/tanzania-renewable-energy-potential/
172. Ibid
173. Sosis, K & Hankins, M, (2015). Power to the people. Policy options to attract investment in off-grid renewable energy in Tanzania
174. Ibid
175. Tanzania Energy Situation.https://energypedia.info/wiki/Tanzania_Energy_Situation

Table 14 Energy regulatory bodies in Tanzania

Institution	Role
Ministry of Energy and Minerals (MEM)	Develop energy and mineral resources and manage the energy sector
Tanzania Electric Supply Company (TANESCO)	Generation, transmission, and distribution, serving customers on the main grid and isolated grids
Rural Energy Agency (REA)	Promote modern energy access in rural areas through efficient and rational use of energy, grants, project finance, capacity-building, and technical assistance
Energy and Water Utilities Regulatory Authority (EWURA)	Technical and economic regulator of Tanzania's electricity, petroleum, natural gas, and water sectors
Rural Energy Fund	Provides grants towards the capital costs of projects, technical assistance, training and other forms of capacity building

5.3 FINDINGS

5.3.1 Affordability

According to the National Bureau of Statistics the current electrification rate shows that many Tanzanian households continue to rely on kerosene lamps, 58.4%. The above-mentioned factor added to a widely dispersed population makes a compelling case for off-grid energy solutions.

GoT has shown its support to OGS electrification through its tax and tariff policies. To make solar PV more attractive, VAT and import tax for main solar components have been removed, reducing their cost to final consumers. Government has further continued its support by assisting companies with business models pegged to mobile phone Pay-As-You-Go (PAYGO) with financing schemes that enables users to pay slowly in instalments within periods of 12 – 18 months.

5.3.2 Innovation and Technology

Several companies are providing affordable and reliable innovative energy models to communities that currently lack power. Such companies include, Off-Grid Electric, Simu Solar, Jaza and M-Power among others. M-Power builds on the mobile phone industry's business model (PAYGO) and applies it to the provision of light and electric power. It does this through an innovative approach whereby customers pre-pay for electrical services using mobile money. Once customers pre-pay they are sent secure unlock codes via their phones. These codes are then entered into small-scale, radically efficient solar photovoltaic (PV) systems installed in the customer's home and electricity is provided. Consumers do not buy or finance the systems; they merely pay for the services.

Engie Mobisol, a subsidiary of Germany's Mobisol GmbH offers a state-of-the-art clean energy solution for home and business. Plug and play products are integrated with affordable mobile payment plans and the latest PAYGO technology. Customers pay off their home solar systems in monthly instalments via their mobile phones while Mobisol guarantees a one-year warranty for lights and 20 years for the solar panels. The contract also includes free servicing by qualified technicians during the duration of the warranty.

176. PV Magazine, (20th December, 2020). https://www.pv-magazine.com/2020/12/16/tanzania
177. IRENA, (2017). Renewable Readiness Assessment, United Republic of Tanzania
178. Clyde & Co (January 2017). Tanzania Briefing. The re-organization of Tanzania's electricity sector
179. Energy for Economic Growth, "Tanzania Energy Sector Overview."

5.3.3 Standards and Quality

The development of Pico-solar sector has been majorly hindered by lack of quality control standards and enforcement, resulting in low-quality products being sold predominantly in the off-grid market. Solar products have more than 70% penetration in Tanzania, but quality-verified products command only 17% of the entire market share. This indicates that the market in Tanzania suffers from a very high incidence of counterfeit and substandard solar products. According to Lighting Africa, there is a key market barrier being the inability of consumers to distinguish between good and poor-quality products. Lighting Africa worked with the Tanzania Bureau of Standards (TBS) to integrate the Lighting Global Quality Standards into their regulatory framework. This collaboration has since been finalized and PICO standards gazetted. TBS, through its technical committees, is now reviewing the International Electrotechnical Commission (IEC) Technical Standards on Quality Requirements and Test Methods as at February 2021.

Lighting Africa is supporting the development of a commercial market for quality-verified solar lanterns and solar home systems in the country and had a target to reach 6.5 million people by the end of 2019.

5.3.4 Finance and Investment

The banking sector in collaboration with development partners, are looking increasingly at opportunities to finance renewable energy and energy efficiency projects. With the advent of the Small Power Programme, WB established a US$23 million credit line under Tanzania Energy Development and Access Project(TEDAP) providing long-term liquidity to local commercial banks for re-financing small renewable energy projects. As of June 2020, this line of credit had not been adequately utilised by local commercial banks. An endeavour is underway to unlock this facility and make it more inclusive of sector solar market players. The first two renewable energy mini-grid projects were financed through this credit line. The credit line facility initiated to support the SPPs' access to finance was a pilot and needs to be refined and strengthened through stronger agreements among key stakeholders.

The REA also provides performance-based grants to buy down mini-grid connection costs. Public sector financing of TANESCO comes directly from the Government, REA, multilateral and bilateral lenders and donors. TANESCO also borrows from commercial banks for working capital. IPPs, EPPs and SPPs bring their financing, both equity and debt, some of which is sourced externally.

Equity funds are still rare in Tanzania, although some regional equity funds are looking into investment opportunities under the SPP program. Also, AfDB approved a line of credit for renewable energy through Bank of Africa for about €20 million. Tanzania has received substantial energy sector assistance from its development partners, who have coordinated their efforts to comply with national goals and strategies. The country has a well-coordinated working group of energy-related development partners, which is chaired by WB. The group meets regularly to discuss key sector concerns and challenges, as well as the approaches taken by development partners.

5.3.5 Skills Development

Several universities deliver advanced renewable energy courses and training sessions at the diploma, undergraduate, and master's degree levels. Several programs and organizations, such as the Tanzania Renewable Business Incubator and the Energy Research and Development Institute, foster research and growth in the energy sector to encourage energy access and the development of new technologies. The Energy Change Laboratory, and the Innovative Technology and Energy Centre anchors this.

180. https://www.lightingafrica.org/country/tanzania/
181. AfDB (2015). Renewable Energy in Africa. Tanzania Country Profile
182. https://zolaelectric.com/
183. https://plugintheworld.com/solutions/
184. Lighting Africa (November 2017). Deep Dive Supply Chain Report, Tanzania

5.3.6 Institutional Capacity

The RE institutional framework comprises three agencies (MEM, TANESCO, and REA). Government has since undertaken an Institutional needs assessment, where gaps were identified and a plan to address them was agreed upon but has not been implemented. The pace at which project management issues are resolved has been hampered by institutional challenges rather than teamwork among the three lead agencies. The government put in place a detailed reform road map for institutional transformation and strengthening in the power sector, but incidents and other weaknesses hindered the road map's implementation. The private sector needs to be seen actively participating with their development partners in collaboration with TAREA which oversees the solar business in the country. Cohesion among all the stakeholders will spark off the anticipated growth in the OGS electrification market.

5.4 POLICY REVIEW AND GAP ANALYSIS

The study identified the following policy frameworks that govern or relate to the renewable energy sector in Tanzania.

Table 15 Policies affecting Renewable Energy

Policy	Responsible Institution	Period	Status
Rural Energy Act 2005	Ministry of Energy and Minerals	Open	Current
National Energy Policy	Ministry of Energy and Minerals	2015	Current
Electricity Act	Ministry of Energy and Minerals	2016	Current
National Vision 2025	Planning Commission	2025	Current
National Development Plan	Ministry of Finance and Planning	2016/17 –20/21	Current
The EWURA Act	Ministry of Energy and Minerals	2006	
The Power System Master Plan	Ministry of Energy and Minerals	2016/17 – 20/21	Current
The Energy Efficiency Action Plan 2020	Ministry of Energy and Minerals	2020 - 2040	Current
Public Private Partnership Act	Ministry of Finance and Planning	2010	Current
Electricity Supply Industry Reform Strategy and Roadmap (ESIR)	Ministry of Energy and Minerals	2014–2025	Current

Source: Survey findings

5.4.1 National Development Vision 2025

The goal of Tanzania Vision 2025 is to set in place strategies that will graduate the country from a least developed country to a middle-income country with a high level of human development. Tanzania's vision 2025 is hinged on achieving economic growth through Renewable Energy as a key economic driver and enabler to transforming lives.

185. Ibid
186. https://www.get-invest.eu/market-information/tanzania/energy-sector/
187. The World Bank, (June 2018). TZ-Energy Development and Access Expansion Project (P101645)
188. AfDB (2015). Renewable Energy in Africa. Tanzania Country Profile
189. Ibid.

5.4.2 National Development Plan (2016/17 – 20/21) – NDP II

The theme of NDP II "Nurturing Industrialization for Economic Transformation and Human Development" incorporates the main focus of the two frameworks, namely growth and transformation (NDP I) and poverty reduction (MKUKUTA II). NDP II outlines new interventions to enable Tanzania industrialize in a way that will transform its economy and its society. It also incorporates unfinished interventions from the predecessor Plan and Strategy, respectively, deemed critical for realization of the aspirations of NDP II. NDP II also implements aspects of Tanzania's Development Vision (TDV) 2025 which aspires to have Tanzania transformed into a middle income and semi-industrialized nation by 2025.

The plan highlights the main challenges characterizing the energy sector as low access, by both urban and rural populations and high costs of power production, distribution and transmission. A period of about 40 years of Government monopoly has stifled potential competition and efficiency in electricity supply. For quite some time the subsector has been characterised by overreliance on Hydro Electric Power (HEP), underinvestment, limited diversification of energy resources and inadequate efforts to expand customer base and optimally serve clients.

In general, NDP II has interventions geared towards the realization of the energy targets through promotion of renewable green energy technologies (biogas, LPG, Solar Energy) and strengthening the contribution of natural resources and products to poverty reduction and economic growth.

5.4.3 Rural Energy Act 2005

The Act established the Rural Electrification Agency, and Rural Energy Fund and mandated the Rural Electricity Board to administer the Rural Electrification Fund (REF) which is used to issue subsidies and grants to developers of qualified rural energy projects to improve access to modern energy including renewable energy. The Fund represents a mechanism by which the Rural Energy Board (through REA) fulfils its mandate of providing grants towards the capital costs of projects, technical assistance, training and other forms of capacity building. REF can also co-finance investments in innovative pilot and demonstration projects and applications for renewable energy.

5.4.4 Electricity Act 2008

This act established a general framework for the powers of the Ministry of Energy and Minerals (MEM) and Energy and Water Utilities Regulatory Authority (EWURA). It defined key parameters for EWURA concerning tariff-setting criteria and procedures, criteria for awarding provisional and permanent licenses, monitoring and enforcement activities, requirements for ministerial plans and strategies for rural electrification, dispute resolution procedures and a process for determining the possible future reorganisation of the electricity sector.

5.4.5 National Energy Policy, 2015

The government recognises the fundamental role of energy in the effort to improve national economy towards industrialisation as well as achieving the development vision 2025 and the sustainable development goals 2030.

The policy aims at improving the business environment to attract more private investments and local participation in the Energy Sector by taking into consideration the global initiative of providing sustainable energy for all, and promoting energy conservation and efficiency. It also focuses on increasing access to modern energy services and increasing the share of renewable energies in the electricity generation mix to enhance availability, reliability and security of supply.

5.4.6 The Power System Master Plan

The Government of Tanzania, through TANESCO, established a Power System Master Plan (PSMP) in 2008 to include a radically new plan to direct the growth of Tanzania's power system for the

next 25 years. The Plan's ultimate goal is to re-evaluate short-term (2016-2020), mid-term (2021-2025), and long-term goals (2026 - 2040). These include; fulfilling generation and transmission requirements and the need for connecting presently off-grid regions, opening options for power exchanges with neighbouring countries, and increased supply of reliable power.

According to the plan, to achieve reliable and stable power supply, development of conventional generation plants must be accompanied with the development of renewable energy plants to supplement and backup the fluctuation of renewable energy generation. Considering intermittent output and low utilization factor and of solar (10-15%) and wind (20-30%), contribution of such renewable energy generation to total energy generated is limited.

5.4.7 The Energy and Water Utilities Regulatory Authority Act (EWURA) 2006

The Energy and Water Utilities Regulatory Authority (EWURA) is an autonomous multi-sectoral regulatory authority established by the EWURA Act Cap 414 of the laws of Tanzania. It is responsible for technical and economic regulation of the electricity, petroleum, natural gas and water sectors in Tanzania. The functions of EWURA include among others, licensing, tariff review, monitoring performance and standards with regards to quality, safety, health and environment. EWURA is also responsible for promoting effective competition and economic efficiency, protecting the interests of consumers and promoting the availability of regulated services to all consumers including low income, rural and disadvantaged consumers in the regulated sectors.

5.4.8 Public Private Partnership Act No. 18 of 2010

The PPP -Act was operationalised to give effect to the public-private partnership policy, and specifically

To provide for institutional frameworks for the implementation of public-private agreements between public sector and private sector entities	To set rules, guidelines and procedures governing public-private procurement, development and implementation of public private partnership	To provide for other related matters.

190. Ibid
191. Power Africa Report (2019). Off-Grid Solar Market Assessment Tanzania

This act set forth the responsibilities and obligations of the parties, penalties, remedies, financial management and control requirements, public-party available assistance and dispute resolution. It established Public Private Partnership (PPP) coordination units within the Tanzania Investment Centre and Ministry of Finance.

5.4.9 Electricity Supply Industry Reform Strategy and Roadmap 2014–2025 (ESIR)

The Ministry of Energy and Minerals took a number of steps to boost the electricity sector's efficiency, including implementing the ESIR. The ESIR lays out the steps that the government aims to take to restructure the electricity market. It acknowledges that the ultimate objective in re-organising the sector is to ensure that Tanzania will become a middle-income country by 2025, pursuant to the Tanzania Development Vision 2025.

5.4.10 Solar Tax Regime

In the East African Community, there is an import duty and VAT exemption on certain solar products. Acting as an indirect government subsidy for solar-powered electricity generation equipment, the regulation ensures that Tanzanian companies do not have to pay the standard import duties when buying solar equipment from abroad. It also means there is no payment of value added tax on the sale of solar products. Important to note is that this legislation concerns development and generation equipment only. Solar powered appliances (such as lights) are not eligible for tariff exemption in the EAC region. Products used for the storage of power, such as batteries, do qualify for the tariff waiver. The exemptions (when applicable) are automatically applied and do not require any action from the companies for which they are made.

5.4.12 POLICY GAP ANALYSIS

Policy Status on Affordability:
The National Energy Policy 2015; Section 3.4.2 – Energy Pricing
The policy objective is to institute an appropriate pricing structure to sustain supply and demand sides and enhance affordability on consumers' side.

Existing Situation: VAT and import duty exemptions are in place for all development and generation equipment. Solar powered appliances (such as lights) are not eligible for tariff exemption in Tanzania.

Policy Gap: The policy is not aligned with the existing situation to ensure affordability

Policy Status on Standards and Quality:
The EWURA ACT 2008
The policy has an objective to monitor the performance of the RE sector concerning availability, quality, and standards of services and any contravention as stipulated in Tanzania Bureau of Standards Act or any other written law.

Existing Situation: Government has legislation in place including the Standards Act, 1975. Tanzania Bureau of Standards (TBS) conducts Pre-Shipment Verification of Conformity of Products and carries out impromptu inspections. TBS ensures that minimum quality standards are enforced.

Policy Gap: The policy does not provide for coordination of the different players in enforcement of standards. Currently, there are substandard Solar Panels and batteries on the market.

192. The World Bank, (June 2018). TZ-Energy Development and Access Expansion Project (P101645)
193. EAC, (2009). East African Community Customs Management Act (2004)
194. MEM (2015). National Energy Policy
195. MEM, (2008). EWURA ACT

Policy Status on Innovation and Technology:
The National Energy Policy 2015; Section 3.4.4 – Capacity building, Research and development
The Policy aims at promoting education, vocational training, research and development in the Energy Sector to generate new ideas and technologies.

The Rural Energy Act – Under REF
REF can co-finance investments in innovative pilot and demonstration projects and applications for renewable energy.

Existing Situation: Existence of the pre-pay for electrical services using mobile money whereby consumers do not buy or finance the systems; they merely pay for the services and the PAYGO technologies

Policy Gap: There is no evidence of government efforts or initiatives in promoting RE innovations and technologies.

Policy Status: Finance and Investments
The National Energy Policy 2015; Section 3.4.2 – Energy Pricing
The policy has an objective to ensure the pricing structure provides incentives for promoting investments while sustaining supply and demand for energy

Existing Situation: Rural Energy Fund (REF) and the Rural Energy Board (REB), REA facilitates access to modern energy services in rural areas. It supports public, civic and private entities with grants for capacity building, feasibility studies and capital investment. It also coordinates the work of international partners, who support components of the national electrification programmes.

Policy Gap: No direct policies and programmes promoting full private sector participation and investment in the RE sector.

Policy Status on Institutional Capacity:
The National Energy Policy 2015; Section 3.1.3 – Rural Energy Services
The policy has an objective to strengthen institutional capacity for effective coordination, administration, implementation and monitoring of rural energy projects to accelerate rural electrification to foster socio-economic transformation.

The National Energy Policy 2015; Section 5 – Fiscal, legal and regulatory framework.
The policy has the objectives of reviewing and aligning the Energy Sector's legal and regulatory framework, to guide all actors in the Energy Sector.

Existing Situation: There are several institutional players in the RE sector, among them being MEM, TEREA, EWURA, REA, TANESCO, and TPS. Government is building the capacity of the power sector through overseas training funded by TEDAP to help shepherd the power sector reform.

Policy Gap: There is no policy position on cohesion/ coordination of the different sector players

196. MEM, (2015). National Energy Policy
197. MEM, (2005). Rural Energy Act
198. MEM, (2015). National Energy Policy
199. Ibid

Policy Status on Skills Development
The National Energy Policy 2015; Section 3.1.3 – Rural Energy Services
The government has an objective to facilitate local capacity building for manufacture, installation, maintenance and operation of rural energy systems.

The National Energy Policy 2015; Section 3.4.4 – Capacity building, Research and development
The Policy aims at promoting education, vocational training, research and development in the Energy Sector to generate new ideas and technologies.

Existing Situation: Capacity-building for people working in the energy sector is offered at various universities and research and training institutions in Tanzania. These institutions include Arusha Technical College, Dar es Salaam Institute of Technology, Mbeya Institute of Science and Technology, the University of Dar es Salaam, University of Dodoma and organisations within the Vocational Education Training Authority (Mafinga Lutheran Vocational Training Centre, Legeruki Lutheran Vocational Centre, Hai Vocational Training Centre, Mobisol Academy and M-Power Academy)

Policy Gap: There is no mechanism to regulate and licence renewable energy professionals, however, TAREA is currently working on this.

5.5 RECOMMENDATIONS:

Affordability
The GoT needs to improve on the existing enabling environment for the Tanzanian OGS sector. Supporting financial institutions and permitting solar focussed financiers like Sun Funder to invest in the country. More players on the market have an effect on pricing of the products making them more affordable

Finance and Investment
The Solar investment space is closed and limited to existing government funds, there is need to expand the existing financing options to attract greater private sector participation through more innovative capital structures that can de-risk the sector.

Government should ensure that sources of funding evolve and improve with changing circumstances to enable energy access and renewably powered off-grid electrification.

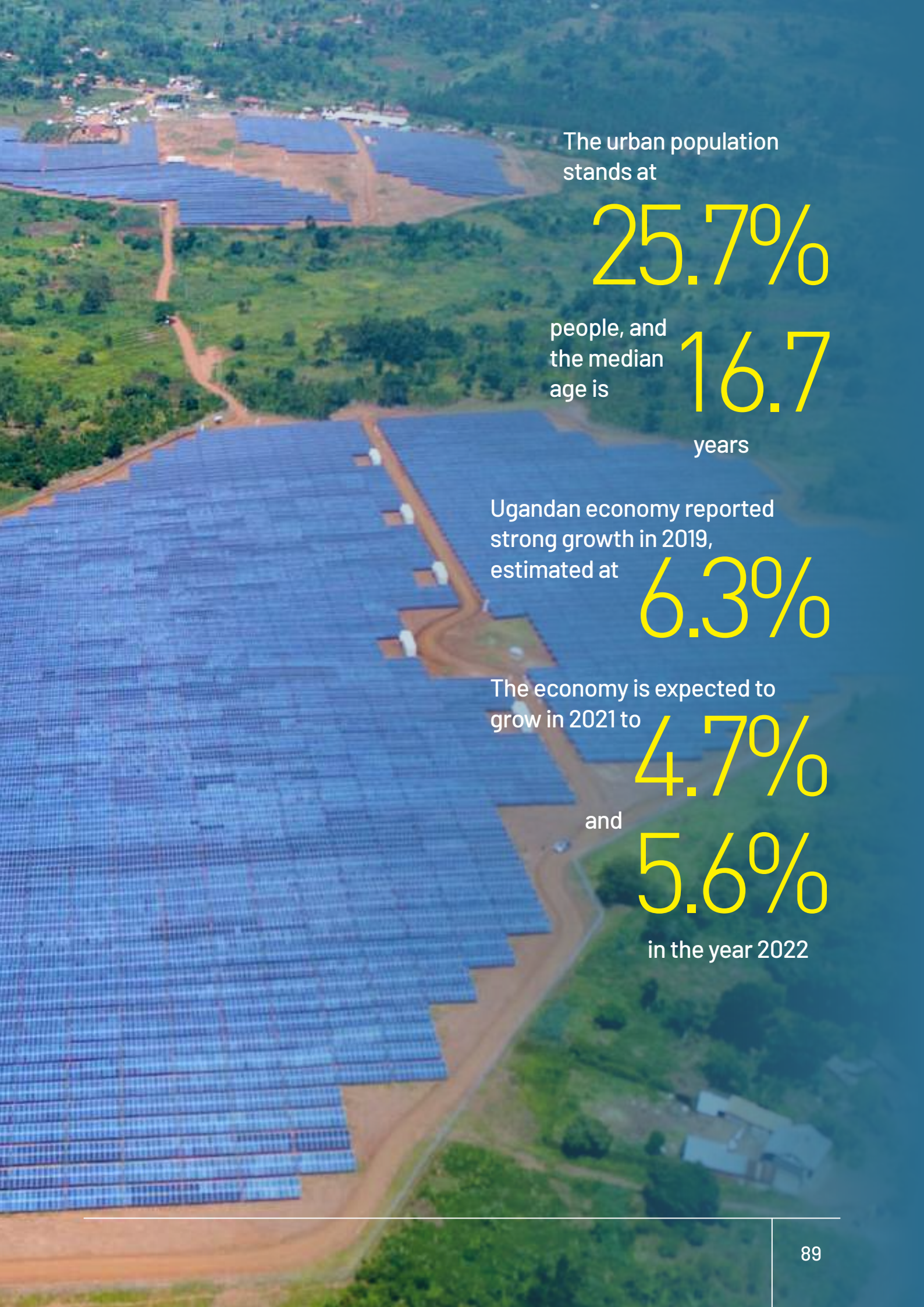
Innovation and Technology
GoT needs to scale up their investment in Research and development in Renewable Energy Technologies in order to boost the Renewable energy sector. This can be done through increased collaboration with the existing tertiary institutions.

Skills Development
GoT needs to put in place mechanisms to license and regulate practitioners and professionals in the RET solar sector. This can be done through the collaboration of the ministry of energy and ministry of education.

Institutional Capacity
Government needs to improve coordination among the different players in the RE sector by establishing an energy steering committee. This will re-align the various departments, authorities and projects to ensure that there is clarity in their mandates and cohesion.

Standards and Quality
The government needs to educate the community, importers and retailers on identifying substandard products. Government through its Renewable Energy unit needs to work with TBS to develop further regulations aligned to IEC standards.
Government needs to work together with existing sector partnerships to build synergies and strengthen their capacity in enforcing regulations including punitive measures against culprits.

6.0 UGANDA



The urban population stands at

25.7%

people, and the median age is

16.7

years

Ugandan economy reported strong growth in 2019, estimated at

6.3%

The economy is expected to grow in 2021 to

4.7%

and

5.6%

in the year 2022

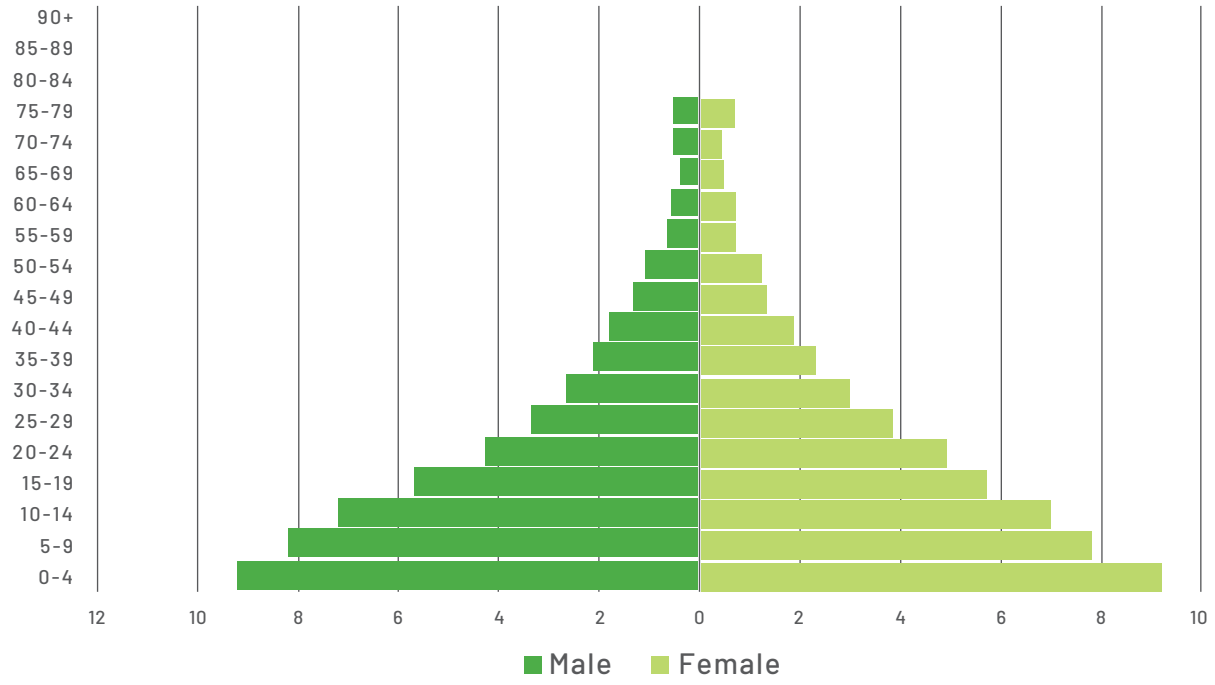
6.1 Country Overview

Uganda is a landlocked country located in East Africa, bordered by Kenya, Tanzania, Rwanda, Democratic Republic of Congo, and South Sudan. The total land mass is 199,810 Km2. It has an estimated population density of 229 per KM2. The urban population stands at 25.7 % amounting to 11,775,012 people, and the median age is 16.7 years.

Uganda has one of the youngest and most rapidly growing populations in the world; its total fertility rate is among the world's highest at 5.8 children per female. Rapid population growth is expected along with demand for jobs, housing, health, and energy. This presents a strong opportunity for the entrenchment of renewable energy, more so, off-grid solar. See Figure 20 below.

Population structure of Uganda

Figure 20 Uganda's Population Pyramid (UBOS, 2014)



The Ugandan economy reported strong growth in 2019, estimated at 6.3%. This growth was subdued in 2020 due to the effects of the New Corona Virus Disease pandemic (COVID 19), and the locust plague which affected the Agriculture sector (recognised as the backbone of Uganda's economy). The economy is expected to grow in 2021 to 4.7% and 5.6% in the year 2022. as aggregate demand improves with the expectation that COVID 19 will be contained by the on-going global vaccine programmes. This presents a strong opportunity for growth in productive and consumptive off-grid solar use in the rural agrarian population where it is needed most.

6.2 Energy Sector

Uganda is richly endowed with natural resources spread out across the country. These include large water bodies such as rivers and lakes that can be harnessed for hydropower, large expanses of forests and shrubs, all year sunshine for solar, natural hot springs for geothermal energy, and large deposits of fossil fuels. (Kenya's geothermal potential is being exploited in the Eastern arm of the East African Rift Valley, while Uganda's geothermal potential is in the Western arm of the East African Rift Valley.) The overall renewable energy power generation potential of the nation estimated to be 5,300 MW.

200. MEM, (2015). National Energy Policy
201. Ibid
202. IRENA, (2017). Renewable Readiness Assessment, United Republic of Tanzania
203. https://www.worldometers.info/world-population/uganda-population/

Table 16 Power Generation in Uganda by sector

Installed Capacities	2015	2016	2017	2018	2019
Electricity installed capacity, Total (MW)	940.6	942.6	978.0	995.0	1212.4
Electricity installed capacity in Total RE (MW)	804.6	806.6	842.0	859.0	1076.4
Electricity installed capacity in Hydropower (MW)	695.0	695.0	708.4	723.4	906.6
Electricity installed capacity in Wind (MW)	0.0	0.0	0.0	0.0	0.0
Electricity installed capacity in Solar (MW)	22.0	24.0	46.0	48.0	82.2
Electricity installed capacity in Bioenergy (MW)	87.6	87.6	87.6	87.6	87.6
Electricity installed capacity in Geothermal (MW)	0.0	0.0	0.0	0.0	0.0
Electricity installed capacity in Non-RE (MW)	136.0	136.0	136.0	136.0	136.0
Electricity installed capacity in Fossil fuels (MW)	136.0	136.0	136.0	136.0	136.0

Source:

6.2.2 Off-Grid electrification

Uganda is endowed with favourable solar irradiation of 1,825 kWh/m^2 to 2,500 kWh/m^2 per year. It is estimated that the current level of rural electrification in Uganda is significantly low; only 8% of rural residences have grid connectivity, 3% have solar home systems, 28% rely on solar lighting systems or solar lanterns and less than 1% are electrified through mini-grids. Average consumption by those who have access is very low (<30 kWh/month). This is mostly caused by constrained affordability for the service with new connections at a high cost of about $200 per connection. Under the rural electrification projects, Small solar applications such as Solar Home Systems or solar water heating are often used. Whereas there is an increase in penetration of grid electricity over the last decade, a large number of the widely dispersed rural population is unlikely to access the national grid in the near term. This leaves a viable space for off-grid energy solutions to play an important role in providing quick access to reliable and modern lighting and energy services to households.

Small Solar Home Systems have been embraced in Uganda for consumptive and productive use. These range from small charging systems (up to 5Wp) to semi-portable systems with a portable module (5-10Wp). They comprise of solar lanterns, torches, and lights with minimum wattage and less operation and maintenance costs. There continues to be a wide market of these solar products in Uganda which mainly target rural areas where the majority of the population lives. Large Solar Home Systems usually have power ratings ranging between 10 - 200Wp. Their adoption rate is relatively high. According to the Uganda Off-grid Market Accelerator report published in 2019, 1.5 million SHS were estimated to have been sold then, with 420,000 being sold on credit through the PAYGO. The buyers were mostly located in the densely populated areas of the central and western regions.

Mini grids are still a new technology in Uganda. To date, only a small number of mini-grids have been installed. However, efforts are underway by the Ministries, donor agencies and Private sector to support mini grid development. Use of

204. https://www.unicef.org/uganda/reports/harnessing-demographic-dividend-uganda
205. https://www.afdb.org/en/countries/east-africa/uganda/uganda-economic-outlook
206. https://www.focus-economics.com/countries/uganda
207. https://www.ubos.org/explore-statistics/4/

solar has gained momentum over the last decade with several lighting systems, water pumps and other OGS products being deployed in schools, health centres, hotels and households which have enjoyed an increase in prominence in urban and rural areas. Members of Uganda Solar Energy Association (USEA) such as Village Energy, Solar Now, Engie (Fenix), Power Trust, and d-light are prominent in driving this growth.

Affordability and availability of solar systems for productive and consumptive use are seen as major hindrances for uptake in rural areas. The initial high cost of purchase and installation is a prime challenge for the target market segments. These have remained limiting factors despite tax waivers on some solar products and components. A clear and favourable tax regime for off-grid solar (OGS) is yet to be achieved due to the prevailing situation of lack of clarity in the tax classification of various solar components for productive and consumptive use. Gains that would have been made from improvement of the national road networks in rural areas are therefore constrained by this situation.

This is compounded by the influx of counterfeit products in the Ugandan market which has impacted client perception of solar products as generally inferior and not able to meet the energy needs of consumers. Access to finance is another critical factor, if solar penetration is to be realized at scale.

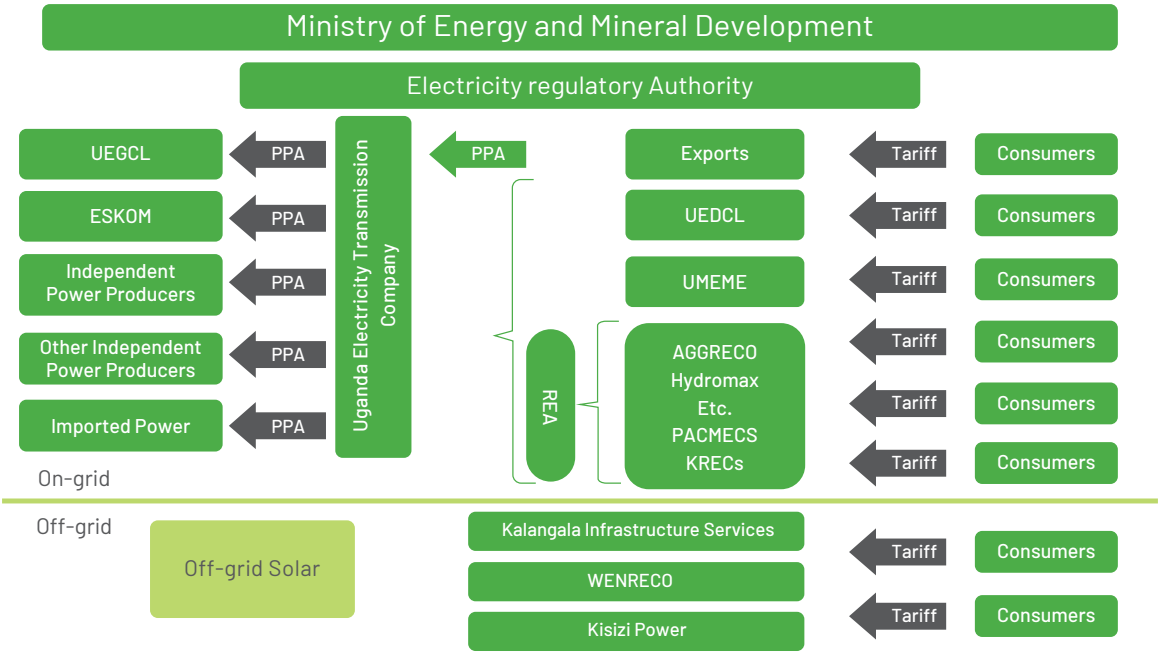
6.2.3 Institutional framework

The Government, through the Ministry of Energy and Minerals Development, is responsible for provision of policy guidance in the development and exploitation of the energy resources, creation of an enabling environment to attract investment, provision and utilisation of energy resources. The structure of the Energy sector is centralised and has been liberalised since 1999 through the Electricity Act, creating three separate companies responsible for generation, transmission and distribution. Due to the general energy generation deficiency since then, the number of Independent Power Producers (IPPs) has consistently increased over the last two decades. Below is the setup of Uganda's Energy institutional framework that drives production and access to electricity.

The Ministry of Energy and Mineral Development (MEMD) implemented the Government's Power Sector Reform and Privatisation Policy, which resulted in liberalisation of Uganda's power sector through the Electricity Act of 1999. As part of this, the state-owned Uganda Electricity Board was unbundled in 2001 and broken up into Uganda Electricity Generation Company Limited (UEGCL), Uganda Electricity Transmission Company Limited (UETCL) and Uganda Electricity Distribution Company Limited (UEDCL). The Electricity Regulatory Authority (ERA) was created at the same time. The GoU has recently taken a decision to start the process of merging some MDAs, including REA.

208. https://www.get-invest.eu/market-information/uganda/renewable-energy-potential/
209. UBOS, ERT III Baseline Survey Findings, 2018
210. https://www.lightingafrica.org/country/uganda
211. https://www.lightingafrica.org/country/uganda/
212. Uganda Off-grid Market Accelerator, 2019, Market Map of Off-grid Energy in Uganda
213. SE4ALL, Uganda's Action Agenda 2015. Ministry of Energy and Mineral Development

Figure 21 Energy Institutional framework of Uganda



Source: Survey findings

Key institutions in the energy sector in Uganda

Table 17 Institutions and their roles in the Energy Sector

Institution	Role
Ministry of Energy and Mineral Development (MEMD)	Policy and strategy formulation.
Electricity Regulatory Authority (ERA)	Regulate the generation, transmission, distribution, sale, export and import of electrical energy in Uganda. Manage licensing and tariffs
Uganda Electricity Generation Company Ltd (UEGCL)	Electricity power generation for sale within Uganda or for export to neighbouring countries. Builds, operates and maintains a several of generation power plants
Uganda Electricity Transmission Company Ltd (UETCL)	Owns and operates the High Voltage Transmission Grid, coordinates the power supply system, dispatches generation facilities, negotiates all bulk power purchase agreements
Uganda Electricity Distribution Company Ltd (UEDCL)	Owns and manages substations and voltage networks
Rural Electrification Agency (REA)	Operationalizes the government's rural electrification function under a public-private partnership framework
Rural Electrification Agency (REA)	Operationalizes the government's rural electrification function under a public-private partnership framework
Energy Sector Working Group (SWG)	Government and development partners discuss matters influencing the sector, and approve long-term plans and policy measures
UMEME	Largest electricity distribution company, mandated to: • operate, maintain, upgrade and expand the distribution network • retail electricity to its customers • to improve efficiency within the electricity distribution system

6.3 FINDINGS

6.3.1 Affordability

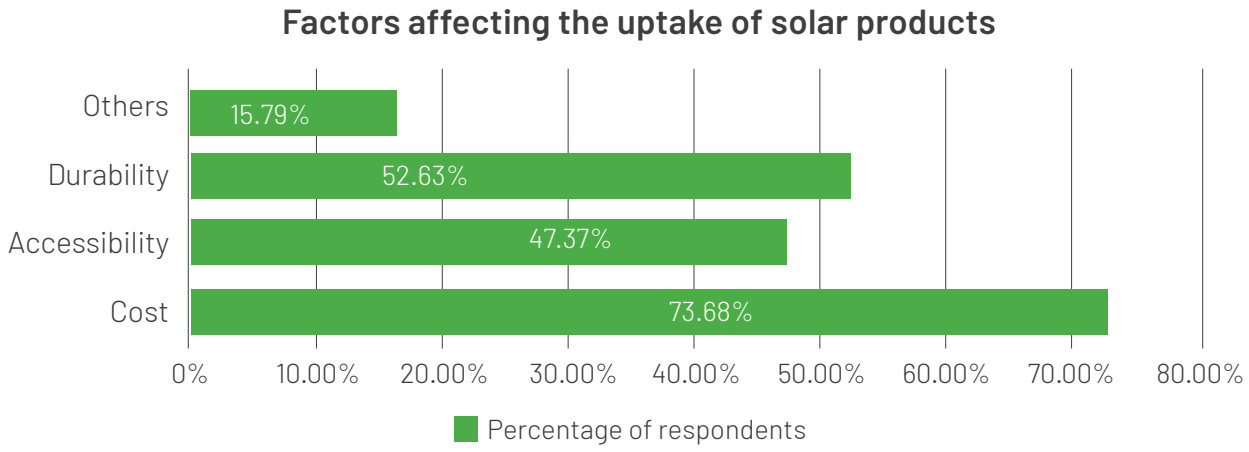
The general price of solar products makes them unaffordable to the majority of Ugandans. Even those who could afford to purchase a solar unit could not buy the desired solar energy capacities, because of the high purchase costs of the equipment. Instead, they resorted to sizes they could only afford, implying therefore that the cost of the solar technologies is still a major limiting factor to uptake.

The tax regime is high, 18% VAT and import duty is levied on solar PV panels and other essential components such as controllers, batteries and inverters forcing companies to pass on costs to customers, effectively reducing uptake. For example, the unit costs for various OGS technologies are; solar PV US$12,000-15,000 per KW and solar water heating US$810-1,500 per KW. The PAYGO technology and business model was identified as an opportunity that has enabled the population to access and afford SHS. Though it comes at a cost, the monthly instalments are more manageable for many end-users. It is important to note that PAYGO is mostly used in SHS. Companies using PAYGO include; M-KOPA, Fenix and Dlight.

Though upfront costs are high for productive use solar systems, there has been subsidisation programmes by way of discounts to popularise use and increase market reach. For example, Solar Now gave special discounts to farmers in need of solar irrigation equipment during Covid 19 with the support of GIZ.

The study found that 74% of respondents attributed cost as the major factor affecting uptake of OGS products. See figure below.

Figure 22 Drivers of affordability of Off-grid Solar in Uganda



Source: Survey findings

6.3.2 Standards and Quality

The OGS sector does not have guidelines in place that specify minimum requirements on standards and quality. However, UNBS in partnership with USEA, supported by REA is developing standards for the sector. These IEC Technical Standards gazetted as of 29th March 2021; (62257-9-8 (Quality Requirements) & 62257-9-5 (Test Methods): Uganda Gazette, pp 47-49. These will increase the quality of solar goods and ensure a level playing field by eliminating counterfeits. The standards will apply to a full range of solar equipment that

214. UNRA, Annual performance report FY 2019/20 august 2020
215. Solar energy viability study, NAPE, 2006
216. https://www.get-invest.eu/market-information/uganda/governmental-framework/

includes batteries, torches, lamps, chargers, fans, radios, cables, and screens, as well as other solar equipment under 350 Wp . A key informant indicated that this standard is only for plug and play SHS. Component based systems do not have a standard yet, although UNBS has some standards for individual components like solar panels. For component based SHS an interim quality framework was developed between UECCC, REA and WB and has been handed to UNBS for standardisation. Solar water pumps have guidelines developed by ministry of water and environment but there is still no real standard. As the standards have been developed UNBS and other players in the RE sector are engaged in activities that promote standards and quality such as the partnership between UNCDF and CREEC to implement a Standards and Quality and Awareness campaign on behalf of USEA for off-grid solar. UNCDF has supported UNBS with electrical testing laboratory equipment, including battery testing equipment for batteries less than 100 Ah, and on solar Photovoltaic (PV) equipment. This is in the bid to fight against counterfeit solar products.

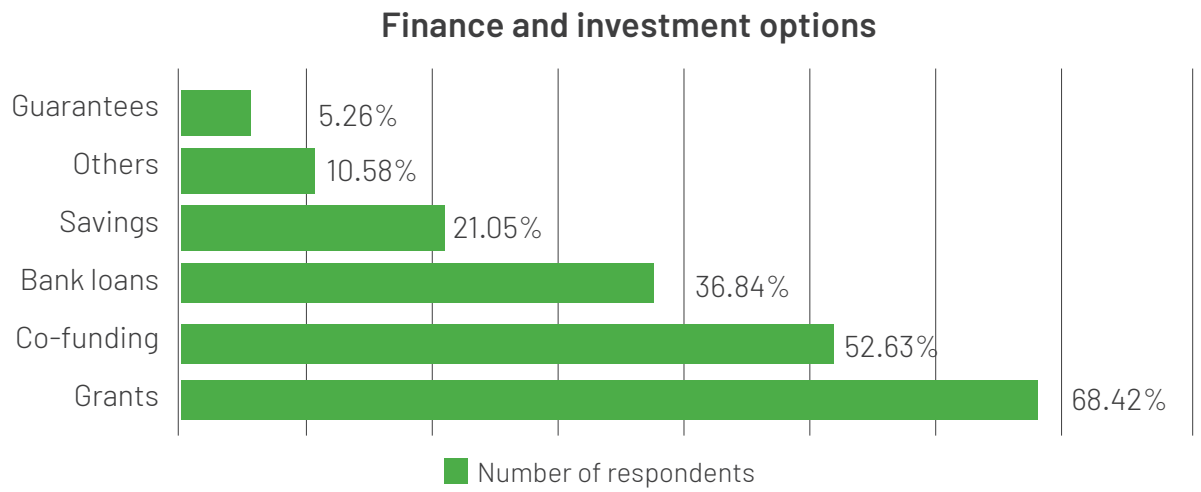
6.3.3 Finance and Investment

The OGS market in Uganda is largely private sector driven and supported by several funding and investment opportunities. The Ugandan government has received funding from development partners such as the African Development Bank, the World Bank, the European Union, DFID, and GIZ, among others, who have launched numerous electrification initiatives, the most notable of which is the Global Energy Transfer Feed-in Tariffs (GET FIT) programme and Energy for Rural Transformation project.

The ERT (phase 3) program has components that include on grid and off-grid investments to enhance energy access. The program aims at ffostering community-based schemes to expand access to the rural households through the construction of Six Pico /Micro hydropower projects in hard-to-reach areas in the country.

Solar businesses look up to their Associations, USEA and UNREEA for key support to access finance. The survey revealed that there are several finance and investment options for off-grid solar companies with grants leading in contribution at 68%, co-funding at 52%, bank loans at 37%, savings at 21%, other options at 11% and guarantees at 5%. See Fig below See Fig below

Figure 23 Finance and Investment options for Off-grid solar.



Source: Survey findings

Although access to finance remains an obstacle (banks do not want to issue loans, Investors not willing to invest in local companies, and solar companies are not investment ready), attempts have been made to work with local banks to provide credit. Uganda Off-grid Market Accelerator (UOMA) has been instrumental in undertaking institutional awareness for commercial banks to undertake local debt financing. Available data indicates that certain businesses, such as Solar Now, have been successful in obtaining financing. M-Kopa secured $55 million in debt funding, and UECCC extended a $8.5 million credit to a consortium of local banks (Centenary Bank, Absa, Finance Trust) for on-ward lending to solar companies as working capital to acquire Solar systems. Targeted Solar Companies are those selling Solar systems on Pay as you go, Pay plan and Cash business models The facility was only able to disburse less than 10% in first 18 months (Nov 2017 - May 2019). A review was done to enable lending for productive use of energy in September 2019. This review yielded the interim standard which is now in place. The interim standard allows companies selling compliant component-based systems to borrow from UECCC.

6.3.4 Innovation & Technology

Several energy stakeholders, including the private sector, government, and development partners, have shared plans and intentions to promote research and development in Renewable Energy technologies, with an eye toward international collaboration and technology transfer. A survey for the solar businesses discovered that 84% of the respondents were engaged in solar innovations, 48% participated at either ideation or development stage in innovation and 26% were both at adoption and using or testing stage. Innovations are majorly reflected in product development improving the productive and consumptive use of solar mainly in irrigation, health and solar drying.

The survey findings also revealed that PAYGO is the main technology that has transformed business in the OGS energy sector. PAYGO is a game-changing credit scheme that eliminates the initial financial obstacle to solar energy access by enabling customers to make a series of small payments to buy time units for using solar energy rather than paying upfront. The technology is gaining traction as a solution that tackles end-customer affordability while still providing ample margins to support scalable operating models.

In Uganda, PAYGO is used at two levels, One as Business to Business - B2B and Business to Customer -B2C. In B2B, companies sell to smaller distributors while in B2C, distributors or companies sell to the customers.

6.3.5 Skills Development

There are efforts by GoU, private sector and development partners to strengthen skills development in the OGS sector. These efforts are not comprehensive enough to achieve the desired competence in the industry. Some of the efforts include; the Renewable Energy Strategy and Plan (RESP) that provides for capacity building support to the entire RE sector. This is financed through Rural Electrification Agency (REA) and ensures that RE programs and the implementing organizations receive the support to facilitate capacity building and achieve the core competencies and knowledge required for high functioning rural electric utilities.

The GoU through the Ministry of Education is working with development partners such as ENABEL, GIZ, and private sector players like the Enlight Academy in implementing the BTVET Strategic Plan. One of the key components of this strategy is promoting training programs in new energy technologies. Handwerkskammer (HWK) has supported Nakawa Vocational Training Institute in starting up a Solar Training laboratory (hub) and undertaking trainings for satellite vocational training institutes across the country. At least 500 solar technicians have been trained so far.

217. NAPE, 2016, Solar Energy Viability Study
218. MEMD, 2019. Renewable Energy Policy of Uganda
219. https://www.independent.co.ug/uganda-solar-sector-standards-review-underway/
220. https://www.unbs.go.ug/news-highlights.php?news=99&read

Centre for Research in Energy and Energy Conservations (CREEC) is an NGO affiliated to Makerere University, the organisation runs solar training programs including technical and testing courses to provide the industry with competent solar system designers and installers. To date they have trained over 600 solar technicians. It was also found that Makerere University offers a MSc. in RE. KIU also offers a post graduate program in Renewable and sustainable energy systems.

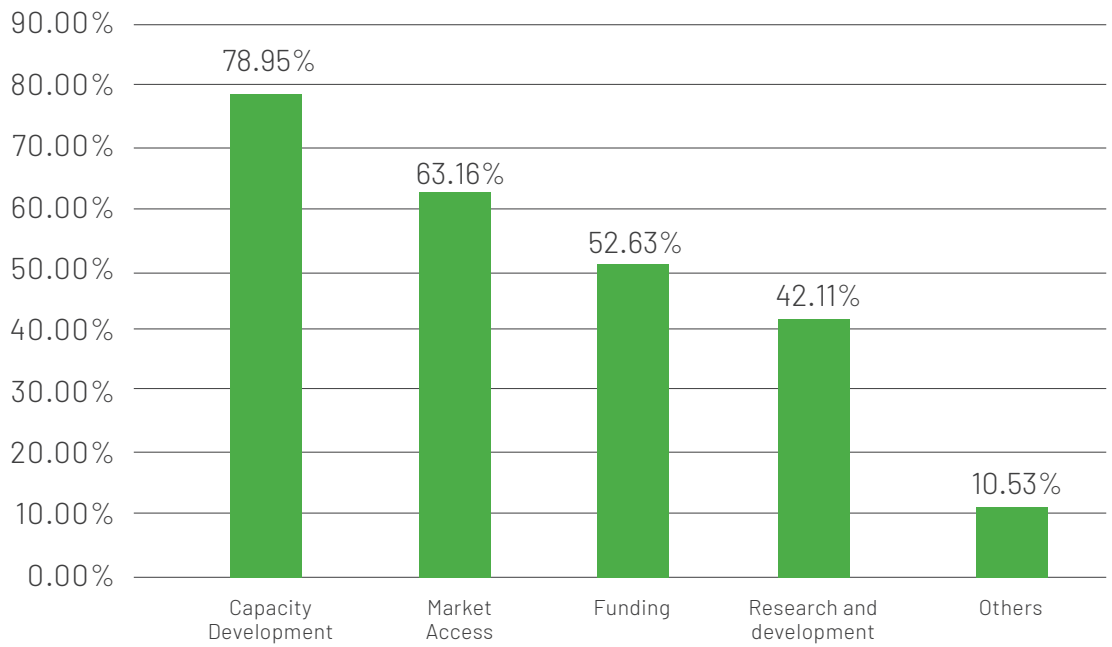
The survey revealed that 50% of the solar companies have participated in hands-on training programs organised by either USEA or UNREEEA. These training programs are supported by donors such as GIZ and DFID. A respondent highlighted that "Trainings are practical and participatory, and one immediately can make use of the acquired skills".

6.3.6 Institutional capacity

The Energy sector has got many stakeholders with each playing different roles to attain a conducive and enabling environment. The government supported by the private sector, development partners, civil society and NREAs aim at achieving affordable and reliable energy.

Uganda's off-grid sector has long had representation since 2015, Currently, there are two vibrant institutions, UNREEEA and USEA. UNREEEA is an umbrella body that brings together a network of six energy associations while USEA is dedicated to facilitating the growth and development of solar energy business in Uganda. Both represent interest of those in the sector. The institutions have grown but still struggle with financial and technical capacity to ably perform their mandates. Survey findings revealed that 95% of the respondents among the solar businesses are active NREA members with 78% joining for capacity development, 63% for market access, 52% for funding, 42% for research and development opportunities and 10% for other reasons. See figure below.

Figure 24 Services sought from NREAs



Source: Survey findings

221. https://www.getfit-uganda.org
222. https://www.psfuganda.org/projects/ert.html
223. UOMA, 2019. Uganda Off-grid energy market accelerator

Key concerns affecting institutional capacity were noted as; the lack of cohesion and resource sharing by the core stakeholders. The mechanisms for coordination amongst government agencies implementing off-grid strategy are weak and dialogue between government and the private sector is not adequate in deriving practical changes for the betterment of the sector.

There are no long-term cross-sectoral working groups within the energy sector in Uganda. Creation of such working group comprising the various institutional players will ensure that there is no duplication of duties by the stakeholders but rather join efforts by sharing information and strategically plan for sector growth. NREAs should be empowered by sufficiently funding them in order to build their teams and support their operations as well as sustainability models. ACE-TAF has undertaken a health check on USEA. Feedback has been shared with the Association. The report reveals that it will be a long time before NREAs can fund their own operations and thus be sustainable. Until then, a blend of sources including grant, subscriptions, advertising revenue among others will be needed.

6.4 POLICY REVIEW AND GAP ANALYSIS

The study unpacked the following relevant policy documents for review and analysis in respect to the Off-grid solar electrification in Uganda:

Table 18 Policies that Affect RE in Uganda.

No.	Policy	Period	Status
1.	Electricity Act	1999	Current
2.	National Energy Policy	2019 - 2029	Current
3.	Energy Policy	2002 - 2012	Expired
4.	The Renewable Energy Policy	2007 - 2017	Expired
5.	NDP II	2015/16 – 2019/2020	Expired
6.	NDP III	2020/21 – 2024/2025	Current
7.	Vision 2040	2020 - 2040	Current
8.	Rural Electrification Strategy and Plan	2013 - 2022	Current
9	Uganda Renewable Energy Feed-in Tariff – Phase 3	2016 - 2018	Expired
10.	Electricity Act	1999	Current
11.	Electricity Connection Policy	(2018 - 2027)	Current
12.	Public-Private Partnership Framework Policy	2010	Current
13	Uganda's SE4ALL Action Agenda	2015	Current

Source: Survey findings

6.4.1. Vision 2040 and the National Development Plan III (2020-2025)

Uganda's vision 2040 recognizes the need to develop and generate modern energy to drive the industry and services sectors to achieve Uganda's middle-income status. It is estimated that Uganda will require 41, 738 MW by 2040 thus increasing its electricity per capita consumption to 3,668 kWh. The required contribution of solar to the energy mix is estimated at solar (5000MW). Uganda's National Development Plan III emphasizes the need for reliable energy supply as critical for economic growth, poverty reduction, as well as the social and cultural transformation of society. The NDP III has set out to construct 200 off-grid mini-grids based on renewable energies and promote use of new energy solutions (solar water heating, solar drying, solar cookers, wind water pumping solutions, solar water pumping solutions) in the next five (5) years leading to 2025.

The vision 2040 and the NDP III are aligned to the Sustainable Development Goal 7 that obligates member states to ensure access to affordable, reliable, sustainable, and modern energy for all. Under Target 7.1, members are expected to ensure universal access to affordable, reliable and modern energy services, and to Uganda's SEA4LL action agenda to double the share of renewable energy.

6.4.2 Draft National Energy Policy, 2019

The draft national energy policy is the overarching energy policy in Uganda, the policy recognizes that Uganda has one of the lowest electrification rates in Africa. The policy emphasizes increased access to reliable, affordable and modern energy services through the following strategic interventions with a focus on renewable energy.

Promote and pilot the innovative development and scale up of off-grid renewable energy supply systems

Develop enabling regulatory frameworks to attract and sustain private sector participation, including community groups and financial institutions, in the provision of energy services

Develop and implement financial support mechanisms, including targeted subsidies, for both energy service providers and consumers

Promote the use of appropriate or low-cost energy supply technologies and products through appropriate fiscal, tariff-based and other incentives

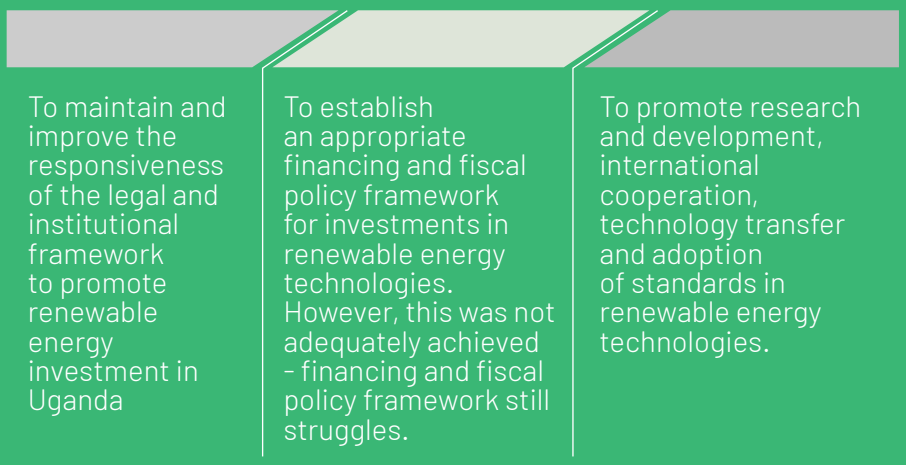
Promote productive use of energy for increased uptake and affordability of energy services in collaboration with other government agencies

224. https://energypedia.info/wiki/Pay-as-you-go_Approaches_(PAYGOO)
225. REA, MEMD (2013). RESP. Pg. 14
226. https://www.creec.or.ug/
227. MFPED (2015), Uganda's Vision 2040

The policy is emphatic in promoting mini-grids and stand-alone solar home systems through the following measures:

6.4.3 Renewable Energy Policy 2007 – 2017

The Renewable Energy Policy aimed at providing a framework to expand the contribution of renewable energy in the energy mix beyond large hydropower from 4% in 2007 to 61% by 2017. This is particularly aimed at positioning renewable as a substantial part of energy consumption. The vision contained in the policy at the point of formulation was:



6.4.4 Renewable Energy Feed-in Tariff Guidelines, 2012

The Uganda renewable energy feed-in tariff guidelines, 2012 aims at encouraging and supporting greater private sector participation in power generation from renewable energy technologies, the tariffs provide a fixed tariff based on the cost of production for a guaranteed period of time. The tariffs are determined as premium payments, which constitute a result-based incentive grant designed to enhance the financial viability of the selected projects. Premium Payments are structured as payments per kWh to chosen private developers, calculated based on the expected generation of eligible projects over the lifetime of the 20-year-long PPA.

In April 2014, a tariff for solar PV was re-introduced, according to the ERA, power from PV plants is not generated in sufficient quantities to allow the interconnection with the national grid. However, one long-term policy measure is to increase diversity and security in energy supply, as enshrined in Uganda Renewable Energy Feed-in Tariff Policy. This is intended to develop small RE projects including solar PV generation. In that regard, the board of ERA considered and approved a Feed –in Tariff (FiT) of US$ 11 Cents per kWh for grid connected solar PV energy.

6.4.5 Rural Electrification Strategic Plan 2013 – 2022

The RESP (2013/22) provides an opportunity by the government of Uganda to include off-grid solar as part of the remedies to achieve rural electrification and access to modern energies. This was noted as revising the RE Scheme to Accelerate Electricity Access.

Government aims at offering off-grid electricity services, comprising energy service technologies not dependent on the national grid shall be offered and furnished to eligible consumers in the service territories in tandem with on-grid electrification services, including solar PV installations and islanded community electrification projects. The policy aims at universal electrification and recognizing the practical limitations of extending formal electricity services including SHS to rural households that are beyond the economic reach of such service options, REA shall also undertake an aggressive program that will render low-cost mobile solar PV devices accessible to every rural Ugandan family within the next 20 years.

6.4.6 Solar Tax regime in Uganda

The tax regime for solar in Uganda is defined by:

- Corporate tax for SHS operators

228. NPA (2020), National Development Plan
229. MEMD (2015), SE4ALL, Uganda's Action Agenda
230. MEMD, (2019), Draft National Energy Policy
231. MEMD, (2007) RE Policy. Pg.16
232. ERA, (2016). Uganda Renewable Energy Feed-in Tariff (REFIT) Phase 3. Pg.3
233. https://www.get-invest.eu/market-information/uganda/governmental-framework/

- Value added tax (VAT)
- Import duty on solar components.

The tax scenario includes, tax exemption on solar generation components and VAT applied to both solar generation and transmission components. Some studies show that the tax regime is favourable for SHS, however, there is Lack of clarity on current tax policies and inconsistent application of tariffs across similar solar components. Solar generation components like panels & batteries are tax exempted when part of plug & play systems while in some cases. Batteries are not exempted especially when imported as stand-alone components. It is noteworthy that tax regulators are hesitant to offer exemptions to some stand-alone components as they are not fully certain of operator's intended use.

Tax treatment on some solar accessories is highlighted in the table below:

Table 19 Tax regimes for Solar components and products in Uganda

Component	Tax treatment	
	VAT	**WHT**
Solar PV module	exempt	6%
Solar control units	18%	6%
PC to AC inverters	18%	6%
Solar cables	18%	6%
Gel Batteries	exempt	6%
Solar meter	18%	6%
Solar refrigerators	exempt	6%

Source: BDO, 2020, Solar Tax Handbook for Uganda

6.5 POLICY GAP ANALYSIS

Table 20 Policy Gap analysis

Policy Status: Affordability

The Uganda Energy Policy 2019; section 4.4 (4) Stand-alone Off-grid systems

States a strategy to enhance affordability of standalone solar systems by providing appropriate incentives.

Uganda Renewable Energy Policy 2007; Section 3.5.2 (2), has a strategy to introduce specific regimes that favour renewable energy. These will include preferential tax treatment, tax exemption and accelerated depreciation. Adapt taxation of conventional energy and fuels in view of the impact on the market for renewables.

Existing Situation: Incentives on specific items (Exempted on Import tax). VAT on all components. VAT is usually not applicable on solar PV systems in Uganda if the equipment is imported as a complete package – e.g., in a container (otherwise VAT could apply on cabling and mounting equipment)

Policy gaps: Uncertainty around the tax regime and inconsistency around how taxes are applied. There is uncertainty with regards to the tax rates to be applied to specific components of solar home systems, components, and related appliances

Available technologies used for access PAYGO have been deemed expensive for the poor due to the high interest rates applied

Policy Status: Standards and Quality

Uganda Energy Policy 2019; section 4.4 (1) on Stand-alone Off-grid systems

The policy has a strategy to formulate and enforce quality standards for components, installation, maintenance and after-sales service of standalone energy technologies and to encourage the off-grid efficient products market by developing product quality standards for off-grid equipment

Uganda Renewable Energy Policy 2007; Section 3.5.5 (5)

The policy has a strategy to develop and adopt standards which govern the design, installation and performance of renewable energy systems and put in place certification processes, to verify that the systems meet these standards.

Existing Situation: The Government of Uganda through UNBS implemented a series of guidelines known as a Pre-Export Verification of Conformity to Standards Programme (PVoC). The PVoC verifies the conformity of all regulated products and enforces their standards. Compliance to PVoC requirements is applicable in addition to any existing import processes. Every consignment of regulated products exported to Uganda must have a Certificate of Conformity.

UNBS received a piece of electrical testing laboratory equipment that conducts test on solar Photovoltaic (PV) equipment (particularly battery testing equipment for battery sizes below 100 Ah) at 24th May 2019.

Existing partnerships have been developed with UNBS, USEA, UNCDF, and DFID and are developing

a quality assurance framework for the solar sector, awareness campaigns and solar technician training conducted both in West Nile and the Eastern region and a capacity building training for both UNBS and URA market surveillance team.
In addition, UNBS reviewed and adopted the IEC Quality Standards in 2020, and they were gazetted in January 2021.

Policy gaps: There is a lack of adequate standards and mechanisms to monitor and ensure quality of RETs. For instance, there are different solar technologies on the market and the general public is not aware of their effectiveness. There is no implementation mechanism or communication strategy to effect the guidelines and regulations. The existing standards need to further be aligned to international frameworks, such as the IEC standards.

Policy status: Innovation and Technology
Uganda Renewable Energy Policy 2007; Section 3.5.5 (3)(In review and poised to be replaced by another Energy Policy drafted in 2019.
The policy has an objective to promote research and development, international cooperation, technology transfer and adoption of standards in renewable energy technologies and a strategy to set up a Research and Development Division under the Renewable Energy Department to liaise with other institutions on R and D in RETs.

Existing situation: Technologies have majorly been seen in consumer financing.
Innovations on payment terms, credit processes, and enabling technology is on the increase with PAYGO being the main business model used in Uganda among businesses.
However, there is no known initiative or program that aims at promoting local innovation in the Off-grid solar sector.

Policy gaps: No apparent budget is provided to institutions of higher learning to specifically conduct R&D. No systems have been put in place either for international cooperation in R&D to easily accelerate technology transfer
There is no research and innovation facilities established

Policy Status: Skills Development
Uganda Renewable Energy Policy 2007; Section 3.4 (i)
The policy has an objective to develop and implement a comprehensive capacity building programme for the Renewable Energy Sub-sector

Existing Situation: Local SHS companies often lack skills to execute key technical & operational tasks
Technical assistance programs & accelerators are unable to offer the long-term support needed to develop this expertise

Policy gaps: There is no skilling policy or strategy to build the Off-grid solar sector workforce. The market for RETs and after sale delivery services is underdeveloped especially in solar technologies.

Policy status: Institutional Capacity

Uganda Renewable Energy Policy 2007; Section 3.4

The Policy has an objective to put in place legal and institutional frameworks to support new renewable energy investments.

Existing situation; The lead institution responsible for Renewable Energy is the Ministry of Energy and Mineral Development, the policy recognizes private sector bodies, and particularly sub groups on energy, as critical in engaging Government in developing an enabling environment and market growth for the solar industry.

No mechanism for coordination amongst government agencies implementing off-grid strategy, or for dialogue between government and the private sector (Steering Committee). There are no forums for sharing information, getting feedback, and working together on the design, implementation and monitoring of policies and programmes is hampering the development of an enabling environment for growth. The Uganda National Renewable Energy and Energy Efficiency Association (UNREEEA) and Uganda Solar Energy Association (USEA) are recognized as key stakeholders in the Renewable Energy space in Uganda.

Policy gaps; The existing framework has limited consideration for off-grid solar in regard to a dedicated department or unit to enable focus and achievement of the vision 2040 objectives. The budget allocation for Off-grid is minimal, the funds allocated are for large hydro power production, and the solar sector is largely funded through development support. Isimba (183 MW), Karuma (600 MW), Muzizi (44 MW) are some examples of large hydropower projects developed under the policy. Whereas UNREEEA and USEA are recognized by GoU, there is no clear institutional mandate in working with Government and other stakeholders in the RE space.

Policy status: Finance and Investment

Uganda Renewable Energy Policy 2007; Section 3.4 (ii)

The Policy has an objective to establish an appropriate financing and fiscal policy framework for RET investments and a strategy to introduce fiscal measures that favour renewable energy investments with strategies to Implement, through public-private partnerships (PPP), innovative financing mechanisms, including targeted subsidies and to enhance social service provision through grant financing of renewable energy projects.

A strategy to develop financing schemes adapted to local needs and traditions, such as revolving funds, to enable market development for small, appropriate renewable energy technologies for rural development, such as household solar PV systems.

Uganda Energy Policy 2019; section 4.4 (5) Stand-alone Off-grid systems

The policy has a strategy to formulate comprehensive and innovative financing mechanisms to extend credit to unserved customers and SMEs.

Existing situation; Public - Private Partnerships. There are several projects underway to support both on grid and off-grid solar (Tables of projects in report)
Private partners are licensed and also acquiring SHS and Solar PVs. Solar home systems distribution is mostly driven by the private sector offering credit, with majority of sales coming from PAYGO operators. Government Participation: MEMD set up the Uganda Energy Credit Capitalisation Company Limited (UECCC) to focus on off-grid energy production through facilitation of Pico hydropower dams, Financing of off-grid productive and consumptive PV solar companies in Uganda, and supporting business development services to businesses engaged in the aforementioned areas. The company also offers tools to attract investments for the private sector, including partial risk guarantees during the early phase of projects and credit enhancement instruments directed at reducing the risks faced by commercial lenders and other financial institutions .

Policy gaps; Financing mechanisms to support investments in renewable energy projects and to address the affordability of consumers are either inappropriate or inadequate.

RECOMMENDATIONS

Affordability

The Government of Uganda should clarify all tax rates, including any planned future tax changes when they are being considered, and to ensure these taxes are consistently applied through providing training and support to the Uganda Revenue Authority, Uganda National Bureau of Standards and other relevant government officials.

Zero rating of Off-grid Solar products for VAT to make off-grid solar affordable and available to off-grid clients, Government should consider Zero-rating solar products in regard to VAT. This will in turn reduce the purchase price for the end users, making the systems affordable to the target clients. The multiplier effect of this action will touch on the key issues of affordability and accessibility of off-grid solar products.

Finance and Investments

Companies involved in promoting off-grid solar product consumption have found a lot of difficulty in accessing appropriate finance for their operations at all stages of their growth and development. Financial incentives along with appropriately structured financing are needed to enable companies to serve underserved geographical areas, as well as bottom-of-pyramid customers. These will support the Solar Companies to meet their working capital needs. It is ideal for them to have financing afforded to them to reduce foreign exchange risk. This is recommended because foreign Impact Investment financers tend to offer foreign denominated financing. On the other hand, local financiers generally provide inappropriately structured financing to businesses in the sector because they don't fully understand it. UOMA has done some good work in sensitizing the local financial institutions on energy projects and financing requirements (2017 - 2020). This should progress alongside development and rolling out of new financing instruments including local debt financing and blended finance options among others.

It is recommended that financial institutions offering credit to off-grid Solar companies are empowered to do more of this with the right incentives and blended financial instruments to de-risk financing businesses in the sector.

More catalytic financing is needed to be availed to off-grid solar businesses in tandem with more information being availed to concerned businesses of the availability of catalytic and conventional financing available under the mandate of the Uganda Energy Credit Capitalisation Company Limited. There seems to be information asymmetry between providers of appropriate financing and those who need it. Uganda Development Bank Ltd is also considering financing for energy SMEs. There is need to balance financing brackets among financing institutions to manage competition and enhance collaboration for the advancement of the OGS sector to take the great opportunity the solar market presents for them

Lobbying for more development finance to be invested in enabling off-grid solar market in Uganda. There is a growing global focus on investment in renewable clean energies. As such more development financiers are dedicated to the RE sector. This needs to be stimulated and leveraged for the benefit of the local RE sector. International agencies like the KfW, DFID, USAID, SIDA and others may be targeted to support local financial institutions in a more intentional manner to invest and strengthen the off-grid solar sector.

234. REA, MEMD (2013). RESP Pg. 12
235. REA, MEMD, (2013) RESP Pg. 12
236. UMOA, 2019, Uganda Off-grid energy market accelerator
237. MEMD, (2019), National Energy PolicyMEMD (2007). RE Policy
238. MEMD (2007). RE Policy
239. MEMD, (2019), National Energy Policy
240. MEMD (2007). RE Policy

Institutional Capacity

Government should consider establishing an off-grid solar strategy steering committee to ensure effective coordination and collaboration across government, development partners and private sector or to facilitate robust partnership between the government and private sector concerning the development of the solar sector. This will ensure that policies and strategies can effectively be implemented and thus by 2030 ensure more access to affordable, reliable, and modern energy services

Innovation and Technology

Government needs to locally encourage investment in off-grid solar technologies by providing seed capital for innovative companies involved in the solar industry, as well as support for young solar companies in terms of capacity building and development. It is noteworthy that many of the companies involved in the solar industry are young and in need of such support to meaningfully scale their operations. Across all the EA countries, innovation and technology refers to PAYGO which is now a decade old. It makes sense to create a fund for innovation to enable entrepreneurs to transition their ideas into functional products and services hence the new innovations.

Standards and Quality

Government has aligned its regulations to the IEC Quality Standards, emphasis now should be on enforcement and sensitization of stakeholders.

Skills Development

GoU needs to strengthen skills development policy on OGS including collaborations with tertiary institutions to establish long and short courses in solar technologies. PSFU has been running a Skilling Uganda project which helped build skills across a wide range of sectors. USEA has benefitted from this through training of solar technicians in 2018/19. The policy should emphasize licencing and accreditation of solar technicians. This will support in the scale up of OGS electrification market in Uganda and thus enhance achieving national energy targets.

241. https://www.unbs.go.ug/news-highlights.php?news=99&read
242. MEMD (2007). RE Policy
243. MEMD (2007). RE Policy
244. MEMD (2007). RE Policy
245. MEMD, (2019), National Energy Policy
246. http://www.ueccc.or.ug/index.php/latest-news

7.0 CONCLUSION

This study largely centred on policies which affect RE, with particular focus on OGS. The policy gap analysis revealed policy asymmetry across EA countries. Whereas some countries like Kenya, Uganda, Rwanda and Tanzania have seemingly established appropriate policies, strategies and regulations to govern the OGS sector, Burundi's RE policy environment is still in its formative stages.
In-light of the policy gap analysis and specific country recommendations, an industry position paper has been separately developed under the common themes including quality standards, affordability, institutional capacity, finance and investment, innovation and technology and skills development. Countries like Kenya, Rwanda and Uganda have shown progress in the OGS sector on the thematic areas of quality and standards, finance and investment and affordability. There is need for all EAC countries through their NREA's and other advocacy platforms to engage their governments both regionally and nationally with regard to strengthening the OGS market.

In the short run, it would be imperative for the NREA's and regional energy stakeholders to focus on addressing the uneven tax regime, strengthen enforcement of regulations and stimulating the private sector investment in order to trigger growth of the OGS sector. The industry position paper provides a short and medium to long term goals that need to be addressed at a regional and country level. Further to this, an advocacy plan has been developed to support the NREA's in their advocacy agenda on strengthening the OGS electrification market.

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