Renewable Energy Market Landscape Study

covering 15 countries in Southern and East Africa

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Volume I I

Country Profiles
Stakeholder Maps

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Country Profiles

Renewable Energy Market Landscape Study

Country profile – Botswana

1. Overview

Indicator	Data
Population	2.62 million (2015)
Population density	3.2 persons/km^2 [i]
Global Tracking Framework Indicators [ii]	
Access to electricity	56.48% (70.68% urban, 37.52% rural)
Access to improved cooking	62.52%
RE as proportion of the mix	29.17% (of which 29.16% is traditional biomass)
Other Indicators	
Reliance on energy imports (2014) (IEA)	43% of total final energy supply (48% of total final electricity consumption)
Centralised or liberalised electricity sector	Centralised
Bundled generation, transmission and distribution?	Yes
Existence of renewable energy IPPs	Yes
Import duties on renewable energy products	Yes (although machinery for manufacturing is duty free)
RAGA/ AA/ IP	RAGA – Not publicly available
Renewable energy strategy	Not publicly available
Number of EEP Phase I & II projects	10
Total EEP contribution (% of total budget)	39%
Average daily solar irradiance [iii]	6,640 Wh/m^2/day
Electricity subsidies	Yes
Fuel subsidies	Kerosene partly subsidised [iv]

Botswana has an extensive coal deposits estimated to provide approximately 212 billion tonnes (7.1 million tonnes of measured reserves), up to 630,000 tonnes of which are used annually to produce electricity.[v] Woody biomass makes up 38% of total final energy consumption, of which rural households consume an estimated 25.7%.[vi] The electricity imports to Botswana from the South African Power Pool have reduced significantly (by 63%) between 2008 and 2011. However, load shedding reportedly continues to be necessary. The expansion of the capacity of the coal fired power station at Morupule B to meet overall current demand (capacity of 732 MW) was intended to resolve power shortages but since its commissioning in 2012 technical difficulties have interrupted supply, and it was subsequently put up for sale. The Botswana Power Corporation (BPC) declared a loss of US$ 180 million for 2015-16.[vii] Morupule A was to be refurbished but this has been delayed. Current generation capacity is 415 MW, including two diesel back-up power plants. BPC has now launched a bid for 100 MW concentrated solar power plant to attempt to make up the power deficit.

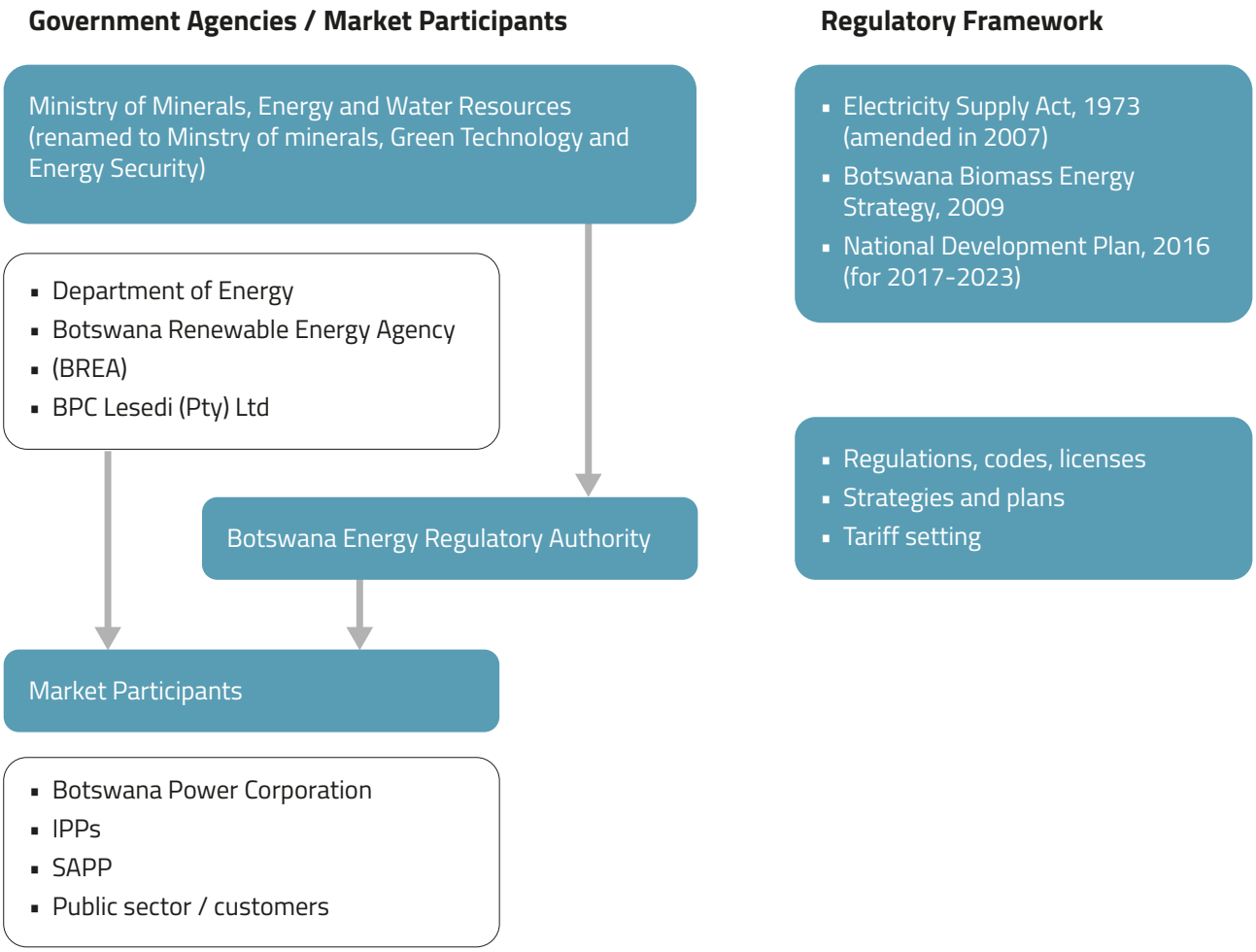
The Rural Electrification Scheme increased rural connections dramatically from 4% in 1996 to 57% in 2011. The government has now introduced a standard cost for connection to increase the affordability of establishing a grid connection for poorer households.[viii]

2. Institutional framework

Institutional structure

The Ministry of Minerals, Energy and Water Resources (MMEWR) (being renamed to Ministry of Minerals, Green Technology and Energy Security (MMGE)) is responsible for providing the strategic direction for the energy sector in Botswana. The Department of Energy has the mandate for establishing the policy, legal and regulatory framework for the supply and demand-side management of energy in the country. The Botswana Energy Regulatory Authority (BERA) is an independent body that is mandated to oversee the economic sustainability of energy supply, setting tariff regulations and overseeing efficiency of supply. However, the government also provides guidance on their objectives in terms of energy provision and subsidy levels. The intention is to establish a Botswana Renewable Energy Agency (BREA) that can promote and coordinate the uptake of renewable energy in the country.

Figure 1: Institutional structure for the energy sector in Botswana



The Botswana Power Corporation (BPC) is responsible for the generation, transmission and distribution of electricity across a national grid that is focused on the east of the country, reflecting partially the density of the pop-

ulation across the country. BPC Lesedi (Pty) Ltd was established in 2008 to develop renewable energy generation and specifically renewable rural electrification. It is not clear how the mandate differs from BREA. The Ministry of Environment, Wildlife and Tourism (MEWT) focuses on climate change issues and has recently published Nationally Appropriate Mitigation Actions (NAMA) (2016).

Policy framework

The National Development Plan (NDP) 10 places an emphasis on self-sufficiency rather than the least-cost solution. The National Energy Policy (2015) takes this ambition further by aiming to become a net exporter of energy. However, based on recent challenges in expanding the generation capacity of Morupule B, this may take some time to realise. The intention of the NDP is to establish a cost-reflective tariff, and steps are being taken to achieve this. There is no indication that unbundling the transmission and distribution of energy is likely. The NDP 11 (2017-2023) promotes specific renewable technologies, such as solar water heating, concentrated solar power and biofuels.

The Department of Energy is currently working on developing both a renewable energy and an energy efficiency strategy. The Renewable Energy Roadmap (2014) outlines the intention to establish an IPP (Independent Power Producer) framework and Renewable Energy Feed-in Tariffs (REFITs) by 2015. The NAMA (2016) defines renewable energy as fundamental to delivering on reducing GHG emissions by 15% by 2030. The introduction of REFITs is outlined as a fundamental policy measure.

Other key policies include:

- The Electricity Supply Act (1973, amended in 2007)
- The Botswana Energy Master Plan (revised in 2004)
- The Botswana Biomass Strategy (2009)

The National Energy Efficiency Strategy for Botswana (draft) targets a 25% decrease in total final energy consumption in 2023 relative to 2017. This is to be achieved through a cross-section of measures, including the reduction of fuel wood for cooking and the increased use of solar water heaters. The measures outlined are broad-based and cover all sectors of the economy. The strategy has not yet been adopted by Cabinet as yet.

3. Technology review

Renewable Energy

The proliferation of renewable technologies is extremely low in Botswana. This is perhaps due to the abundance of coal reserves, amounting to 66% of the resources in Africa. The Mmamabula IPP project is estimated to provide 1,200 MW of generation capacity, although it is based on coal. The up-scaling of Morupule power station was seen as a significant threat to the motivation of the government to increase renewable energy in the mix however due to its failure, the government is now taking action, launching procurement for coal bed methane power projects, a large-scale solar farm and requesting expressions of interest for hybrid rural networks in 20 isolated villages (26th May 2017).

Hydro

The potential for hydropower is considered to be limited in the country. There are shortages of water and therefore there is not considered to be any scope for hydro projects.

Solar

The potential for solar technology is significant in Botswana. There are approximately 3,200 hours of sunshine per year. However, this potential is relatively poorly exploited. A 1.3 MW solar PV pilot project was funded by JICA and

Shumba Coal plans to develop a 100 MW Solar PV station with a potential for 200 MW. The government has invited bids for over 100 MW solar installations however without standard Power Purchase Agreement (PPAs), there may be some reservations about embarking on these IPP projects. The government has performed pre-feasibility studies for Concentrated Solar Power (CSP) and recently awarded a contract to a consortium including BPC and a Spanish Renewable Energy Centre (CENER).

There are stand-alone systems being used that have been purchased privately, particularly in the hospitality industry but issues of battery maintenance and panel degradation have resulted in systems not lasting as long as anticipated. The EEP supported two initiatives to bring light to rural off-grid communities and a project for 1 MW village concept. The same developer is proposing to install a 200 MW solar PV plant.

The Rural Photovoltaic Electrification Project (Re-Botswana) was completed in 2014 by UNDP. The programme had six components: delivery of technology packages, policy support and policy framework, awareness raising and changing of perceptions, private and public sector strengthening and training, financial engineering, and learning and replication. The programme was incredibly complex and the impact of it limited due to the capacity within government, as well as of the private sector. The technologies used were solar PV combined with LPG.

The potential for solar water heaters is estimated to yield savings of 40 MW of which 20 MW has reportedly been saved to date.[ix]

Biomass, stoves and biogas

LPG is used widely for cooking in Botswana, with approximately 70% of households using LPG in urban areas. However, it is more expensive than wood and therefore inaccessible for the bottom-of-the-pyramid. Fuel wood is used by 53% of rural households and despite previous efforts to encourage the use of improved cook stoves, the uptake has been very low (BEST, 2009). The Programme for Biomass Energy and Conservation (ProBEC) was established in 2007 and later superseded by BPC Lesedi, whose mandate it is to promote energy efficiency cook stoves. The intention is to produce them for export. Production however is very low and has not reached viable levels as yet, and the penetration of household use of energy efficient cook stoves is much lower than anticipated.

Jatropha farming appears strongly as a technology in the Renewable Energy Roadmap (2014). However, the use of this technology has been met with very limited success across the continent and is a controversial plant to grow, unless intercropped with food crops. The research programme outlined will presumably highlight these challenges.

Biogas from manure is considered to be a potential source however the installation of digesters per household is costly and therefore uptake is likely to be limited among poor households. However, three landfill gas projects are outlined in the Biomass Strategy (2009).[x] In addition, coal depots and biodiesel from energy crops are also suggested.

Wind

The relatively low wind speeds (2-3.5 m/s) in Botswana do not lend themselves to viable project development. Large-scale potential is lacking.[xi]

4. Stakeholder review

The renewable energy and energy efficiency sector in Botswana is in its infancy. There are few stakeholders in the sector that are active and engaged. The Botswana Confederation of Commerce, Industry and Manpower (BOCCIM) is a key partner for the government as it is the only umbrella body representing the private sector that is engaged in the sector and is vocal. It is therefore stretched to provide input in various fora across sectors. The mining industry in Botswana is particularly energy intensive and some mines are introducing energy savings measures and replacing

water heaters with solar equipment. The Rural Industries Promotions Company (Botswana) (RIPCO-B) implemented the National PV Rural Electrification Programme through its operational arm, the Rural Industries Innovation Centre (RIIC) in the 1990s.

Under the Clean Development Mechanism (CDM), a number of projects were supported in Botswana based on biogas, coal based methane for power generation, landfill gas, and a project was developed for a 120 MW solar farm. There are interested IPPs in Botswana, particularly with the increasing electricity tariffs.

The World Bank, AfDB, EU, DANIDA, JICA, SIDA, UNDP/GEF and the Development Bank for Southern Africa have all been engaged in supporting renewable energy and energy efficiency in Botswana at various stages. The most significant programmes are those of the World Bank and UNDP/GEF. Very little information is available on available financing. The South Africa-based banks provide funding for small-scale systems, although proof of income and/ or collateral is required.

5. Market review

The Botswana market for renewable energy is not particularly dynamic. The most significant threat to the market is the emphasis on coal fired production, particularly as it is locally available. Due to the scale of the electricity generation deficit, the current focus is on large-scale IPPs. Many of the policy commitments and reforms have not yet resulted in implementation, although the government appears to be committed towards building the market due to the challenges being faced with the coal-fired generation. The framework for IPPs has been developed and the Renewable Energy Feed-in Tariff (REFIT) has been introduced. The government has also taken positive steps towards increasing the national tariffs to be cost-reflective.

The REFIT was introduced in 2010 and up to 2014, 43.5 MW were expected to be installed based on biomass (12 MW), biogas (8.5 MW), landfill gas (3 MW), solar PV 5 kW to 25 kW (2 MW) and solar PV 25 kW to 1 MW (18 MW).

The main potential exists for solar and biomass/ biogas projects, although models for how these technologies can provide off-grid have only been tested to a very limited extent. Cook stoves have been rolled out but commercially viable manufacturing has not been established.

There are a limited number of private sector installers of solar PV technologies and the landed cost of the technology is a deterrent. As in other countries, the impact of renewable energy on the existing grid infrastructure is considered to be challenging to manage for the utility. The cost of investing in renewable energy is also considered to be significant in a resource constrained setting. Therefore, the least-cost scenario often is prioritised.

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Lack of reliable data and research reduces the ability of investors to assess potential	▪ There is a complete dearth of information regarding the off-grid energy market potential in Botswana. ▪ National statistics are dated and contradictory in terms of energy needs and uses in poor households.	▪ In-depth studies on energy consumption patterns and energy needs would inform private sector interventions.
Government emphasis is on non-renewable energy sources	▪ In general, the renewable energy framework is currently weak although the renewable energy strategy is being developed. ▪ The REFIT only covers installations of under 5 MW. ▪ There is no standard PPA framework in place. ▪ The recognition of coal as a local resource is important as the exploitation of coal reduces the needs for imports and provides jobs locally.	▪ When the renewable energy strategy has been launched, identify opportunities for the private sector to support in the delivery of government objectives. ▪ Donors to support the government in developing the framework to accommodate an increasing proportion of renewable energy sources in the energy mix.
Capacity of key sectoral stakeholders is weak	▪ Local technical capacity and awareness within the private sector is limited ▪ Relevant government departments also have limited awareness of renewable energy and energy efficiency.	▪ Link key stakeholders into regional programmes and institutions to develop capacity, particularly SACREEE.
The local manufacturing capacity for renewable energy is lacking	▪ As a land-locked country, there is a dependence on product imports. ▪ Local manufacturing of solar water heaters and solar PV has not been established.	▪ Developing local manufacturing (at least assembly) presents a productive opportunity to reduce costs and increase job prospects locally.
The supply chain has not been well developed for renewable energy products	▪ There are few installers, designers and maintainers of renewable energy installations. ▪ The cost of importation of products is high, affecting the business case for its implementation. ▪ Off-grid energy access has not been addressed in a significant way therefore there is a lack of lessons to learn.	▪ As tariff prices increase and the challenges of reliable supply continue, the case for renewable energy will improve. ▪ It will be necessary to support innovative projects in Botswana to test various models of implementation. ▪ The business case of off-grid energy access may never be strong on the basis of the spread out nature of the population and the numbers involved.
Lack of leaders in the sector to further capacity and awareness building	▪ Identifying champions in the sector is challenging in Botswana. ▪ The absence of strong associations to represent the private sector is obvious.	▪ Develop local stakeholder capacity in renewable energy. ▪ Raise market awareness through large-scale campaigns.
Lack of financing available in the market	▪ The financing of renewable energy is limited. ▪ There is no current evidence of programmes that underpin credit support to broaden the uptake of renewable energy products.	▪ Providing support through financial institutions to on-lend to SMEs that are delivery renewable energy access could be considered.
Stove production has not reached commercial scale	▪ The production of energy efficient cook stoves has not reached a commercial scale. Even though LPG is more popular in Botswana, the use of fuel wood is still common (53% of rural households) and therefore this presents an opportunity. ▪ Extensive marketing of cook stoves is required.	▪ Developing local manufacturing capacity is positive for the economy overall and therefore consideration could be given to this effort.

7. Implications for the Theory of Change

In the case of Botswana, the theory of change is weak, primarily because the stage at which the energy sector is and the availability of coal as a resource. The business case for developing off-grid energy solutions for the rural poor has not been tested or proven to date. Bankable projects are limited and primarily focus on larger scale on-grid solutions. The REFIT framework is only applicable to small scale IPPs of under 5MW. The solar PV market is limited and standards have yet to be applied to ensure that quality technologies are being sold.

In order to better understand what exactly is required to meet local needs in Botswana, it may be necessary to undertake a more in-depth study of market drivers and barriers. Mapping the market value chain, identifying the gaps, and agreeing with development partners how these gaps can be addressed will be necessary to stimulate the market without distorting it.

The recent call for expressions of interest for public-private partnerships to fill this gap in 20 rural villages will provide useful evidence of the models that could viably be adopted for sustainable energy access in isolated rural settings.

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[i] *Botswana: Statistics Botswana, 2011*

[ii] *http://gtf.esmap.org/*

[iii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System – Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iv] *Botswana: Rapid Assessment and Gap Analysis, 2015*

[v] *http://unctad.org/*

[vi] *ibid*

[vii] *http://www.reuters.com/article/us-botswana-power-idUSKBN1300EQ*

[viii] *Botswana: Rapid Assessment and Gap Analysis, 2015*

[ix] *ibid*

[x] *http://s3.amazonaws.com/zanran_storage/www.euei-pdf.org/ContentPages/2489500910.pdf*

[xi] *https://www.africa-eu-renewables.org/market-information/botswana/renewable-energy-potential/*

Country profile – Burundi

1. Overview

Indicator	Data
Population	10.8 million (2014)
Population density	350 persons/km2 (2015)
Global Tracking Framework Indicators [i]	
Access to electricity	7% (52.1% urban and 2% rural)
Access to improved cooking	2.11%
RE as proportion of the mix	90.05% (87.66% traditional solid biomass, 0.99% modern biomass, 1.40% hydro)
Other Indicators	
Reliance on energy imports (2014) (IEA)	58% of total final electricity supply
Centralised or liberalised electricity sector	Generation liberalised since 2015 but other segments centralised
Bundled generation, transmission and distribution?	Whole system bundled
Existence of renewable energy IPPs	Yes
Import duties on renewable energy products	0% duties only (VAT and other tariffs applied)
RAGA/ AA/ IP	RAGA
Renewable energy strategy	No
Number of EEP Phase I & II projects	10
Total EEP contribution (% of total budget)	€3.7m (5.9%)
Average daily solar irradiance [ii]	5,240 Wh/m2/day
Electricity subsidies	Yes [iii]
Fuel subsidies	Fuel subsidies eliminated in 2013 [iv]

Burundi's total energy consumption is divided between 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 seen as economically viable. To date, the installed capacity is 68.9 MW from which 24% is imported from Ruzizi I&II. A further 147 MW is to be tapped from Ruzizi III, a regional Public-Private Partnership (PPP), benefitting Rwanda, Burundi and DRC, funded by the AfDB and the EU-Africa Infrastructure Trust Fund.[v]

Electricity from hydropower accounts for over 75% of all electricity produced on-grid. Other renewable energy resources play an insignificant role – though there is significant potential for solar, biomass, etc. Wood is consumed mainly for cooking in rural areas and even remains prominent in urban areas. For cooking, the main sources are wood, charcoal and peat.

2. Institutional framework

Burundi has just begun (since early 2015) to implement elements of supportive policy frameworks to spur renewable energy development. It has adopted legislation and assigned responsible institutions to achieve various targets. Thus, the Ministries of Energy, Finance and Environment are the key in managing and implementing renewable energy and energy efficiency policies through their various departments and agencies. Since the introduction of a new law of electricity re-organization (Law No 1/13 of 23rd April 2015) and a PPP law (Law No 1/14 of 27th April 2015) were enacted, the electricity sector is open to private investment through IPPs, with the following government and financial institutions supporting the sector:

Table 1: The key institutions in the sector and their roles

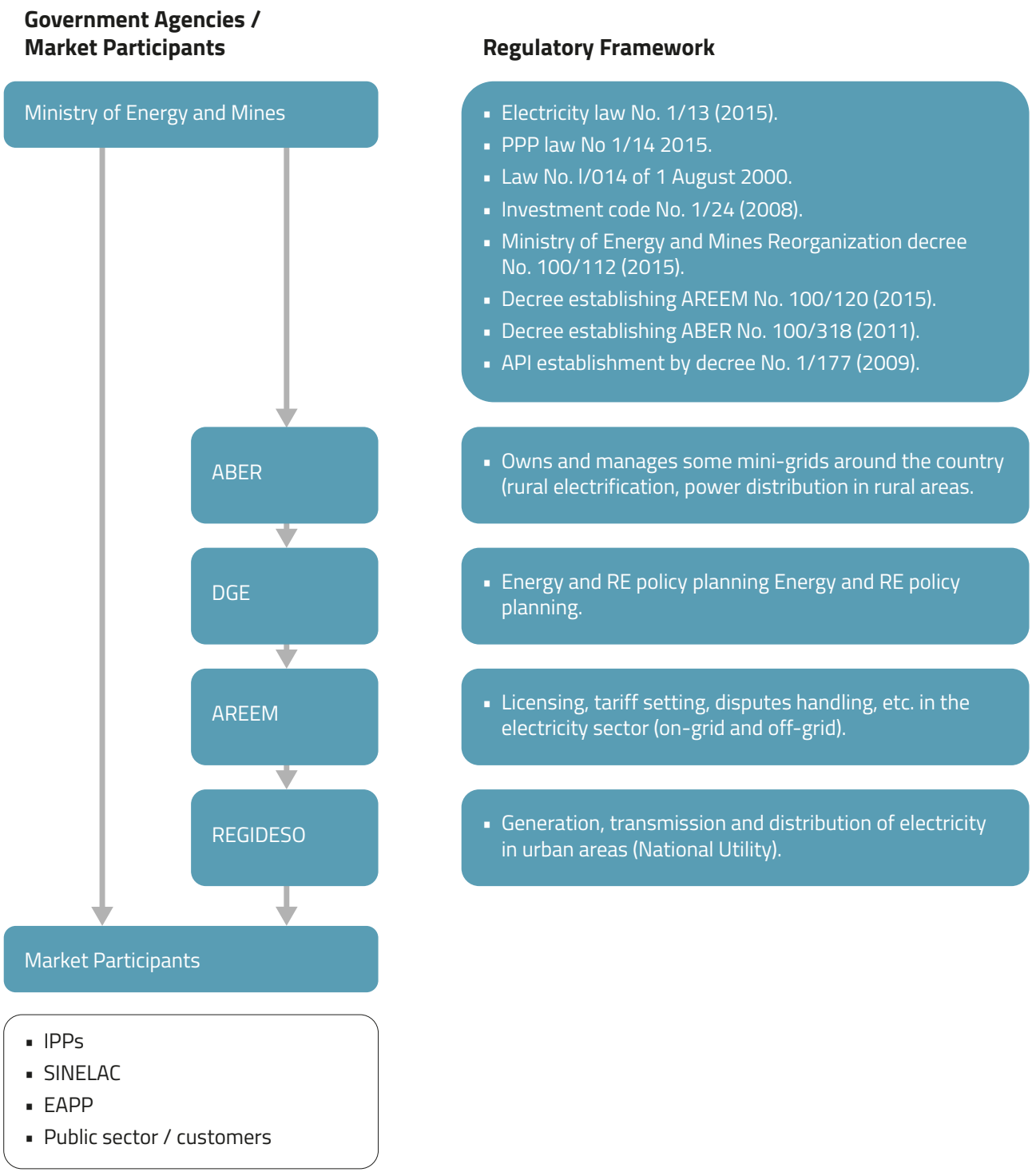
Institution	Role
Ministry of Energy and Mines	Strategy to support sustainable development through the provision of electricity.
Agency of Regulation of Water, Electricity and Mines (AREEM)	Licensing, tariff setting, disputes handling, etc. in the electricity sector (on-grid and off-grid).
National Utility (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.
National Peat Office (ONATOUR)	Produces peat and sells mainly to community services, such as prisons, barracks, schools and hospitals.
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.
Burundi Central Bank (BRB)	Issues a comfort letter to Independent Power Producer.

Since the legal framework is new and not yet fully implemented, the mandate of these institutions may be subject to changes and updates. In addition there are ongoing structural reforms under the auspices of the World Bank whereby the legal and regulatory framework has to be re-established in order to comply with regional and international best practices – e.g., structural reforms of the power utility, grid code establishment, support to the regulator, etc.

The Cadre Stratégique de Croissance et de Lutte contre la Pauvreté (CSLP) (2007) guides national development priorities. The Decentralised Rural Electrification (DRE) Strategy (2015-17) was developed with the support of UNICEF and aims to understand the challenges for rural electrification, focusing on three areas:

- Situation analysis, evidence generation, and policy advocacy
- Building of partnerships with key actors for rapid, effective, and sustainable implementation of proven solutions at scale
- Development and implementation of off-grid energy projects at the household, community, and social infrastructure level.[vi]

Figure 1: Institutional structure for the energy sector in Burundi



The strategie sectorielle pour le secteur de l'énergie au Burundi (2011) is based on the development plan Vision Burundi 2025 and the National Poverty Reduction Strategy Paper. The strategy does not contain specific targets but includes several recommendations especially on improved governance of the sector. It also lists planned initiatives and development directions for different sectors and technologies: hydropower, grid extension, wind, solar, petroleum exploration, biogas, energy efficiency, thermal power plants, etc. Private sector investors are specifically mentioned

in the strategy as key to initiating the energy transition, including as IPPs, but the strategy does not include specific regulation or policies as such.

The focus of the current energy policy is on rehabilitation of existing (hydropower) plants and distribution grids as well as the development of new hydroelectric sites. Furthermore, a rural electrification program is planned mainly by grid extension and by providing information on alternative energy sources affordable for low-income households.[vii] For solar systems, priority is given to the electrification of social infrastructure structure (schools, hospitals, health centres, pumping stations, local administration offices) in remote, off-grid areas. For wind energy the strategy is the electrification of social infrastructure in off-grid and remote areas.[viii]

There are no supportive legal tools and comprehensive plans related to Feed-in Tariffs, energy efficiency and renewable energy, despite the existence of institutions that have the mandate to implement the legal framework in these areas.

The following policies are in the process of being drafted:

- National Master Plan for generation, transmission and distribution.
- Grid code.

3. Technology review

Electricity supply on-grid is done by the national utility (for water and electricity) and is bundled. Due to the introduction of the new electricity law, IPPs are now possible and two are in the pipeline for hydropower and for solar PV. Burundi has a vast renewable energy potential that has been marginally exploited to date.[ix]

Hydropower

In Burundi, the predominant source of electricity is hydropower (over 75%). It has the lowest cost of generation of all electricity sources due to the abundant water resources (around 1700 MW potential capacity) and donors and/or investors mainly cover the investment cost.

Some hydropower IPPs are in the development phase thanks to the new electricity law which gives access to power generation for private investors in the framework of PPPs or concessions. Two hydropower IPPs have finalised Power Purchase Agreement (PPA) negotiations and are expected to receive final approval for their projects by mid-2017.

Solar Energy

Despite a huge potential for solar technology in Burundi, which would improve the energy access rate and rate of electrification, solar technologies are not widespread across the country. The average annual power received is around 2,000 kWh / m²/year.[x] On the larger scale, Gigawatt Global has signed a 25-year PPA with REGIDESO for a 7.5 MW solar plant that broke ground in January 2017.

With funding from GIZ, Endev Burundi focuses on providing access to electricity through market introduction of solar PV systems for households, SMEs and social institutions. The country project funds PV systems to electrify social infrastructure (schools, health posts, city halls and street light), and promotes pico-PV and solar home systems through road shows (promotion of solar multi service stations).

Some solar home systems, community kits, few public solar lighting systems and pico-systems are scattered in the country, but there are no statistics available (the energy balance for the whole system does not exist in Burundi).

However, it remains obvious that solar PV solutions (grid-connected photovoltaic plants, and hybrid off-grid plants, stand-alone photovoltaic generators, solar pumps, solar home systems) are considered to be one solution for the energy crisis in Burundi, particularly in rural areas where electrification is only 2%. In Burundi, the solar technology should be conceived of as an integrated solution (a combination of technologies) because the beneficiaries would be different according to the size of the infrastructure and the purchasing power, since most of them are located in rural areas and with critical standards of living.

Biomass

Fuel wood (70.8%), agricultural waste (18.4%), charcoal (5.8%) and bagasse (1.0%) together account for over 95% of the country's energy consumption. With regard to these figures, woody biomass remains a dominant energy source for cooking and heating; around 98% of the population is still using solid fuel for cooking. The challenge is how to make it renewable by introducing efficiency and environmental protection. This is a business opportunity that needs to be supported in the framework of grants and technical assistance.

Apart from various projects funded by EEP, EnDev facilitates the promotion and distribution of improved cook stoves through third parties (private companies or individuals). Herein EnDev creates a platform to share experiences, especially from neighbouring Kenya and Uganda. The project will ensure that Burundi will benefit from knowledge transfer in the development of improved cook stoves.

Biogas

Thanks to the technical assistance from GIZ and China, Burundi built a solid basis and good practice in biogas technology during the 80's and 90's. This included household bio-digesters constructed on livestock farms, as well as the building of biogas plants connected to the toilets of schools and other institutions. Private contractors were commissioned for larger plants. The training of craftsmen, the establishment of a service system and the opening of credit funds were to provide the basis for a self-reliant dissemination concept. By 1992, 206 small-scale plants, and 84 institutional plants with digester volumes of over 100 m3 had been constructed. However, biogas activity appears to have decreased significantly in Burundi, despite the awareness of this technology, the technical capacity acquired and the existing potential.

4. Stakeholder review

In Burundi, stakeholders are made of national government institutions, private sector companies, donors and financiers, NGOs and civil society. With regards to the institutional set up of renewable energy and energy efficiency in Burundi, it is sufficient to cover all aspects required for sustainable development of the sector. However, their mandate is not fully or totally defined: the legal and regulatory tools are incomplete or even far from sufficient.

In Burundi, energy stakeholders are not well organized and integrated except that most private bodies have a recognized association BUREA (Burundi Renewable Energy Association) that is in need of capacity building. Donors and financiers comprise international organisations, but most of them are giving support to grid-connected projects in the framework of bilateral or multilateral cooperation. The main programmes that are being funded by the following donors:

- The Jiji & Mulembwe hydro project (49MW): World Bank, European Union, African Development Bank and European Investment Bank.
- Electrification of 30 health centres and 20 secondary schools, solar mini-grids (off-grid) by SESMA Burundi Project, Rehabilitation of Mini-grid of Kigwena, Ryarusera, Nyabikere and Butezi: European Union.
- Rusumo Falls: World Bank and African Development Bank.

- Rural electrification in Kirundo province: Arab Bank for Economic Development in Africa (BADEA) and he OPEC Fund for International Development (OFID).
- Hydroelectric Plant of Ruzibazi: Chinese Exim Bank.
- Hydroelectric Kabu: Exim Bank of India.

For energy efficiency, stakeholders are not sufficient to implement demand-side strategies while the country is facing a deficit of 30 MW (grid-connected). The concept of ESCOs is not well known in Burundi and at present, there are no companies providing the comprehensive services of an ESCO.

5. Market review

With regards to renewable energy and energy efficiency in Burundi, a few private companies are operating but they are not well integrated in order to provide a large and reliable package of solutions at affordable cost. The technical and management capabilities are still weak. In most cases, renewable energy equipment is not easily affordable (70% of the population still lives under the poverty threshold) despite the technological innovations that have brought costs down.

The EU has sponsored the installation of 150 PV off grid mini-power plants on 40 health centres and one hospital with 20 kWp in eight provinces in Burundi. ENERSOL SPRL (Belgium) was responsible for the technical and engineering and supporting installation and logistics from Belgium to Bujumbura. ETRAVE (Burundi) was responsible for logistics and administration in Burundi and the installation of devices.

There is no policy (law) that would encourage or discourage renewable energy adoption, and also there is no policy to dis-incentivise non-renewable/ fossil fuels. Furthermore, significant tax relief on renewable energy equipment is not applied for import duties, and high VAT and the absence of competition is leading to high cost of service.

The solution of a sustainable integration of businesses is a combination of solar technologies after conducting a baseline to design the best solutions which take into consideration the willingness to pay, the purchasing power of subscribers, the cost of service, the payment approach with some discounts, etc.[xi]

Stakeholders are not protected against unfair competition – especially in renewable energy. An accreditation solution would work well in Burundi to stimulate the availability of technical capacity, as well as ensure that consumers are able to identify quality solutions. Local commercial institutions are currently not lending for renewable energy projects. Therefore, the sector is reliant on government and/or donor funding.

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
The legal and regulatory framework is incomplete and assistance is required in this regards	▪ The new electricity law does not have the legal supporting tools. ▪ IPPs feel the weight of an incomplete regulatory framework due to poor cross-government understanding and inconsistent application of the law.	▪ The government has got assistance to develop some legal aspects based on best practices. ▪ During the forthcoming reforms, the Regulator will be involved and will have the chance to play an advocating role.
Small-scale projects are costly during the development phase	▪ Long administration procedures and fixed costs so high due to delays.	▪ Funding small-scale projects especially during development phase would add an improvement to the viability.
Off-grid energy needs are not known due to lack of data	▪ There is a lack of resources to access data information and policy makers do not have aligned points of view because they don't have the same information.	▪ The Government has put in place departments in charge of renewable energy and they are likely aware of setting up an information system and action plans.
Renewable energy equipment and solutions are still perceived to be expensive	▪ Renewable energy are difficult to propagate through free-market mechanisms. ▪ There is a lack for awareness of renewable energy & energy efficiency benefits especially in rural areas.	▪ Grant facility is necessary in rural areas (off-grid). ▪ A growing number of small factories require the provision of electricity, especially in rural areas where the grid does not extend - private companies are organising the promotion of renewable energy solutions to potential subscribers.
Projects that combine renewable energy and agriculture transformation are not popular	▪ There is a lack of knowledge in agri-business and value chain management. ▪ Investors are pessimistic to undertake projects that have long cost recovery period due to political instability.	▪ The government has policy of gathering people into community villages whereby access to electricity will be made easy. ▪ Some IPPs are developing some projects with a combination of energy generation and agri-business value chains and they are intending seeking funds from international institutions.

7. Implications for the Theory of Change

In the EEP theory of change for Burundi, the access to grants and technology etc. are not an end but a means to an end. However, because of the new and fragile environment in Burundi, grants are indeed an essential tool to help integrate local and regional realities with international best practices in the sector.

The government is taking steps in the right direction to allow the private sector to invest more in the sector. However, laws and regulations governing this sector need to be updated or implemented in a consistent, independent, transparent, and predictable way. In the short term, providing VAT relief on renewable energy and energy efficiency equipment would make a difference for a lot of people and help push residential use. Supporting the implementation of pay as-you-go systems can increase the reach of renewable energy solutions in townships.

The following table shows the funding mechanisms relevant to the local context:

Technology	On-Grid	Off-Grid
Hydro	Grants for both the development and the scale-up or construction phases (only small-scale project with no economies of scale).	Grants from the development phase through the construction phase, and the reasoning is to get a price per kWh that makes the project bankable and with tariffs that are on par with the national standards. Grants for small hydropower schemes in combination with agro-processing facilities should also be prioritized.
	Concessional loan facility or loan guarantee to commercial banks.	Concessional loan facility or loan guarantee to commercial banks in highly risky countries such as Burundi are necessary to stimulate the sector and get projects moving through the pipeline, which will then create a track record to show the real actual risk of developing and building projects in Burundi.
Solar	Grant for development and capacity building.	Concessional loan facility or loan guarantee to commercial banks in highly risky countries would be very helpful.
	Concessional loan facility or loan guarantee to commercial banks in highly risky countries would be very helpful.	A baseline study has to be conducted for designing an integrated solution (instead of one unique package or technology).
Biomass modern energy for cooking	N/A	Grants for development phase and installation.

[i] *http://gtf.esmap.org/*

[ii] *Irradiation on optimally inclined plane (Wh/m²/day), EU JRC (2015) Photovoltaic Geographical Information System – Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iii] *https://www.reeep.org/burundi-2012*

[iv] *https://www.imf.org/external/pubs/ft/scr/2015/cr1588.pdf*

[v] *EAC Renewable Energy And Energy Efficiency, Regional report, 2016*

[vi] *http://causetech.net/files/DRE-Strategy-One-pager.pdf*

[vii] *Rapport de l'enquête modulaire sur les conditions de vie des ménages 2013/2014, 2015*

[viii] *http://www.comesa.int/wp-content/uploads/2016/12/Regulatory-Framework-on-Off-Grid-Electrification-EN-1.pdf*

[ix] *Etude diagnostique du secteur de l'Energie au Burundi dans le cadre de l'initiative du Secrétaire Général des Nations Unies sur l'Energie durable pour tous, 2013*

[x] *Stratégie nationale de développement des energies nouvelles et renouvelables à l'horizon 2030*

[xi] *Investment opportunities in renewable energy Burundi, 2012*

Country profile – Kenya

1. Overview

Indicator	Data
Population	47 million (2016)
Population density	81 persons/ km^2
Global Tracking Framework Indicators [i]	
Access to electricity	36% (68% urban and 13% rural) (2014)
Access to improved cooking	38% (2014)
RE as proportion of the mix	75% of total final energy consumption
Other Indicators	
Reliance on energy imports (2014) (IEA)	20% of total primary energy supply
Centralised or liberalised electricity sector	Centralised
Bundled generation, transmission and distribution?	No Generation – Kenya Electricity Generating Company & IPPs Transmission & distribution: Kenya Power and Lighting Company
Existence of renewable energy IPPs	Yes
Import duties on renewable energy products	Unassembled solar equipment and wind turbines are exempt from VAT and off-grid equipment (DC-charged) is also exempt from import duties. Hydraulic turbines and water wheels are free from import duty but pay 16% VAT.
RAGA/ AA/ IP	RAGA, AA and IP
Renewable energy strategy	IP
Number of EEP Phase I & II projects	48
Total EEP contribution (% of total budget)	€ 11.3 million (58%)
Average daily solar irradiance [ii]	3,610 Wh/m^2/day
Electricity subsidies	Yes [iii iv]
Fuel subsidies	No subsidies on kerosene or diesel, (taxes on kerosene, so that LPG is encouraged) [v]

Kenya has a well-developed electricity grid compared to other East African countries and significant renewable energy generation. Electricity is mainly generated from Kenyan hydro and geothermal power where Kenya is the 8th largest geothermal electricity producer worldwide. Imports from Uganda and Ethiopia play a lesser role. The market

for off-grid solar is also one of the most well-developed in Africa where a well-developed mobile phone network and the fact that almost Kenyans utilise mobile finance creates a strong basis for pay-as-you-go solar home systems.

There are therefore three main challenges ahead: 1) a growing demand for electricity that exceeds the plans to increase installed capacity; 2) growing imports of petrol to fuel the transport sector, and 3) rapidly diminishing forest resources in a country where 80 % of the population are still dependent on firewood or charcoal as their primary source of cooking fuel.

2. Institutional framework

Institutional structure

The Ministry of Energy and Petroleum (MOEP) is responsible for the strategic oversight of the energy sector in Kenya. Its main tasks involve the development of energy policy, legal and regulatory framework, including the Feed-in-Tariffs (FITs), and VAT and import duty exemptions on solar equipment. The Ministry is composed of four Directorates: Electrical (transmission and generation), Petroleum, Renewable Energy (off-grid electricity, cogeneration, energy efficiency and bio-energy) and Geo-thermal Exploration. MOEP also runs county-based local energy centres.

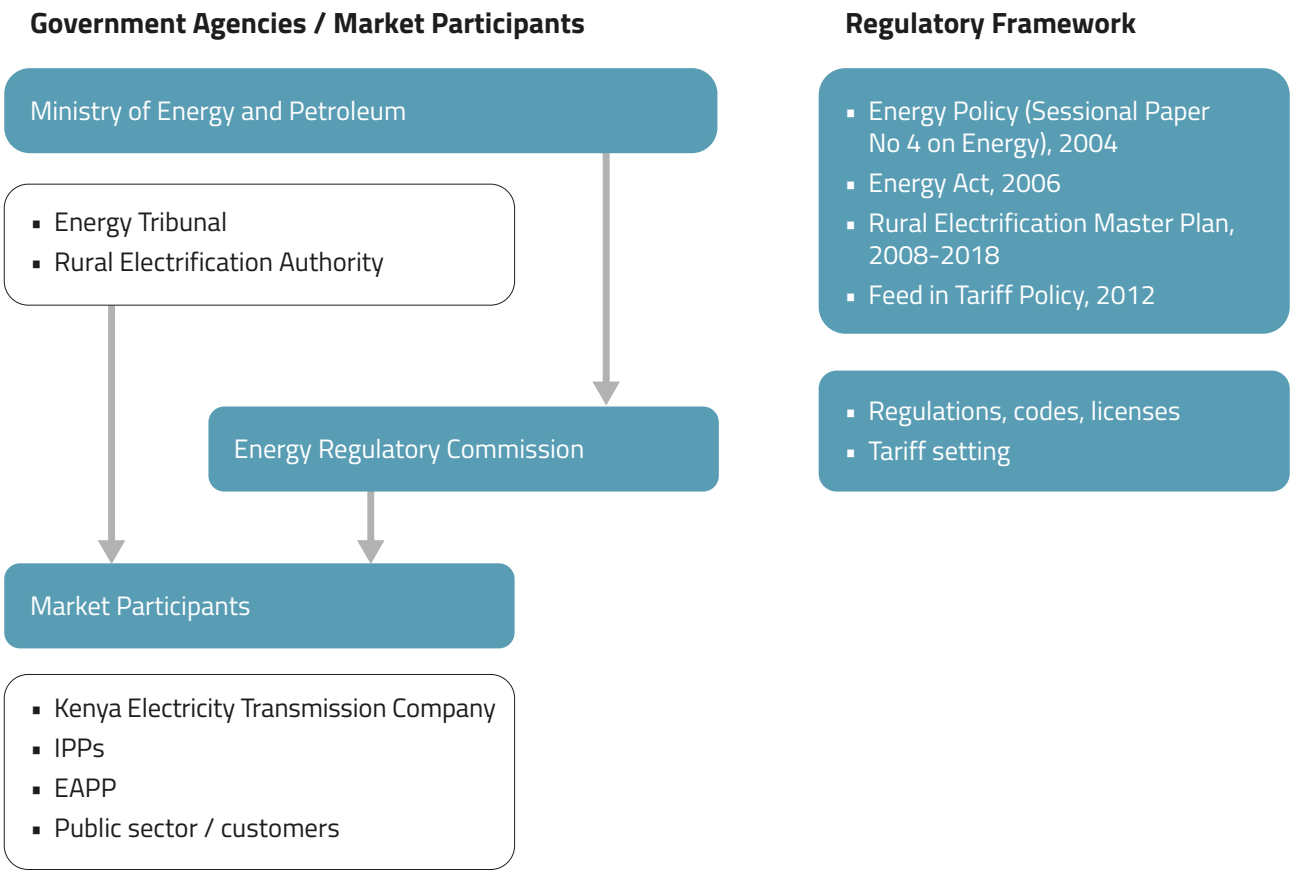
Kenya Power and Lighting Company (KPLC) is the sole distributor of grid electricity and the operator of several micro-grids. KPLC are obligated to buy electricity from all power generators, public as well as private. Private IPPs currently contribute 11% of the electricity produced. Kenya Electricity Generating Company Ltd (KenGen) handles all public power generation and is the largest power generator in Kenya operating 1,500 MW of installed capacity composed of hydro, geothermal, and conventional fossil fuelled power plants (mainly petroleum). Kenya Electricity Transmission Company Ltd (KETRACO) plans, designs, builds, operates and maintains new electricity transmission lines and associated substations. The Energy Regulatory Commission (ERC) was established under the Energy Act of 2006, as landmark in the process of modernising the energy sector in Kenya. The ERC is a government structure that operates independently from the Ministry and is tasked with tariff setting, establishing power purchase agreements and network service contracts for the renewable energy and the petroleum subsectors, as well as enforcement of regulations governing the sector. The Energy Tribunal within MOEP is a judicial body where the decisions of ERC can be appealed.

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

Kenya has taken significant steps to devolve government to county administrations. By the Energy Bill of 2015, Kenya's 47 county governments became responsible for local energy planning. These plans are aggregated into a national Rural Electrification Master Plan by MOEP, the last version of which was revised in 2008. The previous Master Plan was developed solely by MOEP, as the rural electrification strategy with the newly created REA as lead agency.

The 2015 Bill also gave county governments powers to enforce national energy and environmental protection laws, and mandates them to establish county-level funds for energy efficiency. The Bill is currently implemented very differently in the 47 counties, but in all counties, local governments are gaining importance for the energy sector.

Figure 1: Institutional structure for the energy sector in Kenya



Policy framework

Since the Energy Act of 2006, several energy-related policies, acts, bills, regulations and amendments have been developed. Vision 2030 is Kenya's overall development vision for sustainable growth, to develop Kenya into "a newly-industrialising, middle-income country providing a high quality of life to all its citizens in a clean and secure environment". Concerning energy, the Vision targets 100% access to electricity by 2030, and 10% GDP growth through infrastructure development. The frequency of power outages (33% compared to 1% in South Africa) is identified as a major obstacle for development and is connected to an over dependency on hydropower in the energy mix. Concerning job creation, development of Kenyan cook stove and solar lantern production is part of the political strategy.

The Least-Cost Power Development Plan 2013–33 is the Kenyan Governments rolling 20-year national energy plan. It aims to raise installed electricity capacity to 22.7 GW by 2033, planning for a range of different renewable energy sources (hydro, geothermal, solar, wind), coal and nuclear. The main thrust is to increase geothermal peak capacity to 5.5 GW.

The Energy Bill of 2015 and subsequent Petroleum Act and Mining Act streamlined existing energy regulations across renewable energy, petroleum exploration, coal mining, and nuclear. It also sought to implement the devolution policies inherent in the new constitution from 2010 where decentralised county governance is a central part in the energy policy framework. Some critique has been expressed that although attempts have been made to streamline policies, it also increased the complexity of the sector by creating a host of new regulatory requirements.[vi] A key element in the Bill is its emphasis on supporting local employment and manufacturing and in particular within the counties where a project is being implemented.

Kenya has had a liberalised procurement framework for IPPs since 1998. The FiT Policy was first developed in 2008 and was revised in 2012 when the current standardised Power Purchase Agreements (PPAs) and connection guidelines were enacted. The FiT is the main instrument to expand renewable electricity generation and establishes tariffs for wind, hydro, biomass, biogas and solar for grid integrated installations above and below 10 MW of capacity. The FiT varies across technologies from between US$ 0.0825 /kWh (large-scale hydro) to US$ 0.12 /kWh (solar).

The National Climate Change Action Plan (NCCAP) 2013-2017 has set an ambitious target for Kenya of reducing greenhouse gas (GHG) emissions by 15% by 2015 and by 70% by 2030 compared to 2010 levels.[vii] NCCAP identifies a reduction potential of 5.6 Mt CO2e a year in 2030 from the promotion of clean cook stoves and 1.5 metric tonnes CO2e from substituting kerosene lamps with solar lanterns and other renewable lighting.

The building regulations do incorporate some requirements for renewable and energy efficiency measures, such as the solar-heating. Regulations from 2012 oblige users of more than 100 litres of hot water per day to install solar water heaters, and requires that large buildings are energy audited, followed up by an energy investment plan. The solar heater policy allows for a five year period of grace and is coming into force in 2017.

3. Technology review

Renewable energy makes up 80% of the current electricity mix, which is one of the highest percentages in the world. It is estimated that Kenya has an even higher potential for grid-integrated renewables: 7,000 MW geothermal, 6,000 MW large hydro, 3,000 MW small hydro and abundant resources of solar and wind energy. Kenya has great potential in the geothermal sphere, accounting for 7 of the 15 GW of potential geothermal energy in Africa. In fact, it is the world's 8th largest producer of geothermal energy. Solar and wind-energy projects are under development. Wind provides 0.4% of the total electricity supply but that percentage will increase as many of the wind energy projects designed after 2014 will begin to supply the grid.

The figures below display the current development of the electricity grid and the planned expansions of several government programs. Figure 2 forms the basis of the ongoing Last-mile program that connected 1 million Kenyans in 2016. The red zone depicts a 15 km radius from the existing grid, which is targeted for grid extensions and intensification. Outside this zone, population density drops making micro-grids and domestic solar the best options for electrification; the Ministry and REA are electrifying public institutions with stand-alone PV in these areas.

Figure 2: Existing grid

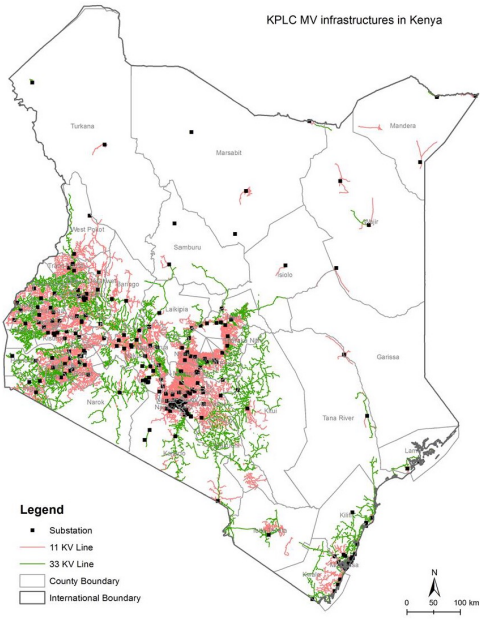
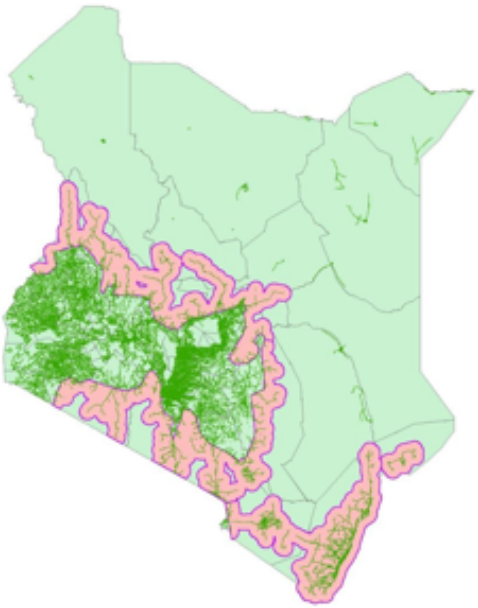


Figure 3: Planned grid extensions and intensifications (red zone)



Micro-grids

There are currently 21 mini-grids in Kenya, 19 of which are owned by REA and operated by either KenGen or KPLC. Only two mini-grids are operated by IPPs nationwide. All of them are based on thermal generation (diesel generators) but a few include hybrid solutions supplementing the generators with solar or wind power. Small-scale hydropowered mini-grids exist in Kenya but are not counted as such in the above statistics. They are often connected to tea plantations but since 2005, hydropowered community mini-grids have been set up mostly in Northern Kenya.[viii] The advantage of mini-grids depends on the population density and productive and industrial uses of energy, where smaller systems cannot deliver high enough loads.

Off-grid solar

Kenya has one of the most active commercial PV markets in sub-Saharan Africa, with an installed PV capacity in the range of 4 MW. An estimated 300,000 rural households in Kenya have solar home systems and annual PV sales in Kenya are between 10,000-20,000 systems. According to the Kenyan Renewable Energy Association (KEREA) the average solar PV system size for households in Kenya is 25-30 Wp and costs, on average, slightly more than a grid connection with KPLC. Owing to the small size and dramatic improvements in the efficiency of white light emitting diodes (LEDs), it has become possible to create compact, affordable, rugged, and cost-effective illumination systems. Pay-as-you-go business models make it possible for many to pay for their PV solution from the savings on reduced usage of kerosene and candles.

A recent study in 44 of Kenya's 47 counties documents that solar home systems are also popular among urban consumers already grid connected, who purchase them due to grid unreliability. Thus, off-grid PV is not limited to off-grid areas or to the rural poor households. In general, consumers replied that reliability was the most important reason for purchasing their system or to save fuel costs. Ease of use, lack of an alternative where no grid was available or lack of knowledge of an alternative where the grid was available were also given as reasons by many respondents.[ix]

Smaller PV systems are found in both low-income and middle-income households, while solar home systems are mostly installed in middle and high-income households. Unassembled solar equipment has benefited from VAT and import duty exemption since 2014 which has helped the market to flourish. A recent amendment (2016) in the East African Community Customs Management Act has lifted the duty exemption for on-grid solar equipment but systems for off-grid use (that can only be charged using panels) are still duty exempt.

Biomass and cook stoves

Up to 80% of Kenyan households rely on wood fuel or charcoal for cooking, which creates significant pressure on biomass resources of the country. While demand for biomass is estimated at 40.5 million tonnes annually (in 2013), Kenya's resources are currently only able to supply 31 million tonnes annually meaning that forest resources are currently being reduced by at least 10 tonnes every year and that figure is growing as the population increases.[x]

It is estimated that 1.5-3 million improved stoves are currently deployed, mostly of Tier 1 quality.[xi] There is a range of different models and a recent market study by UNDP found that consumers were willing to pay up between KSh 2,000-4,000 (€ 17-35) for the better models.

Biogas and waste-to-energy

Biogas is gaining momentum in Kenya. Over 200,000 systems are installed today. Since 2009, many installers have entered the market providing biogas digesters to farmers. GIZ and SNV have undertaken a significant intervention to develop the local skills-base for biogas installations based on fixed dome technologies. The Kenya National Domestic Biogas Programme ended in 2014 and gave rise to the Association of Biogas Contractors in Kenya. However, the potential for biogas was not being adequately exploited and contractors were not able to advise farmers of how to use

the energy to greatest effect, with the exception of using it for household cooking.[xii] A handful of large-scale biogas plants are also under development.

Waste-to-energy projects are emerging but are still in their early stages. UNIDO is supporting projects to convert agricultural waste-to-electricity. Co-generation systems are also being applied on a small scale.

Energy efficiency

Besides the LED-appliances often distributed with off-grid PV and improved cook stoves, there is a lack of energy efficiency initiatives in Kenya, which is striking given the high costs of electricity (US$ 0.150/ kWh compared to South Africa US$ 0.040/ kWh). A standards and labelling programme (Energy Star) for five appliance types was developed with assistance of UNDP and financed by GEF in 2013.

4. Stakeholder review

Grid electricity

The major stakeholders concerning on-grid electricity are the public institutions KPLC, KenGen, KENTRACO, REA and ERC. Since 2014, a range of IPPs has developed energy projects and currently supply the grid with 11% of the total energy supply (2014). The projects include heavy-duty fuel oil plants, wind farms, geothermal, hydro and solar installations. The IPPs are generally instigated and managed by international companies who have global experience and access to equity.

REA, KPLC, KenGen and ERC are the main stakeholders concerning mini-grids, while private companies such as Mobisol, M-Kopa, d.light, and Azuri are the main players concerning domestic PV. Many companies work in cooperation with local distributors who have several products for the same targets group: solar lanterns, solar home systems, cook stoves and non-energy products.

Clean Cook Stoves Association of Kenya (CCAK) is one of the main stakeholders in the last decade. An offshoot of the Global Alliance for Clean Cookstoves and hosted by GIZ, the association aims to professionalise stove production, introducing quality standards. In the last five years a host of different companies is emerging.

The Centre for Energy Efficiency and Conservation (CEEC) was established in 2006 and is managed by the Kenyan Association of Manufacturers (KAM). CEEC is supported by MOEP and Danida. Its main activities involve training and certification of energy managers and energy auditing. Strathmore University (SU) is a key player in the development of the renewable energy sector in Kenya. It also hosts the DFID and Danida supported Kenya Climate Innovation Centre (KCIC) that incubates new ventures in renewable energy.

The Kenya Renewable Energy Association (KEREA), which is an interest forum with members across the sector from government, public sector, the general public and private companies, influences the development of the industry.[xiii]

5. Market review

Several International donors play a major role in planning and funding grid extension and intensification in Kenya. The major donor agencies are the World Bank, EU, AFD, DFID and development banks such as EIB, KfW, CDC and AfDB. As of early 2017, KPLC served 5.5 million consumers while there are concurrently 9.3 million households within the KPLC service territory. Since 2013, 3.6 million were connected, many through the public 'Last Mile' programme implemented by KPLC and funded by AFD and EIB. In March 2017, the media made allegations of mis-reporting on the part of KPLC in order to satisfy the political targets. KPLC claims it has connected 1.2 million clients in 2016 but almost a million of those are non-vending. Critics argue that many have not received a meter, while KPLC argues that

they are not using their grid connection or that their consumption is so small that they have not yet consumed the 30 kWh prepayment that came with the meter.

Several power generation projects are in the pipeline, many financed through private equity with support of international support mechanisms like the US OPIC program, the European SCAT program, ENJI, etc. In general, the grid-based electricity sector is developing rapidly based on the FiT and investors are looking for more suitable project to fund.

Off-grid electricity

To achieve the target of 100% electrification, several programs have been launched. The main funders of mini-grid projects are KfW and GIZ (EnDEv) who are promoting hybrid mini-grids through the ProSolar programme with REA and KPLC as the implementers. AFD and DFID cooperate with the Green Mini-grids Programme, also supported by the International Climate Fund. The French organisation, IED and Practical Action Consulting manage the facility that launched its first call for proposals in March 2017. The initiative involves a range of possible funding mechanisms: loans through credit lines administered by Kenyan local partner banks, concessional finance, results-based incentives, grants and guarantees.

The Renewable Energy Performance Platform (REPP) supports small to medium-sized renewable energy projects (below 25 MW) throughout sub-Saharan Africa. In Kenya, two run-of-river hydro projects have been selected. A wide range of other renewable energy technologies is covered by the support, including wind, solar PV, geothermal, waste-to-energy (landfill gas and thermal waste to energy), biomass and biogas. The support mechanism is results-based grants.

In March 2017, the largest off-grid initiative was launched: The World Bank-supported KOSAP program was launched in cooperation with the Government of Kenya. The US$ 150 million program targets the 14 marginalised or underserved counties of Kenya where grid extensions are either not planned in the Last Mile program or will not be extended much. These counties represent 72% of the country's total land area and 20% of the country's population. KOSAP will support mini-grids through REA and KPLC and stand-alone PV solutions through public procurement that will reduce transaction costs for private sector stakeholders. Electrification and solar water pumping of community structures and technical assistance to county level energy governance are also components of the program.

Figure 4: The 14 underserved counties targeted by the KOSAP program

Biomass and improved cook stoves

KOSAP also involves a cook stoves component of US$ 6 million for distributing 150,000 cook stoves. The pilot phase will target the four northwestern counties (Turkana, Marsabit, West Pokot and Samburu).

A Nationally Appropriate Mitigation Action (NAMA) has been developed under UNDPs Low Emission Capacity Building programme and was only completed by December 2016. It involves the establishment of 28 Energy Productivity Zones (five of which are to be situated in the marginalised counties), 500 kWp grid-integrated solar, one million PV lanterns and one million improved cook stoves. The Ministry of Environment and Natural Resources is the coordinating authority with MOEP and REA as the implementing partners.

The first NAMA support project (NSP) has been launched targeting the charcoal sector. Supported activities are forest management, charcoal production from sustainable sourced biomass and commissioning of efficient charcoal kilns. An interest rate subsidy fund of € 7 million and a guarantee fund of € 4 million are being provided. Besides UNDP, the German Ministry of the Environment, the British Department of Energy and Climate Change, the Danish Ministry of Climate, Energy and Building, and the EU are partners. The Kenya Forestry Research Institute and county governments are the main implementing partners.

Several private sector companies are involved in distributing cooking stoves of varying efficiency; several supported by the second phase of EEP have set up a production facility in Kenya. Burn Manufacturing, an EEP supported project, has sold over 283,363 stoves since 2013 and produces these high-quality stoves (Tier 4) locally. The Jikokoa costs Ksh 4,000 (USD$ 35) and has become popular due to the nationwide marketing campaign, as well as the after-sales service, however cannot be purchased by the rural poor without access to financing.[xiv] Despite these successes, efficient stoves have not yet reached large-scale market penetration and only approximately 25% of households that utilise biomass as cooking fuel own an improved stove.

Other financial access options

Crowdfunding platforms such as TRINE, lendahand, and KIVA are very active in Kenya. Different platforms offer different services, mostly providing access to credit, but grants and other financial models are accessible. Crowdfunding platforms provide small ticket loans and are mostly relevant for smaller-scale companies given the transaction costs.

Local banks in Kenya provide credit to Kenyan business and are a key instrument of the AFD-led SUNREF program, that is a financing facility for renewable energy projects at low interest rates but also trains banks in assessing renewable energy projects and assesses whether projects are eligible for the facility prior to their contact to the local banks. However, current practices emphasise a track record, meaning that high demands for collateral (up to 120%) will be made if a company has no history with the financial institution. On the other hand, companies with long track records can access local debt without hardly any collateral. SUNREF Kenya does not yet seem to have the intended effect on local banks when it comes to funding smaller-scale renewable energy companies where many are upstarts or in their first scale-up phase.

An interest rate cap of 4% above the base rate set by the Central Bank of Kenya was introduced in 2016. This currently caps interest rates at 14.5%. The cap is criticised by IMF and World Bank after growth rates have declined in Kenya.

The American Power Africa initiative also has an active presence in Kenya. Power Africa hosts a range of different support mechanisms such as grants for small-scale start-ups (DFAVE), support for feasibility studies (USDA), credit guarantee facilities (DCA), Energy Star labelling (DoE), etc.

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Access to finance for smaller scale IPP projects	▪ Local banks require client history or demand high collateral ▪ International investors, besides crowdfunding platforms, are more interested in the on-grid electricity sector than off-grid energy projects.	▪ Several donor-funded programs have been launched this year targeting the off-grid sector to buy down the lending risk.
Micro-grid IPPs are crowded out with public funding	▪ REA and KPLC own and operate most mini-grids in Kenya, and run the planned mini-grids supported by Prosolar and KOSAP, leaving few areas for IPPs.	▪ Supporting IPPs will probably be a better strategy in the long run to gear public financing of mi-ni-grids with private capital.
Mini-grid developers in Kenya lack security in the event of grid expansion	▪ Insecurity over exit conditions if a mini-grid is connected to the grid. Exit conditions are negotiated on a case-by-case basis. ▪ Lack of security of investment makes mini-grids unattractive to larger private investors.	▪ GIZ is currently assisting MOEP in strengthening the regulations in order to create greater security of investment for mini-grid IPPs.
Contradictions between energy and climate policy	▪ The ambition to develop coal mining and petroleum fields in Kenya's overall Vision 2030 and LCDP in order to reach 100% electrification is not fully in line with the Climate Change Action Plan that sets ambitious GHG emission reduction targets.	▪ Energy efficiency initiatives are promising rem-edies to solve the contradictions. For instance, ESCO-financed retrofit of larger buildings, public lighting; two business models that are imple-mented with success in India.
High transaction costs in marginalised areas	▪ Off-grid energy markets are well developed in the central and southern parts of the country where population density is high. Low density makes distribution and service costly. ▪ Some counties bordering South Sudan, Ethiopia and Somalia are subject to higher levels of conflict than the rest of the country.	▪ The large-scale KOSAP program specifically targets off grid expansion in these areas.
Lacking initiatives in energy efficiency	▪ Energy efficiency receives little attention from public programmes and the private sector	▪ The relatively high electricity tariff should create incentives for energy efficiency ▪ The Energy Efficiency Strategy of South Africa could serve as inspiration for Kenya ▪ The requirement on solar heaters put into force this year is an example of promising public initi-atives in the sector that can stimulate business development for energy efficiency.
Technologies such as biogas have a strong rural poverty impact but are not being exploited	▪ There are currently no subsidies for smaller scale biogas solutions. Compared to on-grid IPPs that benefit from the FiT.	▪ Inspiration as how to subsidise developing energy companies can be sought in Rwanda where the sector is thriving.

→

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Current accessible biomass resources do not meet the demand	▪ Efficient cook stoves do not enjoy the same attention from government, international donors or investors as access to electricity does, although the situation is alarming. ▪ The magnitude of the current private sector led stove market does not meet the scale of the challenge.	▪ The devolution process where county governments are increasingly enacting both environmental protection and energy planning at local level instead of sector-confined public institutions, could perhaps be an accelerator for public initiatives in this area. ▪ Factories for Kenyan LPG-gas production are currently under construction in order to propagate a fuel switch from ligneous-based fuels. Biogas has the same potential without the negative impact on GHG emissions if the digestion process is contained to prevent methane-leakage. There are currently no standards in Kenya for large-scale bio-digesters.

7. Implications for the Theory of Change

The analysis of the Kenyan energy market generally confirms and validates the Theory of Change for EEP Phase III, especially concerning the overall demand for grants or other types of soft financial support mechanisms targeting small-scale companies in the renewable energy sector.

However, three considerations could be drawn from the analysis:

1. While EEP is technology agnostic, the current challenges are technology dependent. This consideration could be taken into consideration by allocating different scores for different technologies when evaluating project proposals.
2. The rapid acceleration of private capital to the grid-integrated projects proves that the capital market is ready to step in if policy conditions are right. These policy conditions are clearly not sufficient for the off-grid sector, especially concerning the mini-grid sector in Kenya. Supporting innovative policy solutions, such as creating PPAs that allow for cross-subsidies across market segments for off-grid provision is necessary to stimulate this market.
3. Biomass and cook stoves do not attract private capital investors as much as grid-integrated electricity generation. The scale-up of existing solutions is urgently needed. This consideration could lead to a higher ticket size for cook stoves, where the risk of distorting the capital market is lower than in other areas.

[i] *http://gtf.esmap.org/*

[ii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System - Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iii] *http://news.trust.org/item/20160914071101-xf0ln*

[iv] *https://www.africa-eu-renewables.org/market-information/kenya/energy-sector/*

[v] *http://www.energy.go.ke/index.php/projects/246-liquefied-petroleum-gas-plant-and-three-million-cylinder-project.html*

[vi] *https://www.standardmedia.co.ke/business/article/2001233193/shocking-kenya-power-details-of-fake-meter-activations-to-please-president-uhuru; https://www.kenyans.co.ke/news/kenya-power-staff-have-allegedly-inflated-figures-last-mile-electricity-project-17588*

[vii] *Kenya had an emission of 0.33 tonnes CO2eq pr. capita in 2015; 0% change from 2010.*

[viii] *Project Design Study on the Renewable Energy Development for Off-Grid Power Supply in Rural Regions of Kenya, 2014*

[ix] *Renewable Energy Resource Assessment 44 Counties. County datasheets2, 2017. Ministry of Energy & Petroleum*

[x] *Analysis of Demand and Supply of Wood Products in Kenya, 2013*

[xi] *www.se4all-africa.org*

[xii] *ACP-EU Energy Facility Site Visit Report, Up scaling the Smaller Biogas Plants for Agricultural Producers and Processes.*

[xiii] *http://kerea.org/membership/our-members/*

[xiv] *EEP S&EA Mid-term Evaluation, 2015*

Country profile – Lesotho

1. Overview

Indicator	Data
Population	2,13 million (2015, World Bank)
Population density	70 persons per km^2
Global Tracking Framework Indicators [i]	
Access to electricity	31.79% 60% urban and 12% rural
Access to improved cooking	31.79%
RE as proportion of the mix	51.82% (47.37% traditional biomass; 4.44% hydro)
Other Indicators	
Reliance on energy imports (2014) (IEA)	No data but installed capacity is approximately 72 MW and reported peaks go up to 143 MW (2014)
Centralised or liberalised electricity sector	Centralised
Bundled generation, transmission and distribution?	Yes
Existence of renewable energy IPPs	Not presently
Import duties on renewable energy products	Yes
RAGA/ AA/ IP	RAGA
Renewable energy strategy	No
Number of EEP Phase I & II projects	2
Total EEP contribution (% of total budget)	€ 401,330 (81%)
Average daily solar irradiance [ii]	6,320 Wh/m^2/day
Electricity subsidies	Yes for domestic consumers [iii]
Fuel subsidies	Paraffin

Local generation capacity in Lesotho is primarily based on hydropower for approximately 56% of overall consumption (although data is lacking).[iv] The deficit is imported from South Africa and Mozambique through the Southern Africa Power Pool (SAPP). A series of programmes are underway to increase the generation from hydropower under the Lesotho Highlands Water Project (LHWP). The infrastructure is dated and the enabling framework has not yet been established for Independent Power Producers (IPPs) to feed into the grid. However, the recently developed National Energy Policy 2015-2025 aims to address these issues.

Energy access in rural areas is challenging due to the dispersed population and mountainous landscape, although the population is perhaps more concentrated into pockets. A significant amount of biomass is consumed for cooking. Lesotho is also water poor, increasing the importance of the food, water and energy nexus.

2. Institutional framework

Institutional structure

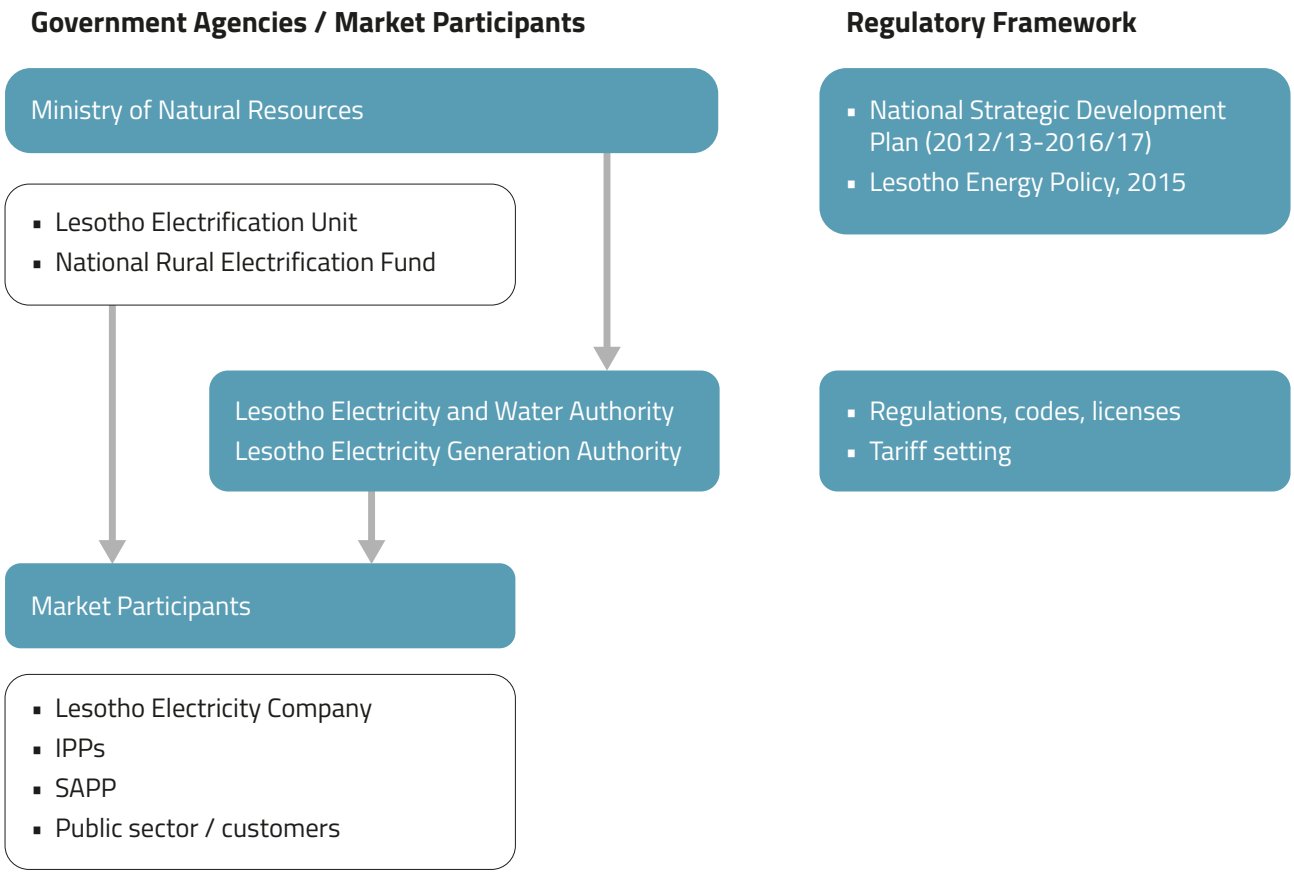
The Ministry of Energy, Meteorology and Water Affairs is responsible for the overall policy and legislative framework. It would appear that the sector has been restructured recently although there is little information of how this has affected the sector. The table below provides a summary of the roles of the key stakeholders.

Table 1: Key institutions in the energy sector in Lesotho (RAGA, 2014)

Institution	Role
Ministry of Energy, Meteorology and Water Affairs	Policy, plans, strategy, programs formulation, enforcement and information dissemination.
Petroleum Fund	Funding viable energy projects and research and development in the petroleum sector.
Lesotho Electricity Authority (LEA)	Electricity sector regulation.
Lesotho Electricity Generation Authority (LEGA)	Development and management of electricity generation projects to supply Lesotho and the region with electricity.
Lesotho Electricity Company	Public electricity transmission, distribution and supply in urban and financially viable areas of the country.
Lesotho Electrification Unit	Build, Operate and Transfer (BOT) of electricity transmission, distribution and supply network and management of National Rural Electrification Fund (NREF).
National Rural Electrification Fund (NREF)	Rural electrification fund.
Appropriate Technology Services	Design, research and development of appropriate technology applications for SMEs.

The structure of the sector is centralised, although there is currently significant effort being placed on establishing the framework for IPP investment.

Figure 1: Institutional structure for the energy sector in Lesotho



Policy framework

The Ministry of Energy, Meteorology and Water Affairs has recently produced the Lesotho Energy Policy 2015-2025. Its absence was highlighted as a major barrier in the RAGA and therefore its formulation is a positive step. The policy identifies the limitations that it aims to address. These limitations include:

a) The local private sector and cooperative associations participation in energy business is limited;

b) Biomass fuels are becoming a scarce commodity due to among others the prevailing drought conditions and excessive harvesting;

c) Inadequate and old network infrastructure for electricity transmission;

d) Undeveloped energy sector coordination;

e) Limited clarity on institutional responsibilities leading to loss of accountability;

f) Limited energy efficiency programmes and activities;

g) Limited penetration of renewable energy technologies and services;

h) Limited access to funding to support energy infrastructure

i) Inadequate storage for petroleum product

j) Limited participation of Basotho in the supply chain of petroleum products.[v]

Although the policy does address some of these concerns, there is little indication of how they will be implemented and no targets have been set. As yet, the country has not developed a strategy that will inform the design of the interventions. The key features of the new policy are:

- to improve the management framework for the sector,
- to promote biowaste-to-energy generation and reduce biomass consumption, increase rural, decentralised energy access using renewable technologies,
- to encourage the uptake of solar water heaters,
- support the establishment of RE Energy Service Companies (RESCOs),
- to improve energy efficiency, although it is not clear how this would be achieved,
- to establish a REFIT programme that will allow the private sector to engage in power generation, as well as opening large-scale power generation projects through open tenders,
- to establish a cost-reflective tariff.

The Lesotho Intended Nationally Determined Contribution to GHG emission reductions highlights several targets for the energy sector:

- Improving energy efficiency by 20% by 2020,
- Increasing electricity coverage /access to 35% of households in 2015, 50% in 2020 and 80% by 2030,
- With increase in rural electrification, paraffin consumption is expected to come down from 30,434 kilolitres (2014) to 25,000 kilolitres in 2020,
- Potential reduction of transmission and distribution losses from 2015 until 2030 by 0.5% per annum (total of 7.50%),
- Increase renewable energy sources by 200 MW by 2020: 40MW from Solar (2017/2018); 35 MW from wind (2017); 125 MW from hydropower (2025),
- To disseminate efficient stoves to reach a penetration rate of 30% in 2030,
- To reduce progressively the use of wood for heating in order to reach 10% by 2030,
- Replacement of fuel wood with LPG at the rate of 10% a year from 2020 to 2030.[vi]

The UNDP and GEF are supporting a project titled "Development of Cornerstone Public Policies and Institutional Capacities to accelerate Sustainable Energy for All (SE4All) Progress" which commenced in 2016. The objective of the project is to support the development of policies and tracking tools and catalyse investments in village-based energy provision models (e.g. mini-grids) that will contribute to the successful achievement of Lesotho's Vision 2020 and SE4All goals.[vii] The main activities being implemented include producing an energy baseline, developing the SE4ALL Action Agenda and Investment Prospectus, as well as establishing 60 village energy schemes through competitive selection. The budget allocated is US $9.4 million.

3. Technology review

Renewable Energy

Security of supply is the major concerns for the government. The Muela hydropower plant provides 72 MW of the 145 MW peak demand. In recent years, due to the regional power shortages, the vulnerability of the country has be-

come apparent, affecting the ability of the government to meet demand, particularly of the manufacturing (textiles) industry and diamond mines. Work has recently been undertaken in scoping the potential for hydro, wind and solar power in Lesotho.

Hydro

Hydropower provides significant potential in Lesotho. It is estimated that 22 sites present a total estimated potential of 14,000 MW of generation capacity and a further 4,000 MW of pumped storage capacity. The African Development Bank has recently supported the rehabilitation of the Mantsonyane mini-hydro power plant and improvements to the electricity infrastructure.

Solar

The solar potentials in Lesotho are significant, both for electricity and water heating purposes, with the annual sum of direct normal irradiation of 3,500 kWh/m2. The Department of Energy has estimated that 30 percent of rural households could afford solar PV if a financing mechanism is provided for. However, government subsidies and the free distribution solar home systems have historically distorted markets. The government has provided for small-scale interventions, such as the distribution of 200 solar home systems in Mphaki with AfDB support. Several potential IPPs have approach the government to establish Power Purchase Agreements (PPAs) but the decision was taken to first formulate the regulatory framework to support these arrangements.[viii]

Under the UNDP funded Lesotho Renewable Energy-Based Rural Electrification Project (LREBRE), the Lesotho Solar Energy Society was reactivated, and 5000 households benefited from the installation of solar PV panels. The National University certified 19 solar PV practitioners, and 50% of solar dealers received training. A credit guarantee scheme was provided for in rural areas in order that residents could access loans.

Biomass, stoves and biogas

Biomass is the main source of energy for rural households, particularly for cooking. There are manufacturers and distributors of energy efficiency cook stoves in Lesotho, including Fairtrade International (FLO), atmosfair (Save80). In 2013, FAO assessed a project that trained farmers on stove construction using cow dung. Alternative Technology Services have been engaged in disseminating the Mabotle, Thaba-Tseka and Nkokonono stoves models however continued use has been limited due to the multi-functionality of a three-stone fire (cooking, heating and light). African Clean Energy (ACE) has developed a stove that is manufactured in Lesotho that combines efficient cooking with a battery pack for a light and solar phone charging, although it is currently sold for significantly more than the simple stoves (approximately €40).

Biogas technology has been exploited previously however poor workmanship and maintenance have reduced their success. The Technology for Economic Development (TED) programme, supported by EEP, the Department of Energy and the University of Science and Technology Beijing (USTB), has installed over 100 biogas plants for rural households across five locations. In Lesotho, communal grazing lands are used for cattle, which may provide an opportunity for biogas production.

Wind

The wind potential in the region is significant with average wind speeds between 3.5 and 25 m/s. The IFC/ ESMAP is supporting feasibility studies for high wind energy potential near Katse Dam, Mohale Dam and Mphaki in the South of Lesotho that are due to be completed in 2017. These studies will inform the design of a PPP using wind energy as the main source. The Lesotho Highlands Power Project aims to establish 10 GW of generation, 6 GW of which will come from wind power and 4 GW from pumped storage hydropower. However, this project was announced in 2011 and has yet to get off the ground. PowerNet, a private developer, is developing a 35MW wind farm at Letseng however there were difficulties in securing the necessary land rights for the project site.[ix]

4. Stakeholder review

Additional support has been provided to the energy sector by a number of donors, namely the World Bank, the African Development Bank (AfDB), the Global Environment Facility (GEF), UNDP and the Governments of Norway, China, Japan, Germany and Sweden, have contributed to the Universal Access Fund (UAF) within LEA. Capacity building and development of planning strategies, as well as capital projects were financed from these funds.

The Lesotho energy sector is in its infancy and is therefore not yet very dynamic. A number of non-governmental oranisations (NGOs) have been active in the sector, including the Lesotho Solar Energy Society (LESES), Lesotho Chamber of Commerce, Technology for Economic Development (TED), the Lesotho Electricity Contractors Association (LECA) and the Transformation Resource Centre (TRC). The private sector in Lesotho has been engaged across the supply chain. Production and distribution of efficient stoves, development of biogas plants and production and distribution of other solar appliances is also done by the local private sector. More than 80% of the solar dealers in Lesotho are members of LESES, over 100 members in 2010.[x]

The LREBRE programme attracted financing by advancing government guaranteed loans to local contractors in a credit guarantee scheme financial model implemented by the Department of Energy.[xi] An Energy Research Centre has been established under the National University of Lesotho, which is the strategic hub for interdisciplinary research, education and advocacy in sustainable energy and renewable energy technologies (RETs) as adaptive measures towards climate change's adverse impacts.[xii]

5. Market review

The political landscape in Lesotho is based on a centralised structure, with the state-owned utility, LEC, controlling grid energy supply. The Energy Policy does suggest that decentralisation is intended. The LEC submitted an application for an increase in tariffs of 16.9% towards achieving greater viability in March 2017 to make them more cost-reflective. The decentralisation of energy services may improve the capacity for revenue collection. However, the policy framework would need to be adjusted as the Local Government Act does not mandate District or Community Council to engage in electricity service delivery.[xiii]

IPPs are engaging with the government on providing wind, hydro and solar on-grid generation however there is little information available as to the degree of interest in off-grid solutions. The majority of off-grid initiatives seem to be managed by NGOs and Lesotho Solar Energy Society (LESES), Lesotho Chamber of Commerce, Technology for Economic Development (TED), the Lesotho Electricity Contractors Association (LECA) and the Transformation Resource Centre (TRC). The National University of Lesotho Energy Research Centre was launched in May 2017 and has links across the region with organisations like SACREEE, the National Energy Institute of Namibia, among others.[xiv]

The final evaluation LREBRE supported by the Ministry of Energy, Meteorology and Water Affairs, the UNDP and GEF was negative in terms of the impact of the project for several reasons. The most significant cause of system failure and the subsequent inability to maintain the systems was due to the lack of awareness of how to operate the system effectively and how to contact service providers in the event of failure. The training and certification of solar PV installers is recommended going forward, particularly in ensuring the standard of work undertaken. The associations and research centres mentioned above would be important to involve in furthering this.

In terms of financing institutions, local banks participated in the LREBRE project on the basis of the government guaranteed loans under the credit guarantee scheme provided to local contractors. Three of the four commercial banks are South African based and provide loans for renewable energy.

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
The policy framework needs to be improved to encourage private sector engagement	▪ The Government of Lesotho has committed to developing the political, legal and regulatory framework to encourage private sector engagement in energy service delivery.	▪ The future incorporation of IPPs appears only to be a question of time while the framework is being formulated. ▪ The regulatory framework for off-grid IPPs also needs to be addressed in this process. A core component of these regulations should be standards for equipment to ensure that quality, efficient equipment is procured. ▪ South Africa plays an influential role in Lesotho and could lead the way, specifically on energy efficiency due to the standards applied to imported products.
Private sector off-grid energy services	▪ The business case for off-grid mini-grids is somehow limited based on the ability to pay, the dispersion of customers and the cost of investment.	▪ A combination of a market-based approach and a government-led approach may be necessary as off-grid rural energy electrification. ▪ It may be necessary to subsidise service provision for the private sector to engage.
Economies of scale for home-based systems are not enough, productive uses need to be encouraged	▪ The challenge in developing a business model that suits rural off-grid contexts is developing the critical mass such that the limited profit per user is considered to provide a significant return with a large customer base.	▪ Particularly in a context where the population is sparse, grant financing may be required. Business sustainability may require cross-subsidy models to be employed. ▪ Developing capacity will be necessary to ensure that remote users are able to maintain their equipment and productive uses are encouraged.
A multi-pronged approach	▪ The lack of availability of data for Lesotho makes it challenging to get a comprehensive overview of the status of energy services in Lesotho. ▪ Due to the stage of development of rural off-grid solutions in Lesotho, the LREBRE project suggests that there should be a detailed market analysis.	▪ A market analysis should seek to identify what types of business models would meet the needs of different market segments. ▪ It may also be appropriate to test the rent-to-own models on the basis that affordability is limited.
Support to on-grid IPPs will become necessary once the regulations are revised	▪ The availability of financing for energy in Lesotho is limited.	▪ Once the regulations are revised, IPP projects may require initial start-up funds to prepare feasibility studies and establish effective business models.

7. Implications for the Theory of Change

The energy services sector is at an earlier stage of development than in many of the surrounding countries. The legal and regulatory framework is not in place although the policy framework is being developed. There will be a need to support knowledge transfer to the sector once this is in place.

Developing bankable off-grid projects is challenging in Lesotho due to the absence of an economy of scale. There is potential in peri-urban areas, which would then satisfy the Theory of Change (TOC) however there is some question as to whether providing off-grid energy access presents a viable business case. Rent-to-own business models, such as those of Mobisol and Off:Grid Electric may be more suited to this context, although there may need to be guarantees in place if the grid were to be extended to these areas.

[i] *http://gtf.esmap.org/*

[ii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System - Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iii] *Rapid Assessment and Gap Analysis for Lesotho*

[iv] *http://promethium.co.za/wp-content/uploads/2016/03/2016-03-21-Report-Electricity-Market-Reform-in-SADC-final.pdf*

[v] *http://www.solarthermalworld.org/sites/gstec/files/news/file/2016-03-10/lesotho_energy_policy_.pdf*

[vi] *http://www4.unfccc.int/ndcregistry/PublishedDocuments/Lesotho%20First/Lesotho%27s%20INDC%20Report%20%20-%20September%20 2015.pdf*

[vii] *https://www.thegef.org/project/development-cornerstone-public-policies-and-institutional-capacities-accelerate-sustainable*

[viii] *http://documents.worldbank.org/curated/en/580181470238798259/pdf/PIDC72941.pdf*

[ix] *http://documents.worldbank.org/curated/en/580181470238798259/pdf/PIDC72941.pdf*

[x] *https://www.reeep.org/lesotho-2012*

[xi] *www.undp-aap.org/sites/undp-aap.org/files/Lesotho_Report_Assessment%20of%20energy%20for%20rural%20dev_may2012.pdf*

[xii] *http://erc.nul.ls/about/*

[xiii] *https://erc.undp.org/evaluation/documents/download/8779*

[xiv] *http://sasei.nust.na/sites/default/files/NUL-ERC-PressRelease-May2017.pdf*

Country profile – Malawi

1. Overview

Indicator	Data
Population	17.21 million
Population density	139 persons/km^2 (2008 population and household census); 184.3/ km^2 (2016 estimates NSO)
Global Tracking Framework Indicators [i]	
Access to electricity	11.9% (46.1% urban, 4.7% rural)
Access to improved cooking	3.18%
RE as proportion of the mix	80.6% (traditional solid biomass: 34.4%, modern biomass: 37.1%, hydro: 9.1%)
Other Indicators	
Reliance on energy imports (2014) (IEA)	97% of refined petroleum
Centralised or liberalised electricity sector	Liberalised
Bundled generation, transmission and distribution?	Unbundled as per January 2017 into EGENCO (generation) and ESCOM (transmission and distribution)
Existence of renewable energy IPPs	Yes but not yet operational; only one is licenced
Import duties on renewable energy products	Yes. Import duty exemption on pico-solar
RAGA/ AA/ IP	RAGA (but not available)
Renewable energy strategy	Draft not yet approved
Number of EEP Phase I & II projects	None
Total EEP contribution (% of total budget)	N/A
Average daily solar irradiance [ii]	6,450 Wh/m^2/day
Electricity subsidies	Yes [iii]
Fuel subsidies	Kerosene [iv]

Malawi's major energy sources comprise of biomass (89%), liquid fuels and gas (6%), hydro electric power (3%), coal (1%) and solar power (0.2%).[v] Although wind, geothermal and nuclear power are considered to form part of the potential sources of energy, there are currently no substantive power plants established for this purpose.

By usage, biomass dominates all sources of energy consumption across Malawi. In fact, biomass provides 99.4% of all energy consumption in rural areas while it accounts for 35% of all energy consumption in urban centres.[vi] This is followed by liquid fuels at about 6%, electricity at 2.3% and the remainder comes from coal and solar power. So, although the National Energy Policy 2003 undertook to reduce reliance on biomass to 50% by 2020,[vii] there has been only a 4% change over the past 16 years. By consumption, the energy sector is dominated by households which use

up to 83% of the total energy. This is followed by manufacturing industries at 11.9% and the service industry at less than 2%.[viii] This means that households constitute Malawi's main energy market.

Technologically, with the exception of biomass, generation of power in Malawi is dominated by hydroelectric power which accounts for 94% of all electricity generated in Malawi while thermal (coal and generators) provide 5.8% and solar PV the remaining 0.2%.[ix] Access to electricity is available to only 11.9% of the total population, with 99% thereof concentrated in urban centres.

2. Institutional framework

Institutional structure

From an energy governance perspective, the energy sector in Malawi has the following institutional setup:

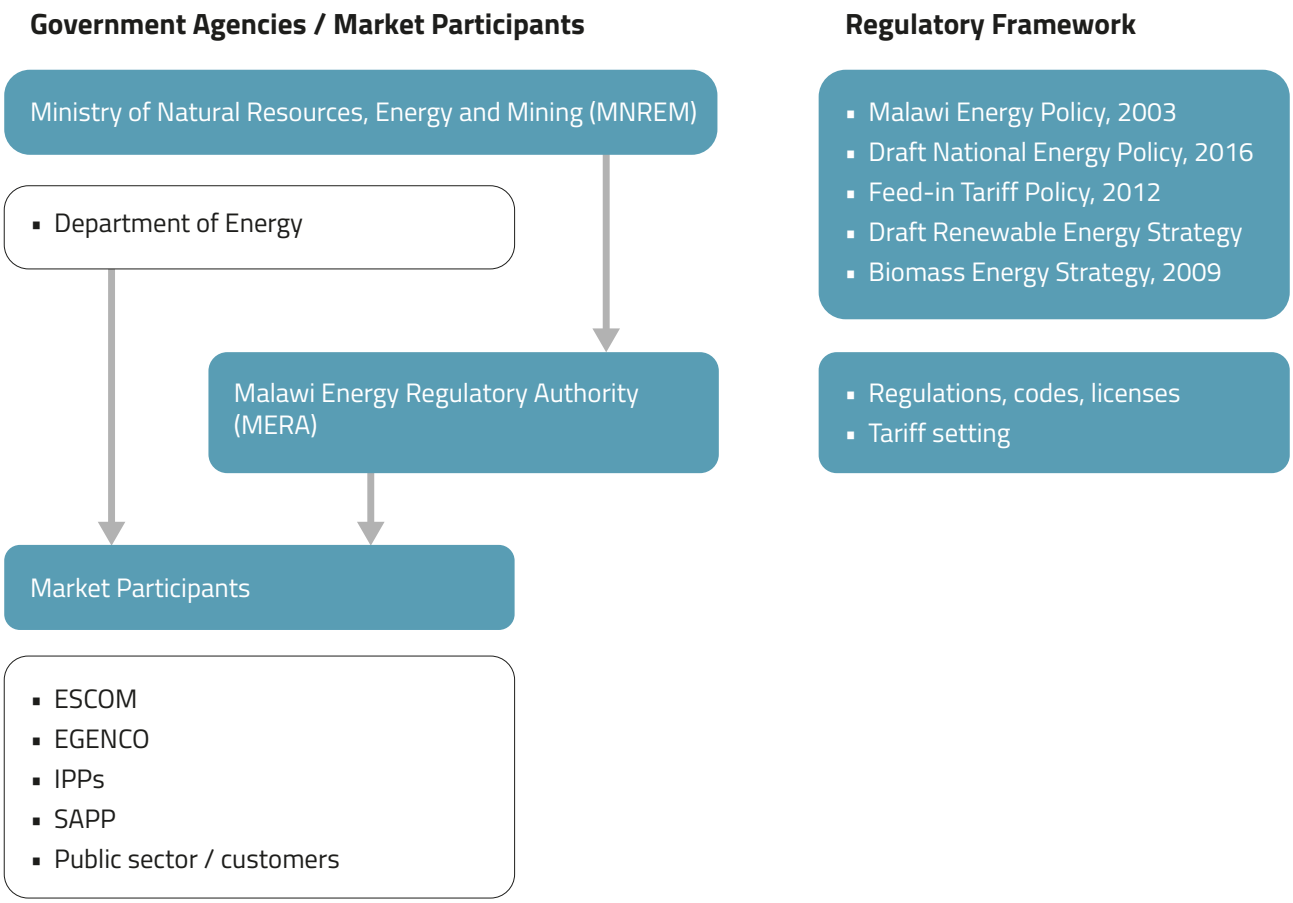
Table 1: The key institutions in the sector and their roles

Institution	Role
Ministry of Natural Resources, Energy and Mining (MNREM)	Energy legislation and policies. Responsible for all upstream energy activities such as exploration and extraction of fossil fuels and minerals, which may be used as sources of energy.
Malawi Energy Regulatory Authority (MERA)	Statutory corporation created under the Energy Regulation Act, 2004, which mandates MERA to regulate all activities in the energy industry including licensing, approving tariffs, monitoring and enforcing compliance, developing standards etc.
Electricity Supply Corporation of Malawi (ESCOM)	State-owned power producing company; in control of transmission and distribution of electric power in the country. Used to be in charge of generation, but was unbundled as from 1/1/2017 as part of the energy reforms aimed at improving the efficiency of energy provision in the country.
Electricity Generation Company Ltd (EGENCO)	Following the reforms, EGENCO was established and will solely be responsible for electricity generation starting 1/1/2017
Malawi Electricity Generation Agency (MEGA)	The first licenced generator and distributor of electricity in the Mulanje region based on micro-hydro power.

Political framework

The National Energy Policy (2003) set out to achieve three long-term goals, namely, to make the energy sector sufficiently robust and efficient to support government's socio-economic agenda of poverty reduction, sustainable economic development, and enhanced labour productivity; to catalyse the establishment of a more liberalised, private sector-driven energy supply industry in which pricing will reflect competition and efficiency; and to transform the country's energy economy from one that is overly dependent on biomass to one with a high modern energy component in the energy mix.

Figure 1: Institutional structure for the energy sector in Malawi



Following the review of the NEP 2003, the Draft National Energy Policy 2016 states its main goal as "access to affordable, reliable, sustainable, efficient and modern energy for all Malawians by 2030." It has seven specific objectives that include strengthening the electricity supply industry and making it more efficient and capable of providing adequate, affordable and reliable electricity supply for industrialisation; rural transformation, sustainable economic development and wealth creation; ensuring availability of LPG, biogas and natural gas in sufficient quantities at affordable prices for industrial and domestic purposes; and to enable households and institutions move away from biomass to LPG, biogas and natural gas, as fuel for cooking and other purposes; and ensuring the establishment of a vibrant, reliable, incentivised and sustainable private sector driven Renewable Energy Technologies (RETs) industry.

The Feed-in Tariff Policy (2012) is intended to facilitate renewable energy resource mobilisation by providing investment security and market stability for investors in electricity generation from renewable energy sources, reduce transaction and administrative costs and delays by eliminating the conventional bidding processes, and encouraging private investors to operate their power plants prudently and efficiently so as to maximise returns.

The Draft Renewable Energy Strategy (not published) recognises that the use of renewable energy technologies have the potential to increase the productivity of industries and businesses. It puts forward various strategies that Malawi needs to implement in order increase the market penetration of renewable energy sources.

The overall objective of the Biomass Energy Strategy (2009) is to ensure a sustainable supply of affordable wood-fuels through increased supply of sustainable wood-fuels, established efficient usage of energy and creation of institutional capacity to manage the biomass energy sector effectiveness in the implementation of the strategy.

Malawi has a very well developed legal framework governing the energy sector subject to some minor observations. There are 6 main laws, namely: (i) the Energy Regulation Act (ii) the Electricity Act (iii) the Rural Electrification Act (iv) the Liquid Fuels and Gas (Production and Supply) Act (v) the Environment Management Act and (vi) the Malawi Bureau of Standards Act. Through collaboration with the Malawi Bureau of Standards (MBS), MERA has been able to promulgate Malawi Standards (MS) regulating minimum quality standards of some products used in the energy industry such are wires, solar panels, light bulbs, etc.

3. Technology review

Energy Sources now and in the future

Malawi has seven main potential sources of energy, namely: biomass, liquid fuels and gas, hydro electric power, coal, solar power, wind power, and nuclear power. At the moment, only the first five are being used with biomass contributing almost 90% of the total energy needs of the country, followed by liquid fuels and gas at 6%, then hydro electric power at 2.3% and coal and RETs contributing the remaining 1%. However, going into the future, the Energy Policy 2003 projected a steady increase in the uptake of hydroelectric power and solar power as shown in the table below.

Table 1: Renewable Energy Baseline and 2030 Targets

RE source	2016 capacity	2030 target	Target Percentage
Large hydro	281.5 MW	1,471 MW	Percent of generation: 56
Small hydro	4.35 MW	103.35 MW	Percent of generation: 4
Solar	.38	550 MW	Percent of generation: 21
Bagasse	18 MW	46 MW	Percent of generation: 1.8
TOTAL	**303.85**	**2,170 MW**	**Percent of generation: 83**

Hydro

Generation of power in Malawi is dominated by hydropower on the Shire River and South Rukuru Rivers. This accounts for 94% of all electricity generated in Malawi. There is considerable potential for mini-grids in rural areas due to the cost of connecting to the grid. Only 30% of the rural population is planned to be connected to the grid by 2030. The rest will be served through mini-grids and PV. However, the main rivers in Malawi are fed from Mount Mulanje, which is being rapidly deforested. Protecting the watershed is vital to ensuring that the water sources are sustained.

Solar

It is estimated that between 2011 and 2015, over 300,000 pico solar products have been sold in Malawi, representing market penetration of about 1.8%. By 2016, it was estimated that there were 5,000 solar home systems, 2, 000 solar water heaters and more than 7 off-grid mini grids supplying electricity to about 900 people.[x] Based on current sales volumes provided by SunnyMoney, pico-solar products are fast becoming an alternative source for lighting, replacing the wick paraffin lamps. The benefits of pico-solar products is obvious as, if used as a substitute for a paraffin or kerosene lamp, it repays itself in 3-4 months.[xi] This presents an opportunity for a growing market of pico-solar products and other solar systems as communities get to realise the advantages of this technology, and as distribution-channels and consumer financing-services become better developed.

Six solar-wind hybrid systems were established across six districts with a capacity of 25 kW each. However, they fell into disrepair due to the cost of replacement of the batteries. The Ministry of Energy and Mines acknowledged that a viable business model had not been developed.

Biomass, stoves and biogas

Biomass forms Malawi's mainstay source of energy. However, it is estimated that at the consumption rate of 7.5 million tonnes annually, the use of biomass is unsustainable. This rate is more than twice the recommended sustainable supply of 3.7 million tonnes per year. The Malawi Biomass Energy Strategy, 2009 rises to this challenge and sets out to 'ensure a sustainable supply of affordable wood-fuels' by increasing the supply of sustainable wood-fuels, the efficiency of energy use and creating the institutional capacity to manage the biomass energy sector effectively.

Currently the Government, donor community and NGOs have heightened efforts to increase the manufacture, use and uptake of improved cook stoves as one way of reducing the rapid deforestation and improving energy efficiency. It is estimated that there over 500, 000 improved cook-stoves currently in use.[xii] The Draft National Energy Policy, 2016 puts biomass as the second priority policy area under which the Government shall 'build strong partnerships with the private sector and NGOs (including PPPs) to promote the manufacture, supply, use and financing of improved cook stoves, brick kilns, charcoal kilns and biomass briquettes and pellets'.

Wind

Malawi has potential for wind energy with wind speeds averaging 2-7 m/s[xiii] especially along the shores of Lake Malawi. A recent study on grid capacity indicates that renewables development of solar and wind of 15 to 17 MW (dependent on location) could be accommodated across the network up to a maximum total capacity of 70 MW[xiv]. However, with exception to small scale wind powered water pumps, there are no medium or large scale wind powered electricity generation both on-grid and off-grid at the moment.

Geothermal

Currently geothermal energy is not being exploited. A study performed by the UN Environmental Programme indicates a potential for geothermal power development in Malawi, with 21 key hot springs having been reported in the region of Chitipa-Karonga down to its southern region.

4. Stakeholder review

The energy sector in Malawi has a number of key stakeholders ranging from Government ministries, departments and agencies to private independent power producers and social private enterprises. Below is a summary of the most notable stakeholders in the energy sector based on their current involvement.

The donor community plays a critical role in the energy sector from sponsoring legal and policy reforms to infrastructure development and popularisation of energy access and promotion of the use of cleaner and more efficient forms of energy. The promotion of solar and mini hydro off-grid power solutions and improved cook stoves are largely sponsored by donors. Most of these initiatives are implemented by a number of Non-Governmental Organisations (NGOs), which work directly with communities. For example the supply of off-grid mini hydroelectric power in Mulanje is only made possible by the combined efforts of UNDP, Scottish Government and the Mulanje Energy Generation Agency (MEGA) and the communities concerned.

The energy sector, and specifically renewables, is characterised by poor coordination. This means that as a sub-sector, there is a lack of influence over public policy and that efforts are being duplicated in addressing similar challenges.

SUMMARY OF KEY STAKEHOLDERS IN THE ENERGY SECTOR				
MDAs	**DONORS/ Cooperating Partners**	**NGOs**	**PRIVATE SECTOR**	**CONSUMERS**
Ministry of Natural Resources, Energy and Mining Department of Energy Department of Forestry Department of Environment Affairs and Climate Change Malawi Energy Regulatory Authority Malawi Bureau of Standards ESCOM EGENCO NOCMA Malawi Revenue Authority	UNDP DFID USAID Irish Aid MCAMalawi NORAD BIF	Cooperation Network for Renewable Energy in Malawi (CONFREMA) Total Land Care Oxfam EvDev/MAEVE Concern Universal/ United Purpose Practical Action Community Energy Malawi Sunny Money Mbaula Network Mulanje Renewable Energy Association	38 IPPs Mulanje Energy Generation Agency	Households (84%) Commercial Industries (15%) Service Industry (2%)

5. Market review

Malawi is one of the least developed countries in the world, with latest estimates showing it to be at the bottom of the last 10%, with gross domestic product based on purchasing-power-parity (PPP) per capita Gross Domestic Product (GDP) of about USD780 in 2013. GDP composition by sector in 2013 was 27% agriculture, 18% industry and 54.2% services. Agriculture is the mainstay of Malawi's economy and supports 84.7% of the population residing in rural areas. It also accounts for 27% of the GDP, 90% of export earnings and 46% of wage employment. Over 80% of the labour force is engaged in agriculture. These factors must be borne in mind when considering Malawi as an energy market.

On-grid

Since the launch of the new IPP framework, the Government of Malawi has signed term sheet agreements with 27 IPPs that will generate power from coal, liquid fuels, biomass, solar, wind and hydro-sources. CDEN, a French company, is planning to build a 100 MW solar power plant and the Pamodzi Coal-Fired Power Plant will generate 120 MW.

One concern that has been raised both by ESCOM as an off-taker as well as several IPPs, is that the tariff regulations under the Energy Regulation Act and the Feed-in Tariff Policy are too prescriptive to allow for private sector investment in the energy industry. The first issue relates to subjecting all tariffs to the approval of MERA, which in some cases results in the charging tariffs that are not cost effective.[xv] Secondly, the Feed-in Tariff Policy only entitles ESCOM to recover 75% of the cost from customers while the IPP is entitled to recover 100% of the cost. This means that ESCOM would be forced to subsidise power supply without any financial gain to it.

Off-grid market

83% of energy is consumed by households compared to only 11.9% consumed by industry. In terms of the EEP & SEA focus on off-grid power generation and supply, the demand analysis shows that 88.5% of all energy consumed comes from biomass.[xvi] For lighting purposes, however, the majority of people in the rural areas use paraffin wick lamps. For the majority of rural people, they do not have to pay for firewood as they use trees on their lands or communal woodlots and crop residues. This means that although in theory, rural electrification is projected to reduce biomass dependency, the majority of the rural people are too poor to afford paying for electricity and to buy electrical appliances required for cooking or heating water.

The market for electricity appliances lies in other services: lighting, communication technology (phone charging, TV, radio), ventilation, refrigeration, etc. The strategy aims for 100% access to pico-solar product by 2030. Grid extension is planned to provide 30% of the rural population with electricity in 2030, but the current level of IPPs is less than desired and the national strategy underlines the need to set a national target for IPP involvement as well as addressing barriers.

RETs generally have high upfront costs to procure and install. Supplying off-grid power to rural communities means that the operator has limited chances of recovering quick returns on the capital due to the high poverty levels, which in turn affect the people's ability to pay for power. From an investment point of view, rural energy markets are subprime, risky and uncompetitive. Faced with this reality, commercial banks are reluctant to finance small-scale off-grid power generation ventures.

Biomass and cook stoves

Concern Universal has done significant work in developing a cook stove value chain. They have not only established a nationally recognised cook stove model and local production but have tapped into carbon credits that are pumped back into the producing communities. However, this has been a long-term investment and full commercialisation of has yet to be achieved. Deforestation in Malawi is one of the most devastating issues for the country, resulting in the deployment of the army to protect the dwindling forest area in August 2016. Unsustainable charcoal production is the major contributor to this trend. The mass production and roll out of cook stoves to urban areas, where the purchase power is greater should be combined with introducing and marketing alternative energy for cooking. However, the strategy will need to consider the whole value chain, including providing alternative employment for the current illegal charcoal producers.

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Lack of legislation on biomass and RETs	▪ MERA cannot effectively regulate the supply and use of these energies on the market in the absence of these laws. ▪ Leads to the proliferation of substandard solar PV and pico solar products. ▪ Leads to the unsustainable exploitation and use of these energy sources, particularly with respect to biomass. [xvii]	▪ Projections show growth in the RETs market. The increased use of solar power in the energy mix means that there will be more opportunities for increased market penetration of RETs between now and 2030 ▪ Increased energy access targets and energy sources in the Draft National Energy Policy. Malawi targets for RETs by 2030 are: ▪ 75,000 SHS (Solar Home System) ▪ 13,500 mini grids ▪ 4, 500,000 pico solar products
Over-prescriptive tariff regulations and policy	▪ All tariffs are subject to the approval of MERA which sometimes result in tariffs that are not cost effective. ▪ The Feed-in Tariff Policy leads to losses for ESCOM when the FiT is higher than the tariff charged to the end customer. Thus ESCOM subsidises power supply without any financial gain to it.	▪ The unbundling of ESCOM has created the much awaited space for the private sector participation in the generation, transmission and distribution of electric power. Currently, ESCOM is already soliciting bids for the provision of 70MW from independent power producers. This will open up the RETs market in Malawi for on-grid power supply as well as off-grid power supply. ▪ The Feed-in Tariff Policy is set for review on the adoption of the New National Energy Policy.
Imposition of VAT on RETs	▪ Although the Government has waived all import duties on RE technologies, the customer still has to pay 16.5% VAT of the purchase price. This may explain the low market penetration of RETs	▪ The entry into the energy market of large scale solar independent power producers may create a conductive environment for removal of purchase VAT on RETs.
Lack of appropriate technical skills and financial capacity lead to poor working solar PV	▪ Facts on the ground show that most of the solar PV installations are not working either due to poor installation, lack of proper maintenance or inability to acquire new batteries. ▪ Reason a: Malawi's general lack of appropriate technical skills to install, repair or maintain the systems. ▪ Reason b: people's low financial capacity to buy replacement batteries once the initial batteries' life span runs out.	▪ The opening of Renewable Energy Department at the University of Mzuzu and the provision of RETs training may minimise the problem in the medium to long term
Poor coordination between stakeholders	▪ Many players in the energy sector disparately doing more or less the same things, but lacking coordination. ▪ As a sub energy sector, the players do not speak with one voice to influence public policy. ▪ Time and resources are wasted by doing the same things at the same time.	▪ The creation of the Malawi Renewable Energy Partnership Group comprising of MDAs, Donors and NGOs in the energy sector based at the Department of Energy may improve coordination
Limited small scale funding opportunities	▪ High rural poverty limits off-grid operators' ability to recover up-front investment costs. ▪ Commercial banks are reluctant to finance small scale off-grid power generation ventures as there are no guarantees that such ventures would be able pay back the loans.	▪ This means that the majority of mini hydro and off-grid solar systems are either donor funded or Government funded.

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Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Inability to pay for energy	▪ Over 80% of the population lives in rural areas, the majority of whom live below the poverty line, so they are unable to pay for energy	▪ The rapid growth and uptake of pico solar is providing new energy tastes and demands which may affect people's willingness to pay for improved and cleaner sources of energy
Low commercial power demand	▪ Malawi has a very small industry base. ▪ The mere availability of additional power may not necessarily lead to an increased use of energy. ▪ The low commercial power demand may dissuade potential investors from investing in energy.	▪ Growing national and international interest in increased access to energy and the use of cleaner and efficient energy (SE4ALL) ▪ Availability of funding opportunities for greener energies (GEF, REDD+)

7. Implications for the Theory of Change

The discussion of the gaps, barriers and opportunities above presents the two sides of the energy market in Malawi, which has an implication on the design and approach that the EEP & SEA ought to take into account before rolling out its interventions.

The purchase power of poor Malawians is very limited. At the same time, the failure of the six solar villages that provision of free off-grid power without accompanying cost recovery measures is doomed to fail. MEGA micro-hydro scheme has failed to establish a viable business model and are now scaling production up and boosting productive uses. Finding the right business model for the provision of financing off-grid renewable energy based systems across Malawi will require various options to be tested. Some stakeholders have suggested that the social enterprise business model or PAYG model may be among some more realistic approaches to be taken.

In conclusion therefore, there are a number of small scale off-grid renewable energy systems being tried in Malawi but none of them have existed long enough to provide clear lessons on what works better and what does not. EEP & SEA has a part to play in fostering the transfer of successful business models and supporting the private sector in adapting to the local context. The success of off-grid energy solutions will largely depend on the extent to which it may meet the energy needs of the rural underserved population as well as their ability to pay.

[i] *http://gtf.esmap.org/*

[ii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System - Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iii] *http://www.ijretr.org/IJRETR_ Vol.%206,%20No.%204,%20April%202017/Electricity.pdf*

[iv] *Rapid Assessment Gap Analysis Rwanda, 2014*

[v] *Draft National Energy Policy 2016*

[vi] *Biomass Energy Strategy, 2009*

[vii] *National Energy Policy, 2003*

[viii] *Draft National Energy Policy 2016 and Support to SE4ALL Country Actions, Processes in Malawi: Action Agenda*

[ix] *National Energy Policy Review Status Report , 2016*

[x] *Support to SE4ALL Country Actions processes in Malawi Action Agenda*

[xi] *Pico Solar Products (PSP): Market Analysis and Strategy, 2014*

[xii] *Draft Support to SE4ALL Country Actions processes in Malawi Action Agenda Report*

[xiii] *Malawi Energy Profile, 2013*

[xiv] *Grid Capacity Study, 2016*

[xv] *Draft National Energy Policy, 2016*

[xvi] *Biomass Energy Strategy, 2009*

[xvii] *See the Draft National Energy Policy, 2016*

Country profile – Mozambique

1. Overview

Indicator	Data
Population	27.97 million (2015)
Population density	36 people/km^2
Global Tracking Framework Indicators [i]	
Access to electricity	21.22% (urban 53.75%, rural 5.97%)
Access to improved cooking	4.39%
RE as proportion of the mix	88.85% (traditional biomass 70.43%, 91.16% of electricity, modern renewables 9.62%)
Other Indicators	
Reliance on energy imports (2014) (IEA)	Net exporter
Centralised or liberalised electricity sector	Centralised
Bundled generation, transmission and distribution?	Bundled
Existence of renewable energy IPPs	Yes
Import duties on renewable energy products	Yes
RAGA/ AA/ IP	No
Renewable energy strategy	Strategy For New And Renewable Energy Development (EDENR) 2011-2025
Number of EEP Phase I & II projects	14
Total EEP contribution (% of total budget)	€ 3,084,467 (44%)
Average daily solar irradiance [ii]	5,770 Wh/m^2/day
Electricity subsidies	Yes [iii]
Fuel subsidies	Yes (petrol, diesel, gas) [iv]

The generation of electricity in Mozambique has been met by the significant hydropower resources, making Mozambique an important contributor to the Southern African Power Pool. However, the widely spread rural population has posed a challenge for the Ministry of Mineral Resources and Energy, and the Fundo de Energia (FUNAE) to achieve significant rural electrification. Logistical challenges in accessing remote communities affect the ability of the government and private sector to achieving their goal of 100% energy access by 2030.

2. Institutional framework

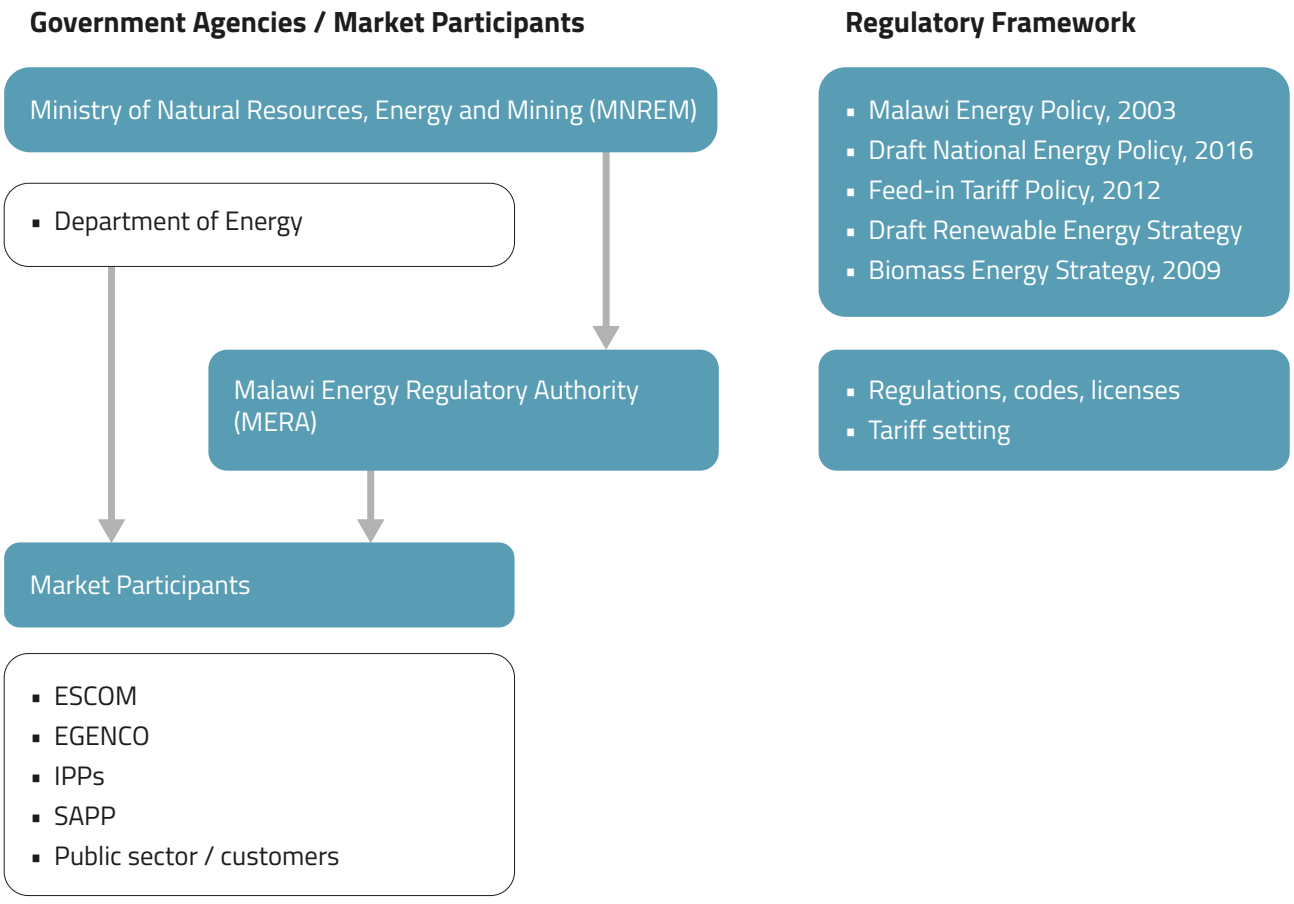
Institutional structure

The Ministry of Mineral Resources and Energy is responsible for national energy planning, policy formulation and overseeing the operation and development of the energy sector. The Conselho Nacional de Electricidade (CNELEC)

is a governmental consultative body in tariff setting and issuing generation concessions, conciliation, mediation and arbitration authority for disputes between different concessionaires, as well as between concessionaires and consumers. It has administrative and financial autonomy and a consultative mandate. CNELEC is being transformed into the Energy Regulatory Authority (ARENE), a fully independent body with executive powers covering the whole energy sector. This process is not complete as yet.

Electricidade de Moçambique (EDM) is a vertically integrated, government owned electricity utility responsible for generating and transmitting electricity, and distributing it through the national grid. Founded in 1977, EDM buys most of its power from Cahora Bassa. EdM currently owns hydro/gas and diesel capacity, as well as the national power grid, excluding lines owned by HCB and Mozambique Transmission Company (MOTRACO).

Figure 1: Institutional structure for the energy sector in Mozambique



Hidroeléctrica de Cahora Bassa (HCB) is the operator of the Cahora Bassa Dam that was built in 1969 by the Portuguese administration. It is the largest power producer in the country with an installed capacity of 2,075 MW. The Mozambican government owns 92.5% of the company and the Portuguese government owns the remaining 7.5%. In 1998, MOTRACO was founded as a Joint Venture between EDM, the South African Eskom Holdings Limited (Eskom) and Swaziland Electricity Company (SEC) principally to supply electricity to Mozal Aluminium Smelters and wheeling between the three partners.

FUNAE was established in 1997 as a public institution. Its objectives are to develop, produce and use different forms of low-cost power and promote the conservation and rational, sustainable management of power resources. Over 60% of the financing has been provided by international funding/donor agencies. Although FUNAE is designed to catalyse and enable rural electrification, it is in fact also operating and maintaining off-grid electricity supply, in a role as a utility.

Policy framework

The energy policy aims to achieve 100% energy access by 2030. "Access" is not clearly defined and could be provided for through grid, mini-grid or off-grid solutions. As of 2011 the national grid supplied about 18% of the country covering in 95 out of the 128 districts. Mozambique's energy potential is one of the highest in Africa, with an installed generation capacity of around 2,475 MW and substantial energy resources, ranging from fossil fuels (natural gas and coal) to renewables (solar, hydro, wind, geothermal and tidal sources of power).[v] In 2014, 92% of the energy came from hydro, 7% from natural gas and 1% of petroleum products. Most of the electricity produced from the hydro is exported and some is imported again due to the lack of a transmission backbone that can transport electricity from the centre of the country, where it is produced, down to the south.

Since 2000, annual energy production has increased by approximately 6%. This expansion is largely driven by developments in the natural gas and hydro markets. There is currently a 110 MW gas-fired plant being built, two coal-fired power plants of 900 MW, and a 1.5 GW large hydro project to be led by the Brazilian power company, Electrobas, however the project is controversial due to its environmental impact.

In 2009, Mozambique approved a policy for renewable energy followed by a strategy that was approved in 2011. The aim is to develop national renewable resources for generating electricity, ensuring that demand can be met, diversifying the energy mix and preserving the environment. This is to be accomplished by using both off- and on-grid applications. The off-grid component is linked to the Action Plan for the Reduction of Absolute Poverty, which considers access to electricity as a catalyst for poverty alleviation and economic development.

Despite the promotion of rural electrification and the establishment of FUNAE as the body to further this goal, the vast distances in Mozambique and the spread out homes combined with the sheer numbers makes it hard to imagine that the target of full electrification will be met by 2030 through business-as-usual measures. Despite significant National and Donor support provided to rural electrification, the current electrification rate is still low around 22% and only around 6% in the rural areas. Action is required to mobilise the deployment of the private sector for installation, operation and maintenance of the rural energy systems.

The government has developed the regulations for the Renewable Energy Feed-in-Tariff (REFIT) framework targeting plants below 10 MW. The tariff is differentiation by plant size and technology. Due to the political instability in 2014/15 and the devaluation of the local currency the current REFIT is not sufficient to attract private investment. Currently, all renewable energy equipment is imported and with a weak currency and low electricity prices the private sector is not adequately incentivised.

The government has completely revised the legal and fiscal framework for the mining and hydrocarbon sectors, with a view to increasing revenues and enlarging domestic participation, a very important issue for the country in light of the history of ownership of Cahora Bassa dam. The issue of job creation is important and does refer to all potential investments in the energy sector.

Mozambique has not yet developed targets or specific interventions for energy efficiency. The grid-electricity is relatively cheap compared with prices in the region and relatively stable in the sense that the connected consumers seldom experience blackouts. Therefore the typical drivers of energy efficiency policy are not in existence.

3. Technology review

Renewable energy

As mentioned above, Mozambique has significant resources that exceed national energy demand for the next few decades. The Government of Mozambique published the Renewable Energy Atlas of Mozambique 2014 that provides mapping on a technical and economic prefeasibility level, of 1,500 renewable energy project sites, 85% of which are hydropower sites. Four hundred and twelve of these projects are considered to be high priority.[vi] Pursuant to the Atlas, the potential of the renewable sources is the following the following potentials from these priority sites: 1.4 GW from hydro, 600 MW from solar, 230 MW from wind and 128 MW from biomass. Over 10,000 villages assessed presented potential for renewable or hybrid systems of between 5 and 100 kW. Solar hybrid and wind hybrid were assessed to be the most economical.[vii]

Hydro

The main emphasis to date has been on large-scale hydropower plants, although this is changing due to the large discoveries of coal and natural gas. It also reactivated the Hydroelectric Project Implementation Technical Unit to increase the speed at which investment projects in the areas of power production and transmission are being implemented. FUNAE implemented, operated and maintained the first micro-hydro system at Majaua to be implemented in over 20 years under the ACP-EU Energy Facility. However, the floods of 2015 caused irreparable damage to the powerhouse and equipment. Pico-hydro power (>5kW) is considered to be one of the most cost-effective options.

Solar

Solar is used for mini-grids and stand-alone solutions and FUNAE reports on 2 mini-grids, each just under 500 kW. Solar home systems are used for off-grid electrification and EEP has also supported a solar home systems project implemented by FUNAE. The most significant challenge in the projects implemented has been the reliance on FUNAE as the operator of the installations.

Solar water heaters are not a dominant technology in the market largely because those households that can afford hot water also live in areas that are well served with relatively cheap grid-connected electricity.

Biogas

EEP has supported several projects in Mozambique including pilot biogas projects and despite documented success in the pilot project, there has been no structured process to use the learning from the pilot project to introduce biogas on a larger scale. The EEP project was established at a hospital and the biogas energy was used to sterilize equipment, heat water and cooking.

Biomass

The biomass resources include forest biomass with more than 1.7 million hectares of forests from which there is enormous potential for energy production, estimated to be around 1.006 MW.[viii] Industrial and agro-industrial biowaste includes the paper and pulp industry and an estimated capacity of around 280 MW. The sugar industry is assessed to represent 831 MW of unexploited energy resource. It is estimated that there is a potential of 63 MW production potential from landfill sites.

Less than 5% of households in Mozambique use a modern form of energy for cooking at home, the remainder use charcoal and wood fuel. In rural areas, where the majority of the population lives, 97% of households rely on daily wood fetching for their energy needs. In urban areas charcoal has become the prevailing fuel of choice, accounting for approximately 50% of all energy consumption expenditure.

Mozambique has seen numerous improved cook-stove projects in the past decade. EEP has also supported improved cook stoves through Kulima and through ADPP. Currently GIZ is coordinating a multi-donor large programme for rural energy access (EnDev) Energy for Development. Included in this programme is the dissemination of improved cook stoves. GIZ undertakes initial testing to check actual wood savings from the stoves. Women mostly cook outdoors and the improved cook stoves are not fitted with chimneys.

Wind

Mozambique has winds of moderate-low intensity with average speeds between 4 and 6 meters per second at 80 meters height. However, in the south of the country and in the highlands of the Centre and North, winds can reach higher speeds. The wind regime in the coastal areas is relatively stable throughout the year with higher intensity between the months of September to November.

Based on wind maps and wind measurements from over 60 sites, it is estimated that Mozambique has a wind potential in the order of 4.5 GW of which around 1.1 GW is exploitable in areas allowing for immediate connection to the grid. Within this sub-set, about 230 MW are considered projects with high potential, characterised by having more than 3.000 NEPs (equivalent hours at rated power). The remaining 3.4 GW of potential wind projects identified are constrained by the weak national electricity grid.

4. Stakeholder review

As mentioned above, GIZ in collaboration with Norway, Holland, Swiss, Sweden, UK Aid and previously also Australia and Denmark is coordinating EnDev, a large-scale programme. EnDev is a rural energy access programme testing stoves and solar home systems and tendering technology to be purchased from suppliers and partnering with NGOs to see the implementation through. GIZ performs the oversight and monitoring role.

The Associaçao Lusofono de Energias Renovaveis (the renewable energy association for Portuguese-speaking countries, ALER) is currently supporting the setting up of Associaçao Moçambique Energias Renovaveis (AMER). The association will be officially launched in October 2017. The main mission will be to promote business development, local capacity building and information/ knowledge exchange. AMER could provide the coordination that has been missing. FUNAE among others confirm their participation under the AMER umbrella.

The private sector in the energy fields are mainly hardware supplier, is largely non-existent and because both FUNAE and the GIZ's preferred rural energy access model has focused on separate supply import and installation contracts and no maintenance contracts the private sector has not really established itself inside the country. Based on the revised macro-economic policies and the design of the new UKAid energy programme it is likely that increased local production could emerge. Most companies operating in the energy space have external head-offices.

Mozambique has a well-established NGO sector also covering energy. The many NGO's have a long tradition for operations in the field and many rural energy access successes, including the promotion of cook stoves.

Mozambique has a relatively well-developed banking sector but with the recent downgrade of the economy to RD (Restricted Default), the lending appetite has reduced. A main player in the energy space is the BCI Bank, which operates several credit lines including a KfW credit line directed toward the energy sector. BCI has taken the initiative to have their staff trained by KfW on energy risks, energy projects and opportunities.

Mozambique's energy sector has received support from a significant number of donors and many have supported rural development, including energy. To date, the World Bank, EU, AFD, the Portguese, Spanish, Chinese, Indian, Danish and Finnish governments have contributed to the sector. Funds have and are being made available for pilot schemes and there are a significant number of reports documenting links between interventions and developments.

The Belgian Technical Cooperation (BTC) supports FUNAE with mini-grids in rural areas and has recently initiated a maintenance programme for mini-grids through the private sector.

UKAid is one of the large agencies in Mozambique. Of special relevance to the EEP is BRIHLO (to shine), a GBP 23.7 million programme running over the next 5 years covering rural energy. In particular, BRILMO will incorporate stoves, solar home systems, private sector solar PV mini-grids and technical assistance for institutional support and barrier removal.

Japan is also very active also in the energy sector and has latest in 2017 signed an agreement to build a 100 MW large gas-powered energy plant expected to provide 10% of Mozambique's current electricity need.

5. Market review

Mozambique is currently facing high unemployment and a volatile currency as well as a low-intensity armed conflict between the government and the armed faction of the Resistência Nacional Moçambicana (RENAMO) opposition party is on-going. It cannot be ignored that this is a significant deterrent for investors, particularly since it is only 15 years since the last civil war ended.

The energy sector in Mozambique is quite vibrant, partly stimulated by the FUNAE's impetus to expand rural electrification. However, in the context of the centralised management structure and the significant role of the government in providing energy access solutions at a subsidised price, the market for private sector engagement is somewhat more challenging.

Mozambique's market for off-grid market products is far from developed in comparison to the markets in East Africa. A number of factors undermine the potential dynamic rural development growth. The recent credit downgrading by international lending agencies has affected the Mozambican economy. The market is often viewed as a "hit-and-run" market: off-grid energy products are imported in bulk for sale to specific projects. This approach further undermines the local economy as there are few value-adding activities in the energy market.

To date FUNAE has implemented close to 1,000 off-grid projects, including mini-grid systems. The principal management model has been to oversee the implementation of projects directly. FUNAE oversees the implementation process and undertakes quality control of installations and equipment. While this model has resulted in speedy installations, the model has not generated local jobs in the private sector as FUNAE is using internal resources to operate and maintain systems. It further reduces the ability of the private sector to engage as it has created the perception that the government will provide energy access at low cost.

Recently, FUNAE has established a factory to produce solar panels in a bid to improve the local market. FUNAE sees itself as an alternative, off-grid utility. As FUNAE's services are subsidised and the tariffs that can be applied are required to conform to national tariffs, it is argued that FUNAE's multiple roles dampens the market for the private sector. The counterargument is that someone must start local solar panel production and since the private sector has not taken up this business opportunity, FUNAE has taken the initiative.

It is estimated that 75% of the Mozambican population lives off-grid. This is equivalent to an immediately addressable market of 21 million off-grid people or somewhere between 2 to 4 million households, depending on the population count in households.[ix] Despite Mozambique having millions of households in need of modern energy services, these households simply may not be able to afford the cost, even if provided on a pay-as-you-go basis, unless the equipment was being installed and the cost of service did not exceed the costs of traditional energy sources (e.g. candles and kerosene). The experience in Mozambique is that grant-donated solar home systems are not maintained due to the cost of parts, particularly batteries.

The SE4ALL assessment of mini-grid markets in Mozambique provides an excellent overview of the market potential based on the average annual expenditure on energy and the potential population. The potential is clearly most significant for stand-alone systems in terms of the area that could be covered and the ease of deployment. However, business models would need to incorporate an effective warranty and maintenance infrastructure to ensure sustainability.

Rural interventions must be mindful about going where the purchase power is and the seasonal nature of income generation in these areas. The establishment of any business needs to be done through existing entrepreneurs and significant marketing is required. The government has often provided the poor households with free services, including free cook stoves. These free services undermine parallel initiatives where stoves are sold through local entrepreneurs. The upcoming AMER might also be used to establish coordination fora for each technology and thus help agree and plan coordinated market approaches that do not undermine each other.

Figure 2: Estimated market size split by grid extension, mini grid and standalone

Province	Grid Extension (population)	Mini Grid (population)	Stand Alone Systems (population)	Percentage Mini Grid (%)	Mini Grid Market Size Estimate ($)
Cabo Delgado	497,884	326,164	1,103,480	16.9	3,668,954
Gaza	844,965	35,039	289,038	3.0	394,147
Inhambane	761,645	288,211	475,893	18.9	3,242,028
Manica	1,713,050	12,788	150,977	0.7	143,850
Maputo	1,012,150	1,889,140	277,503	59.4	21,250,558
Nampula	3,020,700	717,449	1,084,450	14.9	8,070,440
Niassa	738,654	25,853	840,300	1.6	290,815
Sofala	857,987	451,958	431,554	26.0	5,083,985
Tete	788,869	510,900	1,228,760	20.2	5,747,012
Zambezia	1,426,630	1,361,990	1,988,490	28.5	15,320,753
Total	**11,662,534**	**5,619,491**	**7,870,445**	**22.3**	**63,212,530**
Area (km2)	242,831	28,702	403,791	4.3	

Source: SE4ALL Mini Grid Market Opportunity Assessment: Mozambique, 2017

Mozambique has a very well developed hydropower industry for large-scale production. Yet contrary to countries like Nepal where their large-scale hydro-industry has paved the way for a healthy micro-hydro industry Mozambique has seen no trickle-down effect in the industry towards servicing poor or rural areas. The business case for doing so has not been proven.

There is no tax-exemption on renewable energy or energy efficiency components or technologies. There is no VAT exemption or subsidies in place. The landed cost for renewable energy products is therefore high. The electricity price is still subsidised and the national tariff is capped. There is very little uptake in the market for solar water heaters or other domestic appliances. Yet when asked, most report to have an improved cook stove for back up and to have

some solar / or would like to have a solar product for the same purpose. The market for solar would therefore benefit for increased focus on local production are taken up by FUNAE and other main actors the rural energy access market, and more solar factories are established.

Although in general project financing is readily available in Mozambique, banks are not familiar with renewable energy projects, and are therefore risk averse. The typical financing tenors of five to seven years are also too short for renewable energy projects. The capacity of project developers in developing bankable renewable energy project proposals is also weak. Micro-finance institutions (MFIs) have become active since they were regulated by the Central Bank of Mozambique.

The World Bank recently closed an USD$ 18 million project to encourage rural, renewable energy access by financing the implementation of: (i) decentralized micro and small investments, including the installation of 500 solar PV systems in rural school and health clinics, and the electrification of 30 rural villages; (ii) promotion/dissemination of 50,000 improved wood fuel stoves for use in the household and SME sectors, introduction of 1,250 improved charcoal kilns, and support to interfuel substitution for traditional biomass in household and institutions (schools, clinics, etc.); (iii) demonstration projects to accelerate the sustainable market penetration in agriculture, household, SME and for rural mobility, including deployment of 70 multifunctional platforms in rural villages; and (iv) capacity development and institutional strengthening of FUNAE.[x]

Key initiatives that are being undertaken to address these barriers described above and stimulate private sector engagement in the market include the following:

- The Sustainable Energy for Africa (SEFA) funded project to revise the legal framework for mini-grids.
- The UNEP project in Titimane that seeks to demonstrate the potential for private sector investment.
- The DFID funded Brilho project described above is providing similar start-up grants to new businesses and working capital loans to established ones.
- The announcement in June 2017 of a US$ 55 million investment to build Mozambique's first utility scale solar PV plant in Mocuba.

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
The successes of large-scale hydro are not replicated for small-scale	▪ The skills development of local engineers in the large hydro sector has not included business development of a pico- or micro- hydropower generation industry. ▪ The business case for small-scale, off-grid pico-/ micro-hydropower is not available.	▪ Significant opportunities may exist to scale hydro energy to the needs in more densely populated rural areas. The involvement of research combined with knowledge from the EEP funding countries may be very relevant. ▪ Pico- and micro-hydro lend themselves to local production, including the equipment and would therefore generate employment but also place Mozambique in a favorable market position in the region as leading hydro-technology producer. Because of pico- and micro-hydro's relative small unit-cost this market could potentially be interesting to support for the EEP.
VAT and tax incentives	▪ Absence of tax incentives and zero-rating of renewable energy, off-grid products undermines affordability. ▪ Subsidies applied by government further affect the business case.	▪ The attention could be focused toward establishment of local factories for all off-grid technologies. The market is significant enough to warrant assembling and production factories. ▪ Lessons can be drawn from FUNAE's solar panel factory and support could be used as a vehicle to assess the business case for more renewable energy factories. ▪ Donors such as GIZ and UKAid are providing support for barrier removal including VAT and tax clarification.
Maintenance business	▪ Rural energy provision is traditionally treated on a case-by-case project basis. The government or a donor allocates funds, organises a tender, and delivers and installs energy solutions. But most often the maintenance is not addressed. There are non-working energy systems all over rural Mozambique.	▪ Recently, FUNAE has started to train some local manpower in basic repair and fault finding or FUNAE has requested that the installer ensures such training is incorporated. Experience from South Africa's off-grid market show that unless the maintenance is part of the installation package then it is unlikely to happen.[xi] In case of Mozambique, the question remains who will pay the local "repair" person, who will ensure supplies are shipped to the rural areas, who oversees the quality of the repairs, and who controls the payment and income. Additional questions can be added. ▪ Sustained maintenance is only likely to happen if the supply contractor is held responsible for the continued functionality of the energy systems and/or there is a very local business that performs the service. This could be the private sector mini-grid business operator.

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Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Stove market	▪ Government distributions of free stoves add important welfare for very poor people. The free services do, however undermine willingness to pay and therefore, undermines creation of sustainable rural jobs building even simple improved stoves.	▪ EEP has already supported several stove projects and these have been great successes in their own rights but none of the projects have been sustainable. Additional support for stoves in Mozambique should be linked with a firm national decision clarifying where stoves are distributed for free and where stoves are treated as a valued tradable commodity. Conflicting views exist among stakeholders about which approach should be used. The reality may be that both free distribution and sale might be relevant because of the high number of severely poor and the number of poor households. ▪ AMER is assumed to help clarify a market segmentation based on income and physical geographical areas.
Solar home systems and PV market	▪ Lack of standards and national quality approval undermines reputation and durability. ▪ Lack of quality control also may lead to influx of substandard products that in turn will undermine willingness to pay.	▪ The solar market is vast and requires strict standards and quality control. All interventions are recommended to include an element of contribution to build up test laboratories and systematic quality control of all solar home systems and solar products.
Energy efficiency	▪ Relative low price on electricity and relative sufficient supply reduces the acute need for energy efficiency. ▪ Absence of a national energy efficiency strategy with endorsable goals and interventions reduces energy efficiency options to voluntary options.	▪ The surplus energy supply is under pressure due to the electrification expansion combined with general growth of the middle class with some purchase power. This opens a market for industrial and households energy efficiency in the medium term. ▪ Options for local production may enhance the energy efficiency market, as local products will be less price affected due to the instability of the local currency. The local production may be attractive if the risk is bought down.
Synergies with other initiatives	▪ The revised budget has been developed and is not yet before Parliament.	▪ EEP could link the programme with other larger projects that are active in the rural energy sector. An obvious potential partner could be the UKAid supported BRILMO that focus on private sector establishment in the rural energy market. The EEP support could be directed towards successful entrepreneurs that need grant support to move from rural mini-grid to rural off grid support. ▪ Other business models exist to link EEP projects with both the BRILMO and the FUNAE implemented maintenance of local solar home systems project funded by the BTC. ▪ Linking EEP with already existing private business initiatives could contribute to reduce not only the project risk but also the turn-around time from application to actual support if a portion of EEP funds were earmarked for Mozambique.

7. Implications for the Theory of Change

The proposed market opportunities for the EEP will not lead to any change in the Theory of Change. The experience from EEP I and II is that regional projects exclude Mozambique because the market are very different from East Africa and also the remaining southern African market. Added to this, the language barrier within the region reduces the degree of collaboration across the region. The main private sector players in Mozambique are Portuguese or Brazilian companies.

As with other countries in the region, the development of bankable projects is challenging in the rural, sparsely populated areas. FUNAE is attempting to fulfil this niche at the moment. The unique dynamic in Mozambique is the role of the government in providing rural energy access and the degree to which subsidies and price caps affect the energy market.

Only around 41% of Namibia's electricity demand is supplied by domestic power plants; the rest is covered by electricity imports from the Southern African Power Pool (SAPP) member countries. Namibia imports power mainly from South Africa, Zambia, and Zimbabwe . In a country where population density is as low as 2.6 people per km^2, the challenge of providing access to electricity to the 79% of the rural population that do not currently have access is in establishing off-grid solutions that are feasible to establish and maintain.

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[i] *http://gtf.esmap.org/*

[ii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System - Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iii] *https://www.export.gov/article?id=Mozambique-Energy*

[iv] *http://zitamar.com/imf-joins-calls-end-fuel-subsidies-debt-crisis-mozambique/*

[v] *Mozambique policy review, Energy Sector, 2015*

[vi] *http://atlas.funae.co.mz/*

[vii] *Mini Grid Market Opportunity Assessment: Mozambique, 2017*

[viii] *ibid*

[ix] *Solar Market Attractiveness Study, 2016*

[x] *http://projects.worldbank.org/P108444/mz-energy-development-access-project-apl-2?lang=en*

[xi] *South Africa Renewable Energy Off-grid Market TOR 3B Sustainability, 2016*

Country profile – Namibia

1. Overview

Indicator	Data
Population	2.4 million (2014)
Population density	2.6 persons/ km^2
Global Tracking Framework Indicators [i]	
Access to electricity	50% (83.2% urban and 21.3% rural)
Access to improved cooking	45.9%
RE as proportion of the mix	28% of total final energy consumption
Other Indicators	
Reliance on energy imports (2014) (IEA)	58% of total final electricity supply
Centralised or liberalised electricity sector	Centralised
Bundled generation, transmission and distribution?	Yes
Existence of renewable energy IPPs	Yes
Import duties on renewable energy products	Yes
RAGA/ AA/ IP	RAGA
Renewable energy strategy	Draft being approved by Cabinet
Number of EEP Phase I & II projects	13
Total EEP contribution (% of total budget)	€2.7m (17%)
Average daily solar irradiance [ii]	6,860 Wh/m^2/day
Electricity subsidies	Yes [iii]
Fuel subsidies	Fuel price subsidy to remote areas [iv]

Only around 41% of Namibia's electricity demand is supplied by domestic power plants; the rest is covered by electricity imports from the Southern African Power Pool[v] (SAPP) member countries. Namibia imports power mainly from South Africa, Zambia, and Zimbabwe.[vi] In a country where population density is as low as 2.6 people per km^2, the challenge of providing access to electricity to the 79% of the rural population that do not currently have access is in establishing off-grid solutions that are feasible to establish and maintain.

2. Institutional framework

Institutional structure

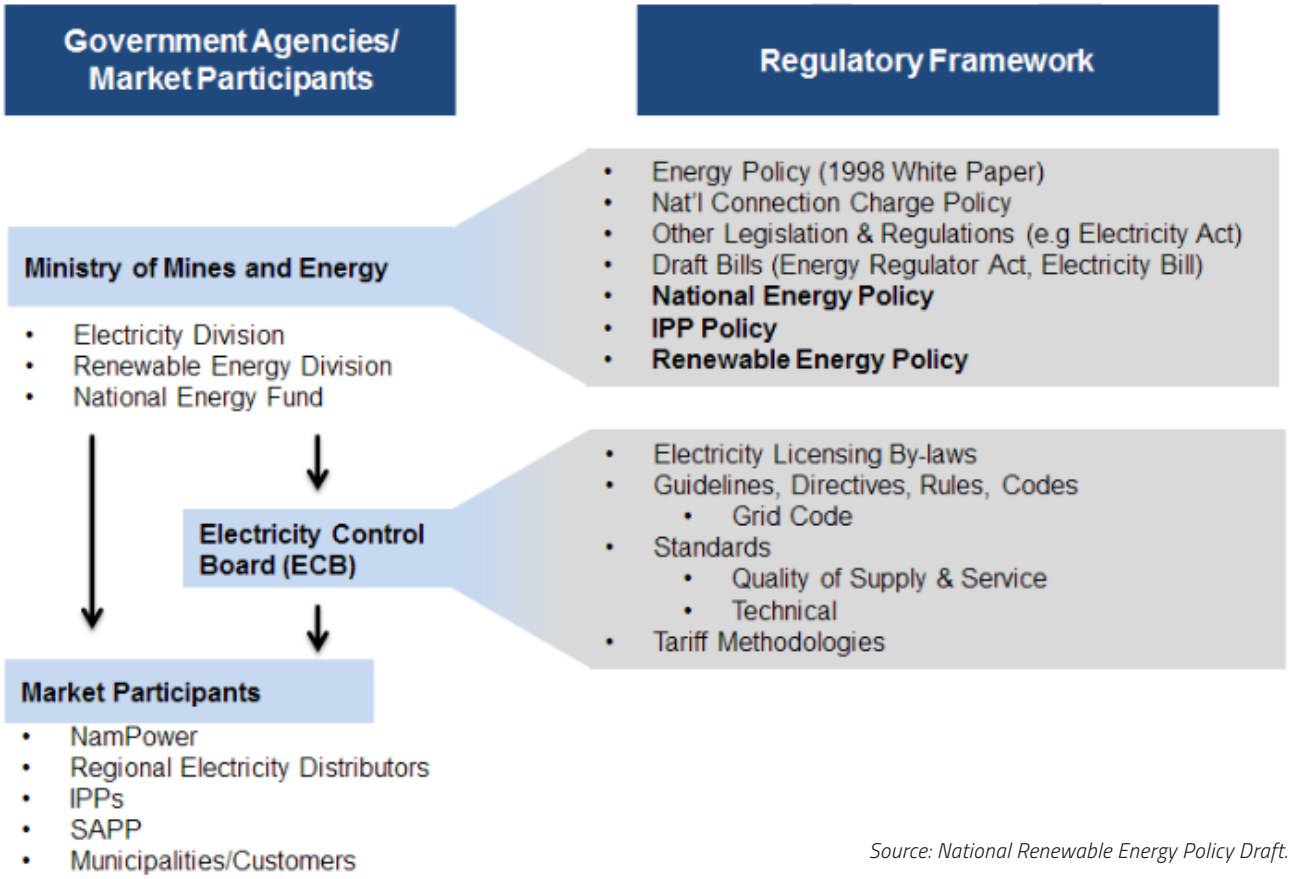
The Ministry of Mines and Energy are responsible for policy guidance and direction of the energy sector. The national regulator is the Electricity Control Board, which was established in 2000. NamPower, the national electricity utility, is a state-owned company with a mandate to generate, trade, transmit, import, export and distribute electricity. Through the Directorate of Energy, NamPower is partly responsible for rural electrification.

There are three Regional Electricity Distributors (REDs), companies namely: Northern Regional Electricity Distributor (NORED), Central North Regional Electricity Distributor (CENO RED) and Erongo Regional Electricity Distributor Company (ERONGO RED), and Local Authorities and Regional Councils who are responsible for distribution and supply of electricity. The owners of a RED (its shareholders) are the participating stakeholders – i.e. the local authorities, regional councils and NamPower, to which stakeholders transferred their assets and/or customers to the RED in exchange for shareholding. There are two off grid systems namely: Tsumkwe Mini Grid, and Gam Solar P.V Mini grid. Fourteen IPPs have been selected and PPAs provided for the generation of electricity from a variety of renewable energy sources, but primarily solar PV. Larger scale IPPs are being contracted through open tender at present.

The Ministry of Finance provides funding for the Environmental Investment Fund (EIF), which supports NGOs, SMEs, and Local Government. The EIF runs a number of loans and guarantees schemes. The EIF has been working with SME Bank to make access to finance more readily available however this was recently suspended to do irregularities at SME Bank. The Development Bank of Namibia provides finance to larger scale IPPs.

The National Energy Institute (NEI), operating under the Namibia University of Science and Technology, has the mandate to undertake research, development, capacity building and awareness creation in the energy field, including energy efficiency. The National Technical Committee on Renewable Energy (NTCRE) headed by the National Standards Institute. The NTCRE develops norms, standards and codes of practice for the performance, manufacture, installation and maintenance of RE technologies.

Figure 1: The institutional and regulatory framework of Namibia's energy sector



Source: National Renewable Energy Policy Draft.

Policy framework

Key policies include:

- The White Paper on Energy Policy 1998
- National Integrated Resource Plan, 2016
- The Electricity Act, 2007
- Rural Electricity Distribution Master Plan (REDMP), 2010
- Off-Grid Energization Master Plan (OGEMP), 2007 (to be updated)
- National Connection Charge Policy, 2015
- National Policy on Climate Change, 2011
- Namibia's Intended Nationally Determined Contribution to the UNFCCC, 2015.

The following policies are being drafted:

- Draft Electricity Bill
- Draft Namibia Energy Regulatory Authority Bill
- Draft Independent Power Producer (IPP) Framework, 2016
- Draft Renewable Energy Policy, 2016 (going through Cabinet). This includes the promotion of productive uses through an inter-governmental implementation committee.

The OGEMP classifies off-grid areas into three categories.

- Off-grid areas are those areas that, according to the REDMP, will not have access to electricity within 20 years.
- Pre-grid areas, as defined in the REDMP, are those areas that would not have access to electricity within five years. However, the OGEMP will only focus on providing access to pre-grid areas that would not have access to electricity within 10 years in the updated REDMP GIS database.
- Grey areas are locations where it is not clear in the 2005 REDMP how or if access to electricity will be provided.

There are three main tools designed for the electrification of the off-grid areas defined in the OGEMP:

- Electrification of rural public institutions;
- Energy Shops; and
- The Solar Revolving Fund.

The REDMP 2010 provides a priority list of 2,879 rural localities to be electrified in the next 20 years; the areas are prioritized based on a points score system. The REDMP also identifies 27 localities for off-grid electrification noting that renewable energy sources are integral. However, the implementation of these key policies has been limited.

3. Technology review

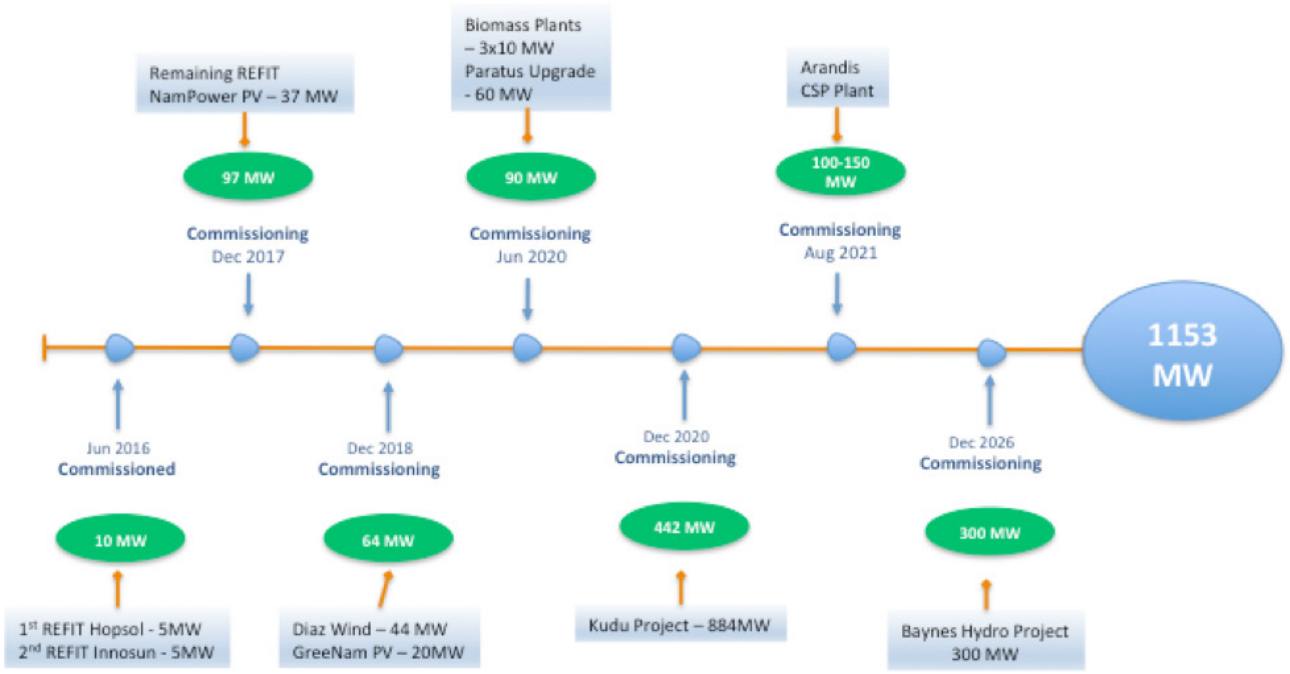
Electricity Supply

The electricity demand through the national grid is supplied by domestic electric power plants (thermal and large scale hydro) and imports from neighbouring countries. The majority of Namibia's local power generation is provided

by four power plants; Ruacana Hydropower station (332 MW), susceptible to rainfall patterns, Van Eck (120 MW) coal-fired plant of low efficiency and high cost as there is no coal mined locally, and Paratus (12 MW) and Anixas (23 MW), both of which are run on diesel. Total installed generation capacity is therefore 487 MW. There are a number of planned initiatives as summarised in *Figure 2* below.

Paratus upgrade 60MW is a diesel plant, Kudu is natural gas, and Hospol and Innosun are solar PV.

Figure 2: New generation coming online between 2016 and 2026



Source: MME, 2016

Renewable Energy

Energy security is a major concern for the Government of Namibia due to the reliance on imports. Electricity production is also susceptible to environmental or seasonal variations in Zambia and Zimbabwe, of which there have been several in recent years, therefore increasing the degree of vulnerability for Namibia. For this reason, the Namibian government is keen on reducing reliance and diversifying energy sources. Electricity Control Board (ECB) has established three levels at which IPPs can integrate with the grid:

i. A net metering policy has been agreed and will be rolled out once the legal and regulatory framework has been defined.

ii. Under the Renewable Energy Feed-In Tariffs programme (REFIT) fourteen IPP projects have been licenced to feed into the grid from solar and wind installations. The maximum installed capacity of these installations is 5 MW and the fourteen projects are expected to add 70 MW to the generation capacity.

iii. Open tenders have been launched for grid-connected PV projects above 5 MW. Three of them – the 10 MW PV Gerus, the 10 MW PV Osana and the 10 MW PV Kokerbook – have been put out to tender by NamPower and IPPs have been selected.

Hydro

Namibia's hydro potential is limited to a few rivers only. However, it should not be overlooked that the Ruacana power plant, the only grid-connected hydro power plant, supplies more than 80 per cent of Namibia´s power generation capacity. There is potential for a number of small-scale hydro power plants (with the capacity of each below 10 MW) on the lower Orange River in Namibia's south, and the Okavango River in the country's north-east. At least 120 MW could be realised if the identified potential throughout the country is developed, and could contribute some 0.3 TWh of green electricity per year.[vii] However, hydro power electricity has a risk of facing drought conditions and this should be taken account of in the planning. The Baynes hydro-electricity scheme (300 MW) with storage dam, also on the Kunene River and downstream of Ruacana, is being planned by Nampower.

Solar

Solar energy potential is the most abundant renewable energy source in Namibia. Namibia has an excellent sunshine regime, which produces annual energy yields of between 1,600 kWh/kWp in coastal areas and up to about 2,100 kWh/kWp in selected locations in southern Namibia. On average, a roof-mounted, grid-connected PV array with a capacity of one kWp will produce about 1,850 kWh of electrical energy per year.

The following PV projects already exist in Namibia.[viii]

- A 64 kWp grid-connected rooftop PV on the NamPower building in Windhoek.[ix]
- Small PV plants with mini grids in Tsumkwe and Gam. Both Tsumkwe and Gam have experienced difficulties in terms of the maintenance and proper use of the installations.
- PV technology is already used to some extent for off-grid applications, providing electricity to farms, lodges, and off-grid homes and businesses, as well as for pumping water, especially in rural areas (often with battery or diesel back-up). However, the potential to further exploit this is considered to be significant.
- Innosun will build a third 5 MW solar park at Aussenkehr, on the banks of the Orange River.[x]

Under its climate change programme, the EU is providing/ replacing solar water pumps to farms in northern Namibia.

Biomass

The so-called invader bush covers substantial areas in northern Namibia. The energy content of Namibian invader bush broadly ranges between 4 and 6 kWh/kg. As well using invader bush for its energy content in the form of wood logs, pellets, briquettes, wood chips or feedstock for combustion it can also be a replacement for wood products in building materials and composite wood products, and as an additive in animal feeds.

The CBEND Project (Combating Bush Encroachment for Namibia's Development) has installed a 250 kW bush-to electricity power plant on a commercial farm in the Otavi area, in one of the most bush infested areas of Namibia. It is considered as a proof-of-concept project to determine the financial feasibility of this approach, assess the technical robustness of the technology, and establish Namibia's first independent power producer.[xi] Although in some quarters, there is doubt about gasification technology for electricity generation.

GIZ has been very active in promoting the use of the invader bush. There are environmental considerations with the removal of the invader bush. The encroachment of the bush is a result of over-grazing the grassland area, weakening the grass and allowing the bush to become aggressive. The risk is that the soil is being depleted, leading to land degradation.

O&L Energy, a project supported by the EEP programme, has established a commercially viable thermal heating plant that supplies hot water to the brewery of its sister company. The high calorific value of the bush means it is efficient however converting this for electricity production has yet to be proven to investors.

Other non-electricity projects and initiatives include:

- Cheetah Conservation Fund's "Bushblok" project uses invader bush to produce wood briquettes, which can replace fire wood;
- Energy for Future's proposed "Bush-to-Fuel Project" envisages providing wood chips for the Ohorongo Cement plant;

Wind

There is only one large-scale installation: the Lüderitz wind park in Walvis Bay built by Innovent with one turbine and a capacity of 220 kW, which was erected in 2005, feeds the power grid operated the by regional provider ErongoRED. Other, non-electricity wind-based projects are the small/micro installations ("American-style" turbines) used for water pumping, which are very common in Namibia, especially on farms. This technology has been successfully used for decades and although the current trend is to replace it with solar energy sources, there were still about 30,000 wind water pumps installed in the country in 2005, the second highest number in Africa.[xii]

The 5 MW Ombepo Wind Farm that will be grid connected is nearing completion. The construction of the US$ 13.6 million wind power project at Lüderitz is being built by a Namibia-French, Innosun Energy Holdings.[xiii]

Stand-Alone and Off-Grid Electricity Solutions

In rural and remote areas where neither the main grid nor mini grids are available, the people depend on standalone electricity sources, mainly diesel generators. In recent years the usage of solar technologies has been increasing and hybrid solar/diesel systems have proved to be technically sound off-grid solutions for people in areas far away from the national grid4. However, there are challenges due to the sparse population. Elephant Energy, an EEP grant holder, has attempted to roll out a rent-to-own model for the provision of small-scale SHSs. However, challenges have been faced in maintaining the equipment and establishing a commercially viable model of operation due to the costs of logistics and the low density of the population.

Energy efficient cook stoves

Over 90% of rural households use wood for cooking in Namibia. Overall, 46% of the population has access to clean cooking fuels and technologies. There are several local models of cook stoves that reduce wood consumption, such as Tsotso, Vesto and Ezy, as well as solar cookers. The EEP programme supported a pilot cook stove project to disseminate stoves through SMEs in rural areas. The use of the encroacher bush as an alternative fuel source for cooking could be investigated.

4. Stakeholder review

The key institutions regulated to manage and deliver services in the energy sector are described in Section 2. The management structure employed in Namibia is based a single buyer model, effectively resulting in the centralised provision of energy and a monopoly held by the state utility, Nampower. Nampower is responsible for generation and transmission, and distribution. The government has established Regional Energy Distributors (REDs) in which local authorities are shareholders. Three out of the five intended REDs are operational, NORED, CENO RED and ERONGO RED while there are negotiations around the creation of the other two.

In 2016, the Namibian Government opened the electricity market to IPPs, issuing 14 licences to existing project developers based on standard PPAs. Of these 14 projects. Four installations are operational with Nampower as the sole off-taker. CENO RED has also established a PPP with Innosun to provide electricity to the local RED distribution network and for the surplus to be purchased by Nampower. Not all PPAs have been signed and the private sector has reported that the non-standard terms of the PPA, where the government does not provide any guarantees, has

reduced the attractiveness of the projects to potential financiers. It does however appear that local banking institutions have greater confidence in national stability and therefore have loaned money despite this.

Financial services are increasingly available for renewable energy and include the MME Solar Revolving Fund, Development Bank of Namibia, Rand Merchant Bank, First Merchant Bank, Bank Windhoek, Standard Bank, SME Bank, as well as Kongalend, a micro-financing institution. However, all require proof of income, appear to lend on a small scale to SMEs, thereby reducing their relevance.

There is a registered list of renewable energy goods and service providers who are members of the Renewable Energy Industry Association of Namibia (REIAoN). This list is used for the basis of the EIF programme which provides credit to end users to purchase and install RE products. Fifty members focus on solar energy and three on wind. The monthly publication produced by REIAoN is used by the ECB and the NEI in keeping abreast with developments in the sector.

5. Market review

Financing and support instruments for rural electrification include the solar revolving fund, environmental investment fund, register of products for Namibian solar energy technologies, and code of practice for Namibian solar energy technologies.

The Solar Revolving Fund, administered by the Renewable Energy Division the MME, provides loans to households and communities for solar water heaters, solar water pumps and solar homes systems at a favourable interest rate of 5 percent during the loan period of five years. The maximum loan amount is around US$ 2,600 for solar water heaters, between US$ 530 and US$ 3,100 for solar home systems and US$ 4,400 for solar water pumps. Uptake of the loans has been high, and the fund has not been able to keep up with the demand. More than 1,000 systems of varying sizes have been installed through the SRF, and a repayment rate above 85 per cent has been reported.

The Environmental Investment Fund, under the Ministry of Environment and Tourism provides grants and subsidized loans, for acquiring a variety of renewable energy technologies, for lighting, pumping water and powering a range of household appliances, including solar water heaters. The financing can be provided to civil society organizations, private sector and individuals from Namibia.

The Development Bank of Namibia (DBN) has opened the market by investing in RE projects. KfW is looking to work with DBN on providing financing to IPPs although there is skepticism that the benefits of the soft loans provided are being passed on to project developers. Individual loans are available through First National Bank (FNB), South African based, for the installation of renewable energy in homes. SME Bank was collaborating with the EIF to provide loans to 2,000 households at an interest rate of 4.25% per year over five years. However, recent irregularities resulted in SME Bank being taken over by the Bank of Namibia.

Kongalend provides microfinance to individuals and SMEs for renewable energy at an interest rate of up to 15.6%. However, all the financing mentioned above is only available on verification of income, requiring a pay slip or bank statement. This naturally excludes the underserved, particularly those outside of the urban centers, for whom formal employment is not available.

There is not a great deal of donor related activity being implemented in Namibia, with the exception of the regional programmes being implemented. KfW Bank, AfDB and the Green Climate Fund (GCF) are providing large-scale financing and the UNDP, World Bank and GIZ are involved in the development of energy resources for Namibia. GIZ is particularly focused on developing biomass using the invader bush that has proved to be a hindrance for Namibian farmers. The EU has supported some projects under its climate change programme and supports the installation of solar water pumps for farmers.

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Policy and regulatory	▪ The Energy White Paper (1998), OGEMP (2007) an REDMP (2010) recognising that they are somewhat out-dated. ▪ The scope of activities included in the OGEMP is extremely limited; it prescribes a specific solution and restricts the roles of key actors with the MME providing a revolving fund, technical assistance, and equipment and the private sector being locked into providing shops in specific areas with specific equipment.	▪ The Ministry intends to revise the Energy White Paper (1998), OGEMP (2007) an REDMP (2010). There is some scope to support this process in collaboration with SE4ALL to define specific policy measures required to stimulate sustainable off-grid energy access markets. ▪ A greater liberalisation of the electricity sector would enhance the ability of the private sector to identify ventures that would address user needs.
Small-scale grid integrated independent power production	▪ Namibia has significant renewable energy potential. However, uptake and use of RE for mainstream electricity generation remain slow.	▪ Significant progress has been made in terms of the establishment of the IPP framework and the signing of 14 contracts of up to 5MW. There is potential to expand on this through the establishment of IPPs at RED level, supporting them with local distribution networks however, as Nampower remains the primary off-taker, therefore reducing the potential for local supply to the underserved or targeting specific customer groups. Changing this will require revisions to the market structure within the on-grid energy sector and it is not altogether clear whether the ECB and government consider this to be advisable.
Access to Finance	▪ Some private sector players are concerned about the exchange rate fluctuations that mean that any loan geared to foreign currency is challenging to service due to the devaluation of the South African Rand. ▪ The Solar Revolving Fund only offers loans of up to approximately EUR 2,075 supporting mainly individual installations and makes use of the list of registered service providers under REIAoN.	▪ There is potential to support the work of the DBN in extending credit lines to small-scale IPPs, particularly now that the work of the EIF in collaboration with SME Bank has halted, although DBN is keen to keep their transactions costs down. Portfolio funding may be more attractive in this context. ▪ The fund is overseen and managed by the MME and therefore could potentially include an SME component with a more significant loan portfolio There may be a possibility to link with microfinancing institutions such as Kongalend to attract SMEs to develop business ideas to address the off-grid energy market.
Economies of scale	▪ The greatest challenge for private sector engagement in Namibia is the absence of economies of scale, particularly in rural areas. The sparse population and distances between homesteads does negate the commercial viability of on and off-grid solutions. The lessons learned from the two off-grid mini grids are that the maintenance of the infrastructure is expensive and local ownership is lacking, resulting in the infrastructure being abused. There is currently no obvious business model to provide off-grid, small-scale solutions for the rural poor.	▪ PPAs could be provided to private sector players that are servicing peri-urban, more densely populated areas, ensuring economies of scale. For the rural poor, it may be necessary to consider a subsidised model of energy provision to make the venture commercially viable.

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Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Energy efficient cook stoves	▪ There is reportedly market potential to develop the cook stove supply chain. However, it would appear that current schemes are very small in scale. ▪ The use of the encroacher bush as an alternative fuel source to be scaled up commercially could be supported.	▪ There is significant information to learn from other countries in the region and business models could be enhanced to scale up production. ▪ Business case would need to be investigated due to the availability of free fuel wood.

7. Implications for the Theory of Change

Small-scale IPP projects are bankable despite the lack of government guarantees due to a general market confidence in the stability of Nampower and the government. However, currency fluctuations and the devaluation of the Rand appear to affect private sector willingness to take loans geared to foreign currency. The continued expansion of small-scale, renewable projects may not be promoted by ECB in the short term due to difficulties in managing the variable supply from renewable energy IPPs and the current supply infrastructure.

Developing bankable off-grid projects is challenging in Namibia due to the absence of an economy of scale. There is potential in peri-urban areas, which would then satisfy the TOC however this would require a change of regulation to allow for the direct distribution to local customers. Rent-to-own business models, such as those of Mobisol and Off:Grid Electric may be more suited to this context, although there may need to be guarantees in place if the grid were to be extended to these areas.

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[i] *http://gtf.esmap.org/*

[ii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System – Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iii] *http://www.mme.gov.na/directorates/energy/nef/*

[iv] *http://www.mme.gov.na/petroleum/downstream/*

[v] *https://www.reeep.org/namibia-2014*

[vi] *http://www.nampower.com.na/public/docs/annual-reports/Nampower Annual Report 2014.pdf*

[vii] *National Appropriate Mitigation Actions through electrification with Renewable Energies, 2015*

[viii] *Supportive framework conditions for mini-grids employing renewable and hybrid generation in the SADC Region. Namibia Case Study. Gap analysis and National Action Plan, 2014*

[ix] *http://www.nampower.com.na/public/docs/annual-reports/NP_AR2013_Final.pdf*

[x] *https://www.esi-africa.com/news/namibia-5mw-wind-project-near-completion/*

[xi] *drfn.org.na/projects/energy/cbend*

[xii] *Baseline study: Barrier removal to Namibian Renewable Energy Programme, 2005*

[xiii] *https://www.esi-africa.com/news/namibia-5mw-wind-project-near-completion/*

Country profile – Rwanda

1. Overview

Indicator	Data
Population	11.61 million (2015)
Population density	470.6 persons/ km^2
Global Tracking Framework Indicators [i]	
Access to electricity	19.8% (2014) 24% (2016, MININFRA) (71.8% urban, 9.1% rural) (2014)
Access to improved cooking	2% 60% of population has been reached with improved cooking stoves (but of poor standard)
RE as proportion of the mix	88.45% (80.26% traditional biomass, other 8.19%)
Other Indicators	
Reliance on energy imports (2014) (IEA)	11% of energy consumption comes from imported petroleum products
Centralised or liberalised electricity sector	Centralised
Bundled generation, transmission and distribution?	Yes
Existence of renewable energy IPPs	Yes
Import duties on renewable energy products	Tax exemption for some off-grid solar products and appliances
RAGA/ AA/ IP	RAGA
Renewable energy strategy	No
Number of EEP Phase I & II projects	14
Total EEP contribution (% of total budget)	€5,136,681 (11.9%)
Average daily solar irradiance [ii]	4,980 Wh/m^2/day
Electricity subsidies	Yes [iii]
Fuel subsidies	Yes, on fuel [iv]

Local generation capacity in Rwanda is based on hydropower for approximately 50% of overall consumption; solar, peat and methane for about 10%; and thermal generation approximately 40%. However, only 20% of the population has access to electricity, the vast majority of those are situated in urban areas. Furthermore, the government aims to increase private sector growth and to attract businesses to the country. Therefore, the government has ambitious targets to rapidly scale up its energy infrastructure, from less than 100 Megawatt (MW) production capacity in 2014 to 563 MW by 2018. An enabling framework has been established for Independent Power Producers (IPPs) to feed into the grid.

Energy access in rural areas is challenging due to the dispersed population and mountainous landscape. A significant amount of biomass is consumed for cooking.

2. Institutional framework

Institutional structure

The Ministry of Infrastructure (MININFRA) is responsible for developing energy policy and strategy. The Rwanda Energy Group (REG) is responsible for translating energy sector policies and programs into the implementation of projects to reach the targets set, and to operate and maintain the power system of the country. REG was established in 2014, when EWSA (Energy Water and Sanitation Authority) was restructured into an energy company and a water and sanitation company to improve technical planning and operational performance. REG comprises an electricity utility company, EUCL, and an electricity development company, EDCL.

Table 1: Key institutions in the energy sector in Rwanda (RAGA, 2014)

Institution	Role
MININFRA	Policy and strategy formulation Granting both concessions and MoU's
Rwanda Energy Group Ltd, EDCL and EUCL	Operation and maintenance of electricity transmission, distribution and supply network. REG: Implementing Company, providing both technical assessment, and Power Purchase Agreements EDCL: Development of new energy generation projects and transmission structures EUCL: Generation, bulk transmission and distribution and retailing functions on a commercial basis
Rwanda Development Board (RDB)	Investment process, guidance, facilitation, leading negotiations for strategic projects, issuing Environmental Impact Assessment (EIA) certificate [v]
Ministry of Finance and Economic Planning (MINECOFIN)	Fiduciary framework to manage grants, loans, and other concessional finance from development partners into the sector
Rwanda Utilities Regulatory Authority (RURA)	Setting tariffs, regulate the sector, and provision of licenses in the sector
Rwanda Environment Management Authority (REMA)	Responsible authority for the EIA procedures (while RDB issues the certificates). Responsible for monitoring implementation of environmental protection measures recommended by EIA studies and the conduct of Environmental Audits. Approvals of national climate finance projects
National Fund for Environment and Climate Change (FONERWA)	Mobilizing and harmonizing funds across various areas sectors to support Rwanda's green growth and sustainable development
Energy Sector Working Group (SWG)	Government and development partners discuss matters influencing the sector, and approve long-term plans and policy measures

The structure of the sector is centralised, although there is an increasing number of IPPs since 2013. The six large IPPs are: KivuWatt developing 100 MW from methane; Hakan developing 120 MW from peat; Symbion Power developing 50 MW from methane; Goldsol II developing 10 MW from solar; Ngali Energy developing 45 MW from hydropower; Gigawatt Global operating an 8.5 MW solar PV plant.

Policy framework

The National Energy Policy (2015) prioritises new grid connections and promotes more cost effective, off-grid energy access business models using Public-Private Partnership (PPP) procurement frameworks. The policy aims to:

a) Maximise use of indigenous energy resources to meet Rwanda's long-term development plans;

b) Improve energy access;

c) Foster strong and independent regulation of the electricity sector;

d) Increase private sector participation in developing power projects;

e) Enhance energy sector governance with open and transparent procurement processes;

f) Lower the cost of electricity supply;

g) Introduce cost-reflective energy prices and "smart subsidies" aligned to social protection principles;[vi]

h) Enhance regional cooperation in energy;

i) Strengthen the capacity of public sector agencies and their ability to engage with the private sector;

j) Promote efficient utilization of energy resources;

k) Promote new and renewable energy technologies through enabling frameworks, including feed-in-tariffs.

The targets for household electricity access are 70% by 2017/18 and 100% by 2020. The Rural Electrification Strategy (2016) commits to ensuring that Rwanda's households have access to electricity through the most cost-effective means by developing programmes that will facilitate the end-users to access less costly technologies and increase private sector participation in the provision of these solutions.[vii] A range of options from standalone solar systems through to isolated mini-grids and grid connection will be available.

Programmes under the Rural Electrification Strategy:

1. Government will establish a mechanism to allow low-income households to access modern energy services through a basic solar system as a basic necessity.
2. Government will establish a risk-mitigation facility targeting the private sector such that solar products will be made available on financial terms that the population can afford.
3. Mini-grids will be developed by the private sector with the government playing a key role in identifying sites and establishing a framework through which these can become financially viable investments.
4. Government will continue to roll out the electricity network via the Electricity Access Roll out Program (EARP), focusing on connecting high consumption users and driving economic growth.

A driving principle of the strategy is that the private sector shall take a lead role in financing and delivering off grid energy access: Private sector actors demonstrate significant interest in the delivery of rural electrification technologies, such as solar home systems and mini-grids. In order to facilitate private sector involvement, the government aims to de-risk their investment through the provision of a risk-mitigation facility. Some of the sources of public finance available includes the Scaling up Renewable Energy Program (SREP), from the Climate Investment Funds which approved a total of up to USD $50 Million that will be used in developing private sector led off-grid and mini-grid markets in Rwanda.

A framework to promote energy efficiency and further the development of private sector businesses in this field is not yet in place. An energy efficiency strategy is currently under development and a draft strategy will be presented by the end of June 2017. The Guidelines Promoting Energy Efficiency Measures (2013) disseminate measures for energy efficient electricity use.

3. Technology review

Renewable Energy

There is significant potential for hydro and solar power in Rwanda and more recent work is being undertaken in scoping the potential of geothermal and wind power. The targets set for the use of renewable energy in reaching the now reduced goal of more than 1 GW generation capacity comprised 340 MW of hydropower, 310 MW of geothermal power, 300 MW of methane-based power (not renewable), and 200 MW of peat-based power.

Hydro

Hydropower provides significant potential in Rwanda. Currently, seven grid-connected plants provide 137.5 MW of generation capacity. Four plants are proposed in the near future, totalling 547 MW, including Ruzizi 145 MW and Rusumo 90 MW, which are under construction. Rwanda's major rivers have 333 potential sites for micro-hydropower. [viii]

Solar

The solar potentials in Rwanda are significant, both for electricity and water heating (SWH) purposes; the monthly averaged global solar radiation varies between 4.3 to 5.2 kWh/m2/day across Rwanda. The Residential Solar Water Heating Program available to the residential sector targeted the installation of 12,000 SWHs by the end of 2015, saving 23,328 MWh.[ix] Two grid connected solar PV plants have a capacity of almost 11 MW (8.5 MW Rwamagana Solar Power Station; 2.4 MW Ngoma Solar Power Station) and the 10 MW Kayonza Solar Power Station is under development. Solar home systems form an important part of the rural electrification strategy, and are being installed in large numbers. The government target for 2017/18 is that 22% of households will own a small off-grid system consisting of four light bulbs, a phone charging point and a radio. The total number of systems sold in 2016 was around 41,000 based on self-reported data from companies. One of these is Ignite Power Ltd, a solar financing company that has signed an implementation agreement with MININFRA to provide quality solar home systems to 250,000 households in rural areas.

Biomass, stoves and biogas

Biomass is the main source of energy for rural households, particularly for cooking. The impact on available biomass resources is detrimental and multiple efforts are being made to reduce biomass use. Manufacturers and distributors of energy efficiency cook stoves are supplying the domestic market in Rwanda, but the quality of the stoves is not assured. The Government of Rwanda is seeking to promote gas (not necessarily biogas) in cities to replace biomass for cooking, for example by improving the LPG market, such as temporary suspension of VAT on LPG imports. The stove producer, Iniyneri, has introduced a bio-gasifier stove with the support of the EEP programme based on wood pellets that reduce fuel consumption and the smoke emitted considerably.

Although peat is not renewable, the local reserves are fuelling the 15 MW peat plant at Gishoma. The intention is to install 80 MW of generation capacity, and potentially an additional 40 MW. On a smaller scale, by mid-2013 about 3,365 biogas digesters have been constructed in households by 41 local companies, and over 50 large biogas digesters have been constructed in institutions. The government target is that 20% of cattle farmers are using biogas by 2017; the current status is unknown.

Wind

The wind potential in Rwanda is limited, but could be employed for stand-alone solutions, such as mechanical windmills and for small-scale electricity generation.

Geothermal

The government estimates that with extensive exploration and appraisal drilling, geothermal can contribute generation capacity of more than 20 MW in the short term and over 300 MW in the long term. The exact size of the resource is not yet proven. The currently planned developments are: 10 MW from a test generation site at Kinigi; 10 MW from a test generation site at Karisimbi; and 50 MW of production scale generation at Kinigi / Karisimbi.

4. Stakeholder review

On-grid

Despite being very forward thinking in terms of energy needs, the power sector is very much dominated by the MINIFRA and EDCL. However, based on the establishment of an IPP framework and the establishment of a robust framework, a number of large IPPs are now feeding into the grid. However, due to the potential oversupply of generation capacity, it is unlikely that additional Power Purchasing Agreements (PPAs) will be signed for grid-connected projects for the time being.

Off-grid IPPs

Given the widely dispersed population and the mountainous geographical landscape, off-grid electrification plays an important part in the Rwandan energy sector. The Rural Electrification Strategy, therefore, foresees its expansion, such as for example through mini-grids. Besides MINIFRA, it is therefore the Rwanda Utilities Regulatory Authority (RURA) that is the regulator of the off-grid sector.[x] From the Government side, it is EDCL that is generating off-grid energy. There are also a number of IPPs providing off-grid energy, both hydro and thermal.

Private sector

The private sector is not very well developed in Rwanda. The SE4ALL RAGA 2014 highlights this as being a significantly limiting factor and that there is little likelihood of the private sector driving transformation in Rwanda, thereby implying that foreign investors would need to be part of the process in order to meet the off-grid needs. The biogas digester industry is strong in that there are around fifty companies providing the systems. The Rwanda Renewable Energy Association represents the IPPs, and the main stand alone solar companies are Munyax Eco, GLE, and Mobisol. Inyenyeri produces cook stoves and there are around 20 micro-hydro power producers.

Donors and financing institutions

There are multiple banks giving loans, however, interest rates often prohibit smaller actors to get capital. An essential actor is FONERWA – the National Fund for Environment and Climate Change – which channels both national and international grants for creating green growth. There are several active donor organisations in the country. One major progamme that is implemented by GIZ and funded by the Governments of Germany, the Netherlands, Norway, Sweden, Switzerland and the United Kingdom, is 'Energising Development (EnDev) Rwanda'. Its goal is to improve energy supply in rural areas. Other active donors are AfDB, BTC, the Dutch Government, EU, German Government, JICA, KfW, Power Africa, UNDP and the World Bank.

Research institutes, associations and NGOs

Institutes, such as the Integrated Polytechnic Regional Centers, the Tumba College of Technology, the School of Science and Technology (part of the University of Rwanda) contribute with local research and developing skilled labour.

Energy Private Developer's Association is an organisation for all energy players in Rwanda giving support through market information and networking.

Energy efficiency

Energy efficiency has not played a priority on the energy agenda – neither by the Government nor by the private sector. The development of a national energy efficiency strategy is, however, currently ongoing. One sub-sector that is already dealing with the issue more concretely is improved cookstoves. Mainly depending on biomass, energy efficiency is increased by programmes introducing solar water heating and biogas digesters,[xi] for example. Active stakeholders are manufacturing and distributing companies, such as Inyenyeri, and cooperatives, including "Ubumwe" and AJDR.

5. Market review

The political landscape in Rwanda is based on a centralised structure, with the state owned utility, REG, controlling grid energy supply. Rwanda Development Board has defined the following investment opportunities for private developers:[xii]

- Geothermal
- Peat to power
- Micro Hydropower
- Off-grid, and mini-grid solutions

For private electricity suppliers, Feed-in Tariffs (FiTs) have been established for IPPs in order to promote renewable energy electricity generation. The FiTs are not fixed, but subject to negotiation. Recently, EUCL seeks to decrease the rate per kWh from €0.13 – 0.15 / kWh to €0.09 – 0.10 /kWh. This is in response to the potential over-supply of generation capacity, which is anticipated to exceed demand, but which the EUCL would be committed to pay for. The electricity tariffs for private consumers for low consuming households (up to 15 kWh/month) as from 1st January 2017 are 89 RWF or €0.10 /kWh, for consumption between 15 and 50 kWh it is 182 RWF or €0.20 /kWh, and for small scale industries: 126 RWF or €0.15 /kWh.[xiii] Therefore, EUCL is now renegotiating the PPAs that were close to being secured. This would impact on the feasibility of the IPPs, especially for micro- and pico-hydro projects.

In terms of financing, commercial banks in Rwanda lack experience in energy sector financing, and do not have the capacity to perform due diligence. The Rwandan market is too small for the banks to create a substantial loan portfolio. Interest rates for loans in local currency are high (15-19% plus margin), and 100-120% collateral is required. International companies with access to foreign financing have an advantage compared to local companies. Bank loans have a 5-7 year tenor but financing for infrastructure typically demands a 10-year credit line. Furthermore, the high interest rates lead to repayment problems during a period when business viability is tenuous.

The institutional landscape is marked by the lack of uniform application of rules and regulation. This applies in particular to imported goods, where products are cleared at the Rwandan border and again in Kigali, which results in additional warehousing fees. Likewise, repetitive checks of the same products within the East African Community (EAC) due to a lack of coordination between clearing agents is causing delays and higher costs. Divergent processes within the EAC makes it difficult for companies to import duty-free and at times, double taxation occurs. The inaccessibility and limited capacity of customs staff to assess and calculate the new duties on solar products is considered to be a barrier and at times, the rate of taxation is at the discretion of the customs agent.

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Legislation is new and creates uncertainties	▪ The new Rural Electrification Strategy (RES) still generates market uncertainties in relation to unclear policy development and implementation.	▪ Political will is high: Rwanda has set a target of 100% electricity access by 2030, 50% of which should access the highest tiers (3-5) through the deployment of both on-grid and mini-grid access. [xiv] This requires private sector participation, which can happen despite unclear policy implementation if the system is flexible.
PPAs, licensing and concessions need to be simplified and standardised	▪ Extensive time and capacity is needed to negotiate a PPA. ▪ The change in the business case due to revisions of FiTs affects investor confidence.	▪ Avoid the case-by-case basis used now by developing a standardised PPA; ▪ Support companies during the processing of the approvals; ▪ Exploit ease of getting licence for mini-grids. The RURA Regulation governing the Simplified Licensing Framework for Rural Electrification in Rwanda was approved in September 2015 and exempts IPPs from licenses for mini-grids below 50 kW, a simplified license for those below 1,000 kW, and a Small-Power Distribution License for grid-connected mini-grids.
Lack of private sector capacity and experience hampers small commercial electricity projects	▪ The limited market in Rwanda requires companies to diversify for business viability, despite a lack of adequate, specialised expertise; ▪ It is new for private companies in Rwanda to go into the energy business, e.g. hydropower, so they run into technical problems; ▪ Generally, there is a lack of entrepreneurial capacity in the country.	▪ Consultancies like Energy4Impact help companies build up capacity to source finance and implement energy projects.
Standards of equipment need to be developed	▪ Sub-standard equipment for solar home systems leads to market attrition; ▪ All material is imported due to a lack of local production capacity.	▪ More R&D may be needed to develop production capacity in Rwanda.
No possibility to exploit on-grid market currently	▪ Current demand is lower than generation capacity due to limited transmission and distribution capacity. The transmission grid is inefficient evidenced by the 22% losses: 17% technical, 5% commercial. Therefore, government does not want to add more capacity to the grid. Some otherwise feasible almost-ready projects have been declined due to this. ▪ Interconnection lines (Burundi, Tanzania, DRC) are few, and not exploitable.	▪ Donors to continue assistance upgrading the transmission grid. ▪ Rwanda could become a net energy exporter to surrounding countries and the East African Power Pool.
Biomass and improved cooking stoves are a priority	▪ The increasing population and rising incomes per capita will result in a higher demand for energy for cooking. ▪ The government wants a reduction of the consumption of biomass (firewood/ charcoal) but there are few alternatives, such as LPG and kerosene, which are more expensive. Electricity is no real option due to the high costs and the low connection rate.	▪ Large potential for efficient cooking stoves. In 2014, only 2% of the population had access to improved cooking, and most of the efficient stoves only have a two-year lifetime. ▪ The limited biomass resources can constitute good opportunities for innovative businesses that seek to provide solutions. ▪ Continue to provide grants to efficient stoves.

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Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Solar home systems should be sustainable	▪ Solar home systems are often too small to satisfy household energy needs; ▪ Some solar home systems are sub-standard, creating problems, and market attrition; ▪ Worn-out batteries in solar home systems are not being properly disposed of.	▪ Promote grants to highly efficient DC appliances allowing households to get sufficient energy services despite low capacity solar home systems. ▪ EnDev is only giving grants to solar home systems that conform with Lighting Global (LG) standards, which is an international standard specifically developed for off-grid solar systems. This could be applied across the board for EEP-supported projects. ▪ Continue to support projects that do not only provide access to energy, but also the maintenance. ▪ Used batteries from solar home systems must be dealt with sustainably; include this in project descriptions and business plan.
Lack of knowledge to develop long-term business plans	▪ Investing in a mini-grid is a considerable investment over a period of five to 10 and some even up to 20 years. Therefore companies will plan mini-grids in areas that are not immediately targeted for grid extension. However, companies have expressed difficulties in obtaining a clear guarantee that the national grid will not be extended in certain areas.	▪ EDCL to provide long-term concessions and publish commitments regarding grid extension plans. ▪ Encouraging the government to develop a strategy for when the grid arrives in collaboration with project developers is necessary; converting to IPPs when the grid arrives is a possibility.
Purchasing power is too low to afford even access corresponding to MTF 2	▪ MININFRA and EDCL would like to stipulate that solar home systems have at least 3 light points (MTF 2). The population may be too poor to afford this; ▪ For some poor households even a tariff of 50 RWF/day (€ 0.05) would not be affordable).	▪ In general, payment methods for energy services to the very poor need to be further developed. ▪ Grant proposals need to include an element that helps communities implement productive uses of energy, so that they can pay for the electricity. ▪ Performing research into the drivers of the social economy, potential productive uses and energy usage patterns would inform project developers to design innovative solutions.
Access to working capital creates constraints for private sector companies, especially local companies	▪ The need for trade financing is not met (e.g. company wins a tender to sell solar products to an NGO; banks are not readily interested in pre-financing the import even though it is linked to an awarded tender); ▪ Small companies may not have the financial means to use PAYG systems (requires companies to pay the cost up-front or to deal with the delay of revenues generated by the PAYG model); ▪ Some companies have preferred to use own equity, as they were too busy to present good proposals to grant schemes.	▪ Grants to fill the gap?
Lack of willingness / ability of commercial banks to invest in the sector - underpinning credit support is necessary	▪ Commercial banks lack experience lending to the energy sector and credit conditions make the cost of borrowing too high; ▪ Loan tenor is 5-7 years, but infrastructure financing is needed for 10 years.	▪ FIs need TA for how to read PPA, contracts, details with contractors. ▪ Providing credit guarantee mechanisms is necessary at this stage although banks have a greater risk appetite for some technologies over others.

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Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Complicated import procedures	▪ Multiple stages of clearance for imported equipment, which lead to warehousing fees; ▪ Repetitive checks of the same products within the EAC due to lack of coordination is causing delays and higher costs; ▪ Divergent processes within the EAC make it difficult for companies to import duty-free and sometimes double taxation occurs; ▪ Unclear or unavailable contact persons and limited processing capacity at Rwandan customs	▪ Need for assistance (by other programme than EEP – not within its scope) for institutional capacity building of customs officials; ▪ Consider whether there is a need to further streamline application of rules and procedures within the EAC.
Market distortions are crowding out the private sector	▪ The free distribution of systems foreseen in the Programme 1 of the RES may distort the market and decrease the willingness of customers to pay market price for a solar system. It could also lead to a second-hand market with unrealistic low prices.	▪ Coordinate and discuss in the Energy Sector Working Group the trade-off between providing access to energy and creating sustainable businesses. ▪ Exploit business opportunities in maintenance and repair of solar home systems.
Energy efficiency needs to be addressed to avoid an energy demand explosion. Increasing energy costs would reduce the disposable income of the poor	▪ An energy efficiency strategy and regulations are not in place; ▪ No standards and labelling – apart from some voluntary agreements; ▪ Institutional setting for energy efficiency labelling, standards enforcement and monitoring of targets are not in place.	▪ Draft energy efficiency strategy will be published end June 2017. ▪ The strategy needs to provide the potential for setting requirements and creating opportunities for EE businesses. ▪ There is need for an action plan to implement and enforce the strategy.

7. Implications for the Theory of Change

The energy services sector is at an earlier stage of development than in many of the surrounding countries. There are multiple opportunities for mini-grids and off-grid solutions, but developing bankable off-grid projects is challenging in Rwanda due to the absence of an economy of scale. Rent-to-own business models, such as those of Mobisol and Off:Grid Electric may be more suited to this context, although there may need to be guarantees in place if the grid were to be extended to these areas.

For mini-grids, clear tariff regimes need to be in place for companies to develop a good business case. In order to promote the participation of local companies, support to the development of the business case as well as the process of approvals, etc. is required.

The legal and regulatory framework for energy efficiency is not in place although the strategy is being developed. There will be a need to support knowledge transfer to the sector once this is in place and develop the financing framework to promote energy efficiency measures and private sector players.

[i] *http://gtf.esmap.org/*

[ii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System - Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iii] *Ministry of Infrastructure: SE4All RAGA, 2014http://www.gov.rw/news_detail/?tx_ttnews%5Btt_news%5D=1284&cHash=5d0b9cbd-049f1947d07bf3dc0a448dc8*

[iv] *The Economist: Utility prices increase sharply, 2015: http://country.eiu.com/article.aspx?articleid=123475396&Country=Rwanda&topic=Economy&subtopic=For_8*

[v] *One Stop Centre Registration Portal, 2017: http://osc.rdb.rw/*

[vi] *Rwanda Energy Policy, 2015*

[vii] *Rural Electrification Strategy, 2016*

[viii] *Hydropower in Rwanda, 2014: http://www.mininfra.gov.rw/index.php?id=79*

[ix] *http://www.reg.rw/images/pdf/Description%20of%20SolaRwanda%20Program%20Updated%202014%2002%2011.pdf*

[x] *Rural Electrification Strategy, 2016*

[xi] *SE4All RAGA, 2014*

[xii] *http://www.rdb.rw/rdb/energy.html*

[xiii] *Rwanda Energy Group: Announcement on new Electricity Tariff, 2016: http://reg.rw/index.php/tariff-publication*

[xiv] *Beyond Connections: Energy Access Redefined: Introducing Multi-Tier Approach to Measuring Energy Access, n. d.: http://www.se4all.org/sites/default/files/Beyond-Connections-Introducing-Multi-Tier-Framework-for-Tracking-Energy-Access.pdf*

Country profile – Seychelles

1. Overview

Indicator	Data
Population	91,400 (2014)
Population density	163 persons/ km² (Mahé: 434 persons/ km2, Victoria: 3,000 persons/ km²)
Global Tracking Framework Indicators [i]	
Access to electricity	99% (100% Urban, Rural 98.74%)
Access to improved cooking	100% (almost all households use LPG for cooking)
RE as proportion of the mix	2.4% (2016) (0.7% from solar home systems, 1.7% from wind)
Other Indicators	
Reliance on energy imports (2014) (IEA)	97.6% (2016)
Centralised or liberalised electricity sector	Centralised (provision to 3 main islands)
Bundled generation, transmission and distribution?	Yes
Existence of renewable energy IPPs	None
Import duties on renewable energy products	15% exemption of import taxes
RAGA/ AA/ IP	No
Renewable energy strategy	No
Number of EEP Phase I & II projects	1
Total EEP contribution (% of total budget)	0.5%
Average daily solar irradiance [ii]	5,880 Wh/m²/day
Electricity subsidies	Yes [iii]
Fuel subsidies	Yes

Seychelles is still fully reliant on imported fossil fuels in 2008, when the oil prices surged. The majority of the energy produced is from diesel fuelled thermal power stations with an installed capacity of 95 MW (2009).[iv] Since then, the Seychelles has sought to diversify into renewable energy sources, mostly through solar and wind, but also micro-hydro and biomass/municipal solid waste. As per the National Energy Policy for 2010-30, a 5% and 15% share of renewable energy is therefore targeted for 2020 and 2030 respectively. It is estimated that the consumption of electricity has increased on average by 5.5% per year over the past decade and will double between 2007 and 2030.[v]

2. Institutional framework

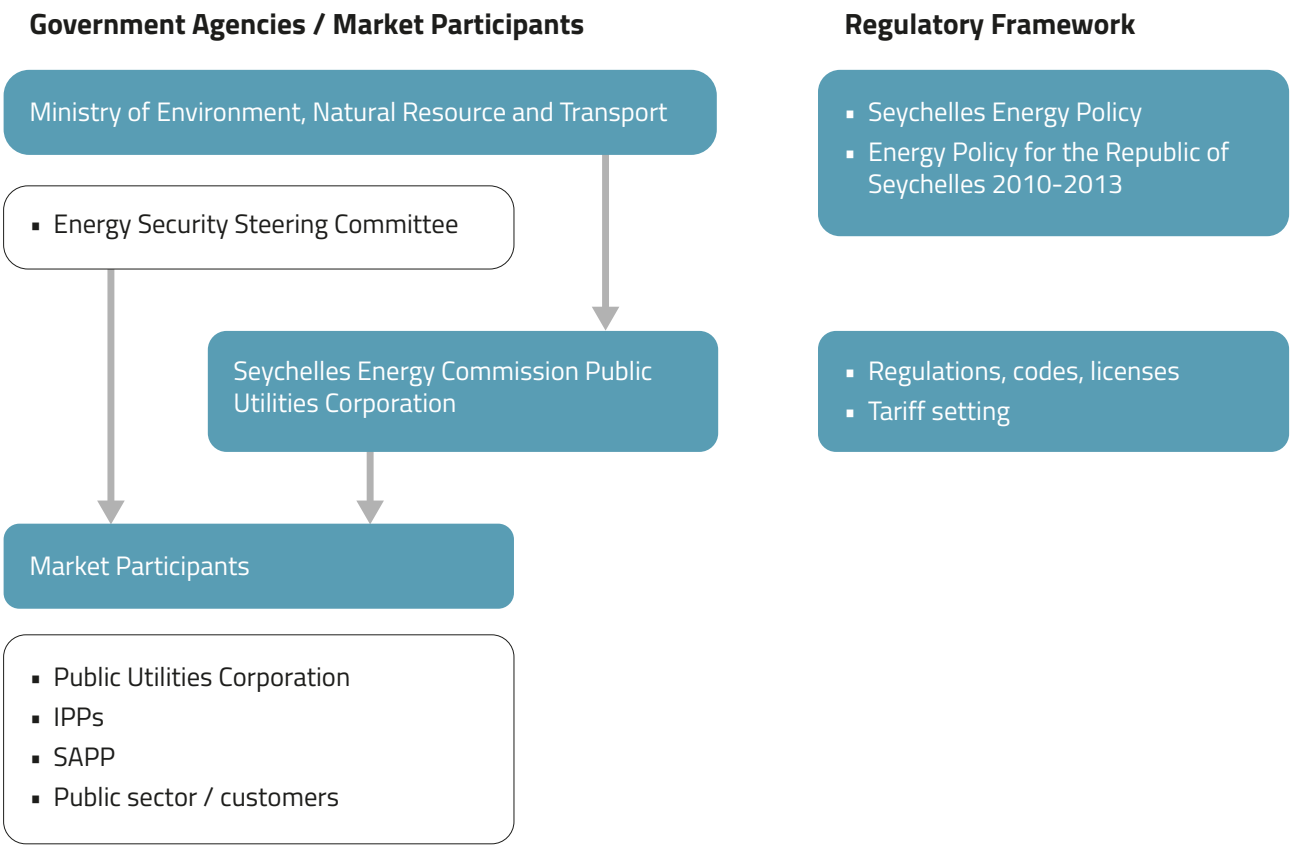
Institutional structure

The Ministry of Environment, Energy and Climate Change (MEECC) is responsible for the energy and water supply, as well as ensuring environmental sustainability. The mandate of the Ministry is to energy ensure affordable energy access for all, promote energy efficiency and democratise access to renewable energy, focusing on developing the strategic framework to encourage this.

The Seychelles Energy Commission (SEC) was established in 2009 to regulate the generation of electricity and advise the government in delivering adequate, reliable, cost-effective and affordable electricity supply. Its primary functions include to:

- Coordinate the development and strategic planning of the energy sector;
- Formulate a national energy plan and implement the national energy policy;
- Promote renewable energy and energy efficiency, as well as conservation of energy;
- Collect and maintain energy data and produce national energy statistics; and
- Propose regulations that are necessary or expedient for the energy sector.[vi]

Figure 1: The institutional framework for the energy sector in the Seychelles



The Public Utilities Corporation (PUC) is a statutory corporate body that is responsible for providing the three main islands of Mahé, Praslin and La Digue with electricity, water and sewerage services. It is the sole producer and distributor of public electricity. The PUC comprises the Generation Section and the Electricity Transmission & Distribution Section and operates two power stations on Mahé and Praslin.

The Seychelles Petroleum Company (SEYPEC) is a fully integrated parastatal oil company with activities in supplying fuel to the domestic market, bunkering of vessels, aviation refuelling activities and the management of its shipping arm. It is the sole importer and distributor of petroleum products in Seychelles. These are primarily imported from the Gulf Region.

Policy framework

The Seychelles Sustainable Development Strategy (2011-2020) provides for all environment-related programs and policies. One of its strategic objectives for the energy sector is the "promotion of renewable and alternative energy at the national level". The Energy Policy (2010-2030) provides for key strategies related to energy security and also outlines a ten-year outlook and action plans for energy security, energy efficiency, and renewable energy. As an Island State that has no fossil fuel reserves, the Government of the Seychelles is almost completely reliant on fuel imports but has adopted environmental sustainability at the forefront of its policy framework. It has also clearly defined Independent Power Producer (IPP) regulations that promote the development of renewable energy in the country. This Policy officially recognises the importance of renewable energy, as well as the commitment to its exploitation. The Energy Policy sets a target of 15% renewable electricity by 2030 that will primarily be met through the adoption of solar PV.

The Public Utilities Corporation (PUC) Act (1985) authorises the operations of the PUC as the sole supplier for electricity, water and sewerage in the country in terms of Section 5 (1) of the Act. The Act gives the PUC the legal mandate to regulate energy production and supply throughout the country.

The Energy Act (2012) replaced the Seychelles Energy Commission (SEC) Act (2009), which established the Seychelles Energy Commission (SEC) as an independent energy regulator. The Act requires that power is supplied to the grid from a diversity of sources. It provides for the liberalisation of energy markets in the country and allows IPPs to operate alongside PUC. It promotes renewable energy and energy efficiency while protecting the environment. The mandates of PUC Act and Energy Act overlap resulting in unclear roles and functions of both the PUC and SEC resulting in limited legal impact. There are ongoing discussions to review both Acts, repeal the PUC Act and rationalise the roles and functions and promote co-ordination of energy-related institutions.

Some of the fiscal and regulatory measures that have been adopted include the exemption of duty on all imports of renewable energy technologies, removal of taxes on solar water heaters and other energy saving devices; and a new policy to remove all conventional vehicles from the island of La Digue, allowing only electric or hybrid vehicles.[vii] The tax laws have been amended to disincentivise the importation of non-renewable technologies, such as diesel generators that are subject to a 15% import duty under the Goods and Services Tax Act. The Promotion of Environment Friendly Energy Regulations of 2010 also provides for exemptions for renewable energy technologies. Under the VAT Act 2010, goods imported for the generation or production of renewable technologies, as endorsed by the Seychelles Energy Commission, are exempted from Value Added Tax. All imports of equipment used in the generation of renewable energy are exempted in terms of Section 16(1)(a) of the VAT Promotion of Environment Friendly Energy Regulations SI 65 of 2012, First Schedule, Part I. These Regulations are administered under the Trades Tax Act.

The National Climate Change Strategy (SNCCS) (2009) aims to mainstream climate change into sustainable development through a cross-sectoral approach that addresses matters of policy, institutions, capacity building and civil society involvement. Its strategic objectives are to advance understanding of climate change, its impacts and appro-

priate responses; put in place measures to adapt, build resilience and minimize vulnerability to the impacts of climate change; achieve sustainable energy security through reduction of greenhouse gas emissions; mainstream climate change considerations into national policies, strategies and plans; and build capacity and social empowerment at all levels to adequately respond to climate change.

The Republic of Seychelles Intended Nationally Determined Contribution (INDC) September 2015 states that the Seychelles will reduce its economy-wide absolute GHG emissions by 122.5 $ktCO_2e$ (21.4%) in 2025 and estimated 188 $ktCO_2e$ in 2030 (29.0%) relative to baseline emissions. Among the measures are a National Energy Efficiency Programme, including:

- the promotion of energy-efficient appliances: target of 10% energy savings in 2035;
- the promotion of solar water heating: target of 80% of needs in households, and 80% in services by 2035;
- new regulations on the use of air-conditioning, target of 20% energy savings in the services sector;
- new building code for household dwellings (features natural ventilation, roof insulation), target of 50% energy savings on fans & ac in households by 2035; and
- the promotion of cogeneration (production of hot water from waste heat from electricity generation) in hotels, target to cover 20% of hot water needs by 2035.

3. Technology review

The renewable energy technology options that are appropriate in the country identified by the Energy Policy are solar PV, wind power, micro-hydro, and biomass/ municipal solid waste. Another potential form of renewable energy production is ocean thermal conversion.

Micro-hydro

Micro-hydro technology is attractive on a cost basis, but its size potential is very limited (1-2 MW for the entire country).[viii]

Solar PV

The potential for solar PV systems in the Seychelles is strong. Pilot data from the PUC indicate that solar radiation values for Seychelles are good; average annual Full Load Hours (FLH) are estimated at 1,300 (3.56 per day). Thus, solar PV systems have been prioritised by the Government; one of the reasons given is that it is a simple, proven technology that is easy to install and maintain and which is highly important in a small, remote island nation with limited technical expertise or access to replacement parts. EEP has funded one feasibility study for a 5 MW solar PV plant to be implemented by NextGen.

The solar PV systems are mostly off-grid, especially for outlying islands that are not connected to the national grid. The hospitality industry has a high energy demand mainly used for air conditioning, water heating, refrigeration, freezing, and desalination. By the end of 2014, there were 62 solar PV installations connected to the national grid on Mahé, Praslin and La Digue amounting to 904 kW of generation capacity. An additional 68 kW of power is generated from 13 known grid-independent systems including 25 kW at the Aldabra Atoll Research Station, 7.5 kW in the Aride Nature Reserve, 2 kW in the Curieuse National Marine Park and 5 kW on Cerf Island.[x]

According to PUC, as of December 2016, there are 197 individual customers (residential and commercial) who have installed a total 2.056 MW capacity solar PV on their roof. The installed PV capacity Praslin and La Digue is 419 kW, and 1,637 KW for Mahé.

The PUC will donate solar PV systems to low income households to allow them to participate in the renewable energy transition so that their electricity bills are reduced. The households are selected from the welfare list (Agency for Social Protection) using specified criteria to narrow it down. Phase 1: 25 households had a 3 kW PV system installed on their rooftops, using PUC's own funds. Phase 2 will add 75 other households and install a 1 MW collective solar farm on Ile de Romainville. The estimated cost of US$ 3.5m will be financed by a grant from the Government of India.

The SEC has issued a tender for Providence Lagoon 4 MW PV farm, which is supported by the Clinton Climate Initiative. The prospective IPPs have been shortlisted. In 2009, the Government of Seychelles launched its "Zero Carbon Emission" concept and piloted a project together with the German Energy Agency GmbH (DENA) to demonstrate the viability of roof top solar photovoltaic (PV) installation in the Seychelles.[xi] A total of 10kWp was installed by Sea & Sun Technology GmbH for 5 households, 1 government Institution and a private business.[xii]

Biomass and biogas

There is no electricity generated from biomass, but municipal solid waste-to-energy projects have the potential to provide 6 MW of energy, and there are thus plans to establish a biogas plant will be installed on the main landfill in Mahé. The other potential for biogas lies in converting waste into renewable energy from prison and pig farms, and several projects are being implemented with the Government of China.

Wind energy

There is potential for wind energy on the island with wind speeds of 6.9 - 7.5 m/s at 80 metres on some sites. However, the exploitation of wind resources in Seychelles is limited by the mountainous terrain, which makes access for large machinery difficult. There is potential to exploit the monsoon winds in the south by 2030.[xiii] The Port Victoria Wind Power Project (6 MW) contributes significantly towards meeting the target to produce 15% of electricity generation from renewable energy sources by 2030.[xiv] This represents over 8% of Mahé Island's grid capacity and it supplies approximately 3% of total energy that translates to a reduction of about 1.5 million litres of imported fuel per year.[xv] The project will generate 6-7 GWh of electricity per year powering more than 2,100 homes.[xvi]

Ocean thermal energy conversion

The potential for ocean thermal conversion have not been exploited although there was investigation into its viability in the early 2000s.

4. Stakeholder review

The main sectors that demand energy are Land Transport; Industrial (Seychelles has two processing factories and one canning factory for fisheries); and Residential (electricity is the main energy source and nearly all houses are connected to the grid, while LPG is widely used for cooking). The "other important sectors include air and sea transport (primarily fuel for inter-island travel and trade); manufacturing and construction (primarily electricity but also gas oil for plant operations and heat production); commercial and institutional (primarily electricity, although LPG is used for cooking in all hotels, guest houses and restaurants); and fisheries (primarily fuel for this industry, which is the 2nd largest, after tourism, in the country)".[xvii] As an Island Nation, Seychelles has multiple off-grid hotels and nature reserves.

The Island Development Company (IDC) and private hotels are the main producers and consumers of electricity on the other islands. The IDC manages most of the 100+ outer islands in the Seychelles archipelago and is investigating opportunities for alternatives to oil-generated electricity, as are the management institutions for some of the islands (e.g. the Seychelles Islands Foundation).

Seychelles is a signatory to the SIDS DOCK Support Programme, which is a joint initiative of UNDP and the World Bank funded by the Government of Denmark that was developed in close consultation with the Alliance of Small Island States (AOSIS). Under this Programme, Seychelles is committed to meeting critical goals toward sustainable development planning by 2033. These are to increase energy efficiency by a minimum of 25% (relative to a 2005 baseline), generate a minimum of 50% of electric power from renewable energy sources, and decrease by 20%-30% the use of liquid petroleum fuels in transportation.[xviii] The programme aims to remove the barriers to exploiting renewable energy and energy efficiency potentials as well as support specific demonstration initiatives.

By 2013, the Government of Seychelles began to implement the GEF funded project "Promoting Grid Connected Rooftop Photovoltaic systems in Seychelles". The objective is to increase the use of grid-connected PV systems as a sustainable means of generating electricity in selected main islands and smaller islands of the Seychelles, with a focus on small-scale producers that are already connected to the national electricity grid. The project target is to install 1.3 MW of grid-connected rooftop PV by the end of 2016.

The education sector has shown interest in renewable energy. The Ministry of Education is seeking funding to install solar PV panels at 35 primary and secondary schools to ensure they reduce consumption of electricity from the grid. The four private schools have installed solar PV panels to supply the air conditioners and to reduce their electricity bills.

UNEP and SEC are carrying out a Technology Needs Assessment for Climate Change for the Energy and Transport Sector. This has involved participatory stakeholder mapping and analysis. It is envisaged that this study will identify more ideas on how to reduce reliance on fossil fuels and also include the participation of more women in the sector.

There is limited participation of research institutions, such as the University of Seychelles, which is not active in research related to renewable energy. The University has signed a MOU with Teri University in India to provide a course on renewable energy for Middle Managers in Energy Management and Planning for Investments in Renewable Energy Technologies.

Very few NGOs are involved in renewable energy projects. Some of them are involved in biodiversity related issues in national parks and reserves that invest in solar for lighting. There has been good collaboration between Government, Private Sector and CSOs such as S4S and Seychelles Youth Hub in relation to renewable energy. The S4S has carried out a snap survey on the use of renewable energy by small business, fishermen and farmers. It established that they use electricity for irrigation, poultry and cold rooms for their produce. The Fishermen's Association was supported by GEF, in the first attempt to use renewable energy in the fisheries sector. The Association signed a memorandum of understanding with Seychelles Fisheries Authorities for the cold storage to use renewable energy technology.

The main donors involved are UNDP GEF, IRENA- Abu Dhabi Fund for Development (ADFD), AFD, JICA and EIB. There are at least 6 suppliers/installers in Seychelles offering a range of panels and inverters (PV supplier).[xix]

5. Market review

Since the overall rate of electrification is almost 100%, the greatest priority for the government is to reduce its reliance on energy imports and increase efficiency. The market is mainly focused on replacing the fossil fuel generation with renewable, on-grid generation capacity. For example, there are a number of off-grid resorts that rely on diesel generators. There is a risk of oil spillage during fuel transport to the different islands. The adoption of renewable energy technologies can help these becoming self-sufficient.

Despite the goal of establishing a democratised energy sector, the single buyer model limits the extent to which IPPs can offer off-grid solutions. The tariff regime is being reviewed with a view to becoming more cost-reflective. There

is no current feed-in tariff system in place. According to the UNDP Energy Policy Report "The average electricity tariff level should have been somewhere in the range of 13% to 17% (say 15%) higher in 2008".[xx] Cogeneration appears to be an area of significant potential, however unless licences for distribution can be issued, the benefits of cogeneration will be internal to the company. The SEC website presents a list of only eight renewable energy companies, primarily dealing in solar PV. This indicates the limited size of the current market.

The Seychelles Efficiency and Renewable Energy Programme supports households and small businesses to finance investment in renewable energy under a government initiative to encourage commercial banks and the Development Bank of Seychelles (DBS) to finance renewable energy projects. Under the programme, businesses can benefit from a loan from a commercial bank or from DBS amounting to a maximum R150, 000 (approximately €10,000) with 5% interest.[xxi]

The Government and UNDP GEF Project on PV (2016) are supporting renewable energy projects through a Rebate Scheme. This Scheme has a rebate of up to 25% of costs of installing solar PV for homeowners up to a maximum rebate of SCR 25,200, to encourage installation of solar PV systems. This is paid from a Fund set up by Government and UNDP-GEF.

The UNDP GEF Non-Scheme Loan has a low interest rate of 5%. This is aimed at assisting the public to invest in renewable energy and energy efficiency appliances. The business sector has interest in renewable energy and energy efficient refrigerators and freezers. There is a loan-subsidized scheme under the Seychelles Renewable Energy and Energy Efficiency Programme, applicable to the residential sector. The SEC is supposed to approve products that should be bought using the loan, to ensure that the products that are bought are energy efficient.

The African Development Bank (AfDB) 2016-2020 Country Strategy Paper (CSP) for Seychelles aims to foster a more diversified economy with greater resilience to external shocks and job creation for youth. It contains a US$ 39 million financing package that will be complemented with trust fund resources, climate funds as well as resources to be mobilised from parallel and co-financing mechanisms.[xxii]

The Mauritius Commercial Bank's (MCB) green loan initiative was extended to the Seychelles in 2016, providing up to 100% financing for loan values of between US$ 5,500 to US$ 7.6 million. The facility is supported by AFD.

Energy Efficiency

The Government of Seychelles and UNDP GEF Resource Efficiency Project aims to improve the existing market with more efficient technologies. The Project is proposing the introduction of VAT exemptions and minimum energy performance standards for air conditioners, refrigerators, freezers, washing machines and lighting products.

Whereas households are less aware of energy efficiency, the hotel and hospitality industry is quite aware of the benefits of energy efficient appliances. For example, the hotel and hospitality industry has replaced appliances, such as LED lighting, water heating and technology for regulating temperatures in the rooms. Building codes that promote energy and water efficient buildings have not yet been enacted into enforceable regulations.

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
The legal and regulatory framework governing IPPs is vague and contradictory	▪ Unclear regulatory framework especially when the Electricity Regulations empowers the PUC to grant permits to auto-producers or IPPs. ▪ Absence of regulations that address the issue of electricity from auto-producers or IPPs being fed back into the grid. ▪ Legality of PUC to buy electricity from IPPs even at negotiated tariffs is unclear.	▪ Emphasise work towards: - Proposals to review and strengthen the Energy Act. - Improved regulation and licensing of electricity services, including the generation, transmission, and distribution of electricity (unbundling of the sector). - A clear definition of the division of responsibilities between the PUC (production, transmission and distribution) and auto-producers or IPPs. - Definition of a tariff methodology. - Rules for auto-producers and IPP's (i.e. a Grid Code).
Access to financing is limited	▪ Low access to funding by Government, PUC, SEC and private sector. ▪ No adequate maintenance support for end users. ▪ There limited space for land areas for solar farms. ▪ There are no special grants for civil society organisations (CSOs) to stimulate investments in renewable energy. ▪ The business case for renewable energy has to be taken into consideration based on the island context, which is logistically challenging, and the relatively small customer base.	▪ There is political will to adopt renewable energy technologies, for example, the Government has expressed its willingness to support financial mechanisms for renewable energy. [xxiii] ▪ Financial Incentive Schemes for PV systems from GEF, the Ministry of Finance, the European Investment Bank, and the International Finance Corporation to stimulate investments are in existence and could be supported. ▪ The Seychelles is open for business and new technologies. ▪ There is a need to exploit opportunities for Ocean Thermal conversion. ▪ There are tax incentives on all renewable equipment, and exemptions on energy efficient appliances. ▪ A variety of private businesses have expressed interest in installing and managing solar PV systems, for example, the hotels and Island Development Corporation. Training will be provided to government and private financial institutions on assessing and making loans by the EIB.
Local manufacturing would reduce the need for costly imports of products	▪ No local manufacturing of renewable energy and energy efficiency products resulting in imports, and without standards for renewable energy solutions, poor quality projects are being imported.	▪ Training Program to support Market Development under the UNDP GEF Project.[xxiv] ▪ The SEC developing standards for the renewable energy technologies.

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Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Technical and knowledge barriers	▪ Existing technical and institutional capacity and experience with RETs is extremely limited, e.g. limited technical capacity to install and operate PV systems and to connect them to the electricity grid. ▪ Insufficient capacity to train technicians. ▪ Lack of technical standards or certification requirements for labour associated with renewable energy systems. ▪ Limited access to information on the opportunities and advantages of solar PV technology. ▪ Absence of any detailed assessments of national energy resources, including projected electricity demand and supply. ▪ Lack of awareness among importers and public of quality standards. ▪ Imports of products result in the technologies being very expensive. ▪ No testing facilities or testing facilities are too expensive for the government departments such as SEC. It relies on testing reports, which are authenticated by the Seychelles Bureau of Standards (SBS) that also has a shortage of staff.	▪ Support to programs on technical training and certification processes for solar PV and other RETs; targeted studies of national energy resources and electricity grid requirements. ▪ Capacity building of PV market that include suppliers and service companies. ▪ Information sharing and awareness raising on the technical, financial and socio-economic aspects of renewable energy opportunities in the country, will be designed and conducted. ▪ Several NGOs that include Sustainability for Seychelles and the Sea Level Rise Foundation have conducted numerous public education and awareness campaigns on climate change issues. They are willing to raise awareness of renewable energy technologies in Seychelles. ▪ Studies have been carried out that include 2011 Wind Resource Assessment; 2014 Grid Absorption Capacity, Grid Code, Feed-In Tariffs and Model Power Purchase Agreements for Renewable Energy Systems; 2016 A 100% Renewable Seychelles; and 2016 Formulation of Master Plan for Development of Micro Grid in Remote Islands. ▪ Update information and statistics on energy imports, energy production and energy consumption by SEC / PUC / SEYPEC / National Bureau of Statistics (NBS) ▪ Provide guidance / strategies for energy efficiency and renewable energy programs, including incentives by SEC / PUC / NGOs.
Infrastructural barriers	▪ The PUC has obsolete equipment and an unstable national grid, which cannot handle more power generated from solar PVs. This means the PUC decides the capacity of the solar PV.	▪ The PUC is looking for funding from Green Climate Fund to upgrade the grid and promote access to renewable energy.

7. Implications for the Theory of Change

Seychelles already has close to 100% electricity access but the main part of the electricity production is based on expensive imported fossil fuels. Despite the intention of democratising the energy sector, this does not seem to have been implemented yet. The single buyer model means that PUC would purchase all electricity generated and supplied into the grid, however due to the aging and obsolete infrastructure and grid instability, the amount of renewable energy generated that can feed into the grid is limited, according to SEC.

Unlike the other countries within the EEP S&EA region, providing energy access is not the main concern for the Island. Replacing the fossil fuel consumption with renewable energy and introducing energy efficiency measures to reduce the effect of growing demands are the main concerns. Encouraging co-generation and providing distribution licences to hotels and businesses in the outer islands would relieve the pressure on the IDC to meet needs.

The private sector is not significantly developed to meet demand and local awareness and technical capacity is lacking. However, schemes such as the distribution of solar home systems by PUC to poor households does not facilitate the formulation of market-based solutions.

The main results that will be achieved under the existing Theory of Change are the reduction of CO2 emissions from the fossil fuel consumption and reduced carbon footprint that is displaced by renewable energy and the avoidance of increases of demand in future through the energy efficiency measures.

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[i] *http://gtf.esmap.org/*

[ii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System - Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iii] *Seychelles Climate Change Policy Assessment, 2017*

[iv] *https://www.reeep.org/seychelles-2012*

[v] *Seychelles Energy Commission Technical Specifications for Grid-Connected Photovoltaic Power Systems, 2014*

[vi] *http://www.sec.sc/index.php/objectives-functions*

[vii] *http://www.pcusey.sc/index.php/component/remository/Photovoltaic-Systems-(PV)-Project/Project-Technical-Reports--and--Others/SEC-Technical-Specifications-for-Grid-Connected-Photovoltaic-Power-Systems-Feb-2014/?Itemid=*

[viii] *ibid*

[ix] *ibid*

[x] *http://gtf.esmap.org/country/seychelles.*

[xi] *www.renewables-made-in-germany.com.*

[xii] *www.sea-sun-tech.com/energy/dena.html*

[xiii] *Solar Power Integration on the Seychelles Islands, 2016*

[xiv] *ibid*

[xv] *ibid*

[xvi] *Renewable energy mini-grids: An alternative approach to energy access in southern Africa, 2016*

[xvii] *ibid*

[xviii] *ibid*

[xix] *http://www.sec.sc/index.php/electricity-sector/generation/renewable-energy*

[xx] *Seychelles Energy Commission Technical Specifications for Grid-Connected Photovoltaic Power Systems, 2014*

[xxi] *http://www.sec.sc/index.php/15-latest-news/70-renewable-energy-scheme-to-benefit-businesses*

[xxii] *https://www.afdb.org/en/news-and-events/afdb-seychelles-new-development-strategy-targets-diversification-and-resilience-15413/*

[xxiii] *Seychelles Energy Commission Technical Specifications for Grid-Connected Photovoltaic Power Systems, 2014*

[xxiv] *ibid*

Country profile – South Africa

1. Overview

Indicator	Data
Population	55.01 million
Population density	45.35 person/km²
Global Tracking Framework Indicators [i]	
Access to electricity	86% (94.06% urban, 71.38% rural)
Access to improved cooking	81.84%
RE as proportion of the mix	16.59% (13.32% traditional biomass; 0.45% modern renewables)
Other Indicators	
Reliance on energy imports (2014) (IEA)	23% of TPEC
Centralised or liberalised electricity sector	Partially liberalisation [ii]
Bundled generation, transmission and distribution?	Bundled generation and transmission, distribution decentralised
Existence of renewable energy IPPs	Yes
Import duties on renewable energy products	Yes
RAGA/ AA/ IP	No
Renewable energy strategy	No
Number of EEP Phase I & II projects	37
Total EEP contribution (% of total budget)	€6,486,744 (49%)
Average daily solar irradiance [iii]	6,870 Wh/m²/day
Electricity subsidies	Yes [iv]
Fuel subsidies	Yes for transport, electricity and heat / no for industry and buildings. [v] Type of fuel subsidised are gasoline, kerosene, diesel, and LPG. [vi vii]

South Africa is at the forefront of addressing renewable energy and energy efficiency across the continent. The government established the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) having rejected the establishment of feed-in-tariffs. Since then, 102 IPPs have been selected through an open tendering process amounting to 6,327 MW of additional generation capacity, 53% of which generate electricity through onshore wind projects, 36% solar PV, and 9% solar CSP, and 4% from landfill gas, biomass and small hydro.

Off-grid solutions however have largely been neglected, primarily due to the government's commitment to ensuring universal grid access. Biomass consumption is significant although the data available is dated and unreliable. Gov-

ernment programmes have previously sought to displace wood fuel and charcoal consumption with LPG however this failed primarily due to cost and a lack of infrastructure.

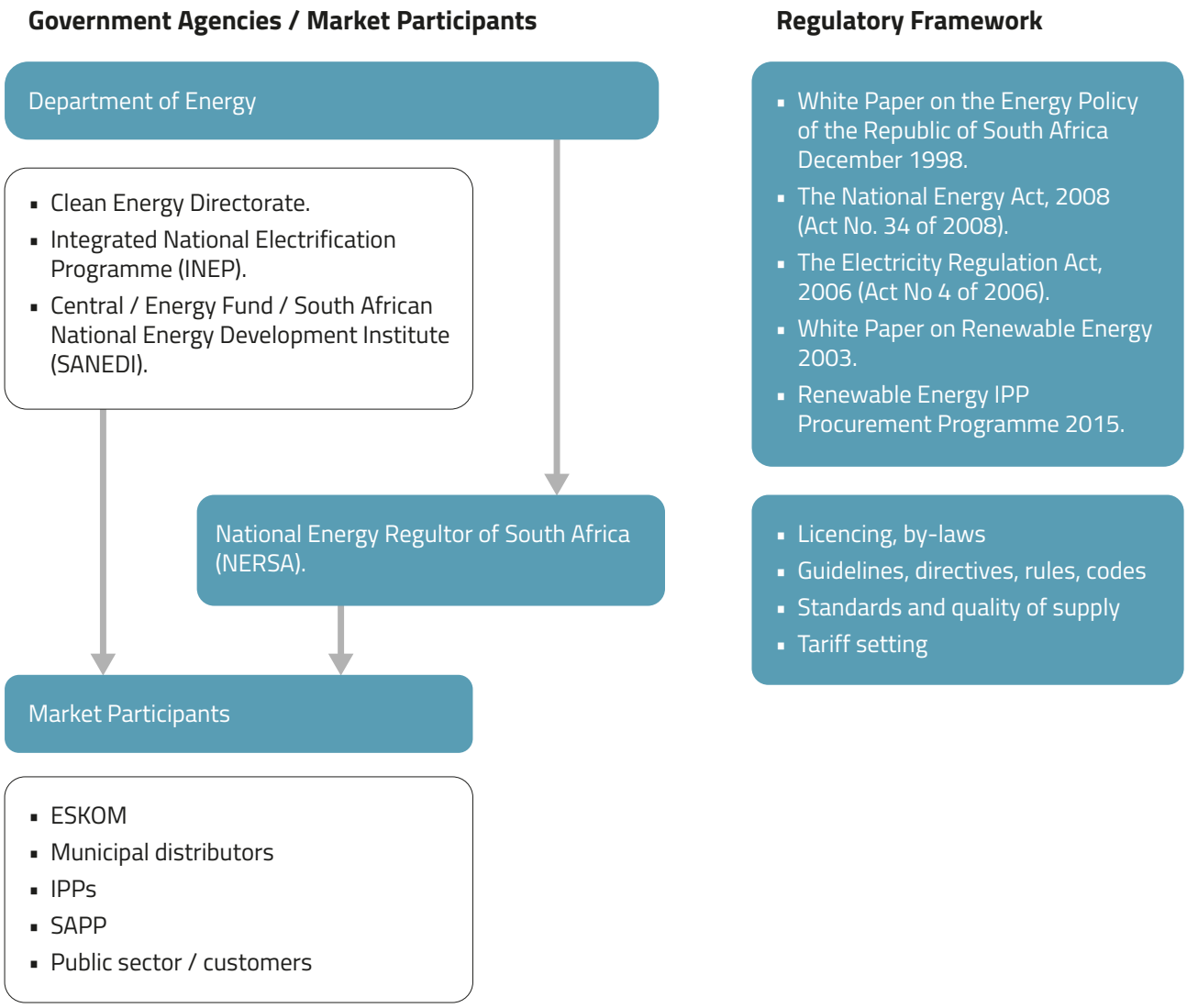
2. Institutional framework

Institutional structure

The Department of Energy in South Africa is responsible for establishing the policy, legal and regulatory framework to address energy services across South Africa. The Clean Energy Directorate: Renewable Energy Initiatives overseas the formulation of national policy and drives the implementation of the interventions that are prioritized nationally. Under the Central Energy Fund (CEF), South African National Energy Development Institute (SANEDI) undertakes applied energy research and development, demonstration and deployment and specific measures to promote the uptake of Green Energy and Energy Efficiency in South Africa.

The Department of Environmental Affairs has developed GHG mitigation studies for the most significant sectors, including the public, industry and transport sectors, which include the implementation of renewable energy and energy efficiency projects.

Figure 1: Institutional structure for the energy sector in South Africa



The National Energy Regulator of South Africa (NERSA) is responsible for awarding and managing licences for electricity production. Eskom, the national utility, dominates the power sector in South Africa. As the principal off-taker, Eskom signs the PPAs with IPPs. Under the REIPPPP programme, 102 IPPs have been selected through an open tendering process amounting to 6,327 MW of additional generation capacity. 2,200 MW have been delayed as PPAs have not been signed since 2015.[viii] South Africa is a member of the South African Power Pool, linked to Zimbabwe and Mozambique. Before the Kusile and Medupi coal-fired power stations were completed, South Africa was very reliant on the energy imported to fill the deficit of generation capacity. 164 local municipalities, 1 district municipality and 8 metropolitan municipalities have licences to distribute electrical power.

Policy framework

The overarching policy framework for renewable energy in South Africa is the White Paper on Energy Policy (1998) and the 2003 White Paper on Renewable Energy (WPRE), and the 2011 National Climate Change Response White Paper Policy. The progress towards achieving national goals is reported in the State of Renewable Energy Report 2015.[ix] South Africa is proud to take the lead in terms of renewables, setting a target of commissioning 17.8 GW of newly generated electricity from renewable energy sources between 2010 and 2030. The South African government has committed to reduce its emissions (below business as usual) by 34% by 2020, progressing to 42% by 2025.

The Integrated Resource Plan 2010-2030 calls for the doubling of electricity capacity using diverse sources, including renewables, specifically the importation of large-scale hydro. The amended Electricity Regulations Act (ERA, 2006) facilitated establishment of REIPPPP. The ERA provides Ministerial powers to determine the new capacity that is required. Three Ministerial Determinations for the procurement of 3,725 MW by 2016, 3,200 MW by 2020 and 6,300 MW by 2025, have been issued. In 2009, NERSA published REFITs however these were not implemented and instead were used as a cap for the competitive tendering. 100 MW was allocated to the procurement of small projects of between 1 MW and 5 MW.

Energy Efficiency

The Department of Energy produced the first National Energy Efficiency Strategy (NEES) in 2005 with the support of a DANIDA capacity building programme. Since then, significant work has been undertaken in developing interventions, particularly across the buildings, public and industrial sector. The regulatory framework is also quite robust in that there are tax incentives for the performance of retrofits and standards have been or will be introduced for the energy performance of buildings (SANS 10400XA) and appliances (standards and labelling).

Under the Energy Efficiency Demand Side Management (EEDSM) programme supported by GIZ, municipalities have received grants to perform retrofits and monitor their energy savings. Within the public sector, the partnership with the Department of Public Works has been instrumental in beginning the process of mainstreaming energy efficiency in buildings management under the Leading by Example initiative, starting with the fundamentals of establishing the energy consumption and then undertaking energy audits with a view to performing retrofits. In the industrial sector, the National Cleaner Production Centre (supported by UNDP/ GEF) and the Private Sector Energy Efficiency Programme (PSEE) (supported by DfID) have funded the performance of audits and some retrofits. The post-2015 NEES has been promulgated for comment as well and is now awaiting submission to Cabinet.

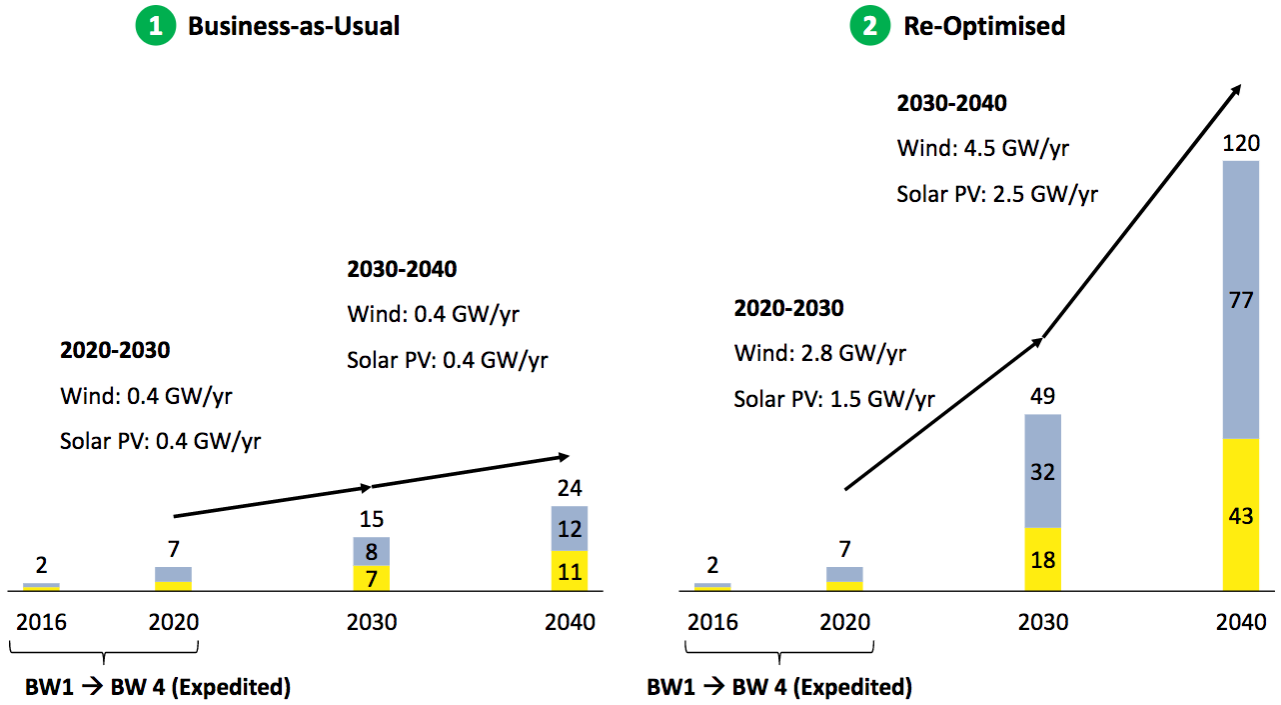
3. Technology review

Renewable Energy

As mentioned above, 102 IPPs have been selected through an open tendering process amounting to 6,327 MW of additional generation capacity, 53% of which generate electricity through onshore wind projects, 36% solar PV, and 9% solar CSP, and 4% from landfill gas, biomass and small hydro. The bankability of the projects is improved as the

level of risk has been mitigated by government guarantees. The Council for Scientific and Industrial Research (CSIR) has re-worked the IRP projections for 2040 adjusting primarily for the changes in the prices and accessibility of technology. As shown below, generating capacity from solar and wind is anticipated to total 7 GW/year.

Figure 2: Revised projections of the renewable energy mix re-optimised (Source: CSIR) (yellow for solar and grey for wind) [x]



Hydro

There are three large-scale hydropower plants amounting to 642 MW of installed capacity. There is potential to expand on hydro production however as South Africa is a water stressed country, the exploitation of this potential should take the impact on water resources into consideration. Under the REIPPPP programme, no small hydro projects have been shortlisted to date.

Solar

The country has an average of more than 2,500 hours of sunshine per year, placing it in the top-3 in the world for solar potential. Under the four REIPPPP rounds to date (up to April 2015), solar PV has accounted for 1,899 MW, and CSP for 400 MW.

Government policy allows for 50 kWh of free basic electricity per month to those that are grid connected. For those that have not been connected to the grid, more than 96,000 solar home systems have been installed under the rural off-grid electrification programme, which began in 2001. The South African government has invested in excess of ZAR 350 million (approximately €42 million in 2001) in this programme. The models being provided incorporate the provision of light, mobile phone charging and a radio and/or TV, thus tier 3 according to the World Bank multi-tier framework. The New Household Electrification Strategy (NHES) aims to achieve universal energy access (97% of households) by 2030 and has identified a target of 300,000 households for electrification with non-grid solutions by 2025. Learning from the previous scheme of distribution, the Department of Energy is directly overseeing the

contracting of the supply and installation of equipment. In terms of the impact of the initial roll out, it is reported that the distributed solar home systems are not being maintained and have not had the desired impact, in part due to them being provided for free. The dissemination of solar water heaters has been promoted through a mass rollout strategy to low to mid-high income homes. Other off-grid solutions include the commitment to the rollout of solar water heaters (SWH) to both low-income and mid-to-high income households. The NDP has a long-term vision of 5 million SWH installations by 2030.

Biomass, stoves and biogas

With technical support from the Netherlands government, a Biomass Action Plan is being developed. A Bioenergy Atlas has been launched and is available online (http://bea.dirisa.org/). This facility will support potential project developers in identifying potentials and exploiting them. There is significant potential for biomass generation although there is a history of some project failures, such as in the case of Howick Wood Pellet Plant and Tstsikamma Biomass Plant, due to unfavourable PPA conditions with Eskom.[xi] LPG was being promoted in rural areas to replace wood use however, due to issues of poor distribution networks and the cost of investing in gas bottles, this failed.

Biogas is being exploited broadly, particularly as the industrial sector presents opportunities for production and as an off taker. Eight projects were supported by the EEP programme. Electricity is being generated from wood waste at pulp and paper plants and bagasse from the sugar industry. South Africa is developing the use of methane from municipal waste for power generation.[xxi] The Bio2Watt project, the first viable biogas project in South Africa, was supported by EEP and has a capacity of 4 MW to be sold to an industrial off taker in Bronkhorspruit. WEC Projects has established a municipal biogas plant from wastewater treatment and is now feeding 1.2 MW into the grid.

Improved cook stoves are being marketed in South Africa despite that only 18% of the does not have access to improved modern fuels for cooking, but this is still more than 10 million people. The businesses use various channels of distribution and models of stove. A project supported by EEP, 5 Star Stoves is rolling out a franchise model. Restio Energy has distributed more than 32,000 stoves across the country, as well as 1,700 Household Energy Kits that include a solar light and mobile phone charging capability.

Wind

The Department of Energy, with support from the GEF through the UNDP, and DANIDA, has developed the first numerically verified Wind Atlas for South Africa (WASA I). In addition, Ten wind measurement masts, each 60 metres high, were erected throughout the Western Cape, parts of the Eastern Cape and Northern Cape provinces to provide observational data that was correlated with the modelled data to provide the numerical wind atlas. The WASA has demonstrated significant wind energy potential in coastal areas and inland. The Cookhouse wind farm began feeding into the grid in 2014 and was the largest wind farm in Africa until recently, with 66 turbines generating 138 MW. There is significant interest from large-scale power producers in investing in wind energy in South Africa. Companies such as Vestas, Siemens and Nordex provide the turbines and it is estimated that 2,000 jobs were sustained in the wind industry in 2015. The total installed wind power is 1.13 GW and it is expected to rise to reach 5.6 GW by 2020. The REIPPPP has been instrumental in stimulating this market.

Energy efficiency

Energy efficiency has gained in recognition in South Africa. It is a crosscutting issue and therefore stakeholders from every service delivery function are relevant to the realisation of energy savings. There is a strong emphasis on buildings efficiency in South Africa, primarily driven by the introduction of energy performance standards for buildings. CSIR has established a model for low-cost social housing, of which approximately 900,000 are built per year that is extremely energy efficient for the same investment price. The ESCO model is reportedly being tested for schools in undertaking retrofits for roofing and cooking facilities.

4. Stakeholder review

On-grid

The Government of South Africa has taken the lead in the region in encouraging investment in renewable energy. The main focus of this investment has been on on-grid IPPs and there is little incentive for off-grid solutions. The role of Eskom, the state owned utility, is pivotal in the South African market. The signing of PPAs with Eskom has been on hold for two years due to the reluctance of Eskom to be bound to purchase the generation from the renewable plants, particularly now that the Medupi coal fired power station is gradually being connected, unit 3 out of 6 having been connected on the 6th June 2017. The President instructed Eskom to finalise the PPA process in his State of Nation Address 2017, requiring Eskom to take action. The new Minister of Energy Mmamoloko Kubayi has agreed to embark on a new process for the signing of cooperation agreements with Russia, the US, South Korea, France, and China in relation to nuclear power. In May 2017, the Minister committed to see through the government pledges on renewable energies and stated that the choice was not between nuclear or renewable energy.[xiii]

The growing private sector investment and the creation of jobs in the renewable energy sector has increased the influence of the private sector in encouraging policy change. The disappointing degree of participation of IPPs in previous rounds of the REIPPPP demonstrated to the Department of Energy and Eskom, at a time when the gap in generation capacity was affecting the reliability of power, that a change of approach was necessary.

Off-grid

The availability of renewable energy products and technical expertise in South Africa is relatively strong. As the provider of goods and services across the region, the private sector in South Africa is buoyant however the majority of private sector businesses are engaged in either supplying middle-income households or as contractors for large-scale government programmes. There are some NGO off-grid schemes but scale has not been achieved in terms of biogas, solar home systems, mini or micro grids, solar kiosks or appliances. ISHACK for example is being subsidised through the free basic electricity allowance to provide solar home systems in informal settlements and rural areas. There is a segment of suppliers that are servicing the energy needs of the domestic and agricultural sector, primarily providing small scale solar PV and solar water pumping services, such as Kestrel Renewable Energy Installations.

Donors and financing institutions

The main donors engaging in South African renewable energy and energy efficiency are UNDP, GEF, JICA, the Danish Energy Agency, GIZ (SAGEN), SECCO, REEEP (including Germany, Norway, Austria, Switzerland and UK), AFD (Green Credit Line), KfW, BMZ, World Bank, AfDB, IFC and Power Africa/ USAID. Many are provided a combination of technical assistance and investment financing to stimulate the market. AFD for example is partnering with IDC, Nedbank and ABSA to on-lend for small-scale renewable energy projects. The Development Bank of South Africa is a key funder of the REIPPPP projects.

Research institutes, associations and NGOs

There are a number of institutions working in the energy space to develop innovative solutions. The South African National Energy Development Institute (SANEDI) has the mandate to support the government in promoting green energy and energy efficiency. Under the REEEP programme, SANEDI, has established the Renewable Energy Centre of Research and Development (RECORD), supporting various technological platforms to establish the potential for their use in South Africa and to bring together stakeholders to encourage their development. The platform covers solar, waste-to-energy and biomass technologies. The CSIR, the Energy Research Centre at the University of Cape Town, and Sustainability Energy Africa, the Sustainable Energy Society of Southern Africa (SESSA), Centre for Renewable and Sustainable Energy Studies (CRSES) and the Energy Efficiency Hub at the University of Pretoria are also active in energy research.

Energy efficiency

The stakeholders in the energy efficiency space in South Africa cut across all sectors. The public sector initiatives are being led by the Department of Energy in collaboration with the Department of Public Works. GIZ is working closely with the Department of Energy and local government (municipalities) to introduce energy saving measures across those municipalities receiving Treasury grants. Representation from the residential sector is primarily addressed through the South African Local Government Association (SALGA), which is supporting municipalities (as electricity distributors) in implementing energy efficiency strategies.

In the commercial sector, the South African Property Owners Association (SAPOA) is a key partner. Growthpoint, the largest commercial property trust in the country, leads their sustainability committee. Business Unity South Africa (BUSA), the Energy Intensive User Group, and the National Business Initiative (NBI) represent the industrial sector.

Finally, the transport sector is made up of a variety of different actors, including of course the Department for Transport, National Association of Automobile Manufacturers of South Africa (NAAMSA), Airports Company South Africa (ACSA), Passenger Rail Agency of South Africa (PRASA), Transnet, South African National Roads Agency Limited (SANRAL), Electronic National Administration Traffic Information System (eNatis) and the South African Maritime Safety Authority (SAMSA).

5. Market review

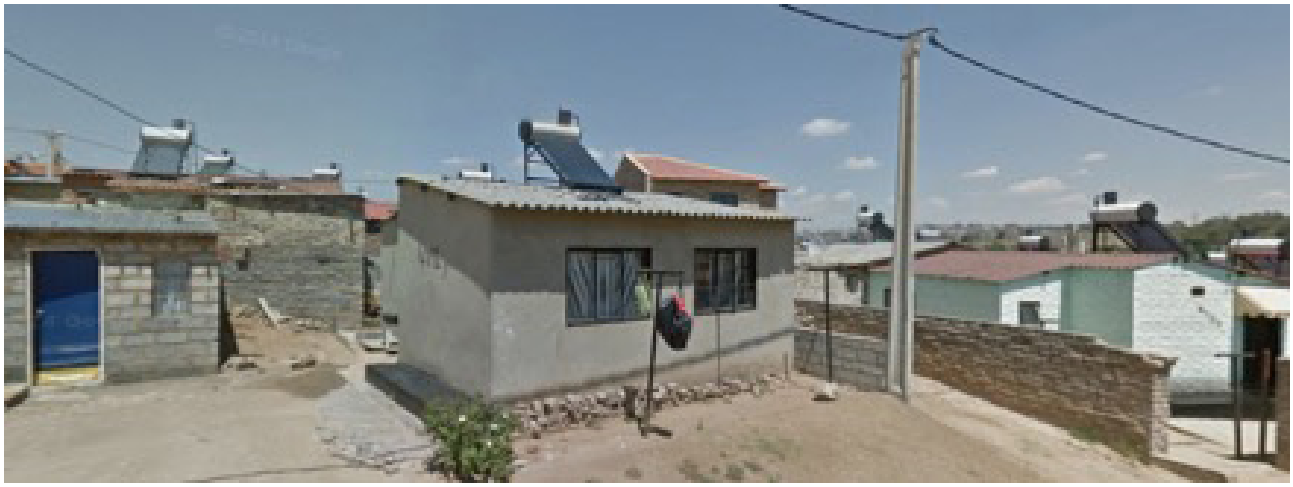
The market for renewable energy in South Africa is very strong, primarily in terms of the small-scale IPPs. It is more challenging for IPPs to get access to finance and the transaction costs involved in bidding as a small project are considered to be significant. Even though the volume of customers that are underserved may be significant, the private sector in South Africa has traditionally focused on providing services where risks are minimal and where energy intensity and ability to pay is higher. The viability of operating in a market segment where purchase power is low and where the government has historically rolled out massive programmes has not attracted significant interest.

Financing of renewable energy is becoming easier but is still not readily available. As of July 2015, 133,775 megawatt-hours had been transacted in the South African REC programme. Private investors, ranging from multinational paper companies and wind turbine and PV cell manufacturers to local private banks, are engaging in renewables. DBSA, along with IDC and the Public Investment Corporation, have provided major support to South Africa's REIPPPP, contributing ZAR 6.7 billion (approximately USD 558 million) in loans and an additional ZAR 1.3 billion (approximately USD 108 million) in grants under its Black Empowerment programmes, for the first two REIPPPP bidding phases. Despite these funding flows, there is some indication that there is little incentive for the finance industry to participate in providing funds for smaller IPP schemes. The transaction costs are too high and potentially the risk greater, particularly if the size of them does not warrant guarantees. The Solar PV rooftop market has been steadily growing without added incentives and this may perhaps be due to the recent issues of reliability of supply. In general, off-grid solutions have not been developed significantly in part, as mentioned above, due to the relative size and purchase power of the market but also due to market distortions brought about by mass roll outs of technologies.

On the part of local communities, there is a lack of trust in off-grid solutions, particularly those provided for free as it is considered to be an indication that the government is resigning its responsibilities to provide grid access, a promise that is often given to rural communities. Projects like ISHACK have therefore encountered difficulties in obtaining buy-in from peri-urban or rural communities on the basis that the government may down-prioritise the investment if they see that communities have found their own solutions. It is not primarily technological issues that are perceived to be problematic, rather it is the need to subsidise the early stages of wood pellet market development and distribution channels until the scale of the market can generate returns that no longer require subsidy. International Institute for Environment and Development (IIED) suggests focusing on smaller scale community based biomass

models, using local communities to establish distribution channels in combination with stove producers. The current building standards of South Africa require that half of the demand for hot water is met by non-electrical element heating, boosting the use of solar water heaters in the country. However, the quality of workmanship in installing equipment during the mass roll out of the solar water heater programme has significant consequences for the credibility of renewable energy solutions.

Figure 3: Solar water heaters installed at different orientations in Marlboro, South Africa (Source: Google Maps)



6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
The successes of large scale IPPs are not replicated for small-scale	▪ The bidding process is cumbersome and costly for small-scale IPP projects. This affects the feasibility. ▪ The business case for small-scale, off-grid IPPs necessitates a base load in the local area, e.g. a local factory or farm.	▪ Funding could be provided specifically to the bidding process for small projects, provided technical support was given to ensure that the bids were of good quality and based on a sound feasibility study ▪ There is some scope to stimulate the formulation of IPPs that not only feed into the grid but also provide to surrounding communities and local anchor loads, including local distribution networks. This diversifies the off-taker and makes the link with providing services to the underserved. Due to the extent of the grid network, this may be more feasible. ▪ Palm Tree Power (a manufacturer of small wind-power technologies) may be a good example of how technology does not need to be overcomplicated. Identifying project technologies that are relevant and suit the local context is not as simple as it sounds.
Financing is still required to encourage commercial banks to provide affordable credit	▪ The risks and transaction costs associated with renewable energy is still considered to make supporting off-grid energy access and small-scale IPPs unattractive.	▪ Providing credit guarantee mechanisms is necessary at this stage although banks have a greater risk appetite for some technologies than others.

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Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Market distortions are crowding out the private sector	▪ The mass rollout programmes have not been proven to be effective in enhancing the quality of life and the equipment provided is not installed correctly or maintained.	▪ The government is committed to providing an equivalent to the free basic electricity allowance for those on the grid. ISHACK make use of this to subsidise the monthly subscription to a PAYG model of solar home system. ▪ There are a number of programmes working on capacity development of technicians and accreditation, the formalisation of which should be promoted and enforced.
Public perception of off-grid energy is that it is inferior – the poor people's solution	▪ The political rhetoric has promised grid connection to all areas of the country and the free basic electricity allowance of 50 kWh per month. Many living in rural areas believe that by accepting the stand alone systems will let the government off the hook with expanding the grid to their area.	▪ Improving the quality of off-grid energy access to provide similar levels of service would reduce this perception. This means improving the services and quality appliances that can be used (e.g. Lighting Global approved DC appliances on solar PV). ▪ Several respondents state that the testing of new and innovative ideas does not occur in poor communities. This is often due to the investment cost of new technologies and society aspires to a living standard that is higher than the current level. Therefore, establishing demonstration projects in urban areas can increase their acceptability. ▪ Concepts such as the Rethaka Repurpose Schoolbag could potentially be up-scaled significantly, grounded in a community priority for education, and help gain the acceptance of children of renewable energy solutions. These solutions also lead to job creation through local manufacturing.
Energy efficiency as it links to poverty reduction could be tackled in public institutions	▪ The energy savings potential within the public schools and hospitals may be limited, based on the experience of the Departments of Energy and Public Works. ▪ Reallocating savings on energy to other budget lines is not possible within the current fiscal framework and instead a project proposal needs to be presented to government.	▪ The portfolio approach may be more effective whereby at a certain scale (e.g. a number of schools), the revenue from savings begins to make business sense through the economies of scale. ▪ Engagement with government on how savings from energy efficiency measures can be used to improve service delivery as an incentive for public sector institutions may be useful. Working with the National Treasury and SE4ALL to identify how the barrier of reallocation of funds may be addressed would open the potential for ESCOs to provide establish viable businesses that improve the quality of education of the poor.
Not much is known about off-grid energy needs in South Africa due to the emphasis on grid connection	▪ The estimates for wood fuel are not based on current or reliable data that has been extrapolated into the future. ▪ There is a lack of understanding of what is needed by rural households and the types of models that could apply.	▪ Performing research into the drivers of the social economy, potential productive uses and energy usage patterns would inform project developers to design innovative solutions.
Technologies such as biogas have a strong rural poverty impact but are not being exploited	▪ Biogas digesters are not being used broadly when there is significant potential in public institutions either from sewage, manure and/ or kitchen waste.	▪ The role of local associations could potentially support the promulgation of technologies such as biogas. ▪ Demonstration projects can help to dispel concerns regarding the use of organic waste and raise awareness.

7. Implications for the Theory of Change

South Africa has developed a strong legal and regulatory framework that supports renewable energy generation on the grid. The technologies being covered are primarily wind and solar PV, with some CSP. Smaller scale IPPs have faced challenges of the cost of bidding and in securing finances in a risk averse market. There is potential to develop bankable projects that exploit alternative technologies, such as biogas.

The off-grid market in South Africa has largely been ignored partly due to the share of the overall market being so small. In addition, the mass rollout schemes being implemented by the government in replacement of the free basic electricity allowance crowds out commercial enterprises. The social perception of off-grid energy supply is an obstacle and therefore potential projects would need to address this perhaps providing a comparable level of service to grid connection and establishing demonstration project, potentially in urban to increase their credibility but also in public sector institutions where the social development impact is demonstrable – although the funds saved from energy savings are currently returned to Treasury.

South Africa is likely to be able to offer knowledge transfer to other countries in the region and developing manufacturing capacity for renewable energy in South Africa may provide a benefit for the whole region. Building on existing standards and encouraging a diversity of technological and business models will need to be adopted. The promotion of alternative energy sources for cooking could be supported.

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[i] *http://gtf.esmap.org/*

[ii] *http://www.greenpeace.org/africa/global/africa/publications/coal/theeskomfactor.pdf*

[iii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System - Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iv] *http://sa.deloitteblog.co.za/wp-content/uploads/2013/02/Demystifying-Tariff-Setting.pdf*

[v] *http://www.climatepolicydatabase.org/index.php?title=Country:South_Africa*

[vi] *G20 subsidies to oil, gas and coal production: South Africa, Country Study, 2015*

[vii] *Fossil Fuel Subsidy and Pricing Policies Recent Developing Country Experience, 2016*

[viii] *http://sarec.org.za/wp-content/uploads/2017/05/SAREC-FAQ-Doc.pdf*

[ix] *http://www.gov.za/sites/www.gov.za/files/State%20of%20Renewable%20Energy%20in%20South%20Africa_s.pdf*

[x] *http://www.engineeringnews.co.za/attachment.php?aa_id=65601*

[xi] *http://pubs.iied.org/pdfs/17165IIED.pdf*

[xii] *http://www.ren21.net/wp-content/uploads/2015/10/REN21_webfile.pdf*

[xiii] *http://citizen.co.za/news/news-national/1512901/energy-minister-wont-appeal-high-court-ruling-nuclear-energy/*

Country profile – Swaziland

1. Overview

Indicator	Data
Population	1.28 million (2015)
Population density	74.82 person/km² (rural 480 persons/km²)
Global Tracking Framework Indicators [i]	
Access to electricity	65% (urban 100%, rural 26.49%)
Access to improved cooking	35.3%
RE as proportion of the mix	63.55% (traditional biomass 21.06%, modern sources 5.15%, 53.26% RE as a share of electricity)
Other Indicators	
Reliance on energy imports (2014) (IEA)	50% (100% of electricity supply) [ii]
Centralised or liberalised electricity sector	Centralised although the Energy Regulatory Act 2007 does aim to liberalise the electricity and petroleum sectors
Bundled generation, transmission and distribution?	Bundled
Existence of renewable energy IPPs	One PPA signed with Ubombo Sugar Ltd
Import duties on renewable energy products	No. Electricity is sold without VAT and there is VAT on RE products (14%)
RAGA/ AA/ IP	RAGA (and Country Action Plan)
Renewable energy strategy	None
Number of EEP Phase I & II projects	3
Total EEP contribution (% of total budget)	€362,882 (68%)
Average daily solar irradiance [iii]	5,640 Wh/m²/day
Electricity subsidies	Yes [iv]
Fuel subsidies	Fuel subsidised [v]

2. Institutional framework

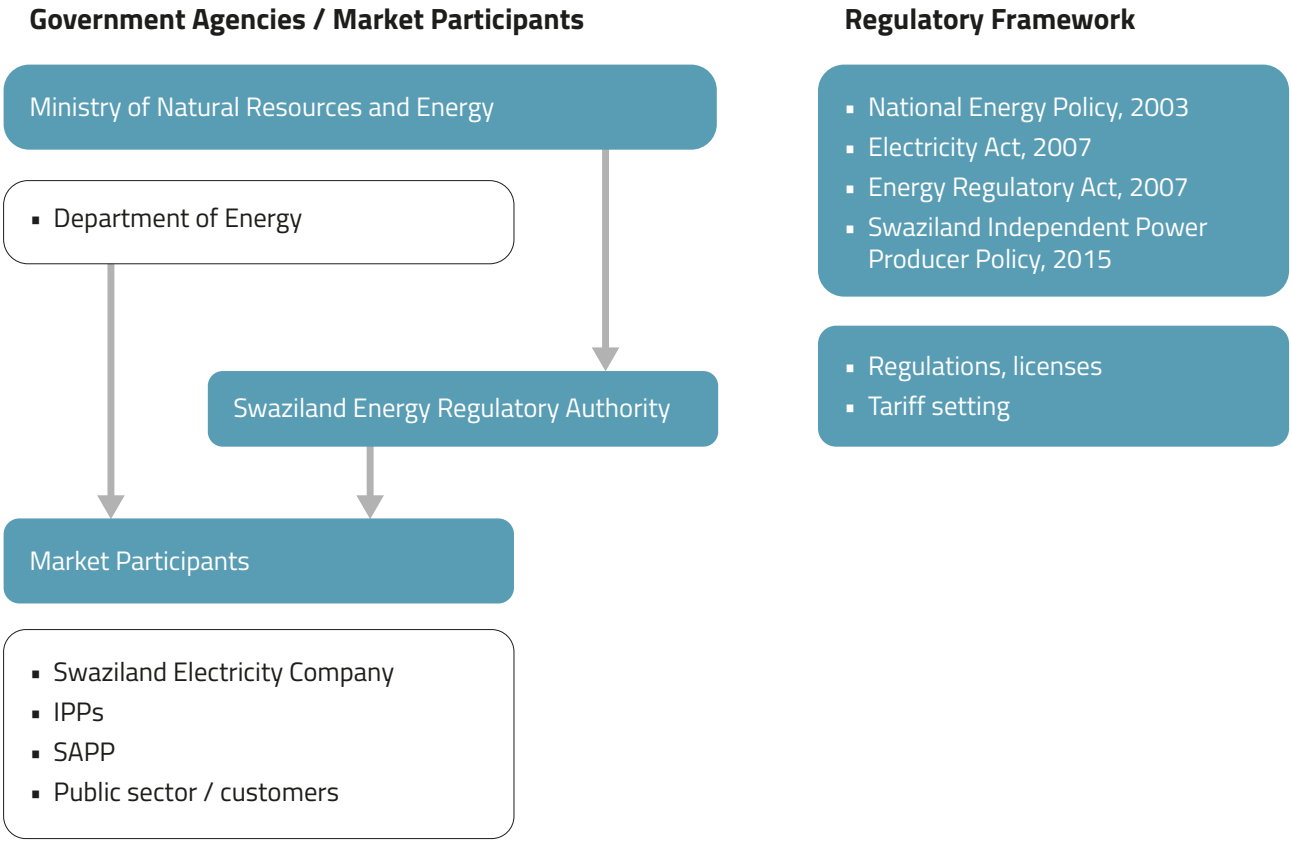
Institutional structure

The Ministry of Natural Resources and Energy (MNRE) is responsible for the strategic and regulatory framework and oversight of the petroleum sector. The Swaziland Energy Regulatory Authority is responsible for the electricity sector regulatory framework, issue electricity production licenses, regulate electricity tariffs and oversee the deregulation of the electricity industry.

Swaziland Electricity Company (SEC) is the state-owned utility. SEC is responsible for transmission and distribution of electricity. The current installed capacity is 69.6 MW, 60.1 MW is hydro and 9.5 MW diesel-generated.[vi] However, due to the drought in 2016, local hydropower production has dwindled and the only current local electricity production comes from the sugar factories. Royal Swaziland Sugar Corporation (RSSC) is the largest producer of Sugar in Swaziland with 3.6 million tons of cane crushed in a year with a planned expansion to increase the cane crushing capacity to 4.2 million tons. RSSC alone has a capacity to export approximately 60 MW of bagasse based electricity to the grid.

Ubombo Sugar Limited (USL) exports electricity from bagasse to SEC. In the year from April 2015 to March 2016, a total of approximately 56 GWh was exported from the USL to the grid over and above the electricity used in the factory and within their reticulation system.

Figure 1: Institutional structure for the energy sector in Swaziland



Policy framework

An Energy Policy dating back to 2003 governs the energy sector and a draft final update of the National Energy Policy dated June 2017. A National Energy Policy Implementation Plan supports the National Energy Policy. Swaziland is committed to have at least 50% renewable energy by 2030. It must be noted that there are advanced discussions to build 300 MW coal generation which in theory would meet all current local electricity demand. The main immediate RE option is embedded generation meaning that there could be a PV market. The utility intends to tender 2 small PV plants in 2018. Swaziland has increased the national electrification rate to over 60% through specific funding for rural grid extension delivered by the national utility. There is no Rural Electrification Agency or Rural Programme. In fact the focus is "eradication of energy poverty" rather than rural energy because rural does not necessarily mean poor.

Rural may also mean rich and electrified. The updated Energy Policy places emphasis on energy security and own production of energy including increased generation of electricity from own resources.

The Swaziland Independent Power Producer Policy (SIPP) was adopted in 2016. This policy includes 38 policy recommendations relevant for the IPP sector to be effective. The SIPP provides a framework that addresses barriers to the development of energy generation and the growth of IPPs, in order to enable a successful transition of Swaziland's energy matrix towards sustainable energy sources and to open the market to the private sector in a controlled way. So far, it is too early to judge the extent to which these recommendations will be adopted.

A draft Energy Efficiency Policy will be circulated for comments later in 2017.

3. Technology review

Renewable Energy

Swaziland has relied on its hydropower potential to provide domestic consumption but recent droughts have significantly reduced this capacity. Although the SIPP allows for the incorporation of renewable generation, there is currently no proactive procurement for IPPs. Renewable energy potential is largely not exploited and there is scope to promote IPP projects, as well as stimulate the market for off-grid renewable energy.

Hydro

The MNRE has a database of 26 potential sites for hydropower ranging from 32 kW to 1.5 MW. Four of these are considered to be viable businesses and T-Colle Investments is apparently intending to build a 360 kW power station in Manzini. Despite the identified potentials, private sector investment has not been forthcoming.[vii] The recent drought situation may be a barrier to realising any future potential if the situation persists.

Biomass

Just over 60% of the total primary energy supply (TPES) comes from solid biomass sources.[viii] This is mainly composed of wood products and bagasse from sugar industries. Traditional biomass is widely used for cooking in Swaziland, with rural areas accounting for up to 90%[ix] of the population using firewood for cooking. There is no recent data about the forest cover in the country. According to the data from 1999, 45% of the land is covered by forest but the forest cover is said to be decreasing to below 25%.

The timber industry is one of the key industries in terms of biomass energy potential. One of the main timber industries, Montigny, holds about 60,000 ha of Forestry Stewardship Council (FSC) certified plantations in the country. According to Montigny, the wood residue (including harvest residue) from their factories alone can produce a total of 35 MW of electricity. Montigny has received support from EEP and has assessed options for a labour intensive energy programme collecting wood waste.

Sugar cane is another major renewable energy source with Royal Swaziland Sugar Corporation (RSSC) having a capacity to export approximately 60 MW of bagasse based electricity to the grid, although it does not have a PPA at present, and Ubombo Sugar Limited providing 35 MW to the grid and distributing to the local area.

Ethanol is the main potential liquid biomass energy option in the country. Swaziland has been exploring the options and possibilities of blending of Ethanol with Petrol since as early as 1995. A pilot blending has been concluded and the goal is to have mandatory blending in place by 2022. A national security depot for fuel is planned to be operational by 2020 / 21 and a blending facility will be established as an integrated part of the national depot.

Solar and wind

There are significant potential for solar technologies. However, the potential is largely untapped. The MNRE installed Solar Home Systems (SHSs) and Solar Water Heaters (SWHs) in off-grid public institutions through its rural electrification programme. In 1997, Triodos Bank and the Energy Research Centre (ECN) of the Netherlands implemented a programme to develop the solar market for rural areas, which initially improved uptake but this died out as Triodos stopped lending to Solar International Swaziland (SIS).

There is a slightly larger system in the village of Bulembu (25 kW) where an NGO is enhancing public service provision through solar PV. Wundersight has developed a 100 kW solar PV pilot in Siteki and is exporting the electricity generated to the grid. They are intending to establish 850 kW in Matsetsa. Three schemes are being negotiated at the moment, Vuselela Energy & Solon Energy Consortium (10 MW), Wunder Energy Ltd (3 x 50 MW) and SGL Power (100 MW). SGL Power is negotiating a 25-year PPA with SEC.

Wind speeds are about 3 m/s at 10 metres and are considered suitable for water pumping rather than electricity generation, although the permeability of the aquifers is considered ot be a limitation for most of the country.[x]

4. Stakeholder review

Key few stakeholders that appear to be providing financing to the energy sector are Old Mutual Bank and First National Bank. The South African banks that are providing loans in South Africa are generally also doing so in Swaziland. However, this requires a regular income and a bank account.

The EU is the only donor who is present in Swaziland and active in the energy sector, although energy at present is not a priority sector. USAID funds a number of studies in the energy sector, such as the completed IPP Study and the upcoming review of the petroleum regulations, as well as an electricity tariff study. The AfDB funds studies and technical assistance in the energy sector including the update of the National Energy Policy.

GIZ has been active in Swaziland since 2008 attempting to work with the MNRE to reduce biomass consumption through energy efficient cook stoves. The intention was to develop a self-sustaining market for stoves, developing local capacity. The programme has not lead to any sustainable uptake of improved stoves or any stove business. The IFC is exploring opportunities to invest in private sector initiatives in value chains like sugar, beef and wood pulp/ forestry, as well as supporting government to attract PPPs in water, sanitation and solar energy. The Taiwanese and Chinese governments are reportedly engaged in the energy sector. Agriculture is a priority sector and biomass actions could therefore fall in under potential areas for support.

There are very few active private sector participants in the energy sector. Several PPAs are being negotiated with the SEC. One is them is Montiqny which is proposing production of electricity based on sawdust. There are a number of other potential IPPs that are investigating potential solar PV projects.

There are a number of private companies who have established roof top PV to secure uninterrupted supply of electricity. Opening the grid for embedded generation is a priority in the updated National Energy Policy and is envisaged to spark great interest. The distribution network is thin in some areas and the phasing in of embedded generation will be planned carefully to avoid congestions and drops of capacity.

The Renewable Energy Association of Swaziland (REASWA) but it is not playing an active role in the market place. They did receive some financing to promote a biogas pilot for a rural community. The University of Swaziland supports strategic planning and the local technical colleges train engineers and technicians for the sector.

The Federation of Trade, Business and Commerce has an Energy Unit and is an engaged partner to promote energy and help remove barriers for trade.

5. Market review

Swaziland's economy is closely linked with the South African economy. Petroleum products are imported via Durban and sold by wholesales with main office in South Africa. The electricity is largely imported from Eskom. The Swaziland energy sector is not particularly dynamic but steps are being taken to put the framework in place to stimulate the sector. The motivation for SEC to take action is in the inability to meet domestic demand without imports, and the associated failure to increase tariffs at the same rate as the cost of imports, affecting the viability of SEC. Applications for significant increases to make tariffs cost-reflective have been toned down from an average of 36.5% per year (2013-18) to just 9.5% for 2013-14 and 5% for subsequent years. The exemption of electricity charges from VAT affects the business case for potential IPPs that would be importing renewable technologies and therefore can't offset the VAT.

Electricity production could accommodate renewable energy sources only but there are plans to build two 150 MW coal power plants. If the coal power plants are constructed there will be little market space for new renewable energy production on a large scale. Swaziland's current electricity consumption sits around 225 MW. The Electricity Act does allow for distributed supply however the uptake has been poor. This is reportedly due a lack of clear regulations and by-laws. A net metering policy is suggested to stimulate the solar PV market. However detailed assessments of the potential for renewable energy are required.

All renewable energy and energy efficiency products are imported, are subject to import duties, and often of questionable quality. Swaziland has no or limited standards for renewable energy products such as solar water heaters, lanterns, PV etc. This has led to import / sale of poor quality products and market attrition. The Triodos project in 1997-2000 demonstrated that solar PV could be viable for rural electricity access however maintenance arrangements needs to be considered carefully as this was the downfall of this project.

Large industries are fully aware of possible energy efficiency measures, use of heat pumps, etc. There are no mandatory requirements for energy efficiency yet. This could change with the introduction of an energy efficiency policy.

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
From large business to rural energy provision	▪ The value chain and assessment of bankability needs further assessment. ▪ Because rural HH's are spread out, it is difficult to make biogas work in rural areas from a central plant unless the gas was bottled and used locally. This aspect needs detailed analysis.	▪ Technologies such as biogas have a strong rural poverty impact and there is potential to develop community level installations. The EEP has already supported Montigny's feasibility study in the field. ▪ The sugar industry, the agricultural industry and the EU have all expressed keen interest to expand the large biogas power production. ▪ Using "waste" from the wood and agricultural sectors will be highly labour intensive and could help alleviate the very high unemployment rate. ▪ Any local energy production is essential to reduce the high level of imports of both diesel and electricity.

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Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Working with IFC to boost the market in solar solutions	▪ The provision of financing to the establishment of viable solar business models is lacking but other donors are looking to enter the space.	▪ Combining financing, establishing a green credit line for private sector players to on-lend to their rural customers, may stimulate the solar market. ▪ Developing the skills of the private sector to maintain installations, ensuring that there installations are sustainable is critical.
Link EEP with national business and national priorities	▪ Engaging the private sector in Swaziland is challenging, as evidenced by the week engagement of project developers under the EEP.	▪ Swaziland is a small country and the industrial association had not heard about EEP, although EEP has supported the Renewable Energy Association of Swaziland (REASWA). There is an opportunity to link EEP with the National Federation of Industry and Commerce's energy group to ensure local vetting of real business opportunities and to use projects to overcome recognised needs from the local businesses. ▪ Linking EEP with local business could be a tool to establish local PV or SHS production / assembling factory. This idea could also include an LED factory, etc. ▪ The main opportunity is for EEP to acknowledge the national macroeconomic priorities as part of the criteria and focus on local jobs in energy, including local component production.
Financing gaps	▪ The risks and transaction costs associated with renewable energy are still considered to make supporting off-grid energy access and small-scale IPPs unattractive.	▪ Use lessons from the various finance support programmes all over southern Africa to gain lessons for funding for renewable energy and energy efficiency. ▪ Many companies in Swaziland would consider own funding options and finance may not necessarily be the biggest hurdle.
Energy efficiency as it links to poverty reduction could be tackled within industries	▪ The energy savings potential from improved cook stoves, to light replacements and industrial efficiencies are largely overlooked. ▪ The public sector is not ideal to drive energy efficiency.	▪ Industry players with a large staff could be used to showcase energy efficiency at both industrial and household levels so workers understand the value of energy efficiency. ▪ A project could be linked with energy efficiency support available in South Africa for the industrial sector.

7. Implications for the Theory of Change

The potential adjustment of EEP focus for Swaziland will not have negative implications for the Theory of Change. In fact, the recommended adjustment will help focus actions towards results and impact. The recommendations target: technology uptake and technology capacity in Swaziland. This is assumed to lead to green growth and sustainable renewable energy businesses in Swaziland. If these assumptions were applied as recommended with a strong focus on the localisation of the production, this would encourage poverty reduction. Job creation is a very critical issue for Swaziland, particularly due to the number of dependents that each employed person is responsible for.

[i] *http://gtf.esmap.org/*

[ii] *Swaziland's SE4ALL Country Action Plan May, 2014*

[iii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System - Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iv] *Electricity Tariff Methodology for the regulation and approval of tariffs, prices and charges in the electricity supply industry, 2011*

[v] *Swaziland Fuel Price Trends and Forecast White Paper, 2015*

[vi] *http://www.gov.sz/irena_rra_swaziland_2014.pdf*

[vii] *http://www.smallhydroworld.org/fileadmin/user_upload/pdf/2016/Africa_Southern/WSHPDR_2016_Swaziland.pdf*

[viii] *Swaziland Final Energy Balance (draft), 2014*

[ix] *Renewables Readiness Assessment, Swaziland, 2014*

[x] *http://www.gov.sz/irena_rra_swaziland_2014.pdf*

Country profile – Tanzania

1. Overview

Indicator	Data
Population	53.5 million (2015)
Population density	60 person/ km²
Global Tracking Framework Indicators [i]	
Access to electricity	Total Tanzania mainland (2016) 32.8% [ii] Rural 4.03% Urban 41.16%
Access to improved cooking	2% (2014)
RE as proportion of the mix	86.67% (including biomass) 0.84% (modern fuels)
Other Indicators	
Reliance on energy imports (2014) (IEA)	13%
Centralised or liberalised electricity sector	Liberalised
Bundled generation, transmission and distribution?	No
Existence of renewable energy IPPs	Yes
Import duties on renewable energy products	Yes
RAGA/ AA/ IP	RAGA/ AA/ IP
Renewable energy strategy	Yes
Number of EEP Phase I & II projects	36
Total EEP contribution (% of total budget)	€11,248,997 (38%)
Average daily solar irradiance [iii]	6,430 Wh/m²/day
Electricity subsidies	Subsidies for connecting low income households and low energy users [iv]
Fuel subsidies	No petroleum or gas subsidies [v]

The Tanzanian energy sector recognised the challenges of providing rural energy access and the importance of using renewable energy sources as far back as 2003. The power sector has been liberalised and Independent Power Producers (IPPs) provide up to 26% of the total current electricity supply.[vi] A combination of mechanisms were used, most notably the use of the fuel levy to support grid expansion and the reduction of connection fees, encouraging new customers to connect. However, within this framework, it has primarily been urban areas that have benefited.

The ambitions of the Rural Energy Agency and the Ministry of Energy and Minerals (MEM) have committed to place specific focus on stand-alone and mini-grid systems. As with many African countries, the consumption of biomass is a major concern. In 2010, biomass represented 90% of total primary energy consumption and therefore the Sustain-

able Energy for All (SE4ALL) Action Agenda places emphasis on operationalising the Biomass Energy Strategy (BEST) to better regulate and reduce biomass consumption.[vii]

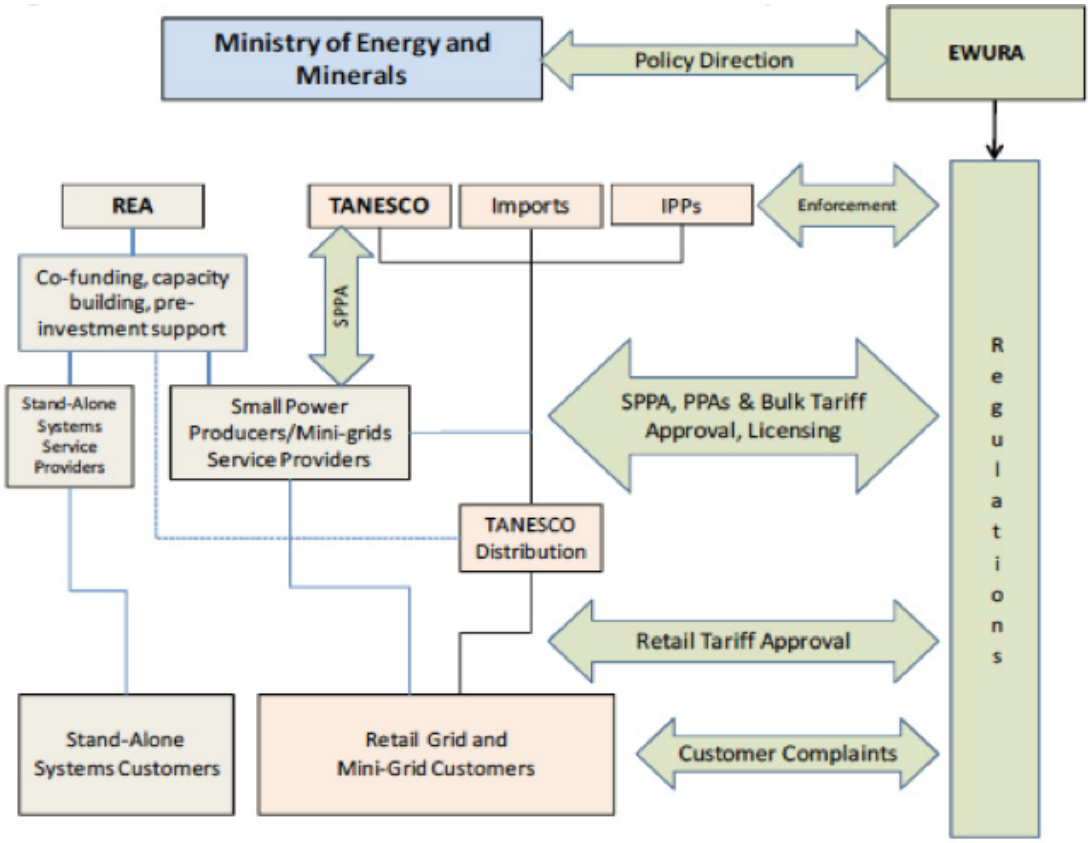
In recent months (2017), the financial standing of Tanzania Electric Supply Company (TANESCO) has raised significant concerns for IPPs feeding into the grid. TANESCO is paying the IPPs intermittently and is in over US$ 300 million of debt, after a previous loan from the World Bank in 2016 of US$ 250 million. However, the recent Presidential directive to disconnect defaulters, including government, has enabled TANESCO to begin to claw back the US$ 56 million owed by government in March 2017.

2. Institutional framework

Institutional structure

The Ministry of Energy and Minerals (MEM) holds the mandate for the policy and regulatory framework. MEM has been very forward thinking in terms of the approach in terms of the policies developed and the recognition of the importance of renewables in the energy mix in 2003, as described below. The Energy and Water Utilities Regulatory Authority (EWURA) combines the regulation of electricity, petroleum, natural gas and water. The Rural Energy Agency has the mandate to promote, stimulate, facilitate and improve modern energy access in rural areas, in order to support rural economic and social development; promote rational and efficient production and use of energy, and facilitate identification and development of improved energy projects and activities in rural areas; finance eligible rural energy projects through the Rural Energy Fund (REF); administer and monitor the grant funds provided; build capacity; and provide technical assistance to project developers and rural communities. REA's mandate excludes biomass energy for thermal services.[viii] TANESCO is the national utility that has historically had a monopoly on power generation, transmission and distribution currently providing 60% of current electricity supply.

Figure 1: Institutional structure for the energy sector in Tanzania



Policy framework

The Government of Tanzania was in fact a leader in incorporating renewable energy in their National Energy Policy in 2003, with a view to reducing consumption of fossil fuels. The government has attempted to encourage the incorporation of renewables to enhance the use of indigenous resources, taking into account environmental considerations and energy efficiency. The policy contains all the elements that are being discussed presently: to include energy as a facilitator of development, the impact this would have on gender, and establishing cost-reflective tariffs. The revised National Energy Policy 2015 reaffirms these commitments and further aims to increase local manufacturing, installation, maintenance and operation of rural energy systems. According to the policy, an appropriate feed-in tariff will be defined for renewable energy although one has been in place since 2008 for hydro and biomass.

The National Rural Electrification Program (NREP) for 2013–2022 is guided by the National Electrification Program Prospectus and is broken down into annual investment plans in the Rural Electrification Master Plan (2016). The intention is to connect 5,500 settlements to the grid by 2022, and 657 villages of more than 1,500 inhabitants have been identified for off-grid energy access projects.[ix] The SE4ALL Investment Prospectus suggests undefined off-grid projects using hydro, biomass, wind, and solar PV or by solar PV, wind and diesel hybrid systems. The estimated cost of these systems is US$ 176.3 million.

The Rural Energy Act of 2005 mandated the Rural Energy Board, Fund and Agency to support TANESCO in expanding the distribution network and provides funds to developers of rural energy projects. The Electricity Act of 2008 that defined the tariff methodology that could be applied, as well as the process and procedures for licencing and dispute resolution. In 2010, the government recognised the role of the private sector as a key agent of change and facilitated their engagement in the public sector through the Public Private Partnership Act No. 18 of 2010. There has also been significant policy reform in Tanzania to address the negative affects of deforestation, which is related to the consumption of wood as a fuel source for cooking. The Electricity Supply Industry Reform Strategy and Roadmap 2014–2025 aims to unbundle TANESCO, taking a significant step towards enabling the private sector to support in expanding service delivery, although approvals are hard to obtain.

Others policies and strategies include:

- Rural Electricity Master Plan 2006;
- Power System Master Plan 2012 (PSMP);
- Electricity Rules for Standardised Small Power Purchase (SPP) Tariffs 2011 including SPP feed-in-tariffs;
- Biofuel Guidelines 2011;
- Biomass Energy Strategy for Tanzania 2014 (BEST);[x]
- Big Results Now! 2012.

3. Technology review

Renewable Energy

The Tanzanian Investment Prospectus identifies 154 development centres that are due to be electrified under the SPP. The technologies to be employed are a combination of small hydro (18), rice-husk-fuelled gasifiers (63) and diesel-PV hybrid systems (73). It is estimated that 600 small development centres could be provided for through hydro or biomass mini-grids. There is potential in Tanzania for most renewable energy sources, geothermal, hydro, wind, solar and biomass. The data below is derived from the SE4ALL RAGA.

Hydro

Due to changes in water levels as a result of recent droughts, the reliability of the water flow for large-scale schemes is not clear. Current installed capacity is 562 MW and with the additional projects under the PSMP an additional 3,000 MW of capacity is expected to be added. Small-scale hydropower is estimated to contribute 480 MW. Of 11 SPPs that have been signed, 4 are based on hydropower with an installed capacity of 20.5 MW. PPAs for six small hydro plants have been agreed with TANESCO providing an additional 29.9 MW. Feasibility studies were being performed on the eight regions to establish potentials.

Solar

Tanzania receives between 2,800-3,500 hours of sunshine per year, and a global horizontal radiation of 4-7 kWh per m² per day. Solar resources are especially good in the central region of the country, and it is being developed both for off-grid and grid-connected solutions. Programmes such as the Sustainable Solar Market Package (SSMP) programme have facilitated the distribution of solar products by providing a one-stop shop for public institutions to obtain solar PV. The PSMP anticipates 120 MWp of solar by 2018. Market spoilage is a significant concern due to the inferior goods that have entered the market. Lighting Africa has been working with government officials to address this.

Biomass, stoves and biogas

As mentioned above, the consumption of biomass as a proportion of total energy consumption is 90%. The BEST 2014 should guide the initiatives being implemented.

There are a number of industries that could recycle waste to produce energy. Two projects supported by the EEP attempted to introduce new technologies into the market, one focusing on sustainable charcoal making and the other using biogas generated from street food waste. However, such projects need to be tested and the time taken for market penetration is significant. It is evident however that addressing biomass consumption does not need to focus on only rural areas but should attempt to reduce peri-urban consumption, as production of charcoal in rural areas is supplying peri-urban demand. According to the SE4ALL RAGA, each tonne of charcoal produced and consumed in Tanzania generates nine tonnes of CO2. Annual consumption is estimated to be one million tonnes, although the sector is informal so this data is speculative, resulting in nine million tonnes of CO_2 emissions.

There is considered to be potential to support dairy farmers to use biogas to pasteurise milk and meet their energy needs, and also generate electricity. CAMARTEC and SNV constructed 11,103 biogas plants between 2009 and 2014. The estimated potential for domestic biogas is 165,000 installations in a ten-year timeframe, reducing significantly domestic biomass consumption for cooking.[xi]

The Tanzania Improved Cook Stove programme (TICS) also being implemented by SNV in collaboration with Endev has exceeded the target of reaching more than 60,000 beneficiaries so far.[xii] Various stove brands are available on the market, one of which, Envirofit, was supported under the EEP.[xiii] However, in general, the clay stoves that are available in rural areas are considered to be of poor quality.[xiv]

Wind

The conditions for wind generation are promising, specifically in Kititimo and Makambako where speeds are over 8 and 9 m/s respectively. Various wind assessments have been performed, some supported by EEP S&EA. The Tanzania SE4ALL Investment Prospectus does identify one such project.

4. Stakeholder review

Government

Despite the progressive stance taken by the government over recent years, some of the policies are not being followed through. The government aims to both bring about a more tenable situation for TANESCO whilst offering electricity at a low price. In recent months, TANESCO submitted an application to revise the electricity tariffs in an effort to establish a more cost reflective tariff, in line with the national policy, however this was rejected. Despite a 40% increase to the tariff in 2012, this affects the ability to do business for the private sector and their willingness to invest in increasing of energy access. In addition, allowing for cost recovery from each tariff band and cross-subsidy would provide much more flexibility and sustainability. The limited capacity of government institutions, particularly REA, to oversee the implementation of projects, and their lack of local presence has resulted in TANESCO filling the void.

On-grid power producers

Apart from the TANESCO-owned generation plants that include a combination of hydro and natural gas, there are over seven gas IPPs feeding into the grid.[xv] Additionally, work is being done to expand the grid infrastructure, not least to tap into the regional power pools.

Off-grid power producers

The World Bank has been implementing the Tanzania Energy Development and Access Expansion Project (TEDAP) since 2008 addressing urban electricity access and rural energy access. The latter component attempted to stimulate the private market in deploying solar equipment under the Sustainable Solar Market Packages programme. Small power producers were encouraged to build local energy networks using results-based financing through local financing institutions.

The EU has supported several IPPs through the ACP-EU Energy Facility, in particular the Mwenga 4MW hydro and JUMEME's solar hybrid mini-grid model. The EEP progamme has supported a number of mini-grid projects, including Devergy and E.on Off-grid Solutions. Devergy is currently working on a larger set of appliances, such as fridges, and productive equipment (e.g. agro tools will be piloted with Energy4Impact).[xvi] E.on is working with NGOs in "an eco-system of partners" to build productive uses, aiming to install 100 new mini-grids in the next few years.[xvii] According to MEM, the majority of mini-grid operators are faith-based charities rather than commercially viable ventures.

The main market growth is being seen in the solar home systems market with Off:Grid Electric (EEP grant holder) taking off in the north and Mobisol (EEP grant holder) and BBoxx penetrating the PAYG market.

NGOs, associations and research institutes

The Tanzanian Renewable Energy Association has a directory of members and of other ogranisations aiming to promote renewables in Tanzania. Although it is in fact very positive that there is a representative association, some project developers report that their capacity as an advocacy group is limited.

The new Innovative Technology and Energy Centre (ITEC) is being opened in August 2017 in Arusha. The aim is to improve overall energy access in rural areas through the training of local technicians to support the proliferation of solar technologies to 65% of the rural population.[xviii] The aim is to improve service provision across sectors, including health, education and entrepreneurship.[xix]

Donors and Financing Institutions

The World Bank, EU, NORAD, SIDA, USAID, UNDP, GEF, BMZ, GIZ and DFID are all engaged in the energy sector in Tanzania. There are some claims that donor dependence is reducing the motivation to develop other financing solutions and options. The TEDAP programme provided a credit line that was managed by the Tanzanian Investment Bank. The commercial banking sector is reportedly looking to support renewable energy but there is no indication what conditions are offered. Donor financing provided by SIDA is staged, focusing on a transition between tiers of access.

5. Market review

The government policies promoting off-grid energy access actively encourage private sector interest. The Tanzanian government has taken significant steps to modernise the energy sector. However, the off taker risks associated with providing energy to the grid is significant and it is not clear how this will be resolved on the basis that tariff increases have been rejected.

However, there are examples of how the government is still trying to allay project developers' concerns. One of the main unknowns regarding mini-grid projects is what will happen when the grid arrives. EWURA has agreed that the SPPs will be able either to sell into the grid or to distribute from the grid, thereby reducing the risk of the developers being left with stranded assets.

During the interviews with MEM and EWURA, two fundamental market barriers to energy access were raised: difficulties in accessing finance and the lack of capacity to develop the case for bankability to source funding. These skills fall outside of the core competencies of the project developers and it is reported that support is required in this regard.

There is scope to investigate the JUMEME concept of mini-grids and study how these models could be improved or better formulated for commercial success. However, this is a long-term process and requires that efforts are made to understand community needs and potentials for productive use. One of the limitations of mini-grids is the rate at which their capacity is reached, requiring strong demand-side management activities to reduce this risk, as well as future expansion plans. Securing land can be challenging for mini-grids and can delay the process significantly.

The scope of support to off-grid is not well understood by the private sector and consumers in Tanzania. There are however examples of how pico and stand-alone solar PV has had a significant impact. The EEP has been instrumental in supporting the development of these models, in particular with Off:Grid Electric. The PAYG leased model increases accessibility by removing the one-off capital cost and in some cases, the maintenance of the system is taken care of during the contract lifetime. However, these business ventures have not achieved commercial viability yet.

The use of biomass for cooking is a significant concern in Tanzania. In order to have significant impact, the whole value chain needs to be addressed, and consideration given to encouraging large-scale production of stoves and improved fuels. The legal and regulatory framework is being tightened to reduce illegal charcoal production however an alternative needs to be supplied. The EEP funded ARTI project established the manufacture of sustainable charcoal and the market for such businesses would be extensive but requires large-scale marketing activities. A number of businesses are experimenting with the "Nespresso model", where the appliance is cheap and the cost is recouped from the fuel required to run it, supplied by the business. This again spreads the burden of the capital investment required if a good quality stove is to be purchased.

6. Gaps, barriers and opportunities

The following gaps, barriers were raised during interviews and through the desk review performed for South Africa:

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
The current political situation and institutional bottlenecks deter investors	▪ The changeable government stance and unwillingness to see through on policy is increasing the investment risk quite significantly. ▪ The turn around times for approvals is considered to be too long by project developers.	▪ The national policy framework will continue to be a barrier. Therefore, building the capacity of local associations would provide the most long-term solution in that they could represent their sector going forward.
Current policy addresses above 1 MW generation	▪ There is no comprehensive strategy for mini-grids and stand-alone systems for access below 1 MW ▪ The mapping of stand-alone and off-grid potentials is weak, resulting in a lack of data for private sector investors. ▪ The cost of providing lease-to-own stand-alone solutions to the consumer is much higher than national tariffs, resulting in some discomfort on the part of government to support these interventions.	▪ The national strategy would benefit from incorporating an off-grid, stand alone component and addressing the issue of cost of supply. Current subsidies are provided to on-grid supply and therefore consideration should be given as to how this can be applied to off-grid schemes to increase affordability.
Market distortions are crowding out the private sector	▪ The electricity subsidies provided distort the market.	▪ Support to the government to encourage that cost-reflective tariffs are adopted with the provision of a cross-subsidy to the poor households.
Low technical capacity to implement and maintain within the private sector	▪ Private sector is not able to develop bankable project proposals. ▪ The low technical capacity of the private sector to develop, roll out and maintain off-grid solutions is a significant barrier.	▪ The capacity issues raised are focused at different phases of the project cycle. Mapping the support necessary and incorporating this into the EEP grant programme may address this barrier.
Low capacity within government to oversee renewable energy projects	▪ There is limited capacity in government institutions to develop this capacity.	▪ Donor funded programmes that support the relevant agencies (GIZ) are attempting to address this capacity shortage.
The quality of information available is poor	▪ There is a dearth of data on the off-grid sector and how best to address this.	▪ Mapping of the off-grid energy sector potential would be valuable to the private sector.
Geographical dispersion of communities	▪ As with other countries, the dispersion of households affects the viability of any commercial initiative.	▪ The emphasis for Tanzania could be placed on developing mini-grid models based on the development centres identified under the REMP, and biomass or biogas for cooking.
Affordability of off-grid solar	▪ The logistical costs of providing off-grid energy access negatively affect the business case for off-grid solutions in very remote areas. ▪ Economies of scale are not there in rural areas.	▪ There is a perception that private sector should be able to provide services to rural areas without subsidy however consideration should be given as to whether cross-subsidies can be applied in the off-grid context as the current business case is weak.

→

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Biomass for cooking is not being addressed in a significant way	▪ Despite the proposed enforcement of regulations to prevent charcoal production, viable alternatives are not available widely. ▪ The quality of cook stoves is perceived to be poor. ▪ The entire cook stove supply chain needs to be bolstered and the activity should no longer be considered an artisan activity for the informal sector.	▪ The production of cook stoves needs to be commercialised and up-scaled quite significantly. ▪ Quality assurance systems need to be established. ▪ Cross-border expansion of strong stove manufacturing (e.g. Burn Manufacturing) should be encouraged.
Standards and labelling of equipment not in place	▪ The quality of products being introduced to the market is resulting in market spoilage.	▪ Development of national standards for energy equipment is required.

7. Implications for the Theory of Change

Tanzania has developed their legal and regulatory framework significantly over recent years and recognised the importance of renewable energy in filling the generation gap. The political context and change of direction in terms of the application of cost-reflective tariffs and the sustainability of TANESCO raises concerns for IPPs. However, TANESCO is beginning to clear some of the arrears.

The most significant opportunity in Tanzania is to identify mini-grid and stand-alone business models that will cater to the development centres highlighted in the REMP as priority areas. Working to increase the productive use of the energy will ensure a stable base load and allowing a long-term concession will facilitate investor confidence. Consideration should be given to a cross-subsidy model across peri-urban and rural areas.

The production of clean cook stoves is a vital activity in Tanzania, particularly based on the prevalence of the use of unsustainable wood fuel. Initiatives that commercialise the local manufacture of good quality stoves would have a significant impact on job creation as well as on reductions of CO2 emissions and improved quality of life. Therefore, learning from models such as Burn Manufacturing and scaling these up would present a valuable opportunity.

[i] *http://gtf.esmap.org/*

[ii] *Energy Access Situation Report Tanzania Mainland, 2016*

[iii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System - Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iv] *Energy Subsidy Policy, 2013*

[v] *Tanzanian energy sector under the universal principles of the Energy Charter, 2015*

[vi] *Tanzania's SE4ALL Rapid Assessment and Gap Analysis, 2013*

[vii] *Tanzania's SE4ALL Action Agenda, December 2015*

[viii] *Tanzania's SE4ALL Rapid Assessment and Gap Analysis, 2013*

[ix] *REA, National Electrification Program Prospectus, 2014.*

[x] *Tanzania's SE4ALL Rapid Assessment and Gap Analysis, 2013*

[xi] *Tanzania Domestic Biogas Programme, http://www.biogas-tanzania.org/tdbp/about/category/why_biogas_in_tanzania*

[xii] *http://www.snv.org/project/tanzania-improved-cookstoves-tics-programme*

[xiii] *http://arti-africa.org/2010/07/cook-stoves/*

[xiv] *Global Alliance for Clean Cookstoves Market Assessment, Tanzania, 2012*

[xv] *http://www.ewura.go.tz/wp-content/uploads/2017/01/Power-System-Master-Plan-Dec.-2016.pdf*

[xvi] *HYSTRA (2017) Reaching scale in access to energy: Lessons from practitioners, May 2017*

[xvii] *http://e4sv.org/rafiki-power-e-mini-grids-improved-livelihoods-tanzania/*

[xviii] *http://www.rea.go.tz/DesktopModules/EasyDNNNews/DocumentDownload.ashx?portalid=1&moduleid=639&articleid=91&documentid=100*

[xix] *https://www.esi-africa.com/news/tanzania-renewable-energy-technology-centre/*

Country profile – Uganda

1. Overview

Indicator	Data
Population	39.03 million (2014)
Population density	195 persons/ km²
Global Tracking Framework Indicators [i]	
Access to electricity	20.4% (51.4% urban, 10.3% rural)
Access to improved cooking	2%
RE as proportion of the mix	89.2% (traditional solid biomass 87.5%, modern renewables 1.7%)
Other Indicators	
Reliance on energy imports (2014) (IEA)	1% electricity import
Centralised or liberalised electricity sector	Centralised
Bundled generation, transmission and distribution?	Unbundled in three segments: generation, transmission and distribution
Existence of renewable energy IPPs	Yes
Import duties on renewable energy products	Tax exemption for some off-grid solar products and appliances
RAGA/ AA/ IP	AA
Renewable energy strategy	Yes: Biomass Energy Strategy (2013) Renewable Energy Policy (2007) Renewable Energy Investment Plan (2011)
Number of EEP Phase I & II projects	10
Total EEP contribution (% of total budget)	€3,317,991 (45.8%)
Average daily solar irradiance [ii]	6,870 Wh/m²/day
Electricity subsidies	Significantly reduced in 2012 [iii]
Fuel subsidies	No kerosene subsidy [iv]

Local generation capacity in Uganda is based on 80.5% hydropower, 2.5% biomass co-generation and 17% thermal (HFO/Diesel).[v] Currently, effective electricity generation capacity is 680 MW, 80 MW above current peak demand, due to the fact that only 20.4% of the population has access to electricity, the majority being situated in urban areas. Energy access in rural areas is challenging due to the dispersed population. With increasing access rates, the demand will increase. Therefore, infrastructure development continues with the upgrade of the national grid, expansion of generation capacity, especially of hydropower, but also exploring the wind and geothermal potential. National oil reserves are now available, but there is no local refining capacity.

Technical losses in the transmission and distribution network have amounted to up to 30%, and the current goal is to reduce the losses to 19%. Development partners are currently financing 10 projects aiming at improving electricity transmission. Improvements to the distribution network, including transformers, are also necessary.

2. Institutional framework

Institutional structure

The Ministry of Energy and Mineral Development (MEMD) is responsible for energy and mineral resources in Uganda providing policy supervisory and oversight in these sectors. The structure of the sector is centralised, although it has been liberalised since 1999 through the Electricity Act, creating three separate companies responsible for generation, transmission and distribution. The number of IPPs is increasing.

Figure 1: the institutional framework of the energy sector in Uganda

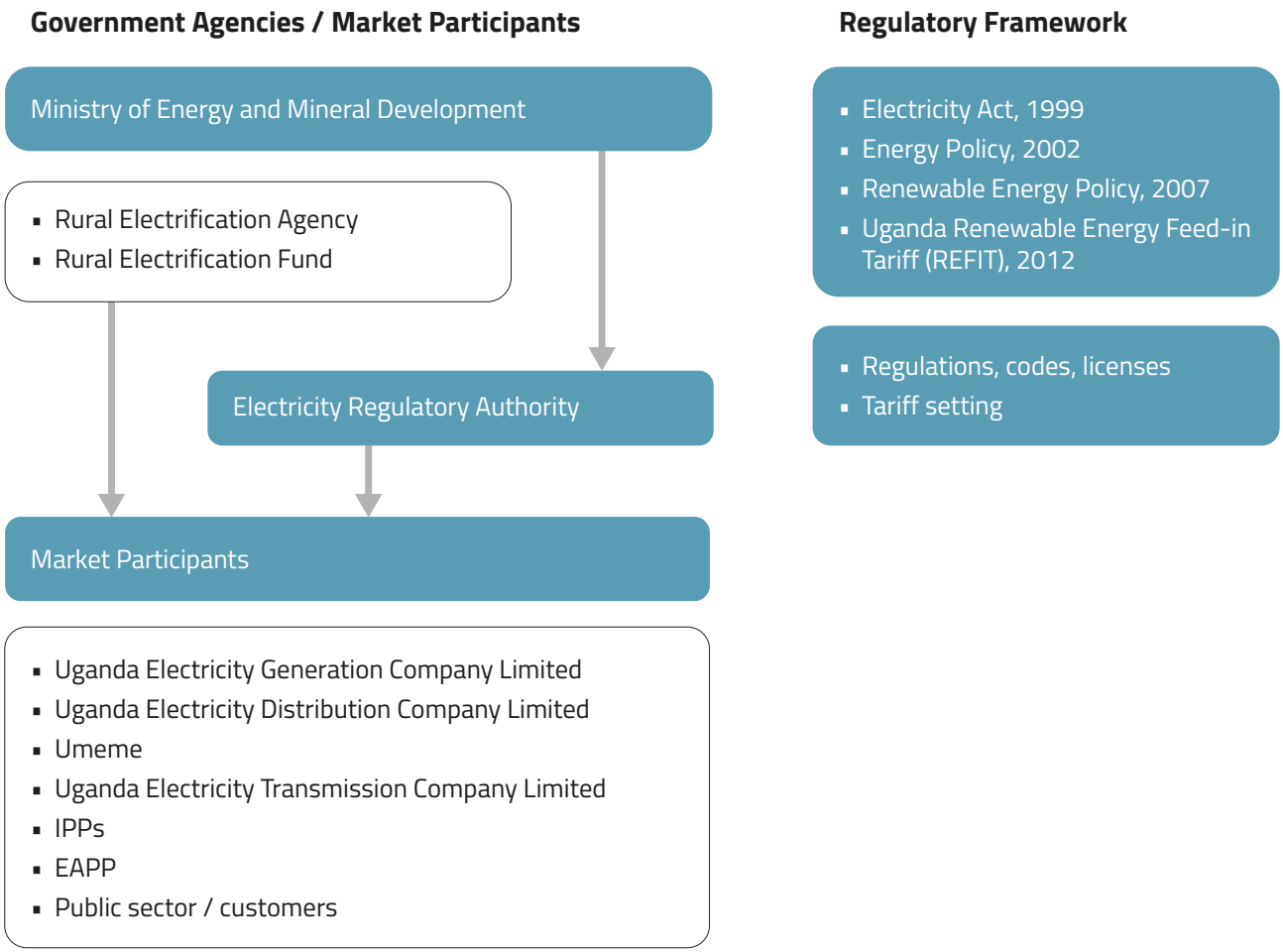


Table 1: Key institutions in the energy sector in Uganda

Institution	Role
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)	Electric power generation and sale within Uganda or for export to neighbouring countries. Builds, operates and maintains a number of electricity 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
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: (i) operate, maintain, upgrade and expand the distribution network, (ii) retail electricity to its customers, and (iii) to improve efficiency within the electricity distribution system.

Policy framework

The guiding policy governing the overall energy sector in Uganda is the Energy Policy for Uganda, 2002, with the goal to "meet the Energy needs of Uganda's population for social and economic development in an environmentally sustainable manner".[vi] The major strategies that have been adopted in this respect are:

- To review and put in place modern policies and legislation that offer a conducive business environment.
- To increase the energy mix in power generation, promote and co-invest in the development of new power generation and transmission projects.
- To acquire and provide necessary information and data to attract and facilitate private sector participation and capital inflow.
- Promote and/ or implement rural electrification through grid extension, development of decentralised power supply systems and use of renewable energy resources.
- To carry out specialized and general training of manpower and strengthening capacity of the institutions responsible for managing and safeguarding the energy and mineral resources.
- Carry out energy audits and consumer awareness campaigns for energy efficiency.[vii]

The mandate of the Renewable Energy Department of the MEMD is "To develop and promote the sustainable use of renewable energy resources and technologies (solar, wind, mini-hydro and biomass) in the country through establishment of a conducive enabling environment".[viii]

The Biomass Energy Strategy (2013) aims at proposing rational and implementable approaches to manage the biomass energy sector. The Rural Electrification Strategy and Plan (2013-2022) aims at establishing an electrification development program that will progressively advance towards the achievement of universal electrification by the year 2040.[ix] Under the SE4All Action Agenda 2015, the objective is now to meet this target by 2030. This will require 570,000 new connections per year in rural areas and 97,000 in urban areas, a steep jump from 2014 levels when less than 100,000 new connections were added per year. This will be challenging, not only with respect to financing, but also human and institutional capacity. Projects such as training of wiremen through the Energy for Rural Transformation program seek to address part of the need for technical capacity.

The Rural Electrification Strategy's programme implementing policies and structures are:

1. The government will assume greater responsibility for planning, financing and overall management of the rural electrification sector. The Strategy explicitly states that the government will absorb the major commercial and financial risk for rural electrification development. This way it will remove a critical obstacle to the rapid advancement of private sector investment in the sector
2. Renewable energy shall be implemented on a model of scaled, multi-technology electricity service territories comprising the entire rural territory of the country. This model shall be the basis for all rural electrification planning, project development and planning, electricity service concessions, financing, supervision and support.
3. Planning and management for all rural electrification sector programs and investment resources will be centralised and managed by REA.
4. Rural electrification services and infrastructure shall be managed by duly licensed non-governmental concession holders.
5. Off-grid electrification services comprising energy service technologies not dependent on the national grid shall be planned, offered and furnished to eligible consumers in the service territories in tandem with on-grid electrification services, to help ensure universal electrification.
6. Capital financing for infrastructure development for electric distribution-based investment shall be furnished under a system of long-term leasing and financing contracts with the electric distribution licensees.
7. The cost of wholesale power to rural concession licensees may be discounted on a needs-test basis in order to make on-grid rural electricity service more affordable.
8. Investment in small distributed power generation facilities as local sources of supply will be given increased priority and enhanced support.
9. New emphasis will be placed on building organisational and professional competencies through technical assistance and training.[x]

Renewable Energy Policy and Private Sector Participation. The Government of Uganda introduced the feed-in-tariff program RE-FIT in 2007 to expand energy services through IPPs and regional concessions. In 2013, the GET-FIT initiative was put in place to help address the issue of increasing capital costs for renewable energy technologies. It provides a premium on the RE-FIT for the first couple of years. Seventeen new PPAs have thus been supported this way. The priority technologies for RE-FIT Phase 3 (2016-2018) include: small hydro power plants up to 20 MW, bagasse power generation, and wind.[xi] These priorities may be updated during each RE-FIT review (every three years).

The government has implemented some initiatives in the area of energy efficiency, but there is no comprehensive legislative, regulatory or strategic framework covering the area. A draft energy efficiency strategy for 2010-2020 has not yet been enacted. The strategy determines appropriate programmes for each of the targeted sectors (households and institutions, industry and commerce, transport, and power transmission and distribution) to achieve the

objectives, as well as horizontal activities needed for effective implementation of sector-related activities. The proposed Energy Efficiency and Conservation Bill and associated regulations were concluded in 2014 but have not been approved yet.

Minimum Energy Performance Standards (MEPS) have been developed for refrigerators, air conditioners, motors, lighting appliances, and freezers. Challenges include a lack of personnel to enforce these standards and regulations, unavailable financing for this intervention and a lack of testing equipment. Promotion of energy efficiency in the residential sector covers the distribution of lights (CFLs in 2008-2011, LEDs distribution ongoing) but the building code does not regulate energy efficiency of new or refurbished buildings.

3. Technology review

Renewable Energy

Uganda has a substantial renewable energy potential capacity, particularly within hydro and biomass, which are also amongst the most economical technologies. Other technologies, such as wind and geothermal, are at the exploratory stage of development.

Hydro

Hydropower provides significant opportunities in Uganda, with the highest potential for development of large hydropower projects along River Nile, estimated at about 2,000 MW. 692 MW is already available through Kiira and Nalubaale (380 MW), Bujagali (250 MW), and some smaller plants. Two plants, Karuma and Isimba will add almost 800 MW upon completion (planned 2018, expected 2021), and 6 other small hydropower plants that will contribute almost 60 MW are under construction.

The government has identified 11 potential sites for micro-hydropower. Furthermore, prospective developers are encouraged to scout for potential sites in the eastern part of Uganda (Mountain Elgon region) and the western districts of Ibanda, Rubiriizi, Buhweju, Kabale, Kisoro, Kabarole and Rukungiri. Several sites have been identified and licensed in the Rwenzori mountain range, but there is still significant untapped potential for small hydropower.

Solar

The solar energy potential in Uganda is encouraging, with average irradiation levels of 5-6 kWh/m2/day, and above 6 kWh/m2/day in the northern and eastern parts of the country. Soroti and Tororo solar power stations (to be completed autumn 2017) each provide 10 MW to the grid. Furthermore, with support from the EEP programme, a 230 kW solar PV mini-grid has electrified Kitobo Island. PV powered mini- and micro-grids have been suggested for off-grid access with installed capacity reaching 26-30 MWp by 2030, targeting villages with 500 to 1000 households. An additional 36-60 MWp will be provided to 100 to 200 households in the neighbourhood of mobile communication base stations.[xii] At least 30,000 solar home systems have already been installed. Five hundred solar water heaters were installed between 2008 and 2010 in a project implemented by MEMD, to create awareness and establish policies to promote solar water heaters, standards, guidelines, and by-laws. Through the World Bank funded Energy for Rural Transformation (ERT) programme, the government now provides a subsidy of 50% of the purchase price of solar water heater units.

Biomass, stoves and biogas

Traditional biomass is used for cooking - 95% of cooking is on biomass. Several programmes and projects target improved cook stoves. Co-generation is viable where there is an excess of agricultural residues such as bagasse, coffee and rice husks, and is already being used by industries, such as sugar producers for their own electricity generation purposes. However the potential is almost threefold the actual capacity of about 95 MW from bagasse, and can be

fed into the national grid.[xiii] The Renewable Energy Policy estimates there are about 500 functioning biogas plants in Uganda. The SE4All Action Agenda targets the installation of 60,000 domestic biogas plants by 2030.

Waste-to-energy

There are no significant projects on municipal waste, but according to the MEMD, it is estimated that Kampala city alone generates 730,000 tons of waste per year, of which 70% is organic waste. There are major districts around the country with considerable waste volumes such as Wakiso, Mbarara and Jinja, all of which represent considerable waste to energy potential. An EEP project managed by Eco-fuel Africa Limited produces briquettes from agricultural waste.

Wind

Recent studies indicate that the wind speed in most areas of Uganda is moderate, with average wind speeds ranging from 2 m/s to about 4 m/s (at less than 10 m). Based on wind data collected by the Meteorology Department, it was concluded that the wind energy resource in Uganda is only sufficient for small-scale electricity generation and for water pumping mainly in the Karamoja region. Small industries in rural areas could benefit from a mill with a maximum load of between 2.5 kVA and 10 kVA. The planned Tororo Wind Power Station will have a capacity of 20 MW (27,000 hp) in the eastern region of Uganda, if financial close is reached.

Geothermal

Western Uganda contains geothermal deposits that have the potential to produce 150 MW of electricity. Investigations have also revealed three major potential areas for detailed exploration, namely Katwe-Kikorongo, Buranga and Kibiro. These are all situated in or near the Western Rift Valley of Uganda. According to the Renewable Energy Policy of Uganda (2007) the combined geothermal potential from these three major areas is 450 MW.

4. Stakeholder review

On-grid

The Government is represented by the Ministry of Infrastructure in regards to national energy matters. While the National Energy Policy has been developed over 15 years ago, RE, biomass, and rural electrification have been the most recent directions taken by the Government. 18MW Mpanga run of the river hydropower project owned by SAEMS, and the 13MW Bugoye run of the river hydropower project owned by TronderEnergi and Norfund, 6MW Ishaha and 9MW Buseruka. Further substantial hydro projects are in the pipeline with the 600MW Karuma and 183MW Isimba projects expected to be commissioned in 2018.

Off-grid

In reaching the rural electrification goal, the Government is actively promoting off-grid services. Many private IPPs dominate the off-grid market, including producing energy for own use (such as for factories). In terms of manufacture and distribution of off-grid equipment, mainly solar and biomass, there are several companies that have a social component as in they directly cater and support the poor. Due to the Rural Electrification Strategy and Plan's objective to promote off-grid services, it is expected that the off-grid sector will grow.

Donors and financing institutions

Numerous development partners support the energy sector, including AFD, Danida, DfID, EU, GIZ, KfW, NORAD, SIDA, UECCC, UNDP/GEF, and the World Bank. These donors are key players for releasing funds for off-grid projects. Besides commercial banks, local financing stakeholders are the Uganda Energy Credit Capitalisation Company (UECCC) – a Government institution – and the Rural Electrification Fund – which is under the Rural Electrification Agency. In addition, there are few micro-finance organisations, such as FINCA.

Research institutes, associations and NGOs

There are various associations representing different perspectives on the energy sector, for instance, from the private sector, manufacturers, or stakeholders in the biomass sub-sector. A Renewable Energy Business Incubator is giving support to renewable energy start-up projects. There are few NGOs in the energy sector, mostly around biogas and clean cooking. However, the Africa Institute for Energy Governance and the Uganda National Renewable Energy & Energy Efficiency Alliance not only do energy research but also promote community education and stir projects for more rural energy access. The Centre for Research in Energy and Energy Conservation focuses on research across bioenergy, solar PV and Pico hydro.

Energy efficiency

There is no national regulatory framework in place specifically targeting energy efficiency, although a draft from before 2010 exists. A big impediment is the high electricity loss in the transmission stage, which is why various development partners are involved in tackling this problem. Nevertheless, also local organizations are targeting energy efficiency as their vision, such as the Uganda National Renewable Energy & Energy Efficiency Alliance, the Uganda Biomass Energy Efficient Technologies Association.

5. Market review

Public institutions involved in the application of the Electricity Act 1999 or the VAT exemption rules seem to lack capacity to implement the rules in a stringent, uniform and efficient way. ERA is responsible for the processing of licences, which is supposed to take 6-9 months.[xiv] However, it can reportedly take four years to get the approval for concessions and tariffs for off-grid generated electricity. The most efficient to date was approved in 2 years. Customs clearance is lengthy (up to 3-4 months), which impacts on cash flow. The regulation on customs duties has actually changed four times since 2011, which can lead to difficulties interpreting it uniformly down the chain.

The government has recently announced free connections for all households to ensure they are connected. With a short-term goal to reach 26% rural electrification, the free connections will cost about US$ 100 million. Although some development partners have confirmed some interest in contributing, there is still a financial gap to fill. However, a free or low-cost connection may ensure that users have legal access to reliable electricity. Cost-reflective tariffs would however need to be introduced to ensure energy efficient consumer behaviour.

In terms of financing, commercial banks in Uganda lack experience in energy sector financing, and are unable to perform the due diligence. Interest rates for loans in local currency are high (20% plus margin), and 100 - 120% collateral is required. International companies with access to foreign financing have an advantage compared to local companies. Bank loans have a 5-7 year tenure but financing for infrastructure typically demands a 10-year credit line. Furthermore, the high interest rates lead to repayment problems during a period when business viability is tenuous.

Private companies lack sufficient knowledge to develop and implement a successful business model for energy provision or energy services. “People want to be entrepreneurs, but don’t know what it takes” as stated by Private Sector Foundation Uganda (PSFU), which implements the Business Uganda Development Scheme - Energy for Rural Transformation (BUDS-ERT) funded by the World Bank. Only three of the 17 developers supported through GET-FiT are local; According to GET-FiT, local developers had developed both feasibility studies and environmental impact assessments, but needed financing. Likewise, few local companies have accessed EEP grants, which may reveal either a lack of awareness or ability to access own financing. The newly established Uganda National Renewable Energy and Energy Efficiency Alliance UNREEEA (2015) represents five biomass, biogas, hydropower, solar and energy efficiency associations in Uganda and aims to strengthen the capacity of member companies.

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Currently, the generation capacity exceeds demand in the electrified areas, limiting new opportunities	▪ On-grid market: The two large hydropower plants under construction will be completed in 2021 and will prove ample electricity to satisfy current demand. Until then, it is unlikely that new PPAs will be signed. ▪ Companies that will run a mini-grid need bankable clear long-term rights, including a licence and 20-year concessions or an agreement on what will happen when the grid arrives.	▪ Donors to continue assistance upgrading the transmission grid
Institutional framework fails to promote IPPs due to lengthy procedures on customs clearance, licensing, PPA	▪ Lengthy customs clearance (up to 3-4 months), which impacts on company cash flow. ▪ Licensing is a lengthy process. ▪ Companies lack access to concrete, up-to-date information. They can't easily access ministries to get the information, which also has to be gathered from MEMD, ERA, and NEMA. ▪ A cost-reflective tariff is rarely approved affecting the business case for the prospective IPP, thus reducing feasibility and willingness to invest.	▪ Government emphasises mini-grids in the future planning. ▪ When development partners provide capacity building to agencies, the measurement of achievement of objectives could include the number of approvals given. ▪ Support to tariff specification. ▪ Support companies during the processing of the approvals. Mentoring particularly with government institutions and donors.
Lack of sufficient knowledge in private sector companies	▪ Local private sector companies lack sufficient human, technical and financial capacity to develop and implement energy projects, including infrastructure projects requiring administrative processes.	▪ Pool of investment advisors is needed. Entities like Energy4Impact and RE Business Incubator help start-up companies build up capacity to finance and implement energy projects. ▪ Donor results-based financing has helped companies focus on achieving the agreed goals, and thereby striving to run a viable business.
Capacity **The limited number of skilled technicians**	▪ Energy efficiency: Energy auditors are only now being trained but will be certified soon. ▪ There is a lack of wiremen although they are being trained through ERT programme.	▪ The lack of skill in on-grid electrification, an activity that has been implemented for decades, indicates similar challenges for off-grid technologies.
Technology: **Biomass and improved cook stoves**	▪ The increasing population and rising incomes per capita will result in a higher demand for cooking energy. ▪ 95% of cooking is on biomass, but the biomass stock is decreasing	▪ Large waste-to-energy potential, if the challenge of gathering waste can be handled through the economic incentive that may arise. Private sector operators that already collect waste in larger cities could be encouraged to take this opportunity forward. ▪ Large potential for efficient cooking. In 2014, only 10% of the population used efficient stoves, and most of those only have a 2-years lifetime. Donors may need to provide support to professional production, and innovative and sustainable business models.

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Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Technologies **Solar home systems**	▪ Solar home systems are needed in sites with dispersed households, predominantly in rural areas where purchase power is low and logistics and economies of scale challenging. ▪ Some solar home systems are sub-standard, creating problems, and market attrition. ▪ Solar home systems are often too small to satisfy household energy needs ▪ Worn-out batteries in solar home systems are not being properly disposed of.	▪ Solar home systems will contribute to reaching the goal of 26% electricity access in rural areas, but projects need to include maintenance, otherwise the access rate will decrease again. ▪ Consider only allocating grants to solar home systems that meet Lighting Global (LG) standards, which is an international standard specifically developed for off-grid solar systems. ▪ Promote grants to highly efficient DC appliances allowing households to optimise the capacity of the solar home systems installed. ▪ Sustainable disposal of used batteries should be included in project description and business plan.
Energy efficiency is not promoted due to lack of legal framework	▪ In the absence of enforcement arrangements, there is no incentive to respect the Bill on Energy Efficiency and Energy Conservation. No labelling. No label and control of sub-standard equipment, e.g. solar home systems.	▪ Support to wider policy environment needs to be emphasised.
Financing: **Lack of willingness/ ability of commercial banks to invest in the sector - financing is still required to encourage commercial banks to provide affordable credit**	▪ High commercial interest rates (20% plus margin), plus requirement for 100-120% collateral leads to difficulties honouring a loan, while at the same time ensuring that the business is viable. ▪ Banks are not able to perform due diligence for the energy projects.	▪ FIs need TA for how to read PPA, contracts, details with contractors. ▪ Providing credit guarantee mechanisms is necessary at this stage although banks have a greater risk appetite for some technologies than others.
Donor financing	▪ Abundant financing available, but there appears to be a lack of donor coordination.	▪ Improve donor coordination, to avoid overlaps and ensure synergies
Market: **Purchasing power is too low to afford access**	▪ Poor households cannot afford to pay the electricity bill on a monthly basis.	▪ In general, payment methods for energy services to the very poor needs to be further developed/ exploited. ▪ Grant proposals need to include an element that helps communities implement productive uses of energy, so that they can pay for the electricity. ▪ Performing research into the drivers of the social economy, potential productive uses and energy usage patterns would inform project developers to design innovative solutions.
Complicated import procedures	▪ Divergent processes within the EAC make it difficult for companies to import duty-free and sometimes double taxation occurs.	▪ Need for assistance (by other programme than EEP – not within its scope) for institutional capacity building of customs authorities. ▪ Consider whether there is a need to further streamline application of rules and procedures within the EAC.

7. Implications for the Theory of Change

Currently, in Uganda, the electricity production capacity is in line with the peak load from the connected consumers. However, with slightly more than 20% access to electricity in Uganda, and only 10% in the rural areas, there is indeed

room for further investments in electricity production. The current involvement of donors in upgrading and extending the transmission and distribution grid is an unconditional part of increasing access.

There are multiple opportunities for mini-grids and off-grid solutions, but developing bankable off-grid projects is challenging in Uganda due to the lack of capacity of local companies and lengthy approval procedures. In order to promote the participation of local companies, support to the development of the business case, as well as the processing of obtaining approvals, is required.

The legal and regulatory framework for energy efficiency is not in place although the strategy framework is being developed. There will be a need to support knowledge transfer to the sector once this is in place. Similarly, in increasing energy access, challenges are related to lengthy licensing procedures, tariffs, and concession durations, or guarantees if the grid reaches the area.

Many companies agree that it would be feasible to operate with an EEP programme that offers grants for innovative projects and a reduced interest loan for scaling up. It is important to continue supporting projects targeting efficient cooking and the sustainable use of wood.

Support to solar PV projects, especially solar home systems need to emphasise the need for after-sales service provision. Furthermore, it is absolutely necessary to ensure that worn-out batteries are responsibly disposed of. The recent announcement by the government of free connections to every household will in order not to distort the off-grid market necessitate a clear timeframe from the government and/or clear announcement of whether free connections to electricity in remote rural areas will in fact be covered through off-grid solutions.

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[i] *http://gtf.esmap.org/*

[ii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System - Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iii] *https://www.imf.org/external/pubs/ft/dp/2013/afr1302.pdf*

[iv] *http://dalberg.com/blog/wp-content/uploads/2017/05/Dalberg-offgrid-policy.pdf*

[v] *http://www.se4all.org/sites/default/files/Uganda_AA_EN_Released.pdf*

[vi] *http://energyandminerals.go.ug/downloads/EnergyPolicy.pdf*

[vii] *http://energyandminerals.go.ug/index.php?id=3*

[viii] *http://energyandminerals.go.ug/downloads/RENEWABLEENERGYINFOFORWEBSITE2017.pdf*

[ix] *http://www.rea.or.ug/resources/strategy%20and%20plan%202013-2022.pdf*

[x] *idem*

[xi] *http://www.era.or.ug/index.php/2013-12-14-14-58-04/guidelines/doc_download/383-uganda-renewable-energy-feed-in-tariff-phase-3-guidelines-2016*

[xii] *http://www.se4all.org/sites/default/files/Uganda_AA_EN_Released.pdf*

[xiii] *ibid*

[xiv] *http://www.era.or.ug/index.php/licences-permits/2013-10-15-15-43-41/licensing-procedure*

Country profile – Zambia

1. Overview

Indicator	Data
Population	16.21 Million (2015)
Population density	21.15 persons/ km^2
Global Tracking Framework Indicators [i]	
Access to electricity	27.9% (2014) (67.7% urban, 9% rural)
Access to improved cooking	16% (2014)
RE as proportion of the mix	0.003% (excluding large hydro) 88% (with large hydro)
Other Indicators	
Reliance on energy imports (2014) (IEA)	10%
Centralised or liberalised electricity sector	Centralised
Bundled generation, transmission and distribution?	No
Existence of renewable energy IPPs	Yes
Import duties on renewable energy products	No
RAGA/ AA/ IP	Draft RAGA, AA and IP
Renewable energy strategy	Draft form
Number of EEP Phase I & II projects	17
Total EEP contribution (% of total budget)	€3.3 million (45%)
Average daily solar irradiance [ii]	6,290 Wh/m²/day
Electricity subsidies	Moving towards cost reflective tariffs planned for 2017 [iii]
Fuel subsidies	Subsidies on fuel removed in 2017 [iv]

Zambia's installed capacity stands at 2,803 MW. However, only 1,806 MW is available mainly due to poor rainfall between 2014 and 2015, but also owing to maintenance and expansion programmes. Zambia has now 85% large hydro and 15% thermal power generation capacity in view of the coming on stream of Maamba Collieries and Ndola Energy, which are coal and heavy fuel based. The maximum power demand is almost 2,000 MW necessitating the import of 200 MW to meet the shortfall.

2. Institutional framework

Institutional structure

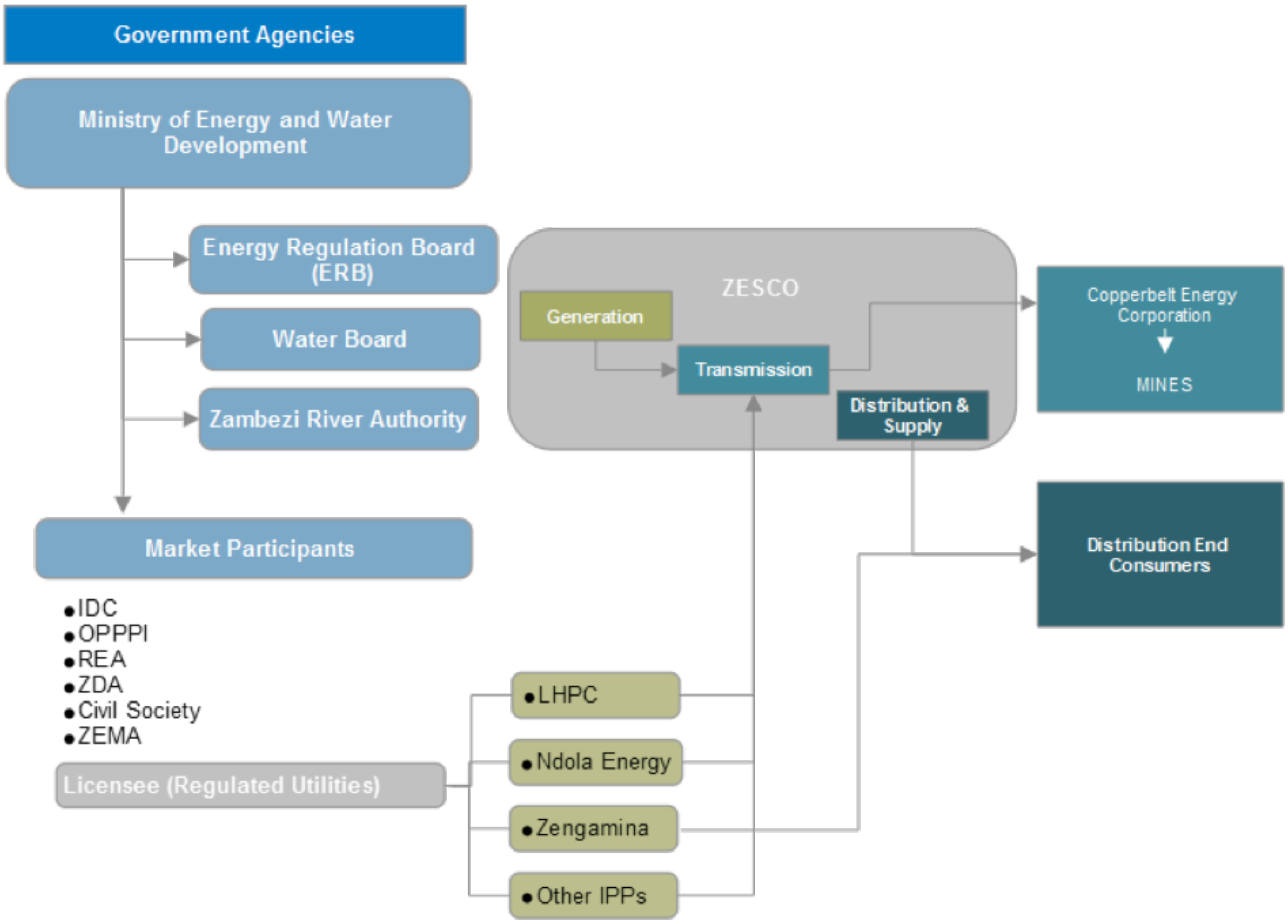
The Ministry of Energy is the principal institution with the mandate for carrying out energy planning and policy development. The Energy Regulation Board (ERB) is responsible for licensing of Independent Power Producers (IPPs),

setting petrol prices and electricity tariffs, developing technical standards, and the promotion of new grid connections for low-income households. The Office for Promoting Private Power Investment (OPPPI) was set up as a 'one window operation' to reduce the complexity of procedures, rules and regulations, and red tape usually associated with obtaining the required approvals, permits and licences for investors in the electricity sector.

The Rural Electrification Authority's (REA) primary aim is to provide electricity infrastructure to rural communities as mandated by Government. REA issued the Rural Electrification Master Plan (REMP) as a blue print for executing this programme in 2011. REA is mandated with the tasks of administering and managing the Rural Electrification Fund (REF), developing and implementing the REMP, mobilizing funds to support rural electrification, encouraging private sector participation in rural electrification through provision of smart subsides, competitive bidding and community mobilization, financing project preparation studies for rural electrification, and recommending policies to the government.

The state-owned power company, ZESCO, retains a monopoly on operating the distribution and transmission network and charges a 5% government excise duty to customers, 3% of which is earmarked for the Rural Electrification Fund (REF) and 2% reserved for other government programmes.[v] There are other independent power producers, namely Lunsenfwa (56 MW), Maamba Collieries (300 MW), Ndola Energy (105 MW), Itezhi tezhi (120 MW), and Kariba North Bank (360 MW). Copperbelt Energy Corporation (CEC) is a transmission and distribution company that buys electricity from ZESCO and sells to the mines.

Figure 1: Institutional structure for the energy sector in Zambia (based on source: NAMA Small Hydro, 2016)



For on-grid extension, once REA has completed the grid extension to rural areas, it hands over the distribution to ZESCO, who charges the customers subsided connection fees. For standalone systems, REA subcontracts to the private sector for installations of solar home systems and the client pays for this service.

Policy framework

The National Energy Policy (NEP) (2008) sets out the government's intentions to harness the energy sector's potential to drive economic growth, while also reducing poverty. Renewable energy technologies play an important role in the NEP in that they have the potential to meet the country's electricity demand requirements in a sustainable manner.

The REMP identified 180 project packages covering 1,217 rural growth centres to be implemented by 2030. The projects mainly focus on-grid extension and a few standalone systems. The total investment is US$ 1.1 billion and its expected spend per year is US$ 50 million. The anticipated result is to increase the rural electrification rate from 3% in 2009 to 51% by 2030. It is envisaged that during this period 500,000 solar home systems and 300,000 solar water heaters will be installed, reducing the load by an expected 40 MW. However, the annual budget is not being met, since REA is only given an estimated US$ 10 million a year for rural electrification.

The Draft Renewable Energy Strategy (2010) aims to increase the contribution of renewables to total national energy needs, including accelerating deployment of solar energy and exploiting the energy potential from small hydropower plants. The Renewable Energy Feed-in-Tariff (REFiT) strategy and regulatory support mechanisms are currently under consideration for final approval by Cabinet.

The National Energy Policy (2008), the Rural Electrification Master Plan (2009) and the draft Renewable Energy Strategy do not provide a clear implementation plan on how to achieve 51% rural electrification by the year 2030. The REMP focuses mostly on-grid extension, which is not necessarily the most cost-effective solution, and is unlikely to be achieved since the committed funding is not being made available.[vi]

Other key policy and legislative documents are:

1. The Electricity Act no.14 of 1995, which regulates the generation, transmission, distribution and supply of electricity and related matters.
2. The Energy Regulation Act Cap 436 (2003) recognizes solar, wind and biofuels as viable energy sources and also establishes licenses and guidelines to facilitate the adoption of renewable technologies, including for solar power and bio-energy, as well as setting off-grid tariffs.
3. The Climate Change Policy (2016) supports and facilitates a coordinated response to climate change by re-aligning its climate sensitive sectors of the economy and society.
4. Zambia's Intended Nationally Determined Contribution (INDC) to the 2015 Agreement on Climate Change UNFCCC (2015) includes both mitigation and adaptation components based on national circumstances.[vii]

3. Technology review

Hydropower mini-grids

Zengamina is a mini-grid located in the Ikelenge district. The scheme is powered by a 750 kW run-of-river hydropower plant. The grid mainly consists of 11 kV distribution lines, but a 15 km length 33 kV line had to be built to feed a large commercial farm and other households, and commercial customers on the way.[viii] The construction of a 1 MW small hydropower plant at Shiwang'andu in the Chinsali District links reliable energy services with productive use activities to enhance the employment opportunities in the rural areas of Zambia.

Solar

Muhanya Solar Limited has launched a Pay-As-You-Go (PAYG) 30 kW mini-grid solar system in Sinda at a cost of US$ 133,700. The pilot project is aimed at building a business case that will attract large-scale private investment in rural areas so that the application of this system can be scaled up to meet the energy demands of the rural poor countrywide. Muhanya Solar with support of Musika is testing the PAYG concept for 60 houses and gauging the level of energy spending capacity to attract further investment and prove to potential investors that the concept was both economically and technically viable.[ix]

The Mpanta solar mini-grid is a 60 kW PV system with a 936 kWh battery bank providing electricity to 480 customers. The tariff structure is based on a monthly fixed rate according to the estimated demand and ability to pay of different classes of consumers. The infrastructure is currently owned under a provisional licence by REA but is run by a local cooperative to which it will be handed over. The business was initially given to Kafita Cooperative but the model is not sustainable since the tariff structure is not adequate to attract a reasonable return on investment. There are plans to bring in an off -taker who can run the mini-grid professionally.[x]

There is an emerging market for solar home systems in Zambia with various companies playing a role in the provision of energy services by solar energy. Their product range includes solar home systems for households (6 Wp-250 kW), for schools and health centres (100 Wp to 600 Wp), solar lanterns, and solar pumps for irrigation.

Biogas for cooking and lighting

In the recent past, a revival of the biogas industry has been instigated by SNV Zambia. The "Energy for Agriculture (E4A)" project supported by the Swedish International Development Agency (SIDA) and SNV is being implemented over a three year period (2015 – 2018) and supports the construction of 3,375 bio-digesters in the Southern, Lusaka, Western, Central, Northern, Eastern and Copperbelt provinces. Its purpose is to provide farming households with access to clean energy, increased employment and income, and improved living conditions through the productive use of waste products – biogas and bio-slurry. It is expected that dairy farmers will be able to utilise biogas as fuel for powering milk chillers and households will be able to use biogas for cooking. The size of the digesters ranges from 4 to 100 m3 producing 1 to 25 m3 of biogas per day with a cost range of between US$ 600 and US$ 7,000, depending on the size of the installation and location.[xi]

The Water and Sanitation Association of Zambia (WASAZA) has been collaborating with the Devolution Trust Fund (DTF) in conjunction with some provincial water utilities at their respective sewage treatment plants. The first project was with Southern Water and Sewerage Company, where WASAZA installed 9 bio-digesters, which were fed by 300 households that are then supplied with biogas for lighting and cooking needs. In Solwezi, they are collaborating with North-Western Water and Sewerage Company so that 120 households feed wastewater into 4 digesters that then supply them with gas.

Southern Biopower started operations in 2008. It executes customised multi-purpose biogas waste management solutions for farms, lodges, households, agro-processing and public institutions. They produce biogas and fertilizer from water hyacinth grown in the waste ponds in the city of Livingstone, among other projects. The gas is piped with gravity pressure to Dambwa site and services hotels along the Zambezi waterfront, while the slurry is used as fertilizer for the banana plantation on site.[1]

Figure 2: Charcoal traders awaiting clearance at the Bulangililo checkpoint in Kitwe. Picture: Nkombo Kachemba

Improved biomass stoves and pelletising

Charcoal is primarily consumed in urban and peri-urban areas in Zambia – 85% of urban households consume charcoal.[xii] However, recent load shedding has also caused an increase in charcoal consumption.[xiii] The drivers for charcoal production are significant due to the fact that there is no widely available, affordable and similar alternative, and the enforcement of regulations is very weak.

It is also estimated that the informal charcoal sector provides an estimated 50,000 jobs (2012). Emerging Cooking Solutions (ECS), a beneficiary of the EEP programme, is producing pellets for their improved cook stove. ECS have three years of experience in Zambia in setting up a pellet factory, design and production of institutional stoves and sales, and distribution of domestic and institutional stoves. Their business model, "the Nespresso model", is focused on capturing the recurring sales from pellets. The typical peri-urban consumer normally uses US$ 200 for cooking fuel per year. Creating the market for pellets requires the implementer to address cultural factors, the distribution backbone, the initial cost of stoves, and marketing. ECS has found that financing solutions are necessary to sell the high-end stoves (Philips and MimiMoto) and have found a payroll deduction model to be the most successful, although this only meets the needs of those in employment. Another company, Vitalite, is also involved in the promotion of improved charcoal stoves and has to date distributed 4,000 stoves in peri-urban areas.[xiv]

Biogas

There are singificant opportunities to produce electricity from poultry farms with a capacity of 100,000 birds per farm. There are quite a good number of farms that meet this criteria including: Crest Zambia, Country Choice, Copperbelt Chickens, Supreme Choice, Zamchick, Golden Lay, and Colchi Farms Limited. Equally there are dairy farms with reasonable numbers of cattle, e.g Kusiya and Rosedale Farms. It would be desirable for the sake of cost effectiveness and taking account of economies of scale for both poultry and dairy farms to have centralised biogas-processing plants where each farm could deliver the feedstock.[xv]

Agriculture or forestry waste is abundant in Zambia. In Zambia, Nakambala Sugar and Kafue Sugar produce electricity for their own consumption in the range of 40 MW and 8 MW, respectively. Opportunities exist for producing electricity from forest residues at Lamba forest, Kaoma sawmills and Mulobezi sawmills.[xvi]

Biomass gasification

ZESCO in conjunction with UNIDO had planned to install a 1 MW biomass electricity generation plant to meet the electricity needs of Kaputa District. This facility was meant to replace the 440 kW capacity diesel generator. ZESCO has since extended the national grid to Kaputa resulting in the concept being taken over by CEC. CEC is intending to install a 1 MW plant using wood waste from the Copperbelt Forestry Corporation near Kitwe. The sawdust will be pelletized and fed into the gasifier. However, preliminary costing indicates that the tariff will be markedly above the market average.

4. Stakeholder review

The main on-grid energy producer is ZESCO, a government utility with an installed capacity of 1,862 MW. Other on-grid independent producers include Kariba North Bank (360 MW), Itezhi Tezhi (120 MW), Lunsemfwa (56 MW),

Ndola Energy (105 MW) and Maamba Collieries (300 MW). Off-grid companies producing electricity are Zengamina Power Company Limited (750 kW), Muhanya Solar Company Limited (30 kW), and Kafita Cooperatives (60 kW). Other planned on-grid systems include 100 MW solar PV, which was sought through a tendering process with support from World Bank with promising tariffs of 7 cents/kWh, Kafue Lower (750 MW), Batoka (1200 MW), and Western Power Company (100 MW). Off-grid system projects include West Lunga (3 MW), Chanda – Chavuma (15 MW), Chikata falls 3.5 MW), and Kasanjiku (600 kW).

Some IPPs have been able to obtain near cost-reflective tariffs at around US$ 0.11/ kWh but the challenge lies with ZESCO, which buys the power from IPPs at a higher tariff than it sells it (US$ 0.06/ kWh). This thereby affects the viability of ZESCO.

Financial institutions involved in the investment of the energy sector include Stanbic Bank Zambia, Zambia Development Bank (ZDB), Pangaea, Kukula Capital, Open Capital Advisers, GroFin and PEP.

There is a long list of businesses in the solar PV sector however the only businesses that appear to be thriving are Vitalite (EEP grant holder), Solar Solutions, Azuri, Sunny Money, Suntech Appropriate Technology Limited, and Muhanya Solar Limited who are involved in design, manufacture, installation, marketing and distribution of solar products on a continuous basis and have sufficient stocks. Most respond to open tenders from government and do not keep stocks. Two companies, Vitalite and Emerging Cooking systems (EEP grant holders) are also involved in improved cook stoves.

The cooperating partners and regional organisations involved in the energy sector in Zambia are DFID Zambia, Finnish Embassy, SIDA/Swedish Embassy, European Union (EU), World Bank Group, USAID/Power Africa, IFC, UNDP, AfDB, UNCDF, KfW/ Get FIT, JICA, SNV, COMESA, SADC, SACREEE and Regional Electricity Regulators Association (RERA). The main civil society organisation that is involved in the energy sector is the World Wildlife Fund (WWF).

The Industrial Development Corporation (IDC) and IFC have established the "Scaling-up Solar" initiative. It currently involves the development of 300 MW of solar PV projects. The project implementation will be undertaken in phases as follows: up to 100 MW (2 projects awarded in 2016) under Phase I, up to 150 MW under Phase II, and up to 50 MW through the Get FIT programme.

5. Market review

Zambia is known for its ease of doing business. The country has had a positive investment framework, recently eliminating minimum capital requirements. However, interest rates on local credit is high (bank lending rates of around 22-24%). Access to credit is limited; lending to the solar sector has not really taken off, with only Vision Fund Zambia beginning to consider loans for solar lights.[xvii]

The penetration of solar PV in Zambia is very low and, in most cases, the market is supported by donor and government funded projects. In 2014, annual sales amounted to US$ 2 - US$ 3 million with donor financing accounting for more than 70% of total sales. The primary reason for the low level of investment in the off-grid solar market, according to most private companies interviewed, is the low population density in Zambia, which makes it very expensive for solar firms to get a foothold in rural areas. This is further exacerbated by the limited availability of payment methods in certain rural areas, where mobile money is not currently available. The mobile money culture has not yet infiltrated Zambia to the same extent as other African countries. Those companies that are currently active in the market have managed to overcome this challenge by partnering with micro-financing institutions or by obtaining concessionary funding from donors.

The limited ability to pay for solar products is also a major constraint to the expansion of the market. Even though solar importers and distributors have come up with innovative financing models, such as fee-for-service and PAYG, the irregularity of household cash flow is a major impediment. A lack of awareness regarding solar power and its possibilities, as well as lack of understanding of the differences between good and poor quality products, has resulted in sub-standard products entering the market. Also, the lack of information regarding available financing options for purchasing these products means that consumers are unable to make informed purchasing decision.

Since the beginning of 2017, ERB has been collaborating with the Zambian Bureau of Standards (ZABS) and the Zambia Revenue Authority (ZRA) to control the quality of the products at the point of entry. Only companies licensed by ERB are entitled to import products free of duties and VAT. This lowers costs for such products and encourages consumers to purchase products only from licensed service providers. However, ZBS lacks the resources to verify equipment standards and ZBS and ERB lack the capacity to adequately enforce the quality regulations and standards on the companies involved in the market, resulting in the rules being applied erratically.

There are currently 28 solar companies that hold a license from ERB to import household solar products. Even though national standards introduced by ZABS are not mandatory, licence conditions imposed by ERB means that licence holders are required to meet quality standards set by ZABS. Conformity assessment of solar energy products can be undertaken by ZABS upon a request from ERB. Companies may also obtain full accreditation but only upon payment of a significantly higher fee, which entitles them to market their products with a formal stamp. Few, if any, solar companies choose this option.

Active investment is occurring in the off-grid space through the introduction of mini-grids with the support of grant financing leveraging private sector investment by SIDA through the Power Africa-Beyond the Grid Facility and United States Africa Development Foundation (USADF) Power Africa Off-Grid Energy Challenge.

Future investments are envisaged in the off-grid space through EU support to the Zambia Energy Sector: Increased Access to Electricity and Renewable Energy production by providing € 25 million to leverage private sector investments aimed at leveraging the tariff which is expected to be high due to the economy of scale of mini grids. A similar approach is planned by the UNDP China – Zambia South South Cooperation on the demonstration of mini-hydros and solar PV, and World Bank- electricity service access project by offering off-grid electrification smart subsidy and off-grid loan facility. DFID intends to support solar home systems through the private sector, once feasibility studies being undertaken are completed, aimed at accelerating the expansion of the household solar market.

The EU funded Increased Access to Electricity and Renewable Energy production and UNDP China – Zambia South-South Cooperation are providing investments to policy and regulatory reforms and capacity building aimed at improving the enabling environment for private sector participation and public officers being ready to provide required services in off-grid space.

JICA is the only one supporting grid extension to rural areas through their project. The question of tariffs for the on-grid system is being addressed by the Energy Regulation Board, although it is not yet cost reflective, and currently a cost of service study is being undertaken which will specify the actual tariffs to be charged for generation, transmission and distribution. However, the tariffs for off-grid systems has not yet be addressed and needs attention in view of the economy of scale of off-grid technologies.

The REMP programme is mainly for electrifying public institutions with funds coming from appropriate ministries and partially subsided solar home systems for households but these were few. There is a risk in some instances of the grid arriving where mini-grids have been installed thereby distorting the market.

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
The policy and regulatory framework is not investment friendly	▪ Household solar is recognised to some extent in the National Energy Policy (2008), the Rural Electrification Master Plan (2009) and the draft Renewable Energy Strategy but there is no clear implementation plan how to achieve 51% rural electrification by the year 2030. ▪ There is inconsistency in the interpretation and application of the Statutory Instrument No 32 and 33 of 2008 – The Customs and Excise Act. The customs and excise act (electrical machinery and equipment) (suspension) regulations 2008: includes exemption of import duties and VAT on Energy efficient lighting lamps, discharge lamps, other than ultra violet lamps, solar geysers, solar batteries, solar panels, invertors for solar power, diesel or semi diesel generator. Although there is VAT and Duty exemption on solar products, payment is required at times. ▪ Lack of standardised Power Purchase Agreements deters potential investors in power generation.	▪ Development of clear targets for each tier (grid, isolated grid, and non-grid) and an implementation plan for achieving the targets. ▪ Consider extending tax exemptions to all renewable energy and energy efficiency products. ▪ Development of standardised Power Purchase Agreements.
The lack of access to finance continues to be an obstacle	▪ A major barrier to investments in access to energy in Zambia and other developing countries is the lack of access to seed, mid- and long-term capital. In immature market conditions, this is aggravated by the reluctance of commercial banks to provide suitable lending that respond to the needs of investors and by the existing capacity limitations in terms of structuring and bringing projects to financial close. ▪ Sourcing finances – high commercial interest rates and currency exchange risk - for instance solar products are imported and must be paid for in foreign currency while products are sold in Kwacha, which makes businesses vulnerable to exchange rate fluctuations. ▪ For solar businesses: margins for household products are low and risks high and, as with any business, firms will find it hard to attract commercial finance. ▪ For consumers: The low disposable income of households, particularly in rural areas, makes it hard for them to cover the relatively large up-front cost related to the purchase of off-grid solar products or to maintain regular payments if credit terms are offered. ▪ Payment methods: Even though the mobile platforms are available in rural areas from a technical perspective, the lack of sales outlets for products means that mobile money is not always an option in many rural areas. ▪ Affordability to off-grid solutions - solar home systems and mini-grids is also an impediment to off-grid access. ▪ The disadvantage of promoting solar home systems and improved cookstoves is that they are not affordable for outright purchase by low-income households.	▪ Support for guarantees, flexible loans, equity, grants were applicable, project development financing e.g. legal advisory services, by financiers and cooperating partners. ▪ Provide support to existing and potential investors in the market that aim at supplying off-grid solar products in rural areas. Support can be in the form of technical assistance, market studies that provide information on the availability of distribution infrastructure in each area, advice on their business plans and financial incentives to expand their business in financially unattractive areas ▪ Encourage the development of financing options for off-grid solar products, such as PAYG, mezzanine funding and loan guarantees in addition to providing business development services to solar companies. ▪ Develop campaigns that aim at informing people about the availability of payment options for financing household solar products ▪ Subsidy, credit mechanisms, innovative payment schemes such as Pay-As-You-Go (including to mobile phones) and efforts to reduce connection costs are required to fast scale up electricity access. ▪ Low-income household need some form of financing mechanisms to enable them to purchase the solar home systems and cook stoves.

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Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Economies of scale are just not present in certain areas	▪ Low population density contributes to high marketing and distribution costs ▪ Several rural areas are experiencing low population density and servicing these customers is not a financially viable option for private companies	▪ Village regrouping and resettlement as a general policy for accelerated energy services to rural areas. ▪ Encourage MFIs to support solar companies that target areas with low penetration (creation of a fund available to solar companies operating in those areas).
Quality and standards are not being enforced	▪ Competition from cheaper products – the market is flooded with substandard products. ▪ Competition from alternative energy sources – competing with illegal untaxed source of energy (charcoal).	▪ Enforcement of standards ▪ Raise the awareness of households regarding the availability of good quality solar products and how to distinguish them from unlicensed products that do not comply with national standards
Market distortions are crowding out the private sector	▪ There is risk in some instances of grid arriving at the place where mini grid has been installed despite the planning indicating it will not reach thereby distorting the market	▪ The government should stick to electrification plans than following a political route
Energy efficiency is gaining policy support but now needs to be put into practice	▪ There is currently no comprehensive national energy efficiency strategy. Energy efficiency and DSM measures are, however, implemented in the electricity sector to align demand with available supply.	▪ As part of the SE4All Initiative, the Government is committed to develop and implement a comprehensive energy efficiency strategy including strengthening the institutional and regulatory framework and implementing proven energy efficiency measures. ▪ With respect to improving energy efficiency for cooking, a significant dissemination program of more energy efficient cook stoves is proposed together with measures to improve the energy efficiency of the charcoaling kilns.
Technologies such as biogas have a strong rural poverty impact but are not being exploited	▪ Biogas digesters are not being used broadly while there is significant potential in public institutions either from sewage, manure and/ or kitchen waste.	▪ The role of local associations could potentially support the promulgation of technologies such as biogas. ▪ Demonstration projects can help to dispel concerns regarding the use of organic waste and raise awareness.

7. Implications for the Theory of Change

The off-grid rural energy markets in Zambia are immature with very few companies currently operational and several barriers that discourage the private sector. Service providers currently operational in Zambia and/or interested in entering the Zambian market are at an early stage of business development and as such unable to absorb or mobilise large amounts of funding. In addition, many of the business models still require a period of piloting and adjustment to the specific opportunities and challenges of the Zambian market. Key risks and barriers to market entry and scale include lack of market information (on e.g. ability and willingness to pay, current energy use, etc.), immaturity of markets for mobile money, volatility of the currency exchange rate of Kwacha, low population density, lack of awareness and inbuilt scepticism of RE solutions among target customers, unclear and long processes for licensing, tariff setting and securing certain fiscal incentives.

Serving the rural household segments with private sector energy solutions often necessitates cross-subsidisation by productive use and/or institutional clients, which are likely to have a more stable, predictable and higher capacity to pay. As such, the market opportunity in both household and productive / institutional market segments needs to be addressed. In line with experience elsewhere, it is anticipated that the productive use segment will require its own incubation stimulus before it can fully play its expected role as anchor client.

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1 *www. southernbiopwer.com*

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i *http://gtf.esmap.org/*

ii *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System - Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

iii *https://www.africa-eu-renewables.org/market-information/zambia/energy-sector/*

iv *http://af.reuters.com/article/investingNews/idAFKCN12K1U1*

v *Draft Zambia SE4ALL Action Agenda, 2017*

vi *Developing Mini-grids in Zambia: How to build sustainable and scalable business models?, 2016*

vii *ibid*

viii *Case study of Shiwangandu Mini Hydro, 2013*

ix *Mini grid assessment in Zambia, Case study of Mpanta mini grid, 2016*

x *Development of an Overarching Comprehensive Framework For Assessing The Economic Basis For Supporting Investments In Biomass Technology in Zambia and Assessment Of Investment Climate For Biomass Energy And Approaches, 2016*

xi *ibid*

xii *Load shedding and charcoal use in Zambia: what are the implications on forest resources?, 2016*

xiii *National Forestry Policy, 2014*

xiv *Developing Mini-grids in Zambia: How to build sustainable and scalable business models?, 2016*

xv *'Zambia's electricity problem, crisis on country's forestry sector', The Zambia Daily Mail newspaper, 18th January, 2016*

xvi *ibid*

xvii *http://www.energynet.co.uk/webfm_send/1688*

Country profile – Zimbabwe

1. Overview

Indicator	Data
Population	13.06 million[i]
Population density	41.2 persons/ km^2
Global Tracking Framework Indicators [ii]	
Access to electricity	40% (83% urban, 13% rural)
Access to improved cooking	32%
RE as proportion of the mix	28% of total final energy consumption
Other Indicators	
Reliance on energy imports (2014) (IEA)	58% of total final electricity supply
Centralised or liberalised electricity sector	Centralised
Bundled generation, transmission and distribution?	Yes
Existence of renewable energy IPPs	21 (state owned, private and community led IPPs)
Import duties on renewable energy products	No
RAGA/ AA/ IP	RAGA & AA
Renewable energy strategy	Draft being approved by Cabinet
Number of EEP Phase I & II projects	N/A
Total EEP contribution (% of total budget)	N/A
Average daily solar irradiance [iii]	6,640 Wh/m^2/day
Electricity subsidies	Yes for low income consumers [iv]
Fuel subsidies	Unknown [v]

The energy sector in Zimbabwe has relied upon financial resources from Government levies and appropriated funds from the Consolidated Revenue Fund, and Donor funding channelled through international NGOs such as Practical Action, SNV, HIVOs, GIZ and Oxfam.

In recent years, the economy of Zimbabwe has suffered significant challenges due to the economic and political situation. Manufacturing has significantly decreased, increasing the reliability of power supply due to a reduction in energy-intensive activities. The Rural Electrification Agency (REA) is taking the initiative to increase off-grid rural energy access, providing solar systems to health clinics and providing necessary transmission infrastructure under donor-funded programmes and there are donor-funded projects have attempted to establish sustainable off-grid models for energy access. However, these initiatives have yet to establish a commercially viable, sustainable business model.

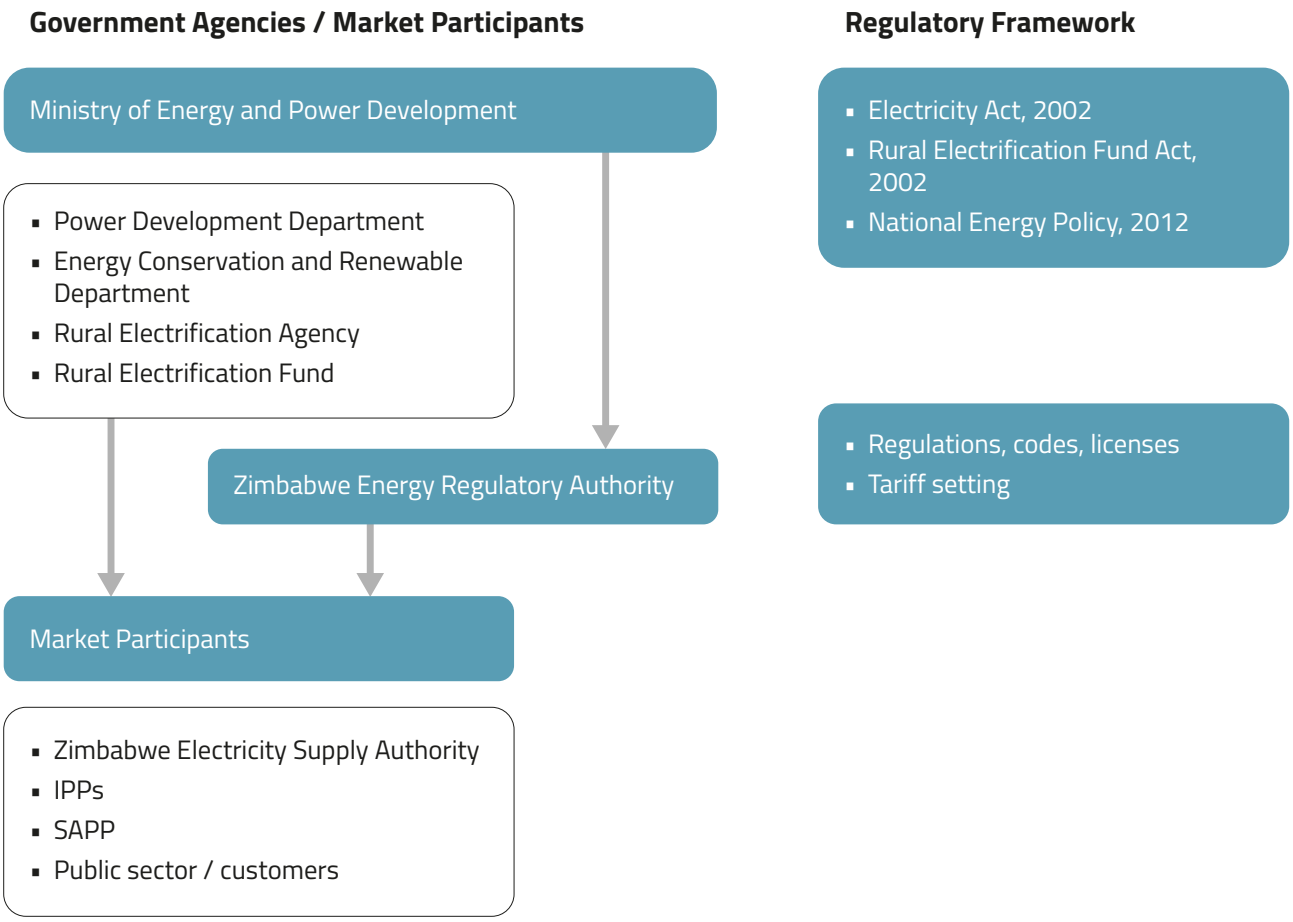
2. Institutional framework

Institutional structure

Table 1: Summary of the roles of the key stakeholders.

Institution	Role
Ministry of Energy and Power Development (MEPD)	Overall responsibility over energy issues, including policy and regulation of the energy sector
Zimbabwe Energy Regulatory Authority (ZERA)	Regulates the procurement, production, transportation, transmission, distribution, importation and exportation of energy derived from any energy source
Rural Electrification Agency (REA)	Electrify all the rural areas. It is funded by the Rural Electrification Fund which is resourced by levies and the Consolidated Revenue Fund
Zimbabwe Electricity Supply Authority (ZESA)	Holding company with four subsidiary companies: - Zimbabwe Power Company (power generation); - ZETDC (Zimbabwe Electricity Transmission and Distribution Company) (transmission, bulk supply, distribution of retail of electricity), sole buyer of electricity from the IPPs; - ZESA Enterprises: manufacturing and support services mainly for ZETDC and to a lesser extent to the general public; - Powertel (telecommunications support for mainly the ZETDC and general public to a lesser extent).
Zambezi River Authority	Operates, monitors and maintains the Kariba Dam complex and any other dams on the Zambezi River between Zimbabwe and Zambia.
Department of Energy Conservation and Renewable Energy	Energy conservation policies, strategies and action plans; technologies and techniques; R&D, promotion of new and renewable sources of energy

Figure 1: Institutional structure for the energy sector in Zimbabwe



Policy framework

The National Energy Policy (NEP)(2012) directs that renewable energy should play a bigger role in the Zimbabwe energy mix and promotes energy efficiency. One of its objectives is to develop the use of other renewable sources of energy to complement conventional sources. The NEP recognises sources such as biomass, hydropower, liquid biofuels and solar. It also recognises other renewables such as wind, biogas, geothermal, solar cooking/ crop drying.

The Draft Renewable Energy Policy seeks to increase access to clean and affordable energy through the addition of installed renewable energy capacity of 1,000 MW by 2025 or 16% of the total generation from renewable energy sources, whichever is higher, and 1,600 MW by 2030 or 23% of total generation from renewable energy sources, whichever is higher. The Draft National Biofuel Policy defines the government approach to promoting liquid biofuels for transport and production of Jatropha.

The Rural Energy Master Plan promotes increased access to electricity grid extension, off-grid solar home systems and mini-grids. This Plan supports a decentralised energy system aimed at improving access to energy. The Renewable Energy Fund promotes and supports renewable projects for electrification.

The Draft National Energy Efficiency Action Plan proposes various energy conservation activities and measures across all sectors. The Plan also promotes the procurement, production, transportation, transmission and distribution of energy in accordance with public demand and recognised international standards.[vi]

The Independent Power Producer Policy Framework provides for the procurement of power from the private sector and incentivises investors. ZERA has developed a Renewable Energy Feed-in Tariff (REFiT) resulting in Independent Power Producers (IPPs) submitting renewable energy power supply proposals. ZERA has developed the Energy Efficiency Audit that takes stock of how energy is used in Zimbabwe and lays out initiatives for reducing energy waste.[vii]

The Electricity Act (2002)

The Electricity Act Amendment of 2003 provides for the unbundling, commercialisation and privatisation of ZESA's different business lines. The Act repealed Sections 68 and 69 of the Electricity Act, which restructured and reconstituted ZESA as a holding company with four subsidiary companies. In relation to the development of an enabling framework for private sector engagement in improving energy access, the Act has reduced the generation and distribution licensing fees to promote ease of doing business.

In addition, the following regulations, codes and standards were developed:

- Regulations on Inefficient Lighting Products Ban and Labelling.
- Generation, Transmission and Distribution Performance Codes
- Solar Photovoltaic Standards
- The Electricity (Solar Water Heating) Regulations, 2016
- Importation of Renewable Energy SI 147 of 2010.

The Rural Electrification Fund supports the establishment of mini-grids. The fund also provides for the extension of the national grid to rural communities and provides off-grid renewable energy solutions, such as solar mini-grids and biomass activities.

Zimbabwe's Intended Nationally Determined Contribution (2015) is committed to a greater use of renewables in the national energy mix. It also recognises the growing threat of water shortages on hydropower potential and the need to adapt.[viii]

The National Climate Response Strategy includes the following activities: developing and implementing incentives that promote and reduce costs of renewable energy such as renewable energy feed-in tariffs, net metering, subsidies and tax redemptions to make renewable energy technologies affordable, and promoting the production of renewable energy equipment that uses bio-fuel, solar and biogas.[ix]

The Zimbabwe Draft Investment Prospectus (June 2016) highlights the importance of solar technologies both on the grid and to unserved populations.[x] It is presented to private investors, international financial institutions and donor agencies.

The Draft Investment Prospectus aims to crowd-in investments that will operationalise the Zimbabwe SE4ALL (Sustainable Energy for All) Action Agenda. This is done combining the different investment opportunities in one.[xi] The Zimbabwe Draft Investment Prospectus (June 2016) presented the following eight investment concept notes, two proposed technical assistance projects and an energy efficiency investment fund. The projects are presented in priority order and cover: manufacture of clean cook stoves, residential solar water heater program, solar power plant, ethanol production plant, biodiesel production plant, energy efficiency & on-site renewable energy at a hospital, health clinics & district offices, Harare mass transit bus system, and recapitalization of national railways of Zimbabwe.

3. Technology review

The national electrification rate in Zimbabwe is 40%. 83% of urban households have access to electricity as compared to 13% in rural areas.[xii] According to the NEP, "Rural communities meet 94% of their cooking energy requirements from traditional fuels, mainly firewood, and 20% of urban households use wood as the main cooking fuel".[xiii] There has been increased use of fuel wood as a result of power outages and loading shedding. The other energy sources are coal, charcoal and liquefied petroleum gas (LPG) and these constitute less than 1% of household energy consumption.[xiv]

Zimbabwe has an installed capacity of around 2,000 MW with ZPC (Zimbabwe Power Company) contributing around 95% of this with 63% of the capacity from thermal based power plants and 37% of the capacity from Kariba Hydro Project.[xv] Bagasse and small hydro-based IPPs with an installed capacity of 102 MW constitute the remaining capacity and supply around 12 MW to the national grid.[xvi] Zimbabwe is importing 50 MW firm power from Mozambique, around 400 MW non-firm power from South Africa and 150 MW non-firm power from Zambia. Zimbabwe is also exporting around 80 MW of power to Namibia based on a commercial agreement between ZPC and NamPower in October 2014. As of 5th June 2017, the electricity generation statistics indicated that Zimbabwe is generating 1050MW of electricity.[xvii]

Hydro technologies

The NEP (2013) noted that the hydropower potential for Zimbabwe is concentrated along the Zambezi River. There is also potential of many micro-hydro sites especially in the Eastern Highlands and dams throughout the country. For example, there are community-led IPPs that include Himalaya and Chipendeke Micro Grid Power Stations and Pungwe A-C Mini-Hydro Power Station that have been supported by Practical Action and SNV. According to Practical Action:

Nyamwanga (30 kW) micro-hydro scheme, in Mutasa District, is run by the Towe Community Cooperative, and has 3,800 beneficiaries.

Ngarura (20 kW) micro-hydro scheme is in Mutasa District, and is run by the Ngarura Community. It has 5,500 beneficiaries.

Hlabiso (30 kW) micro-hydro scheme in Chimanimani District, is run by the Hlabiso Community, and has benefitted 3,800 beneficiaries.

Chipendeke (25 kW) micro-hydro scheme is in Mutare District, and is run by the Chipendeke Community. It has 4,000 beneficiaries. The scheme has connected 35 households, 5 businesses, a clinic, a school and health centre.

Himalaya (75 kW) micro-hydro scheme is in Mutare District and is run by Himalaya Micro-Hydro Association.[xviii]

However, these community-based schemes are struggling to effectively deliver service, due to issues of governance and a lack of professionalization of the service. The role of private sector is important in these schemes but there are no economies of scale, making it unattractive for the private companies.

Solar

The degree of exploitation of solar energy is limited. Green Rhino Energy is developing a 50MW solar photovoltaic power station in Marondera, 70km east of Harare, in a joint venture with a local developer. Meeco Group commissioned the largest solar power plant in Zimbabwe in 2017 with a total capacity of 216 kilowatt peak (kWp).

Only 1% of the technical potential for solar water heaters is being exploited.[xix] The 2015 Solar Heater Programme was instrumental in the development of standards for solar heaters to protect consumers from buying low quality products from the market.

The acute power outages have resulted in growth of solar market, particularly for household lighting, phone charging, radio, television and water heaters. This has increased access to lighting in both urban and rural areas, as well as in clinics and business centres. Solar market has great potential in remote rural areas characterised by haphazard and dispersed settlement patterns and the mountainous topography that is not likely to be electrified both in the short and long term.[xx]

Biogas technologies

There is a partnership between MEPD, Ministry of Agriculture, REA, HIVOS and SNV in implementing the Zimbabwe Domestic Biogas Programme. This Programme promoted and marketed biogas digesters. Its target is to install 7,400 digesters over 5 years. The targeted districts include Tsholotsho, Insiza and Goromonzi where cattle-rearing is wide-spread and there is potential within larger social institutions. However, there is still low awareness of biogas technologies and also over safety issues. Research noted that a household stand-alone biogas model is not feasible but centralised bio-digester can be adopted especially for peri-urban suburbs that are not connected to main sewer lines in Harare and other urban local authorities in Zimbabwe.[xxi] According to Rural Electrification Agency, the Municipal Sewage Treatment Works have potential to harvest 72,340 Methane (m^3/day).

Biofuels technologies

There is potential for biofuels blending program but its success is dependent on mandatory blending of ethanol and biodiesel into the oil fuels and also that sugarcane plantations are not affected by climate change effects, such as drought. Triangle Limited and Hippo Valley Estates produce about 80% of the sugarcane in Zimbabwe. Triangle limited has an ethanol plant that produces 120,000 l/day and gives an annual yield of 40 million litres of ethanol.[xxii] UNICEF stated that the two estates generate 72.5 MW of electricity for own consumption and could sell 10 MW of this to the national grid.[xxiii] Green Fuels in partnership with Agricultural Rural Development Authority (ARDA) are producing ethanol from sugarcane in Chisumbanje and Middle Sabi areas. Research has noted that Zimbabwe has a target to substitute 10% of the nation's fuel requirements with bio-fuels by 2015.[xxiv] For example, Green Fuels Company has built a bio-diesel processing plant with a capacity to produce 35 million litres per annum.

Wind

Average wind speeds are estimated at 3.5 m/s. The Ministry sees potential in the exploitation of wind speeds for water pumping. The NGO ZERO, a regional environmental initiative, has conducted feasibility studies and financed the production of 1 kW and 4 kW wind turbines for off-grid purposes, as well as providing power to municipal buildings, such as clinics. Areas around Bulawayo and the Eastern Highlands could have potential for larger power generation, with wind speeds ranging from 4-6 m/s.[xxv]

4. Stakeholder review

Private sector participation in renewable energy is still in its infancy. As of 6th June 2017, there were 26 licensed solar companies countrywide.[xxvi] The private sector is organised and registered under the REAZ. Some of the private sector players are mobile telephone companies, such as Econet Wireless and Net-One or battery companies like Chloride Zimbabwe. Private sector companies such as Triangle Limited, Hippo Valley Estates and Green fuels are involved in ethanol production and electricity generation.

International NGOs such as SNV, HIVOS, Practical Action and Oxfam are championing the uptake of renewable energy by supporting various technologies at community and household levels. For example, HIVOS has a Green Society Programme with a focus on renewable energy. This Programme focuses on sustainable food and energy. Together with Practical Action, HIVOS has supported the Sustainable Energy for Rural Communities in Zimbabwe and Malawi.

By the end of 2015, there were 21 licensed IPPs and 3 licensed State-Owned power generation projects. However, the licences for the three power generation projects were cancelled, when the project developers failed to meet terms and conditions of the licences.

A select of group of international NGOs, in collaboration with the relevant government ministries, departments and parastatals, are directly involved in the implementation of renewable energy projects and providing technical expertise and performing monitoring and evaluation. This is because there has not been direct funding to the government and its parastatals for these projects from the donors, such as the EU, GIZ and DFID due to targeted sanctions imposed on Zimbabwe in 2000. The Worldwide Fund for Nature supported the development and consultative process of the National Biofuels Policy. UNDP has supported the Development of the National Climate Change Response Strategy, National Climate Change Policy and Climate Change Stocktaking Exercise and National Adaptation Plan.

DFID has recognised household solar as one of the strategies to build resilience and promote access to renewable energy. It also recognises the role played by private sector in climate change, sustainable development and sustainability. DFID Zimbabwe has campaigned for the establishment of the Renewable Energy Association of Zimbabwe (REAZ) under the ACE Programme. This project assessed the market readiness for renewable energy, especially in relation to household solar and the need for a renewable energy policy framework.

The participation of private sector in renewable energy is still in its infancy. As of 6th June 2017, there were 26 licensed Solar Companies countrywide.[xxvii] Some of the private sector players are mobile telephone companies such as Econet Wireless and Net-One and also battery companies like Chloride Zimbabwe. There is no local manufacturing of solar products. The companies are importing the solar kits mainly from China and are involved in assembling, distribution and to a lesser extent provision of after sales maintenance and back up. They mainly sell solar lamps and rooftop solar heating systems that are 1-2 kW. Private sector companies such as Triangle Limited, Hippo Valley Estates and Green Fuels are involved in ethanol production and electricity generation as IPPs offering off-grid solutions.

5. Market review

There are several challenges being faced by IPPs, including land ownership. The land belongs to the state and is administered by the Rural District Councils (RDCs) in rural areas. The influence of the local RDC and their role in determining ownership reduces the sense of certainty on the part of investors and it is common that there are local disputes over the effect of the run-of-river hydropower generation on irrigation. The RDCs charge fees for processing applications, as well as development levies. The security of land rights is not one that solely affects energy generation and is a broader national concern.

The sole off-taker of the electricity generated by on-grid IPPs is ZETDC. The means that the communities who are off-grid but are located where the electricity is generated neither have access to energy nor benefit from these IPPs. According to the IPPs, the energy tariffs for exporting electricity to the grid are not viable because ZERA did not widely consult them. The electricity tariffs are not cost-reflective, which has a knock-on effect on the viability and credit rating of the utility. All equipment used by IPPs is imported and thus expensive.

The ZETDC takes a long period of time to commission the mini-hydro projects. For example, it takes 6 months and above for the hydro plant to be commissioned resulting in being a disincentive to the investors. Numerous IPPs are licensed but have not begun production because they had failed to raise the financing facilities to progress the pro-

jects to bankability.[xxviii] Only Border Timbers, Duru, Nyamingura, Pungwe A, Pungwe B, Hippo Valley Estates, Triangle Estates, and Green Fuel were operating on a commercial basis. However, Border Timbers never supplied to the grid and their steam generator is not currently functioning.

A number of projects that have received donor support to establish rural mini-grids have struggled in developing sustainable and productive uses. The balance between investment cost and system capacity has resulted in under-sized systems and a lack of a significant anchor load that would provide a reliable and regular income.

There is no local manufacturing of solar products, which are mainly imported from China. Local companies are involved in assembling, distribution and to a lesser extent provision of after-sales maintenance and back up. They mainly sell solar lanterns and rooftop solar water heating systems that are 1-2 kW.

The Zimbabwe Draft Investment Prospectus highlights that Zimbabwe is characterized by significant liquidity deficits and limited access to finance.[xxix] The insecurities relating to the access to foreign currency and the dramatic changes of direction in government policy affect the willingness of investors to take risks. The introduction of the Zimbabwean Bond Note, a surrogate currency under a US$ 200 million export incentive facility guaranteed by the African Export Import Bank, and the decision of Government to enforce its use provides cause for concern.

Regarding the Indigenization and Economic Empowerment Policy that mandates 51% ownership by black Zimbabweans in all foreign investments, the Government of Zimbabwe is modifying and providing exceptions to selected investments such as energy sector investments.[xxx] The investment incentives in Zimbabwe include residence and work permits, unlimited foreign capital inflows and borrowing for working capital on the local market, tax incentives on Build-Operate-Transfer (BOT) or Build-Own-Operate-Transfer (BOOT) project financing, fiscal incentives in agriculture, and establishing special investment zones.[xxxi]

6. Gaps, barriers and opportunities

Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
The legal and policy framework	▪ The legal and policy framework regulating the energy sector is very fragmented, un-coordinated and overlapping resulting in omissions and contradicting allocation of responsibilities ▪ There is an unclear regulatory framework on renewable energy and energy efficiency.	▪ Make use of the constitutional alignment agenda, which provides for the review and amendments of relevant laws through the Draft Renewable Energy Policy and Draft Biofuel Policy. The policies propose a National Energy Management Act. ▪ The Draft Policies propose to deal with overlapping functions and promote co-ordination of policies. ▪ Mainstreaming climate change in renewable energy sector.
Institutional framework	▪ The direct and indirect impact of policies on renewable energy and energy efficiency are not clearly defined and considered. ▪ The process of obtaining licences for larger-scale infrastructure and distributing electricity is cumbersome. The licences and permits required for renewable energy projects are challenging to navigate.	▪ The Draft Policies propose co-ordination that involves MEPD internal coordination, as well Inter-ministerial co-ordination. ▪ Zimbabwe has made some improvements towards the ease of doing business thereby demonstrating readiness for investments.[xxxii]

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Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
IPPs	▪ Land ownership is a difficult issue to address in relation to the place where they identify sites that are viable for mini-hydro projects. ▪ The single off-taker requirement with ZETDC does not support energy access in local areas or allow IPPs to diversify their customer base to off-set risk. ▪ The energy tariffs are not viable because they are not a result of wide consultations with the IPPs. ▪ Importation of all equipment such as power generators. ▪ ZETDC commissioning period of mini hydro projects is lengthy. ▪ The majority of licensed IPPs have not initiated energy production due to lack of appropriate financing.	▪ Lease agreements with Rural Development Committees (RDCs) for land use could be implemented. ▪ Existence of enabling environment for lobby of viable tariffs and reduced timeframe to commission mini hydro projects. ▪ Existence of Community Share Ownership Trusts presents an opportunity for local communities to benefit from renewable energy production such as from mini-grids and micro-hydro projects. However, the management of energy provision is not viable without a private sector partner to provide this. ▪ Regulations to exempt duty of selected products. ▪ Green Energy Fund being created by the NEP and Draft Renewable Energy Policy presents an opportunity to support IPPs.
Standards and quality of products	▪ Lack of reputable suppliers of solar products in particular dampens the market. ▪ The poor quality product standards, after sale services and lack of warranties for the products lead to consumer reluctance to buy the solar products, affecting the uptake of these products.	▪ ZERA registers solar companies and recommends them to the consumers. [xxxiii] ▪ Regulations but are not fully enforced. ▪ There are standards on solar products but these are voluntary. ▪ Availability of technical capacity in general is limited, resulting in poor after-scales maintenance.
Markets	▪ There is a lack of appropriate development finance especially in the context of legal advisory and technical services, feasibility studies and environmental impact assessments. ▪ There is a lack of long-term debt finance at a reasonable cost. In addition, most projects are medium to long term and there is no finance in the market for these projects. ▪ The investment risks are high in Zimbabwe deterring foreign investors. ▪ In relation to mini-grids, there are good technical skills but the lack of system maintenance has not been managed successfully by community trusts. The absence of economies of scale are a deterrent for the private sector to step in.	▪ There are significant gaps along the value chain for energy access and energy efficiency. The lack of access to financing, poor quality products, limited technical capacity, economies of scale, customer purchase power are ▪ Renewable energy solutions are becoming cheaper and more affordable. The ease of deployment of these technologies in rural areas increases their relevance. However, import tariffs can be high. ▪ There are several incentives for investors that include residence and work permits, foreign capital inflows, local borrowing, tax incentives on Build-Operate-Transfer (BOT) or Build-Own-Operate-Transfer (BOOT) project financing, fiscal incentives in agriculture, and establishing special investment zones. [xxxiv] ▪ There are several models being tested for off-grid mini-grids and IPPs. Using the learnings from these models should inform future initiatives. There is reportedly co-generation potential that could be tapped into to distribute locally.

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Issues for furthering energy access for the poor	Challenges and barriers identified in stakeholder discussions and relevant reports	Opportunities
Product/product development	▪ There is currently an energy deficit of 600 kW. The Dema Diesel Plant is supposed to generate 200 kW and the balance is imported from Mozambique and South Africa. The energy demand is based on reduced activity in the industrial sector. The situation is likely to change as the economy improves, which will require additional generation capacity. Zimbabwe has embarked on long-term projects such as Kariba South Extension, construction of Batoka Dam and rehabilitation of Hwange Power Station but this is not likely to meet demand for energy for those who are on-grid. ▪ The community-based models do not attract private sector engagement due to the week business case. ▪ For mini-grids, it was noted that there are no anchor customers in rural areas but potential customers, such as water bottling companies like ZLG Water Ltd.	▪ The Renewable Energy Master Plan was mapped using Geographic Information Systems (GIS). This provides an opportunity to assess where electricity is viable and where it is not that is where there is a need to install a backbone for renewable energy sources. ▪ An Energy Map Study was carried out by Practical Action and REA to map the potential sites for micro hydro projects. This means the national grid will focus on industry. The potential for developing mini-hydro and wind projects is in Manicaland province. The southern part of Zimbabwe such as Kariba, Mashonaland West and Hwange has good pockets of wind speed. ▪ Recognition of the urgent need for access to energy by rural households and communities. ▪ Awareness of off-grid energy solutions. ▪ Commitment by INGOs to adopt business models that bring transformational change at the household and community levels. ▪ Significant anchor customers need to be identified and the business case developed to assess whether the cost of electricity could be reduced by supplying local communities. ▪ Most solar mini grids are installed in dryland parts of Zimbabwe where small grains is grown as part of climate change adaptation and increasing food security at the household levels. For example, the Mataruse Mini-Grid powers the small grains processing mill and packaging. This is an activity that the private sector is not doing. The Mataruse Mini-Grid recognised the potential for economic development using natural crops such as small grains.
Skill development and local manufacturing	▪ The brain drain, especially of electronic engineers, has resulted in very few solar technicians. ▪ Despite the fact that engineers are produced by the University of Zimbabwe and Chinhoyi University of Technology, they do not have expertise in project management, policy analysis, business models and entrepreneurship skills that are necessary to develop rural energy access projects. ▪ Lack of incentives for research and development in renewable energy sector. ▪ Absence of incentives for local manufacturing to be established thereby providing the business case for energy supply.	▪ The Ministry of Science and Technology has mandated various tertiary institutions and the Scientific and Industrial Research and Development Centre (SIRDC) to spearhead research and human resource training in the renewable energy sector. ▪ Various donor agencies are engaged in the sector, such as AECF, DFID and INGOs like HIVOS, Practical Action, SNV, and GIZ. There is potential to develop partnerships to support these organisations in supporting the private sector.

7. Implications for the Theory of Change

The Theory of Change for EEP S&EA does not hold in the case of Zimbabwe at present. The political and economic situation makes doing business extremely challenging. Foreign investors will be deterred by the bureaucratic and erratic decisions of government. There is a decreasing demand for improved energy supply due to the reduction in industrial activity and pressure to reduce fuel imports. However, this may change once the economy makes a comeback. The provision of rural energy access is challenging due to the logistics of building installations and the viability of the business case. The low purchase power and sparsely populated rural areas and unplanned human settlement patterns means the applicability of technologies should be considered in light of the amount of maintenance required. Giving consideration to projects that consider an area or region rather than an individual site may improve the viability of a private company performing the role of a utility.

[i] *National Census Report, 2013*

[ii] *http://gtf.esmap.org/*

[iii] *Irradiation on optimally inclined plane (Wh/m2/day), EU JRC (2015) Photovoltaic Geographical Information System - Interactive Maps <online> http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php?lang=en&map=africa*

[iv] *Zimbabwe Rapid Assessment and Gap Analysis, 2012*

[v] *http://climatepolicydatabase.org/index.php?title=Country:Zimbabwe*

[vi] *Support to SE4ALL Zimbabwe Rapid Assessment and Gap Analysis Draft final, 2012*

[vii] *Support to SE4ALL Country Actions Processes in Zimbabwe Draft Investment Prospectus , 2016*

[viii] *Zimbabwe's Intended Nationally Determined Contribution(INDC) Submitted to the United Nations Framework Convention on Climate Change (UNFCCC), 2015*

[ix] *The National Climate Response Strategy*

[x] *Support to SE4ALL Country Actions Processes in Zimbabwe Draft Investment Prospectus, 2016*

[xi] *ibid*

[xii] *National Census Report, 2013*

[xiii] *http://www.energy.gov.zw/index.php/site-administrator*

[xiv] *Sustainable Energy for Children in Zimbabwe Situational Analysis of the Energy Status of Institutions that Support Children in Five Districts of Zimbabwe, 2015*

[xv] *http://www.zpc.co.zw/*

[xvi] *Zimbabwe's Rapid Assessment and Gap Analysis, 2015*

[xvii] *http://www.zpc.co.zw/*

[xviii] *Sustainable Energy for Children in Zimbabwe Situational Analysis of the Energy Status of Institutions that Support Children in Five Districts of Zimbabwe, 2015*

[xix] *Zhttps://www.hivos.org/sites/default/files/zimbabwe_profile.pdf*

[xx] *JUNEP Collaborating Centre on Energy & Environment, 2002*

[xxi] *A Feasibility Study of Biogas Technology to Solving Peri-urban Sanitation Problems in Developing Countries. A Case for Harare, Zimbabwe, 2013*

[xxii] *www.elsevier.com/locate/rser.*

[xxiii] *Sustainable Energy for Children in Zimbabwe Situational Analysis of the Energy Status of Institutions that Support Children in Five Districts of Zimbabwe, 2015*

[xxiv] *https://www.hivos.org/sites/default/files/zimbabwe_profile.pdf*

[xxv] *https://www.africa-eu-renewables.org/market-information/zimbabwe/renewable-energy-potential/*

[xxvi] *http://www.zera.co.zw/*

[xxxvii] *ibid*

[xxxviii] *ZERA Annual Report, 2015*

[xxix] *The landscape for impact investing in Southern Africa, 2016*

[xxx] *Support to SE4ALL Country Actions Processes in Zimbabwe Draft Investment Prospectus, 2016*

[xxxi] *http://www.investzim.com/index.php?option=com_content&view=article&id=240&Itemid=672*

[xxxii] *Zimbabwe Progress Report on the Ease of Doing Business Reforms, 2017*

[xxxiii] *http://www.zera.co.zw/index.php/rsc*

[xxxiv] *http://www.investzim.com/index.php?option=com_content&view=article&id=240&Itemid=672*

Stakeholder Maps

Renewable Energy Market Landscape Study

Stakeholder mapping – Botswana

NATIONAL GOVERNMENT

- Ministry of Minerals, Energy and Water Resources (NMEWR) / Department of Energy Affairs
- Ministry of Environment, Wildlife and Tourism (MEWT)

POWER PRODUCERS

On Grid (Government)

- Botswana Power Corporation
- Eskom (from 2017 to 2019)

On Grid (IPP)

- Karoo Sustainable Energy (KSE)
- POSCO Energy (Korea) / Marubeni (Japan)
- Shumba Energy

Off Grid (Government)

- BPCLesedi (BPC and Electricité de France)

REGULATORY AUTHORITIES

- Botswana Energy Regulation Authority (BERA) – to be established

GOVERNMENT AGENCIES

- Botswana Energy Regulation Authority (BERA) – to be established

PRIVATE & SOCIAL ENTERPRISES

- BioDiesel Botswana (Pty) Ltd*
- Bostrich Products International*
- Future Fuels Africa Pty*
- Future Fuels Africa (Pty) Ltd*
- Golden Links*
- Kgalagadi Resources Development Company (PTY) LTD*
- The Diamond Workshop*
- Tswalelo Pty Ltd*
- SolaHart
- Solamatics Botswana (manufactures SWH and PV)
- Solar International Botswana
- Specialized Solar Systems Botswana
- Videre Botswana*

PRIVATE SECTOR ASSOCIATIONS

- Botswana Investment and Trade Centre
- Solar Industry Association of Botswana (SIAB)

FINANCIAL INSTITUTIONS

- Bank Gaborone
- Commercial Bank of China (ICBC) (invested for BPC)
- Stanbic Bank Botswana

NGO'S & CIVIL SOCIETY

Botswana Community Based Organisations Network

COOPERATING PARTNERS

AfDB
DANIDA
EIB
Finland
GEF
JICA
SIDA
UNDP
UNIDO
World Bank

RESEARCH INSTITUTIONS

Botswana Technology Centre (BOTEC)*
Rural Industries Innovation Centre (RIIC)
University of Botswana

Stakeholder mapping – Burundi

NATIONAL GOVERNMENT

- Ministry of Energy and Mines
- Ministry of Environment
- Ministry of Trade, Industry and Tourism

POWER PRODUCERS

On Grid (Government)

- Burundian Agency for Rural Electrification (ABER)
- L'Energie des Pays des Grands Lacs (EGL)
- Régie nationale de distribution de l'eau et de l'électricité (REGIDESO)
- SNL

On Grid (IPP)

- CRD Holding AB
- Gigawatt Global

Off Grid (Government)

- ABER

Off Grid (Private Sector)

- Gigawatt Global
- SESMABurundi

REGULATORY AUTHORITIES

- AREEM (Electricity, Water and Mining Regulatory Agency)
- EREA (Energy Regulator for East Africa)

GOVERNMENT AGENCIES

- ABER
- Burundi Centre for Alternative Energy Studies (CBEA)
- Directorate General of Energy
- Office National de la Tourbe (ONATOUR)

PRIVATE & SOCIAL ENTERPRISES

- Bioenergy Burundi*
- Gigawatt Global*
- Gigawatt Global Cooperatief*
- Ecosur Afrique*
- ITCO S.A.*
- Nguvu Utilities Burundi
- Solidarite pour un Development Integre Sprl (SDI)*
- Songa Energy Burundi*
- Trama Tecnoambiental SL (TTA)*

PRIVATE SECTOR ASSOCIATIONS

- Burundi Renewable Energy Association (BUREA)
- SESMABurundi

FINANCIAL INSTITUTIONS

- BANCOBU
- Banque de Crédit de Bujumbura (BCB)
- Banque de la République du Burundi (BRB)
- BBCI
- CRDB
- Kenya Commercial Bank (KCB)
- L'Interbank Burundi (IBB)
- La Banque de Gestion et de Financement (BGF)

NGO'S & CIVIL SOCIETY

Institute for University Cooperation*	FVS	The R20 – Regions of Climate Action*

COOPERATING PARTNERS

AFD	Government of China	ONUDI
AFDB	Government of INDIA	UNDP
AIEA	JICA	UNICEF
EU	NELSAP	WB
GIZ	Netherlands	

Stakeholder mapping – Kenya

NATIONAL GOVERNMENT

- Ministry of Energy and Petroleum
- Ministry of Environment and Mineral Resources
- 42 county governments

POWER PRODUCERS

On Grid (Government)

- Geothermal Development Company
- Kenya Electricity Generating Company (KenGen)
- Kenya Electricity Transmission Communication (KETRACO)

On Grid (IPP)

- Agil
- Bidco
- Cummins
- Gulf Power
- Iberafrica Power (Gas Natural Fenosa)
- Imenti
- James Finlay
- Kinangop Wind Power
- Kipeto Energy
- Kleen Energy
- Lake Turkana Wind Power
- Mt Kenya Power
- Mumias Sugar
- Orpower 22
- Orpower 4
- QPEA Menengai
- Rabai Power
- Regen Terem
- Thika Power
- Tindinyo
- Triumph Power Generating Company
- Tsavo Power Company

Off Grid (Government)

- Kenya Electricity Generating Company (KenGen)
- Kenya Petroleum Refinery (KPRL)

Off Grid (Private Sector)

- Cerntech
- Imenti
- James Finlay
- Oserian
- Pan Paper
- Powerhive
- Sotik Highlands
- Sotik Tea
- Unilever

REGULATORY AUTHORITIES

- Energy Regulation Commission

GOVERNMENT AGENCIES

- Kenya Investment Authority
- Kenya Nuclear Electricity Board
- National Environment Management Authority
- Rural Electrification Authority

PRIVATE & SOCIAL ENTERPRISES

- Absolute Energy S.r.l.*
- Aeolus Kenya
- African Solar Designs*
- Afrisol
- A.M. Ventures, Ltd.*
- Angaza Kenya
- Azuri
- Barefoot Power*
- Bboxx
- BP Solar
- Camco Advisory Services Kenya Ltd*
- Chloride Exide
- Crystal Energy Solutions
- d.light*
- EEDadvisory
- Eenovators
- Electrawinds NV*
- Electric Link
- Elicio*
- Energy4Impact
- Enterprise Project Ventures Limited (!nspiraFarms)*
- Envirofit International Inc*
- Flexi Biogas
- Solutions
- Gigawatt Global Cooperatief*
- Global Supply Solutions Ltd*

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PRIVATE & SOCIAL ENTERPRISES

Go Solar
Green Energy Africa
Greenlight Planet
Greenlink
Intercross Agencies
Kenya
iSmart Kenya*
Kamfor*
Kenya Solar Energy (Kensen)
Kleen Energy Limited*
Laikipia Nature Conservancy Ltd (Nairobi)*
Lean Energy Solutions Ltd (Nyando Muhoroni)*
Lean Energy Solutions Ltd*
Little Sun
MKOPA
Mibawa Suppliers
Mobisol
NewLight Africa Limited*
Orb Energy Private Limited*
Power Hive*
PowerGen
Pöyry Management Consulting Oy*
Raj Ushanga House Limited*
Renewable Energy Ventures (K) Ltd.*
Renewables Hub Africa
RIWIK Wind Energy B.V.*
Rokim Group Limited*
Sanergy Limited*
SASINI Ltd.*
S3C Kenya
SAFI International
Schneider Electric
SimGas Tanzania Ltd.*
Skynotch Energy
Solagen Power
Solar Works
Solataa
Sollatek Electronics Kenya Ltd.*
Startle Limited*
Stenrich Cycles S.A.R.L. / Off-grid energy (East Africa) company limited joint venture*
SunnyMoney
Sun Transfer
Takamoto Biogas*
Thrive Energy Technologies
Ubbink
Viability Africa
Xago Africa

PRIVATE SECTOR ASSOCIATIONS

Clean Cookstoves Association of Kenya
East African Climate Innovation Network
Kenya Association of Manufacturers
Kenya Chamber of Commerce and Industry
Kenya Private Sector Alliance

FINANCIAL INSTITUTIONS

African Local Currency Bond Fund
ARC Finance
Ariya Capital
Bank of Africa
Berkely Energy
Bettervest
Blue Haven Initiative
Central Bank of Kenya
Commercial Bank of Africa
Development Bank of Kenya
Diamond Trust Bank
Energy Access Ventures
Frontier Investment Management
Gates Foundation
Kenergy Renewables
Kenya Association of Manufacturers
KIVA
Lendahand
Persistent Energy Capital
Rafiki
Renewable Energy Ventures
Rural Electrification Fund
Shell Foundation
SunFunder
Sustainable Energy Fund for Africa
TRINE
Virunga Power
Willow Impact Investors

NGO'S & CIVIL SOCIETY

AFREPREN
African Christians Organization
BaseCamp Foundation Kenya (Narok County)*
BaseCamp Foundation Kenya (Nairobi)*
Dupoto EMaa
Environment Liaison Centre International (ELCI)*
Food for the Hungry*
Green Africa Foundation
Heinrich Boll Foundation
Help Self Help Centre (Mount Kenya Region)*
Help Self Help Centre (Naromoru)*
Kenya Climate Innovation Center

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NGO'S & CIVIL SOCIETY

Kenya Renewable Energy Association
LivelyHoods Kenya*
Practical Action*
Practical Action Eastern Africa Regional Office*
Self Help Africa*
SNV Netherlands Development Organization*
Sustainable Agriculture Community Development Programme- SACDEP Kenya*
World Vision Australia*

COOPERATING PARTNERS

AFD
AfDB
CDC (UK DFI)
Danida
DFID
EU
European Investment Bank
EnDev
FDA
GIZ
Global Affairs Canada
IFC
JICA
KfW
Power Africa
SIDA
UNDP
UNEP
UNIDO
USAID World Bank

RESEARCH INSTITUTIONS

African Centre for Technology Studies
Kenya Forest Research Institute*
Kenya Industrial Research and Development Institute*
Kenya Institute for Public Policy Research and Analysis
Strathmore University Energy Research Centre

Stakeholder mapping – Lesotho

NATIONAL GOVERNMENT

- Ministry of Natural Resources (MNR)
- Department of Energy (DOE)
- Ministry of Forestry and Land Reclamation

POWER PRODUCERS

On Grid (Government)

- ESKOM (South Africa)
- Lesotho Electricity Company (LEC)
- Lesotho Highlands Development Authority (LHDA)

On Grid (IPP)

- PowerNET Developments (Pty) Ltd

Off Grid (Government)

- Lesotho Electricity Company (LEC)

REGULATORY AUTHORITIES

- Lesotho Electricity Authority (LEA)

GOVERNMENT AGENCIES

- Appropriate Technology Services
- Lesotho Electricity Company (LEC)
- Lesotho Electricity Generation Authority (LEGA)
- Lesotho Electrification Unit (LEU)
- National Rural Electrification Fund (NREF)
- Petroleum Fund (PF)

PRIVATE & SOCIAL ENTERPRISES

- African Clean Energy (ACE)
- Atmosfair (EE cookstoves project) funded by DHL
- Mos-Sun Clean Energy Technnologies(PTY) LTD*
- NETGroup
- Philips
- Solar Turbine Group (STG)

PRIVATE SECTOR ASSOCIATIONS

- Lesotho Chamber of Commerce
- Lesotho Electricity Contractors Association (LECA)
- Lesotho Solar Energy Society (LESES)

FINANCIAL INSTITUTIONS

- Central Bank of Lesotho
- First Postal Bank
- FNB
- Nedbank
- Standard Bank

NGO'S & CIVIL SOCIETY

- Lesotho Council of Non-Governmental Organisations

** EEP grant holder*

COOPERATING PARTNERS

- AfDB
- GEF
- Government of China
- Government of Germany
- Government of Japan
- Government of Norway
- Government of Sweden
- IFC
- UNDP
- World Bank

RESEARCH INSTITUTIONS

- Bethel Business and Community Development Center (BBCDC)
- Energy Research Center (ERC), National University of Lesotho
- Lerotholi Polytechnic
- Technologies for Economic Development (TED)*
- Transformation Resource Centre (TRC)

Stakeholder mapping – Malawi

NATIONAL GOVERNMENT

- Ministry of Natural Resources, Energy and Environment
- Ministry of Gender, Children Disability and Social Welfare

POWER PRODUCERS

On Grid (Government)

- Electricity Generation Company
- Electricity Supply Corporation of Malawi (ESCOM)

On Grid (IPP)

All of the following have so far sent Expressions of Interest only

- Airon Green Energy Turbines
- Atlas Energy Malawi Ltd
- Bua Hydro Power Ltd
- CDC Group UK
- Central African Solar Ltd
- CTI Africa LLC
- Grow Mine Africa (PTY) Ltd
- Habib Energy Ltd
- HE PowerMalawi Ltd
- Intra Energy Company Ltd
- Maple Ltd
- Sinohydro

Off Grid (Government)

All currently nonfunctioning

- Chigunda Solar Village
- Chitawo Solar Village
- Elunyeni Solar Village
- Kadambwe Solar Village
- Kadzuwa Solar Village
- Mdyaka Solar Village

(all nonfunctioning)

Off Grid (Private Sector)

- Mulanje Energy Generation Agency (MEGA)

REGULATORY AUTHORITIES

- Malawi Bureau of Standards
- Malawi Energy Regulatory Authority (MERA)

GOVERNMENT AGENCIES

- Department of Energy
- Department of Environmental Affairs and Climate Change
- Department of Forestry

PRIVATE & SOCIAL ENTERPRISES

- Mulanje Energy Generation Agency (MEGA)
- United Purpose

PRIVATE SECTOR ASSOCIATIONS

- Cooperation Network for Renewable Energy in Malawi (CONFREMA)
- Mbaula Network
- Renewable Energy Association of Malawi (REAMA)

FINANCIAL INSTITUTIONS

- EcoBank Ltd
- First Merchant Bank Ltd
- GEF
- KfW
- National Bank of Malawi Ltd
- Standard Bank (MW) Ltd
- World Bank

NGO'S & CIVIL SOCIETY

- Community Energy Malawi
- Concern Universal/ United Purpose
- EnDev
- MAEVE
- Mulanje Renewable Energy Association
- Practical Action
- Renew'N'able Malawi (RENAMA)
- Sunny Money

COOPERATING PARTNERS

- BIF
- DFID
- GIZ
- Irish Aid
- MCAMalawi
- Scottish Government
- UNDP
- USAID

RESEARCH INSTITUTIONS

- University of Malawi Polytechnic
- University of Mzuzu
- Malawi University of Science and Technology

Stakeholder mapping – Mozambique

NATIONAL GOVERNMENT

Ministry of Mineral Resources & Energy

POWER PRODUCERS

On Grid (Government)	On Grid (IPP)	Off Grid (Government / Private Sector)
Hidroeléctrica de Cahora Bassa (HCB)	Neoen	Funae
Electricidade de Moçambique	Scatec	
MOTRACO	INFRACO	
	Aggreko	

REGULATORY AUTHORITIES

Energy Regulatory Authority (ARENE)

GOVERNMENT AGENCIES

Fundo de Energia (FUNAE)*

Directorate for New and Renewable Energy

National Directorate for Energy
Conselho Nacional de Electricidade (CNELEC)

PRIVATE & SOCIAL ENTERPRISES

Amandla
Ann Kämpe Consulting AB
Bloomberg New Energy Finance
Bop Shop
Dalberg
Ekhaya
Elita Moçambique LDA
Eltel Networks Corporation*
Energia Solar Sustentavel Lda
Energy Sellers Initiative
EON Consulting (Pty) Ltd*
EREL
FUNAE solar PV Factory
General Distributors
Gesto Energia
GM Project
Greenlight
Inovantis
Intertec
LCPower AFRICA – solucoes de energia Lda
Liser Nova Moçambique
Logos
Mkopa
Mocitaly lda / Heliopolis
Modil
Mozambique Carbon Intiatives LDA (MozCarbon)*
Multi-Consult
Panasonic
Progen Mocambique Lda
Prosadc Lda*
RVE.SOL
Self Energy
Siemens lda
Sociedade Algodoeira do Niassa JFS, SA (SAN-JFS)*
Solarkom
Solarworks*
Solmoz Tecnologia e Solucoes lda
SOLTEC
SOTEL Lda
SunBox
Swiss Solar
Titimane Mini Grid
Total
Transaly, Lda
Verde Azul

FINANCIAL INSTITUTIONS

- Banco de Oportunidade
- Banco Unico
- BCI
- BTM
- FSD Moz
- Letshego
- Moza Banco
- RECP
- SunFunder

NGO'S & CIVIL SOCIETY

- ADPP Mozambique (Cabo Delgado Province)*
- ADPP Mozambique (Beira, Sofala, Manica, Nacala, Nampula))*
- Fondazione ACRA*
- KULIMA – Organization for Integrated Socio-Economic Development*

COOPERATING PARTNERS

- AFDB
- Belgian Technical Cooperation
- DFID
- EnDev-Mozambique
- Energy Sector Working Group
- Norwegian Ministry of Foreign Affairs
- SNV
- World Bank

RESEARCH INSTITUTIONS

- Technical University Mozambique
- Instituto de Ciencias e Tecnologia/ One World University*

Stakeholder mapping – Namibia

NATIONAL GOVERNMENT

- Ministry of Mines and Energy
- Ministry of Finance
- Ministry of Environment and Tourism
- The Ministry of Trade and Industry (MTI)

POWER PRODUCERS

On Grid (Government)	On Grid (IPP)	Off Grid (Government / Private Sector)
CENO RED	Omburu Solar P.V	Gam Solar P.V Mini grid
City of Windhoek		Tsumkwe Mini Grid
ERONGO RED		
NAMPOWER		
NORED		

REGULATORY AUTHORITIES

- Electricity Control Board

GOVERNMENT AGENCIES

- Namibia Investment Centre
- National Technical Committee on Renewable Energy (NTCRE)

PRIVATE & SOCIAL ENTERPRISES

- Basil Read Energy (Pty) Ltd*
- Consulting Services Africa*
- Consulting Services Africa (CSA)*
- Natura Energy (Pty) Ltd*
- O&L Namibia*
- Renen Energy Solutions (PTY) Ltd*
- List of government approved suppliers: http://www.mme.gov.na/energy/pdf/ListofSolarServiceProviders.pdf

PRIVATE SECTOR ASSOCIATIONS

- Association of Consultant Engineers of Namibia
- Namibia Chamber of Commerce and Industry
- Namibia Manufacturers Association
- O&L Energy
- Renewable Energy Industry Association of Namibia (REIAoN)

FINANCIAL INSTITUTIONS

- Bank Windhoek
- Development Bank of Namibia
- First National Bank
- Kongeland
- RMB Bank
- SME Bank
- Standard Bank

NGO'S & CIVIL SOCIETY

Citizens Trust
Desert Research Foundation of Namibia (DRFN)
Elephant Energy Trust ("EE")*
Elephant Energy Trust ("EET")*

COOPERATING PARTNERS

AFD
GIZ
KfW
UNDP
USAID Power Africa
World Bank Group

RESEARCH INSTITUTIONS

Namibia Energy Institute
Namibia University of Science and Technology
Polytechnic of Namibia (Windhoek)*
Polytechnic of Namibia (Sossusvlei, Kalahariplaas, Otjimanangombe, Shinyungwe, Leyte, Steinhausen, Ondimbwa and Katwiti)*
Polytechnic Of Namibia-REEEI*
University of Namibia*
VTT Technical Research Centre of Finland*

Stakeholder mapping – Rwanda

NATIONAL GOVERNMENT

- Ministry of Infrastructure
- Ministry of Local Government
- Ministry of Natural Resources

POWER PRODUCERS

On Grid (Government)

- Energy Utility Company Limited (Subsidiary of REG)
- Rwanda Energy Group

On Grid (IPP)

- Africa Energy Services
- Amahoro Energy
- Concessions for: Nyundo, Rwaza-Muko, Rubagabaga, Nyirantaruko, Muhembe and Nyirahindwe I&II.
- Contour Global Kivuwatt
- Energie Nyaruguru, (ENNy)
- Gigawatt Global
- Goldsol/Spain – production
- Hakan AS, Quantum Power, and Themis
- Kibuye Power
- Rwanda Mountain Tea
- Smart Energy Solutions

Off Grid (Government)

- Rwanda Energy Group
- EDCL (Subsidiary of REG)

Off Grid (Private Sector)

- BBOXX
- Electricom Ltd
- ERF
- Great Lakes Energy Ltd
- Green Land Agribusiness Services
- Ignite Power ltd
- Innotech, Consulting Ltd
- Intertech Ltd
- Munyax ECO
- Peat Energy Company

REGULATORY AUTHORITIES

- Energy, Water and Sanitation Ltd
- Rwanda Bureau of Standards
- Rwanda Development Board
- Rwanda Environment Management Authority
- Rwanda Governance Board
- Rwanda Revenue Authority
- Rwanda Utilities Regulatory Agency

GOVERNMENT AGENCIES

- Rwanda Association of Local Government Authorities

PRIVATE & SOCIAL ENTERPRISES

- Africa Energy Service Group
- Afritech Energy*
- Barefoot Power
- BBOXX
- CEEP Hydro Ltd*
- Construction & Renewable Energy Technologies
- DASSY Enterprise Ltd*
- DPA Commodities Supply & Services
- Energy4Impact
- Gigawatt Global Coöperatief U.A.*
- GLE
- Green Waste Energy Development Africa (GWEDA)*
- Inclusive Business and Consultancy
- Inyenyeri*
- Little Sun
- MeshPower Limited*
- Mobisol
- Munyax Eco
- Neseltec LTD (Kirehe district, Eastern Province)*
- Neseltec LTD (Gasabo District, Kigali)*
- Ngali Holdings
- Stop Rwanda
- Nuru Energy East Africa*
- Shemesh Renewable Energy*
- Uages LLC*

PRIVATE SECTOR ASSOCIATIONS

- Energy Private Developers
- Rwanda Renewable Energy Association

FINANCIAL INSTITUTIONS

- "Unguka" Investment Group Ltd
- Banque Populaire du Rwanda
- Development Bank of Rwanda
- FONERWA
- I&M Bank
- Rwanda Hope Foundation
- Umurenge SACCOs

NGO'S & CIVIL SOCIETY

- "Ubumwe" cooperative
- AJDR Cooperative
- Care international
- Delagua Ltd
- Millennium Village Project
- Practical Action*
- Prison Fellowship
- Red Cross
- SNV
- UN Women
- World Vision Rwanda*

COOPERATING PARTNERS

- AfDB
- BTC
- Dutch Government
- EnDev
- EU
- German Government
- GIZ
- JICA
- KfW
- Power Africa
- UNDP
- World Bank

RESEARCH INSTITUTIONS

- Integrated Polytechnic Regional Centers
- Tumba College of Technology
- University of Rwanda / School of Science and Technology

Stakeholder mapping – Seychelles

NATIONAL GOVERNMENT

- Ministry of Energy, Natural Resources and Transport
- Department of Energy and Transport
- Energy Education and Communication working group
- Ministry of Environment, Energy and Climate Change (MEECC)
- Ministry of Finance
- Ministry of National Development

POWER PRODUCERS

On Grid (Government)

- The Public Utility Company (PUC)

Off Grid (Private Sector)

- Indian Ocean Tuna Company
- The Organic Rankine Cycle

REGULATORY AUTHORITIES

- National Economic Council (NEC)
- Seychelles Bureau of Standards (SBS)
- Seychelles Energy Commission (SEC)
- Seychelles Investment Board (SIB)
- Seychelles Qualification Authority (SQA)

GOVERNMENT AGENCIES

- Climate and Environmental Services Division (CESD)
- Department of Industry
- Electricity Transmission & Distribution Section
- Energy Affairs Bureau
- Meteorological Service
- National Bureau of Statistics (NBS)
- Public Enterprise Management Division (PEMD)
- Seychelles Agricultural Agency
- Seychelles Fisheries Authorities
- Seychelles Petroleum Company
- Seychelles Sustainable Tourism Foundation
- Seychelles Tourism Board (STB)
- Small Enterprise Promotion Agency (SEnPA)

PRIVATE & SOCIAL ENTERPRISES

- AEE Solar
- BenQ Solar
- ET Solar Group
- Faktor X New Energy
- Innovation Group (IG)
- NextGen Solaire (Pty) Ltd.*
- Seychelles Island Development Company (IDC)
- Ocean Thermal Energy Conversion (OTEC)
- PV Supplier Company
- Sen & Sun Technology
- Seychelles Island Development (SID)
- Seychelles Islands Foundation
- Seychelles Petroleum Company (SEPEC)
- Solar Energy Solutions
- SUEZ Energy
- Sustainability for Seychelles
- UAEbased energy company Masdar
- Vetiver Tech

PRIVATE SECTOR ASSOCIATIONS

- Private Sector Partners (PV) System Operators
- Seychelles Chamber of Commerce
- Seychelles Chamber of Industry (SCCI)
- Seychelles Fishing Authority

FINANCIAL INSTITUTIONS

- Abu Dhabi Development Bank
- Abu Dhabi Development Fund
- Africa Growing Together Fund (AGTF)
- African Development Bank (ADB)
- Central Bank of Seychelles (CBS)
- ClimDev Africa Special Fund
- European Investment Bank (EIB)
- Fund for Africa Private Sector Assistance (FAPA)
- Infrastructure Fund
- International Fund for Agricultural Development (IFAD)
- Kuwaiti Fund
- Multilateral Investment Guarantee Agency (MIGA)
- Nouvobanq of Commercial of Bank
- OPEC OPID
- Saudi Fund
- SEFA Grant
- Seychelles Development Bank (SDB)
- The Bureau of Ocean Energy Management, Regulation & Enforcement (BOEMRE) of the U.S. Department of Interior

NGO'S & CIVIL SOCIETY

- Citizen Engagement Platform of Seychelles (CEPs)
- Environmental NGO Community

COOPERATING PARTNERS

- Agricultural Development (IFAD)
- China
- European Union (EU)
- GEF Resource Efficiency Seychelles
- German Energy Agency (DENA)
- Government of Denmark
- International Atomic Energy Agency (IAEA)
- International Finance Corporation
- International Finance Corporation
- International Renewable Energy Agency
- Seychelles Islands Foundation (SIF)
- Taiwan
- UNDP
- UNDP/GEF Project Coordination Unit
- World Bank

RESEARCH INSTITUTIONS

- Beijer Institute
- Biomass Technology Group
- Blue Economy Research Institute
- International School Seychelles
- National Institute of Science, Technology and Innovation (NISTI)
- Seychelles Institute of Technology (SIT)
- The Institute for Environmental Analytics (IEA)
- Twente University
- University of Seychelles

Stakeholder mapping – South Africa

NATIONAL GOVERNMENT

- Department of Energy, Directorate: Clean Energy
- Department of Environmental Affairs
- Department of Science and Technology
- Department of Trade and Industry

POWER PRODUCERS

On Grid (Government)

- Eskom

On Grid (IPP)

- 102 preferred bidders
- 6,376 MW in total
- 51 operational as at Sept 2016

Off Grid (Private Sector)

- Cronimet Chrome Mining

DISTRIBUTORS

- 164 local municipalities
- 1 district municipality
- 8 metropolitan municipalities

REGULATORY AUTHORITIES

- National Energy Regulator of South Africa (NERSA)
- Renewable Energy Purchasing Agency (REPA)
- South African Bureau of Standards (SABS)

GOVERNMENT AGENCIES

- National Nuclear Regulator
- Nuclear Energy Corporation of South Africa (NECSA)
- Petroleum Agency of South Africa (PASA)
- South Africa Local Government Association (SALGA)
- South African National Energy Development Institute
- South African Renewable Energy Council
- The Energy Development Corporation (EDC)

PRIVATE & SOCIAL ENTERPRISES

- Bio 2 Watt (Pty) Ltd*
- Ecovate (PTY) LTD*
- Element Consulting Engineers (Pty) Ltd*
- Genergy
- Juwi Renewable Energies
- Kestrel Renewable Energy
- Kingo Energy
- SegenSolar
- Specialised solar systems
- Sunengen Limited*
- Tbv Solar
- The Waste Transformers*

Manufacturers of solar thermal, PV and ovens

- Adequate Energy
- AEG,
- All Power Trust
- Clean Heat Energy Saving Solutions
- Divwatt (Pty) Limited
- Dream Quest Enterprises
- EzyLight
- F S Consulting cc
- Gefran,
- Genergy
- Genersys South Africa
- ITS Solar Water Heating Specialists
- J & J Electronics
- Jinko,
- Kwikot (Pty) Ltd
- Led Lighting Specialist
- Microcare
- MLT Drives
- MLTDrives,
- Olympus Flower
- Renewable Energy Engineers
- Sinetech cc
- SMA,

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PRIVATE & SOCIAL ENTERPRISES

Solar Geyser Suppliers
Solar Harvest Solar Specifics cc
Solar Ray
SolarDirect,
Solardome SA cc
Solco Solar
Solek
Sun Oven SA
SunPower,
Sustainable Products Pst
ZnShine,
Zonhan wind and solar power products

Manufacturers of wind components (blades & towers)

Ctturbine
DCD and Gestamp
Kestrel Wind Turbines
PalmTree Power
Southwest Windpower
Vestas Wind Systems
Zonhan wind and solar power products

Manufacturer of microhydro turbines

ZM Pumps Zonhan wind and solar power products

PRIVATE SECTOR ASSOCIATIONS

Business Unity South Africa
Industry and mining specific associations
National Business Initiative
South Africa Independent Power Producers' Association
South African Wind Energy Association
Southern African Alternative Energy Association (SAAEA)

FINANCIAL INSTITUTIONS

ABSA
Deutsche Bank
Development Bank of South Africa
IDC
Investec
Nedbank
Rand Merchant Bank
South African Green Fund
Standard Bank

NGO'S & CIVIL SOCIETY

Elemental Africa*
Mpumalanga Canegrowers Association (MpCGA)*
Network for Business Sustainability
South African Renewable Energy Council (SAREC)
Sustainable Energy Africa (SEA)

COOPERATING PARTNERS

AFD
Danish Energy Agency
DFID
EU
GIZ
IDC
IFC
JICA
UNDP National Cleaner Production Centre (NCPC)

RESEARCH INSTITUTIONS

Centre for Renewable and Sustainable Energy Studies
Energy Research Centre (ERC)
The Council for Scientific and Industrial
Research (CSIR)
University of South Africa (UNISA)

Stakeholder mapping – Swaziland

NATIONAL GOVERNMENT

- Ministry of Natural Resources and Energy
- Ministry of Economic Development

POWER PRODUCERS

On Grid (Government)	On Grid (IPP)	Off Grid (Private Sector)
Swaziland Electricity Company	Montigny (future)	Royal Swaziland Sugar Corporation
	Royal Swaziland Sugar Corporation	
	Ubombo Sugar Limited	

REGULATORY AUTHORITIES

- Swaziland Energy Regulatory Authority

GOVERNMENT AGENCIES

- Department of Energy

PRIVATE & SOCIAL ENTERPRISES

- Galp Energia
- Montigny
- Swaziland Consulting
- Wundersight Group

PRIVATE SECTOR ASSOCIATIONS

- Federation of Swaziland Employers and Chamber of Commerce

FINANCIAL INSTITUTIONS

- First National Bank
- Old Mutual Bank

NGO'S & CIVIL SOCIETY

- Bulembu Foundation*
- Renewable Energy Association of Swaziland*
- TechnoServe*

COOPERATING PARTNERS

AfDB
EU
GIZ
Government of Taiwan
USAid

RESEARCH INSTITUTIONS

University of Swaziland

Stakeholder mapping – Tanzania

NATIONAL GOVERNMENT

- Ministry of Energy and Minerals (MEM)
- Ministry of Natural Resources and Tourism (MNRT)
- Ministry of Community Development, Gender and Children (MCDWC)

POWER PRODUCERS

On Grid (Government)

- TANESCO

On Grid (IPP)

- Independent Power Tanzania (Diesel)
- Songas
- Symbion
- Tanwat
- TPC
- Wind East Africa

Off Grid (Government)

- TANESCO

Off Grid (Private Sector)

- Camco
- Mufindi Tea Company
- SESCOM
- TADEDO

REGULATORY AUTHORITIES

- Energy and Water Regulatory Authority (EWURA)
- National Environment Management Council (NEMC)

GOVERNMENT AGENCIES

- Mini-Grids Information Portal
- Rural Energy Agency
- Tanzania Investment Centre
- Tanzania Commission for Science and Technology

PRIVATE & SOCIAL ENTERPRISES

- Alternative Energy Tanzania*
- ARTI Energy Baraka Solar Specialists
- CAMATEC
- Continental Energy Corporation*
- Davis & Shirtliff
- Devergy*
- Devergy East Africa Ltd.*
- DT Power GmbH*
- Energy Plus
- Energy4Impact
- Ensol*
- Ensol Tanzania Pty*
- E.ON Off Grid Solutions*
- GCS Tanzania Limited*
- Green Resource AS*
- Green Solutions Limited*
- Helios Foundation for Sustainable Development*
- Hot Africa
- Husk Power Systems*
- Jamii Power Limited*
- Kakute Projects
- M-Kopa
- Mobisol
- Mofajus Investment Ltd. (MIL)*
- Off.Grid:Electric*
- Redavia*
- Redavia GmbH*
- RK-hallit Ltd*
- SESCOM
- SimGas
- Solar Grid
- Solar Sister
- Solea AG*
- Sollatek Tanzania (registered as Power Control Ltd)*
- Space Engineering Company*
- Sustainable Energy Enterprise Company (SEECO)
- Sustainable Energy Solutions*
- Windlab Developments South Africa*

PRIVATE SECTOR ASSOCIATIONS

Tanzania Engineering a & Manufacturing Design Organisation

(TEMDO) Tanzania Private Sector Foundation

FINANCIAL INSTITUTIONS

Access Bank

CBA Bank

CRDB Bank

Equity Bank Tanzania

Financial Sector Deepening Trust

Finca

GroFin

Letshego Bank

National Bank of Commerce

Rural Energy Fund

Small Industries Development Organisation (SIDO)

SunFunder

TIB Development Bank

NGO'S & CIVIL SOCIETY

ACRA - Cooperazione Rurale in Africa e America Latina*

Anglican Church of Tanzania, Diocese of Ruaha*

APPROPRIATE RURAL TECHNOLOGY INSTITUTE- TANZANIA (ARTI-TZ) (Bagamoyo)*

APPROPRIATE RURAL TECHNOLOGY INSTITUTE- TANZANIA (ARTI-TZ) (Dar Es Salaam))*

BEST-Dialogue

CEFA Onlus*

Deutsch-Tansanische Partnerschaft

Fondazione ACRA-CCS*

Istituto Oikos*

North South Initiative

SNV

Tanzania National

Gender & Sustainable Energy Network (NGSEN)

Global Village Energy Partnership (GVEP) International (Energy 4 Impact)*

ONGAWA - Engineering for Human Development*

Tanzania Renewable Energy Association (TAREA)

Tanzania Traditional Energy Development Organization (TADEDO) (Kilimanjaro, Tanga)*

Tanzania Traditional Energy Development Organization (TADEDO) (Mwanga, Hai, Rombo, Bagamoyo, Muheza and Handeni.)*

The Royal Norwegian Society for Development*

Urbis Foundation

COOPERATING PARTNERS

Development Partners Group

DFID

EDCF Korea

EU

Formin

Norad

Power Africa

Sida

UNDP

World Bank

RESEARCH INSTITUTIONS

Centre for Agricultural Mechanization and Rural Technology (CAMARTEC)

Innovative Technology and Energy Centre (ITEC) – future

Tanzania Industrial Research and Development Organization (TIRDO)

University of Dar es Salaam

Stakeholder mapping – Uganda

NATIONAL GOVERNMENT

- Ministry of Energy and Mineral Development
- Ministry of Finance, Planning and Economic Development
- Ministry of Local Government
- Ministry of Water and Environment

POWER PRODUCERS

On Grid (Government)

- Uganda Electricity Generation Co. Ltd.
- West Nile Rural Electrification Company

On Grid (IPP)

- Africa EMS Mpanga
- Bujagali Energy Limited (BEL)
- Bundibugyo Energy Cooperative Society
- Butama Hydro Electricity Company Ltd
- C&G Andijes Uganda Ltd
- Eco clean Power
- Eco-Power Uganda
- Electro-Maxx
- Elgon Hydro Siti (Pvt) Ltd
- Eskom Uganda
- Flow Power
- Greenewus Energy Africa Ltd
- Hydromax (Nkusi) Limited
- Jacobsen Electro
- Keere Power Company Limited
- LubiliaKawembe
- Muvumbe Hydro (U) Ltd
- Ngoromwo Small Hydro Ltd
- PA Technical Services
- Pader and Abim Community Multi Service Cooperative Society
- Rwimi EP Company
- South Asia Energy Management Systems LLC
- UEGCL Maziba
- WENRECO/ MEMD

Off Grid (Private Sector)

- Absolute Energy
- Chapter Six Ltd
- Fenix International
- Kakira Sugar
- Village Energy

REGULATORY AUTHORITIES

- Electricity Regulatory Authority
- National Environment Management Authority
- Uganda Invest Authority

GOVERNMENT AGENCIES

- Rural Electrification Agency
- Rural Electrification Fund
- Uganda Energy Credit Capitalization Company

PRIVATE & SOCIAL ENTERPRISES

- Absolute Energy Servizi S.r.l.*
- Barefoot Power
- Chapter Six Ltd*
- Eco-fuel Africa Limited*
- Energy4Impact
- FERDSULT
- Green Bio Energy Ltd. (GBE)*
- Mott Macdonald
- Little Sun
- Multiple smaller SHS system providers
- Oy Nordic Cast Sourcing Ab*
- Pamoja Cleantech AB*
- Q Energy Consultants B.V.*
- Solar Now Ltd
- Biogas Solutions
- Uganda Stove Manufacturers Ltd*
- UMEME
- Up Energy
- Village Energy

PRIVATE SECTOR ASSOCIATIONS

- Hydropower Association of Uganda
- Private Sector Foundation Uganda
- Uganda Biomass Energy Efficient Technologies Association
- Uganda Manufacturers Association
- Uganda National Alliance for Clean Cooking
- Uganda National Biogas Alliance
- Uganda National Renewable Energy & Energy Efficiency Alliance
- ULPGAs Uganda LPG Association

FINANCIAL INSTITUTIONS

- Barclays Bank
- Centenary Bank
- Enventure
- Finance Trust Bank
- Finca
- Post Bank
- Pride Microfinance
- Renewable Energy Business Incubator

NGO'S & CIVIL SOCIETY

- Foundation Rural Energy Services*
- Heifer Project International*
- Impact Carbon
- Renewable Energy Business Incubator
- SNV
- Solar Sister

COOPERATING PARTNERS

- AFD
- Danida
- DfID
- EU
- GET-FIT
- GIZ
- KfW
- NORAD
- SIDA
- UECCC
- UNDP/GEF
- World Bank

RESEARCH INSTITUTIONS

- Africa Institute for Energy Governance
- Centre for Research in Energy and Energy Conservation (CREEC)

Stakeholder mapping – Zambia

NATIONAL GOVERNMENT

- Ministry of Energy
- Department of Energy
- Ministry of Gender Ministry of Water, Sanitation and Environmental Protection

POWER PRODUCERS

On Grid (Government)

- ZESCO Limited

On Grid (IPP)

- Copper-belt Energy Corporation
- Kabompo Hydro Power Project
- LPC Lufubu Power Company Limited
- North-Western Power Company Limited

Off Grid (Government)

- ZESCO Limited

Off Grid (Private Sector)

- Kafita Cooperative
- Muhanya Solar Company Limited
- Off-Grid Electric
- Sino hydro Power Company

- West Lunga Power Company Limited
- Western Power Company Limited
- Zengamina Power Company Limited

REGULATORY AUTHORITIES

- Energy Regulation Board
- Zambia Environmental Management Agency
- Zambia Bureau of Standards

GOVERNMENT AGENCIES

- Industrial Development Cooperation
- Office for Promoting Private Power Investment
- Rural Electrification Authority
- Zambia Development Agency

PRIVATE & SOCIAL ENTERPRISES

- Azuri
- Basil Read Energy (Pty) Ltd*
- BetterWorld Energy Ltd.*
- Chloride Zambia Limited
- Copperbelt Energy Corporation PLC*
- Davis and Shirtliff
- Zambia
- Differ AS*
- Doranova Oy*
- Ensis Development Ltd*
- id Solar Solutions*
- Livestock Services Cooperative Society
- Melcome Marketing and Distributors Limited
- Muhanya Solar Limited
- Reba Industrial Corporation Limited
- Power Link Solutions Limited Zambia*
- Riders Energy Zambia Limited
- Savenda Management Services Limited
- Solar Solutions
- Solaraid Zambia
- Sunny money
- Sunpower Limited
- Suntech Appropriate Technology Limited
- Total Zambia Limited
- Vagga till Vagga AB*
- Vitalite Zambia (2 projects)*

PRIVATE SECTOR ASSOCIATIONS

- Zambia Association of Manufacturers
- Zambia Chamber of Commerce and Industries
- Zambia National Farmers Union

FINANCIAL INSTITUTIONS

- GroFin
- Kukula Capital
- Open Capital Advisers
- Pangaea
- PEP
- Stanbic Bank Zambia
- Zambia Development Bank (ZDB)

NGO'S & CIVIL SOCIETY

- CeLIM (Pilot)*
- CeLIM (Scale-up)*
- Civil Society Network
- Water and Sanitation Association of Zambia (WASAZA)*
- World Wildlife Fund (WWF)
- Zambia Energy & Environment Organization (ZENGO)

COOPERATING PARTNERS

- AfDB
- COMESA
- DFID Zambia
- European Union (EU)
- Finnish Embassy
- IFC
- JICA
- KfW/ Get Fit
- SIDA/Swedish Embassy
- SNV
- UNCDF
- UNDP
- USAID/Power Africa
- World Bank Group

RESEARCH INSTITUTIONS

- Copperbelt University*
- National Institute for Scientific and Industrial Research, National Technology Council
- University of Zambia

Stakeholder mapping – Zimbabwe

NATIONAL GOVERNMENT

- Ministry of Energy
- Department of Energy and Conservation and Renewable Energy in the Ministry of Energy and Power Development
- Ministry of Environment, Water and Climate
- Ministry of Finance
- Ministry of Science and Technology

POWER PRODUCERS

On Grid (Government)

- ESKOM (Zimbabwe imports power from South Africa)
- NamPower (Zimbabwe imports power from Namibia)
- PowerTel Communications (Pvt) Ltd
- Rural Electrification Fund
- ZESA Enterprises (ZENT)
- ZESCO (Zimbabwe imports power from Zambia)
- Zimbabwe Electricity Distribution Company
- Zimbabwe Power Company

On Grid (IPP)

- 25 IPPs
- 5 IPPs delicensed
- Chipendeke Power Company
- Gwanda Solar Mini Grid
- Nyangani Renewable Energy (Pvt) Ltd
- Rusitu Power Corporation

Off Grid (Government)

- Allied Timbers
- Border Timbers
- Finealt Engineering (Pvt) Ltd
- Wattle Company

Off Grid (Private Sector)

- Green Fuels
- Hippo Valley And Triangle Sugar Estates
- Triangle Ethanol Plant
- Zimbabwe Bio Energy (Pvt) Limited

REGULATORY AUTHORITIES

- Competition and Tariff Commission
- Environmental Management Agency
- Standards Association of Zimbabwe
- Zimbabwe Electricity Regulatory Authority (ZERA)
- Zimbabwe Investment Authority
- Zimbabwe National Water Authority

GOVERNMENT AGENCIES

- Agricultural Extension Services
- Agricultural Rural Development Authority
- Department of Research and Specialist Services
- Exploration Company
- Forestry Commission
- Harare City Council
- National Railways of Zimbabwe
- National Social Security Authority
- Zimbabwe Energy Council
- ZIMSTAT Zimbabwe Statistical Agency

PRIVATE & SOCIAL ENTERPRISES

- A & B Evolving Energies
- A1 Taxi Service Company
- Chloride Zimbabwe
- Clamore Solar
- Comprehensive Energy Solutions
- Cooperative
- Deloitte Zimbabwe
- Drip Tech
- Econet Wireless
- EcoSolar
- Ecosynchron Systems P/L
- Global Solar
- Himalaya MicroHydro Association
- Hlabiso Community,
- Incredible Green t/a Green Sparks
- Joamac
- Machine Electrical Distribution
- Madison Solar
- Micro Sale Enterprises t/a Solar Energy Projects
- Ngarura Community
- Nyafaru and Dazi Microhydro
- Nyamavhuvhu Energy
- Nyamwanga

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PRIVATE & SOCIAL ENTERPRISES

- One Stop Solar
- Oweron Solar Solutions
- Powertile
- Sate Wave
- Solahart Zimbabwe Ltd
- Solar Cool Africa
- Solar Sky
- Summesrand Alternative Energy
- Tendo Electronics
- Thandiwe Investments
- Total Zimbabwe
- Towe Community
- Tregers Zimbabwe
- UK based Sunbird Bioenergy
- Ultimate Power Solutions
- Zimenergy

PRIVATE SECTOR ASSOCIATIONS

- Capernaum Trust
- Dabani Trust
- Malilangwe Trust in Chiredzi
- Renewable Energy Association of Zimbabwe (REAZ)
- Solar Energy Industries Association of Zimbabwe
- Zimbabwe National Chamber of Commerce

FINANCIAL INSTITUTIONS

- African Development Bank
- Commercial Bank of Zimbabwe Holdings
- Development Bank of Southern Africa
- Fund for Africa ("SEFA") administered by the African Development Bank
- Green Climate Fund (GCF
- Green Energy Fund
- Infrastructure Bank of Zimbabwe (IDBZ)
- Reserve Bank of Zimbabwe
- Rural Energy Fund
- Sustainable Energy
- The African Renewable Energy Fund (AREF)
- Zimbabwe Agricultural Development Trust (ZADT)
- Zimbabwe MultiDonor Trust Fund (ZimFund)

NGO'S & CIVIL SOCIETY

- Environment Africa
- HIVOS
- Oxfam
- Practical Action
- SNV
- World Wildlife Fund (WWF)
- ZERO Regional Environment Organization

COOPERATING PARTNERS

- Climate Technology Network (UNIDO
- DFID
- Embassy of Switzerland
- European Union
- French Embassy
- German Agency for Technical Cooperation (GTZ
- Kellog Foundation
- New Foundation
- OPID
- Scottish Government
- SIDA will take over DANIDA Projects (after withdrawal of DANIDA from Zimbabwe)
- Small Hydro Power (ICSHP)
- Solidarmed
- Swedish Embassy
- Swiss Agency for Development and Cooperation (SDC)
- UNDP – GEF
- UNICEF
- United Nations Industrial Development Organization (UNIDO) and International Center on
- USAID
- World Bank Zimbabwe Reconstruction Fund (ZIMREF)

RESEARCH INSTITUTIONS

African Regional

Cooperative Agreement for Research, Development and Training

Department of Mechanical Engineering, University of Zimbabwe

Harare Institute of Technology (HIT)

Institute of Environmental Studies (IES) University of Zimbabwe

National University of Science and Technology (NUST)

Scientific and Industrial Research and Development Centre

The Centre for Development Studies, Renewable Energy Department.

The Chinhoyi University of Technology, Electrical Engineering &

The Environmental Management, Renewable Energy and Climate Change Research Centre