Renewable Energy Market Landscape Study

covering 15 countries in Southern and East Africa

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Volume I

Report

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Disclaimer:

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Abbreviations

ABSA	ABSA Bank of South Africa
ADA	Austrian Development Agency
AECF	Africa Enterprise Challenge Fund
AFD	Agence française de développement
AVG	Average
CO2	Carbon Dioxide
CSP	Concentrating Solar Power
DBN	Development Bank of Namibia
DBSA	Development Bank of South Africa
DC	Direct Current
DEM	Danish Energy Management & Esbensen
DfID	Department for International Development
EAC	East Africa Community
ECO	EEP Coordination Office
EDCL	Energy Development Corporation Limited
EEP	Energy and Environment Partnership
EEP-SEA	Energy and Environment Partnership for Southern and East Africa
ElectriFI	Electrification Financing Initiative
EnDev	Energizing Development
ESCO	Energy Service Company
FEI	Facility for Energy Inclusion
FiT	Feed-In Tariffs
FUNAE	Fundo de Energia
GET-FiT	General Exchange Tariff – Feed-In Tariff
GHG	Greenhouse Gas
GIZ	Gesellschaft für Internationale Zusammenarbeit
GVEP	Global Village Energy Project
GW	Gigawatt
IDC	Industrial Development Corporation
IEA	International Energy Agency
IFC	International Finance Corporation
IPP	Independent Power Producers
IRENA	International Renewable Energy Agency
KWH	Kilowatt hour
MDTF	Multi-Donor Trust Fund
MEGA	Malawi Electricity Generation Agency
MFA	Ministry for Foreign Affairs
MFI	Monetary Financial Institution
MTE	Mid-Term Evaluation
MW	Megawatt
NCF	Nordic Climate Facility
NDF	Nordic Development Fund
NGO	Non-Governmental Organization
PAYG	Pay-as-You-Go
PPA	Power Purchase Agreements
PV	Photovoltaic
R&D	Research and Design
RBF	Results-Based-Financing
REACT	Renewable Energy and Adaptation to Climate Technologies
RECF	Renewable Energy Challenge Fund
RECP	African–EU Renewable Energy Cooperation Programme
REFIT	Renewable Energy Feed-in Tariff
REIPPPP	Renewable Energy Independent Power Producer Procurement
REMP	Rural Electrification Master Plan
RET	Renewable Energy Technologies
SACREEE	SADC Center for Renewable Energy and Energy Efficiency
SADC	South African Development Community
SANEDI	South African National Energy Development Institute
SAPP	Southern African Power Pool
SDG	Sustainable Development Goal
SE4ALL	Sustainable Energy for All
SHS	Solar Home System
SME	Small and Medium Enterprises
SNV	Stichting Nederlandse Vrijwilligers
SUNREF	Sustainable Use of Natural Resources and Environment Finance
TANESCO	Tanzania Electric Supply Company Limited

Executive summary

The Ministry for Foreign Affairs of Finland (MFA) commissioned Danish Energy Management & Esbensen (DEM) to undertake a market landscape study of the 15 countries in Southern and East Africa (S&EA) that have been identified for support under the next phase of the Energy and Environment Partnership programme (EEP). The intention is to establish a Multi-Donor Trust Fund (MDTF) under the Nordic Development Fund (NDF), ensuring close synergies and alignment with other clean energy financing platforms in the region.

The **purpose** of this study is to develop a snapshot of the current status of energy access, opportunities in Southern and East Africa and to reposition the EEP-S&EA market niche and value proposition to meet the needs of the private sector.

The study covers the original 13 countries (Botswana, Burundi, Kenya, Lesotho, Namibia, Mozambique, Rwanda, Seychelles, South Africa, Swaziland, Tanzania, Uganda, and Zambia) plus Zimbabwe and Malawi (referred to as EEP S&EA III region for the purposes of this report).

EEP's market niche in Southern and East Africa

Achieving universal energy access by 2030 requires concerted action by all partners to close funding gaps and enable an energy transition. In the EEP countries alone, an estimated 183 million people live without access to modern energy. There is unilateral acknowledgement of the importance of renewable energy and decentralised energy access in improving energy access however national governments in the region are still focused on grid extension. This is despite the current challenges in meeting demand due to inadequate generation capacity and aging, unreliable infrastructure. Therefore, catalytic change is required, particularly off the grid.

Across the EEP target region, the energy transition has reached various degrees of development. According to the IEA, projected investments in mini-grid and off-grid technologies are estimated to be US$ 6 billion per year while actual needs are estimated at four times that level. The same is true for clean cooking technology where US$ 1 billion is available annually out of a projected US$ 4.5 billion in investment need. There is a clear **funding gap** and more needs to be done to encourage the private sector to provide sustainable solutions to meet demand.

More than 60 donor-supported initiatives are engaged in the energy access space in the EEP region, many having been established in the period since EEP was launched in 2010. Despite the crowding in of many new players, including more commercial and private sector financing, findings from this study confirm that EEP continues to address an underserved niche with direct financing and offers a **unique value proposition** in terms of breadth of geography, technology coverage, scale of support, and risk appetite. EEP's combination of early stage flexible financing, business development support, knowledge exchange and downstream investor networking continues to offer unique value toward enhancing energy access.

The survey responses from 61 EEP grant recipients revealed that the most significant barrier continues to be **access to finance**. It is therefore not surprising that the majority of respondents requested continued financing support, including support in sourcing investors going forward. Several suggested a transition to other forms of financing, such as low interest loans.

Bringing the management of EEP under the Nordic Development Fund (NDF) presents new opportunities, reflecting the link between energy use and the environment, enhancing EEP visibility as a climate finance facility and introducing added flexibility in terms of blended finance instruments. Positioning EEP under the same roof with the Nordic Climate Facility (NCF) also provides for new synergies in financing and knowledge exchange.

The **flexibility** of the EEP mechanism to respond to business needs is considered to be an asset, particularly in adopting a technology neutral approach. The EEP programme has been instrumental in supporting the early development and testing of new technologies and energy access business models, including Pay-As-You-Go (PAYG) solar. These businesses have since scaled up having proven their business concept and are now able to access financing from other donors, development banks, impact investors and commercial financial institutions.

Based on interviews with the private sector and other donors, the majority of financiers in the renewable energy sector are reluctant to engage with project developers in the early stages. The value proposition of EEP is seen as providing early stage financing to project developers and **establishing a robust project pipeline** that can be scaled up, either through EEP or by referring developers to other financing mechanisms. The support of EEP enhances the credibility of the projects seeking to scale up. Grant funding is required during the initial stages of project development to buy down the risk of entering into a new venture and potentially new territories. After this initial phase, concessional loans or guarantees would be appropriate.

Although the role of the EEP is not to address the shortfalls in the enabling framework or the absence of inputs that ensure project sustainability, the success of EEP supported initiatives cannot be divorced from the market system. Many of the barriers referred to in this report are external to the private sector developers and therefore may not be within their sphere of influence. EEP may consider developing and enhancing its **partnerships** with agencies that are better placed to deliver results in these areas, such as SE4ALL, other donor interventions, research institutions, regional agencies and NGOs.

The development impact agenda is often perceived to be additional work for private sector project developers. Incorporating results-based financing and improving the use of customer data for marketing purposes enhances the value added of collecting customer data. The importance of **job creation** particularly as it relates to the youth and particularly women is recognised very strongly in the EEP region. There is a definite opportunity for EEP to support these national priorities by encouraging calls for proposal that build partnerships with **local companies** and support communities in developing productive uses in partnership with NGOs, thereby creating jobs.

Energy efficiency is not mainstreamed in the region, and, in terms of the role of EEP, there are two options in how to drive the agenda forward within the scope of the programme. On the demand side, it is critical that energy efficiency be integrated into the design of all projects. The approach should address technical and behavioural efficiencies, considering the energy rating of appliances, as well as user awareness. On the supply side, the opportunity exists to encourage the provision of energy efficiency services to social institutions, including schools, community centres and clinics, adopting a portfolio approach.

Gaps and market situation for small-scale on-grid and off-grid energy access

Within the EEP S&EA III region, the rate of rural electrification is 22% on average across the region and 12% excluding the Seychelles and South Africa. Access to clean cooking is below 36% for all countries except Botswana, Seychelles, South Africa, and Swaziland. The main barriers to establishing a vibrant off-grid renewable energy access market are familiar to any market or business: stability and openness of the general business climate, the availability of suitable

capital investment, establishing economies of scale, the development and retention of human capital, and failures along the value chain.

One of the most significant challenges in establishing successful off-grid, rural enterprises in Africa is the sparse population distribution. This is particularly the case in Botswana, Namibia, Mozambique, and Zambia but does affect all the countries in the region in remote areas, affecting economies of scale. The private sector therefore focuses on densely populated areas, where purchase power may be greater and the need for extensive infrastructure not so large. The question therefore arises whether there is a commercially viable business model. There is a growing consensus that without grant funding for capital expenditure and cross-subsidy models, viability cannot be achieved.

Government policies are also affecting the business case. The subsidies provided by government to the electricity tariffs and fossil fuels, particularly kerosene, create market distortions that reduce the viability of the commercial models. The market-based approach requires an environment where the prices are self-regulating however private companies are competing with subsidised services and in some cases are restricted to conform to subsidised tariffs.

Small-scale on-grid Independent Power Producers (IPPs)

The interviews with project developers and financial institutions highlighted the importance of standardisation, predictability and fixed policy for the purposes of on-grid IPPs. The commitment to fixed methodologies for establishing FITs, standardisation of PPAs and the issuing of government guarantees are a requirement to attract investors. However, off-taker risk is significant in this region due to the financial standing of the national utilities, the primary off-takers, and their inability to charge a cost reflective tariff in most countries.

Few on-grid IPPs are installing a distribution network locally to ensure that there is an alternative off-taker, thereby reducing the risk further, although the regulations need to allow for this. Although this increases the investment cost, it does also allow for local communities to benefit, and potentially for energy access to be improved. In order to achieve impact, the productive uses of energy are fundamental. Numerous stakeholders have emphasised the importance of the value chain in achieving this. However, most private businesses do not see it as their role to develop the value chain, despite the likelihood that it will increase the profitability of their business.

Mini-grids

The mini-grid market is growing however the business concept has yet to be proven to be viable without donor support and an anchor load, particularly in rural areas. There is a growing consensus that governments need to subsidise the provision of energy access in these areas through public-private partnerships. Cross-subsidisation is necessary to incentivise the provision of services to less profitable, sparsely populated markets. In order to generate adequate revenue to cover operational expenditure, tariffs need to be cost reflective, although this is not permitted in a number of countries as it exceeds national tariffs. Government guarantees regarding future rural electrification plans are not being given broadly, and where they are, they are subject to change. There are examples of concessions being provided and in some cases agreements have been reached to transition to an on-grid IPP when the grid does arrive.

The high, up-front capital investment for mini-grids often means that users are limited to using basic appliances; even when capital costs are covered by grants. The focus needs to be on the quality and relevance of services being provided to protect user perceptions. Sizing of these systems for implicit demand is challenging as demand increases rapidly. This is particularly challenging for solar PV as storage capacity is a significant barrier.

Stand-alone solutions

The growth in the purchase stand-alone solutions has been exponential in East Africa. According to the Overseas Development Institute, Kenya, Tanzania and Ethiopia accounted for 78% of the sales of household solar solutions in

2014, reaching a market penetration of 15-20% of off-grid households. PV modules have decreased in price by 85% over the last ten years, and if efficiency savings are incorporated into appliance design, this will realise future cost savings.[2] This growth is significantly facilitated by the use of mobile pay technologies. In order to increase the productive and efficient use of the systems, efficient DC appliances need to be supplied. A number of project developers are offering modular systems that can be upgraded as purchase power increases, graduating from simple lighting and mobile phone charging to the use of fridges and TVs in homes. However, for many rural areas, these models of rent-to-own are not viable due to the dispersed nature of the settlements.

Cook stoves

Cook stove initiatives have been championed in many countries for decades, not least by GIZ. Many of the improved cook stove models that are in the market across the region are based on GIZ-defined designs. There is a perception that the market is saturated with stove producers. This study has revealed that this is not the case. The scale of the problem with wood fuel consumption and the overall dependence of the rural poor on wood fuel will in fact have a much more significant impact if addressed, particularly in terms of CO_2 emissions, than the introduction of a light in the home. Turning the current cottage industry into large-scale manufacturing of quality stoves, would be an extremely effective measure to improve access to energy.

[2] *Overseas Development Institute (2016). "Accelerating access to electricity in Africa with off-grid solar". Accessed 25 July 2017 on www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/10246.pdf*

1. Introduction

1.1 Background and context

The Energy and Environment Partnership (EEP) for Southern and East Africa was developed in response to the growing recognition by governments, international development agencies, non-governmental organisations (NGOs) and project implementers that access to energy is a fundamental driver of socio-economic progress. The EEP was initiated in 2010 by the Ministry for Foreign Affairs (MFA) of Finland and the Austrian Development Agency (ADA), and was subsequently joined by the Department for International Development (DfID) of the UK. The aim of the programme was to address some of the barriers to the uptake of renewable energy technologies across the southern and eastern Africa region with a particular focus on financing increased energy access to the poor. The EEP effectively provides a challenge fund that seeks to support innovative projects, as well as capital support to the scaling up of projects in the energy and environment sector.

The programme has completed the first phase (Phase I) of implementation (2010-2013), which was managed by the Development Bank of South Africa (DBSA). KPMG Finland is managing Phase II through the EEP Coordination Office in Pretoria (ECO). The second phase is now reaching its completion. The EEP geographical scope currently covers 13 countries including Botswana, Burundi, Kenya, Lesotho, Namibia, Mozambique, Rwanda, Seychelles, South Africa, Swaziland, Tanzania, Uganda, and Zambia.

Based on the progress made during Phase II and the findings of the Mid-Term Evaluation (MTE) of EEP performed by Danish Energy Management & Esbensen (DEM), the funders have taken the decision to transform the programme into a Multi-Donor Trust Fund (MDTF) under the leadership of the Nordic Development Fund (NDF) with the aim of exploiting existing synergies with other donor-funded initiatives to improve the flexibility and effectiveness of the programme.

Before initiating the design of the third phase (Phase III), this market landscape study serves to identify trends in the current energy investment landscape, recognise synergies with other climate and energy programmes, as well as discover market and financing niches that will reinforce the value proposition of the EEP S&EA MDTF. Phase III covers the original 13 countries (Botswana, Burundi, Kenya, Lesotho, Namibia, Mozambique, Rwanda, Seychelles, South Africa, Swaziland, Tanzania, Uganda, and Zambia) plus Zimbabwe and Malawi (referred to as EEP S&EA III region for the purposes of this report).

1.2 Purpose and scope of the study

This market landscape study will ensure that the design of the next phase of the EEP programme is relevant, effective and where possible, aligns to and harmonises with other programmes. Its purpose is to provide the MFA, NDF and other donors with a snapshot of the market situation in each country and thereby a clearer understanding of the market niches that the EEP S&EA could engage in within each country and across the region. The intention is to identify what opportunities are available for the EEP S&EA to influence the market towards increasing its impact on poverty reduction and climate change to inform the design of the Energy and Environment Partnership Southern and East Africa Trust Fund.

The **purpose** of this study is to develop a snapshot of the current status of energy access, opportunities in Southern and East Africa and to revalidate or reposition the EEP-S&EA market niche and value proposition. The market landscape study of the renewable energy sector identifies the gaps in on-grid support for small-scale generation, and both the (i) gaps and (ii) current market status for off-grid.

In terms of the on-grid component of the market study, the primary interest is in understanding the opportunities for Independent Power Producers (IPPs) that feed into the grid. The scope of the study did not consider grid parity or the market opportunities that arise from poor quality grid electricity. Moreover, the opportunities identified are linked to increased energy access for the poor in the region, as opposed to increasing supply to existing or new, higher income or energy-intensive users. The mapping of donor financing for the purposes of optimising resources is an important element of the study however the main focus is to understand in greater detail the challenges that are being faced by business in addressing the needs of the energy poor, in particular competition within the renewable energy market and the barriers to commercial viability.

Although energy efficiency is mentioned as part of the scope of the study, the EEP S&EA has experienced challenges in identifying how to incorporate energy efficiency into a programme aimed to reduce poverty through energy access. The assumption was made that off-grid energy supply intrinsically incorporates energy efficiency in the design. However, there may be scope to consider the opportunities for energy efficiency in terms of green growth and emissions reductions. It is therefore relevant to understand how energy efficiency is perceived by business and what unexploited opportunities may have a poverty reduction impact, albeit indirectly.

1.3 Methodology

The aim of the study is to map and assess the gaps and opportunities for concessional and non-concessional facilities targeting innovation and early stage catalytic financing in renewable energy, energy efficiency and clean technology.

The following activities were undertaken:

1. Mapping of active and planned financing from donors, foundation partners, commercial financing and other financiers.
2. Analysis of what funding mechanisms are most appropriate/successful at a given stage of project development and for a given project type and/or technology.
3. Identifying political economy barriers and opportunities reoccurring in energy markets across the target region.

Political economy analysis

The political economy framework adopted for this study is summarised in *Figure 1* and reflects the core areas of focus. While the political economy analysis provides the opportunity to do a stock take of the status quo in each country, it promotes an understanding of the driving forces behind these trends. It is critical to recognise the diverse contexts in which the EEP S&EA is implemented. Economically, socially and technologically, the countries across the region are at various stages of development. The available data, at times limited, and the insight of key stakeholders in the sector have provided an understanding of why the desired trends cannot be assumed to occur without intervention.

Figure 1: The political economy analysis summarised

Source: World Bank 2011

Data collection – stakeholder mapping and data collection

The stakeholder mapping (Volume II) was the first exercise performed for each country to identify key informants to the data gathering process. The second step was to produce country profiles (Volume II) to provide an overview of general information, energy consumption, the institutional/ legal/ regulatory framework, penetration of technologies, a market review, financing flows, existing projects/ programmes, as well as a summary of challenges and opportunities.

A survey of previously supported projects and follow-up interviews

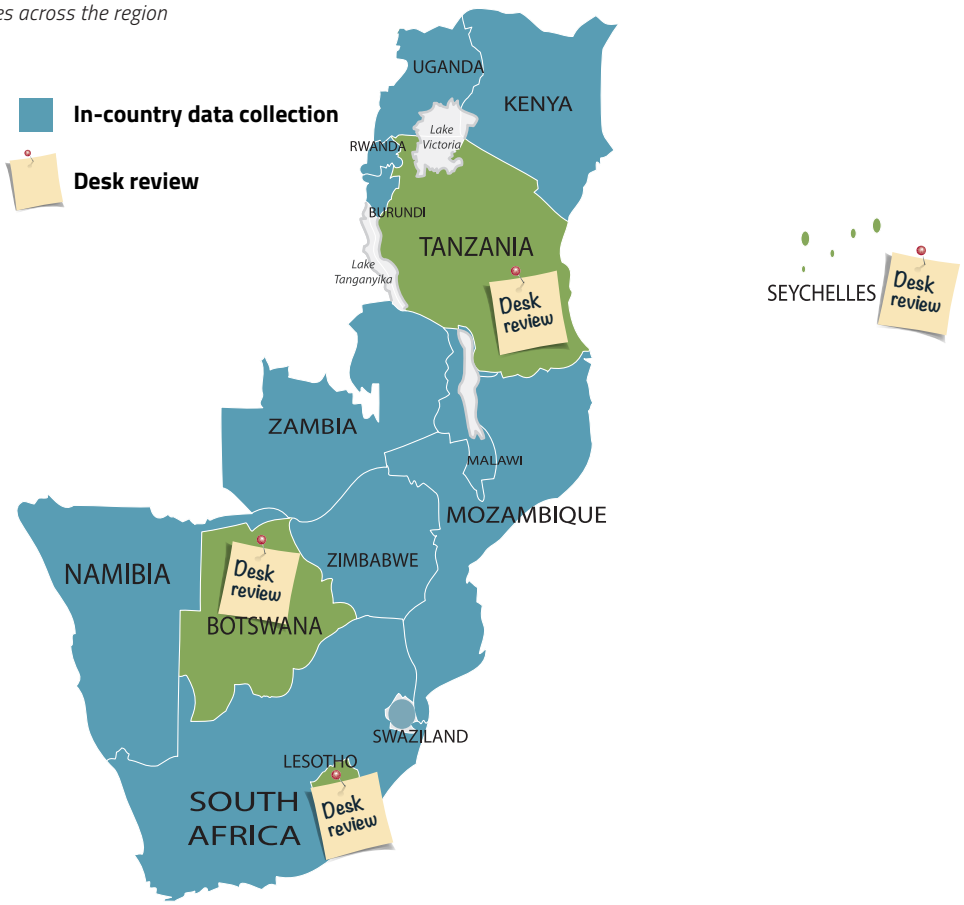
Based on the list of 225 projects that have been supported by the EEP S&EA, a brief survey was circulated requesting information on whether the projects have managed to further develop their concepts, whether this has reached the stage of commercial viability, how this was achieved, and what the current barriers to (further) expansion. Based on the results of the questionnaire, specific businesses were identified for interview. The questionnaire was answered by 61 projects and interviews were conducted with 16 respondents.

In-country data gathering and interviews

In-country data gathering was undertaken in Burundi, Kenya, Malawi, Mozambique, Namibia, Rwanda, South Africa, Swaziland, Uganda, Zambia, and Zimbabwe. The EEP Investors Forum provided the opportunity to also meet with market representatives and investors in Kenya.

For those countries in which in-country data collection was not undertaken, a thorough desk review was performed, as indicated in *Figure 2*.

Figure 2: Data collection activities across the region



A total of 158 interviews were made across countries with the following groups of stakeholders:

- the private sector through business associations and non-EEP project developers
- the funders of renewable energy and energy efficiency private sector projects, including other challenge funds
- the public sector, NGOs and research institutes.

The scope of the study was determined to some extent by the time available for data gathering and initial reporting of findings (one month) on fifteen countries. Where possible, existing groups and fora were used as the conduit to the various stakeholder groups, particularly through donor coordination groups and associations that are already active in the sector. Therefore each country assessment provides an overall snapshot as opposed to an in-depth market assessment.

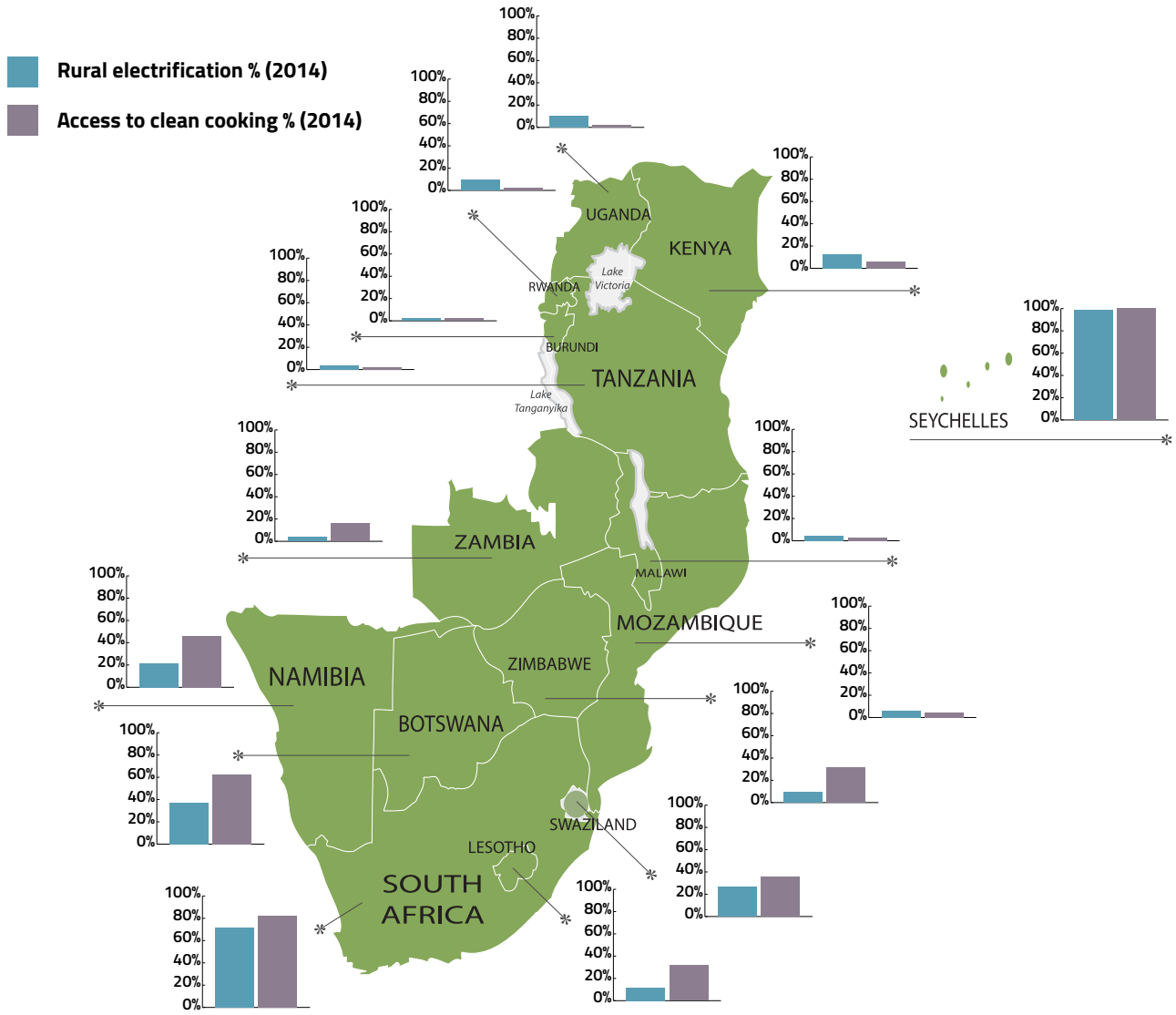
The availability of data was a challenge in a number of the countries being studied, in particular Burundi, Lesotho, and Malawi. Therefore, the interviews were used to fill in the gaps and source additional documentation. Although meeting representatives from relevant organizations provided first-hand information about national policies, market conditions and technologies, the respondents still had knowledge confined to their own sphere of experience.

2. Findings of the market study

This section of the report summarises the main findings from the data collection and analysis across the region. Volume II of this report contains a more detailed snapshot of the status of the markets in each of the countries covered.

The 15 countries that were reviewed under this study form a complex tapestry of social, cultural, economic and political contexts. Therefore, there is significant value in understanding how the EEP can respond to the local context and in so doing, have a greater impact on the local energy access market. Within the EEP S&EA III region, the rate of rural electrification is below 13% and below 36% for access to clean cooking for all countries except Botswana, Seychelles, South Africa, and Swaziland. Even more striking is the rate of *rural* electrification *(see Figure 3 below)*, which is 22% on average across the region and 12% excluding the Seychelles and South Africa.

Figure 3: Rate of rural electrification and access to clean cooking in the EEP S&EA III region



Source: Map produced based on Global Tracking Framework data

The need for capital investment to further renewable energy access for the underserved is not questioned. In 2015, US$ 286 billion was invested in renewable energy globally. Over 60% of global experts estimate that the annual global investment in renewable energy will be greater than US$ 550 billion in 2050.[3] This is not only due to the drive to increase renewables in the energy mix but also due to decreasing the costs of renewable energy technologies (RETs). The second Sustainable Development Goal (SDG) progress report released on the 7th June 2017 states that progress against SDG 7 (affordable and clean energy) falls short of what is necessary to achieve energy access targets for renewable energy and energy efficiency. The report points to ramping up financing, making robust policy commitments, and embracing new technologies.[4]

To a large extent, the market barriers that are being faced in the EEP S&EA III region are not new or unfamiliar or even unique to renewable energy. In 2001, the Risø National Laboratory identified a framework of the key barriers, including market imperfections, distortions, economic and financial, institutional, technical, social and cultural barriers, and many of these hold true today.[5] However, what has changed is the context in which these barriers occur and their influence on the market and therefore the opportunities that exist for the EEP to impact on the market. *The commercial risks of off-grid energy access are high and there is general recognition that without facilities like EEP, the off-grid markets would not attract the investment of the private sector.*

The following sections describe the institutional and political context of the region, the trends in terms of adoption of technologies, the key stakeholders as agents of change, and the external forces that influence the success of the market-based approach. These factors are then considered in relation to the EEP programme and broad recommendations are suggested for the potential niche EEP can carve in accelerating energy access for the poor.

2.1. Institutional framework

The political commitment to increasing energy access and renewable energy is apparent in all the countries in the EEP S&EA III region. All 15 countries have incorporated renewable energy into their national development plans. However, there are notable differences in terms of the degree to which strategies are being implemented, both at national and local government levels. The influence of regional policy is not evident and national government ownership of regional policy appears to be weak.

Small-scale, on-grid independent power producers

All 15 countries are moving towards the liberalisation of the legal and regulatory framework of the electricity sector and therefore the incorporation of renewable energy Independent Power Producers (IPPs). Namibia has recently appointed 14 IPPs offering wind and solar solutions each with an installed capacity of up to 5 MW.

However, the monopoly of the nationally owned utilities has been an impediment for most countries. In South Africa, Eskom refused to sign the recently awarded Power Purchase Agreements (PPAs) under the Renewable Energy Independent Power Producer Procurement (REIPPPP) programme, necessitating Presidential intervention. Despite progress in Namibia, Nampower, as the single off taker, has taken the decision to cap additional generation capacity of 70 MW from small-scale IPPs due to the limitations of the grid infrastructure. In Malawi, the IPP framework has been developed but has yet to be implemented. Likewise, in Rwanda, IPPs that had almost completed the process of obtaining their PPA have been requested to renegotiate their agreements with Energy Development Corporation Limited (EDCL) as the existing grid and associated demand is currently oversupplied. There is also a natural political push back in the countries where fossil fuels provide economic benefits, not least of which is significant employment. Therefore, the drive for renewables is met with concern about whether additional generation capacity will displace non-renewable generation.

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[3] *REN21. 2017 Renewables Global Futures Report: Great debates towards 100% renewable energy(Paris: REN21 Secretariat). ISBN 978-3-9818107-4-5*

[4] *http://sdg.iisd.org/news/un-secretary-general-issues-second-sdg-progress-report accessed 25 July 2017*

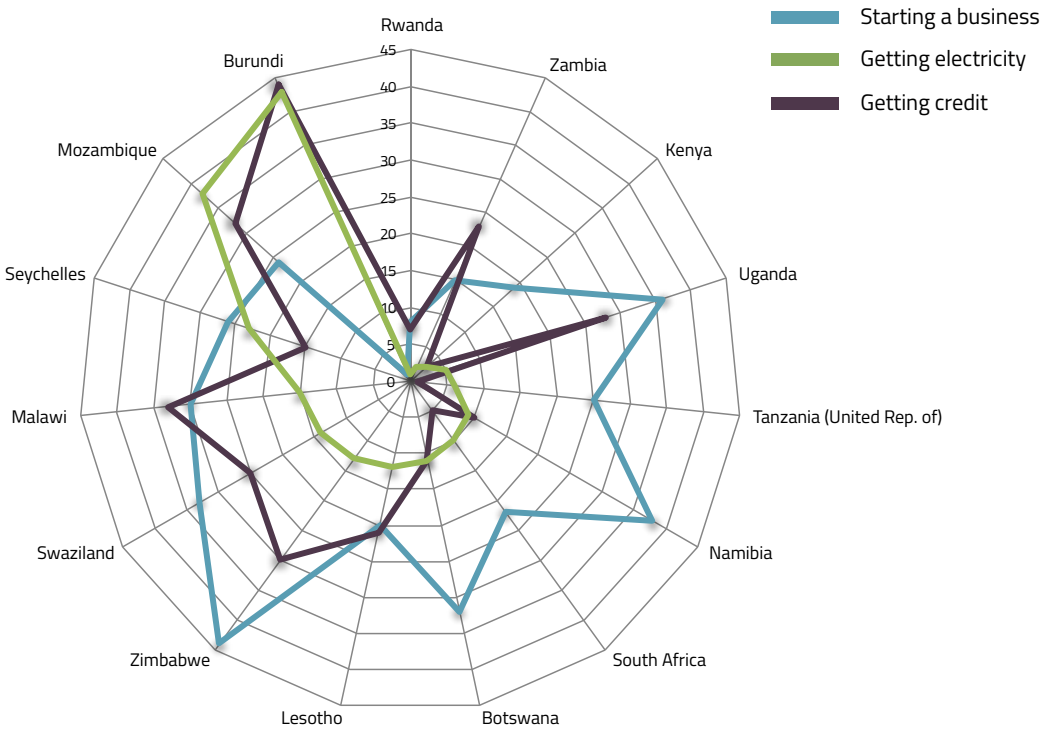
[5] *Painuly, J. P. (2001) "Barriers to renewable energy penetration. A framework for analysis" in Renewable Energy. 24, 1, p. 73-89*

The predictability of policy is also crucial for the region. The Kenyan government moved away from Feed-In Tariffs (FITs) earlier this year towards competitive bidding, also used in South Africa, Zambia and Namibia. This policy change caused concern amongst project developers that had already performed their feasibility assessments based on a FIT arrangement. Tariff setting methodology is often controversial, particularly in the countries where tariff subsidies are provided and tariffs are capped at that level. The Namibian Electricity Control Board has taken the decision to regularise tariffs to be cost-reflective, resulting in an increase of 16.9% in January 2016. The application to increase tariffs in Tanzania to make them more cost reflective recently reportedly led to the removal of the Director of TANESCO and the replacement of the Minister of Energy.

Solar PV equipment has been free of customs duties for years in East Africa. However, customs and excise regimes changed in 2016 when spare parts and accessories for solar equipment became subject to duty. However, the inputs for solar manufacturing are exempted, presumably in an attempt to encourage more local manufacturing. The interpretation of these regulations differs across the region and there is a lack of clarity as to whether, for example, batteries for solar installations are considered to be an accessory or an input. Customs clearance procedures have been reported to be bureaucratic in Kenya and Rwanda, and the technical understanding of what is being imported is limited among customs officers. Duty on imports has been paid at two ports of entry, entry into the East Africa Community (EAC) and entry into Rwanda, in some cases.

The ease of doing business more generally across the region varies. As shown in *Figure 4* below, the ease with which credit can be obtained varies significantly across the region with Burundi, Mozambique and Malawi being the most challenging. However, starting a business in Burundi, Rwanda and Zambia is ranked as being comparatively easy. Streamlining business processes is known to improve investor interest, and this applies also to the energy sector. Obtaining a generation licence in Uganda takes between 2 and 4 years, although it is supposed to take 6-9 months. In January 2017, the Zambian Energy Regulation Board (ERB) introduced a compulsory licence for the import of all solar equipment, introducing a quality certification procedure. Whilst this addresses concerns about the inferior quality of equipment, this also introduces a bureaucratic procedure that reduces commercial agility.

Figure 4: The World Bank's Ease of Doing Business ranking [6]



[6] *http://www.doingbusiness.org/rankings*

Off-grid energy access

All governments in the region continue to promote grid extension, and most consider it to be the solution to the energy access crisis. The political commitment to grid electrification has raised the expectations of rural communities leading to the perception that non-grid solutions are either a stopgap or that accepting other solutions may deter the government from extending the grid to their local area. In Mozambique for example, where the poor grid transmission infrastructure requires that the electricity produced locally is exported and re-imported from South Africa, the Fundo de Energia (FUNAE) is committed to achieving 100% grid electrification in the long-term. However, this is considered to be unrealistic and not cost-effective by donors. FUNAE is testing off-grid solutions, including micro-hydro and solar PV. The Kenyan government has committed to extending the grid to all public institutions in the country, however this does not necessarily mean that energy is accessible for the communities in the vicinity of the grid. In Rwanda on the other hand, reaching 100% electricity access by 2018 is recognised as only being achievable by making use of off-grid energy solutions, due to the terrain and the dispersed population in rural areas. The Namibian government has defined 27 off-grid areas that will not be reached by the grid and recognises that renewable energy solutions are key to electrifying them.

The main concern in relation to mini-grid projects is what will happen when the grid arrives. Obtaining a concession for a significant period and defining compensation mechanisms for stranded assets supports the business case to secure adequate financing.[7] However, rural electrification plans can be unpredictable and political and therefore this is considered to be a significant risk. The differentiation between the regulatory requirements for large-scale IPP projects and smaller-scale, off-grid solutions facilitates the development of off-grid projects, although several countries, including South Africa and Malawi, don't make this distinction raising the cost of bidding for mini-grid IPP projects. In addition, the approval of tariffs that can be applied is often subject to restrictions that prevent off-grid IPPs reflecting the higher investment costs of the off-grid technologies and the absence of the economies of scale in rural areas. In Mozambique, the most significant constraint for private sector engagement is that tariffs are capped at the national, subsidised level.

Stand-alone off-grid solutions, such as solar home systems and micro-grids, are often less tightly regulated, reducing the amount of bureaucracy in establishing enterprises. On the other hand, the policy framework is considered to be lacking in relation to solar home systems. Policy measures that will facilitate the adoption of solar home systems need to cover import duties, quality standards, and reducing the market distortions caused by fuel subsidies.[8] The subsidies often provided on kerosene, the fuel used for lighting in most poor households, are a barrier to private sector suppliers being able to provide competitive renewable solutions. The governments of Botswana, Lesotho, Rwanda, South Africa and Malawi all subsidise kerosene, the latter significantly.

2.2 Technology review

Mini-grid technologies

The most commonly used technology for mini-grids is solar PV. The conditions are ideal for this in Africa although Uganda, Kenya and Rwanda experience significant rainfall, affecting generation capacity. The main considerations in terms of mini-grid technologies are the capacity to meet potential demand and upscale, the time required to build them and the storage capacity for solar, as well as for wind. Solar PV is relatively easy to deploy as opposed to hydropower that usually takes a longer time to construct. Storage is a major limitation at present and as the cost of batteries decrease, storage possibilities will improve. Issues of land ownership can be a problem in relation to the establishment of wind and solar farms.

7 *IFC (2017) Operational and Financial Performance of Mini-Grid DESCOs. Accessed on 25 July 2017 at http://sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/IFC_Minigrids_Benchmarking_Report_Single_Pages_January_2017.pdf*

8 *ibid*

Micro-hydro potential has been identified in most of the countries in the EEP S&EA III region including Malawi, Rwanda, Uganda, Zambia, Zimbabwe and small amounts in Lesotho and Namibia. However, the recent lack of rainfall has affected water levels in the region and raises concerns regarding the sustainability of micro-hydro as a source, particularly if it is also used locally for irrigation purposes. Rift Valley Energy in Tanzania and the Malawi Electricity Generation Agency (MEGA) in Malawi have addressed this by building several installations. MEGA has constructed three powerhouses along the same river within several kilometres of one another. For some hydro projects in Zimbabwe, land and asset ownership has become a bone of contention.

The food, water and energy nexus are worth exploring in more detail on the basis that most of the rural communities within the EEP S&EA III region live on agricultural land and therefore may benefit from considering the entire ecosystem. Biogas, for example, not only helps farmers process the large amounts of manure from livestock but also provides organic digestate to be used as fertiliser. EEP has already supported 31 biogas projects in the region (Botswana, Kenya, Lesotho, Mozambique, Namibia, South Africa, Tanzania, Swaziland, and Zambia) but the application of the technology to mini-grids has not been tested extensively. Equinox in Kenya signed a US$ 250 million deal in May 2017 to establish a 35 MW power plant based on biogas from water hyacinth.

In general, the concerns regarding the technology for mini-grids are limited. As the cost of RETs decreases, the case for mini-grids as a solution improves. According to the IFC, the mini-grid technologies that have scaled-up quickly are modular, can be removed conveniently (containerised) and are relatively cheap to invest in.[9]

Other technologies

The development of pico-RETs has been much faster than anticipated, and actually requires that the forecasts for Integrated Resource Planning, such as in South Africa, have had to be revised to incorporate a greater share of RETs in the energy mix. The increased functionality and decreased cost of pico-RETs have provided a boost to the market.

The review of the EEP S&EA III countries highlighted that the choices of RETs are limited to hydro, solar and wind for the most part. In Kenya and Tanzania, biogas is being used to some effect for thermal energy. GIZ and SNV have implemented large biogas programmes establishing the local technical capacity and working with dairy cooperatives to market the digesters to farmers. However, exploiting the potential for biogas could be taken further for standalone installations if the entrepreneurs had an understanding of potential uses of the energy as it relates to livestock farming and agriculture. In Zambia, water hyacinth is used to pipe biogas to surrounding hotels for cooking, while the slurry is used as a fertiliser for the on-site banana plantation.

In Namibia, O&L Energy (supported by EEP) and GIZ are producing energy (thermal and electrical) from the invader bush, a plant that is encroaching on farmland around Namibia. There are concerns about the use of this bush and the ecological impact of stripping it from grazing land however, as a feedstock it has a high calorific value. The feedstock for biomass power generation needs to be consistent and adequate; even though it may be a waste product, sourcing it and transporting it must be taken into consideration in the feasibility study. Potential for cogeneration exists where timber is being processed and pulp and paper is being produced, for example South Africa, Swaziland and Zimbabwe, as well as agricultural waste-to-energy. Ecofuel Africa, an EEP sponsored project in Uganda, is producing briquettes from agricultural waste.

There is a growing body of evidence that the focus should be moved from the product producing energy to the energy service that becomes accessible. A number of respondents mentioned that the lack of integration of productive uses in project concepts has reduced overall impact. Practical Action is working with various international partners in Kenya to develop a model that encompasses community engagement, while the project developers focus on their

9 *ibid*

technical/ business management roles. Rift Valley Energy in Tanzania is working with GVEP to develop productive uses with SMEs, thereby boosting their revenue. Companies such as Off:Grid Electric, d.light, Mobisol, Bboxx have responded to the drive to innovate and develop more versatile products to meet consumer needs. The introduction of multifunctional cook stoves, such as the ACE Ultra 1 in Lesotho, is an example of such an innovation as it fulfils the primary purpose of cooking, as well as a light and charger for a mobile phone, allowing the producer to charge a much higher price but greater value-for-money for the customer.

The table below provides a brief overview of the potential for the different energy sources in each of the countries. A traffic light system shows whether the potential is low (red), average (yellow) or good (green). Further information can be found in the individual country profiles in Volume II.

Table 1: Summary of technology potential per country

	Biomass	Biogas and waste-to-energy	Geothermal	Hydro	Solar PV and thermal	Wind
Botswana	Fuel-wood used by 53% of rural households, LPG in urban areas. Good potential for improved stoves.	Four biogas projects and two biofuel were funded under EEP (out of 10).	No potential	No potential for hydropower	6,640 Wh/m2/day Relatively unexploited (0.01% of total final energy consumption) Solar thermal presents 20 MW of unrealised savings	Large-scale potential is lacking as wind speeds are low (2-3.5 m/s)
Burundi	Significant potential, but untapped. Traditional biomass used for cooking and heating (98% using solid fuel for cooking).	Good experience and good practice of biogas technology, but exploitation appears to have decreased.	Potential commercial geothermal power production. No available data on feasibility.	Hydropower capacity is 1700 MW, with roughly 300 MW seen as economically viable. Two new hydro-power projects have been awarded PPAs.	5,240 Wh/m2/day Potential, but untapped. Gigawatt Globla has broken ground on 7.5 MW solar power plant.	Potential wind energy near the Lake Tanganyika, not yet exploited and little information on potentials
Kenya	80% of Kenyan households rely on wood fuel or char-coal for cooking, Biomass demand for cooking much larger than available resources. Despite active energy efficient cook stoves many are poor quality.	Growing market for small and large-scale biogas. Waste-to-energy initial stage	Potential 7000 MW geothermal	Potential 6000 MW large hydro, 3000 MW small hydro	Abundant resources in solar	Abundant resources in wind
Lesotho	Several models of stoves are in use but continued use has not been maintained. Potential for multi-functional stoves to be developed.	There is potential for biogas from cattle dung however poor workmanship has led to market spoilage.		Significant potential. 22 sites with total estimated potential of 14,000 MW of generation capacity and 4,000 MW of pumped storage capacity.	6,320 Wh/m2/day Significant potential, both for electricity and water heating purposes. Government distributions distort the market.	Significant potential with average wind speeds between 3.5 and 25 m/s. Feasibility studies to be completed in 2017. The Lesotho Highlands Power Project will install 6 GW wind generation capacity.
Malawi	High reliance on biomass for cooking, only 3% use improved cook stoves. National cook stove action plan. Forests are depleted.			Considerable potential for mini-hydro power generation	6,450 Wh/m2/day Growing market of pico solar products and SHS but still largely unexploited	

Potential: low average good

	Biomass	Biogas and waste-to-energy	Geothermal	Hydro	Solar PV and thermal	Wind
Mozambique	Over 2 MW from wood waste (pulp and paper), agricultural waste and bagasse.	Biogas: Little spread, so may be difficult to break into the market. Estimated potential from landfill 63 MW.		Potential: 1.4 GW available at priority sites identified in RE Atlas	5,770 Wh/m2/day Potential Solar PV: 600 MW at priority sites identified in RE Atlas but large pico solar market potential	Wind speeds of 4-6 m/s Potential: 230 MW available at priority sites identified in RE Atlas
Namibia	Active promotion of the invader bush; potential for further development. Wood fuel is used for cooking, but almost 50% already use efficient stoves			Potential for small-scale hydro power plants on the lower Orange River, and the Okavango River (120 MW). Risk of drought.	6,860 Wh/m2/day Significant potential, concentrated solar power IPP has been awarded. Off-grid pico-solar potential is significant but population very spread out.	6,860 Wh/m2/day Significant potential, concentrated solar power IPP has been awarded. Off-grid pico-solar potential is significant but population very spread out. Mostly used for mechanical wind mills
Rwanda	Significant need for improved stoves as biomass resources are depleted. Market spoilage due to poor quality of stoves already distributed.	Potential for biogas from cattle dung although not widespread. Government target for 20% of farmers using biogas.	Exploration and appraisal drilling ongoing: Potential: 20 MW now and over 300 MW in the long term.	Potential: 340 MW: 333 potential sites for micro-hydro-power on major rivers.	4,980 Wh/m2/day Significant potential. Large reliance on SHS in electrification strategy	Low potential, some opportunities for mechanical farming/ irrigation
Seychelles		Potential: Converting waste into biogas from prison and pig farms. Potential waste-to-energy from municipal solid waste		Potential for ocean thermal conversion. Limited size potential for small hydro (1-2 MW)	5,880 Wh/m2/day Good potential, but may be market distortions as government will donate solar PV systems to low income households	6.9 - 7.5 m/s at 80 metres. Good potential but considered expensive technology (has to replace existing thermal power)
South Africa	Significant potential, e.g. wood pellets. Cook-stoves: 10 million people still lack access to improved cooking. Focus is on LPG	Promising market within biogas, waste-to-energy. Industries (including pulp and paper) provide opportunities for embedded generation and as off-takers. Agricultural waste-to-energy potential is significant, as well as municipal		As it is a water stressed country, the potential to expand on hydro production is small scale	6,870 Wh/m2/day but market is distorted by government rollout policy	Significant potential in coastal areas and inland. The total installed wind power is 1.13 GW and it is expected to rise to reach 5.6 GW by 2020
Swaziland	Forest cover is decreasing, but still above 25%. Firewood is used for cooking. Wood residue (incl. harvest residue) from industries can produce a total of 35 MW. Sugarcane potential 95 MW	Good potential for ethanol from sugar production			5,640 Wh/m2/day Large potential, but remains untapped	3 m/s at 10 metres. Considered good for water pumping

Potential: low average good

	Biomass	Biogas and waste-to-energy	Geothermal	Hydro	Solar PV and thermal	Wind
Swaziland	Forest cover is decreasing, but still above 25%. Firewood is used for cooking. Wood residue (incl. harvest residue) from industries can produce a total of 35 MW. Sugarcane potential 95 MW	Good potential for ethanol from sugar production			5,640 Wh/m2/day Large potential, but remains untapped	3 m/s at 10 metres. Considered good for water pumping
Tanzania	Wood and charcoal constitutes 90% of TFEC. Potential for sugar bagasse, sisal, coffee husk, rice husk, municipal solid waste and forest residue. Cook stoves are generally of poor quality	Little use of biogas but potential for 165,000 installations.	ndicated potential: 650 MW across 50 identified sites. Expected to yield results akin to Kenya. Exploration of Lake Ngozi due to begin 2017-18.	Small hydropower 315 MW potential capacity, Large already in use as main source of electricity in the country. Recent droughts highlight vulnerability.	6,430 Wh/m2/day Good potential: 2800-3200 hours of sunshine/year. Potential for grid-connected solar PV: 800 MW. 17 projects were supported under EEP	Promising wind resources. Potential on-grid sites: Kititimo (9.9 m/s average wind speed at 30 metres) and Makambako (8.9 m/s)
Uganda	Wood fuel resources stressed, need for improved cooking stoves. Electricity Generation based on excess agricultural residues such as bagasse, coffee and rice husks.	SE4All Action Agenda suggested multiplying biogas plant number by 10, to 60,000. Waste-to-Energy: Logistical challenges regarding municipal waste.	Combined potential assessed to be 600 MW across four sites	Large potential, both large and small scale. 11 sites identified for small and large scale	5,910 Wh/m2/day Solar water heaters subsidised by 50%	Low potential mainly for water pumping or small-scale generation, although a wind power plant (20 MW) is under development in the east.
Zambia	Significant charcoal consumption necessitating efficient cooking initiatives. Good opportunities for embedded generation from waste products in sawmills, forestry, and sugar industry.	Opportunities for producing electricity from large poultry and dairy farms.	Some potential exists, exploration is on-going	Hydro-electricity is already being extensively used but large potential remains for small scale hydropower	6,290 Wh/m2/day Emerging market for solar home systems. PAYG models have been employed and mini-grids tested.	Limited potential
Zimbabwe	94% or rural households rely on firewood and charcoal. Strong potential for efficient stoves as highlighted in SE4ALL Action Agenda	Good potential for biogas from cattle in selected districts. Some projects and trained technicians. Biofuels: ethanol from sugar plantations		Good potential, both large and small scale, particularly in the Easter Highlands.	6,430 Wh/m2/day Good potential but has only recently begun to develop due to power shortages.	Low potential, only for pumping. Average wind speeds are estimated at 3.5 m/s.

Potential: low average good

2.3. Stakeholder review

Stakeholder maps for each country can be found in Volume II and provide a non-exhaustive list of the main stakeholders.

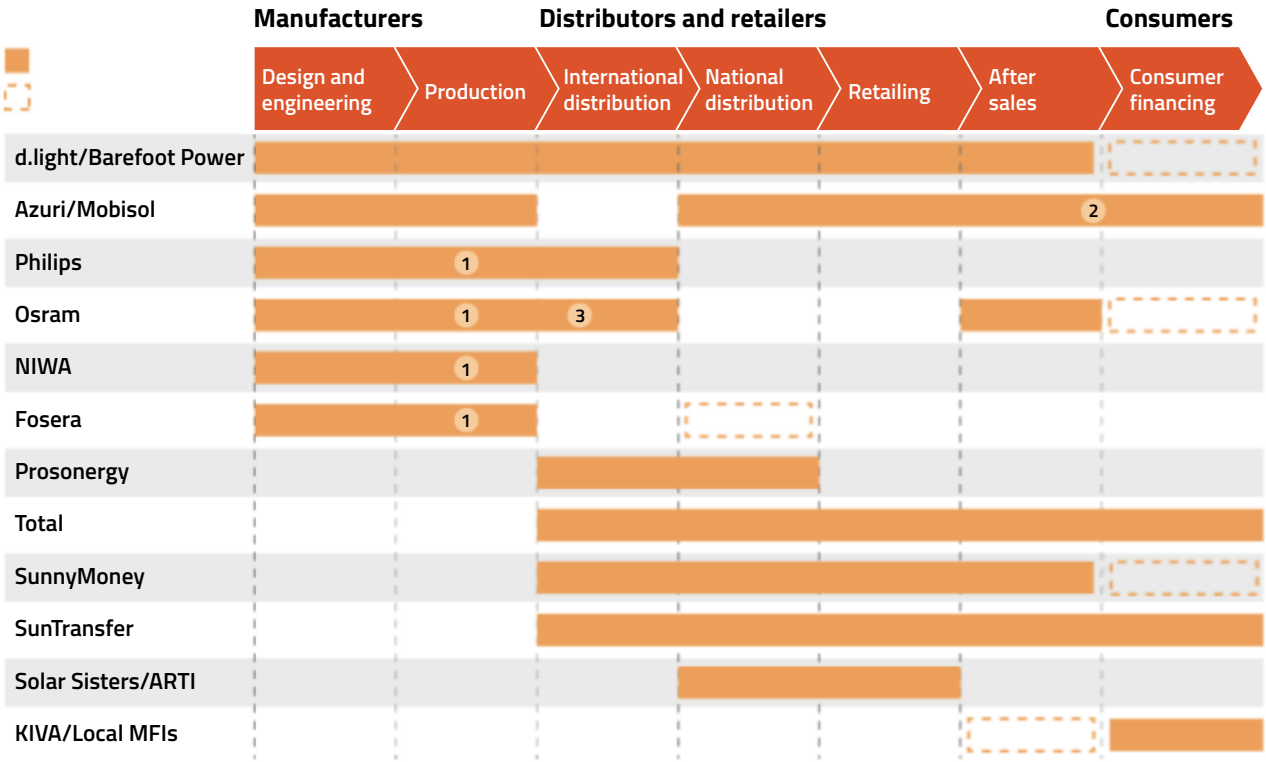
Each country in the region has established a similar institutional framework for the energy sector, including a ministerial department that leads on policy and planning, a regulatory body that manages and monitors service delivery, licences and tariffs, an agency or department responsible for promoting rural electrification, and the national utility. In general, due to the link between energy consumption and greenhouse gas (GHG) emissions, ministries of environment are often also closely involved in the energy sector, particularly in energy efficiency. The level of capacity of ministry staff varies significantly across the region. Countries like Burundi, Malawi, and Namibia are clearly less exposed to RETs and how they can be used in their own context.

The participation of the private sector in off-grid energy varies across the region significantly. The development of the off-grid market in East Africa has been greatly facilitated in recent years by mobile technology. There are a number of examples of expatriate entrepreneurs that have seen the potential to apply simple technologies to the local context and have developed innovative business models very successfully. However, these ventures were supported by grant schemes and have yet to reach commercial viability. Local capacity building has taken place through these enterprises.

There is little engagement with industry associations as agents of change. The capacity of the associations is recognised as being limited to support industry and represent their interests to policy makers. There are some positive examples of effective association engagement in South Africa that could potentially be replicated to other contexts. The African Mini-Grid Developers Association is establishing chapters in Kenya and Tanzania and is working with the Rockefeller Foundation to develop innovative financing models. In broad terms, the degree of cross-border business concept transfer is much lower than would be expected. Simply sharing information does not constitute knowledge exchange and therefore it is important to develop business partnerships across borders. There are significant risks of entering into neighbouring markets for existing businesses and therefore these cross-border alliances can be valuable in minimising the initial risk, particularly if supported with concessional financing or grants.

The role of financing institutions is vital for scaling up projects that are proven. In general across the region, the number of commercial institutions that are prepared to provide loans for renewable energy is increasing. In most countries in the region, commercial banks are beginning to offer green loans. However, these loans are offered to single clients and require proof of income before they will be issued – making them inaccessible to the underserved. The institutions continue to be risk averse and the terms of the loans are not attractive, applying interest rates between 14% in Kenya to 24% in Zambia. Therefore, most commercial institutions require the support of the development banks or donors to buy down the risk through the provision of soft loans or guarantees. Micro-financing institutions are offering credit to consumers particularly in East Africa in collaboration with companies such as iSmart, an EEP supported project. Crowd funding is also being used, with Kiva partnering with energy entrepreneurs to develop their customer base. *Figure 5* below illustrates which of the large off-grid players currently offer financing solutions.

Figure 5: Industry value chain coverage – examples of some of the initiatives offering consumer financing



[1] Manufacturing certain components at own factories.
[2] Implementing pay-as-you-go solutions.
[3] Distributing only in own projects.
Note: MFIs are microfinance institutions.
Sources: United Nations Foundation; A.T. Kearney analysis.

Source: Humanistic Management Centre, 2016

Pay-As-You-Go (PAYG) companies have found themselves with significant working capital shortages and foreign exchange risks as their loans are agreed in hard currency. Lending money is a core business for MFIs and they are now beginning to move into the PAYG segment. FINCA (under Bright Life) in Uganda is one such example, providing loans over four to six months for solar home systems or cook stoves. Using a borrow-to-save concept, the borrower receives some money back at the end of the loan as savings and can obtain follow on credit provided they have a good credit record.[10] However, for most countries, the availability of consumer financing in the off-grid space is not being addressed adequately.

Local communities are engaged primarily through NGO-funded initiatives. On the whole, the private sector does not engage in understanding their communities and developing relationships in order to better serve local community needs. This is not their core business and consumes resources. This may reduce revenue generation, as developing the trust of the customer and their community is considered to be an important element of gaining a market share.

Each country has a research institution that is primarily responsible for furthering and testing the use of RETs in the local environment, testing various models. The role of the SADC Centre for Renewable Energy and Energy Efficiency (SACREEE) recently established in Namibia will be critical in engaging with the local centres of research to develop

[10] *CGAP (2017) Solar Energy: A New Frontier for Microfinance, accessed on 5th July 2017, http://www.cgap.org/blog/solar-energy-new-frontier-microfinance*

national capacity across all stakeholder groups. SACREEE has just launched the SADC Renewable Energy Entrepreneurship Support Facility in collaboration with IRENA to "enhance and strengthen the capacity of small to medium entrepreneurs in assessing the business potentials of sustainable energy, develop viable business plans and loan requests, and managing and maintaining their businesses successfully".[11]

Donor-funded financing facilities

There are a large number of financing mechanisms in Southern and East Africa aimed towards the renewable energy and energy efficiency sectors. The snapshot of current financing mechanisms shown in Volume II cover a broad range of sectors, not only energy. However this amount is far from enough. According to the IEA, projected investments in mini-grid and off-grid technologies are estimated to be US$ 6 billion per year but investment needs are more than four times greater, and US$ 1 billion out of a projected US$ 4.5 billion investment is available for modern cooking technologies.[12]

The main concern of funders in the sector is the project pipeline that can support the achievement of the ambitious goals set for 2030. An estimated 1.2 billion people do not have access to electricity 183 million of which are in the EEP S&EA III region.[13] Addressing the scale of this demand requires considerable action. Various models are being tested and for those models that are successful, of which the pico-solar are the most prolific, scaling up the concept is not achieved in the short term. Achieving commercial viability often requires economies of scale to be reached due to low profit margins, and in many rural cases, requires continuous subsidy.

Currently, there are no financing mechanisms that address the regional coverage of EEP for early stage concessional financing combined with business development support with a view to improving off-grid energy access. Of the mechanisms that are operating in a similar domain, there are limits to the geographic area, technology coverage, scale of support and/or appetite for risk that make EEP a unique value proposition. There is however scope for mechanisms to partner, establishing their role along the value chain and partnering to enhance the project pipeline.

Mechanisms addressing off-grid renewable energy access

The financing mechanisms below provide an example of the support to off-grid renewable energy solutions and businesses, although they only offer small-scale support and are limited in their scope. There are no mechanisms that have the geographical coverage and volume of grant contributions that EEP does.

- **Off-grid Energy Challenge** is one of the initiatives under Power Africa and has since 2013 funded over 70 grants of up to $100,000 per project, giving access to off-grid energy solutions to rural communities and underserved. It covers six Power Africa countries, two of which (Kenya and Tanzania) are in the EEP S&EA III.
- **Beyond the Grid Fund for Zambia** will be quite similar to the proposed EEP, as it provides a blend of grant and concessional funding (loans and guarantees) to rural energy providers with market-based approaches expanding energy access to off-grid solutions or isolated mini-grids. Beyond the Grid Fund for Zambia initiated calls for proposals as recently as 2016 and received proposals in 2017.

[11] *IRENA (2017) SADC Renewable Energy Entrepreneurship Support Facility - Kick-off Meeting, accessed 5th July 2017 http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=30&CatID=79&SubcatID=3844*

[12] *ODI (2015) Universal energy access: can we make it sustainable? accessed 25th July 2017 https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/9866.pdf*

[13] *IEA (2016) World Energy Outlook 2016 – Energy Access Database accessed 5th July 2017 http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/*

- **Renewable Energy Challenge Fund (RECF)** operates on a similar basis to EEP although only in Uganda. It provides grants of up to $150,000 to profit-oriented private organizations with clean cooking solutions in Uganda, especially in rural areas. The RECF was launched in 2017.

Mechanisms where synergies with EEP could be created

Many financing mechanisms promote off-grid renewable energy solutions to reach areas that would normally be supplied without buying down the risk. We have listed below several financing mechanisms that we consider have synergies with the EEP in the following respects: off-grid renewable energy, small-scale on-grid renewable IPPs, type of financing, regional focus (Southern and East Africa), and commercial approach.

- **The Nordic Climate Facility (NCF)** managed by the NDF currently supports 27 projects in the EEP S&EA III region, four of which were awarded under the Renewable Energy and Urban Adaptation window. The objectives of the NCF are similar to those of the EEP, to facilitate knowledge exchange, increase capacity in the region and contribute to sustainable development albeit focusing more on climate change mitigation and adaptation, of which energy is an important part. Therefore, bringing the management of the two programmes under the same fund presents synergies, reflecting the link between energy use and the environment.
- **GET FiT Uganda** supports small-scale renewable energy generation projects promoted by private developers with results-based grant funding, although they are on-grid and larger scale (between 1 MW and 20 MW in installed capacity) than the EEP projects. A premium payment on the FiT is being disbursed to achieve commercial viability. This grant is paid in two steps. First on confirmation of commercial operation, and the remaining half is disbursed alongside the PPA according to energy delivered. GET FiT started in Uganda and supported 17 renewable energy projects with a portfolio of 160 MW capacity, making Uganda the second highest promoter of IPPs in the EEP S&EA region. The initiative is now being rolled out to Zambia. Namibia and Mozambique have also showed an interest in establishing a similar scheme due to its success.
- **Energising Development (EnDev)**, like EEP, provides grants to off-grid extension projects, installation of power plants, and distribution of solar home systems, particularly in rural communities. Off-grid solutions include photovoltaic systems, micro hydro power plants, improved cook stoves, and biogas. A good number of projects have been funded in Burundi, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, although EnDev operates globally in 25 countries in Africa, Asia and Latin America. However an important difference between EEP and EnDev is that EEP provides seed funding to initiatives in their formative stage when achieving results may be limited, whereas EnDev is a Results-Based-Financing (RBF) mechanism that rewards the energy products or services sold. Innovative solutions that have been proven through EEP support may therefore be ready to transition to the EnDev RBF.
- The **Global Alliance for Clean Cookstoves** has various financing facilities: the Pilot Innovation Fund (up to US$ 150,000), the Women's Empowerment Fund, Catalytic Small Grants programme (up to US$ 100,000), the Spark Fund (up to US$ 500,000), the Working Capital Fund in partnership with Deutsche Bank, and the Capacity Building Facility. To date one project is supported in Lesotho, Malawi, Mozambique and Zambia and nine projects in East Africa.

Although these are not regional financing mechanisms, the success of GET FiT Uganda is a good practice model, as it has attracted the interest of stakeholders in several countries. The reason behind this could be that a good framework for IPPs was already in place in Uganda and GET FiT made best use of the framework, responding to the needs of the private developers.

Mechanisms that facilitate scale-up

Larger scale off-grid electrification projects tend to be promoted through non-grant financing such as loans, debt, equity, guarantees, or a mix of financing mechanisms, some of which are described below.

- Africa Enterprise Challenge Fund (AECF) has recently launched the **Renewable Energy and Adaptation to Climate Technologies (REACT)** window and provide repayable and non-repayable grants (between US$ 250,000 and US$ 1.5 million) to private businesses entering the household solar system markets in Malawi, Zambia, and Zimbabwe for off-grid rural electrification.
- **Electrification Financing Initiative (ElectriFI)** seeks to support on-grid and off-grid renewable energy electrification investments globally that will lead to new and improved connections for rural populations by supplying development finance, debt, quasi-equity, equity and guarantees. The maximum amount of any financing solution is € 10 mil.
- **Facility for Energy Inclusion (FEI)** also provides debt financing to small-scale projects (on-grid, mini-grid and off-grid) and small-scale IPPs in sub-Saharan Africa, but the size of each project is under US$ 30 million.
- **Shell Foundation** aims to increase the provision of energy to the poor through the innovation and scale-up of decentralised energy solutions, such as solar lighting, biogas, biomass gasification, and the sale of low-cost energy products. The Foundation takes an even more commercial approach and only selects a small number of very promising off-grid electricity projects in Kenya, Rwanda, and Tanzania. The Foundation was established in 2000 and has supported various sustainability themes since. However, the energy sector is one of the many sectors covered. A number of grant beneficiaries have actually begun as pilot projects with EEP support and received scale-up funding from the Shell Foundation, for example d.light and Off:Grid Electric.

These financing mechanisms and other financial products offered by development banks typically target larger off-grid or on-grid renewable energy projects with significant potential. Notably, projects that have already proved their replicability and scalability and that are ready for the construction phase. Some of the successful EEP projects planning to expand or up-scale could be suitable for this type of financing mechanism.

There are also several initiatives that offer non-financial support, including capacity building (database, advisory services, match making, and other information services), including the SE4ALL technical assistance facility and the Africa Renewable Energy Initiative (AREI). One of the most comprehensive is the **African–EU Renewable Energy Cooperation Programme (RECP)**, which provides knowledge and business support. A database has been developed detailing existing financing mechanisms and also providing market information on several countries including Botswana, Kenya, Lesotho, Mozambique, Rwanda, South Africa, Tanzania, Uganda, Zambia and Zimbabwe. Furthermore, small and medium renewable energy projects can seek advisory support on project development, and structuring and accessing finance.

2.4. Market review

The market review considers the market as it relates to small-scale on-grid IPPs, mini-grids and stand-alone solar home systems and the associated market barriers. A key learning from other similar interventions is that the market needs to drive the technology – an obvious statement; however this is not being practiced broadly. In addition to this, planning should always be defined with a view to growing demand.

2.4.1 Market models

Small-scale on-grid IPPs

Small-scale IPPs have become more common across the region, primarily due to the challenges in meeting demand and concerns regarding energy security. South Africa has been the leader in the region in achieving this, although has had less success in establishing PPAs for small projects (below 10 MW). As mentioned above, the Get FiT project increased the number of IPPs in Uganda.

The interviews with project developers and financial institutions highlighted the importance of standardisation, predictability and fixed policy for the purposes of on-grid IPPs. The commitment to fixed methodologies for establishing FITs, standardisation of PPAs and the issuing of government guarantees are a requirement to attract investors. However, off-taker risk is significant in this region due to the financial standing of the national utilities, the primary off-takers, their inability to charge a cost reflective tariff in most countries, with the exception of Namibia and to some extent South Africa, and the unpredictability of policy. However, national governments are not keen on exposing themselves to risk by providing government guarantees and in some cases, the national legislation does not allow them to do so.

In the case of Namibia, the recent small-scale IPP procurement process that identified 14 projects has apparently gained ground through the Development Bank of Namibia (DBN) which is providing support to the selected projects, giving commercial banks some reassurance. However, project developers are restricted in terms of the financing they can source, meaning that only the large and diverse companies are able to source funding based on the assessment of their balance sheet.

Improving the financial standing of national utilities is recognised as a challenge unless the generation and distribution of electricity is decentralised. Project developers in Tanzania have had significant problems obtaining payment from TANESCO as its debts exceed US$ 300 million having received US$ 250 million in loans in 2013.[14] Africa Greenco proposes a temporary solution, using the portfolio approach to trade within the Southern African Power Pool (SAPP), ensuring that there are buyers and off-takers for the renewable energy that is fed into the grid. This will provide investor and IPP confidence and increase the flexibility of the SAPP to respond to demand. However, it doesn't address the core issue of poor utility management and is a controversial measure on that basis.

Few on-grid IPPs are installing a distribution network locally to ensure that there is an alternative off-taker, thereby reducing the risk further, although the regulations need to allow for this. Although this increases the investment cost, it does also allow for local communities to benefit, and potentially for energy access to be improved. Rift Valley Energy in Tanzania increased their distribution network to mitigate the off-taker risk. With the concerns regarding the utility's debt portfolio, IPPs are reticent to establish PPAs.

Mini-grids

The mini-grid market is growing however the business concept has yet to be proven to be viable. The high, up-front capital investment often requires that users are limited to accessing basic service levels. In order to generate adequate revenue to cover operational expenditure, tariffs need to be cost reflective, although this is not permitted in some countries as it exceeds national tariffs, including Mozambique and Tanzania. Identifying guaranteed off takers is a requirement for mini-grid systems but is not always easy to secure in rural areas without a local productive industry. There are examples of telecommunications towers providing the anchor load, as well as tea factories and milling activities. However, this is context dependent.

[14] *https://www.bloomberg.com/news/articles/2017-02-16/tanzania-power-debacle-casts-shadow-over-12-billion-debt-plan accessed 25 July 2017*

The perception that off-grid electricity provides an inferior service in comparison to grid electricity is related to public awareness and, where mini-grids have been built before, the way in which mini-grids are designed and sized, primarily determined by the cost of investment. The focus needs to be on the quality and relevance of services being provided rather than the modality for the provision of energy. Sizing of these systems for implicit demand is challenging as demand increases rapidly. Combining energy access services and working with local communities to develop how they can use the energy effectively is being tested through a study performed by Practical Action, under which income generation increased by engaging local communities. However, this is not core business for project developers and therefore requires partnerships to be established to develop local business potential.

In order to achieve both commercial viability and impact, the productive uses of energy are fundamental, a fact recognised by stakeholders across the region. Numerous stakeholders have emphasised the importance of the value chain in achieving this. However, most private businesses do not see it as their role and do not necessarily have the internal competencies to develop the value chain, despite the likelihood that it will increase the profitability of their business. Practical Action is working with several private companies in developing a methodology to engage the local community to build efficient end use of the energy being provided and thereby boost the IPP business model. With support from EEP, Absolute Energy Servizi S.r.l. installed a solar PV mini-grid on Kitobo Island, Uganda, included a microfinance fund, and provided training to the users to promote productive uses of electricity, which would allow the company to maximise their income during the 20-year concession period.

More broadly, the debate about the commercial viability of mini-grids is whether achieving it is possible to supply the last mile customer, as revenue does not cover costs. Organisations like the IFC and Rockefeller Foundation consider that public-private partnerships are necessary. There is therefore a need to explore partnerships that bring in cross-subsidy models and the role of government in the provision of energy to rural communities.

Stand-alone solutions

The growth in the stand-alone solutions market has been exponential in East Africa. According to the Overseas Development Institute, Kenya, Tanzania and Ethiopia accounted for 78% of the sales of household solar solutions in 2014, reaching a market penetration of 15-20% of off-grid households. PV modules have decreased in price by 85% over the last ten years, and if efficiency savings are incorporated into appliance design, this will realise future cost savings.[15]

The amount spent on traditional lighting and cooking fuels (kerosene and charcoal) is significant and may be more than the cost of electricity from the grid. However, poor households cannot afford the upfront investment for the solutions on offer.[16] The rapid growth in the PAYG market addresses this challenge and is significantly facilitated by the use of mobile pay technologies to manage the client relationship. It may also reflect the acceptance in these countries that the grid may not arrive in their areas for the next few years. However, in order to increase the productive and efficient use of systems, efficient DC appliances need to be supplied. A number of project developers are offering modular systems that can be upgraded as purchase power increases, graduating from simple lighting and mobile phone charging to the use of fridges and TVs in homes.

Research is being performed to identify models for solar PV installations that are adapted to local contexts, which are varied across the region. The Rockefeller Foundation is supporting research and design (R&D) in India, identifying suitable battery configurations and technical means of reducing capital expenditure. The aim is to support this process in Africa within companies, rather than through external experts.

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15 *Overseas Development Institute (2016). Accelerating access to electricity in Africa with off-grid solar. Accessed 25 July 2017 at www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/10246.pdf.*

16 *IEA (2014a). Africa Energy Outlook – A focus on energy prospects in sub-Saharan Africa. Paris: International Energy Agency*

It is important to adapt successful concepts in the context of the local economic, social, cultural and environmental framework. The proliferation of mobile phone technologies differs across the region and therefore, there is a limited culture for making payments using mobile pay in Zambia, Malawi, Namibia, Swaziland, Mozambique, Lesotho, and even South Africa. A lack of trust in the mobile pay mechanism is partly to blame but also the limited development of the infrastructure in rural areas. The poor performance of some solar home systems and the corresponding consumer experience has affected the market highlighting the importance of quality standards and after-sales maintenance. The responsible disposal of batteries is often overlooked and can have very negative environmental consequences. Many private companies will retrieve spent batteries when supplying new ones but will not pay for the battery. Mobisol has established a responsible recycling programme for the batteries it supplies. Incorporating this should be taken into consideration for all projects that are donor supported.

Cook stoves and improved biomass/ biogas for cooking

Cook stove initiatives have been championed in many countries for decades, not least by GIZ. Many of the improved cook stove models that are in the market across the region are based on GIZ defined designs. However, there is a perception that the market is saturated, although this is not the case. The scale of the unsustainable demand for wood fuel and the overall dependence of the rural poor on traditional biomass would in fact have a much more significant impact if addressed, particularly in terms of CO2 emissions, than the introduction of light in the home. The commercialisation and mass distribution of energy efficient cook stoves is one of the most effective measures to improving access to energy and therefore projects promoting the large-scale commercialisation of stove production are valuable agents of change. Based on the feedback from competitors to Burn Manufacturing's Jikokoa, an EEP funded project, the success has been influenced by the quality of the stove and the national marketing campaign, leading to its broad acceptance.

2.4.2 Market barriers

The main barriers to establishing a vibrant off-grid renewable energy access market relate to the general business climate, the availability of suitable capital investment, establishing economies of scale, the development and retention of human capital, and failures along the value chain. These barriers ring true for all types of project intervention that are attempting to establish a successful private sector model.

> The survey of EEP grant recipients revealed that the most significant barrier continues to be access to finance. It is therefore not surprising that the majority of respondents requested continued financing support, including support in sourcing investors going forward. Several suggested a transition to other forms of financing, such as low interest loans. Business development support did not feature as strongly.

The capital investment costs for mini-grids is significant. Based on the amount of investment required to achieve universal energy access, it is perhaps not surprising that access to finance is inadequate. There is a general increasing willingness of commercial banks to provide loans to renewable energy, although for mini-grid investments, guarantees are usually required. Transaction costs are still considered to be high and the management of the portfolio intensive. In general, current financial products are not suited to the small-scale off-grid project. The portfolio approach has been established as a solution to this challenge, such as SUNREF and Sunfunders. The AFD Green Credit Line programme in Namibia and South Africa has encouraged ABSA and Nedbank to provide loans for solar home systems however off-grid, decentralised solutions are yet to be supported. Even where consumer financing is available, it will only be issued to those that can prove a regular income, therefore excluding the bottom-of-the-pyramid segment.

Figure 6: Responses of EEP grant holders to the barriers that motivated them to apply for EEP funding

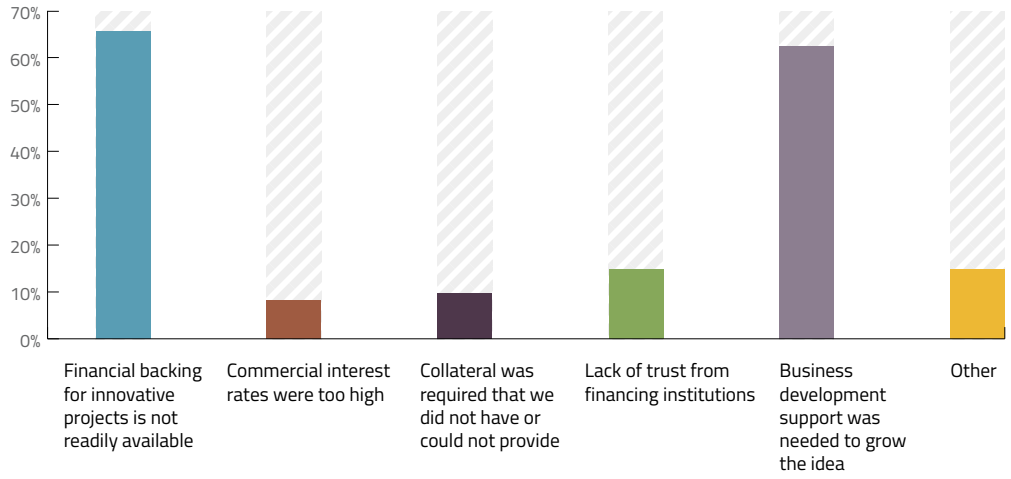
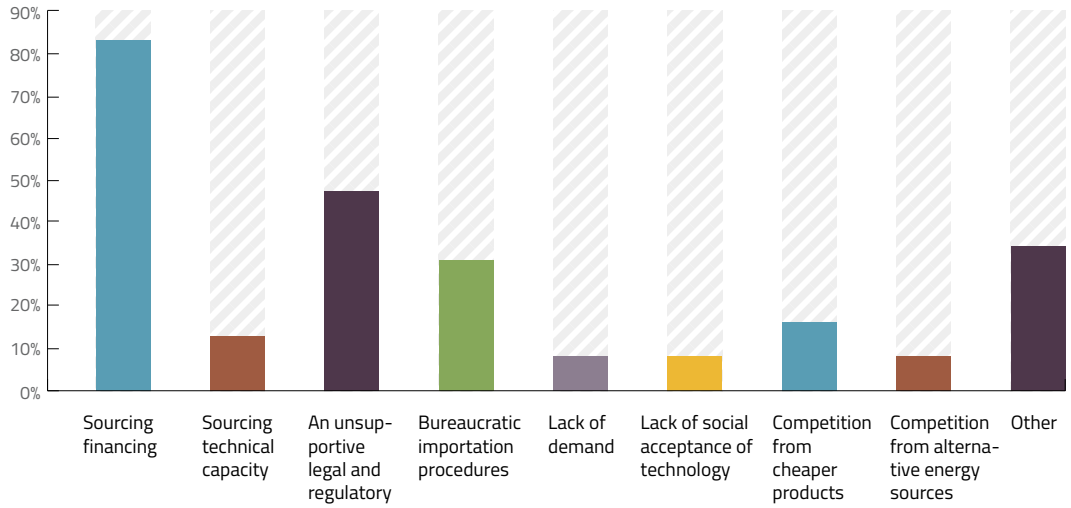


Figure 7: Responses of EEP grant holders to the barriers they are facing currently



Establishing a workable business model for mini-grids has proven difficult for many companies. One of the most significant challenges in establishing successful off-grid, rural enterprises in Africa is the dispersion of the population in rural or remote areas. This is particularly the case in Botswana, Namibia, Mozambique, and Zambia but does apply to most countries in the region. The economies of scale cannot be achieved and therefore the private sector focuses on densely populated areas, where purchase power may be greater and the infrastructure investment not so high. The question therefore arises whether there is a commercially viable business model. As with all public services, there are market segments for which the provision of services cannot be met by the private sector alone.

The subsidies provided by governments to the electricity tariffs and fossil fuels, particularly kerosene, create market distortions that reduce the viability of the commercial models. The market-based approach requires an environment where the prices are self-regulating. However, private companies are competing with subsidised services and in some cases governments are not willing to extend those subsidies to privately run services.

> The particular value-add of grant financing is in providing the incentive for companies to take risks that they would not take otherwise. There needs to be some recognition that the development of business concepts and testing of appropriate models may take longer than the initial grant funding period. Therefore, there needs to be some recognition that business incubation is a long-term process.

2.4.3 Energy efficiency and the EEP S&EA

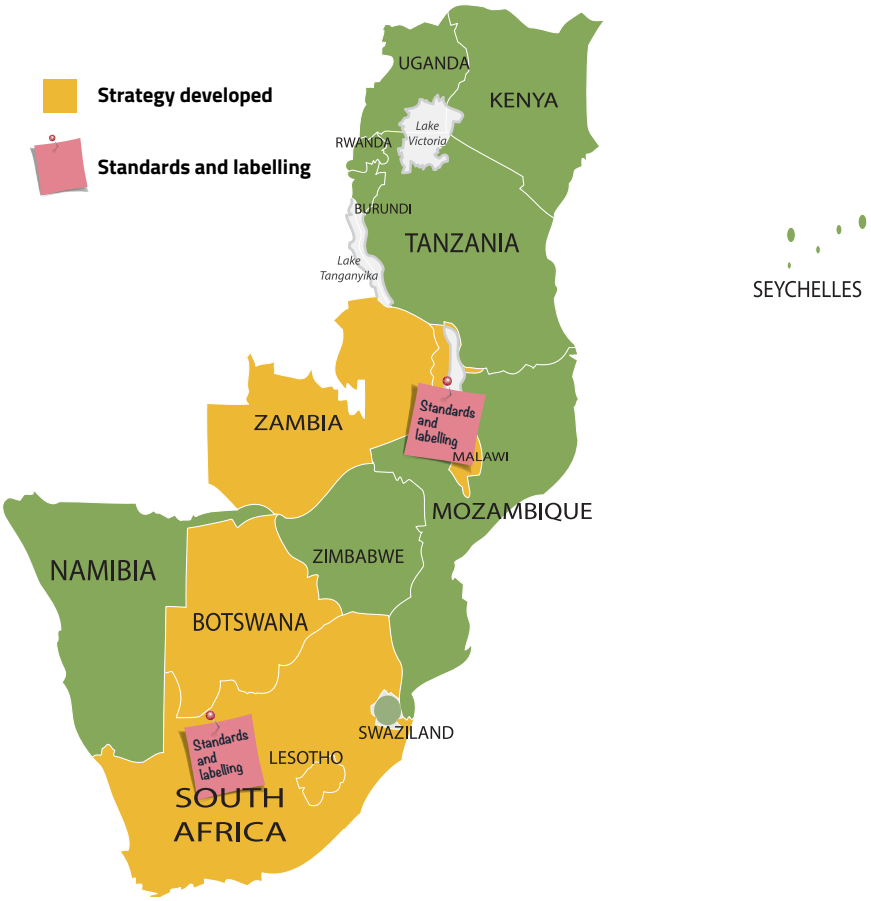
With the exception of South Africa, energy efficiency is neglected across the region. Five countries have developed energy efficiency policies and two have introduced standards and labelling as shown in Figure 8. However, more importantly energy efficiency is only discussed in relation to national policy rather than as an issue that needs to be mainstreamed at all levels of society and in all sectors.

Energy efficiency is a crosscutting theme along the value chain, from generation, to transmission, to distribution and consumption. Bearing in mind the focus of the EEP S&EA, which is to improve the quality of life of the poor, it is generally considered to be premature to address energy efficiency in an energy non-intensive user group until the consumption of these users reaches more significant levels. However, this approach is counter-productive for two reasons:

1. The energy resources available to the rural poor are generally limited, reinforcing the importance of optimising the resources that are available;
2. As standards of living increase, energy consuming behaviour intensifies. Therefore, ensuring that energy efficiency is mainstreamed from the outset supports resource efficiency going forward, thereby mitigating a demand explosion.

On this basis, there are two primary opportunities for EEP S&EA to engage in energy efficiency. On the demand side, energy efficiency is critical and describing how it will be integrated into the design of the project should be a requisite element of the application for funding. The approach should address technical and behavioural efficiencies, considering the energy rating of appliances, as well as user awareness.

Figure 8: Countries that have developed an energy efficiency strategy and standards and labelling



On the supply side, the opportunity exists to encourage the provision of energy efficiency services to social institutions, including schools, community centres and clinics. In South Africa, Energy Service Companies (ESCOs) have begun to take a portfolio approach to social institutions and, in so doing, increasing the revenue from energy savings to a level that is commercially attractive. These initiatives may require seed funding to get established and undertake initial renovations before revenue is generated. Grants could be provided for equipment required to undertake comprehensive energy audits and for monitoring purposes and concessional loans offered for infrastructure costs.

The multiple benefits of supporting such ventures include the release of funding that can be put towards improving service delivery but also the jobs created and the improvement in the quality of energy services received, e.g. improved lighting. The main barrier to achieving this may be the regulations that dictate whether unused funds (energy savings) can be reallocated to other budget lines rather than being returned to Treasury.

3. Implications for the EEP programme

Recognising the value of the EEP Phase I & II

There is a general recognition that the EEP S&EA has supported the private sector and NGOs in establishing services that ordinarily would not have been possible. The flexibility of the mechanism and the technologically agnostic approach is appreciated and gives rise to the private sector innovation that is required to make the transformational change for energy access.

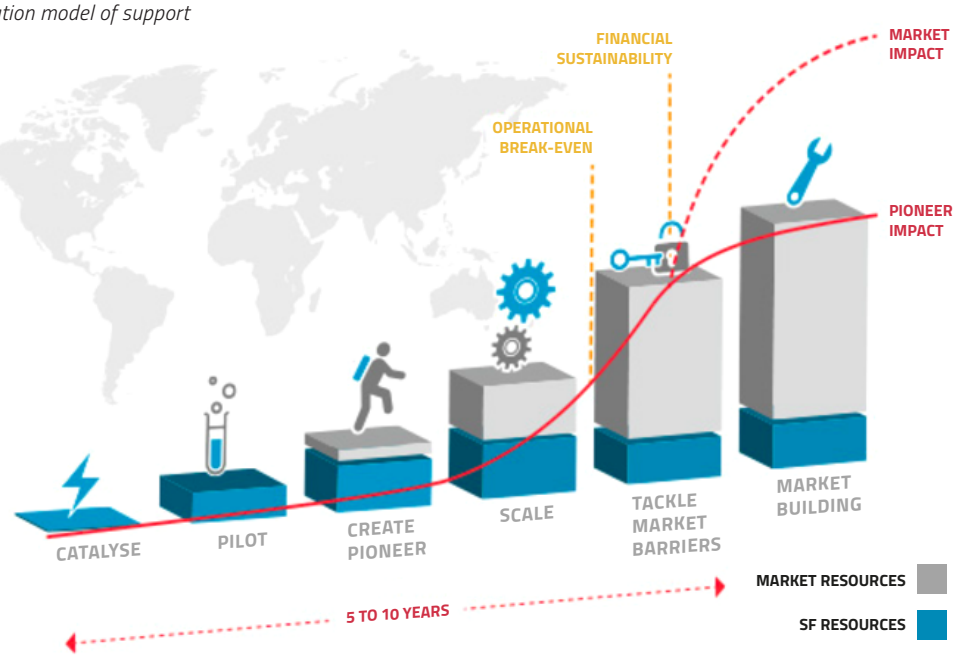
This approach should be maintained without applying strict parameters that developers need to adapt to.

Feeding the project pipeline

The discussions with other funders of energy access projects in the private sector have highlighted that there is still significant need for capital investment in order to develop the project concepts that are necessary for development impact. The majority of programmes are supporting ventures that have a demonstrated performance record, reducing the risk of failure and ensuring that the management capacity is in place. A number of these financing facilities work very intensely with their partners reporting that mentoring is a necessity to ensure effective business development. The donor expectation of a three-year investment has proven to be unrealistic. The Shell Foundation, for example, has developed a model that recognises the long-term commitment required to develop a project idea to full commercial viability. However, they tend to engage with businesses that can demonstrate their management capabilities.

Organisations including the Shell Foundation and the IFC considered that the value of EEP is in identifying innovative projects and supporting them in developing and testing concepts to the point where they can feed into other financing mechanisms. The EEP market niche appears to be in **developing the project pipeline.** The demand for this is high, particularly in light of the credibility given to EEP funded initiatives. In developing the pipeline, the horizon for support and business development is more realistic.

Figure 9: The Shell Foundation model of support

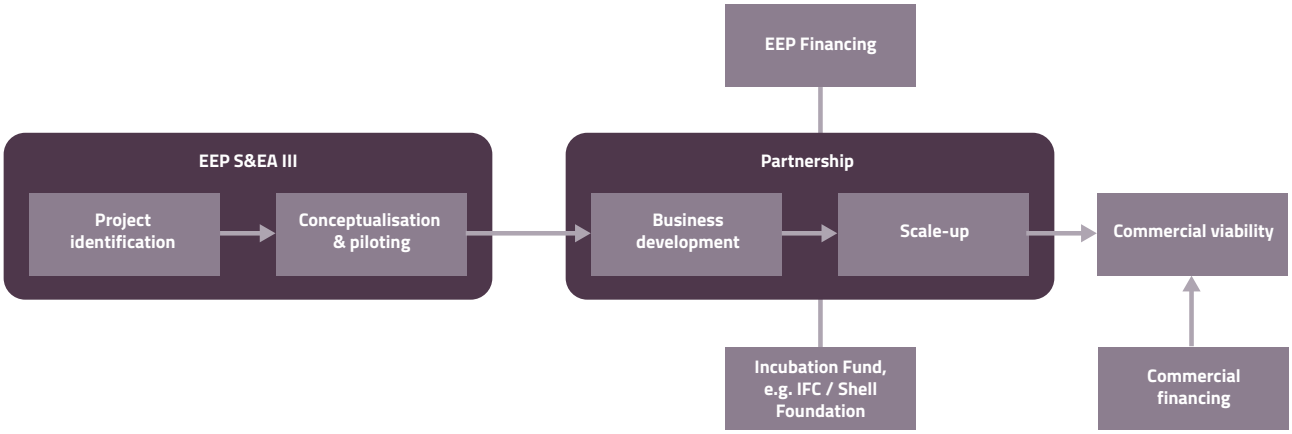


Direct innovation funding and indirect catalytic funding

One potential model for EEP going forward is to be directly engaged with developers in the catalytic phase and once they have transitioned to other funding facilities, to indirectly support them by contributing to the financing of those projects under the oversight of the next level of funder, as shown in Figure 10 below. This will also support the intended focus of the EEP Trust Fund in having separate windows of funding that reflect the development of the business concept.

> Based on feedback from project developers, the initial stage of funding needs to be in the form of a grant to buy down the risk of entering into a new venture while the catalyst funding could be in the form of concessional loans or guarantees, potentially administered through financial institutions or other funders.

Figure 10: Potential models of financing for EEP Phase III



Results-based financing

The use of results-based financing has been recommended by several challenge funds to improve the achievement of results. Although EEP I and II did implement this by identifying milestones of achievement as reported by project developers, the results framework could become a more fundamental performance management tool for which the verification of achievements is required before payments can be made. The Bix Fund uses this model: the anticipated impact is monetised, similar to carbon credits, and pre-financed.

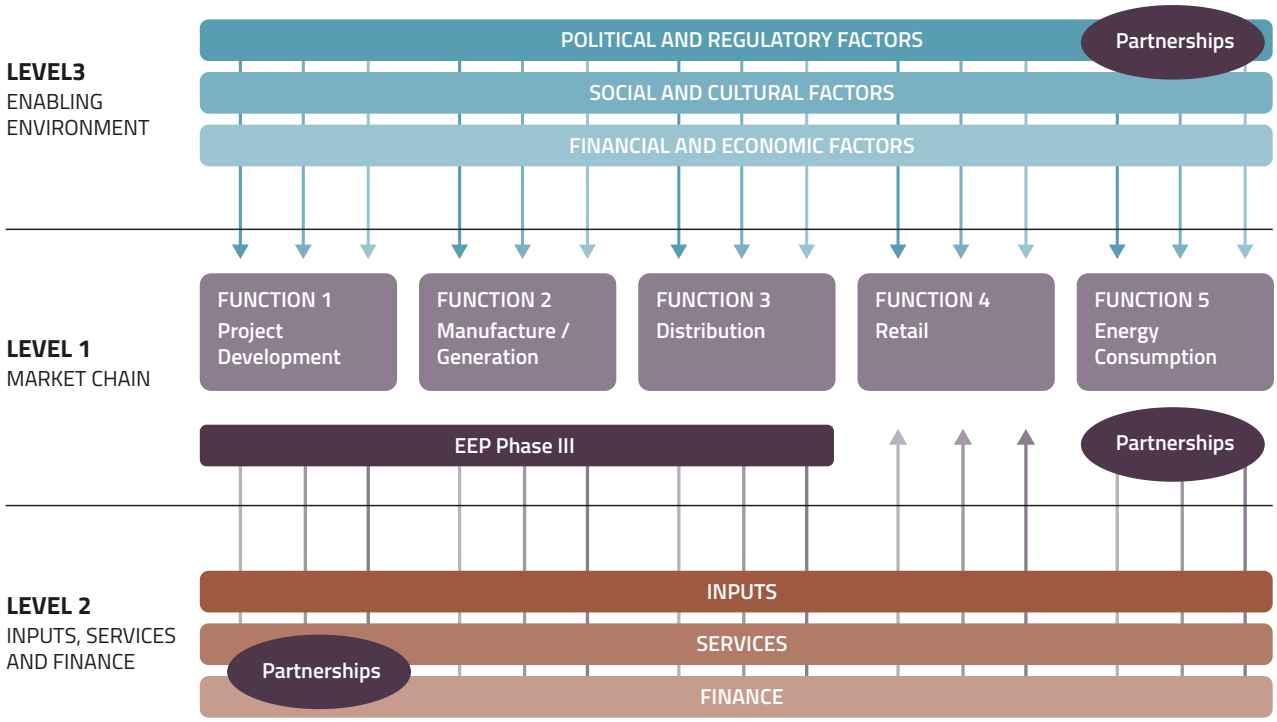
Promoting results-based financing could usefully be applied to EEP projects that have begun operations. In the transition from grant funding to concessional financing, developing results-based indicators will serve both as an incentive and will facilitate the monitoring of performance.

Working to EEP's strengths by developing partnerships

Although the role of the EEP is not to address the barriers presented by the enabling framework or the inputs that ensure project sustainability, the success of EEP supported initiatives cannot be divorced from the market system. Many of the barriers referred to in this report may not be within the sphere of influence of the private sector.

Therefore, in order to support the developers in overcoming these barriers, the EEP could form partnerships with agencies that are engaged in those activities and would be better placed to deliver results.

Figure 11: EEP Phase III in the value chain and its partnerships[17]



The degree of engagement of EEP at the level of policy does not need to be extensive however by establishing partnerships with other programmes, it may be possible to encourage the national authorities to address specific bottlenecks. Making use of organisations such as NGOs to work with communities on developing productive uses within a community, project developers can be sure that the demand for services will increase and the viability of the business improved. It is important that EEP focuses on its strengths, which has been identified by various stakeholder groups as catalysing the market and testing business models to increase energy access for the poor.

Job creation, youth and gender mainstreaming

All the countries in the EEP S&EA region recognise the importance of job creation and particularly as it relates to the youth and particularly women, recognising that youth unemployment can lead to migration and conflict, as well as poor standards of living. There is a definite opportunity for EEP S&EA to support these national priorities by encouraging calls for proposal that build local productive use, thereby creating jobs.

[17] *Based on: European Union Energy Initiative Partnership Dialogue Facility (EUEI PDF) (2015) Building Energy Access Markets: "A Value Chain Analysis of Key Energy Market Systems"*

The projects promoted by EEP bring about benefits for women in the home in terms of the improved quality of life from improved energy access. The opportunities for engaging women in energy access occur along the value chain. Various projects have incorporated women in the selection of employees or entrepreneurs, supporting consumer and entrepreneur financing facilities that encourage women, and capacity building in productive uses. As described above, the NGO-private sector partnership that supports community development through the stimulation of productive use, engaging women, may be a more balanced approach to ensuring socio-economic objectives are met.

4. Overall opportunities across the region

The discussions above highlight the challenges that are faced across the various market models and countries. However, what is clear is that there are also significant opportunities for the private sector to address energy access needs through the development of locally relevant market models, particularly in countries such as Malawi and Zimbabwe.

With all the countries in the region, reducing the unsustainable and alarming consumption of wood fuel is considered to be a priority. Therefore, supporting improved cook stove manufacturing on a large scale, rather as it is being done in many countries as a cottage industry, is recommended to continue under the EEP S&EA, not least because these projects directly reduce carbon emissions, one of the EEP performance metrics. Significant marketing efforts are needed to gain user acceptance.

Please note: complete country profiles are provided in Volume II.

Botswana

The Government of Botswana has introduced a REFIT and the most significant potentials are for solar PV, biomass and biogas. However, the political pressure is now on to get the coal-fired power stations to function. As with a number of countries in the EEP S&EA region, the economies of scale are much weaker in rural areas due to the distribution of the population. Therefore, it will be important to learn from the 1 MW solar PV village concept and other approaches in the region to identify locally appropriate business models. Models for payment (PAYG) and after-sales service may need to be tested to establish feasible arrangements, particularly as mobile money has only recently been introduced.

Burundi

The Burundi context is volatile at present. The energy access market is in its infancy, having opened for the private sector to engage in energy generation however the legal and regulatory framework is still being developed. There is scope for rural mini-grids and stand-alone/ pico systems due to small-scale local production and community centres. The Solar4All initiative supported by EEP is an important pilot project that lessons can be learned from.

Kenya

The Kenyan market has in many ways led the region in developing innovative solutions. The PAYG models of service provision are well established and the micro-financing institutions have begun to engage in supporting renewable energy products. There is a significant amount being done in Kenya to encourage the establishment of mini-grids, although care must be taken to focus on the innovative models and developing the project pipeline as there are several donor programmes in the Kenyan market. The exploitation of biogas on a more commercial scale could be explored, building on the work of GIZ and SNV.

Lesotho

The Lesotho Government is in the process of establishing the framework for IPPs and has taken some positive steps, including increasing electricity tariffs by over 16%. Currently domestic consumers are subsidised. However, policy, legislative and regulatory frameworks are being adapted for this purpose. The potential for off-grid services is not really known, particularly due to the terrain in certain areas. It would need to be established whether service provision can be achieved at a similar cost to the national electricity tariffs and whether the subsidies could be provided to mini-grid operators for connected domestic customers. Due to logistical challenges, off-grid solutions that require maintenance would need to be assessed thoroughly to establish the feasibility.

Malawi

The Government of Malawi has established the framework for IPPs in Malawi having previously only granted a licence to one producer, MEGA. There are now 27 projects in the pipeline and it is unlikely that the capacity exists in the Electricity Supply Commission of Malawi (ESCOM) to manage any additional projects, specifically in light of the non-cost-reflective tariffs being applied. Off-grid solutions are technically possible across various energy sources. The main threats to achieving commercial viability are affordability and maintenance of equipment.

Mozambique

The Mozambican market is unique in so far as it is highly centralised. As a net exporter, the increased generation capacity will feed into the Southern African Power Pool. However, there is considerable potential for mini-grid and stand-alone solutions. The market is somewhat distorted by FUNAE however which sees itself as an off-grid utility to some extent. They have tested various models of implementation but are using their own funding for on-going maintenance and have issues with revenue collection. There are two main reasons for this: (i) any tariffs applied cannot exceed the national subsidised rate and (ii) the political history of the country means that there is an expectation that the government should provide access to energy.

Namibia

The Namibian government is committed to enhancing on-grid IPPs, however the emphasis is on maintaining Nampower as the primary off-taker, perhaps also necessary taking into consideration the amount of energy that is imported into the country. In terms of off-grid access to energy, the business case is very complex and according to Elephant Energy, not commercially viable without some form of innovation or incentive. Therefore, the main opportunities will be in supporting the ministry in establishing mini-grids, although they are likely to require some form of subsidy or a significant anchor load to be feasible.

Rwanda

The overall on-grid generation capacity of Rwanda exceeds demand and therefore there is currently no potential for additional production. Providing energy access to off-grid areas requires government reassurances in case the grid arrives. There are a number of solar PV pilot and demonstration projects that were funded by the EEP for which lessons learned should be collated. As in the case of Malawi, affordability is a critical risk factor in Rwanda, highlighting the need to encourage productive use of the energy. The context in Rwanda may be suitable for testing models of partnerships between NGOs and the private sector to build on productive uses within rural communities.

Seychelles

Energy access in the Seychelles is almost 100%. 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, the legal and regulatory framework is weak and local awareness and technical capacity is lacking. However, identifying opportunities for co-generation could be constructive.

South Africa

The South African market is unique in that the off-grid market is being addressed through the government initiatives to roll out free solar home systems, resulting in market distortions. The emphasis is generally on large-scale interventions in the country, such as Concentrated Solar Power (CSP) and wind. The concept that makes use of the free basic electricity subsidy could be built on to support the business case for a market model for the bottom of the pyramid. The use of biomass and waste-to-energy could incorporate industry for feedstock (food processing, paper and pulp) or landfill sites to provide off-grid, mini-grid electricity to potentially large communities. South Africa may lead the region in terms of technological innovation, specifically as a supplier of equipment and technical expertise in the region. SANEDI is developing renewable energy maps covering most technologies and therefore private sector could identify commercially viable opportunities.

Swaziland

The sugar industry presents significant potential for additional generation capacity in Swaziland. Wood and agricultural waste present an opportunity however with two coal-fired power stations in the pipeline, the commitment to diversifying energy generation is not strong. The cost of imported equipment is very high, and this combined with the national drive to decrease unemployment, increasing local manufacturing of renewable energy products is a possibility. Despite market development programmes in solar PV dating back to 1997, the solar market is relatively weak. The role of the private sector is limited in the energy sector.

Tanzania

The recent reports of utility (Tanzania Electric Supply Company - TANESCO) debt and its general lack of credit worthiness means that investors are reluctant to take the risk and invest in IPPs. 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 Rural Energy Master Plan (REMP) as priority areas. Working to increase the productive use of the energy will ensure a stable base load and allowing long-term concessions will facilitate investor confidence. Consideration should be given to a cross-subsidy model across peri-urban and rural areas.

Uganda

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 approvals, is required. In terms of technologies, the opportunities are diverse and include waste-to-energy, micro-hydro, solar and biogas. The SE4ALL Action Agenda states that 60,000 domestic biogas digesters will be installed by 2030.

Zambia

Zambia is known for its ease of doing business. There are many IPPs in Uganda and several have negotiated separate agreements to feed into the grid. For off-grid systems, solar importers and distributors have come up with innovative financing models, such as fee-for-service and PAYG, as the irregularity of household cash flow is a major impediment.

A lack of awareness regarding solar PV and its possibilities, as well as an inability to distinguish between the qualities of products, have resulted in sub-standard products entering the market.

Zimbabwe

Due to the highly volatile economic environment in Zimbabwe, foreign investment is unlikely and even if it was, servicing loans in foreign currency may be exceptionally challenging. Models are being tested for solar PV mini-grids and micro-hydro power however the commercial viability of these schemes providing electricity to their local community makes the business case tenuous. 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. Stand-alone solutions are likely to be the most effective, particularly as grid reliability is a problem.