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Promoting Green and Inclusive Investment in Kenya: Policies and Innovative Financing Models

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Contents

Abbreviation 4

1. Introduction 6

2. Conceptual background 9

Energy pathways to poverty reduction 9

Financial instruments 12

Definitions 17

3. Methodology 19

Case selection 20

Data analysis 20

Fieldwork 21

Scope, limitations and delimitations 26

Significance of the research 27

4. Socio-economic context 28

5. Why a green energy economy in Kenya? 30

Current situation of the energy sector 30

Power generation 30

Energy access gap 31

Energy pathway to economic growth and poverty reduction 34

6. Green energy potential and developments 36

Solar 36

Wind 37

Geothermal 37

Hydropower 38

Biogas 38

Biomass 39

Energy saving and efficiency 39

7. Kenya's inclusive green development vision 40

8. Policy options and instruments for green energy development in Kenya 43

Strategies and policies for promoting green energy 43

Support instruments and incentives for green energy 46
Feed-in-Tariffs 46
Power purchase agreements 48
Net metering 49
Power wheeling 49
Licensing 50
Regulatory requirements 52
Direct investment support 52
Off-grid and mini-grid power development 53
International development partners activities 55
9. Green financing schemes: case studies 57
Green Lending Scheme: SUNREF 57
Mini-Grids Results-Based Financing 65
Mobile Solar Leasing Scheme: M-Kopa and Azuri 69
10. Conclusion 78
References 84
Annex 1. Matrix of cases 94
Annex 2. Fieldwork data collection protocol 97
Annex 3. Fieldwork interview respondents 98
Annex 4. Policy framework for a green economy in Kenya 99

Abbreviation

AFD	Agence Francaise de Developpement
BAF	Business Advocacy Fund
BAU	business as usual scenario
CFL	compact fluorescent lamp
GEF	Global Environmental Facility
GESIP	Green Economy Strategy and Implementation Plan
GWh	gigawatt hour
DFID	Department of International Development
DTM	Deposit Taking Microfinance
ECA	Economic Consultants Associates
EnDev	Energizing Development
ERC	Energy Regulatory Commission
EU	European Union
EUR	euro
EU-ITF	EU-Africa Infrastructure Trust Fund
FiT	feed-in-tariff
FS	Frankfurt School
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ICA	Infrastructure Consortium for Africa
IED	Innovation Energie Developpement
IFC	International Finance Corporation
IPCCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
KAM	Kenya Association of Manufacturers
KES	Kenyan shilling
KETRCO	Kenyan Electricity Transmission Company
KfW	Die Bank aus Verantwortung
KNBS	Kenya National Bureau of Statistics
KWh	kilowatt hour

LED	light-emitting diode
MOE	Ministry of Energy
MTP	Medium Term Plans
MTEP	Medium Term Expenditure Frameworks
MW	megawatt
NCCRS	National Climate Change Response Strategy
NEMA	National Environmental Management Authority
NGO	non-governmental organization
ODA	Official Development Assistance
PPA	Power Purchase Agreement
PV	Photovoltaics
REEP	Renewable Energy and Energy Efficiency Partnership
REA	Rural Electrification Authority
RET	renewable energy technology
RTA	Regional Technical Assistance
SE	Solar Estimate
SME	small and medium-sized enterprise
SMTP	Second Medium Term Plan
SREP	Scaling up Renewable Energy Programme
TE	Trading Economics
UKSIF	UK Sustainable Investment and Finance Association
UN	United Nations
UN-DESA	United Nations Division for Sustainable Development
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNF	United Nations Foundation
USD	United State's dollar
VAT	value-added tax
WB	World Bank
WEF	World Economic Forum
WF	World Factbook

1. Introduction

The modern world is characterized by technological change accelerating at unprecedented speed. However, even these technological advancements have not prevented humanity from the transitional development models that are based on overexploitation of natural resources for economic growth, pollution and loss of biodiversity, exacerbation of poverty and inequalities. With an increase of recognition of the urgency of these issues, it has become widely accepted that development should go beyond growth-driven path and be sustainably smart through its social inclusiveness and environmental soundness. Based on this, the international community has the notion of sustainable development that is based on three pillars: people, planet and profit. This implies a transition to a new development model based on social cohesion and low-carbon and resource efficient innovation.

In this context, energy poverty and access to clean and renewable energy becomes a major theme in the international development agenda. This is reflected in the recent international development landscape redesign featured by the United Nations' (UN) agreement made in September 2015 on Sustainable Development Goals that include tackling poverty and ensuring adequate access to energy while ensuring climate resilience. Moreover, the UN General Assembly declared 2014-2024 as the international decade of "Sustainable Energy for All" (Hogarth and Granoff 2015). This suggests that in the international development arena energy, poverty and the climate are viewed within a complex linkages framework fostering sustainable development. Indeed, access to cleaner, more efficient and affordable energy services improves economic productivity and standard of living, alleviates poverty and more generally provides better delivery of both social and climate-friendly services. Here, the important term "access" implies not only the vicinity to low-carbon energy sources and technologies, efficient devices, appropriate heating and energy-efficient housing, but also affordability of these clean energy options (Karekezi et al 2012). In the meantime, according to UN estimates, there are many people lacking access to energy – in energy poverty: about 2.8 million do not have access to clean energy services and over 1 billion did not have electricity (UN-DESA 2016; Hogarth and Granoff 2015). In tackling this complex challenge of energy and poverty in the context of sustainability, the *UN Sustainable Energy for All* initiative calls for action to diversify energy supply though the acceleration of the development, dissemination and deployment of affordable and cleaner energy efficiency and renewable energy technologies. It targets the ambitious goal of ensuring universal access to modern energy services and doubling the share of renewable energy and energy efficiency improvement by 2030 (UN-DESA 2016).

These perspectives open up critical issue of channeling huge investment streams via effective financing mechanisms within cross-cutting policy objectives in international

development fora. While policy and academic debates concentrate on sources and types of financial resources, the urgent question arises whether these resources reach the poor, powerless and marginalized users such as small and medium-size enterprises that cannot otherwise afford the products or services and that are in a most need of them. Hence, the importance of research in the area of pro-poor green financing is emerging.

The aim of this research is to examine the green financing landscape focusing on innovative green financing models with potential social benefits concentrating on the case of Kenya, a country where despite having exceptional renewable energy resources, 80% of the population lacks basic access to electricity and 50% of the population live in poverty (Pueyo 2015). The focus is on innovative schemes for financing renewable energy and energy efficiency projects.

Extensive literature review has revealed studies on renewable energy and energy efficiency financing in Kenya. However, these studies either cover Kenya limitedly within multi-country cases focusing more on "green" aspects of various policy and financial tools, while excluding social aspects (Usher and Stricker 2014; Byakola et al. 2009; UNEP 2014 b; Guertler and Royston 2013). Pueyo (2015) studied pro-poor access to green electricity focusing on grid electricity. An exception is the work done by Murai and Kirima (2015), which is, however, limited to the assessment of inclusive green investment potential in Kenya concentrating on the top-down analytics of the financial sector covering broadly all the sectors throughout the economy and largest financial players.

The contribution of the present research is that it examines the enabling policy frameworks and focuses on innovative green financing models specifically for renewable energy and energy efficiency projects where beneficiaries or users are poor households, public institutions (schools and healthcare facilities) and small and medium-size enterprises following the conceptual framework of energy pathways to poverty reduction of Hogarth and Granoff (2015) that emphasizes the importance of renewable energy technologies for poverty reduction. This paper adopts the pro-poor approach that promotes shifting development efforts and related financial flows from large energy projects connected with grid expansion to smaller scale, lower cost and locally sourced renewable energy solutions for better reaching and serving the needs of the poor and small-scale enterprises. This concept was developed recently and the present research is a prelude to the dedicated research stream. The research is backed with empirical analysis via expert opinion selected cases. Moreover, the present research looks at the issue with attention to the broader country context of development trends in Kenya and the energy backbone.

The key research questions are:

1) *Macro level – policy*
   What are the enabling frameworks (policies and incentives) for investments in renewable energy and energy efficiency in Kenya?

2) *Micro level – specific model*
   What are the innovative green financing models operating in Kenya that have potentially social impact component of targeting the poorer customer segments – households, micro-, small- and medium-size enterprises? What are the factors that affect the success of these models and the replication that can provide scaling up of innovative experiences?

The paper is structured into the 10 main sections. Section 2 describes the conceptual background of the research. Section 3 outlines the methodology, including case selection, data to be used, collection and analysis, fieldwork operations, scope, limitations and justification of the research. Section 4 presents the social and economic context of Kenya that together with Section 5 on rationale and importance of green energy economy in Kenya set the stage of the research. Section 6 examines renewable energy potential and development trajectories in Kenya. Section 7 gives Kenya's inclusive green development vision. Section 8 presents green energy economy enabling environment in Kenya. In Section 9, the analysis proceeds to the case studies on innovative financing schemes for investments in clean and renewable energy in Kenya. Key findings and conclusions are in Section 10.

2. Conceptual background

Energy pathways to poverty reduction

The pathway approach is based on the recognition of complexity of the energy service system comprised of social, technological and environmental factors interrelating across multiple scales. Evolution of these factors over time follows path-dependent trajectories. This results in a variety of ways of framing the understanding of any energy system. Various pathway models differ in delimitation of energy system boundaries, prioritizing certain dynamics and outcomes that can be open to different interpretations under contrasting boundaries (Byrne et al 2011). For example, energy pathway for sustainable development of Riahi et al (2014) covers the four global energy challenges (improved energy access, air quality, and energy security while avoiding dangerous climate change) and key characteristics of the related scenarios and energy transition pathways globally. The pathway for energy access is extension of both high-voltage electricity grids and decentralized micro-grids to reach almost universal access to electricity by 2030 and diffusion of clean and efficient cooking fuels and appliances. In this approach there is branching into centralized grid and decentralized mini-grid development strategies. Anderson et al. 2011 in their assessment for European energy pathways developed two pathways focusing on policies that promote energy efficiency and renewable energy sources. The pathways exemplify various strategies for Europe to meet the challenges of climate change and other sustainability goals. Byrne et al. (2011) draws upon an energy pathways approach to understand the challenges of energy and development, in particular, focusing low-carbon energy initiatives in development.

The relationships between energy and poverty are complex, multifaceted by increasingly differentiated conditions in developed and developing countries and among developing countries and within them: level of urbanization and industrialization, availability of energy resources, energy needs and level of population access to various energy sources, etc. In developed countries priorities derive more from climate change and energy security issues rather than from grid expansion and off-grid energy services for the poor perspective, which is the focus in most of developing countries. Important are also the ways and costs of satisfying energy services such as lighting, cooking, heating or cooling and the related impacts on health and environment. This brings to the emergence of two important issues in the agenda of international development: expanding energy access along with increasing clean and renewable energy mix and by this tackling climate change.

In tune with this is the concept of energy pathways to poverty reduction suggested by Hogarth and Granoff (2015) that fits for the goal, theme and geographical area of the present research. In the energy development context of developing countries, especially

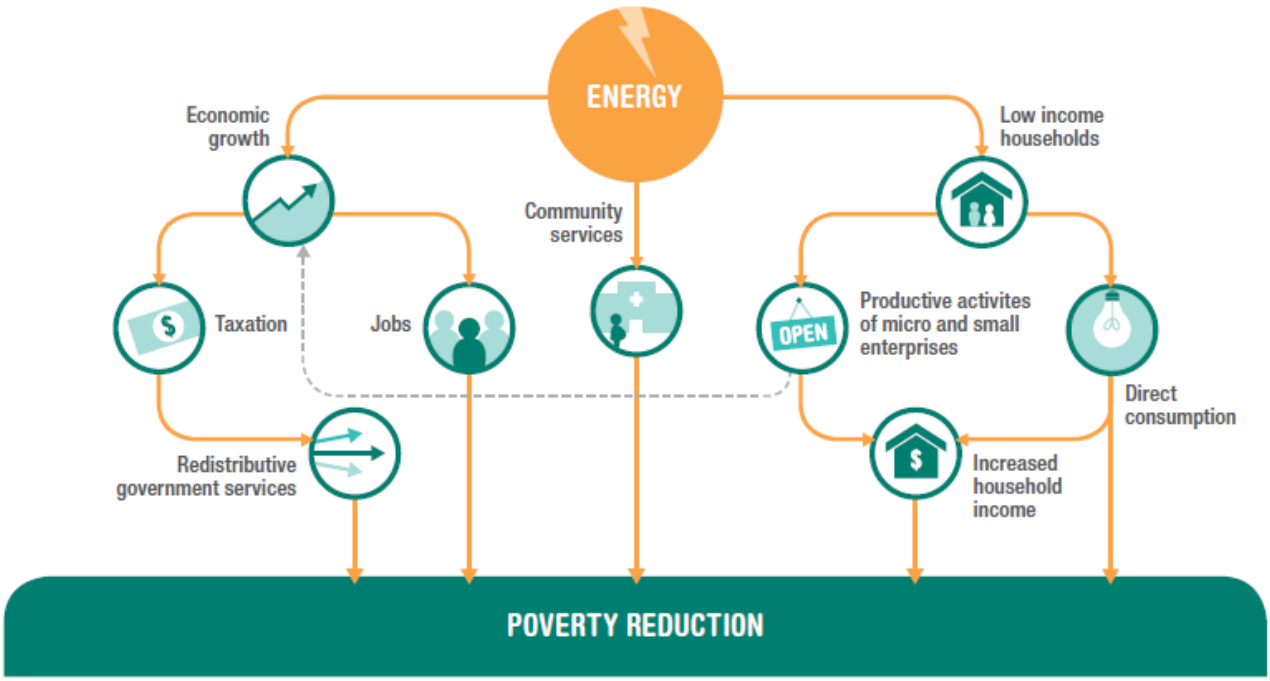
African countries, because of low grid coverage it is usual to have targets of enlarging grids and increasing electricity capacities highlighted with flagship big infrastructural projects. The main proclamation is that massive expansion of power capacity will solve the issue of energy poverty. However, based on figures on energy developments and energy poverty, it seems that most investment in power generation is not enough fitted to serve the need of the poor. Hence, certain questions emerge: "Why do so many poor people not benefit from these projects? Does massive increase of on-grid generation solve the issue of pro-poor energy access?"

Firstly, there is a need to clearly define "energy access". According to the World Energy Outlook 2015, energy access relates to two things: a household having access to electricity and to a relatively clean, safe means of cooking and heating fuels and stove. Hence, energy access is more than just "electricity access" that is defined as having access to reliable, affordable, legal and safe electricity in sufficient quantity to meet basic electricity-related energy needs, such as lighting, a fan and communication technologies. It is not only availability (in a form of grid access or PV panel) and utilization of energy services, but also accessibility in sense of ability of poor households to connect and pay the costs of connection and supply (Pueyo 2015). It also extends to the availability of cooking and heating facilities such as liquefied petroleum gas (LPG) stoves that burn very efficiently and emit few pollutants and are considered as one of one of several pathways to meet the goal of universal energy by 2030, as stated in the United Nations' Sustainable Energy for All Initiative (Kojima 2011).

Access to energy that is "pro-poor" and "inclusive" should improve energy availability, affordability and usage along with consideration of impacts on various measures of the poor. Energy access for the poor means also co-benefits like improved household productivity, night time activities such as children's homework in the evening, employment, new income generation opportunities, as well as quality-of-life activities such as socializing (Pueyo 2015, Byrne et al. 2011). Contrary is "energy access gap" defined as the cumulative deficit of energy access for those living in poverty. However, it should be distinguished from "industrial energy gap" that represents a significant gap between the generation capacity and consumption of industrialized and unindustrialized countries. This difference is given to understand the modern trends in governmental investments in massive expansion of power capacities that while succeeding in narrowing industrial energy gap do not necessarily narrow broader energy access gap. Pueyo (2015) also refers to this as absolute way of reducing poverty by targeting the scale (number of connections) through electrification programs. It is expected that enlarged grid energy projects being necessary for industrialization, will eventually benefit the poor (whether or not they are specifically targeted) through creation of jobs and generation of taxes to feed further public expenditures (Hogarth and Granoff 2015, Pueyo 2015) (Figure 2.1). However, in many cases,

construction of power plant does not guarantee greater access for the poor that lack connection and may not afford high connection and operation prices. Most of expansion in energy generation is used to feed consumption predominantly by industry and service sectors and to meet the growing demand of households that already have access to energy (Hogarth and Granoff 2015). This is in line with Riahi et al (2014) statement that energy utilities mostly target grid expansion projects that envisage the least infrastructure investment relative to demand. Only rural communities that are close to existing grids that have high population density, or where economic activity is greatest are priority areas for connection. In some cases, remote rural areas with the poorest households may also be included in expansion projects because of their social impact, but these are less common for not being economically feasible option for utilities or governments. Overall, expectation is that grid expansion will proceed quickly where the costs are lowest.

Figure 2.1. Energy pathways to poverty reduction



Source: Hogarth and Granoff 2015

Even in the areas that gain access to electricity grids, poor households may remain without electricity for years because of inability to pay connection charges that are usually high (Hogarth and Granoff 2015, Riahi et al 2014). Other factors that influence household connection to the grid are the opportunity for connection costs to be spread over time, supply tariffs, subsidies and bulling (Zomers, A. 2001, Riahi et al 2014). Therefore, the main obstacle for universal energy access is not the technical capacity to generate electricity, but

rather the ability to delivery energy to the most needy. In other words, the objective is not just the number of megawatts installed, but the number of people reached. This is the basis of the concept of energy pathways to poverty reduction that relies on very small, incremental shifts in the provision of energy to the poor. Energy required for this shift is very small part of the industrial energy gap that represents the big gap of installed energy capacity. But this can be the other yet important way of energy poverty reduction through delivery of energy services that improve quality of life, education and health (Figure 2.1). Thus, electricity provision through distributed, clean and renewable energy technologies to households, schools, primary health clinics, and small businesses are better suited to tackle poverty reduction. The study of Szabo et al (2011) with employment of spatial electricity cost model showed that 61% of population in Africa can be served most economically through off-grid and mini-grid systems (with PV option being most attractive for rural areas) with 39% of the rest of the population to be best served through grid expansion.

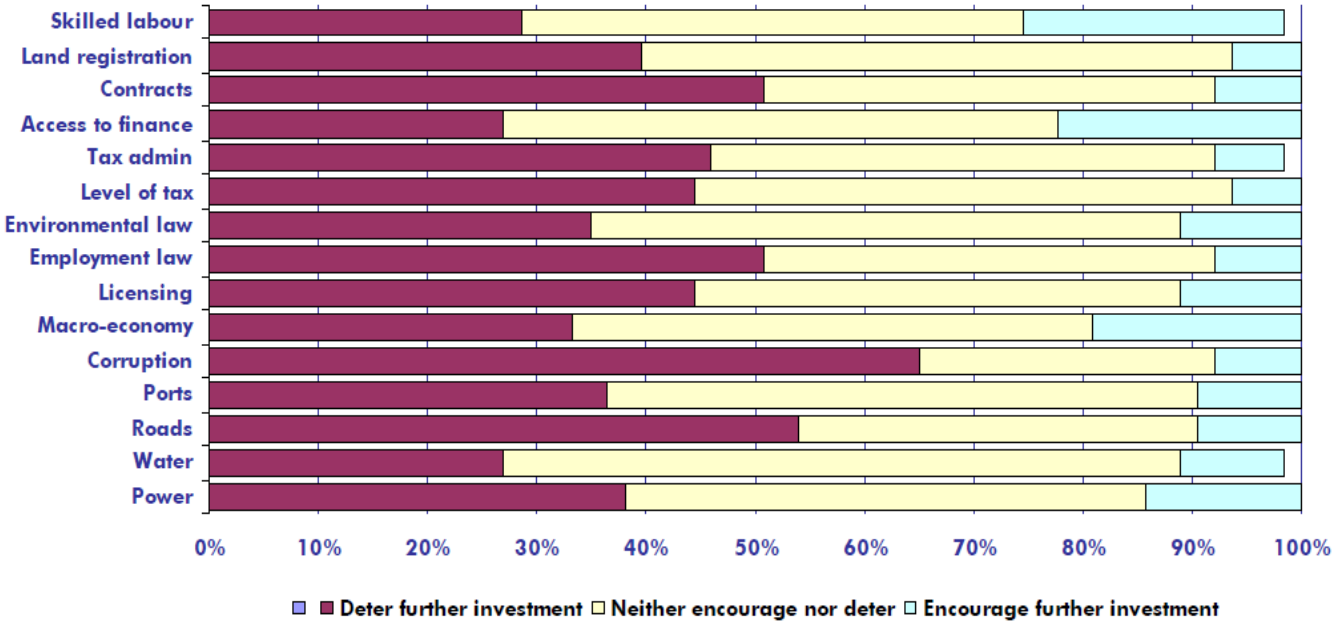
The preference of taking one or the other energy pathway of poverty reduction depends on the objectives and ideology. For, example, the objectives of Sustainable Energy for All is to ensure universal access to modern energy by 2030. In this case, the absolute way or industrial pathway will be emphasized to reach the goal of the scale – number of customers. Alternatively, if the goal is to reduce poverty, the relative way (Pueyo 2015) or energy access gap pathway will be prioritized with electrification programmes that target the poor. This paper adopts the pro-poor approach, exploring the Kenya's energy status and developments, focusing on inclusive financing models for green energy projects.

Financial instruments

In the public policy field of study, there is a large number of instruments available for promoting clean and renewable energy investment (Amin et al 2014; Guertler and Royston 2013). Selection and combination of the right mix of instruments into a successful and innovative financing scheme is not an easy job. The design of a proper scheme may depend on the barriers and risks that prevent clean energy investment by the private sector. This a topical issue especially in developing countries where the difference in financing costs (debt and equity) significantly impact the competitiveness of renewable energy technology (RET) versus fossil fuel technologies The higher financing costs mirror many apparent or actual informational, technical, regulatory, financial and administrative barriers and their related investment risks (Waissbein et al 2013). Examples of financial barriers are high up-front capital costs, high transaction costs, up-front collateral requirement, long-payback period, risk exposure, etc. (WM 2011; Guertler and Royston 2013).

The key challenge of financing clean and renewable energy investment may not so much be the availability of finance itself, but, instead, the need to address existing investment risks that influence the financing costs and competitiveness of clean energy in developing countries (Waissbein et al 2013). Interestingly, according to the survey conducted among business community in Kenya, even though being a frequently mentioned issue, access to finance ranks the 13th out of 15 important factors indicated by respondents hampering the success of their business (BAF 2008). The top three factors include power, roads, and macro-economic policy. Moreover, among the factors access to finance is lowest deterrent to investment negatively affecting investment decision (Figure 2.2). Furthermore, according to the same report, access to finance is the only factor in relation to which, according to respondents, the government efforts are not making issue worse though about 38% indicating of making no efforts, about 45% indicating that it is making some efforts and about 10% thinking that it is doing real effort. Moreover, access to finance is the lowest (15th) in the list of priority factors to be addressed for improving the business environment.

Figure 2.2. Factors affecting investment decision in Kenya



Source: Business Advocacy Fund 2008

The challenge of addressing investment barriers and risks brought to the development of a wide range of financing instruments. Normally, they are broadly grouped into those used to address specific risks of investments, to overcome financing barriers or to scale up return (Amin et al 2014; WB 2011). The results depend on sector and country context (Amin et al 2014). According to Waissbein et al (2013), these instruments are divided into the following

categories, the overall aim of which is to enhance a risk/return profile of the project that can attract private sector investment:

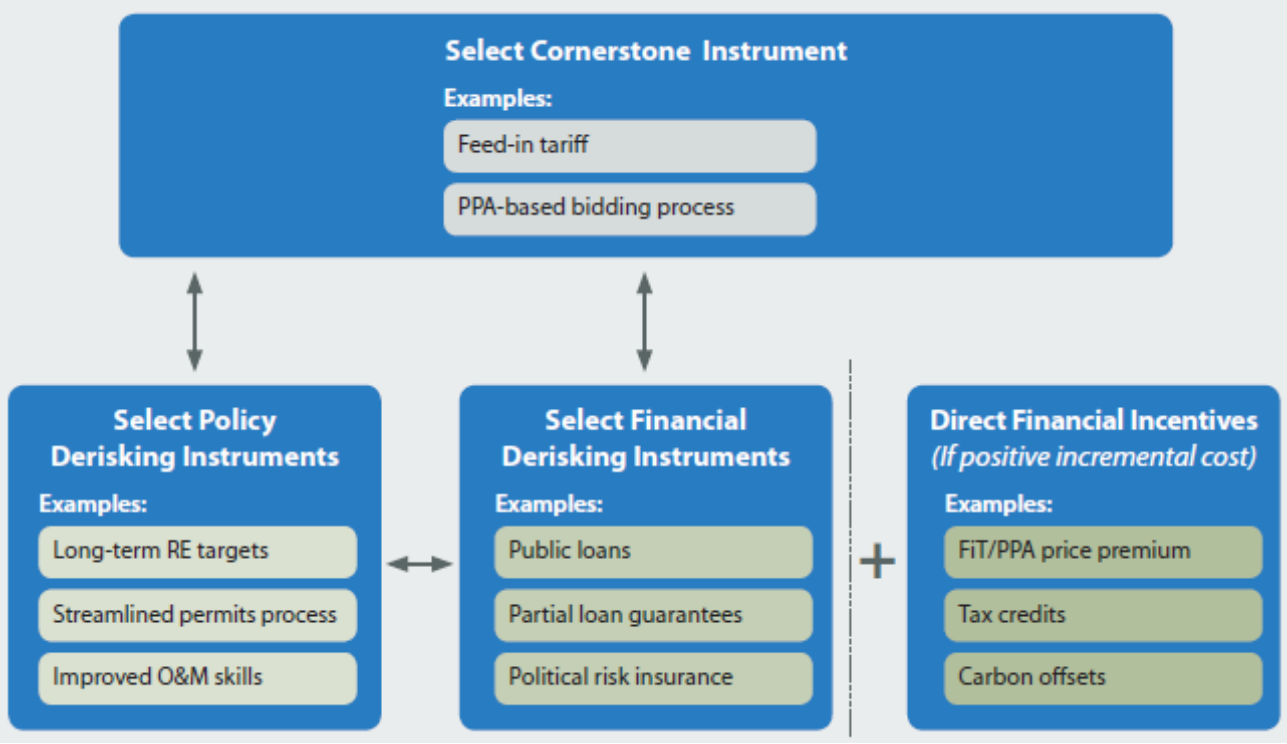
1. **Policy de-risking instruments**
   These include policies and interventions that target to eliminate fundamental barriers that cause risks. A policy de-risking approach can contain clean and renewable energy policy design, permitting processes and administrative procedures, clarification of institutional responsibilities and institutional capacity building, grid connection and management, and skills improvement for local operations and maintenance.

2. **Financial de-risking instruments**
   These instruments are designed for not to eliminate the barriers but, instead, to allocation the risks that investors face to public actors, such as development banks, or private actors, such as commercial banks or service suppliers. A financial de-risking approach involves concessional/soft loans, loan guarantees, use of insurance and public equity co-investments.

3. **Direct financial incentives**
   Policy and financial de-risking mechanisms can be supplemented by direct financial incentives such as price premiums, tax breaks, carbon offsets, etc. that enable to compensate for residual incremental costs and to thereby increase returns.

Risks associated with the performance of the technology are generally better mitigated via warranties and guarantees from suppliers than through the use of financial instruments (WB 2011). A combination of a regulatory policy (de-risking) tool such as guaranteed access to the grid for independent renewable energy producers and return increasing tools such as fixed long-term price for renewable energy can enhance commercial attractiveness of a clean energy project (Waissbein et al 2013). For on-grid large-scale clean energy projects, instruments, such as regulatory standards, feed-in-tariffs, power purchase agreements (PPA), auctions or bidding processes are cornerstone instruments (Figure 2.3) for renewable energy market transformation (Waissbein et al 2013; WB 2011).

Figure 2.3. Public instrument portfolio for promoting large scale clean investment



Source: Waissbein et al 2013

For small scale or off grid projects approach the need for support mechanisms is different and targeted instruments can be utilized (Table2.1). Because of economies of scale, the biggest carrier is high cost and unwillingness of financial institutions to finance small projects. Normally, costs for larger projects range from 0.5 million USD to 1 million USD (WB 2011). This threshold can high even for large on grid renewable projects, leave alone the household, micro, and mini systems that also face the challenge of lack of local demand in rural remote areas, resulting in underused assets and reduced financial returns and attractiveness for IPPs. In this case, use of aggregation or result-based financing that links the payment of funds to the delivery of specific outputs can be used to mitigate small market and small project scale barrier. High costs can be addressed through a well-designed grant or subsidy instruments. For household-level systems, the barrier of uncertainty and unwillingness to buy uncertain quality products can be solved through regulatory requirement for technical specifications or warrantees provided by suppliers.

Table 2.1. Range of financial instruments and their impacts

	Financial Instrument	Impacts / Barriers and risks addressed
Programme / project financing	**Grants**	
	Capital grant	• Reduce project costs and provide longterm finance
	Grant for risk coverage	• Used in wide range of risk coverage instruments (lower interest rates, loan quarantees or first loass tranche) • Reduce high risks for private sector
	Grant for technical assistance/policy support	• Support in early stages/feasibiliy or capacity building • Reduce lack of reasiness/enabling environment/expertise/ awareness
	Project preparation	• Provide long-term finance (equity holdings)
	Equity	
	Venture Capital	• Fund preinvestment costs as risk capital
	Debt	
	Senior debt	• Reduce project costs • Provide long-term finance
	- Loans	• Concessional loans lower overall capital costs and increase profitability • Can levearge significant investment • Provide long-term finance to address lack of sufficiently developed financial sector
	- Green lines of credit	• Provide finance in markets with high interest rates • Build local capacity for green financing within national institutions • Provide short-term finance for projects without consistent cash-flow
	Subordinated debt (mezzanine finance)	• Provide intermediate funding between equity and senior debt, which helps reduce risks to senior lenders while not taking control away from project sponsors • Can extend the term and reduce costs of senior debt
	Asset-backed securities	• Offer project financing via bond offerings rather than via loans • Free public funds for future project development when completed projects are refinanced
	Guarantees and insurance	
	Individual guarantee	• Guarantee a part of the losses incurred by a project in the event of a specified event occurring
	Liquidity guarantee	• Guarantee ability to meet commitments on debt servicing/ financing
	Political risk insurance /Partial risk guarantee	• Provide partial or full coverage credit or policy or regulatory based guarantees • Provide political risk insurance to protect against macroeconomic or political volatility
	Resource insurance	• Insures against lost revenue in the event of lower-than-expected output due to lack of wind or sun (wind/solar insurance) • Insures against costs of failed exploratory wells (contingent risk insurance for geothermal projects)
Targeted instruments	**Results-based financing**	
	Payment against outputs	• Pay grants or subsidies against the delivery of a specified set of outputs • Grants and subsidies are used to reduce the costs
	Contingent project development grants	• Provide preinvestment funding, either as loans that turn to grants if the project is successful or grants that turn to loans
	Carbon financing	• Allow projects to access expected revenue streams from CERs ahead of commissioning or at start of operations
	Small-scale project financing	
	Microfinancing	Provide customers with credit to purchase RET hardware
	Portfolio guarantee and loss reserves	• Guarantee a part of the losses incurred by a portfolio of similar projects in case of a specified event occurring
	Aggregation	• Reduce transactions costs by bundling together similar projects that use standard contracts and specifications.

Source: Authors' own, based on data from Amin et al 2014 and WB 2011

Table 2.1 presents broader view on a range of financing instruments with their impacts that can be applied as ingredients for designing green finance incentive schemes in support of the scaling up of renewable energy and energy efficiency technologies. The present research puts these instruments in macro-level perspective (laws, regulations and governmental action programmes) and micro-level perspective (specific financing schemes at operational level with direct connection to end-users).

Among instruments, it would be important to present in more details the soft loan mechanisms, which is the most widely used tool in macro and micro level financing schemes. More comprehensive descriptions for other tools are provided in Amin et al 2014, WB 2011; Guertler and Royston 2013; Waissbein 2013. Soft loans refers to a loan that is "softened" with lower than market interest rate or interest-free rate. These are also called preferential loans or concessional funding, as well as other flexible arrangements such as longer payment periods or payment holidays. This type of loans are usually introduced by financing institutions to start off the market or to promote some policies through overcoming the related high initial costs and signaling the market about the desired improvement (Guertler and Royston 2013). Mostly, soft loans are used within public-private partnership frameworks with government providing fiscal incentive to banks in a form of low interest rate for related target customers for implementation of green investments (UNEP 2013). Soft loans can be combined with labeling, renewable energy certifications, building codes or grants to be more cost-effective and attractive for specific target groups or (Guertler and Royston 2013). This instrument has a wide range of areas of application, for example, renewable energy and energy efficiency measures in buildings. The advantages of this instrument is that is reduces the economic and market barriers – unavailability of green technologies and high initial costs of green energy solutions, by supporting increased demand for green technologies and enhanced access to capital and cutting of costs for those willing to invest in sustainability improvements (UNEP 2013). Since soft loans are straightforward in designing and introducing, their introduction enables also to overcome regulatory barrier – limited institutional capacity. Moreover, ability to select the target beneficiaries directly or through related projects fosters fulfilling social goals of reducing energy costs and supporting special target groups - low-income households or small- and medium-size enterprises. The limitation of this instrument is that it is not effective for meeting the information barrier such as high rate of illiteracy among target customers or market barrier of high transaction costs (UNEP 2013).

Definitions

Since the present research explores renewable energy and energy efficiency innovative financing models, it is important to add up the following definitions:

- There is no internationally agreed definition of *innovative financing.* According to Das et al (2014), financing approach can be considered innovative if it involves unconventional use of solidarity, public-private partnerships and catalytic instruments to help to raise funds by ensuring new sources and attracting investors/partners beyond the financial aspect of projects or to provide financial solutions to developmental challenges on the ground.

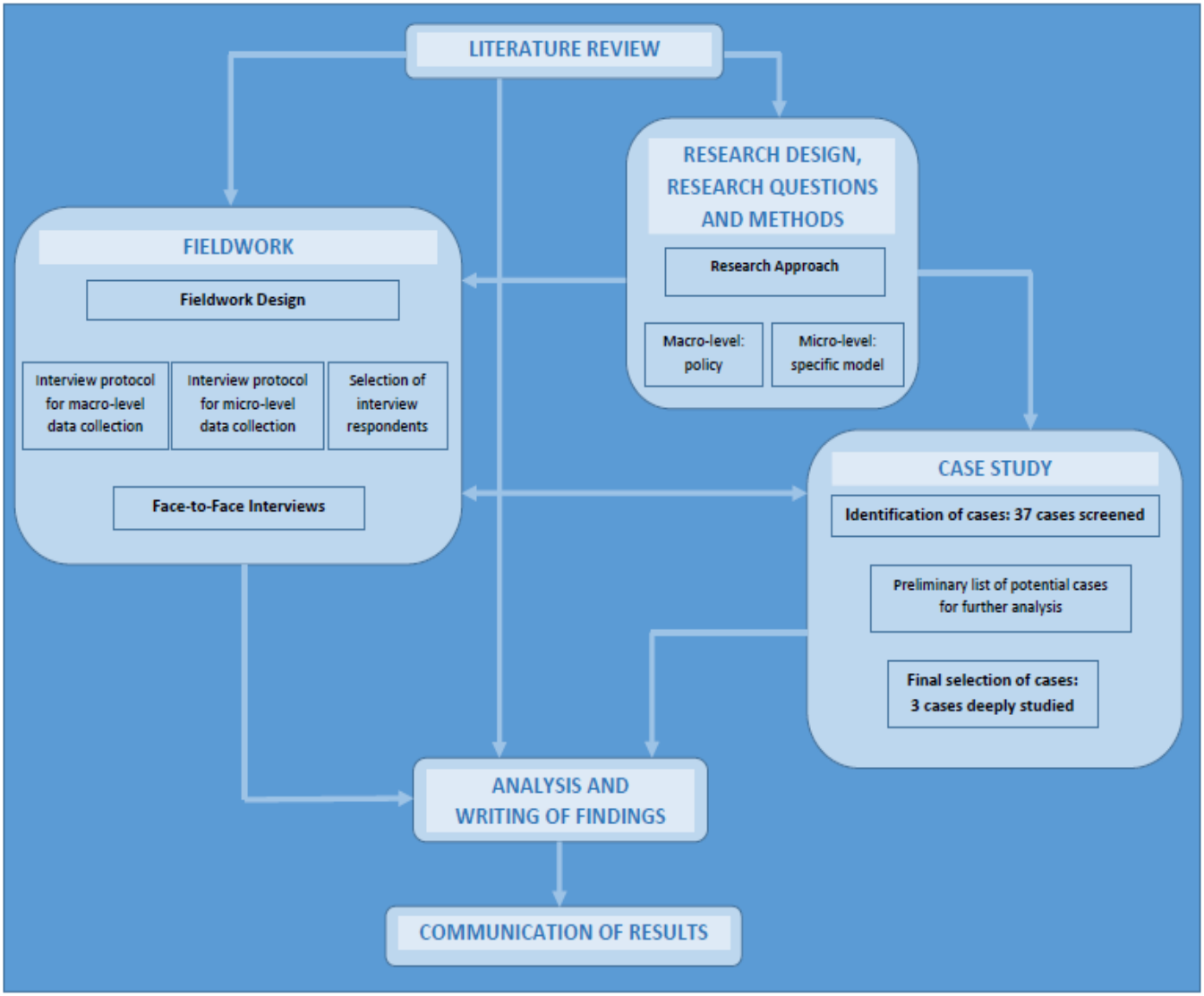
- *Renewable energy* is energy that is generated from natural resource (sunlight, wind, rain, tides and geothermal heat) that can be naturally replenished or renewed. In contrast, fossil fuels are non-renewable and finite resources that will eventually run out and become very expensive and environmentally damaging to be retrieved. Renewable energy technologies include solar power, wind power, hydropower, biomass and biofuels (Ciokosz 2017). Renewable energy technologies are considered clean sources of energy because of their much lower environmental impact than conventional energy technologies. With rapidly falling costs for renewable energy technologies, they start playing significant role in addressing energy security issues. Moreover, these technologies can be only viable solutions in remote off-grid areas.

- *Energy efficiency* is "using less energy to provide the same service" or the utilization of energy in the most cost effective manner with the purpose of confining the growth in energy consumption (LBNL 2017). Something is more energy efficient if it provides more services for the same amount of energy consumed, or if the same services are provided for less mount of energy. The most wide spread example is the compact florescent light bulbs that use up-to five times less energy than an incandescent bulbs to produce the same amount of light. Energy-efficient household appliances include refrigerators, freezers, washing machines, dryers and cooking stoves. Industry, transportation and building sectors hold high potential for energy efficiency from manufacturing, designing and service providing processes. Together with renewable energy technologies, energy efficiency measures are mitigation methods to reduce human greenhouse gas emissions (UNF 2015).

3. Methodology

The paper follows the evaluative multi-case study method based on the mix of documentary research and in-depth interviews methods. This type of research approach is widely employed in governance and public management related research with a motive of drawing lessons through identification of the factors contributing to relative success or failure (Stewart 2012). The desktop documentary research is supplemented by fieldwork with semi-structured interviews conducted in Kenya (Nairobi) in September 2016 with state authorities, practitioners, representatives of international financial institutions, academia and local enterprises. Overall, the research framework is presented in Figure 3.1.

Figure 3.1. Research framework

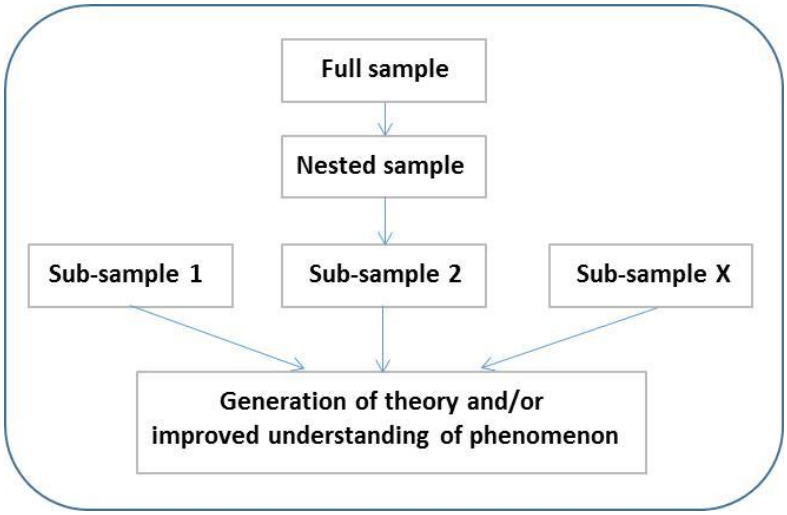


Source: Author's own

Case selection

As a qualitative research, the paper aims to obtain insights into particular social processes and practices and to find the meaning that exists within a specific location and context in its natural setting (Connolly 1998). This general approach is fitted into the Kenyan context. The research follows nested sampling design (Figure 3.2). It is most commonly used for selecting key informants whose voices are used to make case-to-case transfers and analytical generalizations. The employed in this study the random purposeful sampling is among the most appropriate for nested sampling designs (Onwuegbuzie and Houston 2007).

Figure 3.2. Flow of nested sampling design



Source: based on Onwuegbuzie and Houston 2007

Accordingly, as a result of the literature review, a pool of thirty-seven financial schemes (public, developmental, climate, commercial, hybrid) for renewable energy and energy efficiency sectors were identified to learn first-hand about market circumstances. The matrix of cases is presented in Annex 1. Next, out of this pool, three cases were selected that had enough detailed information to proceed with and that have potential social impact and degree of innovation in its approach to be qualified as a model for environmental and social leadership.

Data analysis

The analysis starts with the review of the country context, driving forces and enabling environment for the green and inclusive investments in Kenya, including cross-nation analysis to compare different experiences of different countries. Data analysis represented

the framework, within which the fieldwork was developed. Overall, data was gathered through fieldwork and desktop research and derived from research publications, reports, policy reviews, websites of the national statistical offices and of respective organizations participating in the financing schemes, and other publications. Data verification was conducted through various sources. The preliminary analysis revealed further data needs to be obtained through personal discussions. Hence, data was further qualified and the analysis supplemented through personal interviews with experts and other stakeholders during the field visits.

Fieldwork

The field visits were preceded by thorough analysis of the country context to better understand the socio-economic, development trends and vision of Kenya, energy and green financing sectors along with related regulations and other policy instruments. Fieldwork included semi-structured interviews with: experts from governmental institutions, bank officers and program managers, representatives of international development agencies, clients and other stakeholders and experts of the field. Some of interviewees were identified before field visits, others were selected by snowball method via references of interviewees during the field visit. The interviews were guided by the interview protocol developed beforehand (Annex 2). Taking into account the importance of the fieldwork data collection, this section proceeds with presentation of the detailed procedural framework of fieldwork activities.

For ensuring accuracy and validity of the research findings, it is essential to ensure that the qualitative data was collected in a scientifically consistent manner. For this purpose, the researchers adopted the procedural framework of training manual for data collection developed by Harrell and Bradley (2009) for the US Government.

1. Identification of data collection methods

The present research employed mixed methods for data collection based on both primary and secondary data collection approaches. Mixing of methods was used for the purpose of complementarity, which enables to obtain broader, deeper and more comprehensive social understating and interpretation by employing various methods that excavate different facets or dimensions of the same phenomenon (Greene 2007). In the present research Extraction and secondary data sources were used to extract data from documents, records, websites and other archival sources for getting information desired from the source or across sources for combing data in a required frame. At this stage, preliminary selection of cases was done to be further detailed during the fieldwork. The fieldwork enabled to collect primary data, which comprises an important part of the research. Hence, the interview

technique was employed to go deeper into the topic and to understand thoroughly the answers provided (Harrell and Bradley 2009).

2. Semi-structured interviews

In the present research the purpose of interviews was to collect primary data on two types of information: getting expert knowledge on background information with facts and description of processes and on respondents practices and opinion (for example, when asking whether the respondents find that the financing model was a success).

Semi-structured interviews for qualitative data collection were used during the fieldwork. This is one of the commonly used techniques in policy and development research that is applicable for various types of research questions (Raworth et al. 2012; Harrell and Bradley 2009). In general, interview technique enables to focus on a specific phenomenon by getting clarifications and the depth of information and covering it in a conversational style (Harrell and Bradley 2009; Raworth et al. 2012). It is used when there is a need to go deeper into and to understand more thoroughly a topic. Other benefits of conducting semi-structured interviews is that being average controlled type of interview, it still provides the respondents with the opportunity to express their opinions and experiences in person (Harrell and Bradley 2009). Moreover, this technique enables to collect detailed information in a more conversational style to overcome a barrier of unwillingness of some high status individuals or officials to respond to other data collection tool such as surveys. Qualitative analysis provided by interviews also added to the interpretation of results found through analysis of secondary data obtained previously from various sources. Forthcoming section 4 details on the interviewee selection approach adopted within the framework of this research.

In the present research face-to-face interview approach was employed to address the limitations of e-mail interview approach such as asynchronous communication requiring significant time delays and more efforts to proceed persuade (Opdenakker 2006). Moreover, face-to-face interviews enabled limit the respondent disturbing effects by well prepared guidance in a special direction using an interview protocol and directly reacting on unexpected moments of communication and the opportunity of making adjustments on spot.

3. Framing the research

Some important components of the research framing process were formulated during the first steps of the research, which were further evolved during the literature review. This includes:

- **Formalization of main research questions**

The main research questions are:

1) *Macro level - policy*
   What are the enabling frameworks (policies and incentives) for investments in renewable energy and energy efficiency in Kenya?

2) *Micro level – specific model*
   What are the innovative green financing models operating in Kenya that have potentially social impact component of targeting the poorer customer segments – households, micro-, small- and medium-size enterprises? What are the factors that affect the success of these models and the replication that can provide scaling up of innovative experiences?

- **Identifying sources of information for research questions**

As it was indicated above, interviews comprise one of the employed methods of data collection. Here, the focus is put on fieldwork operations. Accordingly, the source of collection of the primary data in the present research were "respondents" that responded to the researcher language, concepts and questions in their own words. They answered the questions constructed in the researcher's semantics. Harrell and Bradley (2009) differ "respondents" from "actors" that are observed, "subjects" that are used to test hypothesis or "informants" that describe their culture.

- **Determining the subgroups and number of people for interviews**

Taking into account the macro and micro levels of research orientation, the following interview participant types were considered in the research: governmental officials, international development and financing institutions, non-governmental organizations, academia, professional associations, private sector and banks. Based on research question the respondents were grouped into: 1) those who can provide information majorly on policy level aspects with(out) supplement information on specific financing modes; and 2) those who can majorly inform about the specific financing models with(out) supplement information on policies. In total, 25 interviews were conducted during the fieldwork. The lists of respondents are presented in below *Conducting interviews* section and more detailed in Annex 1.

4. Sampling

The sampling method used in the research is an important element of the fieldwork activity. In general, qualitative research employs non-probability sampling since it does not target generating statistically representative sample to draw statistical inference. In this case the number of people interviewed is less important than criteria to be used to select the respondents. The basis for selection are the characteristics of individuals that are normally

chosen to reflect the diversity and breadth of the sample population (Wilmot 2005). Accordingly, within the framework of the present research the main criteria that guided the selection process of interviewees were:

- Who possess relevant information?
- Who would be ready to share information?
- Who can be accessible?

The accuracy of the research depends on the level of the expertise of respondents. The research of interviews as a part of literature review, secondary data analysis and suggestions of expert respondents helped to determine the respondents. Special strategies (such as introductory e-mails followed by phone calls and reminders) have been taken to increase the accessibility of respondents and their willingness to share information.

Normally, in qualitative research the number of sample size is relatively small, because “a phenomenon only need appear once to be of value” (Wilmot 2005:4). As a rule of thumb, Wilmot (2005) suggests a range of 20-50 interviews for face-to-face investigation, depending on the research questions, sampling frame and availability of resources (time, financial and human). In the present research 25 interviews were conducted.

In the research, one of non-probability sampling techniques - judgment sampling, also known as purposive sampling – was used in combination with some elements of snowball sampling. The judgmental sampling is a frame that “reflects some knowledge of the topic, so that people whose opinion will be important to the research, because of what you already know about them, will be selected” (Harrel and Bradley 2009). This approach relies on the judgment of the researcher in the selection process in identifying particular characteristics of the sampling population that will best deliver the answer to the research questions (Lund research 2012). The process involves purposely choosing individuals from the population based on the researcher's knowledge and judgment (Explorable.com 2009). During respondent selection, the researchers verified the capacity of respondents to provide reliable information based on the positions hold and professional skills. Hence, the selection was not only the relevance of organization, but also the professional within the organization.

The present research followed the expert sampling approach to obtain knowledge from individuals that have particular expertise, who can pinpoint potential new aspects of interest and open doors to other participants (Lund research 2012), giving opportunity to combine judgmental sampling with elements of snowball sampling. This combination during the fieldwork enabled to benefit from the respondent proposing or introducing another participant to the present research. The meetings were arranged either later by the researcher or at the spot with the help of the interviewees immediately after the meeting.

Overall, this combination increased the accessibility of respondents and contributed to efficiency and effectiveness of the fieldwork.

5. Developing interview questions and protocol

The first (macro level) questions relate to enabling policies. The second (micro level) questions relate to specific financing models. These research questions framed development of the interview protocol with specified questions asked during the interviews. Based on the research goals, mainly descriptive questions were determined for interviews such as experience and example questions. The Protocol is presented in Annex 2 "Fieldwork data collection protocol". Data collection followed two major streams of questions: policy related and specific model case related questions. In general, all the interviewees were asked questions from policy and specific case questions. More detailed question were asked on related question stream depending on the expertise area of the respondents.

6. Preparing for the interview

Fieldwork strategy was to identify, firstly, the contact details of the interviewees and communicate with them via an-email letter and then to call them so that the interviewee either already be aware of the researcher and the request for a meeting. It was much more reliable during the phone call introduction (also in case of secretaries) to tell that the potential respondents have been contacted via e-mail. During the phone conversation, the respondents were given information about the aim of the research, purpose of the interview and their contribution and the use that will be made of data collected from them. Accordingly, the fieldwork followed several phases:

- *Phase 1:* a preliminary list of potential respondents with contact information was prepared in advance of the fieldtrip.

- *Phase 2:* pre-field trip intensive e-mails and phone calls (with explanation of the purpose and expectation from the respondent) were made to schedule meetings for the first days of the field work.

- *Phase 3:* during the fieldwork, intensive e-mails and calls were made during the first days of the week for making appointments during that week. People could more easily give feedback for more exact date within few coming days rather than in a next week perspective. Moreover, calling them from local phone number also increased positive response rate and willingness to give interviews.

7. Conducting interviews

The fieldwork was conducted in September 2016. The list of experts interviewed (25) is presented in Annex 3. The interviews were conducted on face-to-face bases that enables to establish trust building and get more control of interview process. It also enhanced the opportunity to clarify vague things and ask about details. Another advantage was the synchronous communication in time and place enabling to trace social cues such as voice and gestures to get extra information and direction on how to further the interview process (Opdenakker 2006). The exceptions were two cases when the interviewers asked to have remote interviewing via phone. Some interviews were conducted at the East Africa Power Industry Convention (EAPIC) Clean Energy Expo in Nairobi (September 21-22).

8. Capturing the data

Duration of interviews was within 30-90 minutes. The interviews were fully transcribed under the condition of the respondent permission to avoid information losses and ensure more controlled data analysis. During the interview the researcher maintained neutrality so as not to influence the respondents' answers by not disagreeing or agreeing with the respondents comments or not giving personal opinion. In closing the interviews the research expressed application to the respondent by indicting the usefulness and productiveness of the meeting. With some of respondents agreement was gained to sending some written pieces back for their comments.

It is important to mention that some of the interviewed experts expressed interest in the research and wished to receive the final report with the results of the research. Some also agreed to give comments for a specific part of research related to their scheme.

Scope, limitations and delimitations

There are some limitations and delimitations related to this research, limiting the findings in the following ways. The research scope is bound to the green finance schemes for renewable energy and energy efficiency projects. The petroleum products and the refinery and pipeline systems are outside of the scope of the paper. Moreover, the focus is on technologies that have already passed to deployment, diffusion and commercial maturity stages of development. This implies that Research and Development and Demonstration financing are outside of the scope of the research. Financial schemes with significant social impacts is the next criteria for delineation of the research scope. It will focus on energy access and energy efficiency services to poor household and small and medium-size enterprises. Furthermore, it is assumed that all the respondents have accurately and honestly responded to the interview questions. Finally, due to financial and time restrictions that limit covering a significant number of instruments and respondents, the research is delimited in terms of its generalizability and in terms of geographical coverage.

Significance of the research

The proposed research is important because its findings will be of benefit for practitioners, professional peers and the society considering that the connection of green development with poverty reduction and the importance of green and inclusive investments for promotion of sustainable development. The greater poverty reduction and promotion of sustainable paths of development based on economic, social and environmental pillars justifies the need for more effective and life-changing financial mechanisms. Hence, the scholars, policy makers, development and financial institutions that get acquainted about the results derived the proposed research may take them into consideration while designing the actions within their respective duties. The policy makers may refer for policy improvements, particularly, on what should be emphasized by legislative and administrative bodies in the legislation and implementation schemes to improve access to green finance especially for the poor. For scholars, the research will support to uncover critical areas in financing policies and implementation processes that may researcher have not yet explored.

4. Socio-economic context

Kenya is youthful nation with half of population below 18 years. It has a dynamic, fast-growing economy which is the largest and the most developed in East Africa with the highest regional GDP per capita of 89,240 KES (880 USD) (KNBS 2015). In 2014, Kenya upgraded its status from the low-income to the rank of lower middle-income country with ambition to attain middle-income country status by 2030 as per Vision 2030.

Even in the turmoil of global slowdowns and internal shocks (terrorism and insecurity, extreme weather factors, etc.), the Kenyan economy managed to attain a number of social-economic targets. With slowdown and average growth rate of 5.43% in 2004-2016, in 2016 the economy succeeded in reversing the trend with all sectors registering positive growth rates resulting in an expansion of 5.9% (KNBS 2015). For 2017, World Bank projects 6.1% growth, giving a signal about the recovery of the economy. Moreover, Kenya increased spending in health and education and, as a result, reduced child mortality and attained near universal primary school enrolment (WB 2016).

At the same time, Kenya still faces critical social challenge of tackling rising poverty. The number of people in Kenya living below the poverty line is 43.4 % (WF 2015). Extreme poverty relates to 18% of population with consumption levels insufficient to meet basic food needs (22% in rural and 8% in urban areas) (Pueyo 2015). There is a wide divergence of poverty across the country. In the poorest regions poverty levels are above 70% (Pueyo 2015). Indeed, the poorest regions such Turkana and Marsabit have deprived state of health, education and infrastructure systems and absence of connection to the national electricity grid (Omari 2011). This signifies the importance of inclusive development paths based on pro-poor approaches that “equally values and incorporates the contributions of all stakeholders - including marginalized groups - in addressing development issues” (www.oxfam.org).

Moreover, being a home to the world's most mesmerizing natural wonders with the savannah, mountains, and coastline, Kenya also faces devastating problems of environmental degradation and high vulnerability for climate change effects with overexploitation of resources, including deforestation, soil erosion, desertification, water shortage, domestic and industrial pollution that adversely affect human health and raises the risk of epidemics.

Failure of coping with environmental and social challenges and risks, including adaptation to climate risks can jeopardize the further economic development trend of Kenya. In this

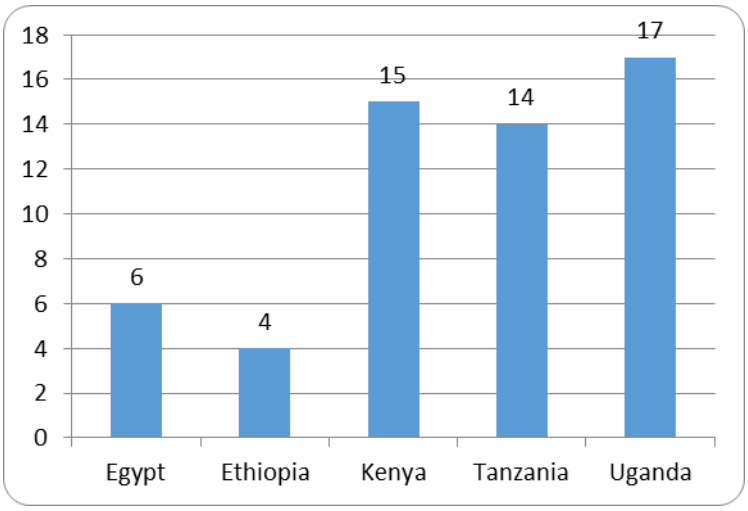
context inclusive green investment can facilitate mitigation of climate change impacts and promote sustainable development while enhancing economic growth.

5. Why a green energy economy in Kenya?

Current situation of the energy sector

Kenya's economy is developing and diversifying on the background of a rapidly growing population, currently amounting 47 million. Accordingly, energy has an essential role to play to fuel the overall growth of Kenya's economy that experiences increased demand backed by strong consumption and investment. However, energy costs and energy inefficiency affect the competitiveness of local businesses, especially, of small and medium enterprises, and the livelihoods of poor households. Small and medium enterprises have growing need for energy that currently comprises 40% of operating costs (Maina 2015). In fact, in Kenya the cost of energy is among the highest compared to other countries in the region (Figure 5.1).

Figure 5.1. Electricity tariffs in Africa (USD cents/MWh), 2014



Source: Authors' own, based on data from Maina 2015

Power generation

In East Africa[1], Kenya records the second highest power generation and power consumption rates after Egypt with Kenyan import of electricity overweighting the export (ICA 2011). The country's current generation capacity is 2,150 MW for providing energy services to its growing population. This, however, can hinder the economic growth plans envisaged by Vision 2030 with ambitious target of increasing generation capacity by 5,538 MW by 2017 and by 23,000 MW by 2030 (SMTP 2013; USAID 2015). As for electricity production, the

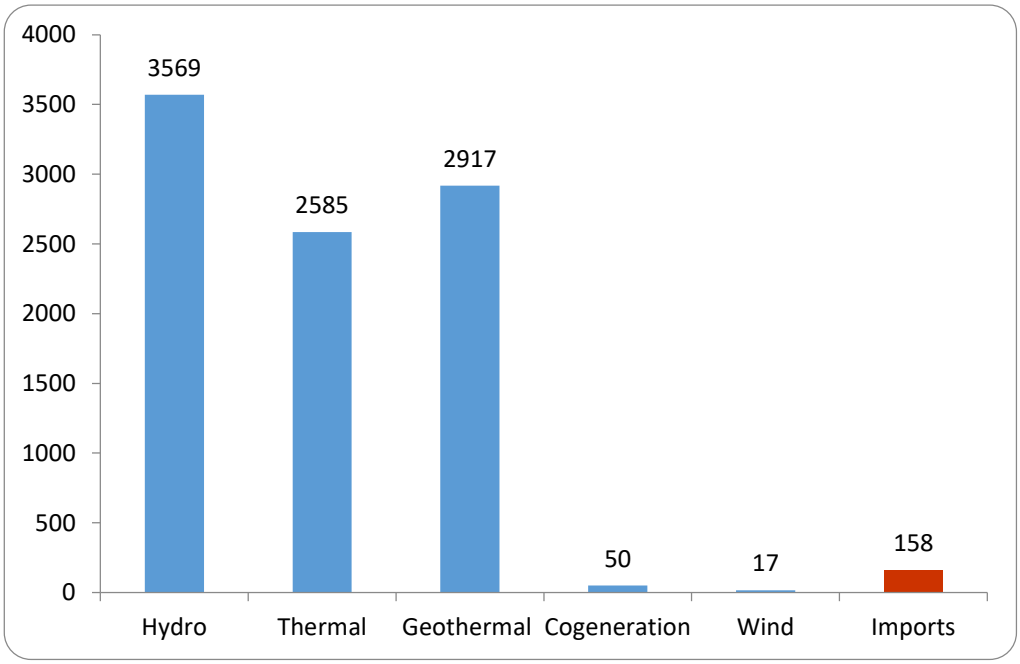
[1] East African countries include Burundi, Congo, Egypt, Ethiopia, Kenya, Libya, Rwanda, Sudan, and Tanzania. Potential member countries are Uganda, Djibouti, and Eritrea.

existing capacity can hardly meet the increasing demand. Moreover, taking into account that almost 40% of electricity comes from hydropower, the situation is particularly difficult during the summer months when water levels are low.

In general, the energy sector of Kenya is dominated by biomass that comprises 68% of energy consumption, predominantly in rural areas where wood fuel and biomass are the main energy sources. Petroleum provides 22%, electricity 9% and other sources 1% of overall energy requirements (MEP 2016a).

According to Kenya National Bureau of Statistics (KNBS), in 2014, in the electricity sector the generation mix totaled to 9,139 GWh. As Figure 5.2 shows there is overdependence on hydropower, which makes up 39%, with its vulnerability to variations in hydrology and climate. Geothermal and thermal make up 32% and 28%, respectively. Solar and wind comprise very small part of less than 1%.

Figure 5.2. Electricity generation by source (GWh), 2014



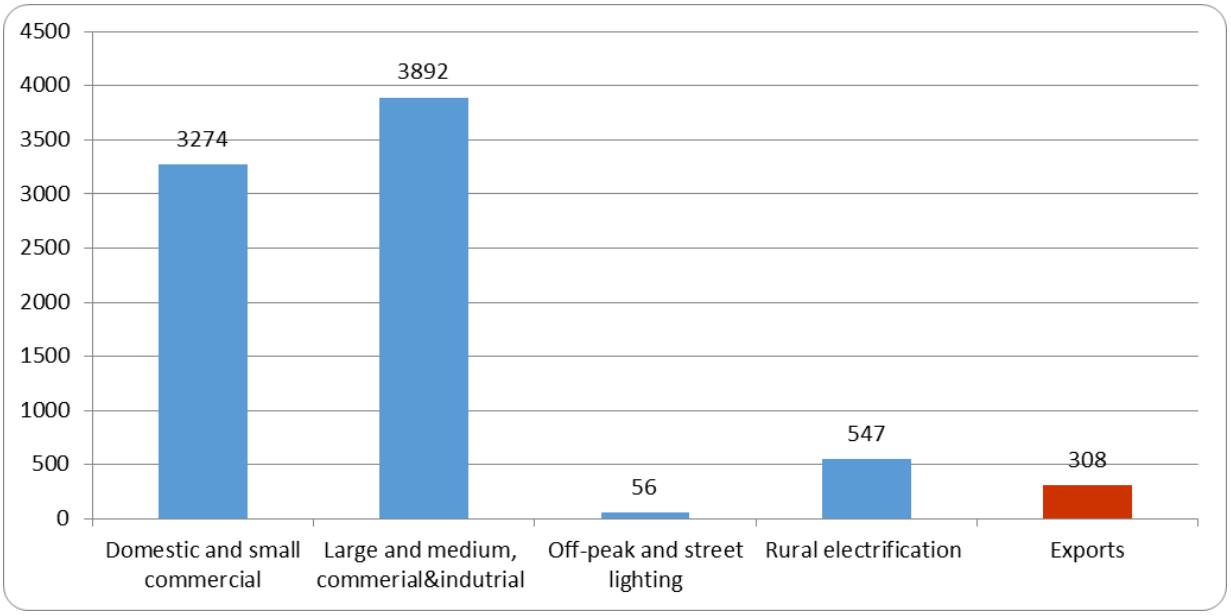
Source: Authors' own, based on data from KNBS 2015

Energy access gap

In 2014, total electricity consumption was 7,769 GWh (KNBS 2015). Figure 5.3 demonstrates that domestic and small commercial sectors are the second largest consumers (42%). At the same time, there is an electricity gap that is larger in rural areas where only 7% of population

has access to electricity. There are significant variations in electrification across the regions in Kenya: Northern and Eastern counties register close to zero percent rural electrification rates contrast to 60% in urban areas of Nairobi, Kiambu, Kajiado and Lamu (Pueyo 2015).

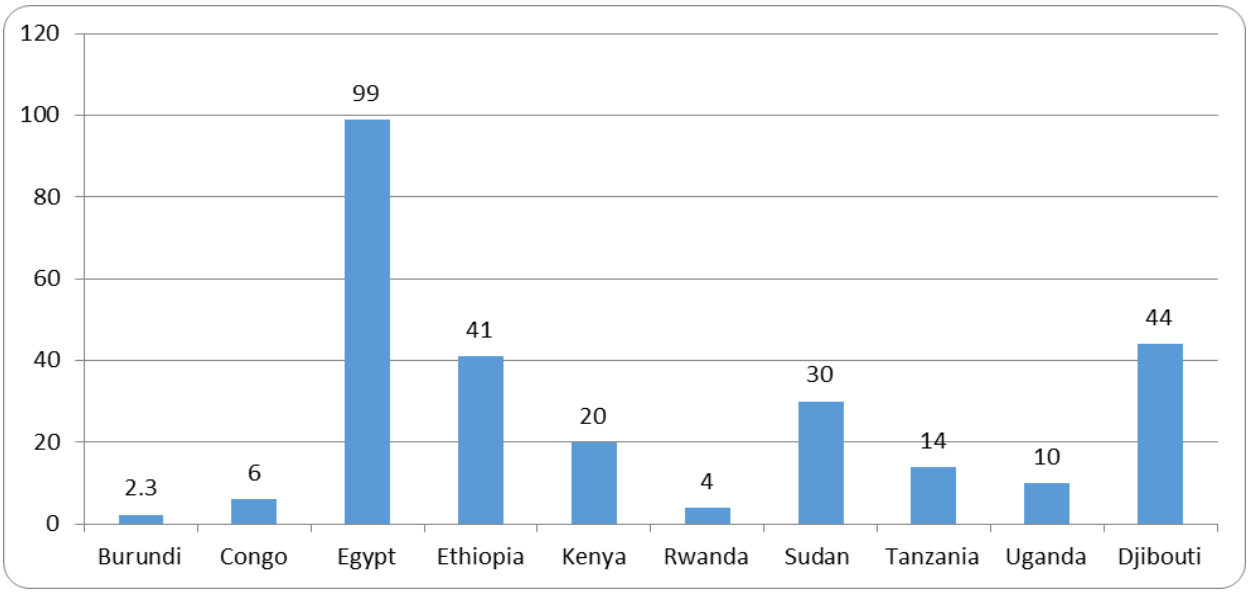
Figure 5.3. Electricity consumption (million KWh), 2014



Source: Authors' own, based on data from KNBS 2015

Overall, access to electricity is very low in Kenya, even on regional level, accounting only 20-21%, which is lower than in Sudan, Ethiopia, Djibouti, and Egypt (Figure 5.4). Moreover, Kenya has the seventh highest deficit in access to electricity in the world (Pueyo 2015). Electricity consumption per capita comprises 169 KWh per year. This figure is much lower compared not only with the world average of 3,045 KWh, but also with average 535 KWh in sub-Saharan Africa and average 219 KWh in all low income countries (Pueyo 2015).

Figure 5.4. Electrification rate in Africa (%), 2009



Source: Authors' own, based on data from ICA 2011

Electricity for lighting is used in 22.7% of households (Mwangi 2014). In urban areas electricity usage for lighting comprises 42%. At the same time, 69.5% of all Kenyan households, concentrated more in rural areas, use kerosene, batteries and candles as a source of lighting (Mwangi 2014). Kerosene for lighting in rural households amounts to 87%. Another interesting statistic regards TV ownership in Kenya, which is largely an urban phenomenon because of high access to electricity. Moreover, areas with high proportions of TV ownership also show low levels of poverty. According to the Kenya Audience Research Foundation 2015 establishment data, only 31% of adults in Kenya can reach TV on daily basis. The remaining 69% live in the 'dark', either because of the lack of access to power or simply inability to buy a TV set.

Some part of capacity gaps in Kenya are redressed by expensive thermal generation from fossil fuels. But with economic development and rising population there is a need also to satisfy increased energy demand through imports of expensive foreign energy, which in its turn retains economic growth. Oil imports amount 25% of the country's import cost account. Moreover, the problem of high energy is accompanies by inefficient energy supply infrastructure with high power losses and fluctuations (REEP 2016). Hence, affordable and locally available energy sources are prioritized.

Energy pathway to economic growth and poverty reduction

Essentially, expensive energy and lack of access to energy are the primary barriers hampering growth. The Kenyan economy bears the high costs of power shortages that are manifested by 7% decline in private sector revenues, 2% and 1.5% cuts of total GDP and GDP growth rates, respectively (Kant et al. 2014). Moreover, low electricity share in energy mix is an indicator of poverty and increase of electrification rates can foster welfare improvement. This fortifies the critical importance of energy access for poverty reduction and economic growth.

The government of Kenya has a goal of increasing electricity connectivity from 20% to 65% by 2022. Energy capacity increase is urged also to fuel a number of energy intensive flagship projects under Vision 2030 such as Technology Park, and railway, iron and steel smelting industries that are expected to significantly increase energy demand but ensure economic growth. Various measures are underway or planned for increasing the national grid.

For example, the Last Mile Connectivity project that envisages a distribution network expansion to cover residents within 600 meters from distribution transformers. Interconnections with neighboring countries are also planned (Pueyo 2015). Last Mile initiative also envisages installation of pre-paid energy meters along with financial support mechanisms for poor households: re-payment of connection fee of KES 15,000 (150 USD) over a period of two years with monthly payment of 625 KES (8 USD) (MEP 2016a). However, there is a concern that though being important, these grid extension measures, prioritizing more industrial development in largest urban are, will divert from universal household access to electricity path and leave off-grid counties representing less than 2% of total consumption by 2010 (Parsons Brickerhoff 2013).

There is a number of problems related to the connectivity of households to the grid. First, it is not economically viable to expand a grid to remote areas with a low density of population. Second, in many cases even if the grid exists, low connectivity to grids for households, especially poor, and small businesses may be explained by high connection charges and low quality of existing grids resulting in a low demand for grid connection. This necessitates the development of decentralized alternative sources of energy, such as solar.

According to the IED (2013) study, taking into account the three parameters (population density of 250 people per km2, distance to the grid of 5 km and availability of renewable and non-renewable resources), 34% of population in Kenya could be better served through grid, 24% of population can be better served through mini-grids and 44% rely on stand-alone systems. Solar energy can capture the largest share of green mini-grid potential and providing servicing to 63% of population, followed by wind (22%), and hydro (10%) and biomass (10%). At the same time, another study on lighting assessment revealed that 34

million population of 41 in Kenya are off-grid and the poor rely on expensive fossil fuels and candles to light their homes (Wanzala 2015). Low-income households in Kenya on average spend around 150 USD per year on kerosene alone, which constitutes about twenty percent of household income on average, highlighting the urgency for efficiency off-grid systems, particularly in rural areas.

This suggests that expansion in centralized power generation serves better the industry and already connected households. It can be an affordable option for regions with high demand per household, high population density and vicinity to the existing grid, before serving the poor. Decentralized green energy systems are better options in isolated regions, for small businesses and poor households that can best gain access through distributed renewable energy technologies. Solar photovoltaic, wind, biomass, and micro-hydro can be cost-effective option for off-grid and mini-grid household connections and help overcoming main barriers of delivering energy services to the poor (Hogarth and Granoff 2015).

6. Green energy potential and developments

Kenya's green energy sector is characterized by various sources and options the further development of which will contribute to meeting the growing demand for energy. According to Least Cost Power Development Plan (LCPDP) 2013-2033, renewable energy in the power generation mix in Kenya is projected to be 42% of the 20,156 MW in 2030 with the total installed capacity of 8,185 MW: 1,039 MW hydro; 5,110 MW geothermal and 2,036 MW wind. However, there are also some more ambitious plans to target 80% of renewable energy in power mix by 2030 (MEP 2016a).

Solar

Kenya is located along the equator which provides sufficient sunshine needed for solar energy collection. Overall performance of Kenya in dissemination of solar technologies is amongst the highest in East Africa (Byakola et al 2009). Even though the use of solar energy increased in Kenya, its contribution to energy balance is not very well studied (Pueyo 2015; Byakola et al 2009).

Off-grid, stand-alone solar PV systems such as solar homes systems are the least cost option for providing off-grid small amounts of electricity to households in remote, rural areas. Solar energy for lighting in Kenya can be 10% cheaper than the national grid, and 10 times cheaper than kerosene wick lamps. The solar home systems are successfully installed in Kenya to mitigate increasing demand for energy services such as lighting, TV, refrigeration and mobile phones (Pueyo 2015). About 14% of the population surveyed using solar as their primary lighting and charging source.

Solar water heaters are mandatory for new buildings, while old building need to be refurbished by 2017 (Kant et al 2014). Estimates of Ondraczek (2013) suggest that in 2010 there were around 320,000 solar home systems in Kenya with a projection to increase in coming years. The demand for solar water heating systems is projected to annually grow by 20% and reach to 800,000 units by 2020 (MEP 2016a). It will come mostly from households, institutional and small commercial users.

According to estimations, in 2014 about of 6MW of solar PV System capacity was installed in residential and commercial sectors in Kenya via private sector investments. By the year 2020, it is projected that the installed capacity of solar photovoltaic systems will reach 100 MWe with annual growth of 220 GWh (MEP 2016a). Currently, the government plans off-grid solar PV systems in all primary schools to provide power for the Laptop Programme. Licensing of solar PV technicians is in process and mandatory Solar PV regulations will soon become enforceable in Kenya. Indeed, the lack of certified installers for solar PV facilities

and lack integrated operation and maintenance services led to a number of flawed facilities installed that are not utilized anymore (Kant at al 2014).

Wind

Wind energy resources are not yet well exploited in Kenya. The present contribution is only 0.3% (MOE 2013). The installed capacity of on-grid wind power was 25MW in 2014 (MEP 2016a). But high potential coupled with increased energy costs pushes wind energy to become more promising, particularly, in remote from grid areas, mountain and costal locations for off-grid community electricity and water pumping, as well as diesel/wind hybrid systems for electricity generation (Byakola et al 2009). There are also opportunities for grid connected wind farms. Currently, Kenya has installed capacity of 5.1 MW wind farms. There are also plans to construct in Turkana area the largest wind (300 MW) farm in Africa. Overall, the government of Kenya projects to increase wind capacity by 2 GW by 2030 (MOE 2013). Wind energy generation not only reduce countries dependency on hydro power but also ensure long-term solution for meeting increasing energy requirements.

To accelerate wind energy projects, Ministry of Energy also developed a broad National Wind Atlas. Moreover, feed-in-tariff policy similar to the European one was introduced to attract private and public investments in wind facilities (Byakola et al 2009). In general feed-in-tariff offers a lower cost of per unit energy generation from all renewable energy sources. For wind energy, the policy ensures a fixed tariff of 11 US cents for electricity generated for the grid by wind farms up to the installed capacity of 1- MW. Feed-in-tariff is active for 20 years from the date of commissioning (MOE 2013).

The experience of wind park developers in Kenya highlights issues in the wind energy generation industry. For example, there are long delays in getting power purchase agreement (PPA). In long-term, feed-in-tariffs are limited and do not provide profitability. The market for wind turbines is immature. There are also general infrastructure related issues such as service roads and high cranes for installation of turbines that are missing in Kenya (Kant et al 2014).

Geothermal

Kenya is the first country in Africa that used geothermal energy for electricity generation. Geothermal energy is the second highest source of energy. The main resources of geothermal is located in the Rift Valley with potential capacity of 2,000 MW. It has high potential and the government of Kenya supports its development. There are a number of exploration works underway. Currently there are three operational geothermal plants with capacity of 120 MW (Byakola et al 2009). About 32% of electricity supply to the grid is provided from geothermal sources. The plans are to develop another four plants

Hydropower

Hydropower is the largest source of electricity generation in Kenya (Figure 5.2) with hydroelectric potential of 6000 MW. There is overreliance on large hydropower production and hydro energy is not a favorable choice anymore in Kenya due to its vulnerability to droughts. At the same time, there is a big potential for stand-alone systems that can play a vital role for meeting energy demand in remote, rural areas. The potential for small hydro is over 3000 MW. There are four main categories of small hydro systems in Kenya: pico (<5 kW), micro (5-100 kW), mini (100-1000kW) and small (1000-10000 kW) (Owiti and Wesley 2011). These decentralized systems may serve to supplement rural electrification program implemented by the government, to assist industries to make savings for energy bills, to feed nearby grid, or just several households without a need for a grid system. The Sessional Paper N4 and the Energy Act are the main legislative base for promoting research, development and production of cost effective small hydro technologies. Feed-in-tariffs for small hydro systems are also in place that can attract interest to invest in small hydropower.

Biogas

Even though there is a high potential for biogas in Kenya, biogas technology is not used widely. About 30% of the 800 biogas digesters installed in late 1980s ceased operation. The main problems are poor management, high initial capital costs, high maintenance costs, limited water supply and weak technical support. The government is ready to assist research and development to revive this sector (MOE 2004).

According to expert opinion, biogas industry has big perspectives for development. There is no tax exemptions for biogas installations, but there is a support from the governmental and development organizations. New technologies enable to produce big amount of energy from biogas to supply to households. This can be very useful especially for remote rural areas, where it can replace conventional energy sources such as paraffin and kerosene for cooking and lighting. The problems, however, are capacity and knowledge of farmers that limits the production of biogass from waste. There is also a lack of technology to utilities all alternative materials. There are also problems with maintenance of facilities: when equipment is broken, there is no back-up service. Development of more favorable legislation with tax exemption on technologies coupled with capacity building programs with wide spectrum of stakeholders could promote developments in this sector. Also, proper financing models for individuals and communities are needed. At the moment there are no interesting models for funding, but once the strategy and framework program is launched, new financing models will be developed.

Biomass

Biomass is the largest primary energy used in Kenya, comprising about 69% of total national primary energy use (MEP 2016a). Percentage of households consuming biomass (firewood, charcoal, and agricultural waste) makes up 83%. Almost 90% of rural population rely on firewood for cooking and heating (Byakola et al 2009). Biomass demand increases when there is a lack of access to other energy sources and when poverty level is increasing. Usages of biomass in Kenya puts pressure on forests and vegetation stocks and fosters land degradation. About 45% of woody biomass is derived from forests. This raises problem of a gap between the existing tree cover versus the minimum constitutional requirement of 10% (MEP 2016a). Moreover, utilization of inefficient technologies, such as three-stone cooking methods, contribute to waste of energy and unsustainable biomass consumption in the country. Hence, improved efficient technologies, such as improved charcoal stoves or improved ceramic wood stoves, can reduce fuel use by 30-50%, cut fuel costs and reduce smoke emissions and significantly improve livelihoods for the poor. There is also a potential to use biomass resources such as agricultural waste from sugar cane for electricity generation in rural regions.

Energy saving and efficiency

Energy saving and using energy more efficiently are important measures of demand-side management of energy for maintaining sustainable and secure energy supplies, reducing energy imports, increasing the productivity of businesses and saving households and businesses money on energy bills. Taking into account dependence of imported petroleum, high energy costs, low levels of electrification and wastage of energy of 10-30%, the government of Kenya is promoting energy saving and efficiency improvement at all levels through appropriate policy designs and project implementation (Kirai 2007). Measures also involved public awareness and capacity building with development of technical competences. Currently, the New Energy Act foresees rules and guidelines for energy efficiency in all facilities plus incentives.

7. Kenya's inclusive green development vision

The Government of Kenya has strong commitment at very high level for green and inclusive development. The country's fundamental legislation - New Constitution 2010, sets out commitment to an ecologically sustainable development and a clean, safe environment for all (Murai and Kirima 2015).

Kenya's development master plan – Vision 2030, proclaims steady growth and transformation of Kenya into "globally competitive and prosperous country with high quality of life". Vision 2030 is based on three pillars - economic, social and political – strengthening the importance of "*macroeconomic stability; continuity in governance reforms, enhanced equity and wealth creation opportunities for the poor*". It aims to reach annual GDP growth of 10 percent and ensure "high quality of life to all its citizens by 2030 in a clean and secure environment" (http://www.vision2030.go.ke). Vision 2030 intends to realize the Kenyan dream of transferring into the league of middle-income countries, where citizens enjoy widespread prosperity and incidents of extreme poverty are few. In the implementation of Vision 2030, infrastructure is the primary issue to be addressed along with priority areas, such as science, technology and innovations, human resources development, security and public sector reforms. Under the Vision, Kenya expected to meet its Millennium Development Goals (MDGs) by 2015. However, because of global crises and domestic hardships this has not been realized.

The Second Medium Term Plans, SMTP (2013-2017) of the Vision 2030 envisages six priority sectors and commitment to increase public spending on expansion and modernization of infrastructure and to create 1 million new jobs, including green jobs (Murai and Kirima 2015). In particular, the SMTP promotes energy infrastructure improvement and the development of new and renewable sources of energy, including generation of energy from solar, wind, biogas and production of bioethanol. It also promotes energy efficiency measures such as improved cooking stoves and charcoal kilns. The SMTP (2013) envisages development of the Renewable Energy Master Plan and revision of the renewable energy database. Selected list of related SMTP projects is presented in Table 7.1.

Table 7.1. Selected list of SMTP projects

Project	Objective	Expected outcome	Implementing agency	Source of funding
Development of new and renewable sources of energy	Enhance access to renewable energy by institutions and households far from the main grid	500 institutions connected to solar energy	MOE/REA	GoK REA
Other renewable energy projects	Enhance access to renewable energy by institutions and households far from the main grid	Household/ institutions supplied with renewable energy facilities	MOE/REA	GoK REA
Co-generation projects: wind and solar hybrid	Increase penetration of renewable in isolated mini-grids	20 wind, solar hybrid generators installed in isolated mini-grinds	MOE/REA	GoK PPP

Source: Authors' own, based on data from SMPT 2013.

Despite Kenya bears little responsibility for human induced climate change related with industrialization and is actually low carbon-intensive economy, it is extremely vulnerable to its impacts. Extreme climatic events can cost Kenya more than 500 million annually, which amounts to 2.6% of the 2013 GDP with projections to increase to 7% of GDP by 2010 (Murai and Kirima 2015). The Kenyan government is committed to implementing adaptation and mitigation measures, such as renewable energy and energy efficiency that also offer a number of social and economic co-benefits. The Kenya's National Climate Change Response Strategy and its National Climate Change Action Plan 2013 foresees distinct low-carbon and resilient development plan that highlights the need for promoting sustainability and tackling climate change issues, such as reduced hydropower generation, declining crop, reduced water supply. The plan is, however, criticized for not being well harmonized with Vision 2030 (Kant et al 2014).

Furthermore, Kenya affirms its commitment to transitioning to a green economy as a means towards sustainable development envisaged by the RIO+20 that addresses important aspects such as ending poverty and ensuring access to energy. Notwithstanding that in Kenya there is no common definition of green economy, it usually means development that promotes resource efficiency, social inclusion, and sustainable infrastructure. Hence, social inclusiveness and renewable energy and energy efficiency investments are among the priority programs supporting green economy transition (GESIP 2015).

Based on this, the Government has developed the 2015 Kenya Green Economy Strategy and Implementation Plan (GESIP) that draws a policy framework for promoting transition to green economy. It stresses the need for tuning green economy initiatives with economic, social and environmental settings of the society and ensuring that they are in line with development goals of Kenya Vision 2030 and SMTP (2013-2017). Accordingly, the GESIP

model focuses on five focus areas: 1) promoting sustainable infrastructure, 2) building resilience, 3) promoting resource efficiency, 4) sustainable natural resource management, 5) social inclusion and sustainable livelihoods. Social inclusion goal of the GESIP 2015 stipulates increased attractiveness to green jobs by increased access to social protection benefits. Moreover, social inclusion stresses the importance of establishment and support of small- and medium size enterprises. Among other things, strategic action lists establishment of SME financing mechanisms, promotion of small and promotion of creation of green-tech start-ups through innovation and replication. Annex 4 details the overall policy framework for a green economy in Kenya.

Accomplishing this ambitious goal of national transformation will require not only a fundamental shift from business as usual to new governance practices and proactive legislating, but also special budgeting and investment models to effectively deal with supportive huge financial resource streams. In fact, the required annual global investments for green economy transition amount to 1-2.5% of global Gross Domestic Product (GDP) till 2050 with highest investment in energy and transport (UNEP 2014 b). In Kenya, according to green development estimations, population will benefit from the economic development under the "2% of GDP for green investment" scenario (GE2%). Under green investment (GE) scenario annual GDP growth rate will be 5.2%, which is higher than 4.6% growth rate under business as usual scenario (BAU). Moreover, under real per capital income is projected to increase from 43,221 KES (428 USD) in 2015 to 69,207 KES (685 USD) in 2030, which is again higher compared to 53,146 KES (664 USD) in 2030 under BAU. Under GE the percentage of the population below poverty line will reduce from 0.33 % in 2015 to 0.16 % in 2030 and amount 2% lower than under BAU. This proves green growth be more inclusive. At the same time, the total investments required for green economy scenario are estimated about 1.2 trillion KES in 2012 to 2030 or about 70 billion KES annually (GESIP 2015). This opens up new opportunities to mobilize the capacity of the financing system to provide long-term financial services to the economy in accordance with sustainability principles, such as inclusive green investment.

8. Policy options and instruments for green energy development in Kenya

The recent high oil prices and need for enhancement of the energy security urged the government of Kenya to set up a new energy policy framework with more emphasis on the development of alternative forms of energy. Alternative or green energy sources benefit not only economics, but also enhance security of supply and generate social benefits to the country. Below described are the key components of the policy and legal framework for green energy in Kenya, many of which are also referred to throughout the paper. This part is brought based on literature review and interview contributions. The interviews helped to highlight new developments and operation limitations in light on practical experiences.

Strategies and policies for promoting green energy

Overall, Kenya's clean and renewable energy governing framework consists of series of sector policies and strategies that are relevant to green energy development. A consolidated list of policy framework is presented in Table 8.1.

Table 8.1. Clean and renewable energy governing framework in Kenya

Strategic Planning	Policy and Law	Regulation	Private Sector Plans
Kenya Vision 2030, est. 2008, economic growth agenda	Energy Policy/ Sessional Paper N4 for 2004 on Energy	Standardised PPA for small scale RE (up to 10 MW), 2012	Kenya Country Action Plan- Cookstoves
Scaling-up Renewable Energy Programme, Investment Plan for Kenya	Energy Act N12, 2006 consol. Electric Power Act N11, 1997 and Petroleum Act Cap.116	Energy/Complaints and Dispute Resolution Regulations, 2012	Kenya National Domestic Biogas Programme
Kenya's Last Mile Connectivity Project, 2015-2017	New Kenyan Constitution, fosters Devolution, 2010	Energy/Energy Management Regulations, 2012	Lighting Africa Programme
Kenya's 5000 MW Power Plan, 2013-2016	Feed-In Tariffs Policy (rev. 2008, 2010, 2012)	Small Scale Grid Connected RE Framework, 2012	
Least Cost Power Development Plan, 2013-2033	Public-Private Partnership Act 2012	Energy/Electricity Licensing Regulation, 2012	
Rural Electrification Master Plan	New National Energy Policy and Bill (latest draft Aug. 2015)	Energy/Solar PV Regulations, 2012	
National Electrification Program Prospectus	New Energy Bill 2016 (latest draft Aug. 2015)	Energy/Solar Water Heating Regulations, 2012	
Power Generation and Transmission Master Plan	New Kenya Electricity Grid Code (2016)	Designation of Energy Users Gazettment	
Kenya National Electrification Strategy	Auctioning expected to replace FiT in 2016	Electric Power/Electrical Installation Work Rules, 2006,	
	Mini-grid Policy (2016)	Petroleum Regulations (11) …	
		Mini-Grid Regulation	

Source: Authors own, based on data from GIZ 2016b and MEP 2016a
Note: marked in green bottom rows are proposed new plans, laws and regulations

In general, literature review (Willcox et al 2015; Muriithi 2016; GIZ 2016; MEP 2016a) and most of interviewed experts expressed the opinion that in the region the Kenyan policy and regulatory framework is much more mature and favorable for clean and renewable energy initiatives to thrive. Kenyan energy system is bigger and can be more advanced than in Tanzania and Uganda. With a number of aspects (for example, advanced feed-in-tariff or mini-grid regulation), it is a pioneer setting the stage for a number of new initiatives kick-off and then to replicated in other countries. Currently, in addition to existing laws and regulations, there is a series of new proposed laws and regulations (marked in green in Table 8.1) that are expected to come into force in the near future. These mainly cover mini-grids and energy pricing aspects. These are essential policy developments taking into account that these mechanisms can stimulate the expansion of micro-decentralized systems that can be a cost-effective solution to remote small settlements in Kenya.

Among the fundamental components of the framework is the Kenya Vision 2030 that constitutes the main development program incorporating a number of targets for inclusive and green energy. It highlights a number of flagship projects that among other include such as rural electrification programmes, energy access scale-up programme, solar electricity generators to public institutions, etc. The Vision 2030 also envisages establishment of solar PV panel manufacturing plant in Kenya, which will strongly enhance the value chain activities of renewable energy industry.

The Energy Policy is implemented through several acts including the New Energy Act 2006 that consolidated the Electric Power Act and the Petroleum Act (MEP 2016a). It provides the national policies and strategies for short- and long-term energy development. According to the act, the Energy Regulatory Commission (ERC) was established with responsibilities for economic and technical regulation of electric power, renewable energy, petroleum subsectors, as well as tariff setting, licensing and dispute settlement. For strengthening the rural electrification process, the Energy Act also constituted the Rural Electrification Authority and Rural Electrification Fund. The agency promotes renewable energy development, including the solar rollout program that targets electrification of all schools (GESIP 2015). The Energy Act stipulates liberalization of energy systems, through there are a number of problems. Participation of private sector in transmission, distribution and supply systems is not possible in case of over 1MW. Improvements are also expected for net metering and electricity banking policies (Kant et al 2014).

National energy planning in Kenya is realized by the policy envisaged in Sessional Paper No4 on Energy (the Energy Policy of 2004). It sets the energy policy framework targeting provision of adequate, cost effective and affordable energy services taking into account environmental and social implications in the domestic sector. For promoting wider penetration of renewable energy technologies, the government took the commitment to support research development in this field and to design incentive package for enhancement of private sector investments in renewable energy and other off-grid generation.

Important for consideration is also the Rural Electrification Programme that is implemented by the Rural Electrification Authority (REA) countrywide with targets to connect 6,304 public facilities such as trading centers, primary and secondary schools, health centers and dispensaries, etc. (SMTP 2015). The program stipulates installation of both grid connection measures and mini-decentralized systems: mini-grids, hybrid mini-grids and off-grid/stand-alone systems. As a result, significant achievements have been registered in electrification of schools (Muriithi 2016). According to Willcox et al (2015) study, under this programme the number of grid connections increased from 205,442 in 2009 to 382,631 in 2012 with an average increase of 23% per year. However, based on the development trend, achieving of

utilities target of expanding rural electrification 40% by 2020 will not be possible unless more drastic measures are implemented to enhance the generation capacity. Among the problems faced were the increased costs of materials and operations related with connection. For mitigating related social impacts, the government launched 2.7 billion KES subsidy programme in 2013 to finance some categories of new household connections, but direct capital subsidies for distribution lines to remote rural areas are not generally available. Moreover, because of poor infrastructure and security issues, transportation of equipment for grid connections in these remote areas became expensive and problematic. Furthermore, it is a long-time consuming process for households and SMEs to get connections to the main grid.

In total, the national grid, that concentrates more in the south, connects 33% of the country covering 86% of the population (Muriithi 2016). Arid northern areas are not economical for grid expansion. Therefore, under the Rural Electrification Master Plan of 2009, in these areas isolated mini-grids and off-grid/stand-alone solar PV and wind installations are stipulated for electrification. Work is in progress with some old off-grid diesel power stations retrofitted and new one constructed or being in progress (Muriithi 2016).

Support instruments and incentives for green energy

Feed-in-Tariffs

Kenya's Feed-in-Tariff (FiT) framework was first established in 2008 with further revisions done in 2010 and 2012. The FiT policy aims to strengthen the enabling environment for promoting generation of electricity using different types of renewable energy resources through reduction of transactional and administrative costs, resources mobilization and encouragement of private investors participation in renewable energy projects. In general, FiT allows power suppliers to sell to the grid and obliges distributes, on favorable conditions, to buy all renewable energy generated power at a fixed price for a fixed period.

Currently, the FiT incentives in Kenya relate to grid connected wind energy, biomass, small-hydro, geothermal, biogas and solar source generated electricity. FiT also applies for off-grid solar generation with minimum capacity of 500 kW. However, even being high for off-grid solar, tariffs is still not enough to enable rapid uptake of these technologies (Willcox et al 2015). Table 8.2 details on FiT tariffs in Kenya for small and large projects. The FiT levels depend on a number of factors, such as investment and maintenance costs and amount of generated electricity.

Table 8.2. Feed-in-tariffs in Kenya

		MW	Std. FiT (USD/kWh)	Escalable portion of tariff (%)	Min capacity (MW)	Max capacity (MW)	Max Cummulative capacity (MW)
Up to 10 MW	Wind	05.-10	0.11	12	0.5	10	
	Hydro	0.5	0.105	8	0.5	10	
		10	0.0825				
	Biomass	0.5-10	0.10	15	0.5	10	
	Biogas	0.2-10	0.10	15	0.2	10	
	Solar, grid	0.5-10	0.12	8	0.5	10	
	Solar, off-grid	0.5-11	0.20	8	0.5	1	
Above 10 MW	Wind	10.1-50	0.11	12	10.1	50	500
	Geothermal	35-70	0.088	20 - first 12 years	35	70	500
				15 - after 12 years			
	Hydro	10.1-20	0.0825	8	10.1	20	200
	Biomass	10.1-40	0.10	15	10.1	40	200
	Solar, grid	10.1-40	0.12	12	10.1	40	100

Source: Authors' own, based on data from MOE 2012

The government of Kenya is dedicated to provide a policy of subsidies and financial support for household connections. In particular, it envisages electrification subsidy of 100, 000 KES per household based on household contribution of 35,000 KES to be paid in installments. The tariff structure also contains a "life tariff" subsidized at a rate of 2 KES for electricity consumption of up to 50 KWh per month for all residential consumers. This subsidy is funded by those households that use above 1,500 KWh per month. Moreover, there is a policy of implementing uniform tariff all over the country with rural users to be subsidized by urban users. As for mini-grids, the publicly owned mini-grids charge uniform tariffs. In case of the privately owned mini-grids, the operator proposes a tariff at levels that can be higher than Kenya Power's grid tariffs and that needs to be approved by the regulator (Willcox et al 2015).

According to some expert opinion, FiT in Kenya is the most progressive in the region. The newly proposed FiT policy makes the connection easier to the national grid. Initially, it was compatibly bidding based on a request proposal for developing a power plant. Revised FIT framework is developer driven. According to it, anyone can design its own power plant project and apply any time to the Ministry of Energy. The advantage is that there is no need for a renewable energy project developer to wait for the Ministry of Energy (MOE) to ask for a proposal. Developers need just to express their interest in applying to the MOE and get the approval for starting the feasibility study activities. Important aspect to note is that as a part of feasibility study, there is a requirement to conduct environmental and social impact assessment, which should be approved by the National Environmental Management

Authority (NEMA) before submission to MOE. After the feasibility study is done, MOE provides approval for a power purchase agreement between the Kenya Power utility and the developer.

The policy revisions also envisage introduction of energy auction as another policy stream. Energy auction is government driven. The government announces an auction for a specific site and specific technology. Those who are auctioning are proposing tariff. Then government makes decision based on tariff. Currently, the Ministry of Energy conducts a feasibility study for hydro and wind projects with a map of sites.

As experts state, currently Ministry of Energy is formulating a regulation to encourage private sector investment in mini-grids. It may include subsidy to cover the difference between cost-reflective tariff and consumer tariff since mini-grids are expensive. The general policy of the government is to ensure equity for all people in Kenya to pay equally for electricity via uniform tariff for everyone. Therefore, the government is ready to subsidize difference of higher cost of generation of power though private sector pushes for charging the cost reflective rate.

It is evident that the policy is to have affordable tariffs. However, energy developers claim that FiT do not match the cost of investment, operation and maintenance. It is also not clear if the uniform tariffs should prevail and if cost-effective tariffs will be allowed (MEP 2016b). Moreover, the FiTs are not indexed for inflation that reduces the profitability over years (Kant et al 2014).

Indeed, the regulation of tariff is crucial. Newly installed power facility project can go down because of improper tariff strategy. An example is Takawiri Island where Powergen company installed mini-grid facility. Initially, when Powergen went to the island, people agreed to connect to the grid since there was no other power option. After some time, residents felt that the tariff is too high and unaffordable for them. Hence, they ceased paying for electricity. The connection was there but people were not using it. As a result, the developer dismantled the facility. But people found another solution of having solar home systems for basic requirements such as lamps, radio, phone charging and even TV (personal communication with expert).

Power purchase agreements

Power purchase agreement (PPA) is a financial contract between the electricity developer and the buyer that may differ based on location of facility and the scale and type of electricity generation technology (Berg 2012). Normally, the developer on the design, permitting, financing, installation of a renewable energy system at a specific site, provision

of the generated power at an agreed rate. In Kenya the power purchase agreements between utilities and developers has to be approved by the Energy Regulatory Commission.

Kenya's FiT Policy is designed to reduce the burden of contracting and negotiations for renewable energy developers through the provision of template FiT Power Purchase Agreements (Willcox et al 2015). For small-scale grid renewable energy projects of up to 10 MW, a Standardized Power Purchase Agreement (PPA) is introduced. While the FiTs are technology specific, the Standardized PPA FiTs are technology neutral. Standardized PPA for small projects envisages no bidding for renewable sites and resources based on "first come, first served" principle. Larger than 10 MW renewable energy projects has to meet dispatch and system stability requirements (MOE 2012).

Among some problems with PPAs, per expert opinion, is that renewable energy project developers need PPAs to be bankable and valid for presenting to banks for getting money. However, the banks have issues related with some items of the PPA that prevent them from getting into finance agreement with project developers. According to expert opinion, nonetheless, there is still a room for negotiations for revisions to make PPAs bankable.

Net metering

Net metering is an arrangement when excess electricity produced is sold back to the interconnecting utility, usually at the retail price. Normally, net metering is considered as an important mechanism for promoting small renewable energy facilities (Berg 2012).

In Kenya, the new Energy Bill 2015, which at the time of writing this study was waiting for s signature of the President of Kenya to become a law, stipulates an important provision for net metering that enable any producer of renewable energy to sell the access of generated power to Kenya Power utility. It is expected that the revised feed-in-tariffs, net metering and innovative power wheeling schemes will enhance Kenya's steps on the way to universal electrification.

Power wheeling

The new Energy Bill also incorporates an innovative power wheeling mechanism. Power wheeling refers to the transportation of electrical power (megawatt-hours) through transmission and distribution lines from within an electrical grid to an electrical load outside the grid boundaries or from one utility service area to another's.

If renewable power generation source is far from user or energy developer does not have is own power transmission lines (connection to the grid), the developer can get into agreement with transmission line owners in Kenya - Kenya Power or Kenya Electricity Transmission Company Limited (KETRACO). The developer can pay wheeling charge to the transmission line owner for transiting power from the source to the user site. This is an analog of road toll payment. Advantage of this approach is to move the least cost power to

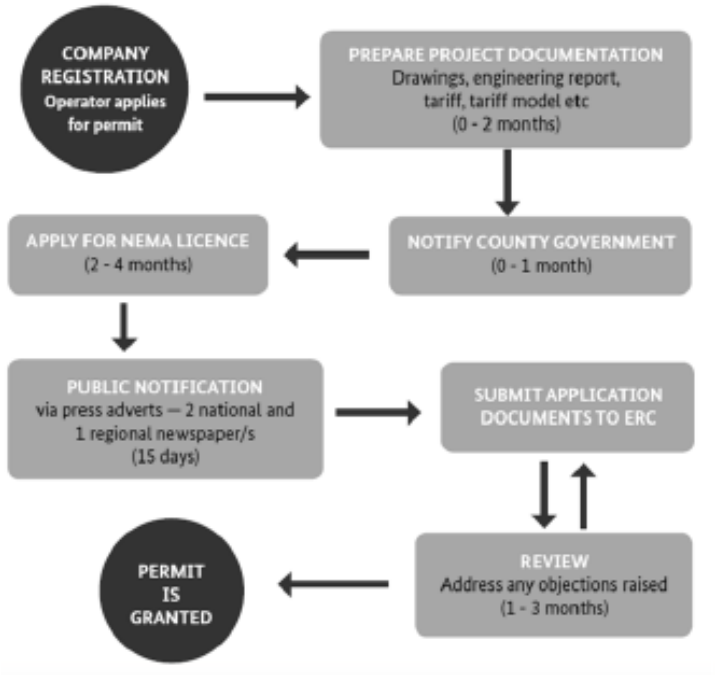
where it is the most needed, maximizing efficiencies. Under power wheeling system utilities can benefit from buying power from another service area rather than building a new more expensive power generation plant.

Licensing

Energy Regulatory Commission issues licenses for individuals and companies that are operating throughout the value chain of solar PV systems: manufacturing, implementation, design and installation. This helps to increase confidence for investments in these technologies. For individuals, application consists of academic and professional credentials of the applicant and written or oral interviews based on which the license is issued approximately within 60-70 days. For companies, the main requirement is to have licensed technicians that can conduct activities. ERC conducts company inspections to check of licensed staff and proper facilities and issues license on average within 30 days. All the individuals and companies licensed are listed on ERC website (personal communication with ERC expert).

Licenses and/or permits are also required for installation and operation of mini-grids. For example, during installation solar installer license is required if solar technology is used along with importation license or permit. During operation licenses or permits are required for power generation, distribution and power supply (Osawa and Telep 2015). Permits are required if facility is less than 3 MW. In case of power facility generating more than 3 MW license is required (GIZ 2016b). The procedural steps for getting permit are presented in Figure 8.1. Before application for installation or operation permit, the developer should get environmental and social impact assessment license from the National Environmental Management Authority (Osawa and Telep 2015).

Figure 8.1. Procedures for getting permits



Source: GIZ 2016 (b).

Even though there is no clear regulatory framework for mini-girds yet, the developments are there. Both the current the Energy Act 2006 and the proposed Energy Bill 2015 establish provisions for developers to apply and obtain generation and distribution licenses through the regulator. Currently, there are already two mini-grid projects (Talek Power and Powerhiv) running with licenses issued by ERC. A lot of interested to mini-grid development is reflected in a number of license requests submitted to ERC (personal communication with ERC expert).

According to experts, major problem is high cost of technology that hinders uptake and low awareness, especially among the poor, on technology. Other big problem in Kenya is the market spoilage, i.e. availability of faulty appliances and facilities in market that discredits renewable energy in general as being something “not actually working”. As a rule, this kind of faulty technologies are cheap and people are going for them and expending this market and spoiling the market of quality products. In 2009, Lighting Africa started the process of testing the quality of solar products available in the African market. As a result, 13 out of 14 Pico PV products did not pass the test. The results of another test conducted in 2012 showed that 46 out of 120 solar facilities again did not pass the quality test (Da Silva 2016).

ERC is putting a lot of efforts for combating this. In particular, it made mandatory for public institutions in their programs to include requirements for licenses. In cooperation with

Kenya Revenue Authority, ERC through tax and customs systems tries to ensure that whatever is brought or produced in the country is done by licensed companies. ERC also works with industry groups to encourage member to have licenses and report any unlicensed cases. For this process, it is important that in Kenya there are laboratories for testing the quality of equipment. Currently, there are no accredited testing laboratories. The laboratory of the Energy Research Centre of the Strathmore University is in process of receiving ISO accreditation soon. The laboratory is equipped with the up-to-date equipment and has qualified experts.

Regulatory requirements

The Energy Management Regulations 2012 requires energy audits for large energy users that exceed energy use of 15,000 KWh per month or 180,000 KWh per year. The audit requirement can cover facilities such as shopping centers, agricultural industries, cement factories, universities, hospitals, big hotels, etc. Another important regulation is the Solar Water Heating Regulation 2012 that requires installation of solar water heaters in existing and new buildings that use more than 100 liters of hot water per day. The transition period for these measures is set for 2017 (MEP 2016a).

According to experts, government also has intention to introduce technical standards for renewable equipment to promote reliable quality facilities. For example, new standards are imposed for cookstoves that need to be tested and given certificate of quality of emission. Kenyan Association of Manufacturers (KAM) developed the main structure for voluntary labeling for home use equipment. The implementation rests with Kenyan Bureau of Standards (KEBS). Minimum performance standards exists also for standalone solar home systems, which are set and regularly revised by the KEBS in collaboration with other energy stakeholders (Willcox et al 2015). These measures help to tackle with issue for fake facilities and cease the perception that solar is bad and expensive to install and operate.

Direct investment support

Direct investment support includes loan guarantees and tax incentives. In the clean energy field in Kenya, these include depreciation allowances and tax holidays including seven-year income tax holiday for renewable energy projects (Pueyo 2015).

VAT Act 2013 allows developers to import equipment at zero rate for power generations from renewable energy: any solar, wind or biogas. Mini-grid equipment is also exempted from value added tax and import duty. There is also a 150% capital tax waiver (Willcox et al 2015). For getting exceptions, there is a requirement to prove that all these are needed for energy production, which proves to difficult. According to experts, the problem with VAT Act is the cumbersome process of applying to many governmental institutions (Ministry of Energy, Ministry of Finance and National Treasury) that may take more than a month time.

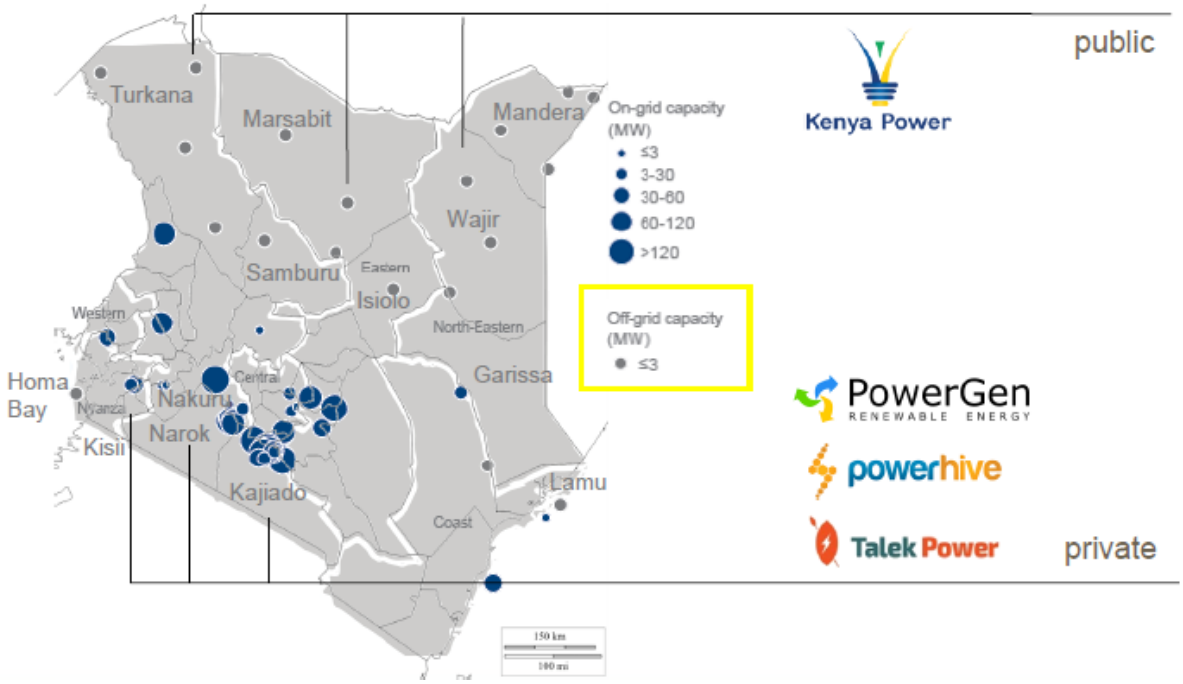
Meanwhile, the government ceased tax exemption for locally produced solar products and suspended licensing of wind and solar projects until 2017, thus, providing mixed signals to investors. As a result, potential investors made choices to go outside Kenya to neighboring countries that have more favorable business environment (Kant et al 2014).

Off-grid and mini-grid power development

Developments in the decentralized systems such as mini-grids, hybrid mini-grids or stand-alone systems (also referred as off-grid solutions) are quite important in the context of tackling poverty in Kenya. Being a leading unsubsidized market for solar systems, Kenya offers promising opportunities for off-grid electrification based on private purchases of clean decentralized photovoltaic technologies. According to assessments, as of 2014, more than 6 MW of solar PV capacity was installed in residential and commercial sectors through the private sector initiative. Expectations are by 2020 to increase it up to 100 MW generating 220 GWh annually (MEP 2016a). The off-grid and decentralized electricity market for micro- and pico-systems, mini-grids, and stand-alone systems in Kenya is about 7 million households. Off-grid/stand-alone solar PV systems are the most widely used technology: over 200,000 systems installed and sales estimated at 20,000 systems per year (MEP 2016a).

Figure 8.2 presents the map of public and private off-grid stations in Kenya. Currently, there are 15 public mini-grids operated by the national electricity utility with a total installed capacity of 15 MW (Willcox et al 2015). Developments occur also in hybrid system segment. There are 18 solar hybrid systems (such as solar/wind or solar/diesel) and some private micro-grids (diesel, small hydro, and solar) with installed capacity of 19 MW. In the case of Lodwar project, hybridization of diesel generators with renewable energy through use of PV panels reduced energy costs by 17,000 USD per month (Mbithi 2014). The projections are to hybrid all micro-grid diesel stations and expand the existing renewable energy plants to increase savings on energy costs.

Figure 8.2. Public and private off-grid stations in Kenya



Source: GIZ 2016b

The supportive regulatory framework is in place in Kenya to enable private sector electricity provision through mini-grids and stand-alone systems (Muriithi 2016). Currently, the regulatory framework for pico-solar and solar home systems for lighting is already developed (MEP 2016a). Improvements are also expected to touch the level of service of the mini-grids and the minimum technical requirements of the mini-grids that will ensure integration with the grid when grids arrives (Muriithi 2016). The commercial operation of mini-grids in governed by: 1) Energy Act, 2006 (sections 6a, 27-31), which will be replaced by the Energy Bill 2015 once approved; 2) Energy/Electricity Licensing Regulation 2012; 3) Environmental Management and Coordination Act 1999, and 4) Kenya Electricity Grid Code (Osawa and Telep 2015).

New regulatory proposals (Table 8.1) on mini-girds and simplified licensing procedures and power purchase agreements for independent power producers are expected to create additional market incentives for private sector investments in these technologies, especially for establishing commercial renewable energy micro grids in rural areas without access to national grid.

Overall, for mini-grids and stand-alone systems, Kenyan policy framework is successful in terms of regulations for tariffs, sales and standards (Muriithi 2016; Willcox et al 2015; GIZ 2016b). As it was already mentioned above, all mini-grid equipment, such as solar PV products and accessories and small hydro facilities, is exempted from value added tax (VAT)

and import duty. There is also a 150% capital tax waiver. Moreover, standalone home systems are duty exempted. The Kenya Bureau of Standards (KEBS) monitors minimum performance standards for products (Willcox et al 2015). At the same time, legislation is less advanced for provisions relating to expropriation and any duty exemptions (Willcox et al 2015). There are no appropriate mini-grid license and regulatory procedures are still autocratic (GIZ 2016b). Moreover, local communities are often unable to benefit from the income-generating potential of off-grid electricity systems due to lack of knowledge and technical capability (Muriithi 2016). Capacity building and awareness raising programs that are under a focus of donor institutions can play a role.

Mini-grids development are attracting more and more attention, especially from the Kenyan Government and international development partners. It is also an area of growing interest from the private sector even though formally the new improved regulatory framework is not yet in force (MEP 2016a). Many donor activities focus on leveraging private sector participation. For example, DfID, AFD working with GIZ, have recently developed an innovative mini-grid development financing scheme resting upon the results based financing tool. It aims at private-sector-operated mini-grids and working with locally based financial institutions. A lot of things are also done by Kenya Power and Rural Electrification Authority. Kenya Power and Lighting Company (KPLC) also operates with installment of a number of hybrid and conventional solar and wind mini-grids in remote areas targeting to reach over 20,000 customers. The Ministry of Energy and Petroleum cooperates with the Kenya Power and the Rural Electrification Authority to scale up hybrid and conventional renewable mini-grids under Kenya's Scaling up Renewable Energy Programme (SREP) Investment Plan with aim to install 68 new sites (MEP 2016a).

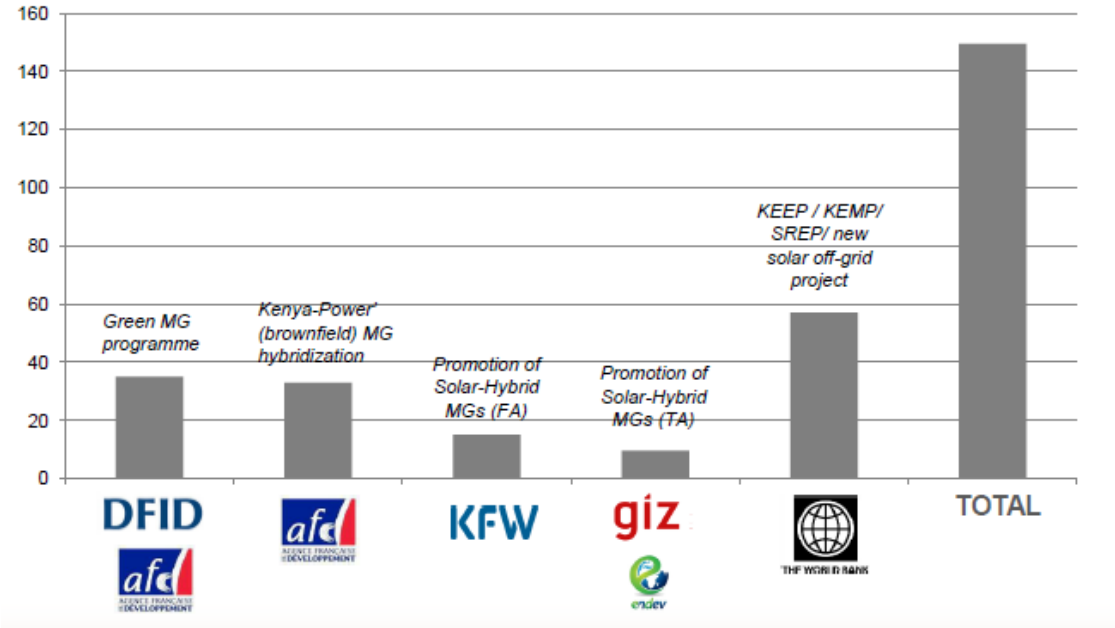
International development partners activities

In addition to large-scale grid-connected renewable energy projects and off-grid power plants being financially supported or directly established by the government, private companies, and NGOs, there is a number of international development organizations focus their activities on policy and financial stream development. For example, donor community supported design of Action Agenda for Sustainable Energy for All initiative. GIZ is active in promoting mini-grids with participation of mini-grid legislation drafting and preparation of guidebooks for mini-grid sizing or site selection (GIZ 2016e; GIZ 2014). Brief details of some of ongoing or planned projects with the supposed financing instruments are given in Annex 1.

There is a donor assistance pool of about 150 million EUR which creates opportunities for the private sector to get involved in the development of green energy market in Kenya (Figure 8.3). With recently increased importance of mini-grid system development in Kenya, international donor organizations, such as the DfID, AFD and GIZ, have developed and

introduced various innovative mini-grid development financing schemes with incorporation of tools like based on results based financing (MEP 2016a). For example, DFID in cooperation with AFD through green mini-grid facility scheme provide greenfield project preparation support and credit for private entrepreneurs. KfW provides 15 million EUR for promoting solar hybrid mini-grids through reversed bidding for private generation component (GIZ 2016b). The strategies, however, are different among different donors. While some go into micro-level operations, others divert from small-scale to more large scale operations. For example, according to expert opinion, EU now goes for blending and co-financing with other donors with a capacity to give grants or loans within big projects with approved value-added.

Figure 8.3. International donor assistance (million EUR)



Source: GIZ 2016b

9. Green financing schemes: case studies

This section is devoted to the examination of renewable energy and energy efficiency financing schemes that aim at households and small- and medium enterprises. These alternative green energy financing models have been developed with a build-in support mechanism of overcoming barriers pertaining investments in this field, such as capital, perceived risks, low awareness, etc. The schemes include elements of best practices and some degrees of innovation in their approaches. The schemes considered are: green lending scheme, mini-grids results-based financing and mobile solar leasing.

Green Lending Scheme: SUNREF

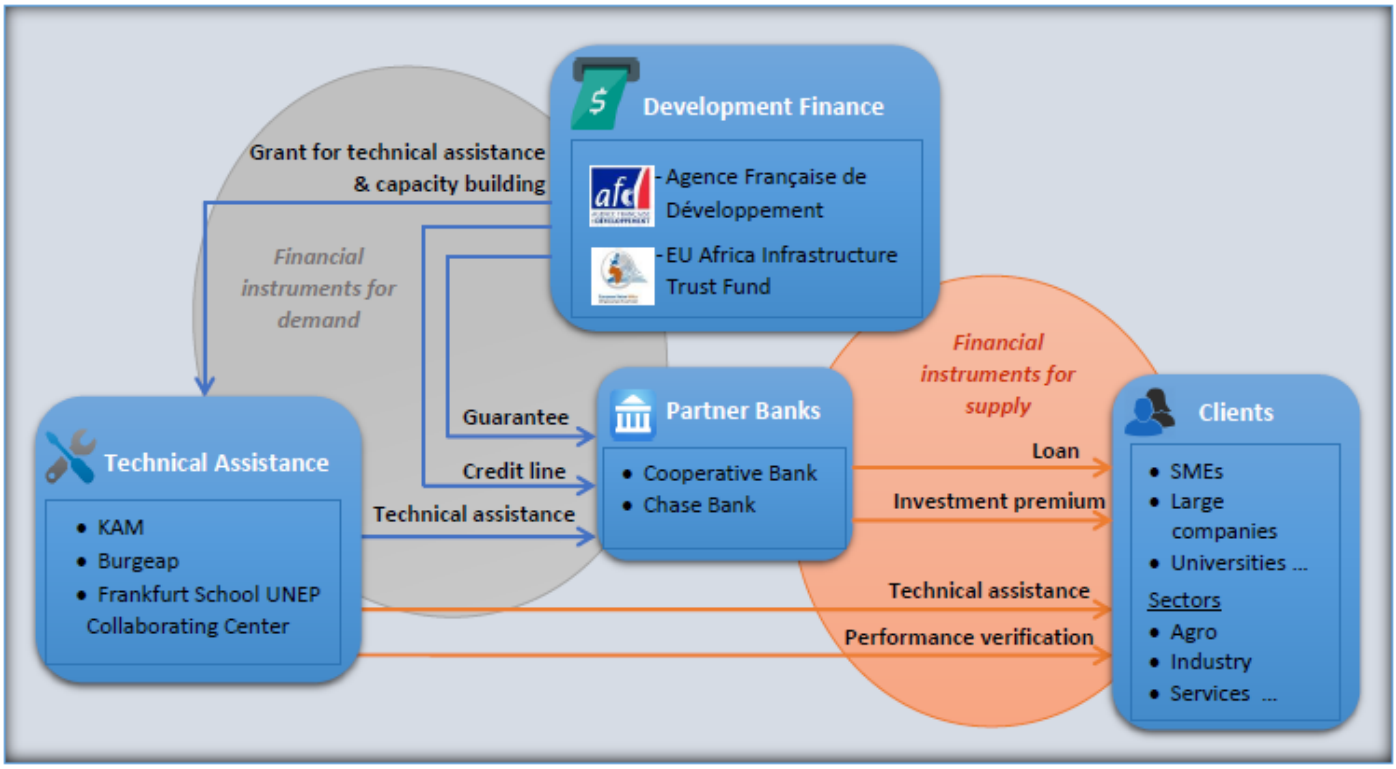
In the international assistance arena, the Agence Française de Développement (AFD) is one of the most dynamic institutions that developed innovative approach of donor assistance in developing countries based on its diverse experience. For meeting the challenge of financing green growth and promoting investments in energy and environmental services it has designed and implemented an innovative scheme SUNREF − Sustainable Use of Natural Resources and Energy Financing, that became AFD's "green finance" label (AFD 2015).

In 2010 the AFD and European Union via the Africa Infrastructure Trust Fund within the SUNREF framework initiated a green lending scheme with credit line and regional technical assistance program for Kenya, Tanzania and Uganda to assist them in boosting investments in green energy technology. The SUREF tool that operates in partnership with local financial institutions/banks aims at promoting green energy and clean technology solutions and environmental transitions. Currently, SUNREF in Kenya is in Phase 2 with commitment of 2 million USD provided by the EU Infrastructure Fund for Africa to stream for green projects (ADF/SUNREF 2014).

SUNREF's innovation rests on the integration of financial instruments for demand and supply sides: technical and financial approaches that together enhance demand of partner banks and supply from project developers. The aim of technical approach is to boost green investment financing via capacity building and identification and development of projects with optimized use of energy and natural resources. The financial approach centers on provision of local partner banks with long-term loans, so called green credit lines, on attractive conditions with incentives such as maturity, rate, investment premium, etc. (www.sunref.org). The schematic view of the SUNREF program design is Kenya is presented in Figure 9.1. Under SUNREF technical assistance with capacity building, training and institutional support components combined with financial assistance tools such as concessional rate loans, grants and guarantees, equity financing enables to overcome a number of barriers that small and medium size green investment developers come across

with (Maina 2015). In general, the mix of financial products: technical assistance grant, capacity building and debt financing through loans to SMEs was stated as a primary success factor of this scheme by all interviewed experts.

Figure 9.1. SUNREF green lending scheme in Kenya



Source: Authors' own

As Figure 9.1 shows, SUNREF lending scheme targets two streams – demand and supply sides. It builds demand in the pre-investment stage for financial institutions through technical assistance and increase of knowledge and the expertise of the main stakeholders such as sponsors, banks, consultants, or equipment providers. The technical assistance component of SUNREF strengthens the stimuli on clean energy project demand side by identification of portfolio of bankable projects. The primary aim is to create an enabling environment for private investments to kick-off. Grants are, normally, issued to finance the soft components of investment projects such as expertise, capacity building, social and environmental costs, etc. On supply side, it ensures the necessary incentives to mobilize the proven clean energy investments from private investors via delivering financial instruments on adequate terms and conditions: risk enhancements or funding subsidies.

As Figure 9.1 shows that AFD works with selected partner banks. Through tender, a local partner bank gets into a special partnership agreement with AFD. The partner bank receives

from AFD low-rate long-term credit lines that can be further refinanced to small- and medium-scale developers for green investments and help them overcome the financial barriers (Maina 2015). Partner banks ensure a role of financing projects and of building-up and managing a portfolio of clean energy projects.

Partner selection process includes criteria such as credit risk policy, availability of climate finance strategy, concentration on green energy projects and focus on small- and medium-scale enterprises. Currently, the SUNREF's partner banks are the Cooperative Bank, the country's third largest bank in Kenya, and Chase Bank (ADF/SUNREF 2014). Experts mentioned about two more banks in the pipeline: CBA and Diamond Trust Bank.

As an incentive to enhance the attractiveness of projects, AFD shares certain credit risks with banks that want to promote their "green" finance portfolios via a guarantee called ARIZ. This smoothens transition to the adoption of environmentally sound technologies while increasing competitiveness.

The overall administration of the SUNREF rests with the Kenya Associations of Manufacturers (KAM) under a contractual agreement with AFD. KAM is one of the leading business associations in Kenya representing over 850 sector members who together contribute to 11.3% of the country's gross domestic product (www.kam.co.ke). It promotes trade and investment, upholds standards, co-operates with the government and encourages the development of business favorable policies. KAM had the experience of partnering with the Global Environmental Facility (GEF) and the Danish International Development Agency. It started with formation of energy management culture and capacity building through trainings for project developers, banks officers, energy auditors and technical personnel at a time when there was lack of understanding of benefits of clean and renewable energy projects among investors, and private banks were not considering the business of financing these projects. Renewable energy legislative framework was also immature yet. On this background, the need emerged to enhance this support model with a financial component. Hence, KAM joined the partnership with AFD under SUNREF model (Maina 2015).

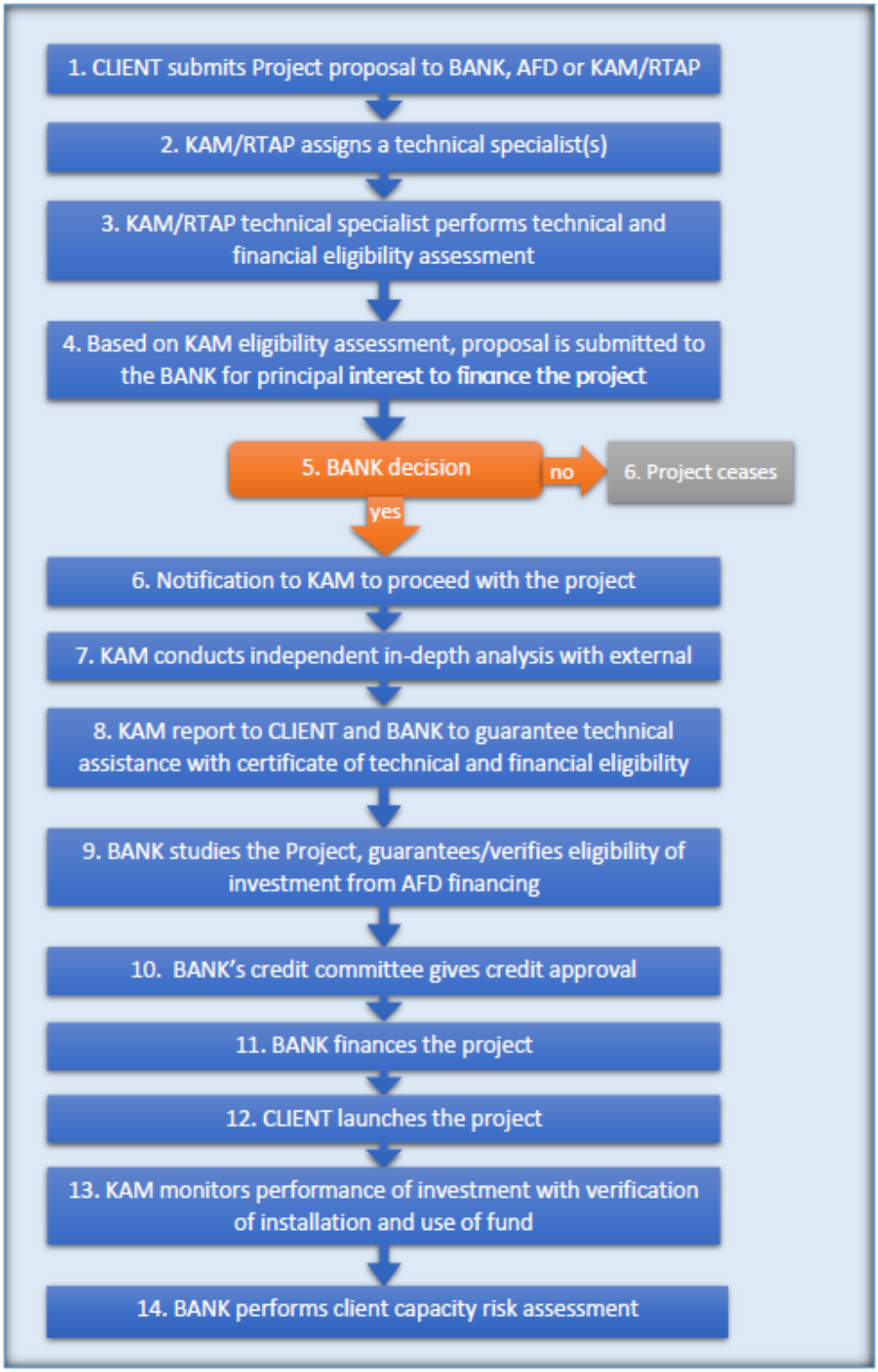
KAM became an umbrella for operation of the Regional Technical Assistance (RTA) Programme that aims at facilitating the origination of viable and bankable clean energy projects. It provides technical and financial support at critical stages of project development and increases the knowledge and the expertise of the main stakeholders: project clients, sponsors, consultants, equipment providers and partner banks for financing clean and renewable energy projects.

The RTA team is managed by a consortium of French engineering consultancy BURGEAP and Frankfurt School, FS - UNEP Collaborating Centre for Climate and Sustainable Energy

Finance, and strengthens the regional technical assistance team originally set-up by KAM (Figure 9.1). RTA team coordinates operations among various stakeholders, smoothens delivery of the consulting services, provides timely adequate and sufficient information to interested parties and contributes to the improvement of the knowledge by capitalizing the experience gained (ADF/SUNREF 2014). This type of operation and collaboration framework with partners enables to better identify promising investment areas and develop action plan based on local specifics to mitigate project development and investment barriers.

The literature suggests technical assistance, in general, as one of the main barriers for the development of clean energy projects. Within SUNREF, technical assistance comprises a critical part of the scheme which is financially supported by the AFD and the European Union via the EU-Africa Infrastructure Trust Fund. Technical assistance is available to the banks, project promoters, equipment providers and banks' potential clients/borrowers that need to meet eligibility criteria assessment (Figure 9.2). Indeed, this financing scheme aims at making clean and renewable energy projects a standardized product that will be considered by commercial banks as a source of revenue and attractive for funding. Hence, the success of operation of the scheme is ensured by rigorously designed procedural framework, presented in Figure 9.2.

Figure 9.2. Green Lending Procedure Flowchart



Source: Authors' own, based on data from fieldwork

The peculiarity of the scheme is the assessment of the project from both technical and financial point of view. The RTA team helps developers at the pre-investment stage to

properly package their projects that can then successfully undergo creditworthiness assessment procedure of banks. It assesses if the submitted projects fulfill the qualifying criteria and makes recommendation to the credit committee of the partner banks. After some rounds of cooperation with AFD and preparation of technical and financial feasibility certificate, the final decision for financing rests with the partner bank's credit committee that examines the project and gives final approval or refusal for project financing.

Normally, technical assistance is done on case-by-case basis through financial assistance with energy audits, support with projects identification, design and monitoring. In general technical assistance is provided either on free-of-charge or at an affordable cost to assess the feasibility of projects by assisting in calculating financial returns, recommending best technologies and optimizing savings. For small size projects, the expert provides a list of approved technologies that can be assessed directly by partner banks without a need for extra technical assessment. This significantly accelerates loan application and improvement (www.sunref.org).

According to the Jeff Murage, Coordinator of the Regional Technical Assistance Programme of KAM, the regional technical assistance program has an important mission to guarantee that the loans provided to private banks were disbursed to the projects that are bankable and deliver proper renewable energy and energy efficiency benefits.

Experts mentioned a number of success factors for the operation of SUNREF scheme. In general, the message was that compared to Tanzania and Uganda, Kenya is much more favorable clean and renewable energy business environment. Moreover, the success of concrete practical steps implemented, in its turn, also accelerated the adoption of supportive laws, such as feed-in-tariffs or PPAs in Kenya. Overall, at the strategic level there is a will, but the situation is different on operational level, where there are a lot of challenges to overcome. For example, currently, a lot of attention is transferred to mini-grids for communities. This is in agenda of many donors. However, the problem here is the lack of regulation with mini-grids, including tariffs. Private sector is not yet ready to support these projects because of many risks. Within SUNREF, AFD has already started mini-grid projects, though the design has not yet been developed.

Among main obstacles with the launch of SUNREF, experts also emphasized the difficulty of delivery of understanding of clean energy project concepts and that this type of projects can work in a technically feasible way and fit with cash flows of customers. Difficulties came over such as low awareness about the benefits and limited project development skills among project developers, lack of skills among bank employees and their protective attitude to changes in their work. Moreover, working with banks is still challenging in Kenya. The problem is that they do not have much experience with renewable energy and energy

efficiency projects, which makes them reluctant to finance this kind of projects or they overprice them. With renewable energy projects difficulties arise with future returns with long-term outlook that is problematic in the money market because of lack of long-term capital. Moreover, banks are more inclined to work with large business, whereas SUNREF targets small- and medium projects.

Overall, experts state that SUNREF is a successful framework, but not sustainable without donor assistance yet. The final goal is to get to the stage of maturity and have sustainability by getting AFD out and providing the banking sector with knowledge and skills to ensure that they finance renewable energy projects with their own resources without relying on external donor help. Hence, there is a need for a lot of capacity building. In that sense, probably, in long-run SUNREF model can become sustainable, not now. Nowadays, banks focus more on business-as-usual transactions such as mortgages, car purchase, etc., but after training they may think of including clean energy projects into their project pipelines.

Training is an important aspect in the banking system. It is challenging to provide capacity building at banks, since they are reluctant and has still to bear risks and AFD cannot force them but to cooperate. Indeed, cooperation with banks was, nonetheless, stated also as a primary competitive advantage of the AFD within SUNREF scheme. In banks there is low awareness, but the willingness is there too. Throughout all these years they managed to succeed in cooperating with local partners and local banks employing regional approach, for example, banks in Kenya have branches in Uganda, which facilitates the scale-up of cooperation efforts. There was a need for time to pass and efforts to put for getting bank's confidence and knowledge for enhancing sustainable model that can support a financing programme.

So far, within the frameworks of the SUNREF, credit lines worth of over 39 million dollars for total investment of more than 55 million dollars were provided in Kenya. As a result of the program, 65 kilotons of CO2 emission were reduced annually through the installation of cumulative renewable energy capacity of 22 MW which is expected to produce 120 GWh annually from renewable energy sources (Bernadat 2016). Some examples of SUNREF projects are presented in Table 9.1.

Table 9.1. Examples of SUNREF projects in Kenya

Sector/Project	Measures	Project outcomes	Figures
Food Industry: Meru Central Dairy Cooperative Union (production of ice-cream, milk powder)	Energy Efficiency measures (boilers, electrical and compressed air systems, etc.).	Reduced operating costs, increased processing capacity, reduced production costs	- Total cost: 2.3 million USD - Annual energy saving: 1.4 GWh - CO2 reduction: 532 tons
Agro business: Tea factory	Hydropower for self-consumption	Turbines feeding tea factory plant demand, peak demand, excess sold to grid	- 2x2.5 MW turbines - 16 million USD investment - 18 GWh/y
Manufacturing: Biomass production and seam supply to textile company	RE and Energy efficiency measures	Biomass briquettes production, operation of efficient boiler, steam sold to another textile company	- 5.3 MW boiler - 1.3 million USD investment
Education: Strathmore University in Nairobi	PV panels for electricity self-consumption	Reduced electricity bills	- 1 million USD investment - 0.9 GWh/y saved - 93000 USD/y energy costs saved - 0.5 MWp covering internal demand during peak hours

Source: Authors' own, based on data from Bernadat 2016 AFD 2015, Maina 2015, www.sunref.org

Interestingly, as stated by interviewed experts within the SUNREF primary target is to build a sustainable market for clean energy technologies, hence, main impact indicators monitored are energy capacities installed, energy savings and CO2 emission avoided. It is not a social impact oriented and there are no special social impact targets and measures for these co-benefits. At the same time, it is widely accepted that renewable energy project that provide access to low-cost new technologies and renewable energy access for isolated household as such already have a huge social impact, especially for the poor in the remote areas or SMEs. With this type of projects there are always new jobs created. Therefore, during project estimation process, projects that have social co-benefits are favored. Moreover, within SUNREF the main beneficiaries are SMEs with social benefits behind but not households, since banks still are not willing to finance individual poor people. This is more with the banks choice. Normally, the smallest project they finance is about 40,000 USD or average 200,000 USD. As experts explain, SUNREF's mission is to support government and help private sector in Kenya to enter the market of renewable energy technologies. ADF as a development fund is not earning from the projects but also tries not to loose. At the same time private partners and SMEs behind the projects are making profit.

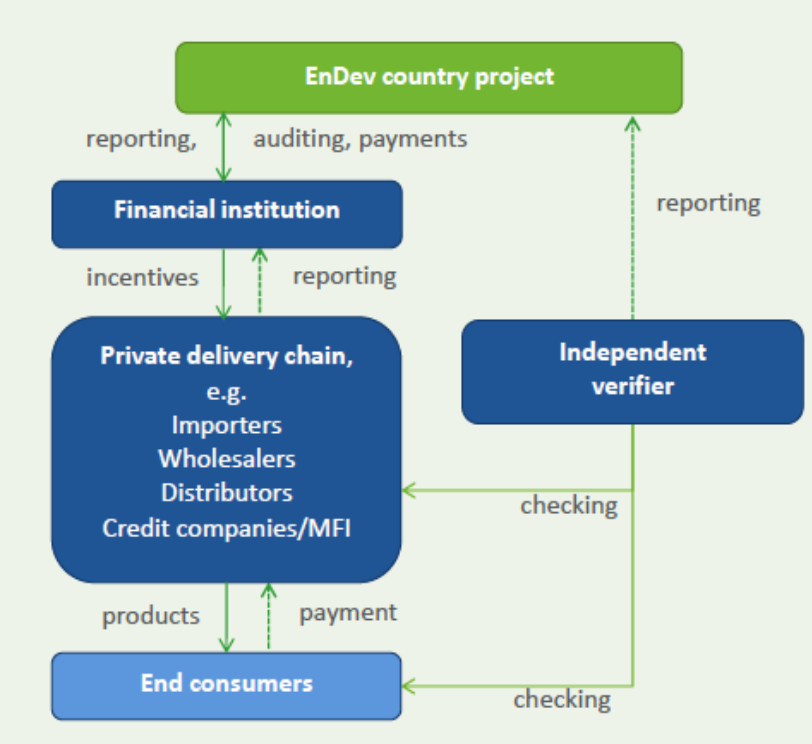
Mini-Grids Results-Based Financing

With recently increased importance of mini-grid system development in Kenya, international donor organizations, such as the DfID, AFD and GIZ, have developed and introduced various mini-grid development financing mechanisms. The present case study focuses on an innovative mini-grid financing scheme that rests on the results- based financing instrument.

The results-based instrument hangs on the "payment by results" principle, widely applied in the health sector. This principle was transferred to the renewable energy market and formulated into the following concept: "Overcome market barriers through contractual agreements with private companies by paying incentives after verification of pre-agreed results" (Liedke 2016:5). This approach provides private sector delivery of clean energy services to the poor.

The general approach of results-based finance scheme (RBF) developed by the Energizing Development (EnDev) for various technological applications is illustrated in Figure 9.3. Energizing Development (EnDev) is an energy access partnership of six donor countries (Netherlands, Germany, Norway, Australia, UK and Switzerland). In Kenya, EnDev is led by the GIZ to promote and finance electricity access through mini-grids.

Figure 9.3. Results-based finance scheme design



Source: Liedke 2016

As Figure 9.3 shows the development agencies (EnDev, GIZ, HIVOS, Practical Action, etc.) set up a project, provide technical assistance, management and monitoring services. The private developer performs accreditation of results-based financing and provides delivery of results. Independent verifier examines the results that have been achieved. Financial institution provides incentives on a condition of having evidence for results achieved by the developer.

Up to date, this innovative approach has already been implemented for market uptake of improved cook-stove, street lights, domestic biogas, water heating and mini-grid connection technologies (Weber 2016; Liedke 2016). The main performance targets under these projects set by the donor agencies, in general, include the number of connected people, CO2 emissions avoided over the lifetime of the product/service sold during the project, jobs created and technologies deployed (Weber 2016).

Main success factor of the scheme is substantial technical assistance for potential developers and financial institutions at the early stage of the development with intensive human capacity development. Technical skills are essential to address the operation challenges that such systems require. Another advantage is the simplicity of the scheme for start-up, operation and replication. Quick verification and release of incentives does not disturbs the financial circles of companies involved in the scheme. However, even with this, financial institutions and private developers usually are reluctant to cooperate and may engage very slowly into the project (Liedke 2016). According to expert opinion, result-based financing scheme functions differently in different markets. The more mature the market is, the less technical assistance and the lower incentives can be injected into the scheme. Awareness raising and success cases can increase the confidence to this type of initiatives.

In Kenya, the managing agency of the results-based financing scheme is the GIZ that also provides technical assistance services, including building of local technical capacities for developing on the grounds the people's ability to install solar systems. In Kenya, the GIZ focuses on the development of mini-girds to promote the achievement of the governmental ambitious goal of 100% electrification by 2020 according to Vision 2030. In rural areas without connection to national power grid, renewable energy sources can be used to supply electricity. The promising way to tackle this challenge is through solar hybrid mini-grids, which are a potential to provide clean, quality and affordable electricity (GIZ 2015). Indeed, within the list of technologies installed under RBF scheme, mini-grids are the most challenging both technologically and administratively, taking into account the immaturity of the mini-grid market and legal environment in Kenya.

To reduce market development risks and to promote the first private sector investments in mini-grids in Kenya, in 2014, the GIZ launched a special Mini-Grids Results-Based Financing scheme. The scheme provides ex-post incentives to private entrepreneurs for the

development, construction, commissioning and operation of solar PV hybrid mini-grids systems that will supply electricity in locations that are far from national grids (Willcox et al 2015). The aim is to provide incentives to project developers to create a market for mini-grid electricity generation and trigger private sector investment.

The peculiarity of the mini-grids results-based financing scheme is that it integrates essential ingredients that ensure establishment of economically sustainable energy solutions and distribution schemes to targeted customers. These include:

- *financial incentives* to the project developer upon achievement of pre-agreed results,
- *independence* that the project developer has on the ways of achieving the results,
- *verification* by a third independent party of the results as a trigger for disbursement,
- *cooperation* with locally based private companies, financial and governmental institutions.

The overall expected impact of the RBF initiative in Kenya is to support implementation of 20 solar hybrid mini-grids in remote rural areas that will deliver clean energy to 22,500 Kenyans (GIZ 2016c). It will intensify rural electrification process compared to the business-as-usual scenario. Population in remote rural areas will have access to clean and affordable electricity that will enhance their living standard. According to expert opinion, the incentive on investment to developers under this scheme also contributes to the reduction of tariff rate at the bottom of pyramid. Using solar energy has also its environmental benefits, as people cease using polluting technologies. Moreover, access to electricity will also promote income generating activities and job creation. Finally, the overall economy will benefit from the development of the private sector and rural retail business.

The partners within this initiative are the UK Department of International Development (DFID) and EnDev (funding entities), the GIZ (managing partner in Kenya through the Promotion of Solar Hybrid Mini-grids Programme) and the Barkley Bank of Kenya, BBK (financing entity). The BBK is responsible for the execution of this RBF project with the GIZ technical assistance (GIZ 2016c). BBK also performs the financial management of the project, assess all application and enters into contractual agreement with private developers (GIZ 2016d). The success of the projects is ensured by cooperation with central governmental authorities, such as Ministry of Energy and Petroleum, Energy Regulatory Commission and local governmental authorities.

The developer within the mini-grid RBF scheme can be private firm, private individuals, joint ventures, registered associations or cooperatives that are registered with the Kenya Energy Regulatory Commission. The developer is expected to install a solar hybrid mini-grid that connects at least 40 customers. This is a type of power supply which combines small-scale

power generation (up to 50 kW installed capacity) and power distribution assets. It is called solar hybrid because the generation technology is solar (minimum 50% of generated power) that is usually mixed with other components, such as diesel generators, wind, gas or battery storage systems (GIZ 2016c). The provision of electricity is done on a commercial basis. Low voltage electricity is provided to users via prepaid meter at a service level agreed between the developer and the user.

Since the electricity provision in Kenya is a regulated business, the developer or operator needs to be licensed by the Energy Regulatory Commission. The procedure is almost the same as for integrated utility in constructing and operating mini-girds, just at a smaller scale. All the applicable regulations such as environmental, transport, construction and health regulations should also apply. All operational, commercial and customer support challenges have to be properly addressed (GIZ 2015).

An essential component of mini-grid RBF scheme is provision of grants as a financial incentive for the private developer. Calculation of the incentive is stipulated by the business plan and energy supply objectives linked with number of electricity consumer connection. All the risks related with project implementation are taken by the private developer. Moreover, the developer also has to secure financing and cover all investment costs through private equity, loans or other sources (GIZ 2016d).

Innovation of the mini-grid RBF scheme rests in the idea of ex-post incentives, i.e. issuing incentives or grants not at the beginning of the project, like traditional grants, but after completion of some actions or achievement of results. These ex-post incentives are provided after the developer demonstrates meeting the pre-agreed results, such as construction, commissioning and operation of the mini-grid, connection of users, generation and delivery of energy. The results in contract should be clearly defined and measurable. The amount of incentive is based on the profitability of the project, technology applied and services delivered. The incentives are usually paid in four installments related with fundamental project activity stages: 1) construction progress incentive; 2) power plant commissioning incentive; 3) connection incentive; and 4) energy production incentive. The sum of construction, commissioning and connection incentives may be limited to 35% of the total investment costs (GIZ 2016d).

Administration of incentives is performed by the Barclay Bank of Kenya that acts as a financial manager. BBK also monitors and verifies directly and through third-party independent verification agent all the results of the project, as well as considers the claims of the private developer. Together with the GIZ, the BBK may perform on-site visits and provide additional technical support for project implementation. The independent verifier opts for the mode and scope of verification in consultation with of the GIZ and BBK (GIZ 2016d).

This innovative business model is still untested but some results are already coming up (GIZ 2016b). The pilot project under this mini-grid RBF scheme was implemented in Talek town, Narok County of Kenya, where solar hybrid mini-grid was installed. The project was conducted in close cooperation with Narok local authorities, German Agro Action and the GIZ. The technology was based on combination of PV modules, battery packs and a diesel generator. The system powers the rural business center and the surrounding community. Another innovation used in the scheme is the mobile money-enabled prepaid metering technology (GIZ 2016e).

This pilot project tested the social and economic viability of the mini-grid RBF scheme, fostering economic, education and improved health. Overall, the Talek Power project has paved the way in the enhancement of rural electrification projects with clean, sustainable and renewable energy sources which has improved the peoples livelihood. The project has demonstrated that solar hybrid mini-grids, when properly designed, are commercially viable (GIZ 2015). Moreover, the implementation of this project enabled the GIZ itself to strengthen its capacity and knowledge on the specifics of the mini-grid sector in Kenya. It also enabled to test and improve the mini-grids results-based finance design and to develop guidelines for mini-grid sizing, locating and licensing. The process was supported by the involvement of communities with enhanced local know-how. The recommendations on mini-grids were also submitted for the improvement of the current legislative and regulatory environment for renewable energy. Currently, the mini-grid RBF scheme has transferred to other locations in Kenya: three solar hybrid mini-grids in villages in Turkana county and three more in Marsabit county Muriithi 2016.

Mobile Solar Leasing Scheme: M-Kopa and Azuri

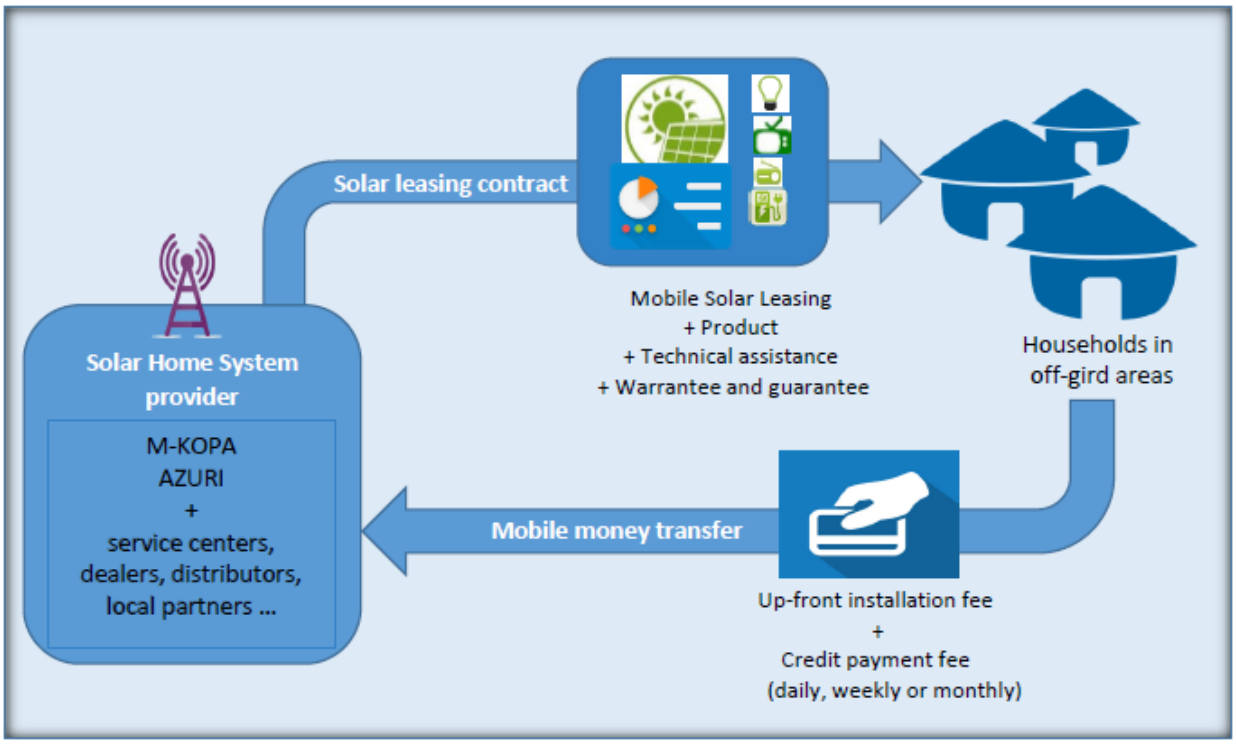
Solar lease is a financing scheme under which one party (leasing company) owns the solar energy equipment and another party makes monthly payment to lease the equipment for the lease period (SE 2016). The customer of the leasing contract, when signing it, lets the leasing company to build a mini solar system at the premises of the customer at no or little cost. The company finances the solar system construction and sells the customer the generated power usually at a rate that is lower than the utility tariff. After the initial contract period there are options to extend the lease at a lower monthly rate, decommission the system or purchase it at a low price (Martin 2013). With significant decrease of the cost of solar systems, the financing companies profit from leasing deals making a win-win situation. However, the problem is that some solar leasing schemes may be with escalating payment requirements over time. The utility inflation rate stipulated in the lease scheme should be one of most important factors in making leasing decision (SE 2016).

In Kenya, an innovative off-grid finance scheme - mobile solar leasing model - is gaining wide popularity. It is also known as pay-as-you-go or pay-per-use solar model that relates to off-

grid energy connections that gradually expand, especially, for those that reside in remote areas and get access to clean and renewable power for the first time. An important part of this case is that it highlights an interesting example, when purely commercial undertaking identifies new market niche with customers for low income and off-grid households and small businesses. Indeed, this is the only model identified in the study that targets the poor households in the remoter areas.

The analysis of the study covers the business cases of two companies that are operating under solar leasing scheme in Kenya: M-Kopa and Azuri. The main common approach of the scheme is presented in Figure 9.4. In general, this scheme is based on provision of financial de-risking instruments such as leasing/loan, technology guarantee and technical assistance service.

Figure 9.4. Solar leasing in Kenya



Source: Authors' own

Technically, the solar leasing scheme is based on a technology platform that combines embedded GSM and mobile money payment and powerful data platforms and provides combination of accounting, inventory tracking and customer relationship management for each pay-as-you-go solar system's performance. Customers, usually households, purchase solar system through dealers or distributors with signing an agreement with terms and

conditions that specify also a special payment plan. The scheme provides a choice to pay for the product fully or take it for a credit under a leasing contract. Normally, the cost of leasing may range from 10 to 20 percent. For reducing risks associated with the performance of the technology, the leasing agreement also provides warranty - a period of time within which the client can return or replace the device in case of failure. Companies also provide guarantees for the supplied products. For example, Azuri guarantees 7 years for batteries and 20 years for solar panels.

This scheme targets the poor. Therefor the product, service and payment conditions should be affordable and easy manageable. Otherwise, they will pay cash or utilize other better services. As a result, companies try to be innovative in technologies, services and business models.

In Kenya, low-income households spend around 150 USD per year on kerosene alone, which constitutes twenty percent of household income on average. The approach under leasing scheme is that the daily payment should be less than the households' daily payments for kerosene, candles or batteries. For example, in case of M-Kopa, with the up-front payment of 35 dollars and daily payment of 50 cents (about 50 KES) for one year, people in Kenya who live off-the-grid can have access to solar energy. After the full payment, the solar system passes to the ownership of the borrower that can afterwards get energy for free. This can be compared to the average cost of 60 KES paid daily by households on kerosene, candles and batteries. Interestingly, M-Kopa remains the sole owner of carbon credits obtained from usage of solar system.

Indeed, this innovative pay-per-use model enables low-income households and small business entities to get a credit for solar power system by paying small up-front amount and spreading payments for several months, normally, up to one year. Payment can continue with upgrade or purchase of new products or services. The payment installments are done on daily, weekly or monthly basis merely though SMS to mobile money platforms, such as M-Pesa. Interestingly, credit payments cannot be done in cash, but only via M-PESA money transfer service of Safaricom communication company that provides wide range of internet mobile services and has the widest footprint across Kenya, covering 64% of mobile networks (Ansr 2013).

According to experts, quickness and ease of leasing documentation and processing is one of the success factors of this scheme. Solar leasing enable to avoid the common problems faced by the poor for taking loans, such as collateral, repayment ability assessment and monitoring, need for office and significant administrative costs.

Another important success factor of the scheme is the integration of solar leasing products with services of Safaricom. Safaricom is almost a monopolist in Kenya market, which makes it easier and more productive for companies such as M-Kopa and Azuri to cooperate and better coordinate their business operations. Safaricom's M-Pesa is also the most successful mobile money transfer or digital finance product in the world.

With entrance of Safaricom on the communication market, within ten years Kenya has witnessed a total transformation of the way in which Kenyans communicate – the mobile revolution that development challenges into business opportunities. Mobile phones have brought great advantages in terms of communication and service provision of M-Pesa and access to internet. Currently, almost two-thirds of Kenyan households (63%) own one or several mobile phones. This implies that with M-Pesa platform three in four Kenyans have access to the financial system (Hailey 2016).

The Kenyan context is that there is a very intensive mobility and high level of internal labor migration with high attachment to the family. Mobile fee is cheap and quite widely distributed with M-Pesa service. Breadwinners are transferring money via M-Pesa mobile money transfer system that also enables cashing though with 1.5% withdrawal fee. This is very popular connection and money transfer tool used by families all over Kenya, especially in remote areas. In total, 86% of Kenyan households use mobile money that simplifies payment habits to be done via M-Pesa mobile money transfer system.

Another important aspect of innovation relates with the technologies that are used. The companies have the policy of providing intelligent solar home systems with latest innovative and culturally adopted technologies and high-quality products that can replace the existing ones. For example, new generation light-emitting diode (LED) lamps or super slim LED TV specifically designed for African off-grid market with robust design and incorporated LED-card technology. These replace solar-powered lanterns. Energy saving technologies spread also to phones, television and radio. But it is not only that. But there is a risk of having now power in bad weather conditions.

Azuri's solution is the smart home system that has automotive client behavior tailored system, which analyzes behavior of the client and weather and ensures optimal performance. It monitors typical energy consumption pattern of users and climatic conditions to adjust power consumption and to ensure not to leave people in dark. If rainy or cloudy, the system adjusts light brightness, battery charging and load conditions to use less power and last for the period of time the users are used to. For example, if the weather was bad and the battery is low and the systems knows that client uses 3 hours in the evening and 1 in the morning, then the system transfers to the saving mode: slightly darkens light for 3 hours to have power to meet morning need. Being technologically complicated, the

solar products are simple to install and upgrade and user-friendly for servicing each customer. These are unique examples of latest smart technologies applied in rural domestic solar systems in supporting off-grind households to get power more efficiently.

The details on main operational features of companies are presented in Table 9.2. In general, the package of solar-powered systems include solar charged equipment or device with solar panel, bulbs, multi-plug phone charger, solar powered radio and digital TV. There are also projections to increase the products and services, for example, upgrade solar TV functionality and content for educational and business activities.

Table 9.2. Main features of innovative pay-per-use solar leasing models in Kenya

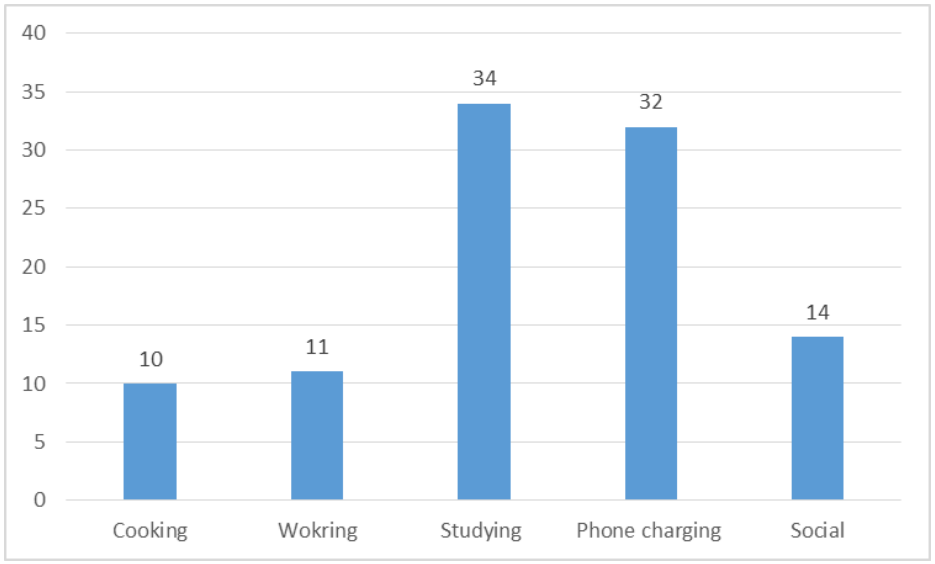
	M-Kopa	Azuri
Products	Solar panels, lights, mobile phone-charging, solar powered radio and TV	Solar panels, lights, satellite TV and portable radio package. Sophisticated climate-based power monitoring and distribution system.
Scale	• Dominates in Kenya • 340,000 homes in East Africa with roughly 260,000 in Kenya 2016 • About 1% of off-grid homes in Kenya • 100 service centers in East Africa, 2016	• Has smaller coverage in Kenya • Dominates in covering more countries in Africa
Customer targets	Small business and low income households	Rural off-grid communities/ households
Customer support	Service centers, dealers, local partners	Distributors act as main distribution and technical support providers, service centers
Payment	• Up front cost: 35 USD • Usually daily payment (50 cents) • Duration: up to 12 months • Opportunity for upgrading	• Up front cost: small one-off installation fee • One a week (149 KES or 1.5 USD for entry product or) or a month payment basis • Duration: up to 18 months • Opportunity to top-up the installed units via text message without shutting off the unit.
Impacts	• Savings: 750 USD saved per household over 4 years using solar system instead of buying kerosene. A typical home saves about 60 KES per day on kerosene, candles and batteries, compared to most households in Kenya having per capita income of 200 KES per day • Fume-free lighting: 125 hours of solar powered lighting per household, per month • CO2 reduction: 1.3 tonnes of CO2 reduced per solar system over 4 years • Employment: 2000 (757 full time staff and 1,251 field agents) in Kenya, Uganda and Tanzania. • Positive health and safety impacts: reduced incidences of fires caused by kerosene lamps and less pollution and better heath due to less indoor pollution • More activities in evenings: more opportunities for study and other household activities. • "Last mile" distribution problem solved to reach remote, rural communities.	• Savings: 700/month KES on kerosene + 20/week KES for two mobile phones vs 140/week KES until system become free (example of one villager) • Local employment in the community. • Time saved: 2.3 hours per week on travelling for acquisition of kerosene • Money and time saved on charging phones at home • Transformed lives for women that manage to have more time and money at their disposal • Get access to much better energy services • Innovation: mobility to overcome distance to provide access to electivity • 97% of users claiming their children study more • Safety: no fire risk, no fear to leave children alone for some time, when mother is working at the farm and ca have more productivity. • Get equipment for ownership and have further free light • Health: less polluted environment
Awards	Financial Times Arcelor Mittal – Boldness in Business Award	"Social Good" Award under Fast Company Innovation by Design

Source: Authors' own, based on data from www.m-kopa.com, www.azuri-technologies.com and fieldwork interviews.

Azuri and M-Kopa operate also outside Kenya: in Tanzania, Uganda, etc. In general, Azuri has more customers in more countries in Africa, but not in Kenya where M-Kopa is dominating. The main advantage of Azuri is its different distribution model. Difference with M-Kopa is that client can't just buy the equipment, bring it home and operate it on its own. Clients with Azuri need to have technician to come, install and show how to operate the product. Distributors buy equipment from Azuri and have their margin on it. They use Azuri's server and software and do the rest job: install the equipment, maintain it and determine the mode of customer payment. This reduces costs for service center and enable wider distribution. Moreover, this models also helps to mitigate the risks of customer non-payment. Agents/technicians are on the ground providing maintenance services at home. This builds up additional incentive for technicians to work good, because they get their percentage of bonus on customer payment. Azuri also operates mini offices that provide jobs to locals after they pass training. Once, they demonstrate good performance, Azuri supports them to get licensing.

As for impacts, according to data provided by Azuri, installation of solar home systems under pay-as-you-go services enables to have better opportunities for cooking, working educational, phone charging and other social activities (Figure 9.5). People not only save money of replacing the usage of kerosene, but also have increased access to services such as better light, secure communication and information exchange. Better quality of lighting enables children to have more hours for educational purposes. Clean and safe lighting that replaces kerosene lighting also reduces the fire threats and the fear of leaving the solar light in premises with children without constant careful control. Clean home lighting is important for bettering quality of life with more opportunities of socialization, getting greater degree of freedom in lifestyle and optimizing productivity at home and in case of small businesses.

Figure 9.5. Main activities performed via solar home systems in Kenya



Source: Authors' own, based on data from www.azuri-technologies.com

Moreover, for reaching remote regions, the business model of these companies incorporates local employment in the community, enabling local partners and small businesses develop profitable and sustainable business within their community. Self-supporting commercial businesses can also be boosted. For example, rural small businesses are able to open for more hours and generate more product sales.

Furthermore, high diffusion of communication/mobile phone services and partnership of M-Pesa with d.light initiative that targets to elimination of kerosene for lighting and to promote the most affordable high-quality lighting for the poor in remote areas enables to mitigate "last mile" problem of spreading essential products and services to remote, rural areas. The "last mile" problem refers to difficulties encountered by network companies in connecting remote area households to the network. In the supply chain these remote areas are the least efficient that cost a third of total cost of delivery (Pierce 2013). By investing charitable money, d.light initiative aims at removing kerosene usage at homes as energy source through promotion of high-quality solar products such as lights or full home systems at the world's most affordable prices (http://acumen.org/investment/d-light-design/).

Last but no least, solar home systems provides clean, safe renewable power to off-grid households at half the cost of the kerosene it replaces, without the need for any government subsidies or tariffs.

Closer to this is also the development of a network of solar charging kiosks, according to which solar charging product companies provide leases to entrepreneurs, who in their turn

provide electricity services to their communities. In some cases kiosks provide Wi-Fi hotspots. This kind of business also operates with the help of crowdfunding for reaching the poorest (Jackson 2015).

10. Conclusion

Kenya records booming economic growth rates, which requires energy to fuel it. Declared by the Vision 2030 – the country's main development agenda, universal electrification goal achievement could be fulfilled not only through large-scale on-grid generation and transmission investments projects, but also through deployment of decentralized clean energy systems in off-grid environments (mini-grids and stand-alone technologies) that leverage private sector participation in energy supply for the last mile most disadvantaged – rural population in remote areas. The political support is there, with constantly upgrading policy and regulatory environment, with public utility capacity, developed information and communication technology and entrepreneurial context, all backed by vast availability of renewable energy sources, especially solar. More detailed findings of the present empirical research that examined enabling policy frameworks and financing mechanisms for promoting pro-poor renewable energy investments are below presented following two streams: policy and specific model related, reflecting macro and micro levels of the study scope.

Macro level - policy related

There is a **governmental commitment and willingness** for energy sector development with increased renewable-rich energy mix. It is dictated by the rapid economic growth with increased energy demand and the ambitious targets to boost energy mix to meet governmental commitment for reaching universal access to modern forms of energy by 2030 under Vision 2030. It is mainly targeting grid connection projects. The prevalent position of the giant utilities in the sector dictate the priority of the centralized energy models. An example is the country's flagship renewable energy project of the Lake Turkana Wind Power, which aims to provide about 300 MW of low cost wind-power to the Kenyan grid. This amounts to 20% of the present installed electricity generating capacity. However, reaching the goal of 100% electrification pushes for promotion and increased take up of smaller scale renewable energy facilities, such as min-grid and off-grid systems that are better solutions for supplying energy to the remote and poor rural areas. Governmental commitment in this respect is expressed by a large-scale Rural Electrification Programme with establishment of a Rural Electrification Authority and a special Rural Electrification Fund. Moreover, the government supports the policy of implementing uniform tariff all over the country to ensure equity for all people in Kenya to pay equally for electricity for everyone through subsidies and financial support for household connections. For supporting minimum electricity access by the bottom of the wealth pyramid, the tariff structure also contains a subsidized "life tariff".

Even having room for improvement, **during recent years Kenya managed to introduce long term supportive frameworks** for renewable energy development in the form of feed-in

tariffs (FiT), tax exemptions, building regulations requiring installation of renewable energy facilities, net metering, power wheeling, auctioning, revised power purchase agreements (PPAs), simplified procedures for project develops, standards, licensing and monitoring by Energy Regulatory Commission. Overall, the policy framework for the development of renewable energy in Kenya is rather advanced. Indeed, Kenya is a regional pioneer. It has more mature policy system than in neighboring countries such as Uganda and Tanzania, where this field has just started changing. However, the levels of financial incentives remain inadequate to attract private sector developers. But the positive trend, according to the interviewees, is that clean energy policies in Kenya are gradually improving in a direction of creating more opportunities and incentives for the business to enter the market.

Clean energy governance framework constantly improves. At the moment, in the pipeline there are a number of new laws and regulations with innovative approaches to be enforced soon. Expectations are high from these changes.

Recently, Kenya adopted a new constitution and passed through **structural reforms** with fundamental **decentralization** of power. Political power and governmental functions were devolved to regions, enhancing their institutional and public finance capacities. This promised the local governments to exercise more decision-making power and to more equitable distribution of public resources. According to a number of respondents, these reforms are to impact the decentralized energy service delivery and can play an important role for promoting local energy solutions based on stand alone power generation such as mini-grid or small off-grid solutions with involvement of communities that will have their own power systems. This is especially the case for the communities that are located beyond the reach of the main electricity network.

A new regulatory framework for mini-grids is currently being developed. It will include important implication based on the analysis of potential mini-grid business models, costs, tariffs, subsidies and other financing, technical standards and procurement, as well as the development of appropriate permits, licenses, labeling and power purchase agreements. Improvements in feed-in-tariff legislation and introduction of innovative technological approaches such as net metering and energy wheeling will accelerate mini-grid and off-grid technology dissemination. Currently, according to VAT Act 2013, mini-grid solar and hydro equipment is also exempted from value added tax and import duty.

Market spoilage is among the main challenges to overcome. The market is strewed with poor quality products, such as faulty solar systems, especially cheap ones that are mostly used by the poor. People are buying the renewable energy equipment and then getting dissatisfied with its service, which reduces trust for renewable energy facilities. Government is planning to introduce technical standards for renewable energy equipment to promote

reliable quality facilities. Solution is the introduction and stricter monitoring by the Energy Regulatory Commission (ERC) of standards and licensing requirements. This process is under the attention of the ERC that deals with awareness raising among the population, enhances the licensing requirements for suppliers, vendors, and technicians and through various mechanisms strengthens the monitoring process for checking all value chain of solar system manufacturing, importation, design and installation. For this process, it is important that in Kenya there are laboratories for testing the quality of equipment. Currently, there are no accredited testing laboratories. The laboratory of the Energy Research Centre of the Strathmore University is in process of receiving ISO accreditation soon. The laboratory is equipped with the up-to-date equipment and has qualified experts.

Another commonly raised issue revealed during the interviews relates to solar **equipment tax exemption**. The claim is that import tax exemption that relates to solar panels does not cover the whole package of the solar system (batteries, transmission lines, etc.). Problems also arise with PPAs and inability of PPA holders to use them for getting financing from banks.

Micro level - specific model related

Mini-grids are not advanced in terms of spread within private sector business. Whatever is done mainly through public assistance or is backed by donor assistance. For example, mini-grid installations powered mostly by diesel generators are run through the government-owned and operated model. Renewable energy based mini-grid installations with solar and wind contributions comprise only 5% of total installed capacity. The new regulation for mini-grids will envisage special provisions to promote more private sector involvement. For example, a subsidy may be implied to cover differences between cost-reflective tariff and consumer tariff.

International organizations play the role of starters and are important for promoting the take-up of renewable mini-grid technologies. To tackle main barriers such as novelty of technologies, high costs, lack of technical capacity and low awareness, international organizations (for example, EU, DFID, GIZ, AFD, etc.) implement various initiatives on mini-grids but these are project based and limited in time. According to interviewees, even being successful from point of view of project effectiveness, these projects still seem not to be sustainable yet without donor technical and financing assistance. However, any new initiative has its difficult start off point. The main aim of international organizations is launching activities in the field, changing the environment via pushing on policy level to make renewables more accessible to larger strata of population, raising awareness and enhancing demand, creating capacity strong enough so that opportunities increase for renewable energy models in general to mature to a viable business and become sustainable on its own.

Interesting financing schemes with innovative approaches have been identified. These include SUNREF green lending scheme, GIZ mini-girds results-based financing and Azuri and M-Kopa mobile solar leasing. Success factors are more specific to financial models, but overall, they include the following favorable legal and regulatory framework, financial, technical and capacity-building support of international organizations, cooperation with financing institutions, special customer related services, networking and mobility.

For renewable energy financing, **community-level models and micro/SME based commercial financing models exist rather than individual financing models.** Except for some cases such as solar leasing models, financing models may target for low level cliental that usually is limited to SMEs or at best to mini enterprises or communities. In most cases individual level financing is absent. Individuals should go for their own or through membership to such microfinance models as Faulu and Sacoo.

Targeting, assessing and managing the social impacts of projects is not practiced. The common perception is that implementation of renewable energy projects, in general, and mini-grids, in particular, is already related with generation of social impacts – access to energy, improved health, jobs, etc. While most of donor assistance or community based financing models favour projects that have social implications (such as jobs created, benefits to community, number of connections), in general, social targets are not priority in many renewable energy financing models. Penetration of renewables through overcoming a number of barriers is already a tough job, but cannot be considered as "silver bullet against all disease".

Common issues related with amplification of renewable energy investments are:

- **Lack of access to technical assistance service:** because of novelty of renewable energy products and scattered nature of users, lack of local technicians for repair and maintenance is a crucial barrier for dissemination of renewable energy installations, especially in remote areas. Overcoming this barrier became one of the strongest success pillars of business models of Azuri and M-Kopa.

- **Lack of access to finance**: high cost of renewable energy facility installation and limited financing options significantly hamper diffusion of renewable energy technologies. Factors such as distrust, uncertainty, low awareness in their turn increase the perception of risks related with renewable energy investments not only among consumers but also among banking officers. Working purely on commercial model basis, banks do not wish to finance renewable energy projects without incentives (such as concessional loans) or prefer large-scale investment

projects. In terms of revenue generation, renewable energy is difficult because of its long-term vision. **Partnership, mix of capital and risk sharing with the government and other stakeholders can foster banks to get into renewable energy deals.** Training is also important on banking side for better understanding and analyzing renewable energy projects.

- **Awareness:** there is low public awareness on energy generation options available and their benefits and hazards involved. Moreover, there is less reliability on technology because of wide supply of cheap substandard facilities (Market Spoilage described above). Hence, not only banking staff but also consumer education barrier needs to be addressed for renewable energy investments to develop further, especially in rural areas.

Yet, successful, innovative and sustainable business models exist that target the poor in remote areas. Examples are solar leasing models of Azuri and M-Kopa. Targeting the poor, first of all, means that the product, service and payment conditions should be affordable and easy manageable. Otherwise, they will pay cash or utilize other better services. As a result, companies try to be innovative in technologies, services and business models. Business model these companies are based on easy loan issuance without collateral, easy accessible technical assistance and technology based on latest industrial and communication technologies such as sophisticated climate-based power monitoring and distribution system.

Innovation and cultural appropriateness can make a market niche from a problem. Overall, these companies succeed in transferring development challenges of reaching the poor with lack of access in long distances into business opportunities to reach the poor in providing clean affordable energy and solving the last mile issue.

The mobile revolution that triggered strong diffusion of mobile telephony technologies became one of the strongest success factors of market penetration of micro solar facility all over Kenya (examples are leasing models of Azuri and M-Kopa). Mobile phones have brought great advantages in terms of communication and service provision though M-Pesa. This kind of leasing tools that was accelerated with rapid development of telecommunication technologies and pay-as-you-go services facilitates clean energy supply to the poor by reducing upfront costs of solar systems, making them more available and affordable.

Tied aid and easily accessible technical assistance model is another factor of success and sustainability of renewable energy technology investments. This is especially important for

remote locations. Training of local technicians and prompt maintenance service provision increases trust and enhances business network of renewable energy technology.

Enabling environment is a key to the success of green energy finance and can be even bigger challenge than the availability of finance itself. Support policy and financial de-risking instruments as additions to direct financial incentives play essential role for private investment in clean energy given their right mix based on the project goal, sector and country context.

Mix, conditions and timing of financing instruments are important. Concessional loans are important part of schemes but not always. For solar leasing, ease of access to a loan and administration with technical support can be even more effective. Product warrantees and guarantees reduce risks and enhance willingness for investment. Timing of incentive delivery and its connection with results achieved is another example of an innovation in financing schemes.

Demand for renewable energy products is, nonetheless, increasing. From the SME side there is a growing demand for renewable energy products. More financing organizations are gradually trying to embrace renewable energy investment projects, though with limited tools for individuals, but with community groups (chama, Faulu) and SMEs. On the household level, solar power installations are also increasing, but now only for rich people. The poor cannot afford them without assistance.

In conclusion, the main message of the research is that policy developments are essential. Yet, in the era of information and communication technologies and mass mobility, the deployment of innovative green technologies, especially in the off-grid environments for small business and low income households, can be fostered not only through powerful institutions with resource capacities such as governmental funds or donor organizations, but also through users that can play important active role in the process of transformations.

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Annex 1. Matrix of cases

N	Name of scheme /business model	Short name	Type of scheme	Brief description	Target sectors /audience	Source
1	Sustainable Use of Natural Resources and Environmental Finance	SUNREF	soft loan with technical assistance an	Innovative model with free technical assistance and soft loan components. Financial approach involves providing local partner banks with long-term loans (green credit lines). These loans can be allocated on favorable terms on the basis of certain criteria (maturity of green financing market, type of investment, target client base)	SME, public insitutions, households, Renewable energy, energy efficiency and natural resources management projects	http://www.proparco.fr/webdav/site/proparco/shared/PORTAILS/Secteur_prive_developpement/PDF/SPD22/REVUE_PSD_22_UK.pdf
2	Energy for Development	e4D	soft loan with technical assistance an	Focussed on a replicable, community based solar mini-grid electrification systems. Economically sustainable approach, whereby	SME, rural communities/households	https://stepsproject.wordpress.com/tag/energy-service-company/
3	M-Kopa, renewable energy start-up	M-Kopa	Solar leasing	Commercial Bank in partnership with Safaricaom provided 860 mln KES (10 mln USD) syndicated loan facility to M-Kopa, renewable energy start-up that provides solar home systems on credit to customers with little formal credit history or collateral	Residential; commercial; public	IFC 2015
4	Microfinance for clean energy	Faulu Kenya	Soft loan	Loans, including group loans for renewable energy measures (Solar thermal, solar PV, LPG stoves, biomass facilities)	Residential; small commercial; small agricultural	http://www.eceee.org/all-news/press/2013/2013-10-22/WEC-EEC-Final
5	Climate finance	Gura proejct	Climate finance	Climate finance under CDM for hydro power plant on Gura river for four factories managed by the Kenya Tea Development Agency (KTDA)	small commercial in remote regions	http://www.undp.org/content/undp/en/home/presscenter/articles/2013/02/20/sustainable-tea-companies-in-kenya-go-green-through-carbon-finance/
6	Lake Turkana Wind Power Project	LTWP	Green bonds	Wind power project in Kenya's Lake Turkana region. The project will add 300MW to power generation capacity and will benefit Kenya by providing clean and affordable energy that will reduce the overall energy cost to end consumers.Green bonds as "an attractive investment portfolio," which will give access to wider sources of funds and long-term capital, and enable on-lending toward green investments	national grid, then distrobuter to the rural electrification initiative.	http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Green_Bonds_Newsletter_-_Issue_N_2_-_July_2015.pdf
7	Energy Service Companies	ESCO	Energy performance contracting	Energy performance contracts, ESCO industry development with provision of energy efficiency measures	Residential, commercial	http://www.academia.edu/25493140/An_international_survey_of_the_energy_service_company_ESCO_industry
8	Kenya solar home systems		Soft loans, cooperation model	Microfinancing for solar and other measures through existing agricultural savings (SACCO financing)	Residential consumers, agricultural cooperatives	http://www.eceee.org/all-news/press/2013/2013-10-22/WEC-EEC-Final
9	Green credit line	Green credit line	Soft loan	AFD offered (3.9 bln KES) to 2 banks, CFC Stanbic and Cooperative Bank, for provide green credit lines for energy efficiency and resource efficiency projects and green mortgage products. The two banks will share the Sh3.9 billion equally and pay AFD an interest rate equivalent to 0.5 per cent above the average three-month LIBOR rate for the first two years of the 12-year facility. This means that the twin banks will pay the French agency an interest of 2.02 per cent since the three months average stands at 1.52 per cent, and they will be expected to lend at about 5.52 per cent to borrowers.	small commercial (small RE and EE projects)	http://www.businessdailyafrica.com/Corporate-News/France-gives-Co-op-Bank--CFC-Sh3-9bn-for-low-cost-credit-/-/539550/1265214/-/crpxy/-/index.html
10	Power Africa		Micro loan financing, grants	Innovative solution for cnnecting people in rural areas to the grid, actively supporting small on -grid power generation projects, as well as projects to provide off -grid and mini-grid solutions for small communities.	People in rural	https://www.usaid.gov/sites/default/files/documents/1860/6.%20Power%20Africa%20Fact%20Sheet_0.pdf

N	Name of scheme /business model	Short name	Type of scheme	Brief description	Target sectors /audience	Source
11	Lake Turkana Wind Farm		Guarantee program with mix of equity financing through consortium and ADB senior debt financing	Guarantee program with international lending and Dutch assistance . The European Investment Bank (EIB) is the single largest lender, it is instrumental in giving a thorough environmental and technical review of the project. Danish export credit agency Eksport Kredit Fonden (EKF) offered to issue guarantees (of around DKr1bn) to the two lenders behind the project: EIB and AfDB	The largest single private-sector investment in Kenya. At up to 310.25MW, it will be the biggest wind farm on the entire African continent	http://trinomics.eu/wp-content/uploads/2015/05/Market-study-to-strenghten-economic.pdf ; http://www.pfie.com/lake-turkana-gets-up-to-speed/21178007.fullarticle
12	Kenya Mini-Grids Results-Based Financing	ProSolar	Results-based financing	Development, commissioning and operation of solar PV hybrid mini-grids in Turkana County of Kenya. Barclays Bank of Kenya has partnered with the German Technical Cooperation to provide financial incentives (construction, connection, production) through a Results Based Financing (RBF) project.	three village centres in Turkana, 200 customers per contract	https://energypedia.info/images/8/8f/Kenya_Mini-Grids_RBF_Project_Brief.pdf
13	Solar-E-Cycles		low solar leasing	A new business model targets the energy poor with a low leasing cost of 50 cents a day thus eliminating barriers to acquisition. With its storage batteries it is also a micro solar power station for off-grid homes, businesses and communities.	energy poor, business and commmunities	http://eepafrica.org/portfolio-item/ken9121/
14	Local Authority Pension Trust		Joint financing model	Partnership - joint venture: Trust, local community (country councils) and GIZ. Trust covers upfromt costs from social sustianbilty budget with revene model based on selling commercial advertising space on lamp poles. GIZ provides technical support	Green street lighting across 19 counties	http://web.unep.org/greeneconomy/sites/unep.org.greeneconomy/files/publications/kenya_ge_assessment_report_low_res_21march_.pdf
15	Africa Enterprise Challenge Fund		Soft loans (interest free), grants, debt	Fund supports businesses who wish to implement innovative, commmerially viable, high impact projects	Business in agriculture, renewable energy for adopting to climate change	www.aecfafrica
16	Sustainable Community Development Services	SCODE	micro loan financing	Facilitating adoption of clean energy technologies and sustainable land use for enhanced livelihoods, e.g. micro loan financing of solar home systems with small forced -draft micro -gasifier stoves		USAID 2015
17	Githunguri Dairy Farmers Co-operative Society	Oikocredit (biogas)	soft loans with guarantees	Loan for installation of biodigesters in milk processing business. Loan is secured using machinary in addition to quarantees issued by board members	smallholder farmers	http://www.energy4impact.org/sites/default/files/financial_institutions_market_study_in_east_africa_2010_gvep_international.pdf
18	Mini-hydro	Muramati SACCO	solf loans	Community based initiave with solf loans based on ability to pay fro funding 6 community mini-hydro projects	communities, public insitutions (health center),	http://www.energy4impact.org/sites/default/files/financial_institutions_market_study_in_east_africa_2010_gvep_international.pdf
19	Sustainable Energy Fund for Africa	SEFA	equity and grants	Providing untied grants and equity support to smaller-size renewable energy and energy efficiency players	SME	http://kerea.org/financing/
20	The Renewable Energy and Adaptation to Climate Technologies	REACT	grants and loans	REACT is a special fund of the Africa Enterprise Challenge Fund that is open to business ideas based on renewable energy and adaptation to climate technologies. Provides financial support (grants and loans) for innovative business ideas (using matching fund principles)	poor in rural areas in Africa	Saini 2011
21	Funding Innovation for Business in Africa	AECF	loans	Special Funding Window of REACT to help with the riskiest elements of the project: mini-grid distribution network	rural households	https://www.b2match.eu/system/biomass-workshop-2013-maputo/files/SAINI.pdf?1364981279
22	Community Based Green Energy Project	CB-GEP	grants under ACP–EU Energy Facility funded under10th European Development Funds	Increase access to modern, affordable and sustainable energy services: improve access to energy services, increase local income and improve management of natural resources	households, institutions, communities in rural and pre-urban areas	GIZ 2016a
23	Global Climate Partnership Fund	GCPF	soft loans/ green lines to banks	Financing through Chase Bank for energy efficeincy and renewable, e.g. small scale renewable energy projects such as captive solat and hydro power plants. It also provides technical assistance.	their existing client portfolio and in the broader Kenyan energy market with a possible further geographical expansion	http://radiocitizen.co.ke/index.php/news/itemlist/tag/Global%20Climate%20Partnership%20Fund

N	Name of scheme /business model	Short name	Type of scheme	Brief description	Target sectors /audience	Source
24	Kenya Womens Finance Trust	KWFT	microfinance	Initiated a renewable energy programme supported by IT Power with funding from Shell Foundation. Over 5000 women accessed LPG for cooking, over 250 households installed solar PV systems and 13 LPG enterprises have been set-up. High upfront cost of modern energy technology could only be solved through distributed payments.	microentrepreneurs, low income groups in rural areas, mostly women	http://www.ruralpovertyportal.org/country/voice/tags/kenya/kwft
25	Small and Micro Enterprise Programme (SMEP)	Solar PV Lantern	solar loan	Solar products are packed with consumer product where clients can access to loan for solar PV and solar latern. Application is through group guarantee method	households	http://www.energy4impact.org/sites/default/files/financial_institutions_market_study_in_east_africa_2010_gvep_international.pdf
26	Sustainable Energy for All	SE4ALL	grant fortechnical assistance	The initiative is expected to catalyse major new investments to accelerate the transformation of the world's energy systems, pursue the elimination of energy poverty, and enhance prosperity through mobilization of all stakeholders to take concrete action toward ensuring universal access to modern energy.	people in off-grid areas	http://www.se4all.org/sites/default/files/Kenya_AA_EN_Released.pdf
27	Kenya Union of Savings and Credit Cooperatives	KUSCCO	solar loans and other energy loans	The energ y-lending activities relate to the promotion of modern energy technologies: solar, biogas, liquified Petroleum Gas (LPG), for cooking purposes. Before pilot-testing any energy-lending operations, all stakeholders agree on criterias of service delivery from initial marketing and promotion to possible loan default and after-warranty service.	households, SME	http://pdf.usaid.gov/pdf_docs/Pnadm641.pdf
28	Lease-to-Own Biogas		biogas leasing	Pilot project of Lease-to-Own Biogas, where farmers pay for the biogas as they use it and eventually own the system.	farmers	http://www.takamotobiogas.com/ ; http://eepafrica.org/portfolio-item/ken7009/
29	Solar/power kiosks	Solar kiosks	power kiosks solar leasing	Solar charging product companies provide leases to entrepreneurs, who in their turn provide electricity services to their communities.	communities, SMEs	http://www.ipsnews.net/2015/12/solar-kiosks-help-light-up-rural-kenya/
30	Kenya's Rural Electricification Fund		loans, free-service arrangement	Fund costs all electricity consumers 5% of the value of monthly electricity consumption (estimated 16 million US$ annually), responsible for 70,000 connections. With access to loans and fee-for-service arrangements, suggest that SHS market reach up to 50% of un-electrified rural homes.	rural households	https://energypedia.info/wiki/Kenya_Energy_Situation
31	Talek Power Mini-grid		grant of technical assistance	Solar hybrid generation power plant combining PV module, battery packs and a diesel generation. Innovation of use of money-enabled prepaid metering technology.	off-grid communities	GIZ 2016a
32	Kneya – Off-Grid Solar Assess Project	Clean Cookstoves	Grant and result based financing	Supports transformation of the market for improved, clean cookstoves in rural counties	rural households, community facilities: hospotals, schools	http://www.kenyacookstoves.org/images/Newsletter/cookstovesvendor.pdf
33	Green-Mini-Grid Facility		preparation support and credit	DFID in cooperation with AFD through green mini-grid facility scheme provide greenfield project preparation support and credit for private entrepreneurs.	private entrepreneurs.	https://www.giz.de/fachexpertise/downloads/2016-en-kenya-regulation-experiences-jasmin-fraatz.pdf
34	Solra hybrid Mini-Grids		reserved bidding/CAPEX subsidy	KfW oromotes solar hybrid mini-grids through reserved bidding for private generation components	private entrepreneurs.	https://www.giz.de/fachexpertise/downloads/2016-en-kenya-regulation-experiences-jasmin-fraatz.pdf
35	Result-based financing	RBF	reserved bidding/production incentive/CAPEX	GIZ/EnDev promotes mini-gird development through result-based model with reversed bidding: incentives fro connection, production incentive (premium per kWh supplied), CAPEX	private entrepreneurs.	https://www.giz.de/fachexpertise/downloads/2016-en-kenya-regulation-experiences-jasmin-fraatz.pdf
36	Azuri solar energy	Azuri	solar leasing	Pay-per-use solar model for off-grid energy connection such as solar home systems with mobile payment platform/ households, communities in remote rural areas .	households, remote rural communties	www.azuri-technologies.com
37	Anchor Business Community Model	ABC	grant for technical assistance	Mini-grid for customers that are splited the customer into three categories: anchor, business, community.	SMEs, industrial or agricultural communities, tourist lodges	GIZ 2016a

Annex 2. Fieldwork data collection protocol

Macro level - policy

- What are the drivers/enabling frameworks in Kenya to promote renewable energy and energy efficiency investments?
  - Enabling laws (incentives, financing mechanisms)
  - Governmental support
  - Regulatory requirements
  - International cooperation
  - Human and technical capacity
- What are policy developments supportive for mini-grid and off-grid installations?
- Do you think these are also favorable to ensure inclusive investments?
- Problems / barriers / remedies

Micro level – specific models/schemes

- Are there any financing schemes that can promote inclusive investments?
- Any interesting cases?
  - Details on scheme structure and operation (financial product, condition, technology, client profile, collaboration)
  - Do you target the poor / micro or small and medium enterprises?
  - Do you have social impact targets/indicators?
  - Do you monitor social impacts?
  - Is the scheme successful?
  - Factors affecting success of a case
  - Is it sustainable?
  - Is it replicable/scaled up?
  - Problems / Barriers / Remedies

Annex 3. Fieldwork interview respondents

1. International development and financing organizations

- Rhoda W. Wachira, Programme Officer, Resource Efficiency and SCP, Regional Office for Africa, United Nations Environmental Programme, UNEP
- Henry Ndede, Coordinator, UNEP-Kenya Country Programme
- Diane Jegam, Programme Officer, French Development Agency (AFD)
- Raphael De Guerre, Programme Officer, French Development Agency (AFD)
- Jean Noel Gangloff, Program Manager, infrastructure Section, Delegation of European Union to Kenya
- Pierre Telep, Advisor, GIZ ProSolar

2. Governmental officials

- Michael Obora, Assistant Director of Agriculture, Climate Change Unit, Ministry of Agriculture, Livestock and Fisheries
- Caroline Kimathi, Assistant Manager, Licensing and Compliance, Energy Regulatory Commission
- Kihara Mungai, Mechanical Engineer, Ministry of Energy

3. Private sector and banks

- Samuel Kiruga, Head of SME, FAULU Microfinance Bank
- Leah Adero Okuma, Business Development, Indra
- Mutiso Mbuiya, Director and Head Consultant, Weaxen Holding Ltd.
- Conrad Whitaker, Delivery Manager, AZURI

4. Professional associations and non-governmental organizations

- Abishek Bharadwaj, SME Advisor, Energy 4 Impact
- James Maillu, Regional Operations Manager, Global Village Energy Partnership, Africa Regional Office
- David Sacotte, Team Leader, SUNREF, Kenya Association of Manufacturers (KAM)
- Jeff Murage, Project Coordinator, SUNREF, Kenya Association of Manufacturers (KAM)
- Kristen Wangama, Expert, Kenya Renewable Energy Association (KEREA)
- Nuru Mugambi, Director of Communications and Public Affairs, Kenya Banker Association
- Myra Mukulu, Executive Secretary/CEO, Clean Cookstoves Association of Kenya

5. Academia

- Gilber Ouma, Lecturer, University of Nairobi, the Institute for Climate Change and Adaptation
- Christopher Oludhe, Senior Lecturer, University of Nairobi, Department of Meteorology
- Geoffrey Ronoh, Manager, Strathmore Energy Research Centre, University of Strathmore
- Anne Wacera, Laboratory Engineer, Strathmore Energy Research Centre, University of Strathmore
- Edward Mungai, Chief Executive Officer, Strathmore Business School

Annex 4. Policy framework for a green economy in Kenya

	STATE PROGRAMME/ STRATEGY/ACTION PLAN	PROVISIONS	MAIN IMPLEMENTATION AGENCY
Overall national development			
1	Constitution of Kenya 2010	– Article 42 recognizes a clean and healthy environment as a right. – Article 60 (c) calls for sustainable and productive management of land resources – Article 69 [(a)-(h)] declares that the State shall ensure sustainable exploitation, utilization, and protection of genetic and biological diversity; establish a system for environmental impact assessment; and achieve and maintain a tree cover of at least 10 per cent of the land area of Kenya.	Government of Kenya
2	Kenya Vision 2030	Over-reaching vision and overall policy framework for sustainable development	Ministry of Devolution and Planning
	First Medium-Term Plan, 2008-2012: Kenya Vision 2030	Programmes and projects for 2008-2012: restoration of ecosystems, including rehabilitation and protection of the five water towers (Mau, Mt. Kenya, Aberdares, Cheregany and Mt. Kenya); preparation of national land use plan, waste management systems, exploration and mining, invasive species, geological mapping, renewable energy and sustainable land use.	Ministry of Devolution and Planning
	Second Medium-Term Plan, 2013-2017	Some programmes and projects for 2013-2017 include: strengthening environmental governance; waste management and pollution control; rehabilitation of urban rivers; rehabilitation and protection of the water towers, forest and wildlife conservation and management; promotion and piloting of green energy; review of water resources management; land reclamation; implementation of the NCCRS and development of a national green economy strategy.	Ministry of Devolution and Planning
4	Population Policy for National Development (PPND)	PPND recognizes the impact of rapid population growth on Kenya's development goals and proposes a multi-sectoral approach to address this issue, with a focus on voluntary family planning.	Ministry of Devolution and Planning
5	Physical Planning Act	Reserve all land planned for open spaces, parks, urban forests and green belts.	Ministry of Lands, Housing and Urban Development
6	Local Government Act (Revised)	Utilization of sewage systems including removal and destruction of refuse and effluents	Ministry of Devolution and Planning
6	Arid and Semi-Arid Lands (ASALs) National Vision and Strategy: Natural Resource Management, 2005-2015	Sets out the overarching principles and broad actions required to transform the Kenyan ASALs into national wealth and employment creators.	Ministry of Devolution and Planning
Health			
7	Public Health Act	Provisions concerning sanitation and health	Ministry of Health
Agriculture			
8	Agricultural Sector Development Strategy (ASDS) 2010-2020	ASDS seeks to progressively reduce unemployment and poverty in Kenya through agriculture, and to spur agriculture back to growth trends.	Ministry of Agriculture, Livestock and Fisheries
9	Agriculture Act	Promotes and maintains stable agriculture and provides for conservation of soil and its fertility; aims to stimulate the development of agricultural land in accordance with the accepted practices of good land management and good husbandry	Ministry of Agriculture, Livestock and Fisheries
10	Agriculture (Farm Forestry) Rules 2009	Promotion and maintenance of farm forest cover of at least 10 per cent of every agricultural land holding and preservation and sustenance of the environment in combating climate change and global warming	Ministry of Agriculture, Livestock and Fisheries
Energy			
11	Draft National Energy Policy - Third Draft	Aims to facilitate provision of clean, sustainable, affordable, reliable and secure energy services at least cost, while protecting the environment.	Ministry of Energy and Petroleum
12	Feed-in Tariffs for Renewable Energy Resource Generated Electricity- Guide for Investors	– Accelerates the development of green energy, including wind, solar and renewable biomass. – Instrument to promote generation of electricity from renewable energy sources	Ministry of Energy and Petroleum

	STATE PROGRAMME/ STRATEGY/ACTION PLAN	PROVISIONS	MAIN IMPLEMENTATION AGENCY
Energy			
13	Least Cost Power Development Plan (LCPDP)	Identifies affordable, low-cost energy sources for Kenyans.	Ministry of Energy and Petroleum
14	Scaling up Renewable Energy Programme (SREP) – Investment Plan for Kenya	GoK and various actors in the Kenyan society seek to use the benefits of SREP in low-income countries to achieve their goals in energy, in a way that improves environmental, economic, social and productive development.	Ministry of Energy and Petroleum
15	Sessional Paper No. 4 of 2004 on Energy	Sessional Paper No. 4 identified the need to integrate energy planning with the national economic, social and environmental policies, as energy is a critical input in the socioeconomic progress of any economy.	Ministry of Energy and Petroleum
16	Energy Act, 2006	Amends and consolidates laws relating to energy.	Ministry of Energy and Petroleum
Manufacturing			
17	Occupational, Safety and Health Act, 2007	Health, safety and welfare of persons employed in factories.	Ministry of Labour, Social Security and Services
Transport			
18	Integrated National Transport Policy	Aims to develop, operate and maintain an efficient, cost-effective, safe, secure and integrated transport system in order to achieve national and international development objectives in a socially, economically and environmentally sustainable manner.	Ministry of Transport and Infrastructure
	Motor Vehicle Emissions Control in Kenya	Provisions for the measurement of vehicular exhaust emissions in the country	Ministry of Environment, Water and Natural Resources
Environmental protection			
19	National Climate Change Response Strategy (NCCRS)	Outlines adaptation and mitigation measures to enhance climate resilience.	Ministry of Environment, Water and Natural Resources
20	National Climate Change Action Plan (NCCAP)	Sets out how the NCCRS will be implemented.	Ministry of Environment, Water and Natural Resources
21	Forests Act	Reservation, protection and sustainable exploitation of forests.	Ministry of Environment, Water and Natural Resources
22	Kenya Forestry Master Plan	Reservation, protection and sustainable exploitation of forests.	Ministry of Environment, Water and Natural Resources
23	Water Act	Water resource management and prohibition of water pollution, including throwing rubbish, refuse, effluent and discharge of trade waste into water.	Ministry of Environment Water and Natural Resources
24	Fisheries Act	Management, exploitation and conservation of fisheries	Ministry of Agriculture, Livestock and Fisheries
25	Environmental Management and Coordination Act	Legal and institutional framework for environmental management and related matters – currently under review.	Ministry of Environment Water and Natural Resources
26	Wildlife Policy	Seeks to balance the needs of the people of Kenya with opportunities for sustainable wildlife conservation and management countrywide.	Ministry of Environment, Water and Natural Resources
UN submissions			
27	Kenya's Climate Change Technology Needs and Needs Assessment Report Under the UNFCCC	The report on Kenya's Technology Needs Assessment is the first step towards factoring the development and diffusion of environmentally-sound technology in the country's investment strategies.	Ministry of Environment Water and Natural Resources
28	Millennium Development Goals (MDGs)	Kenya is committed to the MDGs and is implementing various programmes relevant to GE, especially related to energy and environment.	Ministry of Devolution and Planning
29	First National Communication to UNFCCC	The compilation of the First National Communication (2002) demonstrates that Kenya is willing to meet its obligations under the convention. Kenya ratified the UNFCCC in 1994 signifying its determination to join the international community in combating climate change.	Ministry of Environment, Water and Natural Resources

Source: UNEP 2014b